INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN







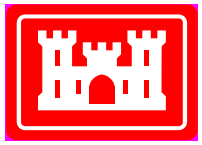


U.S. Army Garrison Aberdeen Proving Ground-
Adelphi Laboratory Center and
Blossom Point Research Facility

September 2025 Update

Integrated Natural Resources Management Plan
2022-2027

U.S. Army Garrison Aberdeen Proving Ground/Adelphi Laboratory Center
Blossom Point Research Facility



Prepared for:

Environmental Division
U.S. Army Garrison Aberdeen Proving Ground/Adelphi Laboratory Center
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September 2022

September 2023, Environmental Division Update 1
September 2024, Environmental Division Update 2
September 2025, Environmental Division Update 3

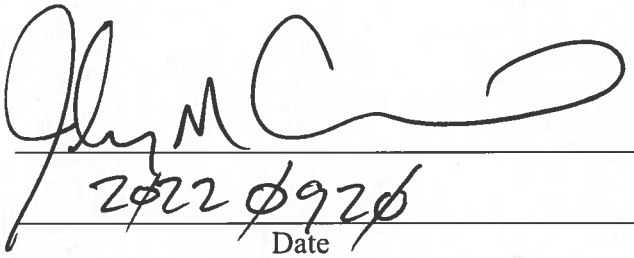
INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
ADELPHI LABORATORY CENTER
BLOSSOM POINT RESEARCH FACILITY

TRIPARTITE AGREEMENT (1 of 3)

This Integrated Natural Resources Management Plan has been developed by the U.S. Army Corps of Engineers, Baltimore District on behalf of the U.S Army Garrison Aberdeen Proving Ground, in cooperation with the U.S. Fish and Wildlife Service and the Maryland Department of Natural Resources. This Integrated Natural Resources Management Plan was subsequently reviewed for operation and effect and updated appropriately. This Integrated Natural Resources Management Plan continues to meet the requirements of the Sikes Act Improvement Act (16 USC 670 et seq, as amended). The signatures below indicate plan approval and continued mutual agreement regarding the cooperative advancement of a fully-integrated ecosystem-based natural resources management program on the installations.

PLAN APPROVAL

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TRIPARTITE AGREEMENT (2 of 3)

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AGENCY AGREEMENT

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TRIPARTITE AGREEMENT (3 of 3)

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AGENCY AGREEMENT

Paul A. Peditto
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March 25, 2022
Date

ANNUAL REVIEW AND COORDINATION PAGE

This page is used to certify the annual review and coordination of the Integrated Natural Resources Management Plan (INRMP) for the U.S. Army Garrison Aberdeen Proving Ground Adelphi Laboratory Center and Blossom Point Research Facility.

By their signatures below, the certifying official acknowledges that the annual review and coordination of the INRMP has occurred for the specified year.

APPROVING OFFICIALS for U.S. ARMY GARRISON ABERDEEN PROVING GROUND/ADELPHI LABORATORY CENTER/BLOSSOM POINT RESEARCH FACILITY REVIEW: 2023

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ANNUAL REVIEW AND COORDINATION PAGE

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EXECUTIVE SUMMARY

PURPOSE OF THE INRMP

Purpose and Scope

This Integrated Natural Resources Management Plan (INRMP) is the U.S. Army Garrison Aberdeen Proving Ground (APG) plan and management strategy for the conservation of natural resources on the Adelphi Laboratory Center (ALC) property in Prince George's and Montgomery Counties and the Blossom Point Research Facility (BPRF) in Charles County, Maryland. The plan covers natural resource management activities for the next five years (2022-2027), but the philosophy embedded in the plan is the foundation from which APG will continue to develop the natural resource management programs at ALC and BPRF beyond 2027. APG will conserve the biological diversity on its facilities and make sound decisions regarding the use of natural resources to support both the military mission and needs of the region and the nation.

The Sikes Act Improvement Act (SAIA) requires military installations in the United States to prepare an INRMP that provides for the following management activities, to the extent that such activities are consistent with the use of the base for military preparedness:

- The conservation and rehabilitation of natural resources on military installations;
- The sustainable multipurpose use of the resources, to include hunting, fishing, trapping, and non-consumptive uses; and
- Public access to the installation, subject to safety requirements and military security.

The SAIA requires preparation of INRMPs in cooperation with the U.S. Fish and Wildlife Service (USFWS), and the head of the appropriate state, territorial, or commonwealth fish and wildlife agency and, under 16 U.S.C. 670a(d)(2), priority shall be given to the entering into of contracts for the procurement of implementation and enforcement services with Federal, state, territorial, or commonwealth agencies having responsibility for conservation and management of fish or wildlife. The SAIA also states that the Department of Defense (DoD) may enter into cooperative agreements with states (territories or commonwealth), local governments, nongovernmental organizations, and individuals, and into interagency agreements with the heads of other Federal departments and agencies (16 U.S.C. 670c). In preparing this INRMP, as required by the SAIA as amended through 2010 (16 United States Code [U.S.C.] §670a et seq.), APG coordinated with the USFWS, Maryland Department of Natural Resources (MDNR) and National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) to ensure that the INRMP includes the appropriate aspects of each agency's requirements with respect to SAIA. The revisions made to update this INRMP are considered to be minor and will not result in biophysical consequences materially different from those anticipated in the existing 2015-2020 INRMP or analyzed in an existing Record of Environmental Consideration (REC). As a result, neither an additional National Environmental Policy Act (NEPA) analysis nor an opportunity for public comment was necessary for this INRMP update. A REC is included in **Chapter 6** of the INRMP.

BENEFITS OF INRMP IMPLEMENTATION

The INRMP provides APG with a single document that describes the state of natural resources and describes natural resources management on ALC and BPRF. The INRMP provides a concise analysis of all levels of the ecosystem, from the interaction of terrestrial and aquatic habitats with each other, to the management methods and goals for individual species. This larger picture provides a broader basis of understanding for planning and budgeting purposes.

IMPLEMENTATION OF THE INRMP

Primary Natural Resources Management Goals

The natural resources program structure has been developed based on installation-specific management situations and is designed to facilitate issue identification and prioritization, as well as project funding, implementation, and tracking. The resource-specific management programs addressed in this INRMP include the following:

- Natural Resources Management Program
- Threatened and Endangered Species Program
- Wetlands Management Program
- Fish and Wildlife Management Program
- Forestry Management Program
- Vegetative Management Program
- Invasive Species Management Program
- Integrated Pest Management Program
- Land Management Program (Soil Erosion)
- Geographic Information System
- Outdoor Recreation Program
- Wildland Fire Management Program
- Coastal Management Program
- Floodplain and Water Resources Management Program

Management issues for each of these programs have been identified and are discussed in the INRMP and provide the basis for the INRMP goals and objectives.

Goals and objectives have been established for the natural resources management programs to promote sustainability and enhance biodiversity (**Table ES-1**). The objectives developed for each goal represent the specific focus areas to achieve the established goals. Staffing, funding, and scheduling requirements for achieving the goals have also been established. The implementation of ten INRMP goals will not require a significant change in the management direction for ALC or BPRF; however, new projects are proposed for execution within this INRMP update.

All requirements set forth in this INRMP requiring the expenditure of APG funds are expressly subject to the availability of appropriations and requirements of the Anti-Deficiency Act

(31 USC section 1341). No obligation undertaken by APG under the terms of this INRMP will require or be interpreted to require a commitment to expend funds not obligated for a particular purpose.

Changes in Existing Management Practices

No changes in existing management practices are proposed under this INRMP update. However, it is recommended that APG continue current management activities and adapt as necessary for effective natural resource management and sustainability of the military mission.

Environmental Impacts of INRMP Implementation

No significant environmental impacts are anticipated as a result of INRMP implementation. APG employs a conscientious approach to environmental management. Natural processes are favored over human intervention under most circumstances. Implementation of the projects in this INRMP will help facilitate natural processes, and create direct, minor benefits for specific species and habitats. A REC is included to satisfy the NEPA requirements for the implementation of this INRMP.

Table ES-1. ALC/BPRF INRMP Goals and Objectives

Goal	Objective
Goal 1: Natural Resource Management Implement a natural resources management program that reflects the principles of ecosystem management and ensures the sustainability of the military mission.	Manage natural resources consistent with environmental laws, regulations and legislation, for Federal, State, DoD or Army rules.
	Use adaptive management strategies to protect, conserve and enhance native fauna and flora with an emphasis on priority species and native biodiversity enhancement.
Goal 2: Rare, Threatened and Endangered Species Ensure protection of federally listed threatened and endangered species and species of special concern and undertake management measures that support conservation and recovery of these species.	Identify and preserve these species in accordance with the Endangered Species Act (ESA), Endangered Species Recovery Plans, U.S. Army regulations and guidance, approved site-specific management plans, including Endangered Species Management Plans (ESMP).
	Protect unique plant species and habitat identified as rare statewide or locally, but without legal protection status, to the extent practical without restricting key mission operations.
Goal 3: Habitat Management Protect and enhance all habitats on ALC and BPRF, particularly sensitive and ecologically significant habitats, in a manner that promotes healthy, sustainable ecological communities.	Monitor all missions/activities for possible adverse impacts to soil resources, water quality and the ecological integrity of aquatic and terrestrial habitats. Adapt management as necessary.

Goal	Objective
Goal 4: Water Resources Protect the integrity of surface and groundwater resources and aquatic habitat to maintain and enhance biodiversity and protect water quality.	Protect aquatic and riparian resources by establishing and maintaining riparian management zones that limit activities within buffers zones around streams and wetlands to those activities that would cause little to no impact on water quality and aquatic habitats. Identify and restore degraded habitats when practical.
	Prevent the degradation of water quality from point and non-point sources of pollution to include sediments, nutrients, and chemical pollution.
	Achieve no net loss of wetlands.
	Protect and improve the stability and resiliency of the BPRF shoreline and prevent further loss of land.
Goal 5: Fish and Wildlife Maintain the diversity of species and habitats currently found at ALC and BPRF, restore and enhance degraded habitats where possible, and promote sustainable management of resources in a manner consistent with ecosystem management principles and the military mission.	Maintain fish and wildlife biodiversity, especially native species, through protecting present wildlife habitats from degradation. Reduce habitat fragmentation and restore native grassland, forest and wetland communities.
	Provide for migratory bird and bald eagle protection.
	Sustain healthy populations of game and nongame species at levels compatible with land use objectives and the military mission.
Goal 6: Forest Resources Conserve and manage forest resources in a sustainable fashion that maintains biodiversity, ecological functions and values, as well as the military mission.	Protect forest resources from unacceptable losses to damage agents and degradation resulting from insects and disease, invasive species, and wildfire.
	Carry on the objective of forest resources management at BPRF for an optimum combination of uses (multiple-use management) including: - Wildlife habitat preservation and enhancement; - Wetland, watershed, and groundwater protection; - Possible timber production; - Protection of the shoreline and natural resources in support of the Chesapeake Bay Action Plan; - Preservation of existing historical and cultural resources.

Goal	Objective
Goal 7: Pest and Invasive Species Manage and prevent the spread of pests and invasive species that threaten habitat and native species.	Employ judicious use of both non-chemical and chemical control techniques to achieve effective pest management with minimal environmental consequence.
	Identify, monitor and control invasive and pest species and habitat.
	Carry on pest management priorities at ALC and BPRF to include control of disease vectors, protection of real estate, control of nuisance pests, control of undesirable vegetation, protection of beneficial plants, and control of miscellaneous animal pests (such as birds, rodents, and other mammals).
Goal 8: Soil Resources Manage soil resources in a sustainable manner and protect soils from erosion and destabilization through preventative and restoration efforts and prevent potential soil erosion impacts on water quality, habitat quality, and mission objectives.	Monitor soils regularly for erosion and address problem areas as appropriate.
	Protect soil resources from disturbances from earth-moving activities, construction and natural erosive forces through use of best management practices (BMPs).
	Use native species for erosion control.
Goal 9: Community Outreach Encourage relationship with the local community on ALC and BPRF, as appropriate, without interruption to the military mission.	Continue to provide outdoor recreational opportunities to the extent that they do not conflict with the military mission or compromise environmental values.
	Make a positive contribution to local conservation efforts and the community by participating in educational opportunities and providing information on issues affecting ALC, BPRF and the region.
Goal 10: Fire Management The primary goal for fire management at ALC and BPRF is to prevent unacceptable losses to military property from wildfire.	Implement appropriate wildfire prevention and suppression measures.

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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

U.S. ARMY GARRISON ABERDEEN PROVING GROUND ADELPHI LABORATORY CENTER AND BLOSSOM POINT RESEARCH FACILITY

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1.0 INTEGRATED NATURAL RESOURCE MANAGEMENT PLAN OVERVIEW

1.1 PURPOSE

The purpose of the U.S. Army Garrison Aberdeen Proving Ground (APG) 2022-2027 Integrated Natural Resource Management Plan (INRMP) is to guide the conservation and management of natural resources at the Adelphi Laboratory Center (ALC) in Adelphi, which is within Prince George's and Montgomery Counties, Maryland and Blossom Point Research Facility (BPRF) outside of La Plata on Cedar Point Neck, Charles County Maryland. This INRMP supports the installations' commitment to sustaining a healthy environment in which to carry out its mission. It outlines conservation efforts for the natural resources at ALC and BPRF and will aid in ensuring compliance with applicable environmental laws and regulations. This INRMP is an update of the 2015-2020 INRMP for ALC and BPRF and will guide natural resource management at ALC and BPRF from 2022 through 2027 and provide a solid foundation on which to build the program beyond the year 2027. The INRMP is consistent with the Sikes Act Improvement Act (SAIA) and guidance and regulations provided in Department of Defense (DoD) Instruction (DoDI) 4715.03 (Natural Resources ~~Conservation Program~~Management) and DoD Manuel (DoDM) 4715.03 (Integrated Natural Resources Management Plan Implementation Manual).

1.2 SCOPE

This INRMP is the foundation for ecosystem- or landscape-level management of the natural resources at ALC and BPRF. It provides comprehensive elements for use by installation managers to implement management measures to enhance and maintain biodiversity and sustainability through an ecosystem approach while supporting mission requirements. Implementation of this plan applies to organizations both internal and external to ALC and BPRF that influence or have the potential to influence ALC's and BPRF's natural resources, directorates, mission partners, contract personnel, installation residents and their dependents, private groups, and individuals. This INRMP is an integral part of the installations' Environmental Goals and is intended to be used when planning activities that may affect natural resources located on and adjacent to the ALC and BPRF properties.

1.3 GOALS AND OBJECTIVES

The primary goal of the INRMP is to ensure that natural resources are managed to maintain ecosystem viability and ensure the sustainability of military lands and support the military mission. This goal can be achieved through the integration of the military mission activities and the natural resource management program described in this INRMP. ALC has established ten natural resource management program goals with associated objectives which are outlined in **Table 1-1** below.

Table 1-1. ALC/BPRF INRMP Goals and Objectives

Goal	Objective
Goal 1: Natural Resource Management Implement a natural resources management program that reflects the principles of ecosystem management and ensures the sustainability of the military mission.	Manage natural resources consistent with environmental laws, regulations and legislation, for Federal, State, DoD or Army rules.
	Use adaptive management strategies to protect, conserve and enhance native fauna and flora with an emphasis on priority species and native biodiversity enhancement.
Goal 2: Rare, Threatened and Endangered Species Ensure protection of federally listed threatened and endangered species and species of special concern and undertake management measures that support conservation and recovery of these species.	Identify and preserve these species in accordance with the Endangered Species Act (ESA), Endangered Species Recovery Plans, U.S. Army regulations and guidance, approved site-specific management plans, including Endangered Species Management Plans (ESMP).
	Protect unique plant species and habitats identified as rare statewide or locally, but without legal protection status, to the extent practical without restricting key mission operations.
Goal 3: Habitat Management Protect and enhance all habitats on ALC and BPRF, particularly sensitive and ecologically significant habitats, in a manner that promotes healthy, sustainable ecological communities.	Monitor all missions/activities for possible adverse impacts to soil resources, water quality and the ecological integrity of aquatic and terrestrial habitats. Adapt management as necessary.
Goal 4: Water Resources Protect the integrity of surface and groundwater resources and aquatic habitat to maintain and enhance biodiversity and protect water quality.	Protect aquatic and riparian resources by establishing and maintaining riparian management zones that limit activities within buffers zones around streams and wetlands to those activities that would cause little to no impact on water quality and aquatic habitats. Identify and restore degraded habitats when practical.
	Prevent the degradation of water quality from point and non-point sources of pollution to include sediments, nutrients, and chemical pollution.
	Achieve no net loss of wetlands.
	Protect and improve the stability and resiliency of the BPRF shoreline and prevent further loss of land.

Goal	Objective
Goal 5: Fish and Wildlife Maintain the diversity of species and habitats currently found at ALC and BPRF, restore and enhance degraded habitats where possible, and promote sustainable management of resources in a manner consistent with ecosystem management principles and the military mission.	Maintain fish and wildlife biodiversity, especially native species, through protecting present wildlife habitats from degradation. Reduce habitat fragmentation and restore native grassland, forest and wetland communities.
	Provide for migratory bird and bald eagle protection.
	Sustain healthy populations of game and nongame species at levels compatible with land use objectives and the military mission.
Goal 6: Forest Resources Conserve and manage forest resources in a sustainable fashion that maintains biodiversity, ecological functions and values, as well as the military mission.	Protect forest resources from unacceptable losses to damage agents and degradation resulting from insects and disease, invasive species, and wildfire.
	Carry on the objective of forest resources management at BPRF for an optimum combination of uses (multiple-use management) including: - Wildlife habitat preservation and enhancement; - Wetland, watershed, and groundwater protection; - Possible timber production; - Protection of the shoreline and natural resources in support of the Chesapeake Bay Action Plan; - Preservation of existing historical and cultural resources.
Goal 7: Pest and Invasive Species Manage and prevent the spread of pests and invasive species that threaten habitat and native species.	Employ judicious use of both non-chemical and chemical control techniques to achieve effective pest management with minimal environmental consequence.
	Identify, monitor and control invasive and pest species and habitat.
	Carry on pest management priorities at ALC and BPRF to include control of disease vectors, protection of real estate, control of nuisance pests, control of undesirable vegetation, protection of beneficial plants, and control of miscellaneous animal pests (such as birds, rodents, and other mammals).

Goal	Objective
Goal 8: Soil Resources Manage soil resources in a sustainable manner and protect soils from erosion and destabilization through preventative and restoration efforts and prevent potential soil erosion impacts on water quality, habitat quality, and mission objectives.	Monitor soils regularly for erosion and address problem areas as appropriate.
	Protect soil resources from disturbances from earth-moving activities, construction and natural erosive forces through use of best management practices (BMPs).
	Use native species for erosion control.
Goal 9: Community Outreach Encourage relationship with the local community on ALC and BPRF, as appropriate, without interruption to the military mission.	Continue to provide outdoor recreational opportunities to the extent that they do not conflict with the military mission or compromise environmental values.
	Make a positive contribution to local conservation efforts and the community by participating in educational opportunities and providing information on issues affecting ALC, BPRF and the region.
Goal 10: Fire Management The primary goal for fire management at ALC and BPRF is to prevent unacceptable losses to military property from wildfire.	Implement appropriate wildfire prevention and suppression measures.

1.4 RESPONSIBILITIES

1.4.1 Installation Stakeholders

The APG Garrison Commander is directly responsible for operating and maintaining ALC and BPRF, including the implementation and enforcement of this INRMP. The support of the Director of the Army Research Laboratory (ARL) (the major tenant at ALC) and the Director of the Public Works Directorate (DPW) is a critical component of the implementation of this INRMP and integration of natural resources management and the military mission. The ALC Garrison Manager provides day to day oversite of ALC and BPRF.

The DPW maintains an Environmental Division which is responsible for the environmental programs at APG, ALC and BPRF including the management of compliance operations, hazardous waste, environmental restoration, and cultural and natural resources. The Chief of the Environmental Division is responsible for the supervision of all components of the ALC and BPRF natural resources programs. Cultural resources and natural resources staff (teams) are combined into the Environmental Integration Branch.

Implementation of this INRMP requires assistance and support from other Garrison directorates and offices. This includes the Environmental Compliance Branch (e.g., air quality, sediment and

erosion control, stormwater management), DPW Operations and Maintenance (e.g., Pest Control and Grounds Maintenance Contracts), DPW Master Planning (e.g., GIS support, map creation), and the Staff Judge Advocate (e.g., legal reviews).

1.4.2 External Stakeholders

1.4.2.1 U.S. Fish and Wildlife Service (USFWS)

The USFWS is a signatory agency of installation INRMPs in accordance with the Sikes Act. The DoD and Army also consult formally and informally with the USFWS on endangered species and wetland issues, pursuant to applicable legislation including the ESA and Clean Water Act (CWA). The office with responsibility for ALC and BPRF is the USFWS Chesapeake Bay Field Office in Annapolis, Maryland. The USFWS is a signatory cooperator in implementation of this INRMP.

1.4.2.2 Maryland Department of Natural Resources (MDNR)

MDNR oversees the management and use of the state's forests and parks, fisheries, and wildlife. It has statewide responsibilities for assessing and restoring water quality and habitat, managing and regulating recreational boating, fishing and hunting, and managing wetlands, wildlife, and rare, threatened, and endangered species.

MDNR has a Natural Heritage Program as part of a Natural Heritage Network. The heritage program maintains the most comprehensive databases on state rare plant and animal species and natural communities. This information helps guide natural resource management to protect and conserve state-listed rare, threatened or endangered species. The MDNR is a signatory cooperator in implementation of this INRMP.

1.4.2.3 National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS)

The NOAA Fisheries provides guidance concerning the conservation, protection, and management of offshore living marine resources and their habitats. APG coordinated with the NOAA Fisheries for the revision of the INRMP and for any threatened and endangered species and Essential Fish Habitat coordination as needed.

1.5 AUTHORITY

Preparation and implementation of this INRMP is required by the Sikes Act (16 U.S. Code [USC] 670a *et seq.*), DoDI 4715.03 (*Natural Resources ~~Conservation Program~~Management*) (DoD, 20202024~~11~~), Army Regulation (AR) 200-1 (*Environmental Protection and Enhancement*) (DA, 2007), and Army Memorandum (21 March 1997), *Army Goals and Implementing Guidance for Natural Resources Planning Level Survey (PLS) and Integrated Natural Resources Management Plans (INRMP)* (DA, 1997). This INRMP was initially prepared using the *Integrated Natural Resources Management Plan Template* instituted by the DoD in 2006 (DA, 2006). It has been

revised per DODM 4715.03. Additional DoD reference materials used in the development of this INRMP and will be referenced throughout the implementation of this INRMP include the *Best Practices for INRMP Implementation* (Horne Engineering Services, Inc., 2005) and *Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers* (The Nature Conservancy, 2008).

This INRMP has been developed in accordance with the Sikes Act and DoD policies and directives and is the primary mechanism for compliance with natural resources laws and regulations. Federal, state and local laws and regulations, as well as DoD and Army directives may apply to proposed management actions within this INRMP. The following sections describe other laws and policies that guided the development of this INRMP.

1.5.1 The Sikes Act

Under the Natural Resource Management on Military Lands Act of 1960, commonly known as the Sikes Act,

> "The Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate the program, the Secretary of each military department shall prepare and implement an integrated natural resources management plan for each military installation in the United States under the jurisdiction of the Secretary. Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the Secretaries of the military departments shall carry out the program to provide for the conservation and rehabilitation of natural resources on military installations; the sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping, and non-consumptive uses; and subject to safety requirements and military security, public access to military installations to facilitate the use."

Per 16 USC 670a(b) of the SAIA of 2004, to the extent appropriate and applicable, this INRMP provides for the following:

- Fish and wildlife management, land management, forest management, and fish- and wildlife-oriented recreation.
- Fish and wildlife habitat enhancement or modifications.
- Wetland protection, enhancement, and restoration, where necessary for support of fish, wildlife, or plants.
- Integration of, and consistency among, the various activities conducted under the plan.
- Establishment of specific natural resources management goals and objectives and time frames for proposed action.

- Sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources.

- Public access to the military installation that is necessary or appropriate for the use described above, subject to requirements necessary to ensure safety, military security, and fulfillment of the military mission.

- Enforcement of applicable natural resources laws (including regulations).

- No net loss in the capability of military installation lands to support the military mission of the installation.

When fully coordinated with appropriate federal and state agencies, this INRMP fulfills the SAIA as amended though 2018 (16 USC 670 et seq.). The SAIA requires military installations in the United States to prepare an INRMP that provides for the following management activities, to the extent that such activities are consistent with the use of the installation for military preparedness:

1) The conservation and rehabilitation of natural resources on military installations;

2) The sustainable multipurpose use of the resources, to include hunting, fishing, trapping, and non-consumptive uses; and

3) Public access to the installation, subject to safety requirements and military security.

1.5.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA), 42 U.S.C. 4321 *et seq.* requires analysis and evaluation of environmental impacts created by proposed major federal actions. 32 CFR Part 651, Environmental Analysis of Army Actions was rescinded July 3, 2025. ~~32 Code of Federal Regulations (CFR) Part 651 (Environmental Analysis of Army Actions, Federal Register Vol. 67, No. 61, July 1, 2002) and the Council on Environmental Quality (CEQ) (Implementing Guidelines for NEPA, 40 CFR Parts 1500-1508)~~ New DoD NEPA Implementing Procedures which were issued on June 30, 2025 and the Army Guidance Memorandum – DoD NEPA Implementing Procedures which were issued on August 8, 2025 provide guidance that ~~recommend~~ a Record of Environmental Consideration (REC) can be completed using Categorical Exclusion (CATEX) I.C.5 for natural resources management plans that have previously been evaluated through an Environmental Assessment (EA) and where no major changes are proposed in the INRMP. NEPA compliance requirements of proposed Army actions are outlined in ~~32 CFR Part 651~~ in~~.~~ the Army Guidance Memorandum.

NEPA requires Federal agencies to consider environmental consequences of major proposed actions. The NEPA documentation for this updated INRMP is in the form of a REC (**Chapter 6**) and analyzes the potential consequences of the implementation of this INRMP. Recognizing the efficiencies and benefits associated by combining this INRMP and its associated NEPA documentation into one document, this plan has been developed to satisfy both requirements. The

INRMP has been reorganized from Army Guidelines to accommodate NEPA documentation within the plan.

1.5.3 Endangered Species Act

This INRMP has the signatory approval of the USFWS. This signature approval includes agreement that the INRMP complies with the ESA. Review of the INRMP comprises an informal consultation with regard to the ESA. Consultation was also conducted with the National Marine Fisheries Service (NMFS) for endangered marine species under its authority and potentially found in the vicinity of BPRF.

Per provisions of the 2004 National Defense Authorization Act, this INRMP "provides a benefit to the species for which critical habitat is proposed for designation." The USFWS policy [ESA Section 4(a)(3)(B)(i)] states that, where applicable, federal critical habitat designation is not warranted if the INRMP includes certain criteria, which are summarized in **Section 3.2.1,** Endangered Species Act and **Section 4.2,** Threatened and Endangered Species Management.

1.5.4 Department of Defense Directive 4715.1E: Environment, Safety, and Occupational Health (ESOH)

The 30 December 2019 DoD Directive regarding Environment, Safety, and Occupational Health (ESOH) establishes policies to sustain and improve the military mission by managing installations' assets, including natural infrastructure. Natural infrastructure is defined as all natural resources (air, water, and land) that the DoD operates in or controls.

1.5.5 Department of Defense Instruction 4715.03: Natural Resources Management and DoD Manuel 4715.03 Integrated Natural Resources Management Plan Implementation Manual

This updated INRMP was prepared in accordance with DoDI 4715.03 and DoDM 4715.03. DoDI 4715.03 prescribes procedures for integrated management of natural and cultural resources, including preparing an INRMP as required by the SAIA. DoDI 4715.03 also states that "INRMPs shall be prepared, maintained, and implemented for all lands and waters under DoD control that have suitable habitat for conserving and managing natural resources."

DoDM 4715.03 is a manual that establishes implementing guidance to manage DoD's natural resources for mission and stewardship purposes.

1.5.6 Deputy Under Secretary of Defense Sikes Act Policy Memorandum

The 10 October 2002 Deputy Under Secretary of Defense (DUSD) memorandum regarding the *Implementation of Sikes Act Improvement Act: Updated Guidance* defines requirements and expectations associated with USFWS and State natural resources agency coordination, DoD

reporting, implementation and funding, and other miscellaneous requirements, such as no net loss to military lands and cooperative agreements.

1.5.7 Department of Defense Guidance, Implementation of Sikes Act Improvement Amendments: Supplemental Guidance Concerning INRMP Reviews

The DoD Supplemental Guidance, dated November 1, 2004 provided additional clarification of DoD policy regarding the review and revision of INRMPs. This guidance states that, while the Sikes Act specifies that INRMPs must be reviewed "on a regular basis, but not less often than every 5 years," not all INRMP reviews require a revision each 5-year period. The SAIA specifically directs that an INRMP should be reviewed "as to operation and effect," emphasizing that the review is intended to determine whether the existing implemented INRMP meets the requirements of the SAIA and contributes to the conservation and rehabilitation of natural resources on the installation. If it is determined that an existing INRMP is adequate, then a revision is not needed. Further, the review must be performed by the "parties," meaning the installation, the USFWS, and the state regulatory agency (MDNR in this case).

The guidance also reiterates that, although the Sikes Act specifies only that a formal review must be completed no less often than every 5 years, DoD policy requires installations to review INRMPs annually in cooperation with the other parties to the INRMP. Annual reviews facilitate "adaptive management" by providing an opportunity for the parties to review the goals and objectives of the plan, as well as establish a realistic schedule for undertaking proposed actions.

1.5.8 Army Regulation 200-1: Environmental Protection and Enhancement

The Army's commitment to the conservation of its natural resources is further reflected in AR 200-1, *Environmental Protection and Enhancement*. AR 200–1 requires the preparation of INRMPs and prescribes Army policies, procedures, and standards for the "conservation, management, and restoration of land and the renewable natural resources on it, consistent with and in support of the military mission."

~~1.5.9 32 Code of Federal Regulations Part 651: Environmental Effects of Army Actions~~ 1.5.9 Army Guidance - Department of Defense National Environmental Policy Act Implementing Procedures

32 CFR Part 651: Environmental Effects of Army Actions was rescinded by Interim Final Rule Environmental Analysis of Army Action (AR 200-2), 90 Federal Register 29450, July 5, 2025. The Army Guidance Memorandum – DoD NEPA Implementing Procedures were released on August 8, 2025. The memorandum provides guidance for Army implementation of the DoD NEPA Implementing Procedures that were released on June 30, 2025. The DoD Procedures contain an updated list of CATEXs from each branch of the military that can be implanted across the branches.

~~"implements the NEPA of 1969, setting forth the Army's policies and responsibilities for the early integration of environmental considerations into planning and decision-making." 32 CFR Part 651~~

~~codified the former AR 200-2 into Federal regulation. As described in **Section 1.5.2** above, and stated in §651.14, "The Army goal is to concurrently integrate environmental reviews with other Army planning and decision-making actions, thereby avoiding delays in mission accomplishment. To achieve this goal, proponents shall complete NEPA analysis as part of any recommendation or report to decision makers prior to the decision (subject to 40 CFR 1506.1). Early planning (inclusion in Installation Master Plans, INRMPs, Integrated Cultural Resources Management Plans (ICRMPs), Acquisition Strategies, strategic plans, etc.) will allow efficient program or project execution later in the process." To meet this end ,~~ Tthe NEPA requirements for the INRMP are integrated within this INRMP, in the form of a REC (**Chapter 6).**

1.5.10 Headquarters, Department of the Army INRMP Policy Memorandum, 21 March 1997

Headquarters, Department of the Army (HQDA) INRMP Policy Memorandum (21 March 1997) entitled *Army Goals and Implementing Guidance for Natural Resources Planning Level Surveys (PLS) and Integrated Natural Resources Management Plan (INRMP)*. The INRMP Policy Memorandum states that the purpose for completing planning-level surveys and the INRMP is "to ensure that natural resource conservation measures and Army activities on mission land are integrated and are consistent with federal stewardship requirements" (HQDA, 1997).

1.6 STEWARDSHIP AND COMPLIANCE

The Army Strategy for the Environment is based on the concept of sustainability and is designed to sustain the Army now and into the future. This Strategy transitions the Army's compliance-based environmental program to a mission-oriented approach based on the principles of sustainability. A sustainable Army simultaneously meets current as well as future mission requirements worldwide, safeguards human health, improves quality of life, and enhances the natural environment (U.S. Army, 2020).

APG is committed to sustainability through the implementation of this INRMP, which identifies goals and objectives that not only meet compliance requirements but also consider environmental stewardship responsibilities in managing natural resources and mission activities. Stewardship projects such as community outreach through the hunting program, habitat conservation through riparian buffers, and monitoring mission impacts on soils and habitat go beyond compliance requirements to preserve and manage natural resources for the future.

The SAIA encourages environmental stewardship by fostering an open dialogue between facilities and the Federal and state resource agencies. It is the goal of this open dialogue to engender understanding between the parties and stimulate discussion and ideas for better implementation of natural resources protection and enhancement measures at the installation. This openness also helps ensure that stewardship considerations are integrated into planning and analysis for activities and actions at the installation. The Command and staff of APG are committed to environmental stewardship as an integral part of the mission at ALC and BPRF installations. This commitment is evidenced by support of past environmental programs and their full support of this INRMP. It

is important to understand the relationship between the natural resources program and the ARL military mission, which is paramount in developing and implementing this INRMP.

1.7 REVIEW AND REVISION PROCESS

In accordance with the SAIA, ALC is required to work with the USFWS and MDNR to regularly review and revise this INRMP, as necessary, at least once every five years. It is DoD policy that ALC invite the USFWS and MDNR to evaluate the effectiveness of the INRMP to determine whether it is being implemented to meet the requirements of the SAIA and contribute to the conservation and restoration of natural resources on military installations.

DoD Instruction 4715.03 also requires the installation to internally review this INRMP annually and revise as necessary. Annual revisions could include any new environmental compliance requirements, changes in the military mission or installation policy, or other new information that would significantly affect the ability of the installation to implement the INRMP. If the installation mission or its natural resources management issues change significantly from those outlined in the original plan, an INRMP revision, to include coordination with the USFWS and MDNR will be required. As part of the INRMP annual review and coordination process, the Chief of the Environmental Division will make the determination if an INRMP revision is required. A signature page is included in the front of the INRMP to facilitate the annual review.

1.8 MANAGEMENT STRATEGY

While the purpose of this INRMP is to integrate natural resources management and the military mission, the strategy for accomplishing this is an ecosystem-based approach. ALC uses this strategy to comprehensively manage natural resources, as many natural resources are interdependent on each other. A direct impact on a natural resource by an activity under the military mission may indirectly influence several other resources within that ecosystem. The ecosystem-based approach allows natural resource managers to more effectively manage military mission activities to minimize impacts or even enhance the natural resources, and thus the ecosystems, found on their installation.

Ecosystem-based management requires open communication and education of those performing mission-related activities such as training and testing. All parties involved with land activities, have a role in ecosystem management. Coordination with USFWS and MDNR can also enhance the ability of ALC to effectively manage the ecosystems and contribute to environmental stewardship within the larger ecosystems of the state of Maryland.

The goals and objectives outlined in this INRMP (see **Section 1.3**) serve as the guide for ecosystem-based management on ALC. Natural resources management projects and daily land management activities that work towards meeting these goals will result in successful ecosystem management.

1.9 OTHER PLAN INTEGRATION

While this INRMP is developed for the natural resources management on ALC and BPRF, the successful implementation of this INRMP requires integration of other management and mission plans on ALC. The development of this INRMP includes integration of other installation plans, Federal and state regulations and documents that directly or indirectly influence the management of natural resources on ALC. Internal installation stakeholders were consulted and involved in the development of the natural resources program, to ensure this INRMP is implemented and supported across the installation. **Table 1-2** includes a list of ALC plans and Federal and state laws that were incorporated into this INRMP.

Table 1-2. ALC Plans and Federal and State Law Integration Through The INRMP

Specific Plans and Laws	Sections
National Environmental Policy Act	Section 3.3, Chapter 6
Maryland State Wildlife Action Plan	Section 3.7
Clean Water Act	Section 3.2.6, 4.3, 4.19
Endangered Species Act	Section 3.2.1, 4.2
Migratory Bird Treaty Act	Section 3.2.3, 4.8
Bald Eagle Management Plan and Bald and Golden Eagle Protection Act	Section 3.2.2, 4.8
Essential Fish Habitat	Section 3.2.4
Coastal Zone Management Act	Section 3.2.5, 4.18
Integrated Pest Management Plan	Section 4.9, 4.10
Forest Management Plan	Section 4.6
Integrated Wildland Fire Management Plan	Section 4.16

2.0 CURRENT CONDITIONS AND USE

2.1 INSTALLATION INFORMATION

2.1.1 General Description

ALC

ALC (Latitude 39 -1'-45"N, Longitude 76 -58'-19"W) is located in Adelphi, Maryland (**Figure 2-1**). The site straddles the border between two Maryland jurisdictions, Prince George's and Montgomery Counties. Of the total 207-acre area, 84 acres are within Montgomery County and 123 acres are within Prince George's County. ALC is approximately six miles from the District of Columbia. The installation is located within one mile of the Capital Beltway (Interstate 495) and Interstate 95 (I-95). ALC lies in the Anacostia River drainage basin which is a tributary of the Potomac River. It is bordered by residential areas on the east and south and by the General Service Administration's Federal Center on the north and west. ALC consists of four main building areas with parking lots, forested lands and two stream corridors, Paint Branch and Hillandale Tributary.

BPRF

BPRF (Latitude 38 -24 -50"N, Longitude 77 5 -50"W) occupies approximately 1,600 acres on Cedar Point Neck in southern Charles County, Maryland (**Figure 2-2**). It is located approximately 65 miles southeast of ALC. BPRF is approximately 35 miles south of the District of Columbia. The closest town is La Plata, Maryland, which is approximately nine miles northeast of the facility. BPRF is situated on Cedar Point Neck, a peninsula on the north side of the Potomac River and is bounded on three sides by the Potomac and Nanjemoy Creek. The area to the north of the facility includes sparsely populated agricultural and forest lands. BPRF is largely forested with wetlands, open fields, testing areas, and a few buildings.

2.1.2 Regional Land Use

ALC

ALC is located adjacent to Hillandale, Maryland, a suburban residential community. The land adjacent to the installation has a variety of land use designations. The General Services Administration (GSA) owns a large business complex adjacent to ALC to the north and slightly west, which is the headquarters for the U.S. Food and Drug Administration (USFDA). Areas to the east and south of the installation are primarily rural and suburban residential in nature. Paint Branch Park is immediately south of the installation. Prince George's and Montgomery Counties are highly urbanized areas surrounding Washington, D.C. ALC is located just outside the Capital Beltway, which is heavily developed by government agencies, business complexes, commercial areas, and residential communities. Within the area of ALC, there are also several greenways along stream corridors; the greenway for Paint Branch is adjacent to ALC as Paint Branch flows through the installation.

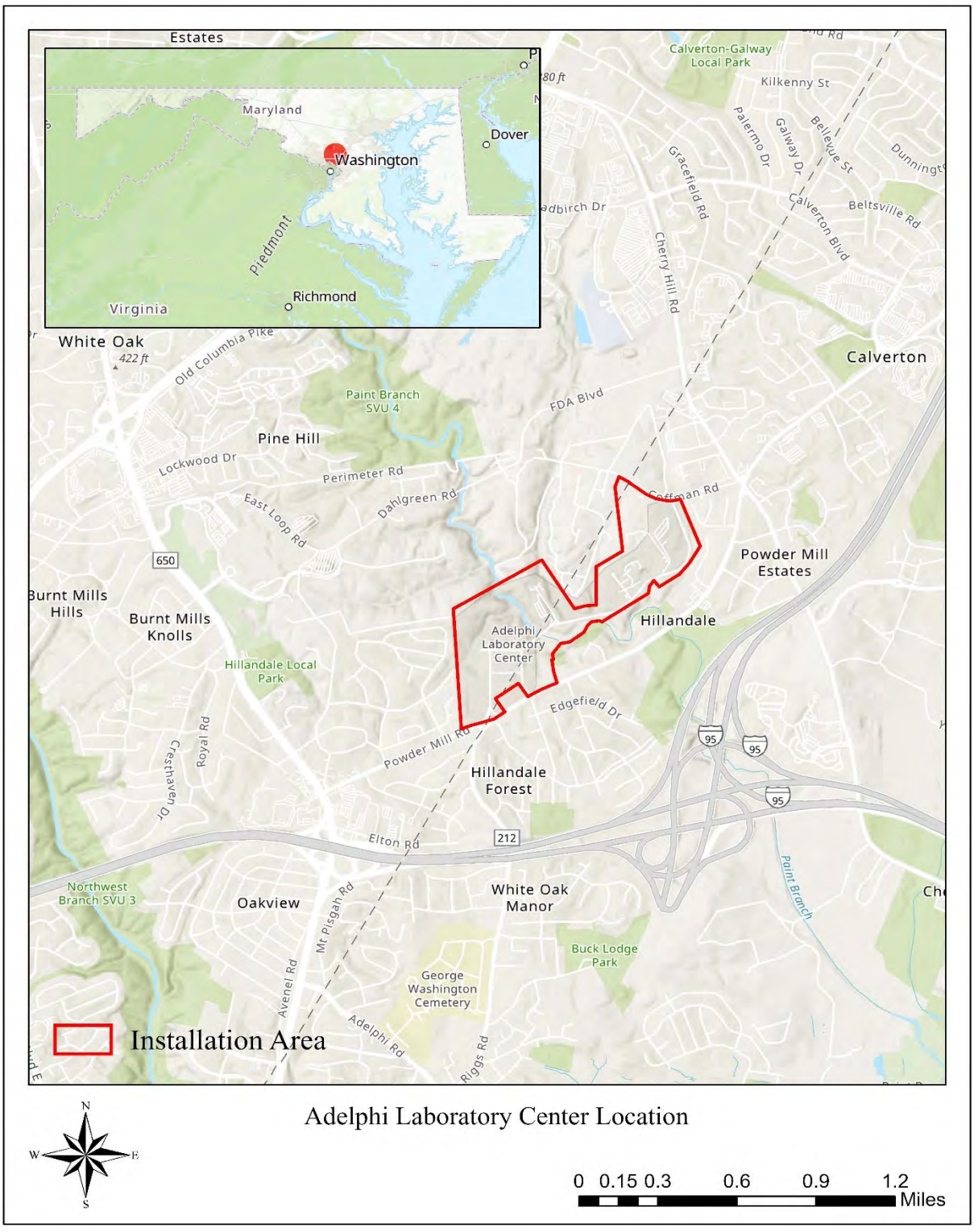
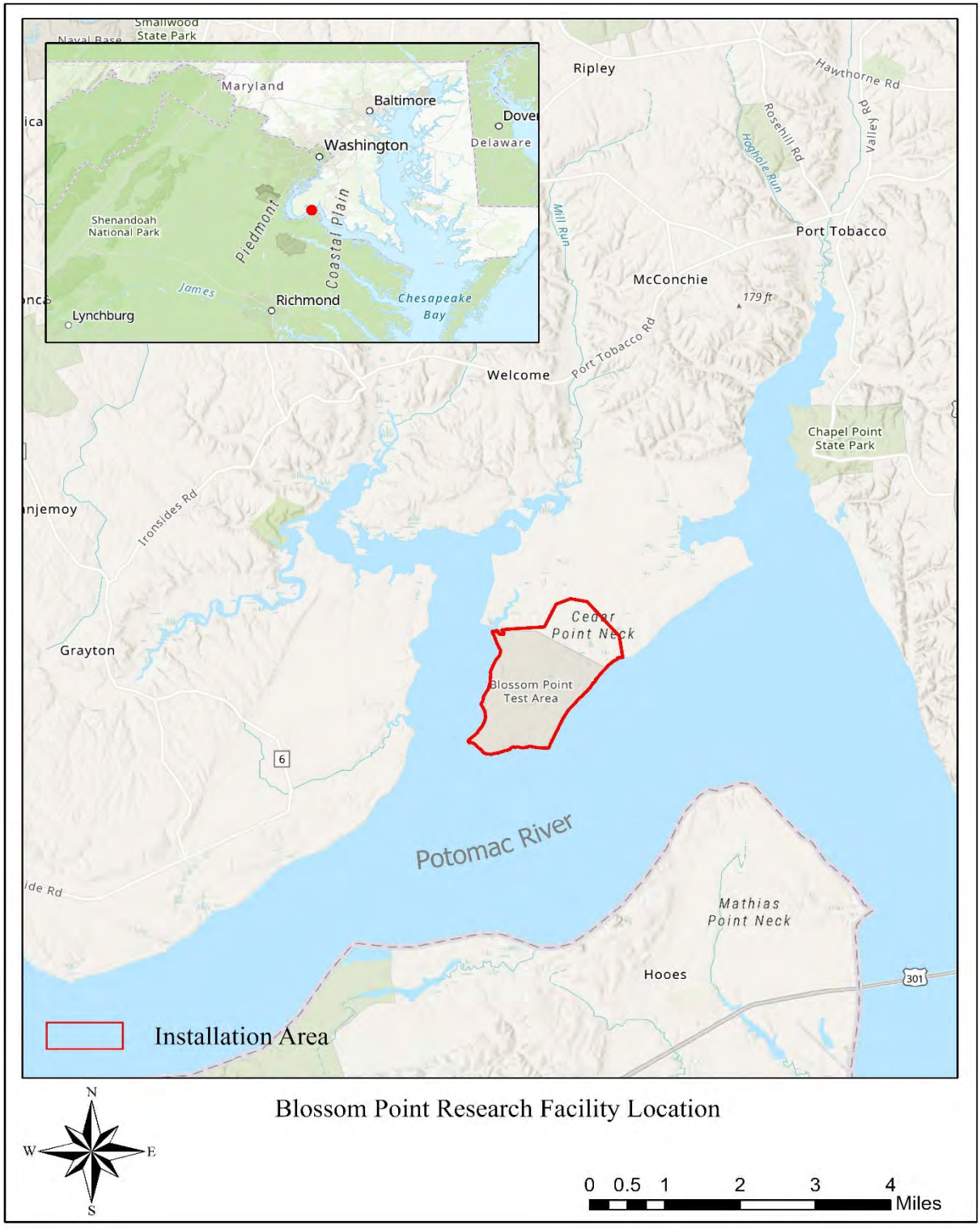


Figure 2-1. Location of ALC



Blossom Point Research Facility Location

Figure 2-2. Location of BPRF

BPRF

BPRF is located on the Cedar Neck Point, a peninsula adjacent to agricultural lands. Charles County is located in southern Maryland between the Patuxent and Potomac Rivers. This county is largely comprised of agricultural lands and forest lands with some residential and urban development. The area surrounding BPRF is presently zoned for a mixture of agricultural and rural residential uses. Most of the land north of the facility has been designated as an "Agricultural Conservation District." The Charles County Comprehensive Master Plan uses this classification to specify property on which only one residential dwelling per every five acres can be placed. This low-density designation is intended to preserve the existing farmland resources and the agricultural economy of the county. The shoreline along Cedar Neck Point, not including the portion on BPRF, is designated as a "Resource Protection District." This land use classification carries restrictions on new development at one residential dwelling per every 20 acres. This area was classified in compliance with the State of Maryland's Chesapeake Bay Critical Area Law.

2.1.3 History and Pre-Military Land Use

ALC

The region that includes ALC has been inhabited since at least 10,000 BC. During the early 17th century, the region was inhabited predominantly by the Algonquin-speaking Piscataway people. During the late 17th century, the Iroquois-speaking Susquehannock predominated in the Chesapeake area. The colony of Maryland was established in 1634 and Prince George's County was established in 1696. Montgomery County was separated from Frederick County in 1776. The ALC area was historically agricultural. As in most of the Chesapeake Tidewater area, tobacco was the most important cash crop and was grown on both large and small plantations. Multiple cropping became more common after the American Revolution, as the soils were depleted of nutrients essential for large-scale tobacco farming.

After the Civil War, the plantations and tobacco-related economy, which had been dependent on slave labor, declined. The area remained largely rural and agricultural into the mid-20th century, with small towns such as Bladensburg and Beltsville serving the agricultural population as localized market and distribution centers. In the late 19th century, a suburban corridor serving the District of Columbia began to develop from the village centers along the railroad line and, later, streetcar lines that ran north and east of the city.

In 1944, the Naval Ordnance Laboratory (later the Naval Surface Warfare Center (NSWC)) was established on a 732-acre (296 ha) site, five miles north of Washington DC. In the early 1970s, ALC was designed and constructed on a 137-acre (55.4 ha) parcel of the original Naval site and the ALC property acquired an adjoining 30-acre (12.1 ha) parcel, referred to as Site W, from the NSWC.

BPRF

Prior to being acquired by the Army, BPRF was owned by the Corporation of Roman Catholic Clergymen of Maryland. In November 1942, the National Bureau of Standards (NBS) leased the southern portion of Cedar Point Neck from the Catholic Church for fuse and ordnance testing. This activity was transferred from the NBS to the Department of the Army (DA) in 1953. In June 1980, the DA bought the land from the Catholic Church.

2.1.4 Military Mission

The mission of APG is to provide test and test support services for authorized customers, within DoD and outside DoD, including government and non-government organizations, domestic and foreign. APG provides comprehensive test and training both real and simulated; provides expert knowledge and technical services including instrumentation application, facility operations, manufacturing and fabrication; exploits emerging technologies; and develops leading edge instrumentation and test methodologies.

ALC

ALC is home to the Headquarters for ARL. ARL provides America's Soldiers a technological edge through scientific research, technology development, and analysis (U.S. Army, 2004). The mission of ARL is to provide the underpinning science, technology, and analysis that enable full-spectrum operations. The Laboratory also provides critical analysis on existing developmental weapon systems, with emphasis on factors such as survivability, lethality, man-machine interface, and battlefield environmental effects. The ARL is unique because it serves as one of the few Army Laboratories that provides highly advanced, specialized, and one-of-a-kind research facilities. The laboratory works in a variety of technical disciplines, through direct in-house laboratory efforts and joint programs with government, industry, and academia.

The mission of ALC is to support innovative science and technology by providing service and infrastructure while optimizing resources, sustaining the environment, and enhancing the well-being of the Army's workforce and community.

BPRF

BPRF is a satellite installation of ALC and serves as a primary test facility for fuses, explosive and pyrotechnic devices, telemetry systems, drones, and lasers. In addition, BPRF tests firing, recovery, and disassembly of explosive-loaded, fused projectiles for rockets, mortars, and cannons. The explosive testing facilities at BPRF are also available to other interested parties. The U.S. Naval Research Laboratory also holds a lease on 291 acres for Project Vanguard, a long-range communications tracking station for satellites.

2.1.5 Operations and Activities

ALC

Most of the operations and activities on ALC occur within buildings and do not impact natural resources. ALC contains a helipad, but it is seldom used.

BPRF

BPRF is used for testing and training activities that include ranges and other open space. These operations and activities are limited to the open areas and meadows and avoid sensitive areas such as forested lands, wetlands, and surface water resources. Unexploded ordnance is a concern at BPRF and munitions of concern can be found on the site, which is being addressed through the Military Munitions Response Program (MMRP).

2.1.6 Constraints Map

ALC

Natural resource constraints on the mission at ALC include wetlands, Paint Branch and Hillandale Run and their respective floodplains, steep slopes, and forested land that provides habitat for forest interior dwelling bird species. Powder Mill Bog (PMB), located south of Floral Drive, potentially supports habitat for two state-endangered species, Long's rush (*Juncus longii*) and capitate beakrush (*Rhynchospora cephalantha*), and any impacts to hydrology or plant species within this bog must be avoided per MDE. MDE enforces a 25-foot buffer on all non-tidal wetlands where any disturbance should be avoided or mitigated. Riparian buffers to protect water quality and brown trout (*Salmo trutta*) habitat may also limit activity within 200-feet of Paint Branch and 150-feet of tributaries to Paint Branch. **Figure 2-3** illustrates these natural resources constraints on ALC. While most of the operations and activities occur within the existing buildings, these constraints do not currently impact the military mission at ALC. However, future development may be constrained by these natural resources.

BPRF

There are several natural resource constraints on the mission at BPRF as much of the facility consists of wetlands, forests, and quality fish and wildlife habitat. There are bald eagle (*Haliaeetus leucocephalus*) nests that are protected under the Federal Bald and Golden Eagle Protection Act. Waterfowl habitat and terrapin and horseshoe crab spawning habitat also exist on this site. Much of the facility is within Maryland's Critical Area. Mission activities must avoid impacts to wetlands and the 100-foot buffer on tidal waters and wetlands; submerged aquatic vegetation; forest habitat for forest interior dwelling bird species; bald eagle nests and habitat; and fish and wildlife habitat. **Figure 2-4** illustrates these natural resource constraints on the mission at BPRF.

2.1.7 Opportunities Map

ALC

Opportunities for mission-related activities on ALC are limited to the existing developed areas and potentially the immature hardwood forested areas. **Figure 2-5** illustrates these opportunity areas at ALC.

BPRF

Opportunities for mission-related activities on BPRF are limited to the existing developed areas and potentially the open fields and meadows outside of the Critical Area. **Figure 2-6** illustrates these opportunity areas at BPRF.

2.2 GENERAL PHYSICAL ENVIRONMENT AND ECOSYSTEMS

2.2.1 Climate

ALC

Summers at ALC are dominated by prevailing winds from the south and southwest which bring warm and humid conditions to the region. Warmest temperatures occur in July with a mean monthly temperature of 76.2 degrees Fahrenheit (°F), or 24.6 degrees Celsius (°C). Cold and dry winds from the northwest dominate the winter months. Coldest temperatures occur in January with a mean monthly average temperature of 33.7 °F (1 °C). The mean annual temperature is approximately 55 °F (13 °C) (NOAA, 2021).

Precipitation events occur evenly throughout the year and bring an average of 44 inches of precipitation to the region. Thunderstorms occur on an average of 30 to 35 days each year; two-thirds of which occur during the months of June, July, and August. The quantity of snowfall in the region varies widely from year to year but averages approximately 19 to 20 inches annually. Normal relative humidity ranges from 50 to 80 percent and typically peaks just before sunrise.

BPRF

Prevailing winds from the south and southwest bring warm and humid conditions to BPRF during the summer months. Warmest temperatures occur in July with a mean monthly temperature of 89 °F, or 32 °C. Cold and dry winds from the northwest dominate the winter months. Coldest temperatures occur in January, with a mean monthly average temperature of 21 °F. The mean annual temperature is approximately 45 °F (HDL, 1983).

Precipitation events occur evenly throughout the year and bring an average of 47 inches of precipitation to the region. Thunderstorms occur, on average, 35 days each year; 70 percent of which occur during the months of May through August. Snowfall varies, but generally averages

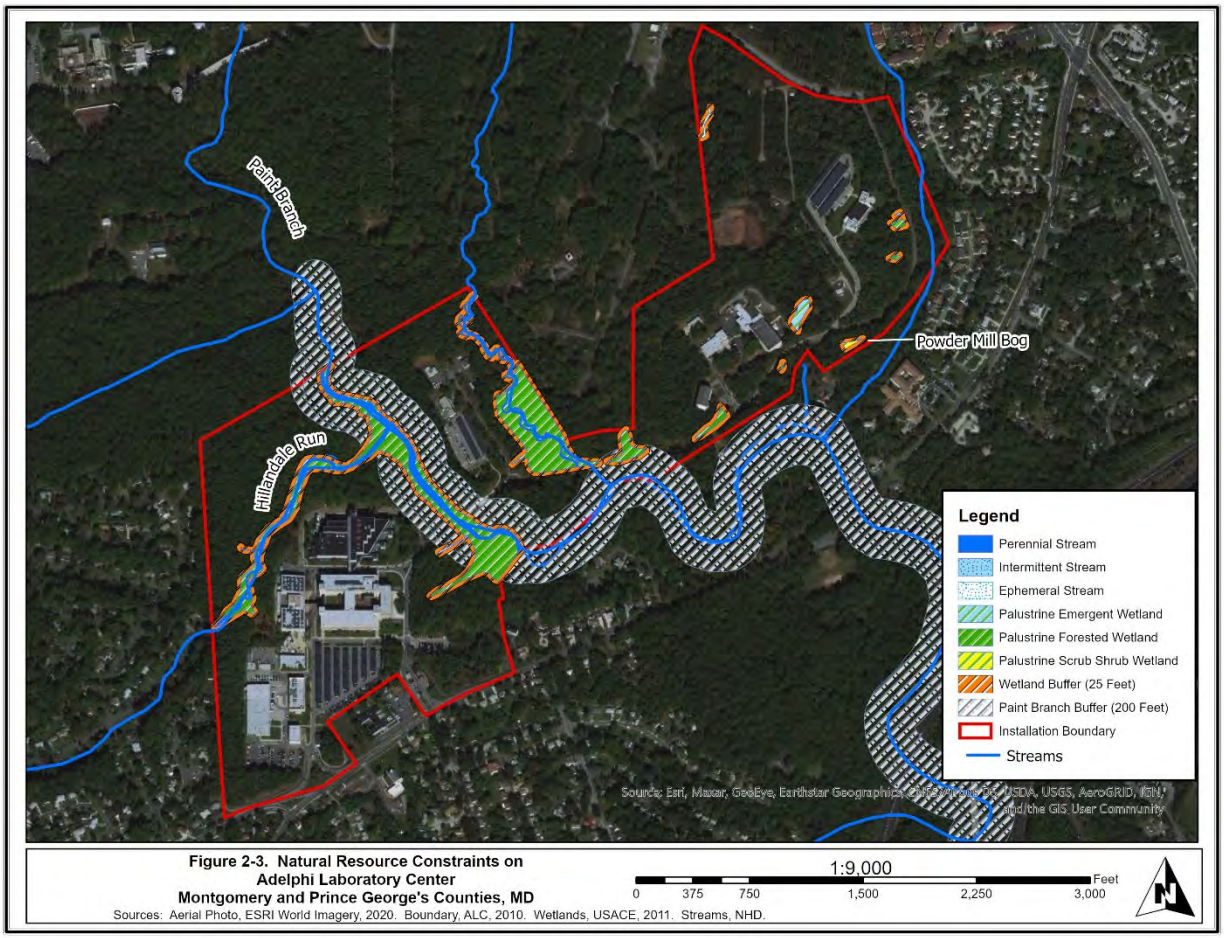


Figure 2-3. Natural Resource Constraints on ALC

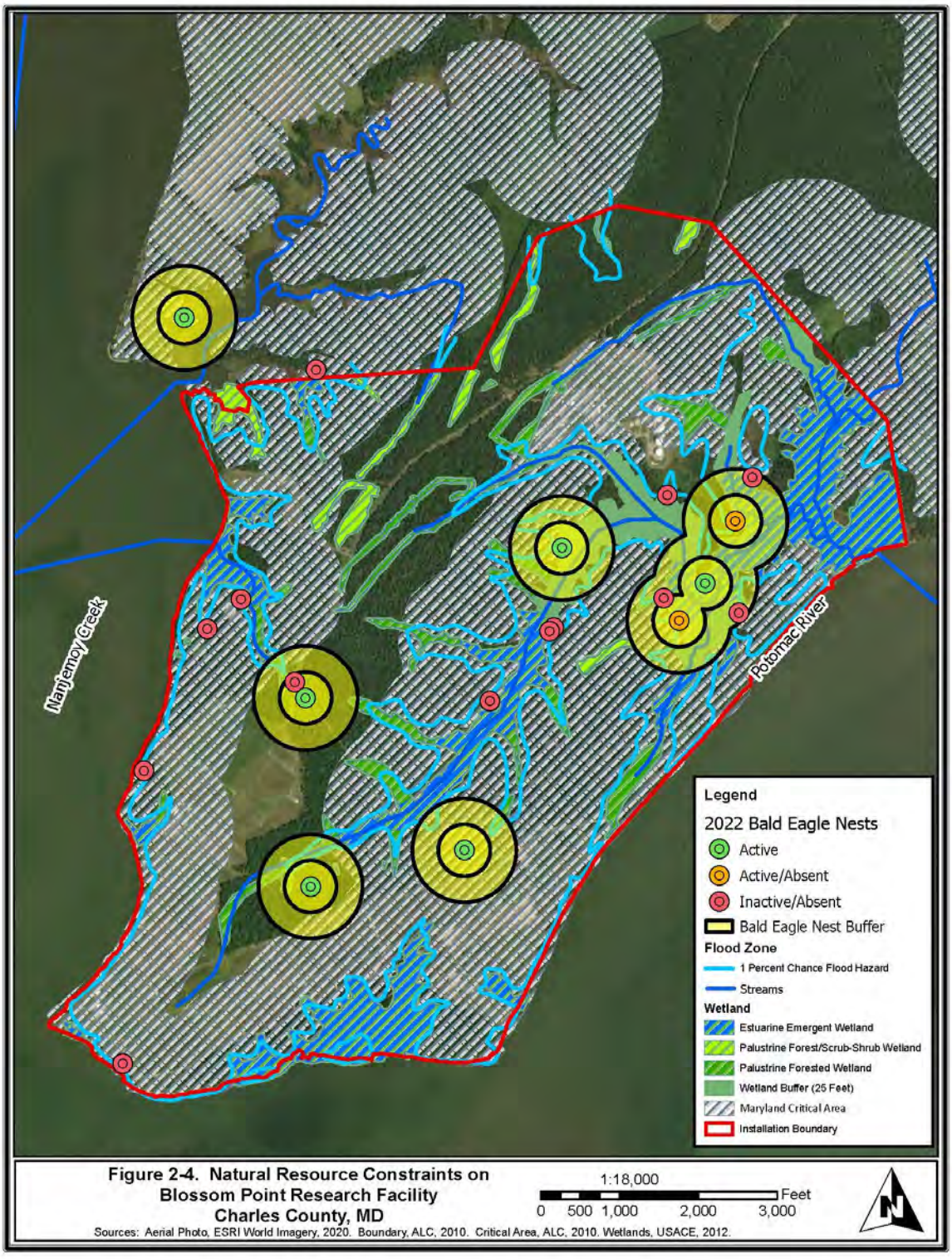


Figure 2-4. Natural Resource Constraints on BPRF
(*note: see Figure2-15 for up to date eagle nest locations*)

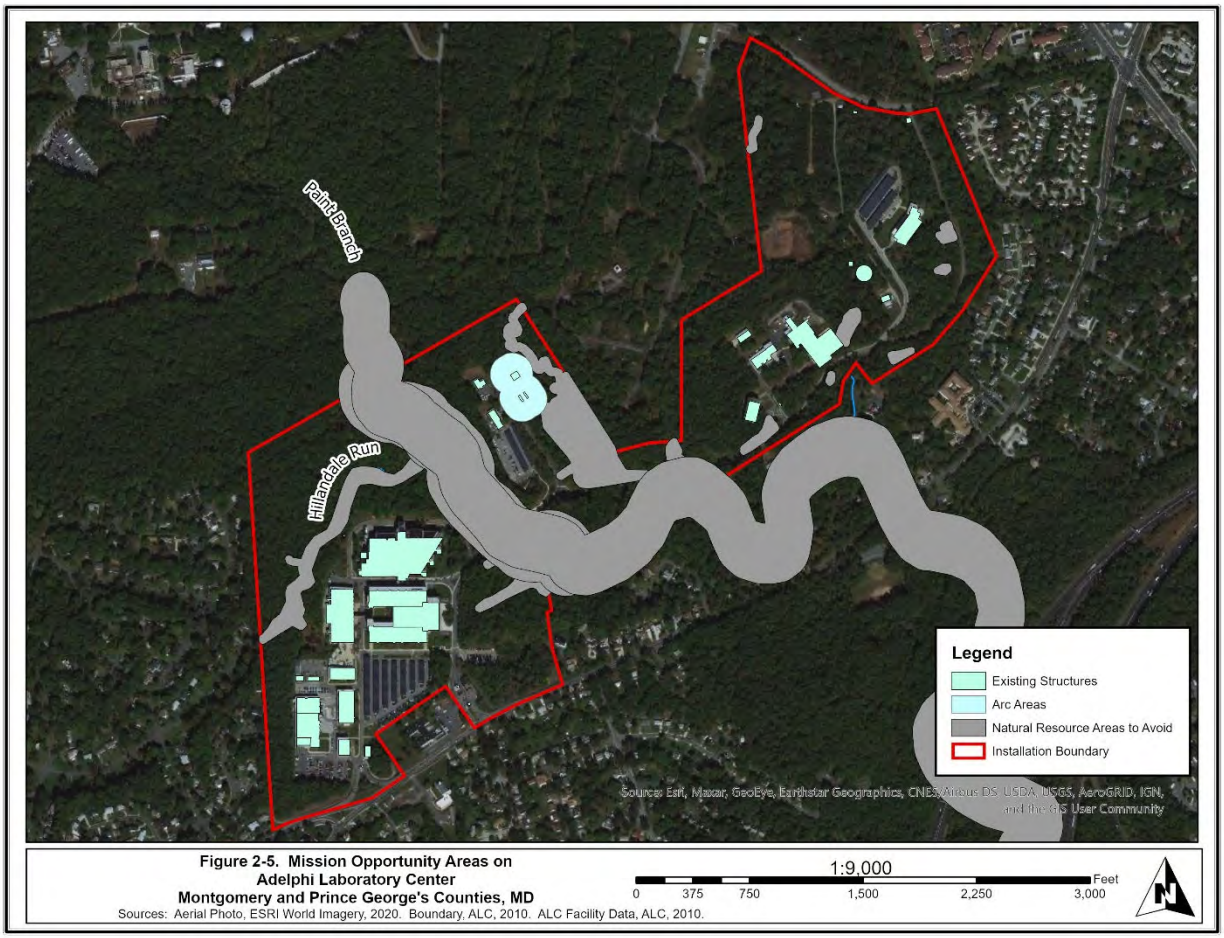


Figure 2-5. Mission Opportunity Areas on ALC



Figure 2-6. Mission Opportunity Areas on BPRF

less than 10 inches annually (ESE, 1981). Normal relative humidity ranges from 50 to 85 percent and typically peaks just before sunrise.

2.2.2 Physiography and Topography

ALC

The terrain of ALC is hilly, with numerous rock outcroppings, sloping generally towards the Paint Branch valley. Elevations range from 138 to 282 feet above mean sea level (MSL). The highest elevations on ALC are found in the 600 Area, reaching 282 feet above MSL and in the northwest and southwest corners of the installation ranging from 274 to 278 feet above MSL. The lowest point on ALC is 138 feet above MSL, at Paint Branch where it flows off the installation at the southern boundary. Slopes found within ALC range from 2 to 40 percent and are steepest along the stream valleys. For further information and mapping, see the Planning Level Survey (PLS) in **Appendix F**.

BPRF

Topography at Blossom Point is characterized by rolling hills with narrow ridge tops and valleys drained by non-tidal and tidal tributaries to Nanjemoy Creek and the Potomac River. Elevations range from MSL along the Potomac River and Nanjemoy Creek to 25 feet above MSL at Upper Cedar Point. In general, the installation is relatively flat with slopes of 2 to 5 percent.

The 4.5-mile shoreline around BPRF has an average bluff height of about 20 feet above MSL. The shoreline, in general, experiences erosive wave action from the Potomac River and is eroding at an average of 1 to 3 feet per year (Wardwell, 2001). Tidal fluctuations are undercutting bluffs causing erosion and slumping which poses a threat to several landfill sites and other structures. There are beaches along the bluff line where sand spits have formed across drowned valleys. Further information about the topography at BPRF can be found in the PLS in **Appendix F and Appendix J**.

2.2.3 Geology and Soils

ALC

ALC lies within the Fall Line region, the geologic transition between the unconsolidated sediments of the Coastal Plain Physiographic Province and the crystalline rocks of the Piedmont Physiographic Province. The Coastal Plain sediments form a wedge-shaped mass, which dips and thickens to the southeast, reaching a thickness of approximately 2,500 to 3,000 feet in southeast Prince George's County. Crystalline rocks of the Piedmont are represented by the Wissahickon Formation, a mica gneiss of Precambian or early Paleozoic age. Saproline commonly occurs in a 16-foot-thick layer atop the Wissahickon, except in areas subject to active erosion. Coastal Plain sediments on ALC are represented by the Potomac Group, which is subdivided into a sand and gravel facies and clay facies, by upland gravel and sand deposits of Tertiary Age, and by Holocene-Aged alluvial deposits along stream channels. The central portion of ALC primarily consists of

rock and saprolite of the Wissahickon Formation while on northwest portion exhibits the sand facies of the Potomac Group. Sediments overlying bedrock at ALC, range from 45 feet thick at higher elevations (e.g., beneath Building 203) to only 8 feet thick near Paint Branch. The saprolite cover is irregular in width and varies in physical composition.

Twenty-three soil types are present at ALC and are presented in **Table 2-1**, below and **Figure 2-7**. The Blocktown channery silt loam, Christiana-Downer complex, and Sassafras-Croom complex cover a majority of the facility. Upland areas have deep, very permeable soils, which are moderately to somewhat excessively well drained, and are subject to severe erosion. Soils on the intermediate elevations and slopes are generally shallower, overlying a dense fragipan, resulting in impeded internal drainage. Soils in the low areas along stream valleys are poorly drained, silty loams.

Outside of the stream corridors, development constraints that occur on the facility are generally slight to moderate and result from steep slopes or perched high water tables. Highly erodible land (HEL) determinations by the Montgomery County and Prince George's County Soil Conservation Districts identified the Croom gravelly (8% slopes or greater), and Manor soils as highly erodible soils.

Table 2-1. Soil Types on ALC

Soil Key	Soil Type	County	Hydric
116E	Blocktown channery silt loam, 25-40% slopes, very rocky	Montgomery	Yes (5% of map unit)
1C	Gaila silt loam, 8-15% slopes	Montgomery	Yes (5% of map unit)
400	Urban land	Montgomery	
54A	Hatboro silt loam, 0-3% slopes, frequently flooded	Montgomery	Yes
59B	Beltsville silt loam, 3-8% slopes	Montgomery	
61B	Croom gravelly loam, 3-8% slopes	Montgomery	
61UB	Croom-Urban land complex, 0-8% slopes	Montgomery	
BaB	Beltsville silt loam, 2-5% slopes	Prince George's	Yes (5% of map unit)
BuB	Beltsville-Urban land complex, 0-5% slopes	Prince George's	Yes (5% of map unit)
ByF	Brinklow-Blockton channery loams, 25-65% slopes	Prince George's	
CaC	Chillum silt loam, 5-10% slopes	Prince George's	

Soil Key	Soil Type	County	Hydric
CaD	Chillum silt loam, 10-15% slopes	Prince George's	
CcC	Christiana-Downer complex, 5-10% slopes	Prince George's	Yes (5% of map unit)
CF	Codorus and Hatboro soils, frequently flooded	Prince George's	Yes (40% of map unit)
CrE	Croom gravelly sandy loam, 15-25% slopes	Prince George's	
CzB	Croom-Urban land complex, 0-5% slopes	Prince George's	
McD	Manor loam, 15-25% slopes	Prince George's	
MfF	Manor-Brinklow complex, 25-65% slopes, very rocky	Prince George's	
RcB	Russett-Christiana complex, 2-5% slopes	Prince George's	Yes (5% of map unit)
ScC	Sassafras-Croom complex, 5-10% slopes	Prince George's	
SnB	Sassafras-Urban land complex, 0-5% slopes	Prince George's	
SnD	Sassafras-Urban land complex, 5-15% slopes	Prince George's	
SOF	Sassafras and Croom soils, 25-40% slopes	Prince George's	Yes (5% of map unit)

BPRF

BPRF is located in the Atlantic Coastal Plain Physiographic Province. The unconsolidated sediments overlie crystalline rock of Precambrian to early Cambrian age. In the area of the installation, approximately 1,300 feet of sediment covers the bedrock. The crystalline basement consists of granite, gabbro, diorite, schist, greenstone, and quartzite. The geologic units encountered from the surface to the bedrock are the Nanjemoy Formation, the Aquia Formation, and the Raritan and Patapsco Formation. The Nanjemoy Formation is present at a depth of 10 to 70 feet below MSL.

The surficial deposits are of both Recent and Pleistocene Age and are derived in large measure from erosion and redeposition of older surfaces to the west and north. Recent deposits are evident in sand bars and beach deposits that now close off earlier eroded drainage areas on the south side of the installation. Late Pleistocene deposits of Talbot Age are found beneath the recent deposits. The older Talbot sediments were laid down as terraces during a period of subsidence. An interval of elevation and erosion intervened during which the existing drainage pattern developed.

Fifteen soil types are present at BPRF, listed in **Table 2-2**, and shown on **Figure 2-8**. The soils are generally poorly to moderately well drained and range in texture from fine sand to silty loams and clay to coarse sands and gravels. Many of these soils types are listed as hydric. The greatest development constraints are associated with the high to moderately high seasonal high water table on BPRF. None of the soil types is classified as HEL by the Charles County Soil Conservation District.

Table 2-2. Soil Types on BPRF

Soil Key	Soil Type	Hydric
AsA	Annemessex silt loam, 0-2% slopes	Yes (15% of map unit)
AsB	Annemessex silt loam, 2-5% slopes	Yes (10% of map unit)
DfA	Dodon fine sandy loam, 0-2% slopes	
DfB	Dodon fine sandy loam, 2-5% slopes	
EkA	Elkton silt loam, 0-2% slopes, frequently ponded	Yes
LQA	Lenni and Quindocqua soils, 0-2% slopes	Yes
LsA	Liverpool silt loam, 0-2% slopes	Yes (5% of map unit)
LsB	Liverpool silt loam, 2-5% slopes	Yes (5% of map unit)
LxD	Liverpool-Piccowaxen complex, 5-15% slopes	
MT	Mispillion and Transquaking soils, tidally flooded	Yes
NG	Nanticoke and Mannington soils, frequently flooded	Yes
PcA	Piccowaxen loam, 0-2% slopes	Yes (10% of map unit)
PcB	Piccowaxen loam, 2-5% slopes	Yes (10% of map unit)
RgB	Reybold loam, gravelly subsoil, 2-5% slopes	
W	Water	Yes

2.3 GENERAL BIOTIC ENVIRONMENT

2.3.1 Threatened and Endangered Species and Species of Concern

2.3.1.1 Special Status Flora and Habitats

ALC

No Federal or state-listed threatened, endangered, or special status flora species were observed on ALC during the PLSs conducted in 2020 or during the 2015 and 2024/2025 Rare, Threatened and Endangered Species Survey (**Appendices F and G**).

In 2002, biologists located the PMB (**Photograph 2-1**), a small Fall-Line Magnolia Bog/Terrace Gravel on ALC. This site is a remnant of a once more widely distributed plant community that has been largely destroyed by drainage or filling for commercial and residential development along the Fall Line in the Maryland and Virginia suburbs of Washington, D.C. Not a true bog, PMB is a groundwater-fed, saturated wetland. Its nutrient poor, gravelly soils support a distinctive plant community that is considered Highly Globally Rare. Fewer than ten Fall Line Terrace Gravel Bogs are known to exist worldwide, and most (including this one) are highly degraded (NatureServe, 2009).



Photograph 2-1. PMB in June 2015

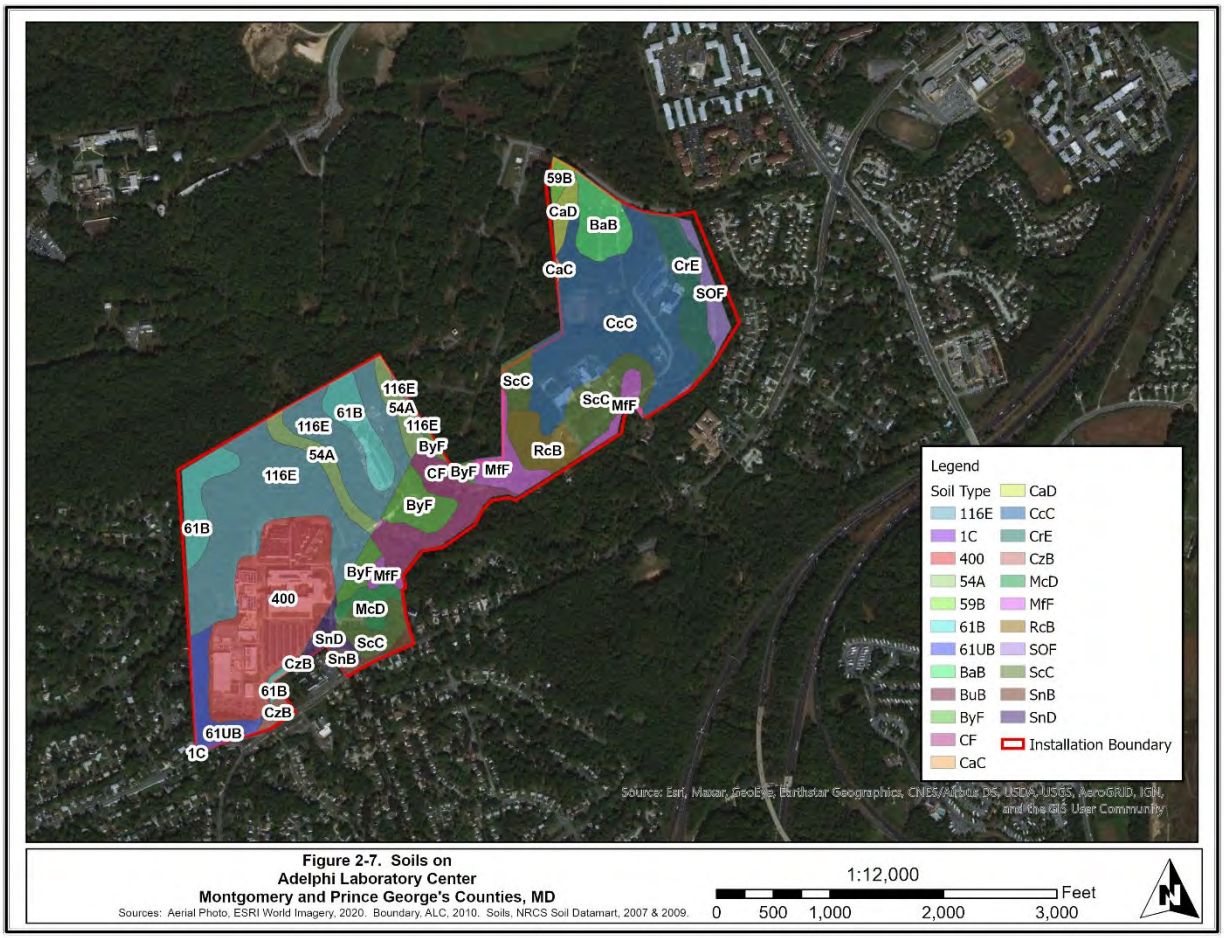


Figure 2-7. Soils on ALC

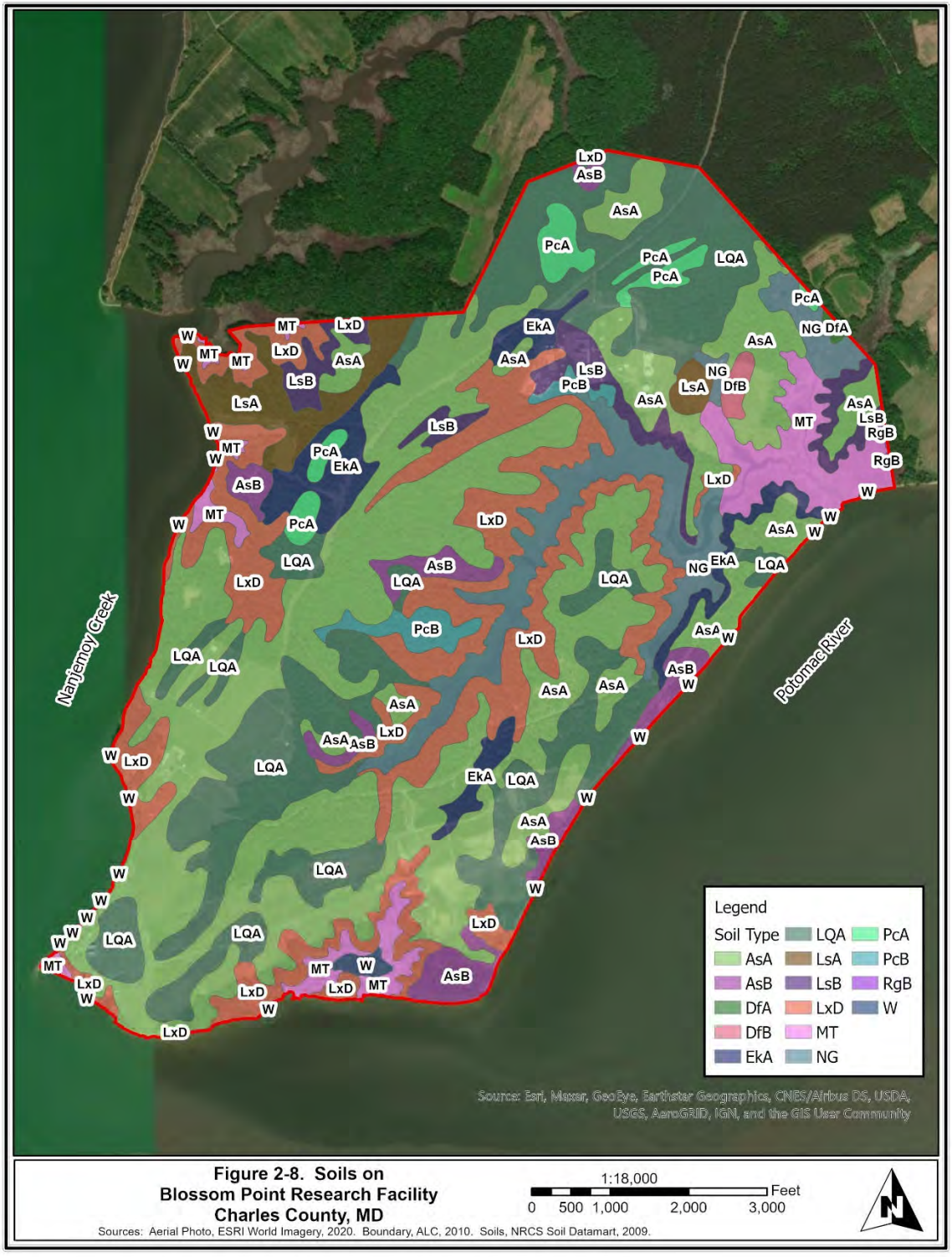


Figure 2-8. Soils on BPRF

Five rare and uncommon plant species were documented at the PMB in 2002 and 2007. **Table 2-3** lists plant species documented by MDNR in 2007 to potentially occur within the PMB. None of these species were observed during the PLSs conducted in June 2015. The area was surveyed again in 2020 and in September 2025, and no rare plant species were observed. Other listed potential plant species can be found in **Table 2-3**.

BPRF

A Threatened and Endangered Species survey was conducted at BPRF in 1999, ~~and~~ 2015, and 2024/2025 and a PLS was conducted in 2020. No Federal or state-listed rare, threatened or endangered floral species were observed during the surveys.

Habitat for the small whorled pogonia (*Isotria medeloides*) exists on BPRF, though this plant is believed to be extirpated from the State of Maryland. The small whorled pogonia habitat is deciduous or deciduous-coniferous forest with light to moderate leaf litter, an open herb layer (occasionally dense ferns), moderate to light shrub layer, and relatively open canopy (Flora of North America, 2002). This plant has not been observed on BPRF. Other listed potential plant species can be found in **Table 2-3**.

Critical habitat for the endangered Chesapeake Bay distinct population segment (DPS) of Atlantic sturgeon (*Acipenser oxyrinchus*) was designated in the Potomac River in 2017. At this time, the mission at BPRF is limited to activities on land and the installation has no jurisdiction on the river.

Table 2-3. Rare, Threatened and Endangered Species and Habitats Potentially Occurring on ALC and BPRF

Scientific Name	Common Name	Status	Location
Flora			
Aeschynomene virginica	Sensitive Joint Vetch	Federally Threatened, State Endangered	ALC (Prince George's County)/ BPRF
Eriocaulon decangulare	Ten-angled Pipewort	G5, S2, State Rare	ALC (PMB)
Juncus longii	Long's Rush	G3Q, S1, State Endangered	ALC (PMB)/BPRF
Pogonia ophioglossoides	Snakemouth Orchid (Rose pogonia)	State Watch List	ALC (PMB)
Rhynchospora cephalantha	Capitate Beakrush	G5, S1, State Endangered	ALC (PMB)
Solidago uliginosa	Bog Goldenrod	State Watch List	ALC (PMB)
Habitats			
Bog and Fen Wetland Complex	Fall-Line Terrace Gravel Bog	State Highly Rare	ALC (Documented)

Scientific Name	Common Name	Status	Location
Fauna			
Acipenser brevirostrum	Shortnose sturgeon	Federally Endangered	BPRF
Acipenser oxyrinchus	Atlantic sturgeon	Federally Endangered (Chesapeake Bay Distinct Population Segment)	BPRF
Alasmidonta heterodon	Dwarf wedge mussel	Endangered, Endangered	BPRF
Ambystoma tigrinum	Eastern tiger salamander	State Endangered	BPRF
Bombus affinis	Rusty Patched Bumble Bee	Federally Endangered	ALC/BPRF
~~*Clemmys guttata*~~	~~Spotted turtle~~	~~Under Federal Review~~	~~ALC/BPRF (Documented on BPRF)~~
Danaus plexippus	Monarch butterfly	~~Candidate Species~~ Proposed Threatened	ALC/BPRF (Documented on ALC)
Elliptio lanceolata	Yellow lance	Federally Threatened	ALC/BPRF
Farancia e. erytrogramma	Rainbow snake	State Endangered	ALC/BPRF
Myotis lucifugus	Little brown bat	Under Federal Review	ALC/BPRF (Documented on ALC & BPRF)
Myotis septentrionalis	Northern long-eared bat	Federally Endangered	ALC/BPRF (Documented on ALC & BPRF)
Myotis sodalis	Indiana bat	Federally Endangered	ALC (Montgomery County)
Perimyotis subflavus	Tricolored bat	Under Federal Review	ALC/BPRF (Documented on ALC & BPRF)
Stygobromus hayi	Hay's Spring amphipod	Federally Endangered	ALC (Montgomery County)
Stygobromus kenki	Kenk's amphipod	Federal Candidate (Resolved Taxon)	ALC (Montgomery County)

(Sources: MDNR 2021; USFWS 2021; NOAA 2021) * updated in 2026~~3~~.

2.3.1.2 Special Status Fauna

ALC

The northern long-eared bat (NLEB) (*Myotis septentrionalis*) was listed as threatened by the USFWS in May 2015. On March 31, 2023, the bat was listed as endangered and was~~. It will be~~ managed ~~in~~ under interim consultation framework until November 2024. The interim consultation provide~~d~~s a streamlined formal section 7 consultation process that provide~~d~~s take authorization for the bat for federal projects that ~~are~~were completed by November 1, 2024, and consistent with the 4(d) rule. On October 23, 2024, the USFWS issued the final guidance and consultation tools for ESA compliance. In September 2022, the tricolored bat (*Perimyotis subflavus)* was proposed to be

listed as endangered. It was expected to be listed in November of 2024, but the listing is still pending. The final consultation tools and guidance for the NLEB can also be used for the tricolored bat.

An acoustic bat survey with focus on the NLEB was conducted at ALC during the summers of 2016, ~~and 2~~2019 and 2024. The NLEB was recorded at one sample site on ALC during the 2016 surveys; ~~however~~however, no NLEB were detected during the 2019 and 2024 surveys. The tricolored bat was detected during all three surveys. See **Appendix G** for a copy of the Bat Survey Reports. ~~There are new bat surveys planned for the summer of 2024 at ALC and BPRF. The status of the tricolored bat is expected to be changed to endangered in the next year~~.

In December 2020, after an extensive status assessment of the monarch butterfly, the USFWS determined that listing the monarch under the Endangered Species Act is warranted but precluded by higher priority listing actions. With this finding, the monarch butterfly became a candidate for listing. ~~The status will be reviewed each year until the USFWS is able to begin developing a proposal to list the monarch.~~

On December 10, 2024, USFWS proposed the monarch be listed as a threatened species. As of March 2026, a listing decision had not been published. The DoD developed a Conservation Strategy in collaboration with USFWS. The strategy and resulting conference opinion provides programmatic guidance for managing the monarch on DoD installations to avoid potential future conflicts. The strategy includes BMPs for mowing, burning and pesticide use in suitable habitats. All military activities require no further action to be in compliance with the strategy. **Appendix G** contains the DoD's 7 (a)(1) Conservation Strategy.

The rusty patched bumble bee (*Bombus affinis*) was listed as endangered by USFWS in January 2017. This bee could occur in the State of Maryland. According to the Environmental Conservation Online Services (ECOS) website, the bee has historically been documented east and west of the D.C. Metro Area. The ALC Environmental Division consulted with the USFWS in April 2017 regarding the rusty patched bumble bee. The USFWS stated that since there were no extant occurrences of the bee in Maryland, no further consultation was required at the time.

Surveys for reptile and amphibian and avian species (**Appendices H and K**) were conducted in 2018 and 2024/2025 at ALC. The Reptile and Amphibian Surveys did not find any Federal or state-listed species. ~~a~~ A total of 49 species were observed at ALC during the Avian Survey. Three species were recorded at ALC which are state-listed as rare, state watchlist, or state watchlist for breeding. This included the sharp-shinned hawk (*Accipiter striatus*) (rare/watchlist for breeding), brown creeper (*Certhia americana*) (state watchlist), and dark-eyed junco (*Junco hyemalis*) (watchlist for breeding).

Additional listed potential species can be found in **Table 2-3.**

BPRF

The herptofaunal survey in 2011 (**Appendix H**) targeted the state-endangered rainbow snake (Benedict, 2011). The rainbow snake (**Photograph 2-2**) is a highly aquatic species, preferring swamps, marshes, and slow-moving streams and can tolerate brackish water. The rainbow snake can also be found on dry land, burrowing in moist soil, muck or a sandy substrate. While habitat exists on BPRF for this species, none were observed during the field survey.

This area of the Potomac River may provide habitat for spawning for the Atlantic sturgeon. The Chesapeake Bay DPS of the Atlantic sturgeon is listed as Endangered under the ESA.

A spotted turtle was photographed on BPRF during the April 2012 field surveys for the BPRF Invasive Species Survey Management Plan and again in 2016. It was observed again in a 2018 survey. The 2012 photograph can be viewed on the last page of the PLS for BPRF in **Appendix F**. ~~The turtle is currently under review by the USFWS to become a listed species .~~ The USFWS removed the spotted turtle as a candidate species in 2025 as the data collected provided the species' population was stable. There is potential for this turtle to occur on ALC as well.

An acoustic bat survey with focus on the NLEB (**Photograph 2-3**) was conducted at BPRF during the summers of 2016, ~~and~~ 2019 and 2024. The NLEB was recorded at one sample site on BPRF during the 2016 surveys; however no NLEB were detected during the 2019 and 2024 surveys. The tricolored bat was detected during all three of these surveys. See **Appendix G** for a copy of the ~~2019~~ Bat Survey Reports.

The rusty patched bumble bee (**Photograph 2-4**) could also potentially occur on BPRF. See the ALC section above for consultation information on the bee.

~~Surveys for reptile and amphibian and avian species (**Appendices H and K**) were conducted in 2018 at BPRF.~~ The 2018 and 2024/2025 Reptile and Amphibian Surveys did not find any Federal or state-listed species.

Surveys for avian species (**Appendices H and K**) were conducted in 2018 at BPRF A total of 94 species were observed at BPRF during the Avian Survey. Eight species were recorded at BPRF which are state-listed as rare, state watchlist, or state watchlist for breeding and/or historically breeding in the state. This included the bald eagle (watchlist), least flycatcher (*Empidonax minimus*) (watchlist), brown creeper (watchlist), red-breasted nuthatch (*Sitta canadensis*) (watchlist for breeding), golden-crowned kinglet (*Regulus satrapa*) (watchlist for breeding), Swainson's thrush (*Catharus ustulatus*) (historically breeding), golden-winged warbler (*Vermivora chrysoptera*) (rare), and dark-eyed junco (watchlist for breeding).

Additional listed potential species can be found in **Table 2-3**.



Photograph 2-2. Rainbow Snake



Photograph 2-3. Northern Long-Eared Bat



Photograph 2-4. Rusty Patched Bumble Bee

2.3.2 Wetlands and Water Resources

2.3.2.1 Wetlands

Wetlands are of critical importance to the protection and maintenance of biological resources, and they provide essential breeding, spawning, nesting, and wintering habitats for many fish, birds, amphibians, and other wildlife species. Wetlands also enhance the quality of surface waters by (1) impeding erosive forces of moving water, (2) trapping waterborne sediment and associated pollutants, (3) maintaining baseflow to surface waters through the gradual release of stored flood waters and groundwater, and (4) providing a natural means of flood control and storm damage protection by absorbing and storing water during high-runoff periods. Wetlands were delineated in 1994 and were rechecked in 2020 in conjunction with the PLSs for the INRMP. There was no jurisdictional determination for the 2020 PLS.

ALC

In 2018 a Wetland Delineation conducted by USACE, Baltimore District, took place at ALC. This survey reduced the acreage of wetlands located on ALC due to the fact that the floodplains associated with the streams on ALC had been previously delineated incorrectly as wetlands.

There are eleven wetlands on ALC, amounting to approximately 2.52 acres (**Figure 2-9**). The previous amount was 10.4 acres. There are scattered small wetlands in the forested areas on the eastern portion of the facility that drain to drainage ditches that eventually flow to Paint Branch.

BPRF

Wetlands are extensive at BPRF (**Figure 2-10**). The 25 wetlands identified on BPRF total approximately 263 acres. Most of these wetlands are estuarine emergent wetlands, palustrine forested, estuarine scrub-shrub and palustrine scrub-shrub wetlands. Dominant wetland vegetation includes common cattail (*Typha latifolia*), sedges (*Carex* spp. and *Cyperus* spp.), and common reed (*Phragmites australis*) (a nonnative and invasive species) in marshes, while high bush blueberry (*Vaccinium corymbosum*), red maple (*Acer rubrum*), American holly (*Ilex opaca*) and sweet gum (*Liquidambar styraciflua*) are dominant in forested wetlands. The estuarine emergent wetlands represent important feeding, resting, and cover areas for migratory and resident birds and waterfowl. A State of Maryland waterfowl management program is currently in place at BPRF. BPRF has several ponds in its tidal marsh areas (**Photograph 2-5**) with water depths less than two feet.



Photograph 2-5. Typical Tidal Wetland on BPRF

Activities on BPRF must also be determined as consistent with the Maryland Tidal Wetland Act, Non-tidal Wetlands Protection Act, and Chesapeake Bay Critical Areas Act. Activities within 25 feet of non-tidal wetlands must be coordinated with the Maryland, Non-tidal Wetlands and Waterways Division. See the PLSs in **Appendix F** for further wetland information.

2.3.2.2 Water Resources

ALC

The dominant hydrologic feature on ALC is Paint Branch (**Figure 2-9**). The stream originates approximately 6 miles north of the installation, cuts in a southeasterly direction through the interior of ALC, and then flows another 4 miles south to its confluence with the Northeast Branch of the

Anacostia River. Ultimately, the Anacostia River empties into the Potomac River, which discharges into the Chesapeake Bay.

Hillandale Run flows east to west across ALC, empties into Paint Branch in the north central portion of the installation. Both streams have predominantly cobble substrates, moderately rapid currents, and well-shaded, undeveloped stream banks (**Photograph 2-6**). Another unnamed tributary of Paint Branch is located primarily outside of the eastern boundary of the installation, more or less parallel to Kuester Road. This stream receives drainage from the 400 Area.

Throughout much of the installation steep side slopes restrict the 100-year floodplain for both tributaries and Paint Branch to their narrow stream valleys. Below their confluence, the floodplain broadens and reaches its widest point, approximately 250 feet, between Floral Drive and the installation's southeastern border.

A stream protective buffer must be maintained adjacent to Paint Branch and its tributaries. The State of Maryland designates these waterways as Class III – Natural Trout Waters. Montgomery County, Maryland guidelines for environmental management of development recommend a minimum buffer width of 200-feet from the stream bank when slope ranges are 25 percent or greater. This 200-foot buffer is applicable to Paint Branch. A 150-foot buffer is to be maintained on the Paint Branch tributaries within the boundaries of ALC.

BPRF

BPRF is located on the north side of the Potomac River at its junction with the Nanjemoy Creek. The Nanjemoy Creek bounds the facility on the west while the Potomac River bounds the facility on the south and east. Several perennial streams and drainage ways dissect the research facility, draining the wetlands and runoff off-site to either the Potomac River or the Nanjemoy Creek. There are truncated ravine heads around the marshland and large shoal areas with weakly developed channels along the shoreline. Freshwater streams generally drain the upstream agricultural lands and become tidally influenced near the Potomac, where the streams are then classified as estuarine. Much of the boundaries of BPRF are shoreline. **Figure 2-10** illustrates the many streams and channels across BPRF.

2.3.2.3 Floodplains

ALC

The 100-year flood elevation at ALC is approximately 155 feet above mean sea level along Paint Branch (**Figure 2-11**). Throughout much of the installation steep side slopes restrict the 100-year floodplain for Paint Branch and both tributaries to their narrow stream valleys. Below their confluence, the floodplain broadens and reaches its widest point, approximately 250 feet, between Floral Drive and the installations' southeastern boarder. This floodplain, which occupies approximately eight acres of land, is generally within the protective stream buffers.



Photograph 2-6 Typical Stream Condition on ALC

BPRF

The high tide elevation is 1-foot above MSL. The average tidal variation is 20 to 40 inches daily. The 100-year tidal flood elevation, established by USACE, Baltimore District, is nine feet above MSL (**Figure 2-12**). The facility is subject to tidal flooding. Approximately one third of the installation is located within the 100-year floodplain.

2.3.2.4 Coastal Zone Management Resources

ALC and BPRF both are within the Maryland Coastal Management Zone, which is designated by county (**Figure 2-13**). ALC is located partly within Prince George's County, which is a coastal zone county. Paint Branch is a major water resource on ALC that contributes to the Chesapeake Bay. Activities that impact the water quality of Paint Branch can also impact the health of the Chesapeake Bay. BPRF is located within Charles County and is bordered by the Potomac River, a main tributary to the Chesapeake Bay. Activities on BPRF can directly impact the health of the Chesapeake Bay, thus appropriate management strategies that can protect and enhance the coastal zone are included in this INRMP.

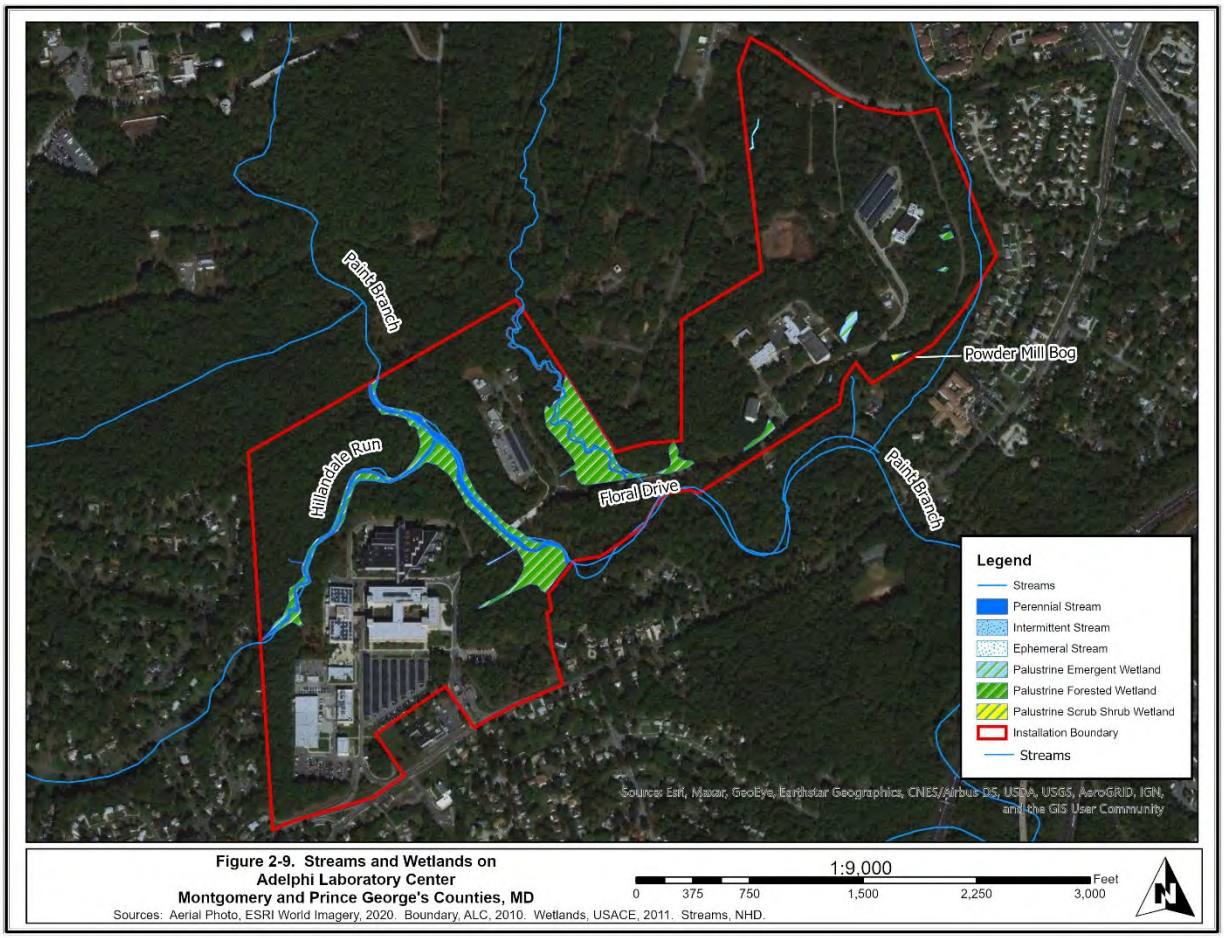


Figure 2-9. Streams and Wetlands on ALC

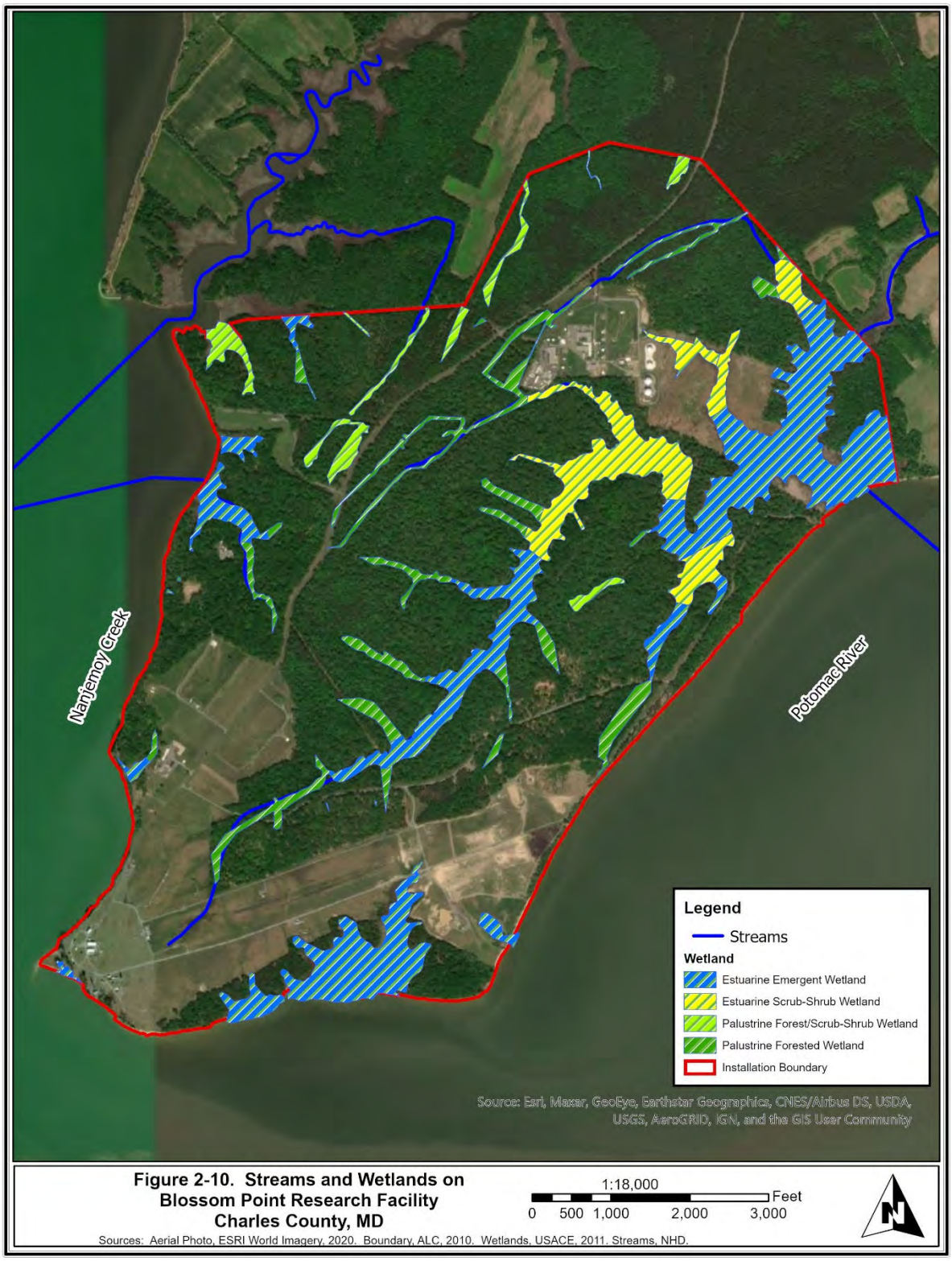


Figure 2-10. Streams and Wetlands on BPRF

BPRF is also within the Chesapeake Bay Critical Area (**Figure 2-14**). The Critical Area includes all land within 1,000 feet of Maryland's tidal waters and tidal wetlands, as well as the waters of the Chesapeake Bay, the Atlantic Coastal Bays, their tidal tributaries and the lands underneath these tidal areas. There are many streams and wetlands on BPRF that contribute to the quality of the Chesapeake Bay. The Critical Area Buffer is the land area immediately adjacent to tidal waters, tidal wetlands, and tributary streams. The minimum Buffer width is 100-feet; however, on some properties it may be wider because of steep slopes, wetlands, or sensitive soils. The Buffer serves as an important protective area for aquatic resources and shoreline habitat. The Buffer is subject to much stricter requirements than the rest of the Critical Area because it is essential to water quality improvement and fish, wildlife, and plant habitat enhancement. A fully forested Buffer is the best environment for filtering pollutants and removing sediment, nutrients, and toxic substances that run off the land and pollute Maryland's waterways. A naturally vegetated Buffer also provides the most functional habitat for wildlife, providing food, cover, and nesting areas. Vegetation along the shoreline is also essential to maintaining the intertidal zone, which is important to a variety of fish, shellfish, crabs, and birds. The Buffer also functions as an important physical barrier between human activity and development-related disturbance and Maryland's streams, creeks, rivers, and bays.

2.3.3 Fauna

ALC

A PLS for fauna was conducted at ALC from 22-24 June 2020. The large tract of contiguous forest provides good habitat for fauna species, especially Forest Interior Dwelling Bird Species (FIDS). Common mammals that were observed during the 2020 survey and previous surveys include white-tailed deer (*Odocoileus virginianus*) and common raccoon (*Procyon lotor*). The floodplains and streams on ALC provide habitat for reptiles and amphibians including bullfrogs (*Rana catesbeiana*), eastern American toad (*Anaxyrus americanus americanus*), and eastern box turtle (*Terrapene carolina*), which were observed during the 2020 survey. Bird species observed during the 2020 survey include American robin (*Turdus migratorius*), great blue heron (*Ardea herodias*), mourning dove (*Zenaida macroura*), turkey vulture (*Cathartes aura*), Cooper's hawk (*Accipiter cooperii*) and red-winged blackbird (*Agelaius phoeniceus*). During the 2020 survey a nesting Cooper's hawk with two young fledglings was observed near Wetland 3.

Thirteen species of amphibians and reptiles were observed on ALC during the 2018 survey, including two species of salamander, five species of frogs and toads, two turtle species, three snake species and one species of lizard (**Photographs 2-7, 2-8 and 2-9**). During the survey that took place in 2024/2025, four new species were observed. There were five species that were observed in 2018 that were not recorded in the new survey. It is possible this was due to drought conditions during this time. More details can be found in **Appendix H**).

A total of 49 species of birds were observed at ALC during the 2018 Avian Survey (**Appendix K**). Nine species recorded at ALC are listed as FIDS and include the red-shouldered hawk (*Buteo lineatus*), hairy woodpecker (*Leuconotopicus villosus*), Acadian flycatcher (*Empidonax virescens*), brown creeper, wood thrush (*Hylocichla mustelina*), red-eyed vireo (*Vireo olivaceus*),

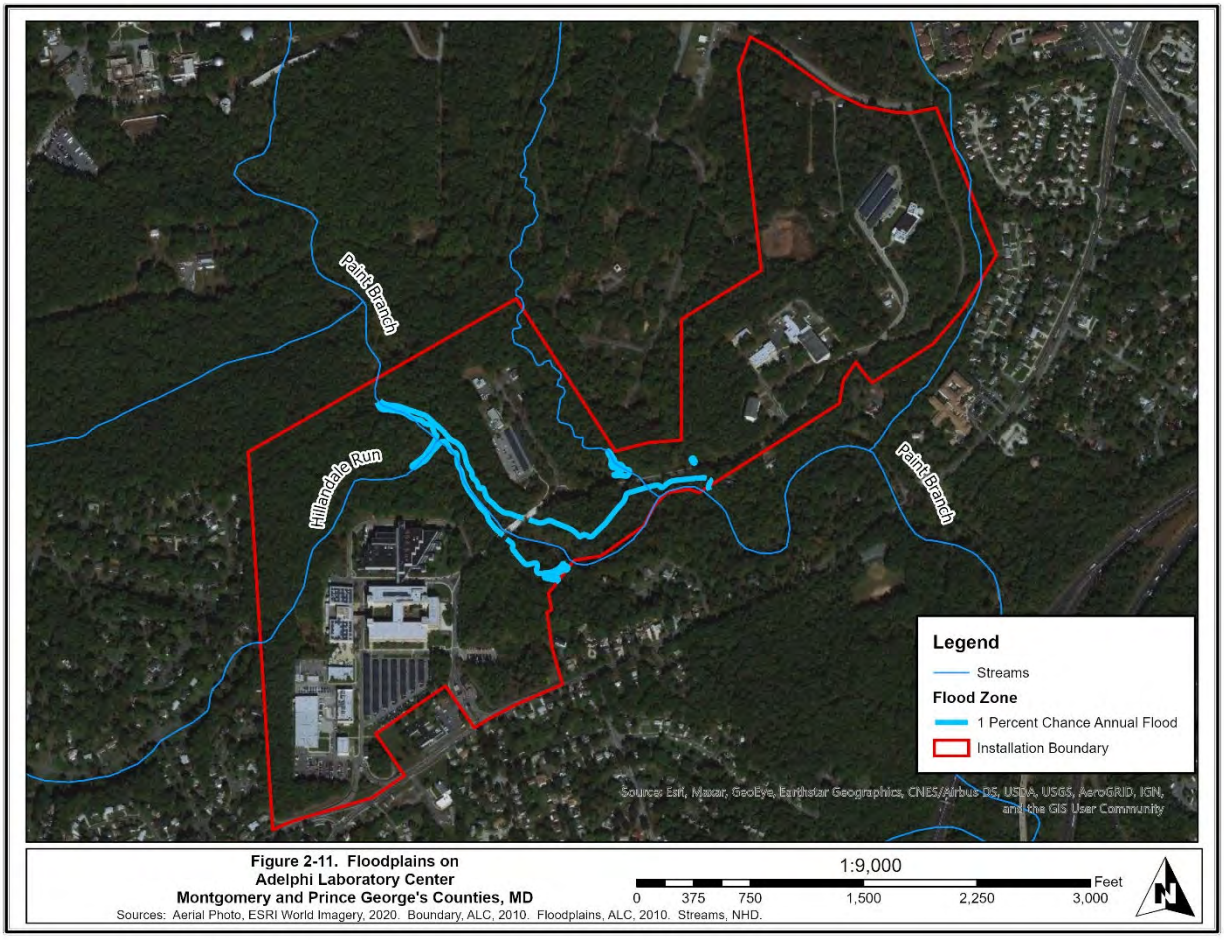


Figure 2-11. Floodplains on ALC

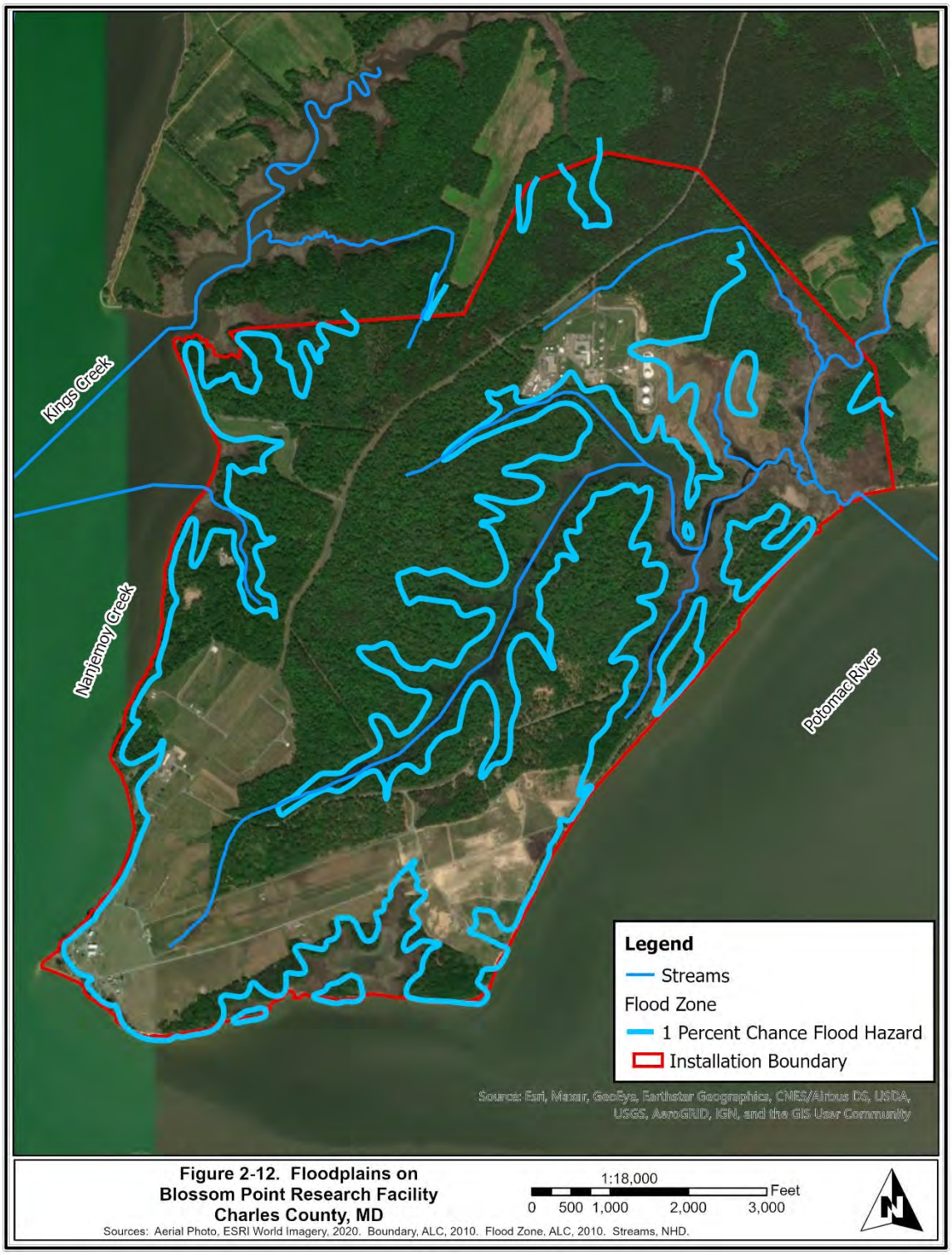


Figure 2-12. Floodplains on BPRF

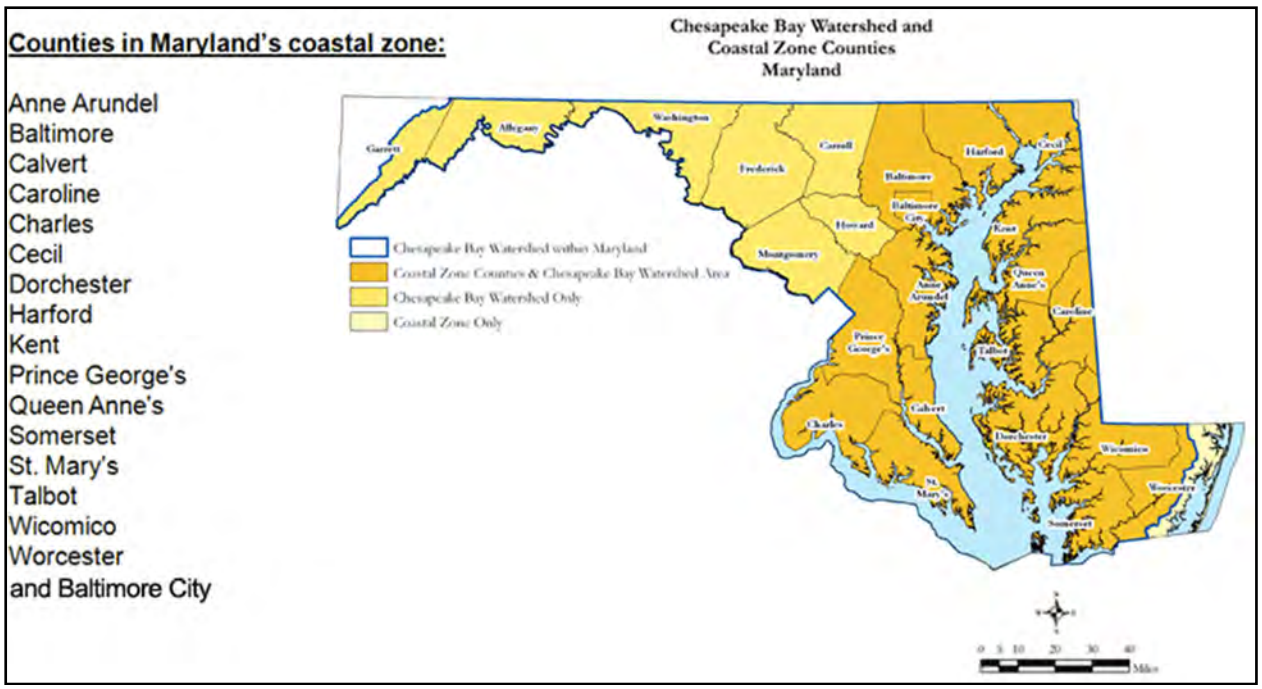


Figure 2-13. Maryland Coastal Zone Management Area

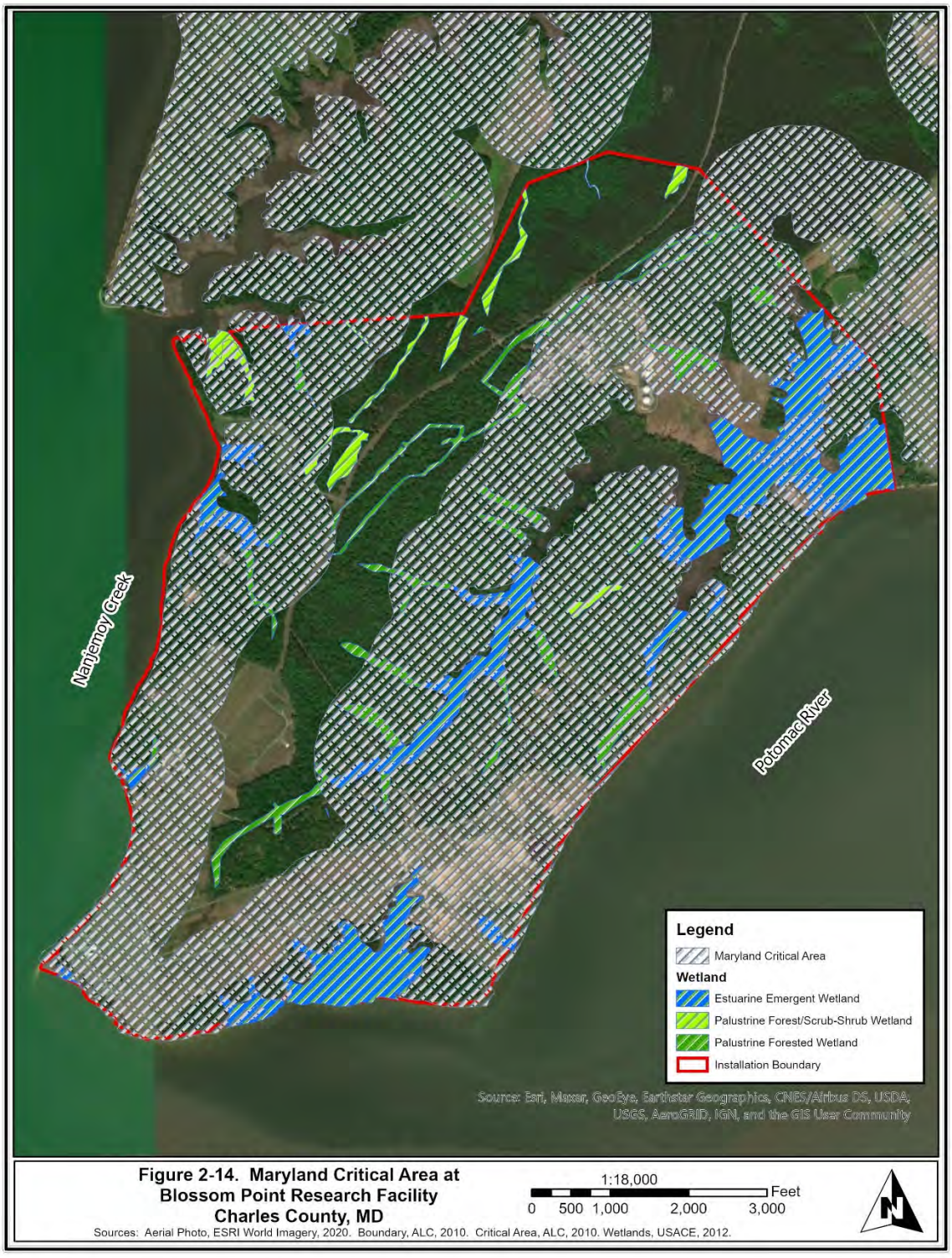


Figure 2-14. Maryland Critical Area at BPRF

northern parula (*Setophaga americana*), Louisiana waterthrush (*Parkesia motacilla*), and scarlet tanager (*Piranga olivacea*). See the PLSs in **Appendix F** for further information.

Spawning areas for brown trout, an important sport fish, are found upstream of ALC in the upper part of Paint Branch (the area upstream of Fairland Road). The Montgomery County Council has designated this area as a Special Protection Area based on its trout spawning capability, high water quality, and the threat posed by the intensity of existing and future development in the watershed.

In 2019, USACE, Baltimore District, delivered the Stream Assessment for Paint Branch and its Associated Tributaries Report. The study assessed the physical, biological and water quality health of Paint Branch and its tributaries on ALC to identify and document fish and macroinvertebrate populations, impaired stream conditions and potential pollution sources. The field work conducted for this project occurred in the fall of 2016 and the spring of 2017. The results of the ALC invertebrate and fish sampling conducted as part of this stream assessment indicated a community typical of an urban stream in this area of Maryland, with midges and snails being the most common invertebrate species, and blacknose dace (*Rhinichthys atratulus*), rosyside dace (*Clinostomus funduloides*), American eel (*Anguilla rostrate*), common shiner (*Luxilus cornutus*) and northern hog sucker (*Hypentelium nigricans*) among the most common fish species.



Photograph 2-7. American Toad Observed on ALC During June 2015 Survey





Photographs 2-8 and 2-9. Box Turtle and Eastern Smooth Earth Snake Observed on ALC During June 2015 Survey

This assessment of Paint Branch was conducted again in 2024. The species and water quality portion of the report was delivered in February 2025. The results of the invertebrate and fish sampling conducted indicated a community typical of an urban stream in this area of Maryland, with midges, snails and caddisfly (*Cheumatopsyche*) being the most common invertebrate species, and blacknose dace (*Rhinichthys atratulus*), rosyside dace (*Clinostomus funduloides*), American eel (*Anguilla rostrate*) and redbreast sunfish (*Lepomis auratus)* among the most common fish species.

BPRF

The installation is suitable for many species of wildlife because of the diversity of habitats. Approximately 9,000 feet of 7-foot chain link fencing has been installed from the road to the water's edge (Port Tobacco Creek and Nanjemoy Creek) on each side of the road.

A PLS for fauna was conducted at BPRF from 4-7 and 19-21 August 2020. The most common game species is the white-tailed deer. Other wildlife includes gray squirrel (*Sciurus carolinensis*), eastern cottontail (*Sylvilagus floridanus*), woodchuck (*Marmota monax*), bobwhite (*Colinus virginianus*), mourning dove (*Zenaida macroura*), black duck (*Anas rubripes*), and wood duck (*Aix sponsa*). Fur bearing species include opossum (*Didelphis virginiana*), mink (*Neovison vison*), muskrat (*Ondatra zibethicus*), striped skunk (*Mephitis mephitis*), beaver (*Castor canadensis*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*) and gray fox (*Urocyon cinereoargenteus*).

Twenty-five species of amphibians and reptiles were observed on BPRF during the 2018 survey, including three species of salamander (**Photograph 2-10**), one species of newt, eight species of frogs and toads, four turtle species, six snake species and three species of lizard. The surveys in 2024/2025 (**Appendix H**) found three new species but nine species observed in 2018 were not recorded. As previously stated, this could have been due to the drought conditions during the field work.

A total of 94 species were observed at BPRF during the 2018 Avian survey (**Appendix K**). Sixteen species recorded at BPRF are listed as FIDS and include the red-shouldered hawk, barred owl (*Strix varia*), hairy woodpecker, pileated woodpecker (*Dryocopus pileatus*), Acadian flycatcher, brown creeper, wood thrush, yellow-throated vireo (*Vireo flavifrons*), red-eyed vireo, northern parula, black-throated green warbler (*Setophaga virens*), black and white warbler (*Mniotilta varia*),



Photograph 2-10. Spotted Salamander Observed on BPRF During 2018 Survey

American redstart (*Setophaga ruticilla*), prothonotary warbler (*Protonotaria citrea*), ovenbird (*Seiurus aurocapilla*), and scarlet tanager.

See the PLSs in **Appendix F** for further information.

Bald eagles are known to nest at BPRF, which are protected under the Federal Bald and Golden Eagle Protection Act. In July 2007, the bald eagle was removed from the Federal List of

Endangered and Threatened Species. Bald eagles will continue to be protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act (MBTA).

A fly over survey and a ground survey were conducted in May 2013 by the Center for Conservation Biology to locate bald eagle nests and assess activity. In addition to the nine known nests, three additional nests were located. Of the active nests, chicks could be observed in three of them from the aerial survey. In 2014, there were four active nests (Center for Conservation Biology, 2013-2016).

Aerial surveys of the bald eagle nests were conducted again on 22 March and 26 April 2015 using a low flying aircraft. There were five active bald eagle nests and a total of seven chicks. In 2016, the aerial surveys were conducted on 6 March and 10 April 2016. There were four active nests and four chicks that were verified. One nest contained chicks, but the surveyors were unable to determine how many chicks were present. In 2017, there were four active nests with three confirmed nests. Two nests were brooding at the time of the last survey, so the biologists were unable to confirm the number of chicks present (Center for Conservation Biology, 2013-2017). In 2018, surveys were conducted in March and April. There were three active nests with chicks present. Three chicks were confirmed in April, and one nest was still brooding, so the total number of chicks was not confirmed. In 2019, the March survey found three active nests with one nest from 2018 moved to a new location on BPRF. In 2022, five nests were observed with each nest containing two chicks.

In 2023, there were four active nests observed with one nest failure. Two of the nests that were successful had two chicks each and the other nest had three chicks. In 2024, there were six active nests and three of those failed. Two had been damaged from a weather event. Of the three nests that were successful, there was one nest with three chicks, another with two chicks and the third nest had chicks but the number couldn't be counted.

The 2025 surveys had similar results from 2024 in that there were six nests but only three were successful and the successful nests were adjacent to the testing ranges. One nest had been absent from weather damage. The successful nests had two chicks each.

Nest 12 was removed in 2016 as part of a tree clearing project near the area leased by the Navy for line of sight for satellite tracking. Pursuant to the permit under which the Nest 12 was removed, nest monitoring was conducted at BPRF for the period 2016-2019 by the Navy, with reporting to the USFWS. There was no monitoring in 2020 due to the disruptions and restrictions resulting from the COVID-19 pandemic. Nest monitoring was cancelled in 2021 due to budget restrictions, was conducted again through a new partnership with the Naval Facilities Engineering Systems Command (NAVFAC) starting in 2022. The locations of the current eagle nests are shown on **Figure 2-15**. The Bald Eagle Management Plan can be found in **Appendix L**. It was updated with the Army Environmental Command (AEC) in 2016.

There are several platforms for osprey (*Pandion haliaetus*) nesting that are maintained by BRPF staff. BPRF also provides suitable FIDS habitat. The waterfront adjacent to BPRF represents a suitable waterfowl concentration and staging area.

In 2024, a Beaver Survey and Management Plan was completed to see if beaver activity was the cause of flooding on some of the roads at BPRF. The survey found the culvert size was the cause of the flooding and not the beaver activity. A copy of the report can be found in **Appendix H**.

The beaches bordering BPRF provide likely terrapin (*Malaclemys terrapin*) and horseshoe crab (*Limulus polyphemus*) spawning habitat, and the waters bordering BPRF, specifically the Potomac River, are likely to provide habitat for anadromous fish, striped bass (*Morone saxatilis*) and largemouth bass (*Micropterus salmoides*). Natural oyster bars are also near the property, typically found a short distance downstream within the mainstem of the ~~River~~ river.

The MDNR conducts fin fish surveys three times each year. The most common species observed from 2003 to 2017 was Atlantic silverside (*Menidia menidia*) and white perch (*Morone americana*).



Photograph 2-11. Juvenile Mink Observed on BPRF in 2025

2.3.4 Flora

ALC

Vegetation at ALC is a mix of oak-hickory-pine forest and Appalachian oak forest. A PLS for flora was conducted at ALC from 22-24 June 2020. The majority of the installation is forested

with urban, developed land and mowed, maintained lawns. Tree species found on the installation include the following:

- Oak – Hickory – Pine Forest:
    - Dominant Species – hickories (*Carya* spp.), loblolly pine (*Pinus taeda*), and white (*Quercus alba*) and post oaks (*Quercus stellata*)

    - Subdominant Species – black gum (*Nyssa sylvatica*), tulip poplar (*Liriodendron tulipifera*), sweetgum (*Liquidambar styraciflua*), persimmon (*Diospyros virginiana*), flowering dogwood (*Cornus florida*), sourwood (*Oxydendrum arboreum*), Virginia pine (*Pinus virginiana*) and a variety of oak species

- Appalachian Oak Forest:
    - Dominant Species – white and northern red oaks (*Quercus rubra*)

    - Subdominant Species – red (*Acer rubrum*) and sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), hickories, tulip poplar, sweetgum, American beech species (*Fagus grandifolia*), and several oak species (*Quercus* spp.)

A stream buffer, discussed in **Section 2.3.2.2**, consists of the forested areas along Paint Branch and its tributaries, which is maintained to protect water resources and habitat. Further information about the floral resources observed at ALC is located in the PLSs in **Appendix F**.

BPRF

Before being cleared for development and agriculture, BPRF was originally classified as an oak-hickory-pine forest. Medium to tall forestland of broadleaf deciduous and needleaf evergreen trees were characteristic of the area. Currently, vegetation types within the installation include maintained lawn, forestland, flat, grassy land, forested and shrub wetlands and tidal marsh. Tree cover consists of natural stands of mixed maples, oaks, black locust (*Robinia pseudoacacia*), black walnut (*Juglans nigra*), sweetgum, blackgum (*Nyssa sylvatica*), ash (*Fraxinus* spp.), willow (*Salix* spp.), tulip poplar (*Liriodendron tulipifera*), Virginia pine, red cedar (*Juniperus virginiana*), and American holly. There are scattered sumac (*Rhus* sp.), tulip poplar, and sycamore (*Platanus occidentalis*) along the streams and swamps. Shrubs and small trees include elderberry (*Sambucus canadensis*), bayberry (*Myrica heterophylla*), autumn-olive (*Elaeagnus* sp.), dogwood (*Cornus florida*.), sweetbay (*Magnolia virginiana*s), and redbud (*Cercis canadensis*). PLSs were conducted from 4-7 and 19-21 August 2020; see the PLSs (**Appendix F**) and the Forest Management Plan (**Appendix M**) for further information.

Range management practices have changed over the years. Ranges were once fully cleared. Current practices allow ranges to revert to grassy vegetation. Appropriate areas are maintained and cleared as firebreaks. Firebreaks, at least 50-feet wide, are required around each aboveground magazine.

In addition to terrestrial vegetation, submerged aquatic vegetation (SAV) has been historically located adjacent to BPRF. SAV is important in providing erosion control, water quality benefits, fish habitat, and is also an important source of primary production.

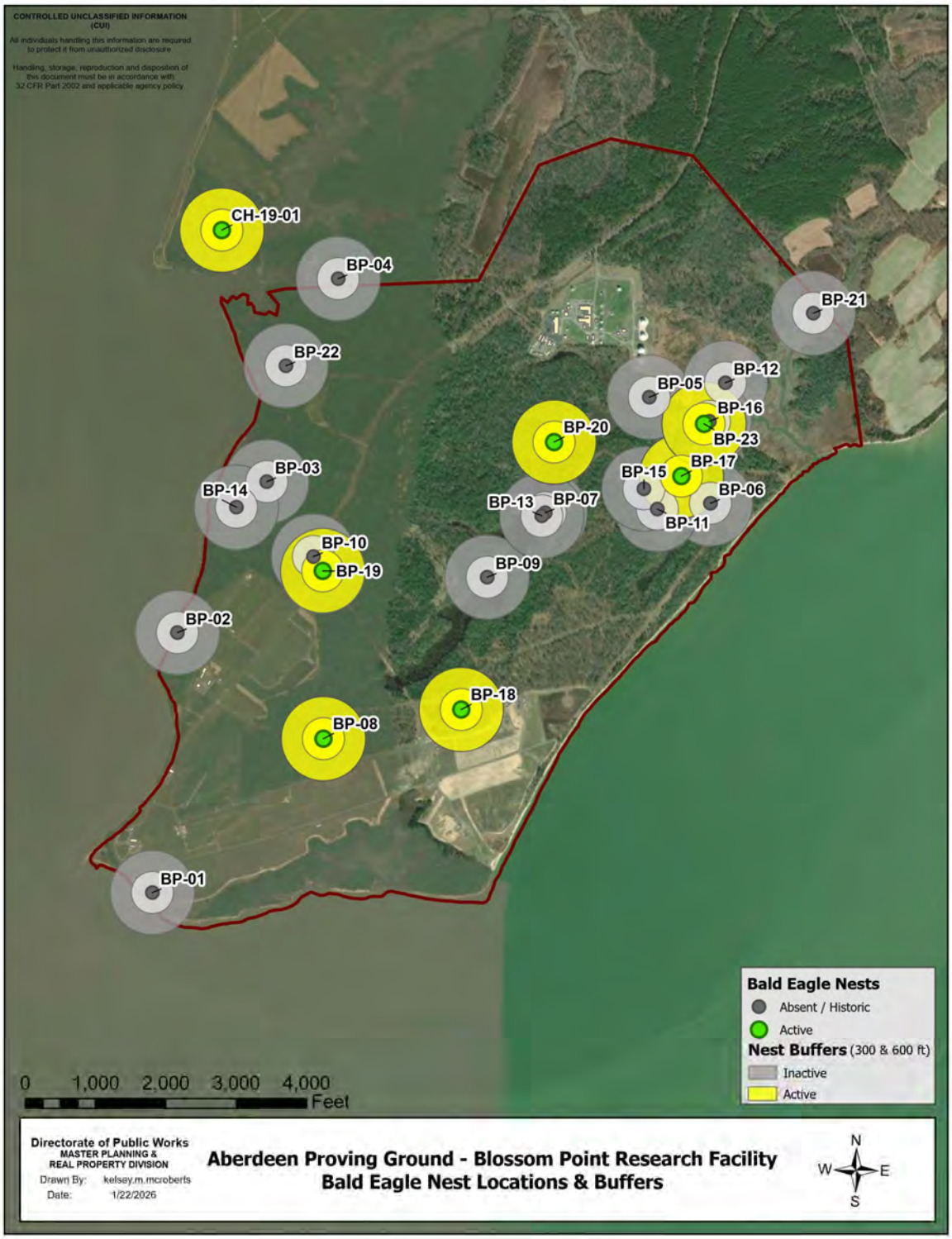


Figure 2-15. Bald Eagle Nests on BPRF

3.0 ENVIRONMENTAL MANAGEMENT STRATEGY AND MISSION SUSTAINABILITY

3.1 SUPPORTING SUSTAINABILITY OF THE MILITARY MISSION AND THE NATURAL ENVIRONMENT

The U.S. Army defines a sustainable Army as simultaneously meeting current as well as future mission requirements worldwide, safeguarding human health, improving the quality of life, and enhancing the natural environment. The Army Strategy for the Environment transitions the Army's compliance-based environmental program to a mission-oriented approach based on the principles of sustainability. The mission of the Army Strategy for the Environment is to continually incorporate environmental considerations in all contingency and combat operations, as our environmental stewardship inevitably becomes a contributing factor in achieving stability. This is a strategy for a homeland that is protected, an environment that is sustained, and waterways and ecological resources that are preserved as natural and economic assets, and an Army that is trusted by the public.

ALC is committed to supporting the military mission through sustainable practices and integrated natural resources management. This INRMP identifies the natural resources on ALC and BPRF, the management programs and the natural resource management goals and objectives to sustain the mission and environment. ALC strives to be a steward of the environment and manage resources not just for compliance purposes but to sustain these resources into the future while supporting the present and future military mission.

3.1.1 Integrate Military Mission and Sustainable Land Use

The mission of ALC is to support innovative science and technology by providing service and infrastructure while optimizing resources, sustaining the environment, and enhancing the well-being of the Army's workforce and community. The primary mission-related activities at ALC and BPRF are research and field testing of weapon systems. ALC and BPRF has integrated sustainable land use and the military mission within their mission statement. This mission is achieved through the natural resource management programs identified within this INRMP, environmental compliance, and regular evaluation of the military mission and land use at ALC and BPRF.

3.1.2 Define Impact to the Military Mission

While the military mission at ALC is achieved primarily within the laboratory facilities, the mission at BPRF requires open lands for field testing and research. Typical types of field tests involve fuses, explosive and pyrotechnic devices, telemetry systems, drones, and lasers. In addition, BPRF tests firing, recovery, and disassembly of explosive-loaded, fused projectiles for rockets, mortars, and cannons. The explosive testing facilities at BPRF are also available to other interested parties. The testing areas on BPRF are limited by wetlands, the Coastal Zone

Management Area, migratory bird habitat, and fish and wildlife habitat. ALC identified all of these significant natural resources and confines testing activities to the fields in the south central portions of BPRF to avoid and minimize impacts to these resources.

ALC also complies with environmental regulations and coordinates with state agencies, such as MDNR to ensure sustainable use of these lands. ALC operates under and meets requirements of permits for stormwater discharge and air emissions for generators and boilers.

3.2 NATURAL RESOURCES CONSULTATION REQUIREMENTS

3.2.1 Endangered Species Act

The ESA of 1973, as amended, requires lands under the jurisdiction of the DA, to conserve listed species. As defined in the ESA, conservation is the use of all methods and procedures necessary to bring any listed species to the point where protections provided by the Act are no longer necessary. Section 7 of the ESA requires the Army to formally consult and confer with the USFWS if any action by the Army may affect a listed species or critical habitat.

The ESA specifically requires agencies not to "take" or "jeopardize" the continued existence of any endangered or threatened species, or to destroy or adversely modify habitat critical to any endangered or threatened species. Under Section 9 of the Act, "take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect"; and under Section 7, "jeopardize" means to engage in any action that would be expected to "reduce appreciably the likelihood of the survival and recovery of a listed species by reducing its reproduction, numbers, or distribution."

Army policy on listed species includes the following elements: balancing mission requirements with endangered species protection, cooperating with regulatory agencies, and conserving biological diversity within the context of the military mission. As required by AR 200-1, the Army must ensure that it carries out mission requirements in compliance with requirements of the ESA. All Army land uses, including military training, testing, timber harvesting, recreation, and grazing, are subject to ESA requirements for the protection of listed species and critical habitat. In fulfilling its conservation responsibilities, the Army is required to work closely and cooperatively with USFWS, which is the federal agency responsible for enforcing the ESA. Installations are encouraged to engage in informal consultation with USFWS while planning projects or activities to ensure ESA compliance. In conserving biological diversity, installation commanders and Army natural resource managers are required to develop and implement policies and strategies to maintain viable populations of native plants and animals, maintain natural genetic variability within and among populations, maintain functioning representations of the full spectrum of ecosystems and biological communities, and integrate human activities with the conservation of biological diversity.

ALC is required to consult with the USFWS whenever they undertake an action that could have an impact on a listed species. Early informal consultation, including correspondence and discussions with USFWS, is the preferred method of consultation as it proactively addresses any concerns. Results of the informal consultation may identify the need for formal consultation, if

the activity may have an effect upon a listed species, as required under Section 7 of the ESA. Through the formal consultation process, the USFWS determine whether a proposed action is likely to jeopardize the continued existence of a listed species, destroy or adversely modify designated critical habitats, or potentially result in the incidental take of a species. The Section 7 formal consultation may result in the issuance of a biological opinion by USFWS, which outlines the conditions under which ALC may proceed with the proposed action in order to remain compliant with the ESA.

3.2.2 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act, enacted in 1940, prohibits take, possession, transport, or sale (among other actions) of live or dead eagles and their parts, nests, or eggs unless authorized by permit. "Take" is defined to include disturbing eagles. The term "disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause injury to an eagle, a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or nest abandonment. If an activity may disturb an eagle nest or roosting or foraging eagles, ALC will coordinate with USFWS for advice and recommendation for how to avoid disturbance and to determine whether a permit is necessary.

3.2.3 Migratory Bird Treaty Act

The MBTA is an international agreement among the United States, Canada and Mexico that protects designated species of birds. Many birds are protected under the MBTA. A complete list of species of migratory birds protected by the MBTA is in 50 CFR 10.13 and can be found at this link:

https://www.fws.gov/birds/management/managed-species/migratory-bird-treaty-act-protected-species.php

The MBTA regulates the taking of these birds, their nests, eggs, parts or products. The MBTA states that it is unlawful "at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, attempt to capture or attempt to kill, purchase, offer to purchase, deliver for shipment, ship, export, import, cause to be shipped, deliver for transport, transport or cause to be transported, carry or cause to be carried or receive for shipment, transportation, carriage or export, possess, offer for sale, sell, offer to sell, barter, offer to barter, any migratory bird, any part, nest or egg of any such bird or any part, nest or egg thereof;" unless and except as permitted by regulations in the MBTA. All persons, organizations and agencies are liable for prosecution for violations and must follow permitting requirements for taking migratory birds. Special purpose permits may be requested and issued that allow for the relocation or transport of migratory birds for management purposes.

3.2.4 Essential Fish Habitat

ALC would be required to coordinate with the NMFS regarding Essential Fish Habitat (EFH) in any cases where they propose to undertake an action that could have an impact under the

Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265). This coordination protects essential breeding and critical life stage habitats for commercially important fish. SAV provides EFH to multiple species offshore at BPRF. NMFS recommends no in river work between 15 February and 15 June of any given year.

Spawning areas for brown trout, an important sport fish, are found upstream of ALC in the upper part of Paint Branch (the area upstream of Fairland Road). The Montgomery County Council has designated this area as a Special Protection Area based on its trout spawning capability, high water quality, and the threat posed by the intensity of existing and future development in the watershed. In an effort to preserve brown trout habitat, MDNR recommends no in-stream work between 1 October and 30 April of any given year.

3.2.5 Coastal Zone Management Act and Maryland Critical Area Law

The Coastal Zone Management Act of 1972 (16 USC 1451 - 1464, as amended) established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Subsequent to Federal approval, each state's plan was required to define boundaries of the coastal zone, to identify uses of the area to be regulated, the mechanism for controlling such uses, and broad guidelines for priorities of uses within the coastal zone. In addition, the 1972 law established a system of criteria and standards for requiring that Federal actions be conducted in a manner consistent with the federally approved plan (Section 307 of the Coastal Zone Management Act (CZMA)). Since the State of Maryland adopted the Critical Areas Law as part of their coastal zone management plan, land management actions at BPRF within the Critical Area should be consistent with the provisions of the Critical Areas regulations and guidelines.

In 1984, to safeguard the Chesapeake Bay from the negative impacts of intense development, the Maryland General Assembly enacted the Chesapeake Bay Critical Area Protection Program, a far-reaching effort to control future land use development in the Chesapeake Bay watershed. The ribbon of land within 1,000 feet of the tidal influence of the Chesapeake Bay was determined to be crucial because development in this "critical area" has direct and immediate effects on the health of the Bay. The Chesapeake Bay Critical Area Commission (2012) was charged with devising a set of criteria which would minimize the adverse effects of human activities on water quality and natural habitats and would foster consistent, uniform and more sensitive development activity within the Critical Area. In cooperation with the Critical Area Commission, local critical area management programs are administered by the 61 local governments whose jurisdictions are partially or entirely within the Critical Area.

Both ALC and BPRF are located within the Coastal Zone Management Area and BPRF is located within the Critical Area. Activities on both facilities are required to be consistent with the CZMA, and the components of the Critical Area program are listed below. In the event of disturbance within 1,000 feet of tidal waters of Maryland's Critical Area, the Critical Area Commission staff shall be contacted.

3.2.5.1 Components of the Critical Area Protection Program

The Critical Area Law requires that each local jurisdiction identify and provide for the establishment, preservation, and maintenance of Habitat Protection Areas. These areas include: a naturally vegetated 100-foot buffer (the Buffer) to tidal wetlands and waters; non-tidal wetlands; the habitats of threatened and endangered species, and species in need of conservation, and their habitat; significant plant and wildlife habitat; and, anadromous fish spawning areas.

Growth Allocation

To accommodate future growth, a local jurisdiction is authorized under the Critical Area Act to change a land use designation and allow development at a density or intensity which exceeds the limits of a site's original designation.

Native Trees and Shrubs Recommended for Planting in the Critical Area

Native shrubs and trees are the species indigenous to an area - occurring prior to European contact. Over the past several hundred years, humans have imported or bred plants to suit their cultural, aesthetic, and environmental needs. A number of species have escaped from cultivated gardens or were planted intentionally into natural areas for wildlife benefit, only to cause havoc in the local ecosystem. While some of these plants do provide benefits to wildlife, the long range results are areas that cannot provide for the year round needs of wildlife and are aesthetically unpleasing.

100-Foot Buffer

A keystone of the Chesapeake Bay Critical Area Protection Program is the establishment, preservation, and maintenance of a 100-foot, naturally vegetated, forested buffer (the Buffer) landward from the Mean High Water Line of tidal waters or from the edge of tidal wetlands and tributary streams. The Buffer acts as a water quality filter for the removal or reduction of sediment, nutrients, and toxic substances found in runoff. The Buffer also minimizes the adverse impact of human activities on habitat within the Critical Area. No disturbance of the Buffer may be permitted by local jurisdictions unless an applicant can meet the strict provisions for a variance.

Non-Tidal Wetlands

The minimum standards established by the state and adopted by the local jurisdictions for the conservation of non-tidal wetlands in the Critical Area include: (a) the establishment and maintenance of a vegetated buffer of 25 feet around areas identified as non-tidal wetlands; (b) new development must not substantially damage or change the character of non-tidal wetlands; (c) only new development that is intrinsically water-dependent, or of substantial economic benefit to the public, is allowed to disturb non-tidal wetlands. In the event of such development, measures must be taken to replace lost non-tidal wetlands and to provide for water quality benefits and habitat protection equal to or greater than that provided by the original wetlands.

Significant Plant and Wildlife Habitat

The Critical Area Criteria require that protection be afforded plant and wildlife habitats which are of significance from a state-wide or local perspective because of their rarity. Under the Criteria, habitats identified for protection include colonial water bird (heron, egret, tern, etc.) nesting areas;

aquatic areas of historic waterfowl concentration; riparian forests (forested areas of 300 feet in width along streams and the Bay's shoreline); relatively undisturbed, large (100 acres or more) tracts of forest which support breeding populations of forest interior-dwelling birds (vireos, warblers, flycatchers, woodpeckers, etc.); certain plant and animal communities which are the best examples of their kind in Maryland; and other areas determined to be of local significance.

3.2.5.2 Critical Areas Land Use Classifications

Portions of BPRF which lie in the state-designated Critical Area are identified on **Figure 2-14**. Lands within the Critical Area are classified into three categories of management areas, in which different types and intensities of uses are allowed to occur.

Intensely Developed Areas (IDAs)

Intensely Developed Areas (IDAs) are defined as areas of twenty or more adjacent acres where residential, commercial, institutional or industrial land uses predominate. IDAs are areas of concentrated development where little natural habitat occurs. In IDAs, the Law requires that new development and redevelopment be accompanied by techniques to reduce water quality impacts associated with stormwater runoff. These techniques are often referred to as best management practices (BMPs). The Criteria specify that these techniques be capable of reducing pollutant loads generated from a developed site to a level at least 10% below the load generated at the same site prior to development. BMPs for meeting the 10% rule include filter and infiltration systems along with stormwater wetland and pond systems. In some cases IDA on-site compliance with the 10% rule proves impossible. In those cases, local jurisdictions may provide an offset program by which equivalent water quality benefits are achieved off-site but within the same watershed. In addition, the clustering of development reduces the amount of impervious surfaces and increases the area of natural vegetation thereby lessening adverse impacts to water quality and habitat areas. The Criteria also specify that development activities minimize destruction of forest and woodland vegetation and secure Habitat Protection Areas. Urban forestry programs benefit water quality by controlling sediment, by reducing runoff and by removing nutrients and other potential pollutants. They also furnish direct habitat value by providing sources of food and areas of temporary shelter for some wildlife species.

Limited Development Areas (LDAs)

Limited Development Areas (LDAs) are areas in which development is of a low or moderate intensity. LDAs contain areas of natural plant and animal habitats but are not dominated by agriculture, wetland, forest, barren land, surface water or open space. The quality of runoff from these areas has not been substantially altered or impaired. Housing densities in LDAs are between one dwelling unit per five acres and four dwelling units per acre. Areas with IDA characteristics but with fewer than 20 acres are classified as LDAs. Development or redevelopment of LDAs must not change the prevailing character of land use and must improve water quality. It must also conserve existing areas of natural habitat and incorporate wildlife corridors that ensure continuity of wildlife and plant habitat. The retention and increase of forested areas is of paramount concern to the health of the Chesapeake and its tributaries. Forest cover affords the Bay a host of benefits including habitat and water temperature mediation. Forest cover also reduces and filters runoff. The Criteria stipulate that developers replace cleared forest cover in ratios ranging from 1:1 to 3:1.

In areas of new development or redevelopment, where no forest coverage existed previously, 15% of the area must be planted with trees. The Criteria allow development in areas where slopes rise 15% or more above grade only if such development can be shown to control soil erosion and runoff. Impervious surfaces (those through which water will not run) contribute to runoff and so threaten the quality of the Bay's waters. Such coverage in LDA development or redevelopment is limited to between 15% and 25% according to the nature and history of the site. Developers are strongly encouraged to use permeable surfaces.

Resource Conservation Areas (RCAs)

RCAs are characterized by natural environments or by resource-utilization activities. Resource-utilization refers to such activities as agriculture, aquaculture, commercial forestry and fisheries activities which the Criteria consider protected land uses. The Criteria limit new development in RCAs to one dwelling unit per 20 acres. The "1-in-20" criterion is intended to ensure that RCAs maintain a natural character, preserving favored land uses while avoiding fragmentation of areas providing adequate to robust wildlife and plant habitat. New commercial and industrial facilities are not allowed in RCAs and that development which is allowed in the RCAs must conform to the standards set for LDAs. Timber harvests conducted in the Critical Area must be done pursuant to a Timber Harvest Plan approved by the MDNR. Such plans, prepared by professional foresters, provide for the protection of water quality, continuity of habitat and the reforestation of timbered areas.

~~3.2.5.3 Army Chesapeake Bay Strategy~~

~~The Army has initiated the Army Chesapeake Bay Strategy in order to address the major issues confronting the bay, including nutrient and sediment pollution, toxic chemical contaminants, habitat loss and over-harvesting of fish and shellfish.~~

~~The five main goals of the strategy are to:~~

- ~~Contribute to restoring and sustaining the water quality of the Chesapeake Bay and its tributaries.~~
- ~~Restore and sustain living resources and healthy habitats on Army installations.~~
- ~~Support the implementation of ecosystem-based fisheries management.~~
- ~~Strengthen stormwater management practices and maintain healthy watersheds.~~
- ~~Foster Chesapeake Bay stewardship.~~

~~Army Installations and USACE continue to develop plans, designs, and construction projects related to ecosystem restoration, navigation, and flood risk management with support from non-federal sponsors in the Chesapeake Bay region (U.S. Army, 2009).~~

~~To facilitate collaboration among its installations located within the Chesapeake Bay watershed, the DoD formed a Chesapeake Bay Action Team. ALC participates in these quarterly conference calls.~~

3.2.6 Wetlands

The U.S. Congress enacted the CWA in 1972 to "*restore and maintain the chemical, physical, and biological integrity of the Nation's waters*." Section 404 of the CWA delegates jurisdictional authority over wetlands to USACE and the U.S. Environmental Protection Agency (USEPA). Waters of the United States protected by the CWA include rivers, streams, estuaries, and most ponds, lakes, and wetlands. USACE and USEPA jointly define wetlands as…"*areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas*." Wetland functions and values include but are not limited to the following: ground water recharge, ground water discharge, flood flow alteration, sediment stabilization, sediment or toxicant retention, nutrient removal or transformation, production export, wildlife diversity/abundance, aquatic diversity/abundance, uniqueness/heritage, and recreation.

Section 404 of the CWA also regulates the discharge of dredge or fill material into wetlands and Waters of the U.S. Any earth-moving activities that may impact wetlands should be avoided; if found unavoidable, coordination with USACE and MDE is required to apply for the appropriate permit to conduct the activity. MDE also regulates activities within 25-feet of non-tidal wetlands and 100-feet of tidal wetlands and waters, where impacts should be avoided or best management practices be employed.

3.2.7 Tribal Governments

In compliance with the American Indian Religious Freedom Act, Executive Order 13007 (Indian Sacred Sites), and DoDI 4715.03, APG must allow Native Americans access to installation sites and resources that are of religious importance, or that are important to the continuance of their cultures, subject to installation safety and security. Sacred sites and traditional cultural properties are identified at the discretion of federally recognized Native American tribes in consultation with APG's Cultural Resources Manager. There are currently no designated Native American sacred sites or traditional cultural properties on ALC or BPRF.

For Tribal Government consultations, ALC and BPRF engages four Native American tribes: the Delaware Tribe of Indians, the Eastern Shawnee Tribe of Oklahoma, the Delaware Nation of Oklahoma, and the Seneca-Cayuga Nation. Tribal governments are consulted as part of the NEPA process at the time of INRMP revisions, and at other times as warranted.

3.2.8 Maryland State Historical Trust

The Natural Resources Manger coordinates internally with Cultural Resources staff to ensure that natural resource management actions are conducted in accordance with the Integrated Cultural Resources Management Plan, and in compliance with federal and state historic preservation laws. For example, actions may require archaeological surveys prior to ground disturbance and

consultation with the Maryland State Historic Preservation Office (SHPO) for impacts to historic structures or cultural resources sites.

3.3 NEPA COMPLIANCE

NEPA was signed into law on January 1, 1970. NEPA requires federal agencies to be instrumental in environmental protection. NEPA is the basic national charter for the protection of the environment and it mandates that Federal agencies use a systematic, interdisciplinary approach to ensure that the impacts of Federal actions on the environment are considered during the decision-making process (NEPA, 1969). Under NEPA, Federal agencies that fund, support, permit, or implement major programs and activities are required to assess the environmental impact of implementing their actions early in the planning process. While the NEPA process is not intended to fulfill the specific requirements of other environmental statutes and regulations, the process is designed to provide the decision-maker with an overview of the major environmental resources to be affected, the interrelationship of these components, and potential conflicts. As such, the NEPA process begins in the early stages of the decision-making process to ensure that planning decisions reflect environmental values, avoid delays later in the process, and head off potential conflicts (CEQ, 1978).

~~32 CFR 651, *Environmental Analysis of Army Actions*, requires full disclosure, documentation, and mitigation of significant impacts on the human environment for Army and Army-related actions (e.g. military training, new technology, equipment testing, construction projects, land management actions, real property transactions, etc.).~~ The purpose of NEPA is to analyze impacts of proposed actions and alternatives for use as a planning and decision-making tool and to give the public a platform for active involvement to ensure (1) federal agencies identify environmental problems; (2) provide alternatives; and (3) mitigate impacts when used early in the planning stages of project development. Integration of NEPA requirements with other planning requirements at the earliest possible time ensures that all activities (construction projects, mission changes, and services contracts) are reviewed for impacts on overall natural resources issues, and ensure that the NEPA documentation fully addresses direct, indirect, and cumulative impacts of activities on natural resources or, in particular, biodiversity.

3.3.1 Levels of Documentation and Public Involvement

There are three main levels of NEPA documentation, each of which has specific levels of analysis and complexity and is dependent on the extent and significance of the impact:

(1) The simplest level of documentation of an action is the REC. This document and its associated categorical exclusions are used when an action individually and cumulatively has already been determined to not have a significant impact on the human ~~environment, but~~environment but have effects that need to be documented.

(2) A more complex level of documentation is the EA. This document is intended to facilitate agency planning and decision-making by increasing the understanding of the potential effects of a proposed action and any alternatives to the action on the human environment.

An EA requires a 30-day public comment period and followed by the publishing of a Finding of No Significant Impact (FNSI), if warranted, which describes the EA's conclusions. If a FNSI is not warranted, then an Environmental Impact Statement (EIS) is required.

(3) The most comprehensive level of NEPA documentation is the EIS. This document is a detailed written statement required by NEPA for major federal actions that have a significant adverse impact on the human environment and includes an extensive analysis of the proposed action and the alternatives. Public meetings and hearings as well as three published documents for public review are required components of an EIS:

a. Notice of Intent (NOI) – a public notice that an EIS will be prepared
b. Notice of Availability (NOA) – a notice published to inform the public that the EIS is available for review
c. Record of Decision (ROD) – a concise public document summarizing the findings and the basis for the decision.

~~In accordance with 32 CFR 651, the environmental review process is initiated early in the concept/planning stages of a proposed action. 32 CFR Part 651 and the Council on Environmental Quality recommend a REC be completed for INRMPs. Recognizing the efficiencies and benefits associated by combining the INRMP and its associated REC into one document, this plan has been developed to satisfy both requirements.~~ The INRMP has been reorganized from Army Guidelines to accommodate NEPA documentation within the plan. The REC is included in **Chapter 6**.

3.3.2 Mitigation Measures

Mitigation is a means to offset damage to the environment when it cannot be avoided through the NEPA process. Below are the six general mitigation tactics~~, as outlined in 32 CFR 651~~:

(1) Avoidance: Avoiding the impact altogether by not taking a certain action or parts of an action. This method avoids environmental impact by eliminating certain activities in certain areas.
(2) Minimize impacts: Minimizing impacts by limiting the degree or magnitude of the action and its implementation. Limiting the degree or magnitude of the action can reduce the extent of an impact.
(3) Restoration of the environment: Rectify the impact by repairing, rehabilitating, or restoring the effect on the environment. This method restores the environment to its previous condition or better.
(4) Preservation and maintenance operations: Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action. This method designs the action so as to reduce adverse environmental effects.
(5) Compensation: Compensate for the impact by replacing or providing substitute resources or environments. This method replaces the resource or environment that will be impacted by the action. Replacement can occur in-kind or otherwise.

(6) Replacement: Replace the resource or environment that will be impacted by the planned projects. Replacement can occur on-site or at another location. This could involve creation of the same type or better quality habitat for a particular impacted fish or wildlife species or creation of habitat for another species.

Mitigation that is identified in a FNSI is a Class 1 "must fund" for environmental purposes (see **Section 5.1.1,** Environmental Funds). This provides a reliable mechanism to fund mitigation included in NEPA documents.

3.4 BENEFICIAL PARTNERSHIPS AND COLLABORATIVE RESOURCE PLANNING

ALC maintains a partnership with MDNR Wildlife and Heritage Division for the coordination of the managed hunting program at BPRF. The MDNR provides professional wildlife biology advice and recommendations regarding game species on the facility. White-tailed deer are the only wildlife species that are presently managed for consumptive use at BPRF.

A State of Maryland waterfowl management program was previously in place, but currently there is no waterfowl hunting on BPRF. Non-game species management is also conducted with assistance from federal and state wildlife agencies.

~~The Army has initiated the Army Chesapeake Bay Strategy in order to address the major issues confronting the bay, including nutrient and sediment pollution, toxic chemical contaminants, habitat loss and over-harvesting of fish and shellfish.~~

~~The five main goals of the strategy are to:~~

- ~~Contribute to restoring and sustaining the water quality of the Chesapeake Bay and its tributaries.~~
- ~~Restore and sustain living resources and healthy habitats on Army installations.~~
- ~~Support the implementation of ecosystem-based fisheries management.~~
- ~~Strengthen stormwater management practices and maintain healthy watersheds.~~
- ~~Foster Chesapeake Bay stewardship.~~

~~Army Installations and USACE continue to develop plans, designs, and construction projects related to ecosystem restoration, navigation, and flood risk management with support from non-federal sponsors in the Chesapeake Bay region (U.S. Army, 2009).~~

~~To facilitate collaboration among its installations located within the Chesapeake Bay watershed, the DoD formed a Chesapeake Bay Action Team. ALC participates in these quarterly conference calls.~~

3.5 PUBLIC ACCESS AND OUTREACH

3.5.1 Public Access and Outdoor Recreation

ALC and BPRF are classified as closed posts, but visitors can be granted access with the proper credentials and a reason to visit. There is currently no Morale, Welfare and Recreation support or Family Housing at either installation.

Outdoor recreation at ALC is available to on-site personnel through an outdoor fitness trail consisting of multiple par course stations along Floral Drive from the 400 to 600 Areas. Should a member of the public inquire about outdoor recreation opportunities, the Natural Resources Manager would work with the Garrison personnel to accommodate the request. All recreational opportunities at ALC and BPRF are open and accessible to anyone regardless of race, religion, creed, national origin or sex.

BPRF currently provides a managed hunting program for white-tailed deer conducted in cooperation with the MDNR. The managed hunting program is conducted via a firearms season exemption for managed hunts from MDNR. The managed hunting season runs from October or November to December and BPRF ~~can hose~~with approximately five hunters per business day. The bag limit per person and the overall season bag limit is set using the results of the yearly spring white-tailed deer Forward Looking Infrared Camera (FLIR) surveys if they are funded. ~~In 2021, hunters were allowed to harvest up to eight deer (four antlerless and two antlered). The overall bag limit for the program in 2021 was 65 deer. In 2022 and 2023, the bag limit was set to 50 deer.~~ The overall bag limit for the program is usually set to 50 deer.

Shotgun is the only weapon authorized for hunting at BPRF. Ammunition used is slug only. Hunting is conducted from stationary stands (located north of the range) which provides a safe environment for the hunters. Stationary stands are more secure than portable stands (less risk of collapse and falls) and shooting from a tree stand at a downward angle provides an additional safety measure.

Conservation Law Enforcement Officers (CLEO) are stationed at APG, but not at ALC or BPRF due to the size of the installations and due to budget constraints. The hunts at BPRF are conducted using Garrison personnel that serve as Wildlife Conservation Officers (WCO) that are appointed by the Garrison Commander. WCOs check hunter's credentials (i.e., Maryland hunting license, safety certificate and shooter qualification) and provide assistance to and from the tree stand if needed. WCOs track deer, ensure harvested deer are properly tagged before leaving BPRF and enter harvest data on the yearly tracking spreadsheet. If outside assistance was needed, the Charles County Sheriff's Department or the MDNR Natural Resources Police would respond to BPRF.

In 2022, the program began using iSportsman for permit sales and harvest data in conjunction with the hunting program at APG. The Rules and Regulations for the managed hunts and a sample hunting permit are included in the White-tailed Deer Management Plan in **Appendix N**. The Rules and Regulations contain the yearly hunting permit fee. The Natural Resources Manager maintains survey and harvest records in the Conservation/Deer Management Folder on ~~the K drive~~SharePoint.

3.5.2 Public Outreach

BPRF has hosted the MDNR "Becoming an Outdoors Woman" White-tailed Deer Hunting Workshop. The workshop consists of a one-day classroom and field ~~work shop~~workshop and an antlerless white-tailed deer hunt on the second day for members of the public.

The public has been solicited by public notice every two years on their interest to establish a Restoration Advisory Board (RAB) for the MMRP program. To date, there has not been sufficient interest to establish a RAB.

3.5.3 Organizations Involved in Public Affairs and Outreach for Natural Resources Programs

The Public Affairs Office is responsible for communications with the public regarding natural resources. Currently, the Public Affairs office publishes public notices for NEPA documents and the solicitation for establishment of a ~~RAB, and~~RAB and develops the program for communicating ALC and BPRF mission and operations to the public.

3.5.4 Natural Resources Awareness Programs

Natural resources awareness programs include making the INRMP available to all personnel on ALC and BPRF. The APG Natural Resources Team hosts a quarterly Conservation Subcommittee Meeting where tenants are invited to hear updates on natural resources projects and issues on the installations.

The ~~ACL~~ ALC Environmental Team hosts an annual Earth Day Walk and puts up poster displays to educate personnel on the environmental and natural resources programs on ALC. The Environmental Division also contributes environmental stories to the ALC News and Facebook page throughout the year.

Personnel and customers at BPRF are made aware of the eagle and osprey nest areas, and protected habitats. Photographs of the listed species such as the rainbow snake and NLEB are posted on the bulletin board in Building 511 at BPRF.

3.6 STATE WILDLIFE ACTION PLAN

Under the Congressional requirements of the relatively new State and Tribal Wildlife Grant Program, all state fish and wildlife agencies had to submit a State Comprehensive Wildlife Conservation Plan or Strategy by October 1, 2005 to the USFWS. These strategies will provide an essential foundation for the future of wildlife conservation and a stimulus to engage the states, federal agencies and other conservation partners to strategically think about their individual and coordinated roles in prioritizing conservation efforts in each state and territory.

In order to meet these requirements, MDNR developed the *Maryland Wildlife Diversity Conservation Plan* in 2005. The plan was intended to summarize the current knowledge of the status of Maryland's wildlife and to guide future efforts in Maryland's wildlife conservation. The Natural Heritage Program, part of the Wildlife and Heritage Service, is the lead agency for the plan's development, with significant input from the Maryland Biological Stream Survey (MBSS) and other public and private stakeholders.

As required by Congress, the Plan must address the needs of both "species in greatest need of conservation" and the "full array of wildlife". Congress has identified eight elements to be examined in the Plan. These elements are:

(1) Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife; and,
(2) Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1); and,
(3) Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats; and,
(4) Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions; and,
(5) Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions; and,
(6) Descriptions of procedures to review the strategy at intervals not to exceed ten years; and,
(7) Plans for coordinating the development, implementation, review, and revision of the plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats; and,
(8) Congress also affirmed through this legislation that broad public participation is an essential element of developing and implementing these plans, the projects that are carried out while these plans are developed, and the Species in Greatest Need of Conservation that Congress has indicated such programs and projects are intended to emphasize.

The 2005 Plan was revised in 2015 and published in June 2016. The plan is now titled the *Maryland State Wildlife Action Plan 2015-2025*. The entire plan can be viewed at:

http://www.dnr.state.md.us/wildlife/Pages/plants_wildlife/SWAP_Submission.aspx
Maryland's 2015 Plan outlines 24 statewide conservation actions. Habitat loss and fragmentation are common themes among the many significant threats addressed in the plan. Through this plan, several species of greatest conservation need have been identified (**Table 3-1**). The list of species can be viewed at:

http://www.dnr.state.md.us/wildlife/Documents/SWAP/SWAP_Chapter3.pdf

A description of Magnolia bog habitat (PMB) can be viewed at:

http://www.dnr.state.md.us/wildlife/Documents/SWAP/SWAP_Chapter4.pdf

Table 3-1. Wildlife Diversity of Maryland Taxa

	Total*	State-listed	Federally-listed	S1 - S3 Ranked	G1 – G3 Ranked	GCN
Mammals	97	19	8	20	17	41
Birds	443	33	6	127	8	141
Herpetofauna	89	19	6	23	10	45
Fishes	>300	17	4	24	6	31
Invertebrates	20,000+	76	3	207	103	350
Total	Over 20,000	164	27	401	144	608

*Native species, including those that have become extirpated in the state.

Key: S1 = Critically imperiled in the state
S2 = Imperiled in the state
S3 = Rare to uncommon and potentially vulnerable to extirpation within in the state
G1 = Critically imperiled across its entire range (i.e., globally)
G2 = Imperiled across its entire range (i.e., globally)
G3 = Rare across its entire range (i.e., globally) or distributed locally in a restricted range
GCN = Species of Greatest Conservation Need

(Source: Maryland State Wildlife Action Plan, 2015)

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4.0 PROGRAM ELEMENTS

This chapter discusses the elements of the ALC natural resource management program. The natural resource management goals and objectives are described in **Chapter 1**, **Table 1-1** and are carried through this chapter where management objectives, ongoing activities and new projects are described and are also summarized in **Appendix B**.

4.1 NATURAL RESOURCES MANAGEMENT PROGRAM

4.1.1 Current Management

This INRMP identifies the components of the ALC natural resources management program. The overarching goal for natural resource management is to implement a natural resources management program that reflects the principles of ecosystem management and ensures the sustainability of the military mission. There are several management plans, strategies and programs that are integrated to create a comprehensive and sustainable program that manages natural resources and supports the military mission. The natural resource management goals and objectives are listed in **Chapter 1** and found with management objectives throughout this chapter and in **Appendix B**.

Ongoing natural resource management programs are described in the following sections. Regular internal reviews of this INRMP occur annually and updates are completed as necessary. The ALC DPW uses this INRMP to guide mission-related activities and related programs to ensure sustainable use of resources while meeting the military mission.

~~Climate Change~~ Impacts to Natural Resources and Military Installation Resilience

~~This INRMP also considers global environmental effects, including the global atmosphere, in accordance with the requirements of EO 12114.~~ DoDI 4715.03 and DoDI 4715.21 requires this INRMP to assess the potential impacts of ~~climate change~~ changing environmental, ecological, and weather conditions to the military mission, military installation and ~~on~~ natural resources and to adaptively manage such resources to minimize adverse mission impacts.

The Army has identified ~~climate change~~this issue as a direct threat to the national security of the U.S. Installations must effectively reduce ~~climate~~ weather vulnerability through a variety of resilience measures tailored to the local threats and estimated consequences in ongoing natural resource planning.

The DoD created the Extreme Conditions Assessment Tool (DECAT) to enhance military and installation resilience in accordance with the National Defense Authorization Acts (NDAA) of Fiscal Years (FY) 2018, 2019, and 2020. DECAT provides authoritative and actionable information to support site-level assessments and Department-wide comparisons of natural hazard exposure. This tool presents information on potential future exposure to extreme weather and changes in environmental conditions that may adversely affect military readiness and lethality.

The exposure assessments and data visualizations presented in DECAT address eight natural hazards identified by Congress (FY 2018 NDAA Section 335, FY 2019 NDAA Section 2805, and FY 2020 NDAA Section 326) as being of greatest concern for military readiness, mission execution, and infrastructure resilience. Exposure scores are presented for the historical base period (based on 56-year aggregations from 1950 to 2005) and for multiple future plausible scenarios.

~~The Army's Climate Assessment Tool was initially developed in 2018 in response to the National Defense Authorization Act (NDAA) for Section 335 requirements and subsequently launched in 2020 to aid installations in assessing the potential exposure to impacts from coastal and riverine flooding, drought, energy demand, heat, historical extreme conditions, land degradation and wildlife. The tool presents information on climate risks as a preliminary step toward understanding potential impacts to mission and operations. An initial version of this tool was made available to 73 installations, including ALC and BPRF. An updated version with data on more climate impacts is now available for deployment at 116 installations. Army policy requires natural resources managers at these installations to use the tool to understand projected climate threats to their installations and be prepared to incorporate climate resilience measures into their natural resources master plans.~~

~~Greenhouse gases (GHG) are components of the atmosphere that contribute to the greenhouse effect and global warming. GHGs can occur naturally in the atmosphere or result from human activities, such as the burning of fossil fuels. Federal agencies, states, and local communities can address global warming by preparing GHG inventories and adopting policies that will result in a decrease of GHG emissions produced by humans.~~

~~According to the Kyoto Protocol, there are six GHGs: carbon dioxide (CO_2), nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (see **Table 4-1**). Although some GHG (CO_2, methane, and nitrous oxide) occur naturally in the atmosphere, human activities have changed GHG atmospheric concentrations. From the pre-industrial era (i.e., ending about 1750) to 2018, concentrations of CO_2 have increased globally by 46 percent. Within the United States, fuel combustion accounted for 92.8 percent of CO_2 emissions in 2018. Globally, approximately 32,840 million metric tons of CO_2 were added to the atmosphere through the combustion of fossil fuels in 2017, of which the United States accounted for approximately 15 percent (USEPA, 2020).~~

~~Table 4-1. Greenhouse Gases and Common Sources and Uses~~

~~Greenhouse Gas~~	~~Common Sources/Uses~~
~~Carbon dioxide (CO_2)~~	~~Mobile and stationary combustion~~
~~Methane~~	~~Coal mining, fuel combustion~~
~~Nitrous oxide~~	~~Fuel combustion, fertilizers~~
~~Hydrofluorocarbon gases~~	~~Refrigerants, fire suppressants, various manufacturing processes~~

~~Perfluorocarbon gases~~	~~Electrical equipment, various manufacturing processes, refrigerants, medicine~~
~~Sulfur hexafluoride~~	~~Electrical equipment, various manufacturing processes, tracer in air modeling, medicine~~

~~Source: USEPA, 2020~~

4.1.2 Proposed Management

ALC will continue the natural resource management program through implementation of existing plans and strategies, and through undertaking the proposed management activities and objectives listed throughout this chapter. The ALC Natural Resource Manager will coordinate with the AEC Natural Resources Community of Practice. The website can be viewed at: https://home.army.mil/aec/.

Other natural resources support will be provided by the DoD Natural Resources Program. The website can be viewed at: https://www.denix.osd.mil/nr/.

ALC will annually review and update this INRMP, as required in AR 200-1 (2007), and also coordinate updates with USFWS and MDNR. The INRMP must also be updated and coordinated for signatures from ALC, USFWS and MDNR at least every five years. The list of goals and objectives (**Appendix B**) can be used to guide the review and adjust programs, per the adaptive management process. ALC will also maintain cooperative agreements and regular coordination with USFWS and MDNR for the management of natural resources and for environmental compliance purposes.

~~Climate Change~~ Impacts to Natural Resources and Military Installation Resilience

According to the DECAT Site Analysis Tool (*https://decat.cwbi.mil*) for ALC, inland flooding, extreme heat and wildfire are the top hazards that could impact natural resources. For BPRF, the hazards include inland flooding, extreme heat and drought. Other hazards that are considered in the DECAT are land degradation, historical extreme conditions, extreme cold and coastal change.

~~According to the Nature Conservancy's Climate Wizard, the average temperature in Maryland could rise as much as six degrees by the year 2050 (The Nature Conservancy, 2018). As temperatures rise, more extreme weather can cause more intense rainstorms and flooding on ALC and BPRF. Shoreline erosion can be accelerated on BPRF. Warmer temperatures could also cause longer periods of drought which can create conditions that can lead to more frequent wildfires, the loss of native flora and fauna, and the increase of nonnative and invasive flora and fauna (NRDC, 2014).~~

~~Using the screening-level impact assessment (National Standard View) of the Army's Section 335 Climate Assessment Tool (https://corpsmapr.usace.army.mil/cm_apex/f?p=116), natural resource managers are able to view maps of projected installation vulnerability through 2050 and 2085 for~~

~~each of eight impact types (coastal and riverine flooding, drought, energy demand, heat, historical extreme conditions, land degradation and wildlife).~~

~~Figure 4-1 provides a one-stop visualization of overall exposure to climate for ALC. Drought is the highest risk category for ALC. Figure 4-2 provides a similar visualization for BPRF. The four categories of most concern at BPRF include drought, wildfire, and riverine and coastal flooding, again with drought being the highest risk category.~~

~~In 2009, Maryland adopted the Greenhouse Gas Emissions Reduction Act of 2009 (GGRA). The Plan calls for 44 percent reduction in greenhouse gas emissions by 2030, surpassing the 40 percent reduction goal required by state laws (MDE, 2019). The Plan can be viewed at: https://mde.maryland.gov/programs/Air/ClimateChange/Pages/Greenhouse-Gas-Emissions-Reduction-Act-(GGRA)-Plan.aspx.~~

~~The Metropolitan Washington Council of Governments the *National Capital Region: Best Practices and Policies to Reduce Greenhouse Gases* in 2008. It describes programs to reduce greenhouse gases that have been adopted by localities in the National Capital Region and that are available as tools to communities seeking more sustainable options for growth and development (MWCG, 2008). The plan can be viewed at: https://www.mwcog.org/documents/2008/02/26/national-capital-region-best-practices-and-policies-to-reduce-greenhouse-gases-air-quality-greenhouse-gas/.~~

Projects that will help ALC and BPRF prepare for ~~climate change~~these hazards include the Shoreline Survey and Management Plan for BPRF (**Appendix J**), ~~a future request to complete~~ shoreline restoration projects at BPRF and the Stream Survey for ALC (including restoration recommendations to repair and prevent further stream bank erosion). The Wildland Fire Management Plan can also prepare the installations for the possible increase in wildfires.

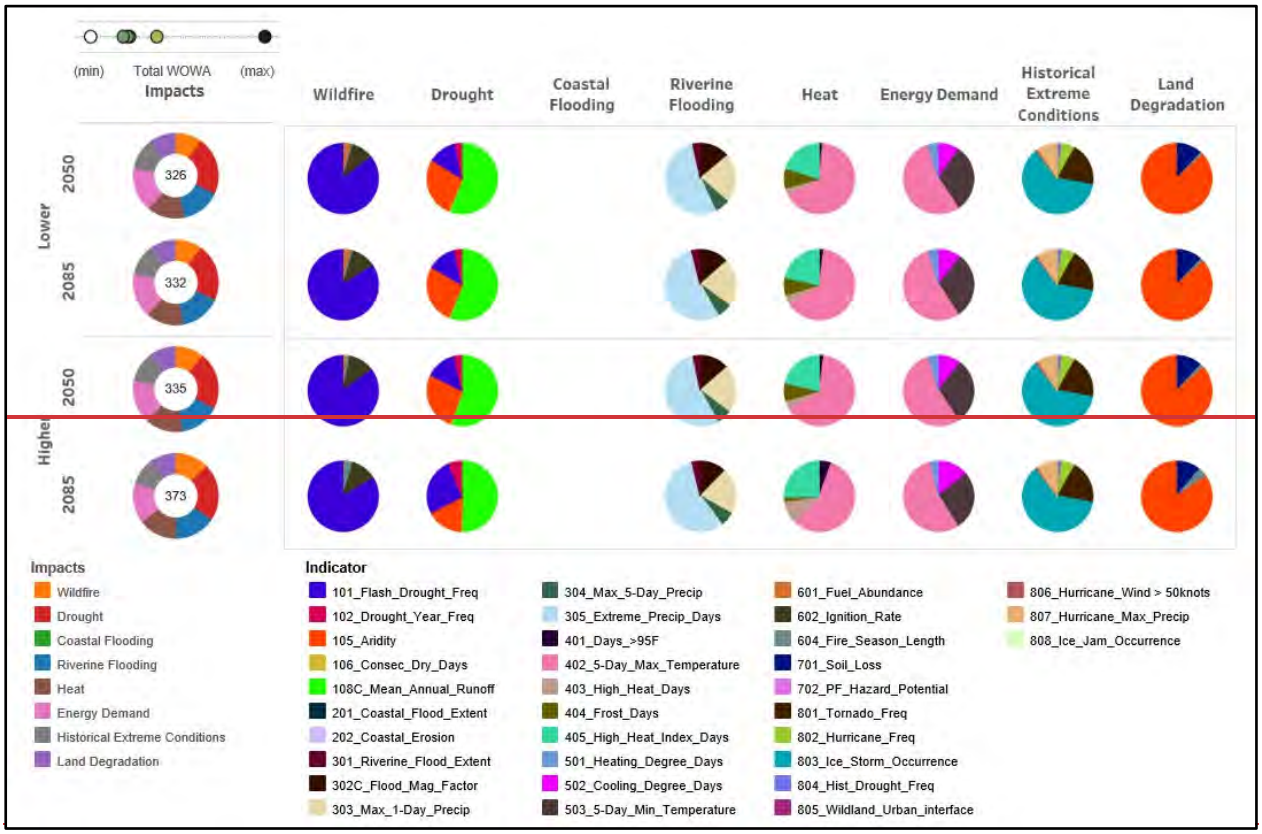
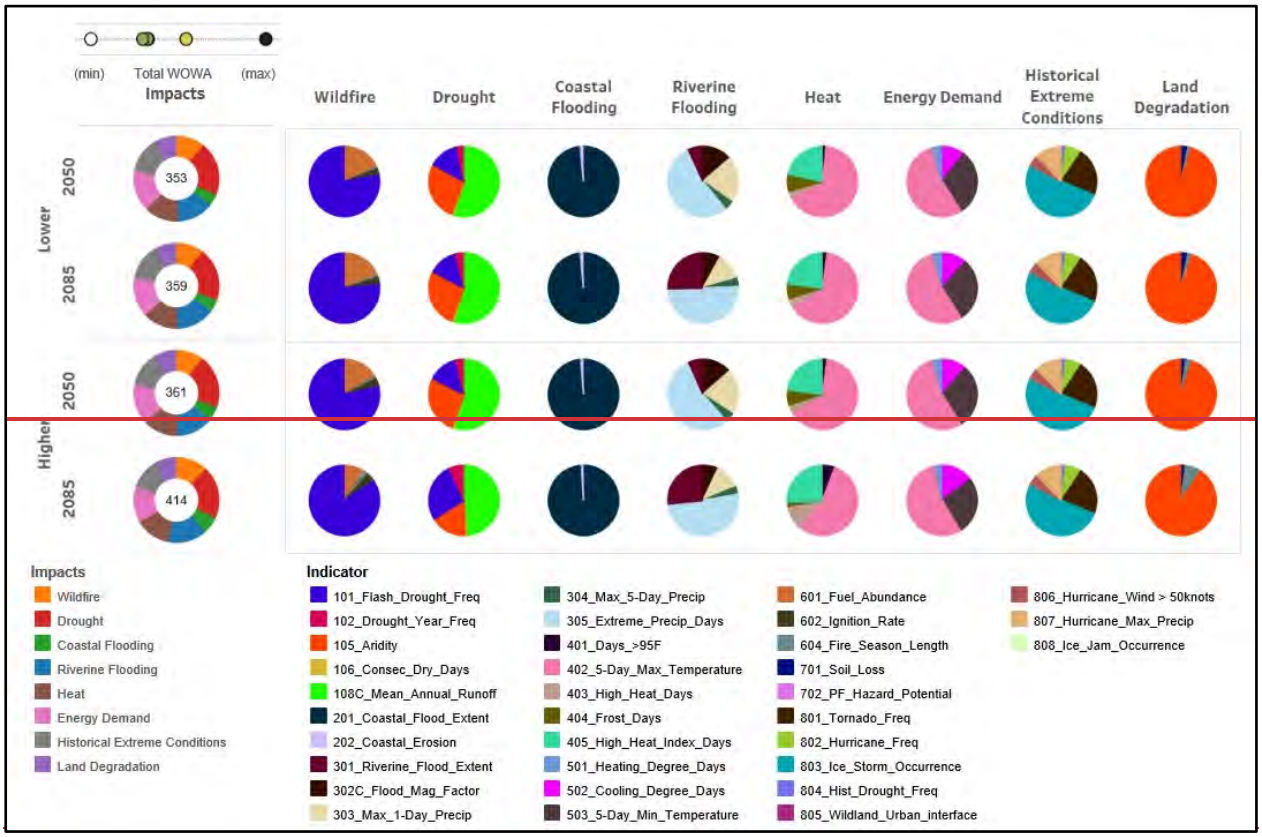


Figure 4-1. ALC Climate Risk Factors



~~Figure 4-2. BPRF Climate Risk Factors~~

4.2 THREATENED AND ENDANGERED SPECIES MANAGEMENT

4.2.1 Current Management

The management goal for rare, threatened and endangered species on ALC and BPRF is to ensure protection of federal- and state-listed threatened and endangered species and species of special concern and undertake management measures that support conservation and recovery of these species consistent with the military mission. The objectives for this goal include:

- Identify and preserve these species in accordance with the ESA, Endangered Species Recovery Plans, U.S. ARs and guidance, and approved site-specific management plans, including ESMPs.

- Protect unique plant species identified as rare statewide or locally, but without legal protection status, to the extent practical without restricting key mission operations.

Ongoing efforts towards this goal include, a Rare, Threatened and Endangered Species Survey conducted on ALC and BPRF in August 2015 (**Appendix G**) and as part of the PLSs for this

INRMP in summer of 2020. No listed species, Federal or state, were observed during these surveys.

The bald eagle is no longer protected under the ~~ESA, but~~ESA but is protected under the Bald and Golden Eagle Protection Act. A management plan was updated in 2016 for the bald eagle, which nests on BPRF. The plan provides guidance for BPRF personnel including the location of nest buffers and Standard Operating Procedures (SOPs) to ensure compliance with the Bald and Golden Eagle Protection Act (BGEPA).

Habitat exists at BPRF that would support populations of the small whorled pogonia, though the plant has not been observed. ALC has undertaken a proactive approach to identifying potential individuals of this federally-threatened species.

The Potomac River, adjacent to BPRF, may provide spawning habitat for sensitive fish species and the Federally-listed Atlantic sturgeon. ALC avoids in-river disturbance and coordinates with MDNR if disturbance may be required to complete the military mission.

ALC and BPRF contain habitat for the ~~federally-threatened~~federally threatened NLEB. ~~A survey was conducted on both installations in the summer of 2019~~. The NLEB was found on ALC and BPRF via acoustic recordings during a previous 2016 survey, but not during the 2019 and 2024 surveys. There are currently no known NLEB hibernaculum or maternity trees on ALC or BPRF. Both sites have the tricolored bat recorded on the site.

A spotted turtle was observed on BPRF in 2012, 2016 and 2018. If this species is listed, additional surveys will be conducted in the future.

The rusty patched bumble bee was listed as endangered in January 2017. This bee has historically been found east and west of the D.C. Metro Area. ALC consulted with the USFWS Ecological Services Office in April 2017 regarding the bee. USFWS said that no action was necessary at this time since there are no extant occurrences of the bee in Maryland.

4.2.2 Proposed Management

ALC will continue the current management measures for the protection of rare, threatened and endangered species. In addition, ALC will undertake the following management measures to meet the management goals and objectives:

- Regularly conduct surveys for federally- and state-listed rare, threatened and endangered species and species of concern at ALC and BPRF. If any species are located, coordinate with the USFWS and MDNR, as appropriate, and develop the appropriate level of management plan (i.e., ESMP, monitoring plan) for their protection.

- Follow the USFWS ~~30-day streamlined~~ consultation process for any projects that could affect the NLEB or tricolored bat.

- Plant more pollinator gardens on ALC ~~and explore a garden for BPRF~~. Ban the use of neonicotinoid pesticides on ALC and BPRF. There are currently no neonicotinoid pesticides in the ALC pesticide inventory.

- Support the USFWS IMCOM funded pollinator habitat conversion project. In 2024, the USFWS selected BPRF as one of the sites for pollinator habitat creation. This project will convert 8.5 acres of mowed grass into a meadow habitat that will benefit pollinator species. This project will save time and money as these areas will only need to be mowed once a year instead of several times a year. The project boundaries were mapped in the summer of 2024 and the first stage of the conversion will start in spring of 2025.

- Avoid disturbance to in-river habitat to protect spawning habitat for the federally protected Atlantic sturgeon. Disturbance to in-river habitat should be both seasonal and minimized. Generally, no in-stream work likely to result in suspended sediments within the water column is allowed in this area of the Potomac River between 15 February and 15 June, inclusive, of any year. In August 2017, the Potomac River was designated as Critical Habitat for the Chesapeake Bay Distinct population segment of the sturgeon.

- Monitor the PMB and avoid any disturbance to this rare habitat. Avoid an increase in sediments or nutrients to the bog from increased impervious area, fertilizers, and septic systems. Remove small trees encroaching this site, such as red maple, tulip tree and sycamore saplings that are less than four inches in diameter. Manually remove invasive species, specifically Japanese stiltgrass (*Microstegium vimineum*) in early August. Manage invasive species encroachment along the nearby road using herbicide. Coordinate invasive species control with the adjacent landowner and Maryland-National Capital Park and Planning. Also note that this site has a globally rare status and is considered a Wetland of Special State Concern, which includes a 100-foot upland buffer to this site.

- Consider designating the PMB as a Special Natural Area by the Garrison Commander.

4.3 WETLANDS MANAGEMENT

4.3.1 Current Management

EO 11990 requires that federal agencies minimize any significant action that contributes to the loss or degradation of wetlands and that action be initiated to enhance their natural value. DA policy is to avoid adverse impacts to existing aquatic resources and to offset those adverse impacts that are unavoidable. The Army also strives to achieve a goal of no net loss of values and functions to existing wetlands per DoDI 4715.03, and it allows no overall net loss of wetlands on Army-controlled lands. DA and ALC will also take a progressive approach toward protecting existing wetlands, rehabilitating degraded wetlands, restoring former wetlands, and creating wetlands in an effort to increase the quality and quantity of the nation's wetland resources.

The main goal for wetlands management at ALC is to protect the integrity of surface and groundwater resources. The primary objective for wetlands management is to maintain a policy of no net loss of wetlands habitat at ALC. Activities occurring both in and adjacent to wetlands that would negatively affect the habitats will be avoided, when possible, in a manner consistent with the CWA and Maryland regulations. Where impacts on wetlands cannot be avoided, ALC will coordinate with USACE and MDE to undertake permit actions, as appropriate.

Wetland delineations were completed on ALC and BPRF in 1994, 2011, 2018 and again in 2020 in conjunction with the PLS for this INRMP (**Appendix F**). Two of the wetlands in the 2018 survey were determined as jurisdictional through the USACE, Regulatory Branch. The 2020 survey has not been reviewed by the regulatory agencies, but the extent of delineated wetlands did not change from 2018 to 2020. Wetlands at ALC are mostly found along the floodplains of Paint Branch and Hillandale Run. Wetlands at BPRF cover much of the facility and are tidally influenced. Protection of these wetlands allows for quality fish and wildlife habitat and water quality benefits.

All activities that affect wetlands require an environmental analysis in accordance with requirements of AR 200-1 and ~~33 CFR Part 651,~~DoD NEPA Implementing Procedures, and Army Guidance Memorandum – DoD NEPA Implementing Procedures as well as applicable federal and state laws and regulations. Under Section 10 of the Rivers and Harbors Act of 1899, permits must be obtained before beginning any work or building any structures in a navigable water of the United States. Section 404 of the Clean Water Act requires permits for the discharge of dredge or fill material into waters of the United States, including wetlands. The regulations established in Title 33 of the CFR Parts 320 to 330, prescribe statutory authorities and general and special policies and procedures relevant to the review of applications for USACE permits. Before beginning any new work in waters of the United States, a district engineer must be contacted and a permit must be obtained, as appropriate.

Activities on BPRF must also be determined as consistent with the Maryland Tidal Wetland Act, Non-Tidal Wetlands Protection Act, and Chesapeake Bay Critical Areas Act. Activities within 25 feet of non-tidal and 100 feet of tidal wetlands must be coordinated with the Maryland, Non-Tidal Wetlands and Waterways Division.

4.3.2 Proposed Management

ALC will continue to avoid any impacts to wetland resources and perform activities consistent with the CWA and Maryland regulations. In order to continue the goal of no net loss of wetlands, ALC will undertake the following management measures:

- Maintain information and mapping of the wetlands located on ALC and BPRF for planning and training purposes. This information should be made available to all personnel involved in activities that could impact wetland resources.

- Monitor all wetland areas for possible adverse impacts resulting from mission activities, invasive species, or functional changes in wetland values or hydrology that may require remedial actions (for example, unwanted beaver dams).

- Maintain a 25-foot management buffer around all non-tidal wetlands and a 100-foot buffer around tidal wetlands. The buffer zone will be increased as necessary based on topography or where monitoring determines that current activities adjacent to a wetland are causing noticeable adverse impacts on the habitat. Activities within buffer zones should be limited to that which would cause little or no impact on or disturbance to the wetland. In cases where established activities already occur within buffer areas, and the activities cannot be reasonably changed, wetland conditions should be monitored to ensure that any impact is minimized.

- Continue current water quality management practices to protect wetlands from non-point source runoff.

- Periodically review installation programs that may potentially affect wetlands and develop appropriate planning procedures and guidelines to avoid the loss of wetland functions or habitat. The Natural Resources Manager will coordinate with other ALC Environmental Division staff to disseminate information on the location of wetlands and wetland conservation requirements.

4.4 LAW ENFORCEMENT OF NATURAL RESOURCES LAWS AND REGULATIONS

Natural resources law enforcement on ALC and BPRF is provided by MDNR Natural Resources Police. There are CLEOs at APG that can be consulted as needed. The ALC Natural Resources Manager works to assure legal compliance of military and civilian activities with regard to natural and cultural resource laws and regulations.

4.5 FISH AND WILDLIFE MANAGEMENT

4.5.1 Current Management

The primary goal of fish and wildlife management is to maintain the diversity of species and habitats currently found at ALC and BPRF, restore and enhance degraded habitats where possible, and promote sustainable management of resources in a manner consistent with ecosystem management principles and the military mission. The primary objective for maintaining fish and wildlife biodiversity is to protect present wildlife habitats from degradation. Sustainable management of fish and wildlife populations includes both direct measures to regulate the populations of game species as well as indirect habitat improvement measures designed to promote stable populations of important non-game species, such as forest-interior and grassland birds. Protection of migratory birds and bald eagles is also an objective of fish and wildlife management that is discussed in **Section 4.8**, Migratory Bird Management.

4.5.1.1 Non-Game Species

The primary goal for non-game species management at ALC is to sustain healthy populations of non-game species at levels compatible with land use objectives and the military mission. The primary means of achieving this goal is to maintain structurally and biologically diverse ecosystems at the installation. Forest Interior Dwelling bird habitat is present at both ALC and BPRF; management activities prevent impacts to this habitat and the bird species.

Numerous techniques for managing non-game species habitat have been identified in other sections of this document dealing with aquatic and terrestrial ecosystems.

Between 1992 and 1995, 15 wild turkeys were relocated from the United States Navy Dahlgren Research Facility to BPRF. The birds were collected using rocket nets and transported to BPRF by U.S. Army personnel. In the ensuing years, these birds have established a population at BPRF.

Non-game species management, as with forest interior and grassland birds, is also conducted with assistance from federal and state wildlife agencies. ALC currently manages the Canada goose population by participating in the USFWS resident goose egg and nest removal program. BPRF personnel maintain osprey nesting platforms at BPRF.

In 2017, 16 new Eastern bluebird boxes were installed on ALC as part as an Eagle Scout Service Project. The project is discussed in **Section 4.8**.

Beaches on BPRF provide likely terrapin and horseshoe crab spawning habitat and therefore permanent and seasonal disturbance to the beach should be minimized. In the event of the need to conduct permanent or seasonal disturbance, APG will contact MDNR Fisheries Service for guidance.

The waterfront adjacent to BPRF is a waterfowl concentration and staging area. Prior to the construction of any water-dependent facilities APG will contact the Maryland Wildlife and Heritage Service (WHS) for technical assistance regarding waterfowl.

4.5.1.2 Pollinators

Preventing continued losses of our country's pollinators requires immediate national attention, as pollinators play a critical role in maintaining diverse ecosystems and in supporting agricultural production. Some three-fourths of all native plants in the world require pollination by an animal, most often an insect, and most often a native bee. Pollinators, most often honey bees, are also responsible for one in every three bites of food we take, and increase our nation's crop values each year by more than 15 billion dollars. Unabated, these losses of our pollinators threaten agricultural production, the maintenance of natural plant communities, and the important services provided by those ecosystems, such as carbon cycling, flood and erosion control, and recreation.

In response to this threat, in June 2014, President Obama issued a memorandum establishing a Pollinator Health Task Force, co-chaired by the Secretary of Agriculture (USDA) and the Administrator of the USEPA. The Task Force created the National Strategy to Promote the Health of Honey Bees and Other Pollinators (Strategy), to promote the health of honey bees and other managed bees, wild bees (both native and introduced species), butterflies and other pollinating insects, and birds and bats. The Strategy was released by the White House on May 19, 2015.

In addition to USDA and USEPA, the Task Force was chartered to include representation from other departments including the DoD.

Building on the current state of the science, and with a renewed emphasis on expanding our understanding of the complex interactions among the various factors impacting pollinator health, the Strategy lays out current and planned Federal actions to achieve the following overarching goals:

• **Honey Bees:** Reduce honey bee colony losses during winter (overwintering mortality) to no more than 15% within 10 years.
• **Monarch Butterflies:** Increase the Eastern population of the monarch butterfly to 225 million butterflies occupying an area of approximately 15 acres (6 hectares) in the overwintering grounds in Mexico, through domestic/international actions and public-private partnerships, by 2020.

• **Pollinator Habitat Acreage:** Restore or enhance 7 million acres of land for pollinators over the next 5 years through Federal actions and public/private partnerships.

The Strategy also advances ambitious Federal commitments to increase and improve habitat for pollinators, both directly through the large variety of facilities and acreages of land managed by the Federal government, and indirectly through the leadership role that Federal agencies can play in interactions with states, localities, the private sector, and citizens. These actions range from planting pollinator gardens and improving land management practices at Federal facilities, to advancing the availability and use of pollinator-friendly seed mixes in land management, restoration, and rehabilitation actions nationwide. The entire Strategy can be viewed at: https://www.whitehouse.gov/blog/2015/05/19/announcing-new-steps-promote-pollinator-health.

A pollinator garden was installed on ALC near the front gate in June 2016 (**Photograph 4-1**). The ALC Pollinator Garden was certified as a Monarch Waystation (monarch habitat) by Monarch Watch in July 2016. Monarch Waystations are places that provide resources necessary for monarchs to produce successive generations and sustain their migration. The following plant species used in the garden and the fauna they benefit are listed below:

- Raydon's favorite aster (*Symphyotrichum oblingifolium*): bees, butterflies
- Bee balm (*Monarda disdyma*): bees, humming birds, butterflies
- Blazing star (*Liatrias spicata*): bees, humming birds, butterflies
- Butterfly weed (*Asclepias tuberose*): Monarch butterfly host and nectar, bees
- Joe-pye weed (*Eupatorium purpureum*): song birds, butterflies

- Native purple coneflower (*Euchinacea purpurea magnus*): song birds, hummingbirds, butterflies, bees
- Swamp milkweed (*Asclepais incarnate*): Monarch butterfly host and nectar, hummingbirds, bees.



Photograph 4-1. ALC Pollinator 2016 Garden

After one year, multiple Monarch butterfly caterpillars and chrysalises were observed in the garden. The photographs below (**Photographs 4-2 and 4-3**) show a Monarch butterfly chrysalis and caterpillar in observed in September 2017.





Photographs 4-2 and 4-3. Monarch Butterfly Chrysalis and Caterpillar in the ALC Pollinator Garden in 2017

4.5.1.3 Game Species

There is currently no fishing program at ALC or BPRF due to the lack of employee interest. Hunting for white-tailed deer has been taking place on BPRF since 1993. The hunting program satisfies the Forestry Management, Wildlife Management and Outdoor Recreation components of this INRMP.

White-tailed deer is the only wildlife species that is presently managed for consumptive use at BPRF. ALC is currently developing a wild turkey hunting program. There was a historic waterfowl hunting blind on BPRF and there are currently other waterfowl blinds in the vicinity of BPRF.

ALC developed a White-tailed Deer Management Plan (**Appendix N**) for ALC and BPRF with the assistance of the MDNR Deer Project Staff in October 2015 when the deer population was at levels significantly above the biological carrying capacity.

White-tailed deer currently exist on ALC and BPRF at population levels above the biological carrying capacity. The USDA Wildlife Services and MDNR have recommended 15 to 20 deer per square mile as a goal for optimal carrying capacity for a deer herd. ALC should have a deer herd of 5 to 10 deer and BPRF should have a herd of 50 to 60 animals.

Results of the white-tailed deer surveys conducted by USDA Wildlife Services using FLIR are shared with the MDNR each ~~spring, and~~spring and are also used to determine the number of deer that can be harvested from each installation. The surveys are conducted on drivable roads from vehicles just after sunset. The following table provides a summary of the FLIR survey data since 2015. Surveys are only conducted if funding is available.

Table 4.2 Summary of White-tailed Deer Surveys from 2005 to 20244~~0~~

Year	Number of Deer Counted on ALC	Number of Deer Counted on BPRF
2015	32	113
2016	20	112
2017	17	N/A
2018	6	87 (January) 57 (April)
2019	11	77
2020	23	78
2024	2	48

Deer herd reduction projects with USDA Wildlife Services provide an additional management tool to achieve the goal of bringing the deer herds to carrying capacity. A deer herd reduction project with the USDA Wildlife Services at ALC was completed in the winter of 2015 and 49 deer were removed. In March 2017, a deer herd reduction project was conducted with the USDA Wildlife Services at BPRF and 31 deer were removed. Another reduction took place in March ~~2018~~2018, and 24 deer were harvested at ALC and 33 deer were harvested from BPRF. All deer harvested during these projects are donated to the Maryland Food Bank and are distributed in the corresponding counties.

The hunting of white-tailed deer is conducted at BPRF via a firearms season exemption for managed hunts from MDNR. The hunting season runs from October to December. The bag limit per person and the overall season bag limit is set using the results of the yearly spring white-tailed deer FLIR surveys. ~~In 2020, hunters were allowed to harvest up to eight deer (four antlerless and two antlered).~~ The overall bag limit ~~in~~ is usually ~~2020~~ 2024 ~~was 65~~ 50 deer and is updated as necessary as the result of deer survey data or from recommendations from the MDNR Deer Project Leader.

BPRF has ~~also~~ hosted~~s~~ the MDNR "Becoming an Outdoors Woman" White-tailed Deer Hunting Workshop ~~each~~ in November. The workshop consists of a one-day classroom and field workshop and an antlerless white-tailed deer hunt on the second day. Due to personnel reductions, BPRF is unable to continue to host the program at this time.

Shotgun is the only weapon authorized for hunting at BPRF. Ammunition used is slug only. Hunting is conducted from stationary stands (located north of the range) which provides a safe environment for the hunters. Stationary stands are more secure than portable stands (less risk of collapse and falls) and shooting from a tree stand at a downward angle provides an additional safety measure.

A wild turkey hunt is being ~~proposed~~ considered at BPRF. The bag limit and season would follow the MDNR guidelines.

CLEO are not stationed at ALC or BPRF due to the small size of the installations and due to budget constraints. The hunts at BPRF are conducted using Wildlife Conservation Officers that are

appointed by the ALC Garrison Manager. If outside assistance was needed, the local police or sheriff's department would respond to BPRF.

The Rules and Regulations for the deer hunts and a sample hunting permit are included in the White-tailed Deer Management Plan in **Appendix N**. The Natural Resources Manager maintains survey and harvest records in the Conservation/ Deer Management Folder on ~~the K drive~~SharePoint. The permits for this program are sold using the iSportsman online program.

4.5.1.4 Fisheries

Spawning areas for brown trout, an important sport fish, are found upstream of ALC in the upper part of Paint Branch (the area upstream of Fairland Road). The Montgomery County Council has designated this area as a Special Protection Area based on its trout spawning capability, high water quality, and the threat posed by the intensity of existing and future development in the watershed. To protect this valuable resource, no in-stream work is permitted between 1 October and 30 April, inclusive, of any year.

In October 2016 and April 2017 and again in 2024~~, a~~ fish surveys took place at ALC as part of an overall stream assessments for the Paint Branch and Hillandale Tributary. The surveys found ~~over~~ about 20 different species of fish during both sampling events (**Photograph 4-4**). Paint Branch is home to three species that cannot tolerate poor water quality. They include the rosyside dace (*Clinostomus funduloides*), blue ridge sculpin (*Cottus caeruleomentum*), and northern hogsucker (*Hypentelium nigricans*). The final report for the surveys can be viewed in ~~the Conservation/Stream Management/2016-2017 Stream Assessment Folder on the K drive.~~Appendix I.



Photograph 4-4. American Eel Observed on ALC During October 2016 Survey

In an effort to preserve striped bass (*Morone saxatilis*) and anadromous fish spawning sites downstream of BPRF, no in-stream work, which results in suspended sediments within the water column, will be conducted in the Potomac River between 15 February and 15 June on any given year, per MDNR. This area of the Potomac River is also pristine largemouth bass (*Micropterus salmoides*) habitat, where impacts to this habitat should be avoided.

Since 1961, the MDNR has been surveying in the Potomac River off Blossom Point for their Estuarine Finfish Recruitment Survey. Sampling consists of taking two hauls with a 100-foot beach seine at established sites, one day per month for three months (July through September). The sampling station off of BPRF has been one of the most productive sites along the Potomac for Atlantic silverside, juvenile striped bass and white perch (*Morone americana*).

In August 2017, critical habitat was designated in more than 3,968 miles of coastal river habitat from Maine to Florida for the Atlantic sturgeon. The Chesapeake Bay distinct population segment of the sturgeon is listed as endangered under the ESA. The waters of the Potomac River off of the coast of BPRF are part of this critical habitat designation. The designation of critical habitat does not include any new restrictions or management measures for recreational or commercial fishing operations, nor does it create any preserves or refuges. When a Federal agency funds, authorizes, or carries out activities that may affect critical habitat, it must work with NOAA Fisheries to avoid or minimize potential impacts to critical habitat (NOAA, 2017). This INRMP can also serve as an exemption to the critical habitat designation.

4.5.2 Proposed Management

Fish and wildlife management at ALC and BPRF is an integrated process that is undertaken by using an ecosystem management approach. Management measures specific to fish and wildlife species are discussed here, while management measures related to these species habitat are discussed in other sections, such as wetlands management and forest resources. Proposed management measures for fish and wildlife management include:

- Continue to monitor populations of non-game species to determine mission related impacts to populations and habitat. Coordinate with appropriate agencies as necessary.

- Continue to implement the white-tailed deer hunting and the deer management program at BPRF to maintain a target herd density of 20 individuals per square mile (50 to 60 animals). Provide harvest records and coordinate with the USDA and MDNR on an annual basis.

- Complete annual surveys of the deer herd population at BPRF in conjunction with the MDNR and USDA Wildlife Services.

- Explore the reestablishment of food plots on BPRF away from the testing ranges for the benefit of turkey and deer species. Also include pollinator species mixes for areas that do not need to be mowed.

- Complete annual surveys of the deer herd population at ALC in conjunction with the MDNR and USDA Wildlife Services.

- Continue the deer management program that was started in the fall of 2015 at ALC to control the deer population within the biological carrying capacity which is a herd of 5 to 10 deer.

- Continue to press for gate upgrades (north and south boundaries) over the Paint Branch that do not allow deer to enter ALC. Press for fence upgrades on the border with FDA/GSA.

- Monitor the impact of deer browsing on native plant communities and timber resources.

- Continue to provide access to the MDNR to conduct the Estuarine Finfish Recruitment Survey.

- Coordinate as appropriate with other organizations and partnerships such as the Partners in Amphibians and Reptile Conservation (PARC) for technical assistance with management and conservation of herpetofauna. Maintain list serve membership. The website can be found at: https://parcplace.org/.

- Coordinate with DoD Partners in Flight (PIF). Maintain list serve membership. The website can be found at: https://partnersinflight.org/.

- Maintain membership and participate in training workshop provided by the National Military Fish and Wildlife Association (NMFWA). The website can be found at: https://www.nmfwa.org/.

- Maintain the Eastern bluebird nest boxes at ALC that were installed in 2017.

- Maintain the existing osprey nesting platforms at BPRF.

- Maintain and enhance various habitats on ALC and BPRF to sustain diversity in landscape, flora and fauna species and conserve native species. Aquatic, wetland, forest and open habitats are discussed in various sections throughout this chapter with habitat management measures that support the goals of fish and wildlife management.

- Maintain the pollinator gardens through weed management, mulch installation and by adding new species.

- Ensure habitat restoration projects use pollinator friendly mixes where feasible.

- Educate Garrison personnel on the environment and the importance of pollinators during National Pollinator Week and Earth Day events (**Photograph 4-5**).

- Continue to allow grassy areas to remain un-mowed at ALC and BPRF that do not pose a security or safety risk.
- Remove nonnative and invasive plant species on ALC and BPRF as funding is available.
- Continue to plant native perennial plant seed mixes at BPRF to promote growth of the forest understory. Protect tree saplings from deer browse with tree tubes and fencing.
- Update the Reptile and Amphibian Survey in 2024~~2~~.
- Update the Avian Survey in 2025~~3~~.
- Update the Bat Surveys in 2024~~2~~.
- Update the ALC Stream Survey in 2023.



Photograph 4-5. Earth Day Walk During April 2017 Fish Survey at ALC

4.6 FORESTRY MANAGEMENT

4.6.1 Current Management

ALC does not contain forest land that can be managed for timber harvest and sale and therefore does not require the development of a Forest Management Plan. Projects for ALC can be found in the Habitat Management Plan (**Appendix P**) and in this INRMP.

ALC manages forest resources at BPRF through the Forest Management Plan (2017), which can be viewed in the Forest Management Folder in the Conservation Folder on ~~the K Drive~~ SharePoint and in **Appendix M**.

The goal for forestry management is to conserve and manage forest resources in a sustainable fashion that maintains biodiversity, ecological functions and values, as well as the military mission. Forestry management objectives include:

- Protect forest resources from unacceptable losses to damage agents and degradation resulting from insects and disease, invasive species, and wildfire.

- The objective of forest resources management for BPRF is for an optimum combination of uses (multiple-use management) including:

    - Wildlife habitat preservation and enhancement;
    - Forested habitat diversity;
    - Wetland, watershed, and groundwater protection;
    - Protection of the shoreline and natural resources in support of the Chesapeake Bay Action Plan; and
    - Preservation of existing historical and cultural resources.

Three forest inventories have been conducted at BPRF. The first was performed in 1981 by a certified professional forester, John Houser (hereafter referred to as the Houser survey). The second was performed in 1997 by John Tingle, a forest ecologist, from USACE Waterways Experiment Station. In 1988, a timber harvest (a pine pulpwood sale) occurred on the facility. The contract for the harvest produced $16,000 of income for the Army forestry program.

The third survey took place in 2016-2017 for the 2017 Forest Management Plan. The USACE Forester designated seven forest compartments and 25 management stands for the 2017 plan. Recommendations from the plan included the reduction of American holly (due to its invasive nature at BPRF), Virginia pine and sweet gum to allow for oak species regeneration, the reduction or removal of dead trees providing fuel for fires, prescribed burning and a reduction of the deer herd which will also allow for oak and other beneficial tree species regeneration. The deer herd at BPRF is close to the carrying capacity at this time, but the damage to the understory was significant due to years of the herd not being managed due to staffing reductions. Implementation of portions of this plan began in 2019 and the project focused on the reduction of American holly, Virginia pine and sweet gum with a diameter at breast height (DBH) of 5 inches or less. The project also focused on the removal of large areas of dead and dying trees near the testing range (at least 50% dead) but ensured an ample amount of snags and logs on the ground would remain for wildlife use. In areas away from the range that were not deemed a wildfire hazard, the target species were removed in a manner that allowed large areas untreated that were left for wildlife bedding and shelter areas with the goal of creating a mosaic of wildlife bedding and shelter areas. Understory saplings were tubed to ensure protection again deer browsing. The 2019 contract focused on the forest compartments that had the highest fire danger and the lowest wildlife habitat quality. The

contract included invasive species management per the Invasive Species Management Plans for ALC and BPRF.

In late 2020, a ~~new~~ forest contract was awarded which continued the same management goals listed above but added the planting of 15 acres of native perennial plant mixtures for the Coastal Plain region that includes species that are beneficial to wildlife. The plantings were spread out over the treated forest compartments in areas that were at risk of invasive species growth. In early 2026, a new forest contract was awarded that will provide maintenance to previously treated compartments and it will provide a way to continue thinning in other compartments. This new contract also allows for the survey and removal of hazard trees which have become more of an issue at ALC.

There have been no major forest fires reported at ~~the~~ either facility. Minor fires are generally restricted to the impact area at BPRF and occur during various ~~fuse~~ test procedures. These are extinguished in accordance with the Fire Protection Plan and the Integrated Wildland Fire Management Plan (**Appendix O**) for the facility.

Gypsy moth (*Lymantria dispar*) infestations are a continuing threat to the hardwoods and could produce significant damage to the ALC's forest resources, on both ALC and BPRF. The moth is found throughout the State of Maryland in its preferred oak forest habitat. Annual aerial surveys for gypsy moth defoliation are conducted by the U.S. Department of Agriculture's Forest Service.

ALC also monitors for the emerald ash borer (EAB) (*Agrilus planipennis*) and spotted lanternfly (SLF) (*Lycorma delicatula*).

The forested areas on both ALC and BPRF are considered suitable FIDS habitat by the MDNR and are managed to conserve this habitat.

4.6.2 Proposed Management

ALC will continue to manage forest resources by protecting forest habitat and employing the Forest Management Plan. Proposed management activities include:

- Continue to implement portions of the Forest Management Plan to include stand improvement objectives to manage for a diversity of species and uneven-aged management and oak species regeneration.
- Continue to plant new understory native species that are beneficial to wildlife.
- Continue to reduce the deer population at ALC and BPRF to help with oak regeneration and understory species regeneration.
- Continue to comply with the Maryland Forest Conservation Act (FCA) regulations for any construction or disturbances to forest resources.

- Continue to implement contract-required BMPs during forest management activities that include: no cutting of vegetation from April to August for the protection of NLEB and migratory birds, no mechanical removal of vegetation within 100 feet of tidal waters and wetlands, no mechanical removal of vegetation within 25 feet of nontidal wetlands and no equipment with a pounds-per-square-inch (PSI) power of greater than 7 allowed to be used.

- Implement provisions of the ESMP for the bald eagle when undertaking forest management activities. Forest management will be done in a manner consistent with minimizing impacts to bald eagles.

- Monitor forest resources for signs of disease, insect outbreaks, excessive damage from wildlife browsing, and wildfire fuel loads.

- Maintain and enhance wildlife habitat by retaining snags, den trees, and coarse woody debris within forest stands consistent with other natural resources objectives and the military mission.

- Prevent the occurrences of wildfires at ALC and BPRF by educating personnel on fire prevention techniques, reducing unnaturally high fuel loads, and restricting the types of activities that can be undertaken based on the level of fire danger in an area.

- Facilitate rapid suppression of wildfires by maintaining existing firebreaks and responding rapidly to contain the spread of wildfires when they do occur, thereby preventing further losses to natural resources and other Army property.

- Evaluate the feasibility of implementing a prescribed burn forest management program at BPRF to reduce natural fuel loads, control invasive species, and improve wildlife habitat. If found feasible, prepare a prescribed burn plan and obtain any necessary approvals or permits.

4.7 VEGETATIVE MANAGEMENT

Vegetative management at ALC is focused on enhancing and maintaining native species populations, eradicating and managing invasive species, and revegetating disturbed areas with native species. Through vegetative management, several INRMP goals are met: soil resources management, fish and wildlife management, habitat management, and invasive species management.

~~EO 13148, *Greening the Government Through Leadership in Environmental Management* (2000), and~~ EO 13112, *Invasive Species* (1999) and EO 13751, Safeguarding the Nation from the Impacts of Invasive Species, advises the use of native species and environmentally sound landscaping in vegetative management. Soil-disturbing activities may require revegetation with native plant species to re-establish herbaceous cover, prevent the spread of invasive species, and enhance habitat.

4.7.1 Current Management

The vegetated lands on ALC consist of undeveloped forest lands and turf and landscaped areas. The forested land management is described above in **Section 4.6**. The turf portion of the grounds includes Kentucky bluegrass (*Poa pratensis*), and fescue species (*Festuca spp*.) that are regularly mowed. The landscaped areas were planted based on a plan approved in 1973, with the objective of creating an attractive and cohesive environment that will promote the physical and psychological well-being of people who work on the facility. The landscaped plantings have matured and the desired effect of a campus-like setting has been achieved. There is also a landscaped courtyard on the second floor of the ALC building complex to provide aesthetic relief for the building inhabitants. In the past nonnative species were used for landscape plants. In the future, only native species will be used in landscaping projects on ALC or BPRF per the Plant Palette developed for the Area Development Plans and Vision Plans for ALC and BPRF.

BPRF has a relatively small amount of land classified as improved grounds due to the field activity and nature of the mission. The improved grounds areas surround the occupied buildings and contain a mixture of Kentucky bluegrass and fescue. Semi-improved grounds include impact areas and test areas that are dominated by a mixture of tall fescue, white clover, and annual and perennial grasses. There are no landscaped areas on BPRF. The management for the large forested areas is described in **Section 4.6**.

Management of the semi-improved grounds is labor-intensive and includes annual mowing in the late summer to early fall time period. This mowing frequency provides for a more diverse wildlife habitat for the many game and non-game species found on the installation, including ground nesting birds, rodents and reptiles, and allow for a significant reduction in fuel costs and equipment maintenance.

4.7.2 Proposed Management

ALC will continue the current management measures and grounds maintenance schedule as discussed above. Proposed management measures, include the following ongoing measures:

- Regular monitoring of the wildlife habitat on the semi-improved areas will be conducted to note progress or areas where a change in management may be necessary to improve the habitat or vegetation conditions while maintaining the mission.

- Monitor areas where soil-disturbing activities may have minimized extent of vegetation.

    - Use native, non-invasive species to restore any disturbed areas or areas requiring revegetation.

- Continue to maintain open fields and non-mowed areas to provide habitat for a wide variety of grassland birds, mammals, and herpetofauna at BPRF. Mowing decks can be raised to 10 to 12 inches and areas should be mowed from the center outward to allow wildlife to escape.

- Implement use of the Plant Palette to ensure native species and species that are beneficial to wildlife and pollinators are used in planting and restoration projects, and for the replacement of aging landscape plants.

4.8 MIGRATORY BIRD MANAGEMENT

4.8.1 Current Management

Migratory bird management is accomplished under the goals of the fish and wildlife management program to maintain the diversity of species and habitats currently found at ALC and BPRF to restore and enhance degraded habitats where possible. The current management activities for migratory bird management include monitoring populations of neotropical migratory birds at ALC and BPRF and monitoring of migratory bird habitat at ALC and BPRF. Avian surveys were conducted at ALC and BPRF in 2018 and have also been conducted as part of the Planning Level Surveys for the 2015 INRMP update and the 2022 update.

In June 2017, sixteen new Eastern blue bird nest boxes were built for ALC by Boy Scout Troop 1441 as part of an Eagle Scout Service Project (**Photograph 4-6**). Half of the boxes were installed by the troop during a volunteer event. The new boxes contain two entrance/exit holes protected by copper portals and predator guards on the support posts.



Photograph 4-6. Eastern Blue Bird Nest Box Being Installed June 2017 at ALC

In 2026, the Natural Resources Manager requested a site survey of the above ground powerlines at BPRF by SMECO. The SMECO Environmental Affairs Coordinator recomeneded the installation Raptor Guards on the top of every power pole, and two flight diverters (Hawk Eye Bird Flight Diverters) on one of the three phases at every span on BPRF. In addition to these protection devices, SMECO will also replace an osprey nesting platform and pole that was damaged in a storm. This project is expected to be completed in the Spring of 2026.

4.8.2 Proposed Management

Ongoing and proposed management activities for migratory bird management include:

- Continue to monitor populations of the bald eagle at BPRF in accordance with the BGEPA. Coordinate efforts with MDNR and USFWS as appropriate. Ensure protection of the bald eagle habitat and nests. If any planned or ongoing activities cannot be conducted in compliance with the National Bald Eagle Management Guidelines (Eagle Management Guidelines), Natural Resources personnel will contact the USFWS Chesapeake Bay Ecological Services Field Office.

- Continue to implement the Bald Eagle Management Plan. Ensure the SOPs in collaboration with USFWS, are followed.

- Continue the partnership for yearly eagle nest monitoring with the Navy Research Laboratory. Aerial surveys are conducted via a contract managed by NAVFAC.

- Continue monitoring populations and habitat for neotropical migratory bird habitat at ALC and BPRF. Conduct another ~~an~~ Avian Species Survey for ALC and BPRF. ~~in 2022~~. A survey was completed in 2018.

- Maintain the Eastern blue bird nest boxes on ALC.

- Maintain the osprey nest platforms at BPRF.

- Continue to consult with USFWS and MDNR on actions that may affect migratory birds protected under the MBTA. ALC will provide notice to USFWS of actions that are intended to intentionally take migratory birds, including but not limited to (1) banding or masking projects, (2) scientific collecting, (3) taxidermy, and (4) depredation control.

- Continue to restrict the removal of vegetation from March to August to protect habitat and nesting birds.

- Continue to protect and improve habitat for FIDS.

- Coordinate with DoD PIF as appropriate for technical support in managing neotropical migratory birds. PIF is concerned with the conservation of neotropical migratory birds and their habitats. Populations of these birds have been declining in recent years due to fragmentation of habitat on breeding grounds, deforestation, and adverse agricultural practices on wintering grounds, pesticide poisoning, nest parasitism, and the cumulative effects of habitat changes along migration routes. The goals of PIF are: (1) determine the status and specific causes of neotropical bird declines, (2) maintain stable populations of species not in decline; and (3) reverse declining population trends through habitat restoration and enhancement. Management opportunities include: (1) inventory, (2) on-the-ground management practices, (3) education, and (4) long-term monitoring to determine changes in populations of these birds on the installation. The website can be viewed at: https://partnersinflight.org/.

- Continue to coordinate powerline protection with SMECO at BPRF.

- Consult the Bird Collision Prevention Alliance for mitigation measures to protect birds from colliding with buildings at ALC and BPRF (https://www.stopbirdcollisions.org/).

- Consult Bird Cast (https://birdcast.org/) to track migration for project BMPs.

4.9 INVASIVE SPECIES MANAGEMENT

4.9.1 Current Management

The goal of the invasive species management program at ALC is to manage and prevent the spread of invasive species that threaten habitat and native species. ALC manages invasive species through the Invasive Species Management Plan (ISMP) for BPRF (USACE, 2013) and the ISMP for ALC (USACE, 2017) (**Appendix Q**). The ISMP identifies prevention as the first line of defense against the spread of invasive species to prevent them from colonizing on the facility. Methods of control or eradication for invasive species found on the facility vary from species to species. Generally, however, there are four methods of management: biological, chemical, manual and mechanical. Each management technique can be initiated as a standalone treatment. In most instances they can be used in conjunction with other management techniques for greater success. Additionally, the appropriate treatment may vary on a case by case basis, i.e., hand pulling Japanese honeysuckle (*Lonicera japonica*) may be practical for a small area, and impractical for a larger area.

ALC monitors and protects the headwaters of wetlands and intermittent streams from unnecessary disturbance in order to prevent invasive species from being transported downstream by flowing water.

4.9.2 Proposed Management

ALC will continue to manage invasive species as planned in the ISMP. Proposed management activities include:

- Continue to implement the ISMP for ALC and BPRF in conjunction with the Forest Management Support Contract.

- Monitor populations of invasive species to assess the success of ongoing treatment efforts and adapt management as necessary.

- Monitor areas where invasive species are likely to originate on the installation, such as along the fenceline. Continue to monitor both ALC and BPRF for introduction or spread of invasive species.

- Plant native species where ground disturbing activities provide an opening for invasive species to spread.

- If herbicides are used, use them in a manner to minimize impacts to sensitive animal and plant species and follow precautionary statements on labels regarding contamination of water if pesticides are applied near wetlands or bodies of water. Only herbicides that are on the ALC Pesticide Use List will be used on ALC and BPRF.

- Invasive species control should be done in a manner consistent with minimizing impacts to bald eagles.

- Remove invasive species from the Powder Mill Bog.

4.10 PEST MANAGEMENT

4.10.1 Current Management

The goal of the pest management program at ALC is to manage and prevent the spread of pests and invasive species that threaten habitat and native species. ALC manages pests through the Integrated Pest Management Plan (IPMP) (USACE, 2020). The objective of the IPMP is to employ the judicious use of both non-chemical and chemical control techniques to achieve effective pest management with minimal environmental consequence. Pest Management priorities at ALC include control of disease vectors, protection of real estate, control of nuisance pests, control of undesirable vegetation, protection of beneficial plants, and control of miscellaneous animal pests (i.e., birds, rodents and other mammals). The four primary control methods for pest management include:

- Mechanical and physical control (physical removal or exclusion of pest)

- Cultural control (altering the environment to make it less suitable or attractive to the pest)
- Biological control (use of other organisms to control a pest)

- Chemical control (use of pesticides)

ALC and BPRF lie within the USDA, Animal and Plant Health Inspection Service (APHIS) high-risk quarantine area for gypsy moth, a dangerous insect to forests and shade trees. Surveillance and control of gypsy moths is coordinated by the USDA Forest Service who conduct annual aerial surveys for gypsy moth defoliation at ALC and BPRF. The gypsy moth has not been a pest species at ALC in recent years.

All of ALC and BPRF are under a USDA quarantine to prevent the spread of the EAB, a beetle destructive to ash trees. The quarantine prohibits anyone from removing ash trees or any hardwood firewood out of quarantined counties. At this time firewood sales are not conducted on ALC or BPRF.

Pest management is targeted at:

- **Disease vectors and medically important pests**: ticks, bees, wasps, hornets, roaches, spiders, ants, mites, chiggers, rodents, birds, flies and mosquitos
- **Quarantine pests**: gypsy moth, EAB, SLF
- **Forest pests:** eastern tent caterpillar, pineshoot beetle, Asian long-horned beetle
- **Real property pests**: stored product pests, stink bug, boxelder bug
- **Weeds and invasive plant species**
- **Pests of ornamental and turf plants**
- **Structural pests:** Subterranean termites, wood boring beetle, wood decaying fungi
- **Vertebrate pests**: Canada geese, birds, feral animals

At the time of the update of this plan, weed control at ALC is being conducted by in-house pest controllers from APG. All other pest control is being conducted via contractors. Contracts for pest management are on file in the office of the IPMC. The current contracts related to pest management at ALC are the contract with Alexandria Pest Services and the contract for Canada goose management (non-chemical) with the Feather Free Zone. There are no contracts for chemical services at BPRF. The Forest Management Support contracts for ALC and BPRF include some chemical control for invasive plant species.

ALC has partnered with the U.S. Army Public Health Center (USAPHC) North at Fort Meade for tick borne disease vector surveys during deer harvests at ALC and managed hunts at BPRF. The ticks are identified and tested for disease vectors. No disease vectors were found at ALC to date, but the following vectors have been recorded at BPRF:

- *Ehrlichia ewingii* (causes Ehrlichiosis)

- *Borrelia burgorferi* (causes Lyme disease)
- *Borrelia miyamotoi* (Tick-borne Relapsing Fever)
- *Anaplasma phagocytophilum* (causes Anaplasmosis)

Copies of the reports can be found in the Integrated Pest Management Folder on the K Drive.

The Environmental Health Service from Walter Reed National Military Medical Center began surveying for mosquitoes in 2018. The surveys are conducted through traps and larval dips. The technicians can apply mosquito briquettes to areas that have standing water that cannot be removed and that are close to areas where the mosquitoes could impact ALC personnel.

4.10.2 Proposed Management

ALC will continue to implement the 2020 IPMP and manage pests primarily through mechanical, physical and cultural control with chemical controls employed when necessary. Proposed management activities include:

- Continue monitoring for pests and manage possible habitat or suitable conditions for pest activity. Continue to coordinate with Environmental Health Service from Walter Reed National Military Medical Center for ALC and BPRF.

- Acquire and deploy 4-Poster Machines in areas of high deer traffic to help reduce the tick population on BPRF. The 4-Poster provides the eradication of ticks without the use of spraying an insecticide over a wide area.

- Continue to conduct pest management controls in a sustainable, ecologically sound fashion as to not impact habitat for endangered species and fish and wildlife, nor degrade water resources and water quality.

- Assess problems with nuisance animals such as raccoons, groundhogs and beavers on a case-by-case basis and remove animals, if needed. If nuisance mammals become a more serious nuisance, a trapping program will be considered to control population levels.

- Regularly review the effectiveness of the IPMP and adapt management measures as necessary for optimal pest management.

4.11 LAND MANAGEMENT (SOIL EROSION)

4.11.1 Current Management

The primary goals of soil conservation and management at ALC are (1) to protect soil resources from erosion and (2) to prevent potential soil erosion impacts on water quality, habitat quality, and mission objectives. Soil erosion resulting from mission activities is not a significant problem at ALC or BPRF due to the flat to gently sloping topography. Storage magazines and bunkers have

been vegetated with orchard and brome grasses, and the vegetative cover is maintained in good repair. Construction activities at ALC have been confined to previously developed areas, minimizing surface disturbances. However, because many soils in upland areas are poorly drained, soil erosion can occur in areas where the vegetative cover has been removed or where surface runoff is concentrated into channels, ditches, or drainage structures.

Soil erosion at ALC is a problem in the following areas: (1) along the eastern Patrol Road and (2) on the slopes adjacent to Paint Branch and the Hillandale Tributary. Soil erosion at BPRF is a problem in the following areas: (1) shoreline along the Potomac River and the Nanjemoy Creek and (2) in the explosives and pyrotechnics research area. ALC will continue the current policy of addressing problem erosion areas through periodic monitoring and inspections of grounds, roadways, and facilities. In addition, a management approach will be developed to avoid disturbing potential problem erosion areas, when possible, in a manner consistent with mission objectives.

4.11.2 Proposed Management

ALC will continue to monitor and inspect grounds, roadways and facilities for erosion and address these areas appropriately. In addition, proposed management activities for soil erosion and land management include:

- Maintain existing road ditches, culverts, and turnouts to ensure proper drainage and minimize the potential for the development of ruts, mud holes, and other erosion related problems. Where necessary, construct new ditches, culverts, or turnouts to divert water away from roads.

- Implement the Shoreline Study and Management Plan for BPRF (**Appendix J**). The management plan provides stabilization and restoration options.

- Per the Shoreline Study and Management Plan, install and maintain shoreline erosion minimization structures along the Potomac River and Nanjemoy Creek at BPRF as funding becomes available. These structures could include offshore breakwaters, revetments, and drainage systems. Non structures can include the planting of native vegetation to create a living shoreline. Following construction establish a monitoring system for assessing the impact of the structures on the aquatic resources, to include submerged aquatic vegetation, fish communities, and water quality.

- Stabilize and seed eroded roadsides and road cuts using native grasses and legumes, when feasible, in a timely manner to minimize impacts to adjacent habitats resulting from the transport and deposition of eroded sediment. During establishment of new vegetation, use geotextile fabrics and mulch to stabilize soil surfaces and prevent further erosion. Where re-establishment of vegetation is not possible, harden slopes and grades with rip-rap, stone, gravel, or other environmentally compatible materials to stabilize slopes.

- Maintain vegetated riparian buffer zones to prevent or minimize stream degradation associated with sediment and other pollutants in runoff. As noted by MDNR, the riparian buffers on ALC should be 200-feet on Paint Branch and 150-feet on tributaries of Paint Branch to protect brown trout habitat. A buffer of 100-feet on tidal waters should be maintained on BPRF for tidal waters.

- Implement the ~~2019~~ ALC Stream Assessment. An area of concern in this assessment is the unnamed stream running along Floral Drive near the back gate of ALC. The stream contains Fall Line Bog habitat. Implement low impact development practices and BMPs such as check dams, bank stabilization, drop structures, and water diversions to reduce erosion and sedimentation in upland areas prone to gully erosion or wash out.

- When soil disturbances are necessary to accomplish mission objectives, use BMP soil conservation measures (such as check dams, wind breaks, and diversions) to control erosion, sedimentation, and dust. Site any intensive land-disturbing activities, when possible, on soils with the least erosion potential based on an analysis of existing soil types, slopes, and vegetative cover.

- Monitor field research areas at BPRF for soil erosion problems and ensure that corrective actions for any soil erosion problems are implemented in a timely manner as to support the testing mission and sustainable use of lands.

4.12 AGRICULTURAL OUTLEASING

There are no agricultural or grazing outleases on ALC or BPRF, nor are any planned for the near future.

4.13 GEOGRAPHIC INFORMATION SYSTEM (GIS) MANAGEMENT

Information management is essential to the natural resources management and planning process. Geographic information system (GIS) is an important computer software tool that allows ALC to organize, evaluate, and spatially display natural resources on ALC and BPRF. GIS data layers can be used to demonstrate spatial locations of natural resources, plan for natural resources management activities, or plan for mission related activities to ensure avoidance of impacts to natural resources. ALC maintains GIS data shapefiles and geodatabase files of natural resource layers on the DPW servers. There is currently no GIS technician working in the DPW, so all GIS support is coordinated through APG.

4.14 OUTDOOR RECREATION

4.14.1 Current Management

Outdoor recreation at ALC includes the hunting program at BPRF. All recreational opportunities at BPRF are open and accessible to ALC employees, members of the U.S. Military, DoD employees, and employees of other Federal agencies. The program ~~allows for~~allows each hunter

to bring a registered guest. These opportunities currently include a white-tailed deer ~~and turkey~~ hunting program conducted in cooperation with the MDNR. See **Section 4.5.1.3** for details on the hunting program.

Due to ~~security reasons~~ALC being a closed installation and lack of personnel, ALC is not open to the public for recreation. A fitness trail was installed in early 2015 at ALC and is open to employees at the installation. Parts of the perimeter road are also used by employees as a walking or running trail.

4.14.2 Proposed Management

As part of the current outdoor recreation program, future activities that ALC plans to undertake include:

- Develop and install environmental signs along the ALC Fitness Trail.
- Continue the white-tailed deer ~~and turkey~~ hunting program at BPRF.
- Update signage for visitors at BPRF.

4.15 BIRD AIRCRAFT STRIKE HAZARD

There are no bird aircraft strike hazard risks at ALC or BPRF due to the lack of aircraft.

4.16 WILDLAND FIRE MANAGEMENT

4.16.1 Current Management

The primary goals for fire management at ALC are to prevent unacceptable losses to military property from wildfire and to use prescribed burning to maintain healthy native ecosystems, where appropriate. The primary objectives to achieve these goals are to implement appropriate wildfire prevention and suppression measures.

There have been no major forest fires reported at ALC or BPRF. Minor fires are generally restricted to the impact area and occur during various fuse test procedures at BPRF. These are extinguished in accordance with the Fire Protection Plan for the facility.

An Integrated Wildland Fire Management Plan for ALC and BPRF was completed in 2018 (**Appendix O**). It was developed by the USACE, Baltimore District, with comments being provided by the APG Fire Department. The plan was updated in 2023 to conform with the general template provided by the 2021 Department of the Army, Installation Wildland Fire Program Implementation Guidance, with modifications to address specific aspects of wildland fire management at ALC and BPRF.

4.16.2 Proposed Management

ALC will continue to operate under the Fire Protection Plan for ALC and BPRF. The following general fire management measures will be undertaken at ALC; more specific measures will be developed as they are required for individual areas (such as specific burn plans) or fire hazards:

- Implement the 20232318 Integrated Wildland Fire Management Plan and ensure cooperative agreements are clearly defined and up-to-date.

- Prevent the occurrences of wildfires at ALC. Wildfire prevention involves minimizing fire occurrence by educating personnel on fire prevention techniques, reducing unnaturally high fuel loads, and restricting the types of activities that can be undertaken based on the level of fire danger in an area. Fuel loads are evaluated during periodic inspections of natural habitats by the ALC Natural Resources Program Manager and during the field work by a certified Forester for the Forest Management Plan update.

- BPRF has two brush all-terrain vehicles (ATVs) for wildfire suppression. Wildfire suppression essentially entails maintaining existing firebreaks and responding rapidly to contain the spread of wildfires when they do occur to prevent further losses to natural resources and other Army property. BPRF and ALC would call for the assistance of the local fire department during a wildfire.

4.17 TRAINING OF NATURAL RESOURCE PERSONNEL

Training of natural resource personnel at ALC is an ongoing effort to ensure knowledge of natural resources management strategies, new regulations and policies, and other related programs are current. This is important to ensure ALC is compliant with environmental legislation and requirements and management activities continue to be adapted and improved.

The IPM program requires that personnel applying pesticides be appropriately trained and certified as well. Any certifications for performing management activities are kept current and, at present, only apply to the IPM program.

Natural resource personnel train military and installation personnel who also play a role in natural resource management at ALC. Conservation awareness training for installation personnel includes information on invasive and pest species management, protected species habitat, bald eagle conservation, and protection of aquatic and riparian resources through the riparian buffers and critical area zone. Personnel are made aware of the monitoring programs for soil erosion and invasive and pest species. Field personnel are provided a briefing at BPRF that includes visual and written information on how to identify potential listed species.

Continual coordination with USFWS, MDNR, and other state agencies can also help keep natural resource personnel current and proactive with natural resource management.

The training workshop for military natural resource managers provided by NMFWA each spring provides a valuable training opportunity. The website for NMFWA can be found at: https://www.nmfwa.org/.

4.18 COASTAL MANAGEMENT

ALC and BPRF are located within the Coastal Management Zone that is protected under the CZMA, as administered by the MDNR. The CZMA was enacted in 1972 to preserve, protect, or enhance the coastal resources of the U.S. for the use and enjoyment of present and future generations (CZMA, 1972). Under its authority, coastal states and territories were encouraged to develop Coastal Zone Management Programs (CZMP) in a partnership with the Federal government. Maryland developed a CZMP through MDNR and MDE that identifies the Coastal Zone as the counties along the Atlantic Ocean, Chesapeake Bay, coastal bays, as well as, the towns, cities and counties that contain and help govern the coastline. A key component of the Maryland CZMP is federal consistency, which requires that federal actions which are reasonably likely to affect any land or water use, or natural resource of a state's coastal zone be conducted in a manner that is consistent with Maryland CZMP.

The Maryland CZMP focuses its work on the complexity of resource management problems of the coast. It takes a comprehensive approach to problem solving, balancing the often competing and conflicting demands of coastal resource use, economic development, and conservation. The Maryland CZMP, like the national Program, focuses its program goals around three central themes:

- Sustainable coastal ecosystems
  - Sustain and improve coastal water quality
  - Protect, restore, and enhance coastal land and water habitats

- Sustainable coastal communities
  - Reduce threats and losses from coastal hazards
  - Sustain, develop, and revitalize ports, harbors, marinas and urban waterfronts
  - Provide public access to the coast
  - Provide appropriate sites for coastal dependent uses
  - Preserve historic, cultural, and esthetic coastal features

- Promoting government efficiency
  - Ensure Federal and state consistency with state policies
  - Simplify permit processes
  - Consider the national interests in the coasts, and provide orderly, predictable facility siting
  - Provide for local government and public participation

ALC and BPRF will ensure that all activities are consistent with the Maryland CZMP and work through the federal consistency process when there may be impacts to coastal resources. The goals

and management programs discussed within this INRMP are complementary to the goals of the Maryland CZMP.

In addition to the federal consistency requirement, Maryland has established the Critical Area Act where a Critical Area is defined as "all land within 1,000 feet of the mean high water line of tidal waters, or the landward edge of tidal wetlands and all waters of and lands under the Chesapeake Bay and Atlantic Coastal Bays and tributaries." The Critical Area Act establishes the Chesapeake Bay Critical Area and Atlantic Coastal Bays Critical Area Protection Programs and the Critical Area Commission to enable the State and local governments to jointly address the impacts of land development on habitat and aquatic resources.

The goals of the Critical Area Protection Programs are to:

- Minimize adverse impacts on water quality that result from pollutants that are discharged from structures or conveyances or that have run off from surrounding lands;
- Conserve fish, wildlife, and plant habitat in the Critical Area; and
- Establish land use policies for development in the Critical Area that accommodate growth and also address the fact that, even if pollution is controlled, the number, movement, and activities of persons in the Critical Area can create adverse environmental impacts.

The Critical Area Commission devised a set of criteria to minimize the adverse effects of human activities on water quality and natural habitats and foster consistent, uniform and more sensitive development activity within the Critical Area. In cooperation with the Critical Area Commission, the 61 local governments whose jurisdictions are partially or entirely within the Critical Area administer local critical area programs.

Much of BPRF is within the Critical Area. ALC manages lands, water resources and habitat within the spirit of the Critical Area Protection Program as demonstrated through the goals and management programs in this INRMP. Critical Area Commission staff will be contacted prior to any activities that cannot be avoided and may impact coastal resources or resources within the critical area.

4.19 FLOODPLAIN AND WATER RESOURCES MANAGEMENT

There are significant water resources on ALC and BPRF that contribute to the health and water quality of the Chesapeake Bay and provide aquatic and riparian habitat for several species. Water resources management includes surface water resources, such as streams and wetlands; groundwater resources; and stormwater management. ALC executes their water resources management program within the Federal and state regulatory programs and coordinates with appropriate agencies as necessary.

4.19.1 Current Management

The primary goal of floodplain and water resources management at ALC is to protect the integrity of surface and groundwater resources and aquatic habitats to maintain and enhance biodiversity and protect water quality. Objectives to meet this goal include:

- Protect aquatic and riparian resources by establishing and maintaining riparian management zones that limit activities within buffer zones around streams and wetlands to those activities that would cause little or no impact on water quality and aquatic habitats. Identify and restore degraded habitats when practical.

- Prevent the degradation of water quality from point and non-point sources of pollution to include sediments, nutrients, and chemical pollution.

- Achieve no net loss of wetlands.

Current ongoing management activities include:

- Avoid impacts to aquatic and riparian resources, to include the riparian buffer area, from mission-related activities to maintain diverse habitats and water quality.

- Employ pollution prevention strategies to protect aquatic and riparian resources through the IPMP by limiting use of pesticides and fertilizers.

- Consider non-point source pollution abatement during construction, operations, and land management plans and activities. Employ best management practices to prevent erosion, sedimentation and discharge of other pollutants to water resources.

- A stream protective buffer is maintained adjacent to Paint Branch and its tributaries. The State of Maryland designates these waterways as Class III – Natural Trout Waters. Montgomery County, Maryland guidelines for environmental management of development recommend a minimum buffer width of 200 feet from the stream bank when slope ranges are 25 percent or greater. This 200-foot buffer is applicable to Paint Branch.

- The United States Geological Survey (USGS) installed a water quality monitoring station in 2007 at ALC on Paint Branch that conducts 24-hour monitoring. The water quality parameters monitored include temperature, pH, specific conductance, dissolved oxygen and turbidity. Every other month, technicians from USGS come to ALC to collect data for the mentioned parameters to cross check the station. The technicians take samples for sediment and bacteria and they are sent to their main laboratory in Denver for processing. Water quality reports from the station have been published by USGS and are available on the ~~DPW server~~Teams in the Conservation/Stream Management folder. The real time and historical data for the station can be viewed online at: http://waterdata.usgs.gov/nwis/inventory/?site_no=01649190&agency_cd=USGS&.

- A Stream Assessment was conducted for Paint Branch, the Hillandale tributary and the unnamed tributary in 2016 and 2017 by the USACE, Baltimore District. The final report was delivered in January 2019. Another assessment was conducted in 2024, however the physical assessment results were still pending as of February 2025. The assessments included physical and biological parameters. —The 2017 physical stream corridor assessment identified a total of 23 problem sites within Paint Branch, Hillandale Run, and the unnamed tributaries to Paint Branch. Not all of these areas call for immediate action due to factors such as difficult access and low severity. A summary of the results of each of the problems sites identified during the physical stream assessment are provided in the Final Assessment located in ~~the Conservation/Stream Management Folder on the K drive~~ SharePoint ~~and~~ in **Appendix I**.

  According to the 2017 assessment, the waterbodies of ALC support a relatively diverse community of invertebrates and fish considering their location in a highly developed area of the state. In total, 3,489 fish from 23 species were collected with several size classes present, indicating a diverse and naturally reproducing fish community in the waterbodies of ALC. Many species of invertebrates were collected, including several taxa considered by Maryland to be intolerant to pollution.

  According to the assessment, turbidity, dissolved oxygen, pH and temperature in Paint Branch, Hillandale Run and the unnamed tributary to Paint Branch were all well within the water quality standards for a Class III stream. All measured total nitrate and nitrite levels are well below the drinking water standard for nitrates, which is set at 10 mg/L. Maryland does not have phosphorus limits for surface waters, however, to prevent eutrophication, the USEPA recommends that total phosphorus levels do not exceed 0.1 mg/L in streams that do not enter a lake or reservoir. In the Fall 2016, the Hillandale Run slightly exceeded this recommended phosphorus level with a measured concentration of 0.17 mg/L but all other locations and sample events met this recommended level. Although a direct comparison to water quality standards is not applicable for all constituents and measurements, in general, the waterbodies of ALC appear to meet applicable criteria and are capable of supporting aquatic life. ~~A copy of the final report is available in the Conservation/Stream Management Folder on the K drive.~~

  Similar to the previous assessment, the 2024 assessment stated that the waterbodies of the ALC support a relatively diverse community of invertebrates and fish considering their location in a highly developed area of the state. In total, 2,422 fish from 22 species were collected with multiple size classes present, indicating a diverse and naturally reproducing fish community in the waterbodies of the ALC. Many species of invertebrates were collected, including several taxa considered by Maryland to be intolerant to pollution.

  The 2016/2017 data was the first aquatic sampling performed at the ALC, the 2024 sampling followed the same methods and was the first sampling event after the baseline sampling to assess potential changes over time. Compared to the baseline sampling the 2024 water quality results were similar, with most results within the range of or close to

the baseline sampling results and meeting applicable water quality criteria (when available).

The spring BIBI invertebrate scores remained the same at the upstream Paint Branch location, increased at the downstream Paint Branch location and decreased at Hillandale Run. The summer invertebrate BIBI scores increased from 2016 at the Paint Branch downstream location but decreased for the upstream Paint Branch and Hillandale Run locations. Overall, invertebrate scores improved at the downstream Paint Branch location compared to baseline but decreased or stayed the same at the Upstream Paint Branch and Hillandale Run locations.

The 2024 fish FIBI scores remained the same in both the spring and summer sampling at the Paint Branch upstream location but decreased significantly at the downstream Paint Branch and Hillandale run locations compared to 2016/2017. At the downstream Paint Branch location, the stream condition rating dropped from good in 2017 to poor in the spring 2024 sampling and from good to fair in the summer 2024 sampling. At Hillandale Run, the stream condition rating dropped from poor in 2016/2017to very poor in both the spring and summer 2024 sampling. It's not clear why the fish scores dropped for two of the three locations while the invertebrate and water quality did not show a similar decrease but it could be related to habitat changes observed during the sampling. Erosion and sedimentation appeared more profound at the downstream Paint Branch location and Hillandale Run. The habitat assessment performed separately by USACE biologists may provide insight into the potential causes.

- A Shoreline Survey and Management Plan for BPRF was completed in 2017 (**Appendix J**). The estimate is an almost 50-foot loss over the next 50 years. The Nanjemoy creek side is losing an average of 1to 3-feeoot per year and the loss is an average of 1.7 feet per year on the Potomac River side. A copy of the final report is available in the Conservation/Blossom Point Shoreline Management/Shoreline Survey and Management Plan Folder on the K driveTeams.

4.19.2 Proposed Management

ALC will continue ongoing water resources management efforts. The following management measures are proposed to protect and enhance surface and groundwater quality as well as aquatic and riparian habitats:

- Regularly review the results of the water quality monitoring from USGS. If degradation of water quality is determined to be occurring, actions will be taken to identify the source of contamination or pollution and implement appropriate remedial measures to cleanup contamination or minimize the pollutants and prevent further deterioration of water quality.

- Establish and maintain vegetated buffers around water bodies to maintain streambank and shoreline vegetation, reduce adverse impacts on water quality, and protect aquatic habitat.

- Maintain a continuous tree canopy over streams in forested habitats to regulate mean summer stream temperatures and to provide a source of organic matter for aquatic biota.

- Maintain buffers of continuous vegetation cover to stabilize stream banks and intercept nonpoint source runoff containing suspended sediments, nutrients, and pollutants. Wider buffers should be established in areas of steep slopes to protect water quality and aquatic habitat.

- Retain a diverse composition of native plant species in the riparian areas, particularly with respect to overstory tree species. Use native vegetation to restore vegetated areas, stabilize banks, and control erosion. No bare soil areas should occur within the buffer.

- Retain standing snags, den trees, potential den trees, and coarse woody debris (CWD) on the forest floor to maintain structurally diverse wildlife habitat and functional nutrient cycles. These provisions should apply both with designated riparian buffers and the broader floodplain communities. Allow naturally occurring CWD to remain in stream channels to provide structural diversity and aquatic habitat.

- Avoid activities that would further fragment or reduce the size of existing riparian areas at ALC.

- Evaluate the feasibility of stream bank stabilization both economically and physically at ALC. Implement low impact development practices and BMPs such as check dams, bank stabilization, drop structures, regenerative stormwater conveyance systems, and water diversions to reduce erosion and sedimentation in upland areas prone to gully erosion or wash out.

    - Monitor the performance of BMPs in protecting aquatic habitats. Adjust workplans, project designs, and activities as necessary using principles of adaptive management to meet changing conditions or provide additional protective measures.

    - Limit timber harvesting and other silvicultural activities within riparian buffer zones for streams and other water bodies. Whenever possible, avoid stream crossings during logging operations and limit activities within buffer zones to those that would cause little or no impact on water quality and aquatic habitats.

- Employ low impact development BMPs where possible to improve water quality and reduce stormwater runoff.

- Any increase in impervious surface must be mitigated to avoid or minimize increase in stormwater runoff using low impact development practices or BMPs. All projects that increase impervious surface must be conducted in consistence with the Energy Independence and Security Act Section 438 and Maryland legislation. Implementing low impact development practices and BMPs to capture and treat runoff prior to discharge will help maintain and improve water quality and stormwater runoff volume.

- Limit pesticide and fertilizer use in riparian buffer zones. All pesticide use will follow objectives contained in the IPMP.

- Regularly review water resources management strategies defined above and mission-related activities to evaluate the condition of these resources and determine the need to adapt the management strategy to further enhance water quality and aquatic and riparian habitat.

- Secure funding to complete an EA and design for the severe erosion affecting newly discovered Magnolia Bog wetland habitat located near the ALC back gate (noted in the Final ALC Stream Assessment).

- Remove the large pieces of debris in Paint Branch on the northern border to improve flow and fish passage (noted in the Final ALC Stream Assessment). This project would require a permit from MDE if mechanical equipment was to be used. Research funding options for this project.

- Continue the partnership with Green Trust Alliance for the completion of the National Coastal Resiliency Fund grant at BPRF.

- As funding is available, implement the shoreline protection projects in the 2017 Shoreline Survey and Management Plan (**Appendix J**).

5.0 IMPLEMENTATION

The implementation of this INRMP requires defined objectives and projects to meet the identified natural resource management goals, the use of cooperative agreements to successfully manage natural resources, and funding to execute projects that achieve the INRMP goals.

5.1 MANAGEMENT OBJECTIVES

Goals and objectives identify the most significant natural resources management programs with respect to the military mission at ALC. The goals and objectives were developed by ALC and provide a clear direction to focus natural resources management efforts and funds. The ten goals outlined in this INRMP cover all of the natural resources found on ALC and BPRF, with an ecosystem based approach for comprehensive management, and to meet the overarching goal of this INRMP and the ALC natural resources management program: to ensure that natural resources are managed to maintain ecosystem viability and ensure the sustainability of military lands and support the military mission. **Table 1-1** outlines these goals and objectives.

Appendix B outlines each goal, their objectives, and management activities and specific projects to achieve the goals and sustainably manage natural resources. The appendix also identifies the priorities of the objectives and projects, number 1 through 4, based on the DoDI 4715.03:

1. Recurring Natural Resources Conservation Management Requirements

    i) Administrative, personnel and other costs associated with managing the DoD Natural Resources Conservation Program that are necessary to meet applicable compliance requirements in Federal and State laws, regulations, EOs, and DoD policies, or in direct support of the military mission.

    ii) DoD components shall give priority to recurring natural resources conservation management requirements associated with the operation of facilities, installations, and deployed weapons systems. These activities include day-to-day costs of sustaining an effective natural resources management program, as well as annual requirements, including manpower, training, supplies, permits, fees, testing and monitoring, sampling and analysis, reporting and recordkeeping, maintenance of natural resources conservation equipment, and compliance self-assessments.

2. Current Compliance

    i) Installations currently out of compliance.

    ii) Signed compliance agreement consent order.

    iii) Meeting requirements with applicable Federal or State laws, regulations, standards, EOs, or DoD policies.

    iv) Immediate and essential maintenance of operational integrity or military mission sustainment.

v) Projects or activities that will be out of compliance if not implemented in the current program year. Those activities include:

(1) Environmental analyses for natural resources conservation projects, and monitoring and studies required to assess and mitigate potential impacts of the military mission on conservation resources.

(2) Planning documentation, master plans, compatible development planning, and INRMPs.

(3) Natural resources planning-level surveys.

(4) Reasonable and prudent measures included in incidental take statements of biological opinions, biological assessments, surveys, monitoring, reporting of assessment results, or habitat protection for listed, at-risk, and candidate species so that proposed or continuing actions can be modified in consultation with the USFWS or NOAA Fisheries Service.

(5) Mitigation to meet existing regulatory permit conditions or written agreements, and included in documents required by the DoD Chesapeake Bay Strategic Action Plan.

(6) Nonpoint source pollution or watershed management studies or actions needed to meet compliance dates cited in approved State coastal nonpoint source pollution control plans, as required to meet consistency determinations consistent with Coastal Zone Management.

(7) Wetlands delineation critical for the prevention of adverse impacts to wetlands, so that continuing actions can be modified to ensure mission continuity.

(8) Compliance with missed deadlines established in DoD executed agreements.

3. Maintenance Requirements. Includes those projects and activities needed to meet an established deadline beyond the current program year and maintain compliance. Examples include:

i) Compliance with future deadlines.

ii) Conservation, GIS mapping, and data management to comply with Federal, State, and local regulations, EOs, and DoD policy.

iii) Efforts undertaken in accordance with non-deadline specific compliance requirements of leadership initiatives.

iv) Wetlands enhancement to minimize wetlands loss and enhance existing degraded wetlands.

v) Conservation recommendations in biological opinions issued pursuant to the ESA.

4. Enhancement Actions Beyond Compliance. Includes those projects and activities that enhance conservation resources or the integrity of the installation mission, or are needed to address overall environmental goals and objectives, but are not specifically required by law, regulation, or EO, and are not of an immediate nature. Examples include:

   i) Community outreach activities such as International Migratory Bird Day, Earth Day, National Public Lands Day, and Arbor Day activities.

   ii) Educational and public awareness projects, such as interpretive displays, oral histories, Watchable Wildlife areas, nature trails, wildlife checklists, and conservation teaching materials.

   iii) Restoration or enhancement of natural resources when no specific compliance requirement dictates a course or timing of action.

   iv) Management and execution of volunteer and partnership programs.

5.2 ACHIEVING NO NET LOSS

Land management at ALC, as with most DoD installations, is based on the concept that these lands were set aside to serve military training and testing purposes. The Sikes Act recognizes the sometimes-conflicting needs of military mission and environmental stewardship, and specifically states that military lands need to be managed for no net loss in the capability to support the military mission. ALC's challenge, therefore, is to balance the need to use its air, land, and water resources for military training and testing with its stewardship responsibility to conserve these resources for future generations. Toward that end, the principles of multiple use, sustained yield, biodiversity conservation, and the conservation of endangered and threatened species are key.

This INRMP is designed to identify potential environmental constraints, so that mission activities can be planned around these constraints, or agreement with resource agencies regarding impacts can be attained. This allows the mission to go forward, without the potential threat posed by the discovery and accidental taking of a previously unidentified resource.

5.3 USE OF COOPERATIVE AGREEMENTS

ALC currently cooperates with MDNR and other agencies on an as-needed basis for specific purposes. ALC maintains a partnership with MDNR Wildlife and Heritage Division for the management of the hunting program at BPRF. Non-game species management is also conducted with assistance from federal and state wildlife agencies. The MDNR provides professional wildlife biology advice and recommendations in regards to game species on the facility. White-tailed deer are the only wildlife species that are presently managed for consumptive use at BPRF.

5.4 FUNDING

All requirements set forth in this INRMP requiring the expenditure of APG funds are expressly subject to the availability of appropriations and requirements of the Anti-Deficiency Act (31 USC section 1341). No obligation undertaken by APG under the terms of this INRMP will require or be interpreted to require a commitment to expend funds not obligated for a particular purpose.

5.4.1 Implementation Funding Options

Natural resources management within the Army relies on a variety of funding mechanisms, some of which are self-generating and all of which have different application rules. Below are general discussions about different sources of funding to implement this INRMP.

5.4.2 Environmental Funds

APG personnel must complete the Annual Work Plan (AWP) each year to identify environmental requirements for the upcoming budget year and submit them for IMCOM and U.S. Army Environmental Center review. The AWP provides the primary means for identifying the current and projected environmental requirements and resources needed to execute the natural resources management program. The AWP satisfies Army reporting requirements, as specified in EO 12088, Office of Management and Budget Circular A-11 and other federal directives. The report is used for a variety of purposes: planning, programming, budgeting and forecasting costs; documenting past accomplishments and expenditures; tracking project execution and monitoring performance; refining and validating requirements for the budget year; and supporting the Program Objective Memorandum for outyear requirements.

Environmental funds are a special subcategory of Operations and Maintenance funds. They are set aside by the DoD for environmental purposes but are still subject to restrictions of Operations and Maintenance funds. Compliance with laws is the key to getting environmental funding. Environmental funds are most commonly used for projects that return the installation to compliance with federal or state laws, especially if noncompliance is accompanied by Notices of

Violation or other enforcement agency actions. “Must fund” classifications include mitigation identified within *Findings of No Significant Impact* and items required within Federal Facilities Compliance Agreements. This INRMP is a Federal Facilities Requirement Agreement, and several projects and programs within it are used to mitigate various military activities. In addition, 1997 amendments to the Sikes Act require implementation of INRMPs, which make implementation of this INRMP a priority for funding. The prioritization scheme detailed in **Section 5.1** from DoDI 4715.03 also indicates the funding priority with compliance being a “must fund” priority.

5.4.3 Operations and Maintenance Funds

Certain projects within this INRMP are either partially or fully funded with Operations and Maintenance funds. General facility pest management (exclusive of invasive weed control related to threatened and endangered species and other range-related pest management) is in this category. Operations and Maintenance funds are not included in budget estimates for this INRMP

6.0 RECORD OF ENVIRONMENTAL CONSIDERATION

Under the NEPA of 1969, Federal agencies are required to analyze and document the environmental consequences of proposed major actions. The intent of NEPA is to protect, restore or enhance the environment through well-informed Federal decisions. This act is premised on the assumption that providing timely information to the decision maker and the public concerning the potential environmental consequences of Proposed Actions will minimize or prevent the impact of federal decisions on the natural and human environment. Thus, the NEPA process includes the systematic, interdisciplinary evaluation of potential environmental consequences expected to result from implementation of a Proposed Action.

As stated in AR 200-1, *Environmental Protection and Enhancement*, "the Army is committed to environmental stewardship in all actions as an integral part of the Army mission" and will "conserve and preserve natural and cultural resources so they will be available for present and future generations to use". This INRMP has been prepared in accordance with AR 200-1 and the 2025 DoD National Environmental Policy Act (NEPA) Implementing Procedures and the 2025 Army Guidance Memorandum – DoD NEPA Implementing Procedures.
~~32 CFR Part 651 which states, "The Army is expected to manage those aspects of the environment affected by Army activities; comprehensively integrating environmental policy objectives into planning and decision-making".~~ This document incorporates ~~32 CFR Part 651~~ the implementing procedures ~~requirements~~ by integrating the installation's INRMP and the associated NEPA analysis, in this case a REC, for implementing the INRMP into this single document.

An EA was prepared in 2002 to document the foreseeable impacts on the natural and human environment of implementing the 2002 INRMP. The analysis performed for that EA found that no significant environmental impacts would result from the implementation of the INRMP, and an EIS was not required. Therefore, a FNSI was prepared and signed in 2004.

The current Proposed Action is the implementation of the updated INRMP. The purpose of the Proposed Action is to carry out the resource-specific management measures that will enable ALC to effectively manage the use and condition of natural resources located on ALC and BPRF. Implementation of the Proposed Action would protect and conserve the natural setting of ALC, while meeting other mission and community support requirements and complying with environmental regulations and policies. The implementation of projects from the INRMP could trigger the need for a REC or EA. Projects will be evaluated on a case-by-case basis.

The REC is included on the following pages.

RECORD OF ENVIRONMENTAL CONSIDERATION

Project Title: Implementation of the *Integrated Natural Resources Management Plan 2022-2027 Adelphi Laboratory Center (ALC) and Blossom Point Research Facility (BPRF).*

Description of the Proposed Action: The U.S. Army Garrison, Aberdeen Proving Ground (APG) plans to implement the above-referenced Integrated Natural Resources Management Plan (INRMP) through the year 2027 to provide for the formal continuation of an integrated and comprehensive method for managing natural resources on ALC and BPRF. The INRMP defines roles and responsibilities for natural resource management within these installations and provides the basis for addressing all applicable legal requirements and best management practices consistent with achievement of the goals, objectives and projects of the installations' military missions.

Duration of the Proposed Action: The INRMP will take effect when signed by the APG Garrison Commander and will remain in effect until it is superseded in the future by a new or revised INRMP.

Reason for Using Record of Environmental Consideration: ~~The proposed action qualifies for a categorical exclusion from National Environmental Policy Act (NEPA) documentation in accordance with 32 CFR Part 651 (1 July 2002), Appendix B, Section II, (b)(3) "Preparation of regulations, procedures, manuals, and other guidance documents that implement, without substantive change, the applicable HQDA or other federal agency regulations, procedures, manuals, and other guidance documents that have been environmentally evaluated (subject to previous NEPA review)."~~
The proposed action qualifies for CATEX I(c)5, "Update and implementation of Integrated Natural Resources Management Plans (INRMPs) and Integrated Cultural Resources Management Plans (ICRMPs), where plan update and implementation activities are similar in type, scope, and degree to those currently allowed and result in no new adverse effects on the environment" from 2025 DoD National Environmental Policy Act (NEPA) Implementing Procedures and the 2025 Army Guidance Memorandum – DoD NEPA Implementing Procedures.

The EA prepared in 2002 to document the foreseeable impacts on the natural and human environment of implementing the 2002 INRMP found that no significant environmental impacts would result from the implementation of the INRMP, and a FNSI was prepared and signed in 2004. Therefore, in accordance with the above categorical exclusion, this REC is being prepared to update the existing EA.

Impacts of the Proposed Action: Potential environmental consequences associated with implementing the INRMP would result in either no effects or beneficial effects for the resource areas. Compared to the No Action Alternative, environmental conditions at ALC and BPRF would improve as a result of implementing the proposed INRMP. Expected consequences of affected resource areas for the Proposed Action are presented in the following paragraphs.

a. Physiography and Topography. The Proposed Action would not affect physiography or topography.

b. Geology. The Proposed Action would not affect geologic resources.

c. Petroleum and Mineral Resources. The Proposed Action would not affect petroleum or mineral resources that may be found on the installations. There are no plans to find or develop such resources on ALC or BPRF.

d. Soils. Beneficial effects would be expected. The Proposed Action includes an integrated program for planning land use, evaluation of land use effects, and maintenance and repair of damaged lands. Brief periods of increased erosion may occur during damaged sites' maintenance and rehabilitation activities, but these would be more than compensated through increased environmental awareness while training and testing; repair and maintenance of the testing areas; and including natural resources implications in military project planning. The Proposed Action offers more effective protection and mitigation for damages incurred to soils due to the military mission than does the No Action Alternative.

e. Water Resources. Beneficial effects would be expected. The Proposed Action includes an integrated program for planning land use, evaluating land use effects, and the management and repair of damaged lands. The Proposed Action describes projects to evaluate and reduce the potential of erosion by maintaining training lands. Brief periods of increased sedimentation may occur during repair and construction activities, but these should be more than compensated for by the reduction in sedimentation to wetlands resulting from including natural resources implications in military project planning. The Proposed Action also includes maintaining a riparian buffer and protecting coastal resources through conservation and habitat enhancement opportunities. The Proposed Action offers more effective protection and mitigation for damages incurred to potential wetlands and area water resources due to the military mission than does the No Action Alternative.

f. Noise Environment. The Proposed Action would not affect installation noise environments. Proposed natural resources management would not create significant noise.

~~**g. Climate.** The Proposed Action would not affect climate.~~

~~h~~g. Flora

General. Beneficial effects would be expected. The Proposed Action would provide management of floral resources at ALC and BPRF. The INRMP uses an ecosystem-based management strategy to achieve biological diversity conservation, in accordance with the DoD Instruction (DoDI) 4715.03 (~~2011~~2025). It emphasizes the use of native species, as emphasized in DoDI 4715.03~~. and EO 13148 (2000)~~.

The Proposed Action includes management plans to protect wetlands at ALC and BPRF and a buffer around them, as required by the Maryland Department of the Environment (MDE). The Proposed Action includes specific actions to manage ecosystems, including monitoring flora resources, identification of potential sensitive ecological areas, and an integrated approach to pest management. These programs include minimizing damage to wildlife habitat from testing activities and other users through habitat protection and monitoring.

Special Status Flora. There are no known federally-listed flora on ALC and BPRF. However, the Proposed Action includes monitoring for small-whorled pogonia (*Isotria medeoloides*) on BPRF. If federally-listed species are identified, management will be identical under both alternatives due to legally mandated requirements associated with the Endangered Species Act (ESA). There are five state-listed species that have previously been observed on ALC: ten-angled pipewort (*Eriocaulon decangulare*), Long's rush (*Juncus longii*), snakemouth orchid (*Rose pogonia*) (*Pogonia ophioglossoides*), capitate beakrush (*Rhynchospora cephalantha*), and bog goldenrod (*Solidago uliginosa*). Continual monitoring and management for these species is included in this ~~INRMP, and~~INRMP and is beneficial to these species.

Wetlands. Implementation of the Proposed Action would protect wetlands and a buffer area around wetlands on ALC and BPRF to prevent or minimize potential impacts that result from training and other mission-related activities.

i. Fauna

General. Beneficial effects would be expected. Implementation of the Proposed Action would improve habitat conditions, which would be beneficial to wildlife populations. Monitoring and enhancement of degraded habitats would be conducted.

Special Status Fauna. The northern long-eared bat (*Myotis septentrionalis*) (NLEB), a federally-listed ~~threatened~~ endangered species, was acoustically detected on both ALC and BPRF during 2016 surveys, but not during the 2019 or 2024 bat surveys. There are no other known federally- or state-listed fauna on ALC or BPRF. There is a management plan for the bald eagle (*Haliaeetus leucocephalus*), which is protected under the Bald and Golden Eagle Protection Act. Habitat exists for the rainbow snake (*Farancia e. erytrogramma*) on BPRF, though it has not been observed. The area of the Potomac River near BPRF provides spawning habitat for the protected Chesapeake Bay Population of the Atlantic sturgeon (*Acipenser oxyrinchus*), and in 2017 the Potomac River was designated as critical habitat for the Atlantic sturgeon. Implementation of the Proposed Action would provide a greater degree of protection and management for species protected under the ESA.

j. Cultural Resources. ALC and BPRF contain sites that have been determined to be eligible for listing in the National Historic Register of Historic Places; however, risks to significant cultural resources are minimal. Review of projects through the National Historic Preservation Act (NHPA) Section 106 process and the NEPA process are used to ensure protection of potential cultural resources while implementing the INRMP.

k. Land Use. Under the Proposed Action, no changes to on-site land uses or land use patterns would occur. Because land uses on-site would not be expected to change, land use patterns in the surrounding area would not be affected.

l. Socioeconomic Environment. The Proposed Action would not have any significant effects on socioeconomic factors in general installation regions.

~~**m. Environmental Justice.** EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* [59 Federal Regulation No. 32], issued in~~

~~February 1994, provides that "*each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations*". The Proposed Action would be confined to ALC and BPRF lands. The Proposed Action would not have significant or disproportionate adverse effects on minority or low-income populations.~~

~~n~~m. **Environmental Health and Safety Risks for Children.** EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, [62 Federal Regulation No. 78] was issued in April 1997. This EO directs each federal agency to "*ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health or safety risks*". Sensitive areas for exposure to children are schools and family housing areas. Environmental health and safety risks are attributable to products that a child might come in contact with or ingest as well as safety around ALC and BPRF. Proposed natural resources management is within boundaries of ALC and BPRF. The Proposed Action would not have significant or disproportionate adverse effects on children or pose health or safety risks.

~~o. **Cumulative Impacts.** A cumulative effect is defined as an effect on the environment that results from the incremental effect of the action when added to other past, present and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place locally or regionally over a period of time.~~

~~Implementation of the INRMP would result in a comprehensive environmental strategy for ALC and BPRF that improves the management approach for natural resources on the installations and meets legal and policy requirements consistent with national natural resources management philosophies. Implementation would improve existing environmental conditions at ALC and BPRF, as shown by the potential for beneficial effects in **Table 6-1**. Over time, adoption of the Proposed Action would enable ALC to achieve its goal of maintaining ecosystem viability and ensuring sustainability of desired military training area conditions.~~

~~There are no known changes planned for ALC or BPRF military missions or to the intensity and extent of testing that presently occurs on ALC or BPRF. While growth and development can be expected to continue outside the installations that may adversely affect the local environment, the cumulative effects of this growth and development will be minimized on resources on the installation by the implementation of the proposed management measures contained in the INRMP.~~

Approval: LEADER.JOHN.1525591456 Digitally signed by LEADER.JOHN.1525591456 Date: 2026.03.25 16:40:53 -04'00'

Date: 3/25/26

Table 6-1. Summary of Potential Environmental Consequences from Proposed Action

Resource Area	Proposed Action
Physiography/Topography	No Effect
Geology	No Effect
Petroleum and Minerals	No Effect
Soils	Beneficial
Water Resources	Beneficial
Noise Environment	No Effect
~~Climate~~	~~No Effect~~
Flora (General)	Beneficial
Special Status Flora	Beneficial
Wetlands	Beneficial
Fauna (General)	Beneficial
Special Status Fauna	Beneficial
Cultural Resources	Beneficial
Land Use, Facilities, and Utilities	No Effect
Socioeconomic Environment	No Effect
~~Environmental Justice~~	~~No Effect~~
Protection of Children	No Effect
Cumulative Impacts	Beneficial
Note: No Effect - Actions have no known demonstrated impacts Beneficial - Actions have apparent beneficial effects	

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APPENDICES

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APPENDIX A:
ACRONYMS

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ACRONYMS

ACUB	Army Compatible Use Buffer
AEC	Army Environmental Command
ALC	Adelphi Laboratory Center
APG	Aberdeen Proving Ground
APHIS	Animal and Plant Health Inspection Service
AR	Army Regulation
ARL	Army Research Laboratory
ATV	All-Terrain Vehicle
AWP	Annual Work Plan
BMP	Best Management Practice
BPRF	Blossom Point Research Facility
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CLEO	Conservation Law Enforcement Officers
CWA	Clean Water Act
CWD	Coarse Woody Debris
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
DA	Department of the Army
DECAT	Department of Defense Extreme Conditions Assessment Tool
DBH	Diameter at Breast Height
DoD	Department of Defense
DoDI	Department of Defense Instruction
DPW	Directorate of Public Works
EA	Environmental Assessment
EAB	Emerald Ash Borer
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
ESMP	Endangered Species Management Plan
ESOH	Environment, Safety, and Occupational Health
FIDS	Forest Interior Dwelling Bird Species
FLIR	Forward Looking Infrared Camera
FNSI	Finding of No Significant Impact
GERB	Garrison Environmental Requirements Build
GHG	Greenhouse Gases
GIS	Geographic Information System
GSA	General Services Administration
HEL	Highly Erodible Land
HQDA	Headquarters, Department of the Army
IDA	Intensely Developed Areas
INRMP	Integrated Natural Resources Management Plan
IPMP	Integrated Pest Management Plan
ISMP	Invasive Species Management Plan
LDA	Limited Development Area

MBSS	Maryland Biological Stream Survey
MBTA	Migratory Bird Treaty Act
MDNR	Maryland Department of Natural Resources
MDE	Maryland Department of the Environment
MHT	Maryland Historic Trust
MMRP	Military Munitions Response Program
MOA	Memoranda of Agreement
MOU	Memorandum of Understanding
MSL	Mean Sea Level
NAVFAC	Naval Facilities Engineering Systems Command
NBS	National Bureau of Standards
NDAA	National Defense Authorization Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMFWA	National Military Fish and Wildlife Association
NLEB	Northern Long-Eared Bat
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NSWC	Naval Surface Warfare Center
PARC	Partners in Amphibians and Reptile Conservation
PIF	Partners in Flight
PLS	Planning Level Survey
PMB	Powder Mill Bog
PSI	Pounds Per Square Inch
RAB	Restoration Advisory Board
RCA	Resource Conservation Areas
REC	Record of Environmental Consideration
ROD	Record of Decision
RTE	Rare, Threatened and Endangered
SAIA	Sikes Act Improvement Act
SAV	Submerged Aquatic Vegetation
SHPO	State Historic Preservation Officer
SLF	Spotted Lanternfly
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFDA	U.S. Food and Drug Administration
USFWS	U.S. Fish and Wildlife Service
WHS	Wildlife and Heritage Service

APPENDIX B:
Natural Resources Management
Goals, Objectives and Projects

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ALC/BPRF INRMP Goals, Objectives, and Projects

Goal	Objective	Project	Project Cost	Implementation Timeframe	Project Priority
Goal 1: Natural Resource Management Implement a natural resources management program that reflects the principles of ecosystem management and ensures the sustainability of the military mission.	Manage natural resources consistent with environmental laws, regulations and legislation, for Federal, State, DoD or Army rules.	Continually review environmental legislation and ensure compliance. Coordinate with appropriate agencies as necessary.	In-House	Ongoing	1
	Use adaptive management strategies to protect, conserve and enhance native fauna and flora with an emphasis on priority species and native biodiversity enhancement.	Review this INRMP annually to include review of all natural resource management programs, and adapt and update as necessary.	In-House	Annually	1
Goal 2: Rare, Threatened and Endangered Species Ensure protection of federally listed threatened and endangered species and species of special concern and undertake management measures that support conservation and recovery of these species.	Identify and preserve these species in accordance with the Endangered Species Act (ESA), Endangered Species Recovery Plans, U.S. Army regulations and guidance, approved site-specific management plans, including Endangered Species Management Plans (ESMP).	Avoid disturbance to in-river habitat to protect spawning habitat for the potentially federally protected Atlantic sturgeon (*Acipenser oxyrinchus*).	In-House	Ongoing	2
		Perform rare, threatened and endangered species survey for federal and state listed species and update management strategy based on findings and consultation with USFWS and MD DNR.		FY2023 FY2027	2
	Protect unique plant species and habitat identified as rare statewide or locally, but without legal protection status, to the extent practical without restricting key mission operations.	Monitor the Powder Mill Bog and avoid any disturbance to this rare habitat. Avoid an increase in sediments or nutrients to the bog from increased impervious area, fertilizers, and septic systems. Remove small trees encroaching this site, such as red maple, tulip tree and sycamore saplings that are less than four inches in diameter. Manually remove invasive species, specifically Japanese stiltgrass in early August. Manage invasive species encroachment along the nearby road using herbicide. Coordinate invasive species control with the adjacent landowner and Maryland-National Capital Park and Planning.	Monitoring = In-House Species Removal TBD	Ongoing	2
Goal 3: Habitat Management Protect and enhance all habitats on ALC and BPRF, particularly sensitive and ecologically significant habitats, in a manner that promotes healthy, sustainable ecological communities.	Monitor all missions/activities for possible adverse impacts to soil resources, water quality and the ecological integrity of aquatic and terrestrial habitats. Adapt management as necessary.	Regularly monitor and inspect habitats for degradation and address causes of degradation. Monitor the impact of deer browsing on native plant communities and timber resources	In-House	Ongoing	3
		Maintain and enhance wildlife habitat by retaining snags, den trees, and coarse woody debris within forest stands consistent with other natural resources objectives and the military mission.	In-House	Ongoing	3
		Update Habitat Management Plan.		FY2028	4
		Replace plants, mulch and remove weeds in ALC Pollinator Garden with CRFCP funds. T&E Management for Monarch butterfly habitat.		Annually	2
		Maintain vegetated riparian buffer zones to prevent or minimize stream degradation associated with sediment and other pollutants in runoff.	In-House	Ongoing	2
		Conduct stream bank stabilization for areas at ALC identified in Stream Assessment. Fund a design, EA and permiting project.		FY2026	3

ALC/BPRF INRMP Goals, Objectives, and Projects

Goal	Objective	Project	Project Cost	Implementation Timeframe	Project Priority
Goal 4: Water Resources Protect the integrity of surface and groundwater resources and aquatic habitat to maintain and enhance biodiversity and protect water quality.	Protect aquatic and riparian resources by establishing and maintaining riparian management zones that limit activities within buffers zones around streams and wetlands to those activities that would cause little to no impact on water quality and aquatic habitats. Identify and restore degraded habitats when practical.	Any increase in impervious surface must be mitigated to avoid or minimize increase in stormwater runoff using low impact development practices or BMPs. All projects that increase impervious surface must be conducted in consistence with the Energy Independence and Security Act Section 438 and Maryland legislation. Implementing low impact development practices and BMPs to capture and treat runoff prior to discharge will help maintain and improve water quality and stormwater runoff volume.	To be included in project construction costs and scheduled with any land improvement or construction activities.		2
		Regularly review water resources management strategies defined above and mission-related activities to evaluate the condition of these resources and determine the need to adapt the management strategy to further enhance water quality and aquatic and riparian habitat.	In-House	Ongoing	1
		Conduct Paint Branch Assessment and Fish Survey at ALC. Centrally funded.		FY2023	2
	Prevent the degradation of water quality from point and non-point sources of pollution to include sediments, nutrients, and chemical pollution.	Continue water quality monitoring program with USGS. Regularly review the results of the water quality monitoring and address and degradation issues.	In-House	Ongoing	2
	Achieve no net loss of wetlands.	Avoid impacts to wetlands and mitigate when unavoidable. Coordinate these efforts with USACE and MD DNR.	In-House	Ongoing	3
		Conduct Wetland Delineation at ALC.		As needed	3
	Protect and improve the stability and resiliency of the BPRF shoreline and prevent further loss of land.	Implement BPRF Shoreline Management Plan.	NCRF Grant to Green Trust/USACE MILCON	Awarded FY23 and Ongoing/Awarded FY25	3
	Maintain fish and wildlife biodiversity, especially native species, through protecting present wildlife habitats from degradation. Reduce habitat fragmentation and restore native grassland, forest and wetland communities.	Update Habitat Management Plan.	Same as previously mentioned		
		Implement riparian buffers and demarcate their boundary. Include this buffer in planning for construction, testing, and training activities.	Same as previously mentioned		
		Implement Forest Management Plan at ALC and BPRF, to include stand improvement prescriptions and invasive species management to manage for a diversity of species and uneven-aged management. Maintain previously treated areas. Plant native species and species benefical to pollinators and wildlife. Note: a new contract started in FY26 and there was no contract in FY25.		FY2021 FY2022 FY2023 FY2024 FY2025 FY2026	2
	Provide for migratory bird and bald eagle protection.	Continue to perform surveys and monitor populations of the bald eagle at BPRF, in conjunction with NAVFAC, in accordance with the ESMP and the Bald and Golden Eagle Protection Act. Coordinate efforts with MD DNR and USFWS as appropriate. Ensure protection of the bald eagle habitat and nests. If any planned or ongoing activities cannot be conducted in compliance with the National Bald Eagle Management Guidelines (Eagle Management Guidelines), BPRF personnel will contact the USFWS or the Chesapeake Bay Ecological Services Field Office.		FY2021 FY2022 FY2023 FY2024 FY2025 FY2026	1
		Ensure nest monitoring reports are submitted to USFWS Chesapeake Bay Field Office and MD DNR via NAVFAC.	In-House	Annually	1

ALC/BPRF INRMP Goals, Objectives, and Projects

Goal	Objective	Project	Project Cost	Implementation Timeframe	Project Priority
Goal 5: Fish and Wildlife Maintain the diversity of species and habitats currently found at ALC and BPRF, restore and enhance degraded habitats where possible, and promote sustainable management of resources in a manner consistent with ecosystem management principles and the military mission.	Sustain healthy populations of game and nongame species at levels compatible with land use objectives and the military mission.	Monitor habitat and populations of non-game species to determine mission related impacts to populations and habitat. Coordinate with appropriate agencies as necessary, particularly for bald eagles, migratory waterfowl, neotropical migratory birds, FIDS, protected fish species and other species of concern. Coordinate as appropriate with other organizations and partnerships such as the Partners in Amphibians and Reptile Conservation (PARC) for herpetofauna and Partners in Flight for migratory birds.	In-House	Ongoing	2
		Wildlife food plots at BPRF. Funded with CRFCP funds.	Varies	Annually if needed	4
		Continue the recreational hunting program at BPRF and monitor species populations to adapt hunting permits, as necessary. Continue to implement the white-tailed deer hunting program at BPRF to maintain a target herd density of 20 individuals per square mile. Provide harvest records and coordinate with the MD DNR on an annual basis.	in-House and collects CRFCP permit fee funds	Ongoing	4
		Conduct a hunting program for wild turkey at BPRF.	TBD	TBD	3
		Complete regular surveys (including FLIR surveys) of the deer herd populations and explore option for a deer management program at ALC and BPRF. Unfunded and moving to in-house capabilties.		FY2021 FY2022 FY2023 FY2024 FY2025 FY2026	3
		Maintain osprey nesting platforms in coordination with SMECO at BPRF.	In-House	Ongoing	2
		Maintain bluebird trail at ALC.	In-House	Ongoing	4
		Conduct Avian Surveys at ALC and BPRF.	In-House In-House	FY2025 FY2028	2
		Conduct Bat Surveys at ALC and BPRF.		FY2024 FY2027	2
		Conduct Reptile and Amphibian Surveys at ALC and BPRF.		FY2024 FY2027	2
Goal 6: Forest Resources Conserve and manage forest resources in a sustainable fashion that maintains biodiversity, ecological functions and values, as well as the military mission.	Protect forest resources from unacceptable losses to damage agents and degradation resulting from insects and disease, invasive species, and wildfire.	Continue to implement the Integrated Pest Management Program. Survey for Emerald Ash Borer and gypsy moth; control as necessary.	In-House	Ongoing	2
	Carry on the objective of forest resources management at BPRF for an optimum combination of uses (multiple-use management) including: - Wildlife habitat preservation and enhancement; - Wetland, watershed, and groundwater protection; - Possible timber production; - Protection of the shoreline and natural resources in support of the Chesapeake Bay Action Plan; - Preservation of existing historical and cultural resources.	Continue to monitor forest resources for signs of disease, excessive damage from wildlife browsing and mission activities, and wildfire fuel loads. Maintain existing firebreaks.	In-House	Ongoing	2
		Maintain and enhance wildlife habitat by retaining snags, den trees, and coarse woody debris within forest stands consistent with other natural resources objectives and the military mission.	Same as previously mentioned		
		Implement Forest Management Plan at BPRF, to include stand improvement prescriptions to manage for a diversity of species and uneven-aged management.	Same as previously mentioned		
		Continue to comply with the Forest Conservation Act regulations for any construction or disturbances to forest resources.	In-House	Ongoing	2

ALC/BPRF INRMP Goals, Objectives, and Projects

Goal	Objective	Project	Project Cost	Implementation Timeframe	Project Priority
Goal 7: Pest and Invasive Species Manage and prevent the spread of pests and invasive species that threaten habitat and native species.	Employ judicious use of both non-chemical and chemical control techniques to achieve effective pest management with minimal environmental consequence.	Continue to implement the Integrated Pest Management Program and the Invasive Species Management Plan. Monitor and assess progress of invasive and pest species management activities, and adapt as necessary. Avoid impacts to other species and habitat from invasive and pest management.	In-House	Ongoing	2
	Identify, monitor and control invasive and pest species and habitat.	Regularly monitor for invasive and pest species and address as appropriate. Monitor for new areas of invasive species and spread of invasive and pest species on ALC and BPRF. Continue to survey for Emerald Ash Borer and gypsy moth and control as necessary.	In-House	Ongoing	3
		Implement Geese Management at ALC. Funded by ARL.		FY2021 FY2022 FY2023 FY2024	3
		Conduct Beaver Survey and Management Plan at BPRF.		FY2023	4
	Carry on pest management priorities at ALC and BPRF to include control of disease vectors, protection of real estate, control of nuisance pests, control of undesirable vegetation, protection of beneficial plants, and control of miscellaneous animal pests (such as birds, rodents, and other mammals).	Regularly review the effectiveness of the Invasive Species Management Plans and update as needed. BPRF Invasives monitored in Forest Management activities.		Review = Annually Updates = BPRF - FY2027 ALC - FY2027	2
		Update Integrated Pest Management Plan.		FY2027	2
		Utilize 4-Poster Deer Self-Treatment Machine at ALC for tick-borne disease prevention.		Annually	4
		Perform Tick Surveys at ALC and BPRF with Army PHC.	In-House	Ongoing	3
Goal 8: Soil Resources Manage soil resources in a sustainable manner and protect soils from erosion and destabilization through preventative and restoration efforts and prevent potential soil erosion impacts on water quality, habitat quality, and mission objectives.	Monitor soils regularly for erosion and address problem areas as appropriate.	Regularly monitor stream banks, roadsides, and other areas subject to erosive forces for erosion. Maintain existing road ditches, culverts, and turnouts to prevent erosion.	In-House	Ongoing	2
		Conduct stream bank stabilization for areas at ALC identified in Stream Assessment.	Same as previously mentioned		
	Protect soil resources from disturbances from earth-moving activities, construction and natural erosive forces through use of best management practices (BMPs).	Implement low impact development BMPs to slow stormwater runoff to reduce soil erosion.	Varies	As needed	3
	Use native species for erosion control.	Plant native species in bare soil areas and in areas subject to erosive forces. Stabilize and seed eroded roadsides and road cuts in a timely manner to minimize impacts of erosion. Use geotextile fabrics and mulch to stabilize soil surface. Harden slopes and grades with rip-rap, stone or gravel when planting is not feasible.	Varies	As needed	2
Goal 9: Community Outreach Encourage relationship with the local community on ALC and BPRF, as appropriate, without interruption to the military mission.	Continue to provide outdoor recreational opportunities to the extent that they do not conflict with the military mission or compromise	Continue the recreational hunting program at BPRF and monitor species populations to adapt hunting permits, as necessary.	Same as previously mentioned		
		Install educational signs on the Fitness Trail at ALC.		FY2028	4
	Make a positive contribution to local conservation efforts and the community by participating in educational opportunities and providing information on issues affecting ALC, BPRF and the region.	Provide educatoinal materials for staff, testing teams, and public with information about natural resources on site.	In-House	Ongoing	4
		Conduct Earth Day Activities at ALC and BPRF.	In-House	Annually	4

ALC/BPRF INRMP Goals, Objectives, and Projects

Goal	Objective	Project	Project Cost	Implementation Timeframe	Project Priority
Goal 10: Fire Management The primary goal for fire management at ALC is to prevent unacceptable losses to military property from wildfire.	Implement appropriate wildfire prevention and suppression measures.	Prevent the occurrences of wildfires at ALC by educating personnel on fire prevention techniques, reducing unnaturally high fuel loads, and restricting the types of activities that can be undertaken based on the level of fire danger in an area. Facilitate rapid suppression of wildfires by maintaining existing firebreaks and responding rapidly to contain the spread of wildfires when they do occur, thereby preventing further losses to natural resources and other Army property.	In-House	Ongoing	1
		Evaluate the feasibility of implementing a prescribed fire plan at BPRF to reduce natural fuel loads, control invasive species, and improve wildlife habitat. Implement burning if found feasible though Forest Plan implementation.	TBD	TBD	4

APPENDIX C:
Agency Coordination Letters

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DEPARTMENT OF THE ARMY
U.S. ARMY INSTALLATION MANAGEMENT COMMAND
ADELPHI LABORATORY CENTER
2800 MILL POWDER ROAD
ADELPHI MARYLAND 20783-1197

July 10, 2020

Mr. Chris Guy
U.S. Fish and Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307

Dear Mr. Guy:

The U.S. Army Garrison Aberdeen Proving Ground is updating an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Encls 1 and 2).

To update the INRMP, Aberdeen Proving Ground will review existing information about natural resources at each site, revise, and augment this information as necessary, and propose appropriate courses of action to improve and protect these resources. The INRMP will be prepared in accordance with appropriate current Department of Defense and Army guidance, focusing on management opportunities in a manner consistent with the mission of the facilities. In accordance with Army regulations, documentation is required through the National Environmental Policy Act process in order to implement the INRMP. It is anticipated a Record of Environmental Consideration will be required to implement the updated INRMP.

Aberdeen Proving Ground is inviting the U.S. Fish and Wildlife Service's participation in the update to initiate an open dialog regarding priorities for natural resources management in Maryland at the Adelphi Laboratory Center and Blossom Point Research Facility.

Aberdeen Proving Ground requests any information the U.S. Fish and Wildlife Service has on the presence of federally protected species listed under the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). Please verify the requirements of Section 7 of the ESA and the U.S. Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) will be met for the two project areas as part of the Record of Environmental Consideration.

Please provide comments within 30 days to Mrs. Bridget Kelly Butcher, U.S. Army Garrison Adelphi Laboratory Center, 2800 Powder Mill Road, IMAL-PWE, Adelphi, Maryland 20783-1197, bridget.c.kellybutcher.civ@mail.mil, 240-694-7258.

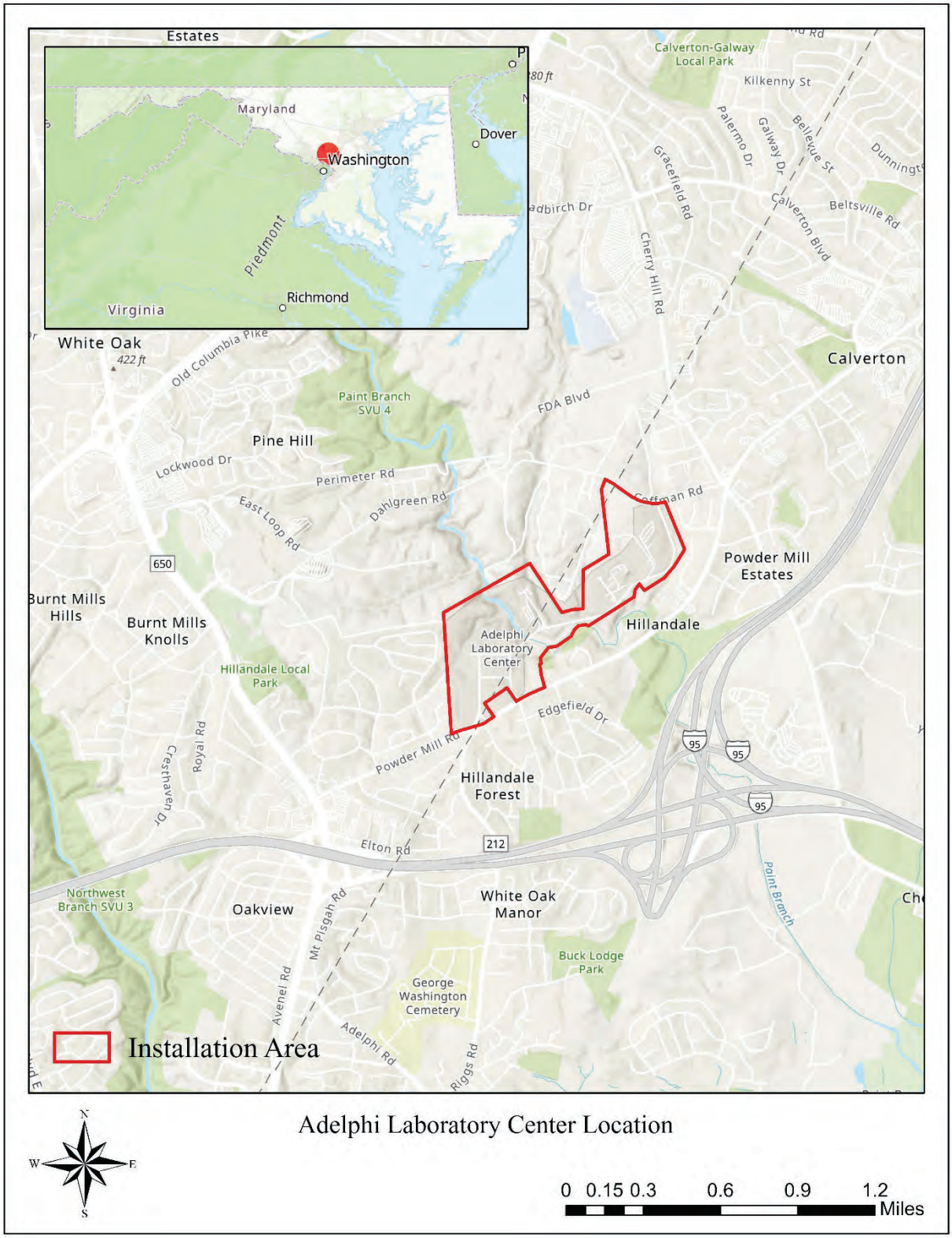
Sincerely,

DEEL.AMY.ELIZABETH.1010776348 Digitally signed by DEEL.AMY.ELIZABETH.1010776348 Date: 2020.07.10 10:45:50 -04'00'

Vance G. Hobbs
Director, Environmental Division
Directorate of Public Works

Enclosures

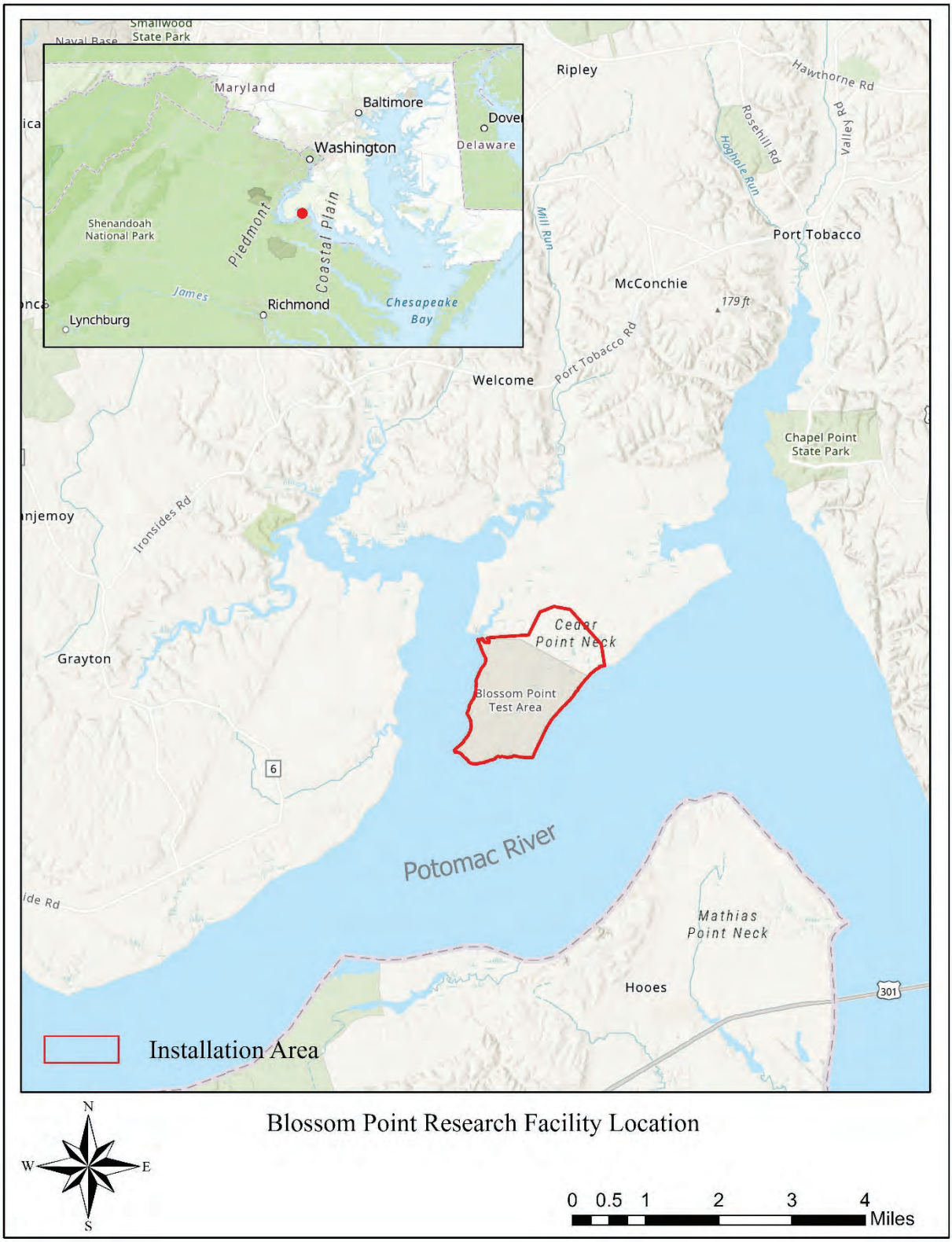
Adelphi Laboratory Center Site Location Map



Adelphi Laboratory Center Location

Enclosure 1

Blossom Point Research Facility Site Location Map



Enclosure 2

United States Department of the Interior
U.S. Fish & Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
410/573 4575

Online Certification Letter

Today's date: 1 February 2021
Project: ALC/BPRF INRMP Update

Dear Applicant for online certification:

Thank you for using the U.S. Fish and Wildlife Service (Service) Chesapeake Bay Field Office online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the referenced project in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA).This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

Based on this information and in accordance with section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), we certify that except for occasional transient individuals, no federally proposed or listed endangered or threatened species are known to exist within the project area. Therefore, no Biological Assessment or further section 7 consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to federally protected threatened or endangered species under our jurisdiction. For additional information on threatened or endangered species in Maryland, you should contact the Maryland Wildlife and Heritage Division at (410) 260-8573. For information in Delaware you should contact the Delaware Division of Fish and Wildlife, Wildlife Species Conservation and Research Program at (302) 735-8658. For information in the District of Columbia, you should contact the National Park Service at (202) 339-8309.

The U.S. Fish and Wildlife Service also works with other Federal agencies and states to minimize loss of wetlands, reduce impacts to fish and migratory birds, including bald eagles, and restore habitat for wildlife. Information on these conservation issues and how development projects can avoid affecting these resources can be found on our website (www.fws.gov/chesapeakebay)

We appreciate the opportunity to provide information relative to fish and wildlife issues, and thank you for your interest in these resources. If you have any questions or need further assistance, please contact Chesapeake Bay Field Office Threatened and Endangered Species program at (410) 573-4527.

Sincerely,

Genevieve LaRouche
Field Supervisor

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
Phone: (410) 573-4599 Fax: (410) 266-9127
http://www.fws.gov/chesapeakebay/
http://www.fws.gov/chesapeakebay/endsppweb/ProjectReview/Index.html

In Reply Refer To: February 01, 2021
Consultation Code: 05E2CB00-2021-SLI-0581
Event Code: 05E2CB00-2021-E-01433
Project Name: ALC/BPRF INRMP Update

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. This species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
(410) 573-4599

Project Summary

Consultation Code: 05E2CB00-2021-SLI-0581
Event Code: 05E2CB00-2021-E-01433
Project Name: ALC/BPRF INRMP Update
Project Type: ** OTHER **
Project Description: Adelphi Laboratory Center and Blossom Point Research Facility INRMP Update

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.421781949999996,-77.09212216497298,14z



Counties: Charles, Montgomery, and Prince George's counties, Maryland

Endangered Species Act Species

There is a total of 1 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 1 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis*	Threatened

No critical habitat has been designated for this species.

This species only needs to be considered under the following conditions:

- Projects with a federal nexus that have tree clearing = to or > 15 acres: 1. REQUEST A SPECIES LIST 2. NEXT STEP: EVALUATE DETERMINATION KEYS 3. SELECT EVALUATE under the Northern Long-Eared Bat (NLEB) Consultation and 4(d) Rule Consistency key

Species profile: https://ecos.fws.gov/ecp/species/9045

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER FORESTED/SHRUB WETLAND

- PFO1A
- PFO1C
- PFO1E
- PFO1R
- PFO1S
- PSS1R
- PSS1T
- PSS1C

RIVERINE

- R3UBH
- R4SBC
- R5UBH

ESTUARINE AND MARINE DEEPWATER

- E1UBL
- E1UBL6

ESTUARINE AND MARINE WETLAND

- E2EM1P
- E2EM1P6
- E2EM2N

FRESHWATER EMERGENT WETLAND

- PEM1A

FRESHWATER POND

- PUBHx

DEPARTMENT OF THE ARMY
U.S. ARMY INSTALLATION MANAGEMENT COMMAND
ADELPHI LABORATORY CENTER
2800 MILL POWDER ROAD
ADELPHI MARYLAND 20783-1197

July 10, 2020

Ms. Lori Byrne
Wildlife and Heritage Service
Department of Natural Resources
580 Taylor Avenue
Tawes Office Building E-1
Annapolis, MD 21401-2352

Dear Ms. Byrne:

The U.S. Army Garrison Aberdeen Proving Ground is updating an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Encls 1 and 2).

To update the INRMP, Aberdeen Proving Ground will review existing information about natural resources at each site, revise, and augment this information as necessary, and propose appropriate courses of action to improve and protect these resources. The INRMP will be prepared in accordance with appropriate current Department of Defense and Army guidance, focusing on management opportunities in a manner consistent with the mission of the facilities. In accordance with Army regulations, documentation is required through the National Environmental Policy Act process in order to implement the INRMP. It is anticipated a Record of Environmental Consideration will be required to implement the updated INRMP.

Aberdeen Proving Ground is inviting the Department of Natural Resources' participation in the update to initiate an open dialog regarding priorities for natural resources management in Maryland at the Adelphi Laboratory Center and Blossom Point Research Facility. Aberdeen Proving Ground requests any information the Department of Natural Resources may have on the presence of state protected species of animals and plants.

Please provide comments within 30 days to Mrs. Bridget Kelly Butcher, U.S. Army Garrison Adelphi Laboratory Center, 2800 Powder Mill Road, IMAL-PWE, Adelphi, Maryland 20783-1197, bridget.c.kellybutcher.civ@mail.mil, 240-694-7258.

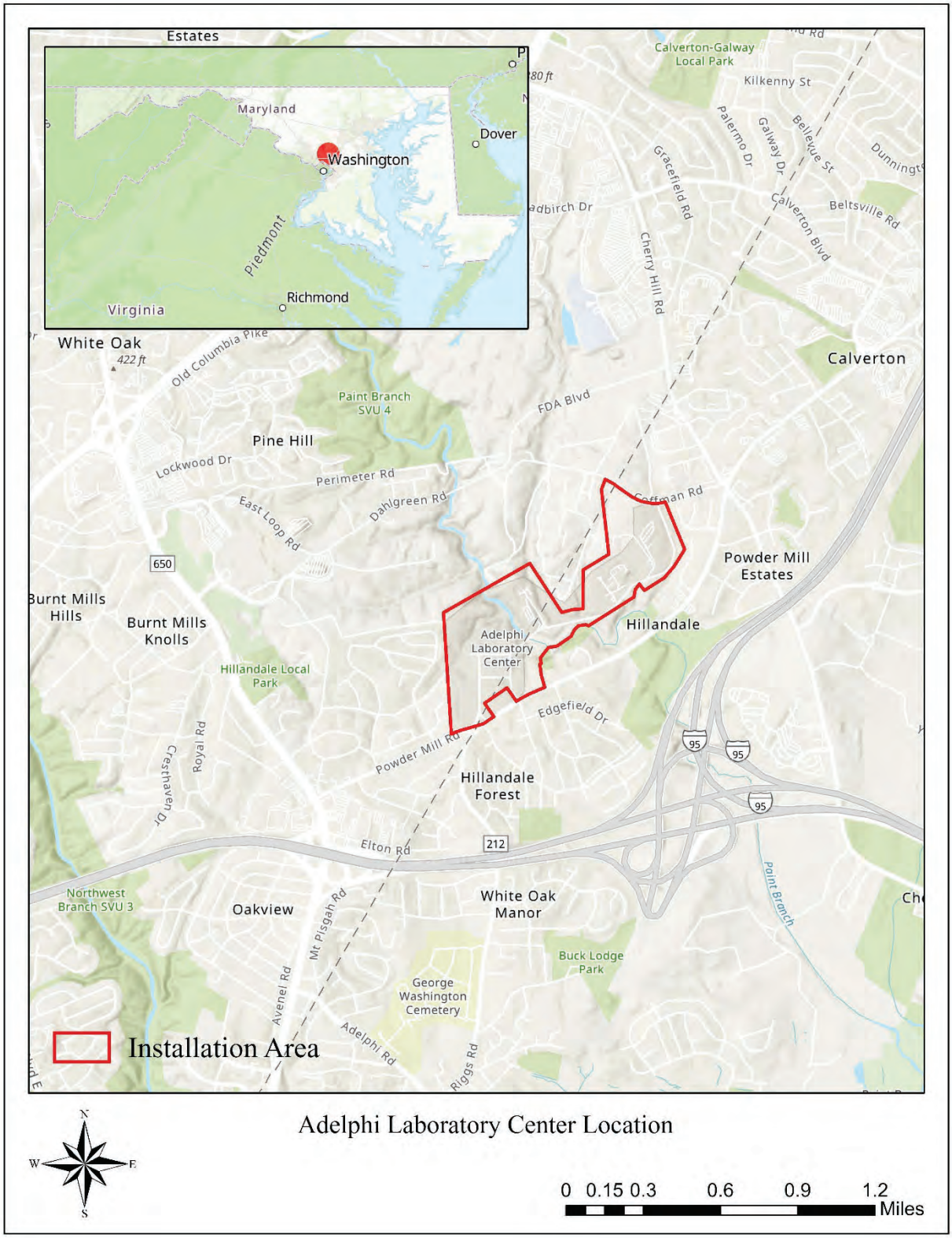
Sincerely,

DEEL.AMY.ELIZABETH.1010776348
Digitally signed by DEEL.AMY.ELIZABETH.1010776348
Date: 2020.07.10 11:22:44 -04'00'

Vance G. Hobbs
Director, Environmental Division
Directorate of Public Works

Enclosures

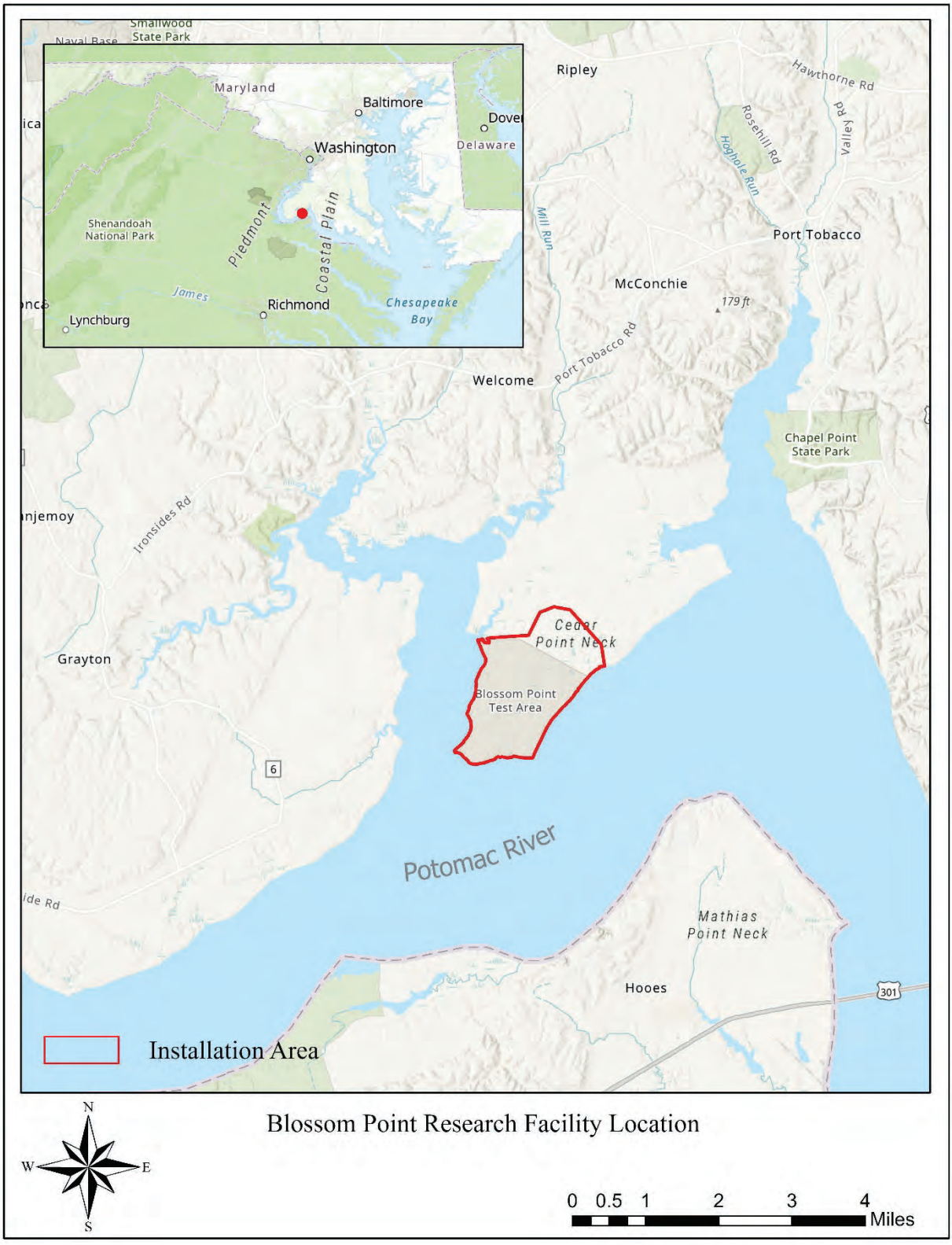
Adelphi Laboratory Center Site Location Map



Adelphi Laboratory Center Location

Enclosure 1

Blossom Point Research Facility Site Location Map



Enclosure 2

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

Larry Hogan, Governor
Boyd Rutherford, Lt. Governor
Jeannie Haddaway-Riccio, Secretary

September 15, 2020

Ms. Bridget Kelly Butcher
Department of the Army
Adelphi Laboratory Center
2800 Powder Mill Road
Adelphi, Maryland 20783-1138

RE: Environmental Review - INRMP for Adelphi Laboratory Center and Blossom Point Research Facility, Prince George's, Montgomery and Charles Counties, Maryland.

Dear Ms. Butcher:

For the **Adelphi Laboratory Center**, the Wildlife and Heritage Service has determined that there is a small remnant fall-line terrace gravel bog on the project site, located in the eastern portion of the property, which is known to support occurrences of rare, threatened or endangered species. Known as Powder Mill Bog, it is the only remaining bog of several which comprised a Powder Mill Bog complex, but the other bogs have been drained or filled during the commercial and residential development of this suburban area. This wetland supports a population of highly rare Ten-angle Pipewort (*Eriocaulon decangulare*) and a population of state-listed endangered Capitate Beakrush (*Rhynchospora cephalantha*), as well as several other watchlist plant species and possible rare odonates.

Also, our remote analysis suggests that the forested area on this property contains Forest Interior Dwelling Bird habitat. Populations of many bird species which depend on this type of forested habitat are declining in Maryland and throughout the eastern United States. Interested landowners can contact us for further voluntary guidelines to help conserve this important habitat.

For the **Blossom Point Research Facility**, the open waters that are adjacent to or part of the site are known historic waterfowl concentration areas. If there is to be any construction of water-dependent facilities please contact Josh Homyack of the Wildlife and Heritage Service at (410) 827-8612 x100 or josh.homyack@maryland.gov for further technical assistance regarding waterfowl.

Also, our remote analysis suggests that the forested area on this property contains Forest Interior Dwelling Bird habitat. Populations of many bird species which depend on this type of forested habitat are declining in Maryland and throughout the eastern United States. Conservation of this habitat is mandated within the Chesapeake Bay Critical Area and should be incorporated into any plans.

Thank you for allowing us the opportunity to review this project. If you should have any further questions regarding this information, please contact me at (410) 260-8573.

Sincerely,

Lori A. Byrne

Lori A. Byrne,
Environmental Review Coordinator
Wildlife and Heritage Service
MD Dept. of Natural Resources

ER# 2020.1126.mo/pg/ch
Cc: K. McCarthy, DNR
J. Homyack, DNR
C. Jones, CAC

DEPARTMENT OF THE ARMY
U.S. ARMY INSTALLATION MANAGEMENT COMMAND
ADELPHI LABORATORY CENTER
2800 MILL POWDER ROAD
ADELPHI MARYLAND 20783-1197

July 10, 2020

Mr. Mark Murray-Brown
Greater Atlantic Regional Fisheries Office
NOAA Fisheries Service
55 Great Republic Drive
Gloucester, MA 01930-2276

Dear Mr. Murray-Brown:

The U.S. Army Garrison Aberdeen Proving Ground is updating an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Encls 1 and 2).

To update the INRMP, Aberdeen Proving Ground will review existing information about natural resources at each site, revise, and augment this information as necessary, and propose appropriate courses of action to improve and protect these resources. The INRMP will be prepared in accordance with appropriate current Department of Defense and Army guidance, focusing on management opportunities in a manner consistent with the mission of the facilities. In accordance with Army regulations, documentation is required through the National Environmental Policy Act process in order to implement the INRMP. It is anticipated a Record of Environmental Consideration will be required to implement the updated INRMP.

Aberdeen Proving Ground is inviting NOAA Fisheries Service's participation in the update to initiate an open dialog regarding priorities for natural resources management in Maryland at the Adelphi Laboratory Center and Blossom Point Research Facility.

Aberdeen Proving Ground requests any information the NOAA Fisheries Service has on the presence of federally protected species listed under the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). The U.S. Fish and Wildlife Service will conduct a consultation on terrestrial plant and animal species and the Maryland Department of Natural Resources will address state-listed terrestrial and aquatic species. Blossom Point Research Facility, located on Cedar Point Neck between the Potomac River and Nanjemoy Creek, has the potential to provide habitat for marine Endangered Species Act-listed species under NOAA Fisheries Service's jurisdiction. The Endangered Species Act Section 7 Mapper available on NOAA

Fisheries Service's website maps the Potomac River, in the reaches adjoining Blossom Point Research Facility, as migrating, foraging, and overwintering grounds for juvenile and adult shortnose sturgeon (*Acipenser brevirostrum*) and as migrating and foraging habitat for juvenile, sub-adult and adult Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). The Potomac River is designated as critical habitat for the Atlantic sturgeon. Please verify the requirements of Section 7 of the Endangered Species Act and the U.S. Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) will be met for the two project areas as part of the Record of Environmental Consideration.

Please provide comments within 30 days to Mrs. Bridget Kelly Butcher, U.S. Army Garrison Adelphi Laboratory Center, 2800 Powder Mill Road, IMAL-PWE, Adelphi, Maryland 20783-1197, bridget.c.kellybutcher.civ@mail.mil, 240-694-7258.

Sincerely,

DEEL.AMY.ELIZABETH.1010776348 Digitally signed by DEEL.AMY.ELIZABETH.1010776348 Date: 2020.07.10 10:42:44 -04'00'

Vance G. Hobbs
Director, Environmental Division
Directorate of Public Works

Enclosures

From:	Kelly Butcher, Bridget C CIV USARMY ID-SUSTAINMENT (USA)
To:	Hopper, Brian D CIV (US); Murray Brown, Mark A CIV (US)
Cc:	Smith, Erica J CIV USARMY CENAB (USA)
Subject:	RE: [Non-DoD Source] Re: Adelphi Lab Center INRMP Agency Coordination
Date:	Friday, July 10, 2020 2:46:28 PM

Hi Brian,

Great- I look forward to working with you as well.

Thanks!
Bridget

From: Brian D Hopper - NOAA Federal [brian.d.hopper@noaa.gov]
Sent: Friday, July 10, 2020 2:34 PM
To: Murray Brown, Mark A CIV (US)
Cc: Kelly Butcher, Bridget C CIV USARMY ID-SUSTAINMENT (USA)
Subject: [Non-DoD Source] Re: Adelphi Lab Center INRMP Agency Coordination

All active links contained in this email were disabled. Please verify the identity of the sender, and confirm the authenticity of all links contained within the message prior to copying and pasting the address to a Web browser.

Hi Bridget,

I would be happy to assist with the INRMP review process. I look forward to working with you.

Regards,
-Brian

On Fri, Jul 10, 2020 at 2:22 PM Mark Murray-Brown - NOAA Federal <mark.murray-brown@noaa.gov < Caution-mailto:mark.murray-brown@noaa.gov > > wrote:

> Bridget - Thank you for your correspondence regarding the subject INRMP. Your GARFO ESA Section 7 POC on this action is Mr Brian Hopper. He will be in touch with you if he has any questions
>
> ---------- Forwarded message ---------
> From: **Kelly Butcher, Bridget C CIV USARMY ID-SUSTAINMENT (USA)** <bridget.c.kellybutcher.civ@mail.mil < Caution-mailto:bridget.c.kellybutcher.civ@mail.mil > >
> Date: Fri, Jul 10, 2020 at 1:50 PM
> Subject: Adelphi Lab Center INRMP Agency Coordination
> To: Murray Brown, Mark A CIV (US) <mark.murray-brown@noaa.gov < Caution-mailto:mark.murray-brown@noaa.gov > >
> Cc: Holthaus, Serena A CTR USARMY ID-SUSTAINMENT (USA) <serena.a.holthaus.ctr@mail.mil < Caution-mailto:serena.a.holthaus.ctr@mail.mil > >, Smith, Erica J CIV USARMY CENAB (USA) <Erica.J.Smith@usace.army.mil < Caution-mailto:Erica.J.Smith@usace.army.mil > >
>
> Hi Mr. Murray-Brown,
>
> Please find our request for agency coordination for the 5-year review of the INRMP for Adelphi Laboratory Center. Adelphi is now a sub-installation under Aberdeen Proving Ground. We will continue to keep our INRMPs separate to make things easier.

Thank you,

Bridget

Bridget Kelly Butcher

Conservation Specialist

APG/Adelphi Laboratory Center

Cell Phone: 240-694-7258

Email: bridget.c.kellybutcher.civ@mail.mil < Caution-mailto:bridget.c.kellybutcher.civ@mail.mil > <Caution-mailto:bridget.c.kellybutcher.civ@mail.mil < Caution-mailto:bridget.c.kellybutcher.civ@mail.mil > >

--

Mark Murray-Brown
ESA Section 7 Coordinator
Protected Resources Division
NOAA National Marine Fisheries Service
Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester MA 01930
(978) 281-9306

For ESA Section 7 guidance and updates on listed species presence and critical habitat analysis please see:
Caution-Blockedwww.greateratlantic.fisheries.noaa.gov/protected/section7/index.html < Caution-https://www.greateratlantic.fisheries.noaa.gov/protected/section7/index.html >

To submit a request for technical information or ESA section 7 consultation please send to:
nmfs.gar.esa.section7@noaa.gov < Caution-mailto:nmfs.gar.esa.section7@noaa.gov >

--

Brian D. Hopper
Protected Resources Division
NOAA Fisheries
Greater Atlantic Regional Fisheries Office
200 Harry S Truman Parkway
Suite 460
Annapolis, MD 21401
410 267 5649
Brian.D.Hopper@noaa.gov < Caution-mailto:brian.d.hopper@noaa.gov >
Caution-Blockedhttp://www.greateratlantic.fisheries.noaa.gov/ < Caution-http://www.greateratlantic.fisheries.noaa.gov/ >



DEPARTMENT OF THE ARMY
U.S. ARMY INSTALLATION MANAGEMENT COMMAND
U.S. ARMY GARRISON ABERDEEN PROVING GROUND
BUILDING 4510, 6429 BOOTHBY HILL AVENUE
ABERDEEN PROVING GROUND MARYLAND 21005-5001

Chief Glenna Wallace
Eastern Shawnee Tribe of Oklahoma
PO Box 350
Seneca, MO 64865

DEC 10 2021

Dear Chief Wallace:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Eastern Shawnee Tribe of Oklahoma related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

The INRMP defines roles and responsibilities for natural resource management within the installations and provides a basis for addressing all applicable legal requirements and best management practices consistent with achievement of the needs, goals, and objectives of the installations' military missions. The INRMP also provides natural resources related goals and proposed projects such as flora and fauna species surveys for the next five years.

In the event that there is a discovery of any unreported archaeological resources or historic property (16 United States Code § 470aa et seq.), Native American sacred site and/or traditional cultural property during the implementation of the INRMP, Aberdeen Proving Ground would implement its "accidental discovery" plan described in the Integrated Cultural Resources Management Plan to comply with the National Historic Preservation Act, Archaeological Resources Protection Act of 1979, Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, 36 Code of Federal Regulations Part 79, and Executive Order 13007, *Indian Sacred Sites*. If prehistoric or historic artifacts that could be associated with Native American, early European, or American settlement are encountered at any time during an INRMP project, Aberdeen Proving Ground would cease all activities involving subsurface disturbance in the vicinity of the discovery until the Aberdeen Proving Ground Cultural Resources Manager, Maryland State Historic Preservation Officer, and selected Native American Tribes are contacted to properly identify and appropriately treat discovered items in accordance with applicable state and Federal law(s).

Implementation of these measures would ensure that the five-year INRMP update would have no adverse effect on historic properties or cultural resources.

Aberdeen Proving Ground would appreciate your written response within 30 days of receipt of this letter. Please respond to: Bridget Kelly Butcher, Adelphi Laboratory Center, AMIM-ALP-E, 2800 Powder Mill Road, Adelphi, MD 20783 or bridget.c.kellybutcher.civ@army.mil.

Sincerely,

Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY INSTALLATION MANAGEMENT COMMAND
U.S. ARMY GARRISON ABERDEEN PROVING GROUND
BUILDING 4510, 6429 BOOTHBY HILL AVENUE
ABERDEEN PROVING GROUND MARYLAND 21005-5001

Mr. Paul Barton
Tribal Historic Preservation Officer
Eastern Shawnee Tribe of Oklahoma
12705 S. 705 Road
Wyandotte, OK 74370-3148

[illegible] 10 2021

Dear Mr. Barton:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Eastern Shawnee Tribe of Oklahoma related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

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Sincerely,



Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY INSTALLATION MANAGEMENT COMMAND
U.S. ARMY GARRISON ABERDEEN PROVING GROUND
BUILDING 4510, 6429 BOOTHBY HILL AVENUE
ABERDEEN PROVING GROUND MARYLAND 21005-5001

DEC 10 2021

Chief William L. Fisher
Seneca-Cayuga Nation
PO Box 453220
Grove, OK 74345-3220

Dear Chief Fisher:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Seneca-Cayuga Nation related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

The INRMP defines roles and responsibilities for natural resource management within the installations and provides a basis for addressing all applicable legal requirements and best management practices consistent with achievement of the needs, goals, and objectives of the installations' military missions. The INRMP also provides natural resources related goals and proposed projects such as flora and fauna species surveys for the next five years.

In the event that there is a discovery of any unreported archaeological resources or historic property (16 United States Code § 470aa et seq.), Native American sacred site and/or traditional cultural property during the implementation of the INRMP, Aberdeen Proving Ground would implement its "accidental discovery" plan described in the Integrated Cultural Resources Management Plan to comply with the National Historic Preservation Act, Archaeological Resources Protection Act of 1979, Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, 36 Code of Federal Regulations Part 79, and Executive Order 13007, *Indian Sacred Sites*. If prehistoric or historic artifacts that could be associated with Native American, early European, or American settlement are encountered at any time during an INRMP project, Aberdeen Proving Ground would cease all activities involving subsurface disturbance in the vicinity of the discovery until the Aberdeen Proving Ground Cultural Resources Manager, Maryland State Historic Preservation Officer, and selected Native American Tribes are contacted to properly identify and appropriately treat discovered items in accordance with applicable state and Federal law(s).

Implementation of these measures would ensure that the five-year INRMP update would have no adverse effect on historic properties or cultural resources.

Aberdeen Proving Ground would appreciate your written response within 30 days of receipt of this letter. Please respond to: Bridget Kelly Butcher, Adelphi Laboratory Center, AMIM-ALP-E, 2800 Powder Mill Road, Adelphi, MD 20783 or bridget.c.kellybutcher.civ@army.mil.

Sincerely,



Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY INSTALLATION MANAGEMENT COMMAND
U.S. ARMY GARRISON ABERDEEN PROVING GROUND
BUILDING 4510, 6429 BOOTHBY HILL AVENUE
ABERDEEN PROVING GROUND MARYLAND 21005-5001

DEC 10 2021

Mr. William Tarrant
Tribal Historic Preservation Officer
Seneca-Cayuga Nation
PO Box 453220
Grove, OK 74345-3220

Dear Mr. Tarrant:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Seneca-Cayuga Nation related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

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Sincerely,

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Chief, Environmental Division
Directorate of Public Works

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U.S. ARMY GARRISON ABERDEEN PROVING GROUND
BUILDING 4510, 6429 BOOTHBY HILL AVENUE
ABERDEEN PROVING GROUND MARYLAND 21005-5001

Mr. Micco Emarthla
Tribal Historic Preservation Officer Director
Seneca-Cayuga Tribe of Oklahoma
23701 S. 655 Road
10 Hwy.
Grove, OK 74344

DEC 10 2021

Dear Mr. Emarthla:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Seneca-Cayuga Tribe of Oklahoma related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

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Sincerely,

Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works

Enclosures

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U.S. ARMY INSTALLATION MANAGEMENT COMMAND
U.S. ARMY GARRISON ABERDEEN PROVING GROUND
BUILDING 4510, 6429 BOOTHBY HILL AVENUE
ABERDEEN PROVING GROUND MARYLAND 21005-5001

Chief Chet Brooks
Delaware Tribe of Indians
5100 Tuxedo Blvd.
Bartlesville, OK 74006

DEC 10 2021

Dear Chief Brooks:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Delaware Tribe of Indians related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

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Sincerely,

Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works

Enclosures

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DEC 10 2021

Mr. Curtis Zunigha
Cultural Director
Delaware Tribe of Indians
5100 Tuxedo Blvd.
Bartlesville, OK 74006

Dear Mr. Zunigha:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Delaware Tribe of Indians related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

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Sincerely,

Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works

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DEC 10 2021

Ms. Susan Bachor
Archaeologist
Delaware Tribe Eastern Office
126 University Circle
East Stroudsburg, PA 18301

Dear Ms. Bachor:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Delaware Tribe Eastern Office related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

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Sincerely,

Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works

Enclosures

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ABERDEEN PROVING GROUND MARYLAND 21005-5001

DEC 10 2021

Dr. Brice Obermeyer
Historic Preservation
Delaware Tribe of Indians
1 Kellog Circle
Emporia, KS 66801

Dear Dr. Obermeyer:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Delaware Tribe of Indians related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

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Chief, Environmental Division
Directorate of Public Works

Enclosures

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U.S. ARMY GARRISON ABERDEEN PROVING GROUND
BUILDING 4510, 6429 BOOTHBY HILL AVENUE
ABERDEEN PROVING GROUND MARYLAND 21005-5001

Ms. Blair Fink
Historic Preservation Representative
Delaware Tribe of Indians
Temple University
115 W. Polett Walk
Philadelphia, PA 19122

DEC 10 2021

Dear Ms. Fink:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Delaware Tribe of Indians related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

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Chief, Environmental Division
Directorate of Public Works

Enclosures

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U.S. ARMY GARRISON ABERDEEN PROVING GROUND
BUILDING 4510, 6429 BOOTHBY HILL AVENUE
ABERDEEN PROVING GROUND MARYLAND 21005-5001

Ms. Deborah Dotson
President
Delaware Nation, Oklahoma
P.O. Box 825
Anadarko, OK 73005

OCT 1 0 2021

Dear Ms. Dotson:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Delaware Nation, Oklahoma related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

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Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works

Enclosures

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BUILDING 4510, 6429 BOOTHBY HILL AVENUE
ABERDEEN PROVING GROUND MARYLAND 21005-5001

Nekole Alligood
Director of Cultural Resources & Section 106
Delaware Nation, Oklahoma
P.O. Box 825
Anadarko, OK 73005

DEC 10 2021

Dear Nekole:

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Sincerely,

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Chief, Environmental Division
Directorate of Public Works

Enclosures

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U.S. ARMY GARRISON ABERDEEN PROVING GROUND
BUILDING 4510, 6429 BOOTHBY HILL AVENUE
ABERDEEN PROVING GROUND MARYLAND 21005-5001

Mr. Darrin Ahshapanek
EPA Director
Delaware Nation
30164 State Hwy. 281
Anadarko, OK 73005

[redacted] 10 2021

Dear Mr. Ahshapanek:

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Directorate of Public Works

Enclosures

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U.S. ARMY GARRISON ABERDEEN PROVING GROUND
BUILDING 4510, 6429 BOOTHBY HILL AVENUE
ABERDEEN PROVING GROUND MARYLAND 21005-5001

Mr. Kerry Holton
Tribal President
Delaware Nation
PO Box 825
Anadarko, OK 73005

[redacted] 10 2021

Dear Mr. Holton:

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[redacted] 10 2021

Mr. Jason Ross
Delaware Nation
31064 State Hwy. 281
Anadarko, OK 73005

Dear Mr. Ross:

The U.S. Army Garrison Aberdeen Proving Ground would like to initiate coordination with the Delaware Nation related to the five-year update of an existing Integrated Natural Resources Management Plan (INRMP). The INRMP addresses natural resources management at two of Aberdeen Proving Ground's site's which include the Adelphi Laboratory Center located in Prince George's and Montgomery Counties, Maryland, and the Blossom Point Research Facility located in Charles County, Maryland (Enclosures 1 and 2).

The INRMP defines roles and responsibilities for natural resource management within the installations and provides a basis for addressing all applicable legal requirements and best management practices consistent with achievement of the needs, goals, and objectives of the installations' military missions. The INRMP also provides natural resources related goals and proposed projects such as flora and fauna species surveys for the next five years.

In the event that there is a discovery of any unreported archaeological resources or historic property (16 United States Code § 470aa et seq.), Native American sacred site and/or traditional cultural property during the implementation of the INRMP, Aberdeen Proving Ground would implement its "accidental discovery" plan described in the Integrated Cultural Resources Management Plan to comply with the National Historic Preservation Act, Archaeological Resources Protection Act of 1979, Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, 36 Code of Federal Regulations Part 79, and Executive Order 13007, *Indian Sacred Sites*. If prehistoric or historic artifacts that could be associated with Native American, early European, or American settlement are encountered at any time during an INRMP project, Aberdeen Proving Ground would cease all activities involving subsurface disturbance in the vicinity of the discovery until the Aberdeen Proving Ground Cultural Resources Manager, Maryland State Historic Preservation Officer, and selected Native American Tribes are contacted to properly identify and appropriately treat discovered items in accordance with applicable state and Federal law(s).

Implementation of these measures would ensure that the five-year INRMP update would have no adverse effect on historic properties or cultural resources.

Aberdeen Proving Ground would appreciate your written response within 30 days of receipt of this letter. Please respond to: Bridget Kelly Butcher, Adelphi Laboratory Center, AMIM-ALP-E, 2800 Powder Mill Road, Adelphi, MD 20783 or bridget.c.kellybutcher.civ@army.mil.

Sincerely,

Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works

Enclosures

EASTERN SHAWNEE
CULTURAL PRESERVATION DEPARTMENT
70500 East 128 Road, Wyandotte, OK 74370

December 14, 2021

Department of The Army Garrison Aberdeen Proving Ground
Buildong 4510, 6429 Boothby Hill Ave.
Aberdeen Proving Ground, Maryland 21005-5001

RE: ***INRMP, Adelphi Laboratory, Prince George and Montgomery Counties, Blossom Point Research, Charles County, Maryland, Multiple Counties County, Maryland***

Dear Ms. Butcher,

The Eastern Shawnee Tribe has received your letter regarding the above referenced project(s) within Multiple Counties County, Maryland. The Eastern Shawnee Tribe is committed to protecting sites important to Tribal Heritage, Culture and Religion. Furthermore, the Tribe is particularly concerned with historical sites that may contain but not limited to the burial(s) of human remains and associated funerary objects.

As described in your correspondence, and upon research of our database(s) and files, we find our people occupied these areas historically and/or prehistorically. However, the project proposes **NO Adverse Effect** or endangerment to known sites of interest to the Eastern Shawnee Tribe. Please continue project as planned. However, should this project inadvertently discover an archeological site or object(s) we request that you immediately contact the Eastern Shawnee Tribe, as well as the appropriate state agencies (within 24 hours). We also ask that all ground disturbing activity stop until the Tribe and State agencies are consulted. Please note that any future changes to this project will require additional consultation.

In accordance with the NHPA of 1966 (16 U.S.C. § 470-470w-6), federally funded, licensed, or permitted undertakings that are subject to the Section 106 review process must determine effects to significant historic properties. As clarified in Section 101(d)(6)(A-B), historic properties may have religious and/or cultural significance to Indian Tribes. Section 106 of NHPA requires Federal agencies to consider the effects of their actions on all significant historic properties (36 CFR Part 800) as does the National Environmental Policy Act of 1969 (43 U.S.C. § 4321-4347 and 40 CFR § 1501.7(a). This letter evidences NHPA and NEPA historic properties compliance pertaining to consultation with this Tribe regarding the referenced proposed projects.

Thank you, for contacting the Eastern Shawnee Tribe, we appreciate your cooperation. Should you have any further questions or comments please contact our Office.

Sincerely,

Paul Barton, Tribal Historic Preservation Officer (THPO)
Eastern Shawnee Tribe of Oklahoma
(918) 666-5151 Ext:1833

DEPARTMENT OF THE ARMY
U.S. ARMY INSTALLATION MANAGEMENT COMMAND
ADELPHI LABORATORY CENTER
2800 MILL POWDER ROAD
ADELPHI MARYLAND 20783-1197

1/25/22

Ms. Genevieve LaRouche
U.S. Fish and Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, Maryland 21401-7307

Dear Ms. LaRouche:

The U.S. Army Garrison Aberdeen Proving Ground (APG) has updated an existing Integrated Natural Resources Management Plan (INRMP). APG is submitting the updated *Integrated Natural Resource Management Plan 2022-2026, U.S. Army Garrison Aberdeen Proving Ground, Adelphi Laboratory Center and Blossom Point Research Facility* for your review and signature. This INRMP addresses natural resources management at the Adelphi Laboratory Center (ALC) located in Prince George's and Montgomery Counties, Maryland and the Blossom Point Research Facility (BPRF) located in Charles County, Maryland.

APG reviewed and updated information about natural resources and natural resources programs on ALC and BPRF and proposed appropriate courses of action to improve and protect these resources in collaboration with and under the direction of the Directorate of Public Works, Environmental Division. The INRMP was prepared in accordance with appropriate current Department of Defense and Army guidance and focuses on management opportunities in a manner consistent with the mission of the facilities. The following is a summary of new reports or updates that were made since the last INRMP 5-year revision:

- Language regarding the realignment of ALC and BPRF under APG's Command.
- Climate Change Section updated to include the Army's Climate Assessment Tool.
- Updates to the Threatened and Endangered Species List.
- Natural Resources Management Goals, Objectives and Projects for the next 5 years.
- Appendix F – Planning Level Surveys were updated in 2021.
- Appendix G – Rare, Threatened and Endangered Surveys (2016 and 2019 Bat Surveys and 2015 Species Survey).
- Appendix H – 2019 Amphibian and Reptile Species Survey.
- Appendix I – 2019 Stream Assessment for Paint Branch and Associated Tributaries on ALC.
- Appendix J – 2017 Shoreline Survey and Management Plan.

- Appendix K – Migratory Bird Management and 2019 Avian Survey.
- Appendix L – 2016 update to the Bald Eagle Management Plan.
- Appendix M – 2017 update to the Forest Management Plan.
- Appendix N – 2015 White-tailed Deer Management Plan.
- Appendix O – 2021 Integrated Wildland Fire Management Plan.
- Appendix P – 2018 Habitat Management Plan.
- Appendix Q – 2015 Invasive Species Management Plan for ALC.

A Record of Environmental Consideration for the 'Implementation of the *Integrated Natural Resources Management Plan 2022-2026, U.S. Army Garrison Aberdeen Proving Ground, Adelphi Laboratory Center and Blossom Point Research Facility*' was also prepared to comply with the National Environmental Policy Act.

To assist the review of the INRMP update, a link to download an electronic copy of the INRMP will be emailed to you from DoD SAFE. Please review and return the signed INRMP Tripartite Agreement within 60 days to Ms. Bridget Kelly Butcher, U.S. Army Garrison Adelphi Laboratory Center, 2800 Powder Mill Road, AMIM-ALP-E, Adelphi, Maryland 20783-1197, bridget.c.kellybutcher.civ@army.mil, 301-394-1062.

Sincerely,

HOBBS.VANCE.G.1229303801 Digitally signed by HOBBS.VANCE.G.1229303801 Date: 2022.01.25 15:34:49 -05'00'

Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works
Aberdeen Proving Ground

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY INSTALLATION MANAGEMENT COMMAND
ADELPHI LABORATORY CENTER
2800 MILL POWDER ROAD
ADELPHI MARYLAND 20783-1197

1/25/22

Ms. Lynn Davidson
Wildlife and Heritage Service
Department of Natural Resources
580 Taylor Avenue
Tawes Office Building E-1
Annapolis, Maryland 21401-2352

Dear Ms. Davidson:

The U.S. Army Garrison Aberdeen Proving Ground (APG) has updated an existing Integrated Natural Resources Management Plan (INRMP). APG is submitting the updated *Integrated Natural Resource Management Plan 2022-2026, U.S. Army Garrison Aberdeen Proving Ground, Adelphi Laboratory Center and Blossom Point Research Facility* for your review and Mr. Peditto's signature. This INRMP addresses natural resources management at the Adelphi Laboratory Center (ALC) located in Prince George's and Montgomery Counties, Maryland and the Blossom Point Research Facility (BPRF) located in Charles County, Maryland.

APG reviewed and updated information about natural resources and natural resources programs on ALC and BPRF and proposed appropriate courses of action to improve and protect these resources in collaboration with and under the direction of the Directorate of Public Works, Environmental Division. The INRMP was prepared in accordance with appropriate current Department of Defense and Army guidance and focuses on management opportunities in a manner consistent with the mission of the facilities. The following is a summary of new reports or updates that were made since the last INRMP 5-year revision:

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Sincerely,

HOBBS.VANCE.G.1229303801 Digitally signed by HOBBS.VANCE.G.1229303801 Date: 2022.01.25 15:36:39 -05'00'

Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works
Aberdeen Proving Ground

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY INSTALLATION MANAGEMENT COMMAND
ADELPHI LABORATORY CENTER
2800 MILL POWDER ROAD
ADELPHI MARYLAND 20783-1197

1/25/22

Mr. Brian D. Hopper
Protected Resources Division, NOAA Fisheries
Greater Atlantic Regional Fisheries Office
200 Harry S Truman Parkway, Suite 460
Annapolis, MD 21401

Dear Mr. Hopper:

The U.S. Army Garrison Aberdeen Proving Ground (APG) has updated an existing Integrated Natural Resources Management Plan (INRMP). APG is submitting the updated *Integrated Natural Resource Management Plan 2022-2026, U.S. Army Garrison Aberdeen Proving Ground, Adelphi Laboratory Center and Blossom Point Research Facility* for your review. This INRMP addresses natural resources management at the Adelphi Laboratory Center (ALC) located in Prince George's and Montgomery Counties, Maryland and the Blossom Point Research Facility (BPRF) located in Charles County, Maryland.

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Sincerely,

HOBBS.VANCE.G.1229303801 Digitally signed by HOBBS.VANCE.G.1229303801 Date: 2022.01.25 15:35:46 -05'00'

Vance G. Hobbs
Chief, Environmental Division
Directorate of Public Works
Aberdeen Proving Ground

APPENDIX D:
Federal Regulations and Other Regulatory Instruments

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Below is a list of the most significant federal laws and regulations, state laws and other regulatory instruments that may govern implementation of this Integrated Natural Resources Management Plan.

Federal Laws

American Indian Religious Freedom Act (42 United States Code (USC) 1996-1996a)
Archaeological and Historic Preservation Act of 1974 (PL 93-291; 16 USC 469 *et seq*.)
Archaeological Resources Protection Act of 1979 (PL 96-95:16 USC 470aa-11)
~~Army National Environmental Policy Act Regulation (32 CFR 651)~~
Bald and Golden Eagle Protection Act (PL 86-70, as amended)
Clean Air Act (as amended through 1990) (42 USC 7401-7642)
Clean Water Act of 1972 (33 USC 1251-1387)
Comprehensive Environmental Response, Compensation, and Liability Act
Conservation and Rehabilitation Program on Military and Public Lands (PL 93-452)
Conservation Programs on Military Reservations (PL 90-465)
Endangered Species Act of 1973 (PL 95-632, as amended)
Energy Independence and Security Act, 2007 (PL 110-140)
Erosion Protection Act (33 USC 426e-426h)
Federal Facilities Compliance Act of 1992 (PL 102-386; amending 42 USC 6961)
Federal Insecticide, Fungicide and Rodenticide Act (7 USC 136 *et seq*.)
Federal Water Pollution Control Act Amendments of 1972 (PL 92-522)
Fish and Wildlife Conservation Act of 1980 (PL 96-366; 16 USC 2901)
Fish and Wildlife Coordination Act (PL 85-624)
Fish and Wildlife Conservation and Natural Resource Management Programs on Military Reservation (Amends Public Law 86-797 (Sikes Act) (PL 96-561)
Migratory Bird Conservation Act (Chapter 257; 45 Stat 1222; 16 USC 715 *et seq*.)
Migratory Bird Treaty Act (PL 65-186; 16 USC 703 *et seq*.)
Native American Graves Protection and Repatriation Act (25 USC, Section 3001 *et seq*.)
National Environmental Policy Act of 1969 (as amended, PL 91-190; 42 USC 4321 *et seq*.)
Noxious Plant Control Act (PL 90-583)
Plant Protection Act of 2000 (replaces Federal Noxious Weed Act of 1973 (PL 93-629))
Resource Conservation and Recovery Act (42 U.S.C. §6901)
Sikes Act Improvement Amendments of 1997 (PL 105-85, as amended; USC Title 16)
Watershed Protection and Flood Prevention Act (PL 92419; 68 Stat 666, as amended and 86 Stat 667; 16 USC 1001)

Executive Orders and Presidential Memoranda

Executive Order 11593, Protection and Enhancement of the Cultural Environment
Executive Order 11988, Floodplain Management
~~Executive Order 11991, Protection and Enhancement of Environmental Quality~~
Executive Order 12608, Protection of Wetlands: Amends Executive Order 11990
~~Executive Order 12898, Environmental Justice~~
Executive Order 13007, Indian Sacred Sites
Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks
Executive Order 13175, Consultation and Coordination with Indian Tribal Governments
Executive Order 13112, Invasive Species, 1999
Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13508, Strategy for Restoring and Protecting the Chesapeake Bay Watershed
Presidential Memorandum – Incorporating Ecosystem Services into Federal Decision Making (October 2015)
Presidential Memorandum – Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators (June 2014)

Department of Defense (DoD) Instructions, Manuals and Policies
DoD Instruction 4715.03, Natural Resources ~~Conservation Program~~ Management
DoD Manual 4715.03, INRMP Implementation Manual
DoD Instruction 4150.07, DoD Pest Management Program
DoD Instruction 4715.16, Cultural Resources Management
DoD Instruction 4710.02, DoD Interactions with Federally-Recognized Tribes
DoD Policy to Use Pollinator-Friendly Management Prescriptions, September 2014
DoD Instruction 4715.21, Improving Military Installation and Critical Resources Resilience
DoD Instruction 4715.28, Military Installation Resilience
DoD NEPA Implementing Procedures, June 2025

Army Regulations (AR) and Implementing Guidance
AR 200-1, Environmental Protection and Enhancement (2007)
Memorandum – Army Policy Guidance for Fish and Wildlife Conservation Fund, 21X5095 (January 2002)
Memorandum – Army Guidance for DoD NEPA Implementing Procedures

Maryland State Laws and Enforceable Policies
Maryland Enforceable Coastal Policies, April 2011
Maryland Stormwater Management and Erosion and Sediment Control Guidelines for State and Federal Projects, February 2015
Erosion and Sediment Control, Code of Maryland Regulations 26.17.01
Endangered Species of Fish Conservation Act, Annotated Code of Maryland, Natural Resources Article, Title 4-2A
Nongame and Endangered Species Conservation Act, Annotated Code of Maryland, Natural Resources Article, Title 10-2A
Nontidal Wetlands Protection Act, Annotated Code of Maryland, Environment Article, Title 5-901(h)(1)
Tidal Wetlands Protection Act, Annotated Code of Maryland, Environment Article, Title 16-101(n)
Stormwater Management Regulations, Code of Maryland Regulations 26.17.02

Other Guidance
~~Climate Adaptation for DoD Natural Resource Managers~~
~~Army Climate Assessment Tool~~
Department of Defense Defense Extreme Conditions Assessment Tool
Sikes Tripartite MOU
Mutual DoD and USFWS Guidelines for Streamlined Review of INRMP Updates
Addressing Migratory Bird Management in INRMPs

APPENDIX E:
Critical Habitat Issues

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Critical Habitat is defined in the Endangered Species Act (ESA) as "specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection." An area can only be established as "Critical Habitat" after the USFWS has published it in the Federal Register. The ESA also states that "the secretary shall not designate as critical habitat any lands or other geographic areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an INRMP prepared under section 101 of the Sikes Act, if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation."

ALC has no area that is considered critical habitat. For BPRF, the Potomac River was designated as critical habitat for the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) in 2017. ALC manage its lands with an ecosystem approach in accordance with the Maryland Coastal Zone Management Act, Bald and Golden Eagle Protection Act and all appropriate regulations, laws and policies. New listings of endangered species will be reviewed regularly and included in the updates of this INRMP.

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APPENDIX F:
Planning Level Surveys

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APPENDIX F:
Planning Level Surveys

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Natural Resources Management Planning Level Survey

Adelphi Laboratory Center
Adelphi, Maryland

Submitted to:

Environmental Management Office
Adelphi Laboratory Center
Adelphi, Maryland 20783

Submitted by:

U.S. Army Corps of Engineers, Baltimore District
2 Hopkins Plaza
Baltimore, Maryland 21201

March 2021

Natural Resources Management Planning Level Survey

Adelphi Laboratory Center
Adelphi, Maryland

EXECUTIVE SUMMARY

Adelphi Laboratory Center (ALC) is located in Adelphi, Maryland (Latitude 39 -1'-45"N, Longitude 76 -58'-19"W), approximately 10 miles north of Washington, D.C. and approximately 26 miles southwest of Baltimore, Maryland. The facility straddles the border between two Maryland jurisdictions, Prince George's and Montgomery Counties, with the majority of the facility residing in Montgomery County. ALC is approximately 207 acres in size. ALC lies in the Anacostia River drainage basin which is a tributary of the Potomac River. It is bordered by residential areas on the east and south and by the General Service Administration's Federal Center on the north and west.

ALC is home to the Headquarters for the Army Research Laboratory (ARL). The mission of ARL is to provide the underpinning science, technology, and analysis that enable full-spectrum operations. The mission of ALC is to support innovative science and technology by providing service and infrastructure while optimizing resources, sustaining the environment, and enhancing the wellbeing of the Army's workforce and community.

This Natural Resources Management Planning Level Survey (PLS) is intended to identify the biological resources of the installation and to address the potential impacts that installation activities may have on federal and/or state endangered and threatened species or any significant biological resource that may exist on the installation property. As part of the assessment procedure, the PLS included an investigation of not only the presence of threatened and endangered species, but also the evaluation of habitat to support these species.

The assessment methodology included contact with the U.S. Fish and Wildlife Service (USFWS), Maryland Department of Natural Resources (MDNR) and Maryland Natural Heritage Program (NHP) to request information regarding threatened and endangered plants and animal species that may be present on the Installation or adjacent properties.

Background information collection was primarily collected from a previous PLS (2011). Existing Geographic Information System data was used to begin the desktop reconnaissance of ALC. Maps of the area were developed from several sources including: U.S. Geological Survey (USGS) Quadrangle, U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NCRS) Soil Data Mart, USFWS National Wetland Inventory Map and MDNR Wetlands map. Data from the Maryland Invasive Plant Council (MISC) was obtained to assist in the identification of invasive plant species that may exist on the installation property.

A field survey of ALC was conducted from June 22-24, 2020. All areas of the installation were subjected to pedestrian reconnaissance, except restricted areas, and information was recorded to document dominant vegetation species, wetlands and stream areas, and wildlife habitat to facilitate preparation of the natural resource maps. All wildlife seen or heard was noted, as were wildlife

signs such as nests, burrows, tracks and scat.

While the facility does not contain any federally- or state-listed threatened or endangered species, there is forested habitat that is considered Forest Interior Dwelling Bird habitat and should be protected. Paint Branch is classified as Class III – Natural Trout Waters by the State of Maryland and must be protected through a stream protective buffer. A stream protective buffer should be applied to Paint Branch and its tributaries on ALC, at a minimum of 200 feet in width. There are also wetlands scattered throughout ALC that must be avoided from impacts. These natural resources must be considered when planning for future construction activities, training and maintenance on the facility to avoid and minimize impacts.

Invasive species and pest management continue to enhance the natural ecosystems and should be continued according to the Invasive Species Management Plan (2017) and Integrated Pest Management Plan (2020).

Natural Resources Management Planning Level Survey

Adelphi Laboratory Center
Adelphi, Maryland

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Natural Resources Management Planning Level Survey

Adelphi Laboratory Center
Adelphi, Maryland

1.0 INTRODUCTION

Adelphi Laboratory Center (ALC) is located in Adelphi, Maryland (Latitude 39 -1'-45"N, Longitude 76 -58'-19"W), approximately 10 miles north of Washington, D.C. and approximately 26 miles southwest of Baltimore, Maryland (Figure 1). The facility straddles the border between two Maryland jurisdictions, Prince George's and Montgomery Counties, with the majority of the facility residing in Montgomery County. ALC is approximately 207 acres in size. ALC lies in the Anacostia River drainage basin, a tributary of the Potomac River.

ALC was acquired by the U.S. Army in 1969 from the U.S. Naval Surface Warfare Center (NSWC), Adelphi, Maryland. ALC is home to the Headquarters for the Army Research Laboratory (ARL). The mission of ARL is to provide the underpinning science, technology, and analysis that enable full-spectrum operations. The mission of ALC is to support innovative science and technology by providing service and infrastructure while optimizing resources, sustaining the environment, and enhancing the wellbeing of the Army's workforce and community.

This Natural Resources Management Planning Level Survey (PLS) is intended to identify the biological resources of the installation and to address the potential impacts that installation activities may have on federal and/or state endangered and threatened species or any significant biological resource that may exist on the installation property. As part of the assessment procedure, the PLS included an investigation of not only the presence of threatened and endangered species, but also the evaluation of habitat to support these species.

2.0 METHODS

2.1 Background Information Search

Background information was collected from a variety of sources to prepare this PLS. Contact was initiated with the U.S. Fish and Wildlife Service (USFWS) and Maryland Department of Natural Resources (MDNR) to request information regarding threatened and endangered plant and animal species that may be present on the Installation or adjacent properties. Existing reports, existing Geographic Information System (GIS) data from ALC and the 2011 PLS were reviewed. Data was collected from several sources including: U.S. Geological Survey (USGS), Topographic Quadrangle, U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NCRS) Soil Data Mart, USFWS National Wetland Inventory (NWI) Map and MDNR wetlands mapping. Data from the Maryland Invasive Species Council (MISC) was obtained to assist in the identification of invasive plant species that may exist on the installation property.



US Army Corps of Engineers
Baltimore District

Figure 1. Adelphi Laboratory Center Location
Montgomery and Prince George's Counties, MD

2.2 Field Surveys

A field survey of ALC was conducted on June 22-24, 2020. All areas of the installation were subjected to pedestrian reconnaissance, except restricted areas, and information was recorded to document dominant vegetation species, wetlands and stream areas, and wildlife habitat to facilitate preparation of the natural resource maps. All wildlife seen or heard was noted, as were wildlife signs such as nests, burrows, tracks and scat.

3.0 RESULTS AND DISCUSSION

3.1 Site Description

ALC generally consists of the land use categories: industrial, installation support, and open space. Within those general categories specific land use designations include research, development and testing, open space/buffers, maintenance and storage, administration, utilities, and explosive storage. The installation maintains a 200-foot forested buffer zone along Paint Branch at the request of the Maryland-National Capital Park and Planning Commission (M-NCPPC) and a 200-foot buffer exists along a short span of Floral Drive east of the bridge from the time the property initially transferred to the Army and continues to this day. The open space consists of tracts of contiguous forest and maintained landscape. Paint Branch runs through ALC, as does Hillandale Run, a tributary of Paint Branch. ALC lies in the Anacostia River drainage basin which is a tributary of the Potomac River. It is bordered by residential areas on the east and south and by the USDA on the north and west.

3.2 Vegetative Cover Types

There are two plant communities generally present on the installation: forested and maintained area. The remaining acreage has been developed and includes buildings, paved or graveled parking areas and sidewalks. A habitat map is presented as Figure 2. Table 1 identifies the plant species associated with each of the designated plant communities.

Forested Area

Vegetation at ALC is a mix of oak-hickory-pine forest and Appalachian oak forest. The majority of the installation is forested with urban, developed land and mowed, maintained lawns. Species found on the installation include the following:

- Oak – Hickory – Pine Forest:
    - Dominant Species – hickories (*Carya* sp.), loblolly pine (*Pinus taeda*), and white and post oaks (*Quercus* sp.)
    - Subdominant Species – blackgum (*Nyssa sylvatica*), tulip poplar (*Liriodnedron tulipifera*), sweetgum (*Liquidambar styracifula*), persimmon (*Diospyros virginiana*), flowering dogwood (*Cornus florida*), sourwood (*Oxydendrum arboretum*), Virginia pine (*Pinus Virginiana*) and a variety of oak species



US Army Corps of Engineers
Baltimore District

Figure 2. Adelphi Laboratory Center
Habitat Areas
Montgomery and Prince George's Counties, MD
Sources: Aerial Photo, Bing Maps, 2010. Boundary, ALC, 2010. Habitats, USACE, 2011.

1 inch = 1,000 feet

0 375 750 1,500 2,250 3,000 Feet

N

- Appalachian Oak Forest:
    - Dominant Species – white and northern red oaks (*Quercus* sp.)
    - Subdominant Species – red and sugar maple (*Acer* sp.), yellow birch (*Betula alleghaniensis*), hickories, tulip poplar, sweetgum, American beech (*Fagus grandifolia*) and several oak species

Common tree species observed on ALC include: northern red oak, white oak (*Quercus alba*), blackgum, tulip poplar, mockernut hickory (*Carya alba*), American beech, Virginia pine, red maple, black locust (*Robinia pseaudoacacia*) and American sycamore (*Platanus occidentalis*). Common shrub species observed on ALC include: Japanese barberry (*Beberis thunbergii*), mountain laurel (*Kalmia latifolia*) and multiflora rose (*Rosa multiflora*). See Table 1 for a complete list of observed species.

The forested areas on ALC are considered Forest Interior Dwelling Bird habitat by MDNR and should be protected if possible.

ALC does not contain forest land that can be managed for timber harvest and sale and therefore does not require the development of a Forest Management Plan. Gypsy moth (*Lymantria dispar dispar*) infestations are a continuing threat to the hardwoods and could produce significant damage to ALC's forest resources. The moth is found throughout the State of Maryland in its preferred oak forest habitat. Annual aerial surveys for gypsy moth defoliation are conducted by the USDA's Forest Service. The emerald ash borer (*Agrilus planipennis*) and spotted lanternfly (*Lycorma delicatula*) also pose a threat to trees at ALC; removal of wood from ALC is prohibited to prevent the spread of these pests.

Maintained Area

The maintained, landscaped areas are located generally around developed areas, such as buildings, roads, and parking lots. These areas generally consist of common grasses and ornamental plants. Common herbaceous species observed on ALC include: Japanese stiltgrass (*Microstegium vimineum*), barnyardgrass (*Echinochloa crus-galli*), common ladyfern (*Athyrium filix-femina*), green bristlegrass (*Setaria viridis*), purpletop tridens (*Tridens flavus*), sericea lespedeza (*Lespedeza cuneata*), wingstem (*Verbesina alternifolia*), roundleaf greenbrier (*Smilax rotundifolia*) and summer grape (*Vitis aestivalis*). See Table 1 for a complete list of observed species.

Table 1. Plant Species Observed on ALC

Common Name	*Scientific Name*
Trees	
American Beech	*Fagus grandifolia*
American Elm	*Ulmus Americana*
American Holly	*Ilex opaca*
American Hornbeam	*Carpinus caroliniana*
American Sycamore	*Platanus occidentalis*
Basswood	*Tilia Americana*

Common Name	*Scientific Name*
Trees	
Black Cherry	*Prunus serotina*
Black Gum	*Nyssa sylvatica*
Black Locust	*Robinia pseudoacacia*
Black Oak	*Quercus velutina*
Blackhaw	*Viburnum prunifolium*
Boxelder	*Acer negundo*
Chestnut Oak	*Quercus prinus*
Common Serviceberry	*Amelanchier arborea*
Crabapple	*Malus angustifolia*
Eastern Red Cedar	*Juniperus virginiana*
Eastern White Pine	*Pinus strobus*
Flowering Dogwood	*Cornus florida*
Green Ash	*Fraxinus pennsylvanica*
Hawthorn**	*Crataegus monogyna*
Hop–Hornbeam**	*Ostrya virginiana*
Ironwood	*Carpinus caroliniana*
Mockernut Hickory	*Carya alba*
Mountain Laurel	*Kalmia latifolia*
Northern Red Oak	*Quercus rubra*
Osage Orange	*Maclura pomifera*
Tree-of Heaven*	*Ailanthus altissima*
Persimmon	*Diospyrus virginiana*
Pin Oak	*Quercus palustris*
Pitch Pine	*Pinus rigida*
Post Oak	*Quercus stellata*
Princess Tree*	*Paulownia tomentosa*
Red Cedar	*Juniperus virginiana*
Red Maple	*Acer rubrum*
River Birch	*Betula nigra*
Sassafras	*Sassafras albidum*
Scarlet Oak	*Quercus coccinea*
Southern Red Oak**	*Quercus falcata*
Spanish Oak	*Quercus falcate*
Sweetbay	*Magnolia virginiana*
Sweetgum	*Liquidambar stiraciflua*
Tulip Poplar	*Liriodendron tulipifera*
Turkey Foot Oak**	*Quercus laevis*
Virginia Pine**	*Pinus virginiana*
White Ash	*Fraxinus americanus*
White Mulberry**	*Morus alba*
White Oak	*Quercus alba*

Common Name	*Scientific Name*
Trees	
White Pine	*Pinus strobus*
Willow Oak	*Quercus phellos*
Witch Hazel	*Hamamelis virginiana*
Shrubs	
Allegheny Blackberry	*Rubus allegheniensis*
Chinese Privet*	*Ligustrum sinense*
Japanese Barberry*	*Beberis thunbergii*
Lowbush Blueberry	*Vaccinium angustifolium*
Mountain Laurel	*Kalmia latifolia*
Multiflora Rose*	*Rosa multiflora*
Spicebush	*Lindera benzoin*
Wineberry*	*Rubus phoenicolasius*
Herbaceous	
Bamboo*	Bambusa spp.
Barnyard Grass	*Echinochloa crus-galli*
Bermuda Grass	*Cynodon dactylon*
Broadleaf Cattail	*Typha latifolia*
Broomsedge Bluestem	*Andropogon virginicus*
Carolina Horsenettle	*Solanum carolinense*
Christmas Fern	*Polystichum acrostichoides*
Common Ladyfern	*Athyrium filix-femina*
Common Mullein	*Verbascum thapsus*
Common Reed*	*Phragmites australis*
Foxtail **	*Setaria spp.*
Gill-Over-the-Ground	*Glechoma hederacea*
Green Bristlegrass	*Setaria viridis*
Horse Thistle**	*Onopordum acaulon*
Jack-in-the-Pulpit	*Arisaema triphyllum*
Japanese Stiltgrass*	*Microstegium vimenium*
Musk Thistle*	*Carduss nutans*
Narrow Leaf Cattail	*Typha angustifolia*
Partridgeberry	*Mitchella repens*
Poison Ivy	*Toxicodendron radicans*
Purpletop Tridens	*Tridens flavus*
Queen Anne's Lace	*Daucus carota*
Sedge	*Carex spp.*
Sericea Lespedeza*	*Lespedeza cuneata*
Skunk Cabbage	*Symplocarpus foetidus*
Small Green Wood Orchid**	*Platanthera clavellata*
White Snakeroot**	*Ageratina altissima*
Wingstem	*Verbesina alternifolia*

Common Name	*Scientific Name*
Vines	
Japanese Honeysuckle*	*Lonicera japonica*
Late-Flowering Thoroughwort	*Eupatorium serotinum*
Mile-A-Minute*	*Polygonum perfoliatum*
Oriental Bittersweet*	*Celastrus orbiculatus*
Pennsylvania Smartweed	*Polygonum pensylvanicum*
Roundleaf Greenbrier	*Smilax rotundifolia*
Summer Grape	*Vitis aestivalis*
Virginia Creeper	*Parthenocissus quinquefolia*

* Invasive species
**New species observed only in 2020

3.3 Surface Waters and Wetlands

Paint Branch and Hillandale Run, a tributary of Paint Branch, are perennial streams on ALC (Figure 3). Paint Branch originates approximately six miles north of the installation, cuts in a southeasterly direction through the interior of ALC, and then flows another four miles south to its confluence with the Northeast Branch of the Anacostia River. Ultimately, the Anacostia River empties into the Potomac River, which discharges into the Chesapeake Bay.

Hillandale Run flows west to east across ALC and empties into Paint Branch in the north central portion of the installation. Both streams have predominantly cobbled substrates, moderately rapid currents, and well-shaded, undeveloped stream banks.

A second tributary of Paint Branch is unnamed and located primarily outside of the eastern boundary of the installation, more or less parallel to Kuester Road. This stream receives drainage from the 400 Area. There are no stream gauges on Paint Branch and ALC has not conducted flow monitoring.

A stream protective buffer must be maintained adjacent to Paint Branch and its tributaries. The State of Maryland designates these waterways as Class III – Natural Trout Waters. Montgomery County, Maryland guidelines for environmental management of development recommend a minimum buffer width of 200 feet from the stream bank when slope ranges are 25 percent or greater. This 200-foot buffer is applicable to Paint Branch. A 150-foot buffer is to be maintained on the Paint Branch tributaries within the boundaries of ALC.

There are 10 wetlands located on ALC, amounting to approximately 10.41 acres (see Figure 3 and Table 2 below). The majority of the wetlands are located within the floodplains of Paint Branch and Hillandale Run. There is also a large wetland area in the center of the site that is associated with an unnamed tributary to Paint Branch that runs along the border of ALC and through ALC under Floral Road near the center of the facility. There are scattered smaller wetlands in the forested areas on the eastern portion of the facility that drain to drainage ditches that eventually flow to Paint Branch.

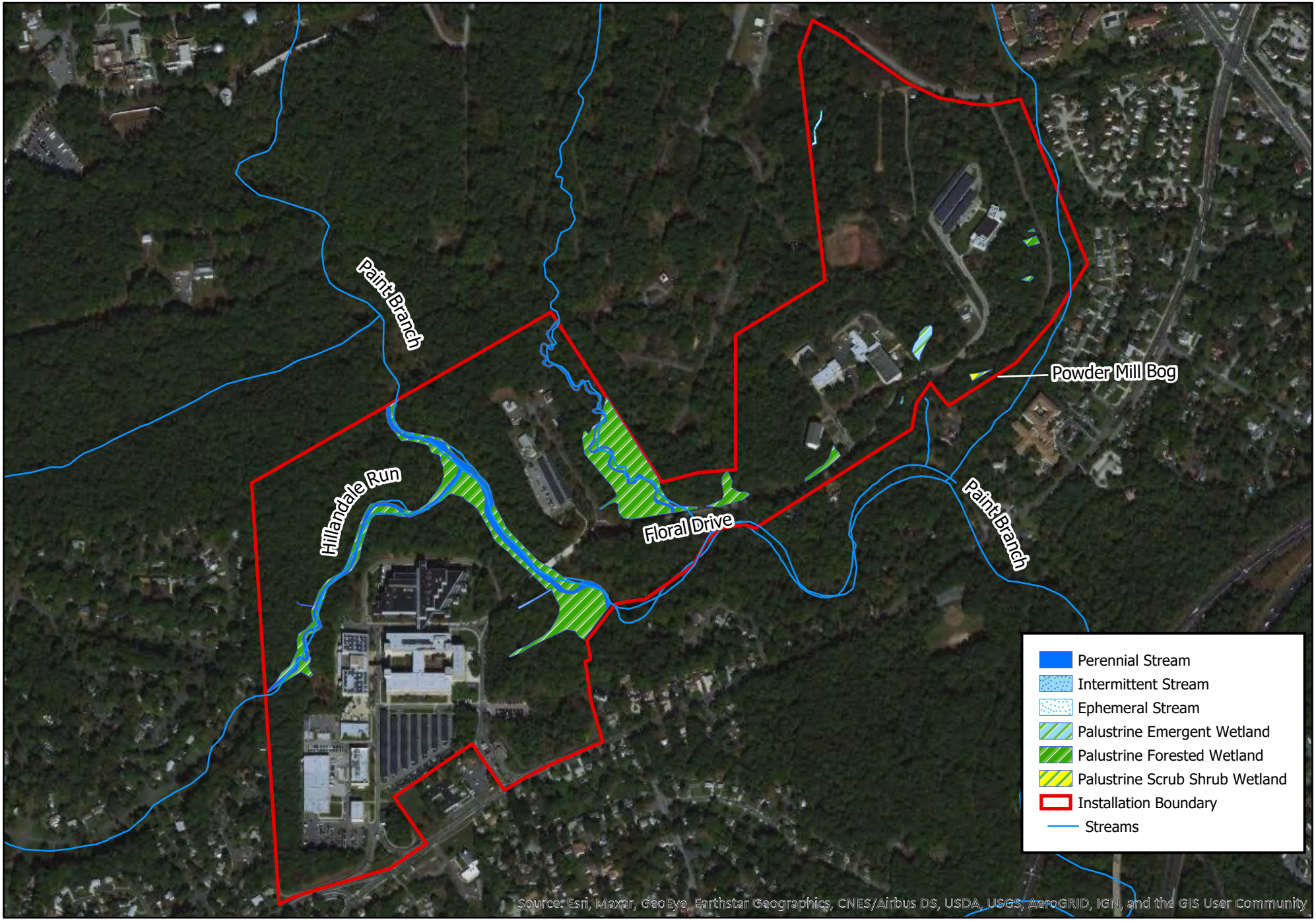


Figure 3. Adelphi Laboratory Center
Wetlands and Streams
Montgomery and Prince George's Counties, MD

1:9,000

0 375 750 1,500 2,250 3,000 Feet

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The Powder Mill Bog (PMB) on ALC is located on the southeastern portion of ALC. This bog is a remnant magnolia bog that drains to Paint Branch that has been known to support habitat for two State-listed endangered species: Long's rush (*Juncus longii*) and Capitate Beakrush (*Rhynchospora cephalantha*). Neither of these species were observed at the time of the 2020 PLS. A few small patches of the uncommon and unique (though not state-rare) small green wood orchid (*Platanthera clavellata*) was observed at the bog during the 2020 PLS. The PMB was observed to have decreased in size, most likely due to several dry summers and the maturation of the surrounding forest. The soils within the bog were completely saturated and coated in organic matter.

Table 2. Wetlands on ALC

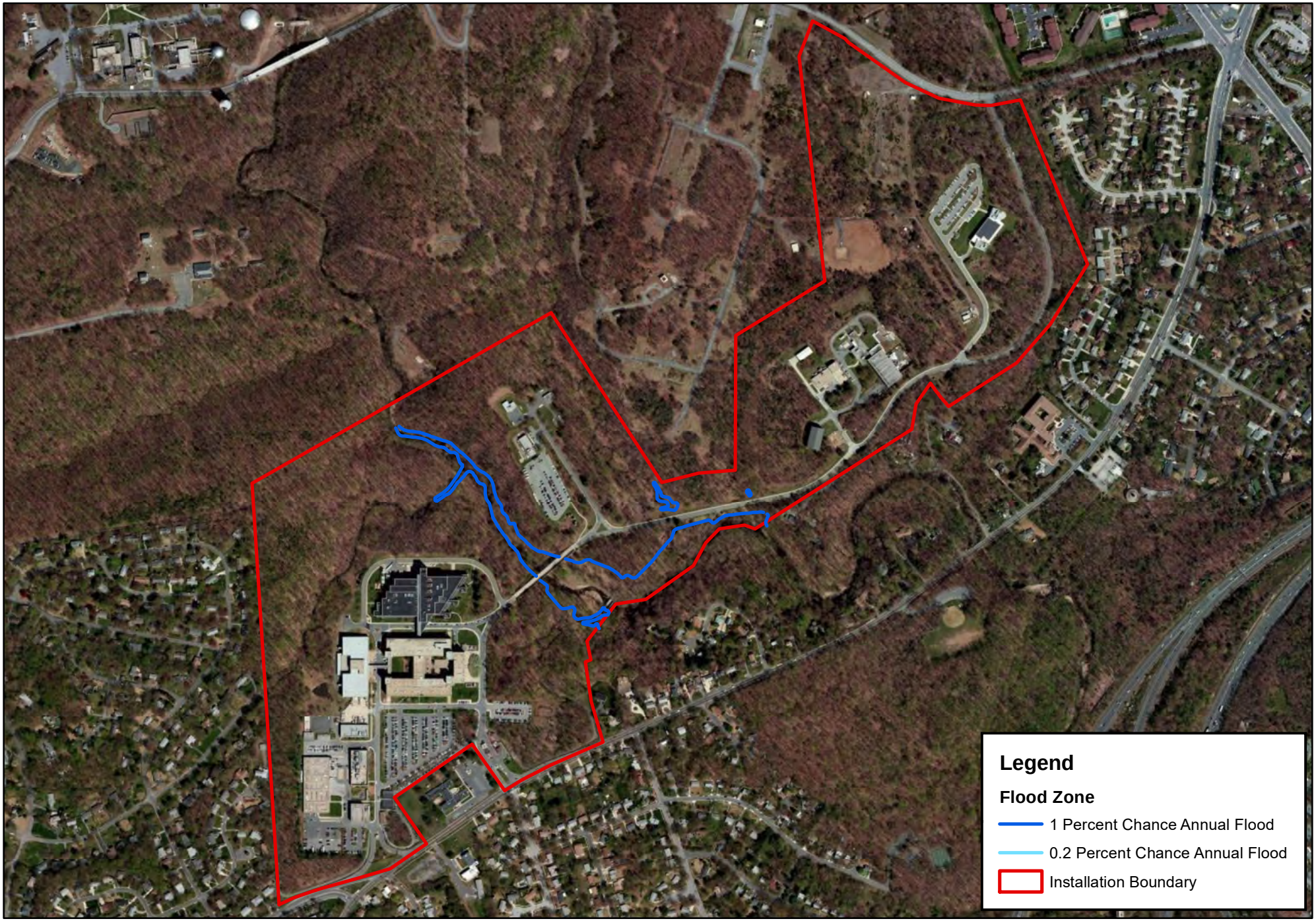
Wetland Name	Wetland Type	Description	Acreage
1	PFO	Drains to ditch, which flows to unnamed tributary to Paint Branch	0.01
2	PFO	Drains to ditch, which flows to unnamed tributary to Paint Branch	0.08
3	PFO	Drains to ditch, which flows to unnamed tributary to Paint Branch	0.03
4 (PMB)	PSS	Remnant Magnolia Bog, drains to Paint Branch	0.06
5	PEM	Drains to pipe, which outfalls to unnamed tributary to Paint Branch	0.26
6	PFO	Isolated	0.01
7	PFO	Floodplain wetland drains to unnamed tributary to Paint Branch	3.87
8	PFO	Drains to unnamed tributary to Paint Branch	0.19
9	PFO	Drains to unnamed tributary to Paint Branch	0.40
10	PFO	Floodplain wetland drains to Hillandale Run and Paint Branch	5.50
		TOTAL WETLAND ACREAGE	**10.41**

3.4 Floodplain

Throughout much of the installation steep side slopes restrict the 100-year floodplain for both the tributaries and Paint Branch to their narrow stream valleys (Figure 4). Below their confluence, the floodplain broadens and reaches its widest point, approximately 250 feet, between Floral Drive and the installation's southeastern border.

3.5 Wildlife

The wildlife species observed on the installation and adjacent area are representative and typical for forested and maintained lawn areas in residential areas. The presence of the chain-link fence around the perimeter of the property tends to restrict entry by larger animals. The 2020 PLS



US Army Corps of Engineers
Baltimore District

Figure 4. Adelphi Laboratory Center
Floodplains
Montgomery and Prince George's Counties, MD

Sources: Aerial Photo, Bing Maps, 2010. Boundary, ALC, 2010. Floodplains, ALC, 2010.

1 inch = 750 feet

0 375 750 1,500 2,250 3,000 Feet

N

revealed a nesting Cooper's hawk (*Accipiter cooperii*) with two young fledglings near Wetland 3. A complete list of observed species is included on Table 3.

Amphibians and Reptiles

A bullfrog (*Rana catesbeiana*), eastern American toad (*Anaxyrus americanus americanus*), and eastern box turtle (*Terrapene carolina*) were observed during the 2020 PLS at Paint Branch and Hillandale Run. The wetlands on ALC provide habitat for amphibians and reptiles that may not have been observed during the 2020 PLS. Herpetofaunal surveys were conducted at ALC from March to October 2018. The findings of these surveys are included in Table 3.

Birds

The bird species that were observed during the 2020 PLS include American robin (*Turdus migratorius*), mourning dove (*Zenaida macroura*), Great Blue Heron (*Ardea herodias*), turkey vulture (*Cathartes aura*), Cooper's hawk, and red-winged blackbird (*Agelaius phoeniceus*). All of the species observed are typical for this area. The forested areas, wetlands and streams provide habitat for Forest Interior Dwelling Birds and other common bird species that may not have been observed at the time of the 2020 PLS. Avian surveys were conducted at ALC in June and September of 2018. Three observed species are Maryland-state listed as rare: sharp-shinned hawk (*Accipiter striatus*), brown creeper (*Certhia americana*), and dark-eyed junco (*Junco hyemalis*).

Mammals

The only mammal observed during the 2020 PLS was a white-tailed deer (*Odocoileus virginianus*). The entire perimeter of the installation is fenced, which has affected the number and diversity of mammals observed, though it is likely that common small mammals could be found on ALC.

Fish and Aquatic Species

MDNR notes that Paint Branch supports brown trout (*Salmo trutta*).

Table 3. Fauna Observed on ALC

Common Name	*Scientific Name*
Amphibians and Reptiles	
Bullfrog	*Rana catesbeiana*
Eastern American Toad	*Anaxyrus americanus americanus*
Eastern Box Turtle	*Terrapene carolina*
Eastern Worm Snake**	*Carphophis amoenus amoenus*
Five-lined Skink**	*Plestiodon fasciatus*
Gray Treefrog**	*Hyla versicolor*
Northern Green Frog**	*Lithobates clamitans melanota*
Northern Two-lined Salamander**	*Eurycea bislineata*

Common Name	*Scientific Name*
Amphibians and Reptiles	
Northern Water Snake**	*Nerodia sipedon sipedon*
Red-backed Salamander**	*Plethodon cinereus*
Spring Peeper**	*Pseudacris crucifer*
Birds	
Acadian Flycatcher	*Empidonax virescens*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Bluejay	*Corvus brachyrhynchos*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Brown Creeper**	*Certhia americana*
Brown Thrasher	*Toxostoma rufum*
Carolina Chickadee**	*Poecil carolinensis*
Carolina Wren**	*Thryothorus ludovicianus*
Common Grackle**	*Quiscalus quiscula*
Cooper's Hawk	*Accipiter cooperii*
Eastern Phoebe**	*Sayornis phoebe*
Eastern Wood Peewee**	*Contopus virens*
European Starling*	*Sturnus vulgaris*
Gray Catbird**	*Dumetella carolinensis*
Great Blue Heron	*Ardea Herodias*
Great-crested Flycatcher**	*Maiarchus crinitus*
House Wren**	*Troglodytes aedon*
Louisiana Waterthrush **	*Seiurus motacilla*
Mourning Dove	*Zenaida macroura*
Northern Cardinal	*Cardinalis cardinalis*
Northern Mockingbird	*Mimus polyglotis*
Northern Parula**	*Parula Americana*
Purple Martin**	*Progne subis*
Red-eyed Vireo**	*Vireo olivaceus*
Red-winged Blackbird	*Agelaius phoeniceus*
Scarlet Tanager**	*Piranga olivacea*
Sharped-shinned Hawk	*Accipiter striatus*
Tufted Titmouse	*Baeolophus bicolor*
White-breasted Nuthatch**	*Sitta carolinensis*
White-eyed Vireo**	*Vireo flavifrons*
White-throated Sparrow	*Zonotrichia albicollis*
Wood Thrush**	*Hylocichla mustelina*
Mammals	
White-tailed Deer	*Odocoileus virginianus*

*Observed during 2011 Planning Level Survey

** Observed only in 2018 Avian and Herpetological Surveys

3.6 Threatened and Endangered Species

USFWS and MDNR were contacted for information regarding threatened and endangered species and significant habitats on or in the vicinity of the installation. The response correspondence received from these agencies is presented in Appendix J of this INRMP.

Federally-Listed Species

The response letter from the USFWS stated that there are no Federally-listed species on ALC. Please see Appendix J of this INRMP for the response letter.

The northern long-eared bat (NLEB) (*Myotis septentrionalis*) was listed as threatened by the USFWS in May 2015. An acoustic bat survey with focus on the NLEB was conducted at ALC during the summers of 2016 and 2019. The NLEB was recorded at one sample site on ALC during the 2016 surveys; however no NLEB were detected during the 2019 surveys.

State-Listed Species

No State-listed threatened, endangered, or special status species were observed on ALC during the 2020 PLS.

Three bird species observed during the 2018 avian surveys are Maryland-state listed as rare: sharp-shinned hawk, brown creeper, and dark-eyed junco. None of these species were observed during the 2020 PLS, though it is possible they still reside on-site.

In 2002, biologists located the PMB, a small Fall-Line Terrace Gravel Bog on ALC. This site is a remnant of a once more widely distributed plant community that has been largely destroyed by drainage or filling for commercial and residential development along the Fall Line in the Maryland and Virginia suburbs of Washington, D.C. Not a true bog, PMB is a groundwater-fed, saturated wetlands. Its nutrient poor, gravelly soils support a distinctive plant community that is considered Highly Globally Rare. Fewer than ten Fall Line Terrace Gravel Bogs are known to exist worldwide, and most (including this one) are highly degraded (NatureServe, 2009).

Five rare and uncommon plant species were documented at the PMB in 2002 and 2007. Table 4 lists plant species documented by MDNR in 2007 to potentially occur within the PMB. None of these species were observed during the PLS conducted in 2020, though it is possible that these species persist on site.

Table 4. State-Listed Rare, Threatened and Endangered Species and Habitats on ALC

Scientific Name	Common Name	Status	Location
Plant Species			
Eriocaulon decangulare	Ten-angled Pipewort	G5, S2, State Rare	Prince George's County
Juncus longii	Long's Rush	G3Q, S1, State Endangered	Montgomery County

Scientific Name	Common Name	Status	Location
Plant Species			
Pogonia ophioglossoides	Snakemouth Orchid (Rose pogonia)	State Watch List	N/A
Rhynchospora cephalantha	Capitate Beakrush	G5, S1, State Endangered	Prince George's County
Solidago uliginosa	Bog Goldenrod	State Watch List	N/A
Habitats			
Bog and Fen Wetland Complex	Fall-Line Terrace Gravel Bog	State Highly Rare	N/A

(Source: MDNR, 2007)

3.7 Invasive Species

Invasive plants that were observed on ALC during the 2020 PLS are noted on Table 1 and include, but are not limited to: Japanese barberry, multiflora rose, musk thistle, Japanese stiltgrass, Japanese honeysuckle, mile-a-minute, common reed and Oriental bittersweet. These species are listed on the Maryland Invasive Species of Concern.

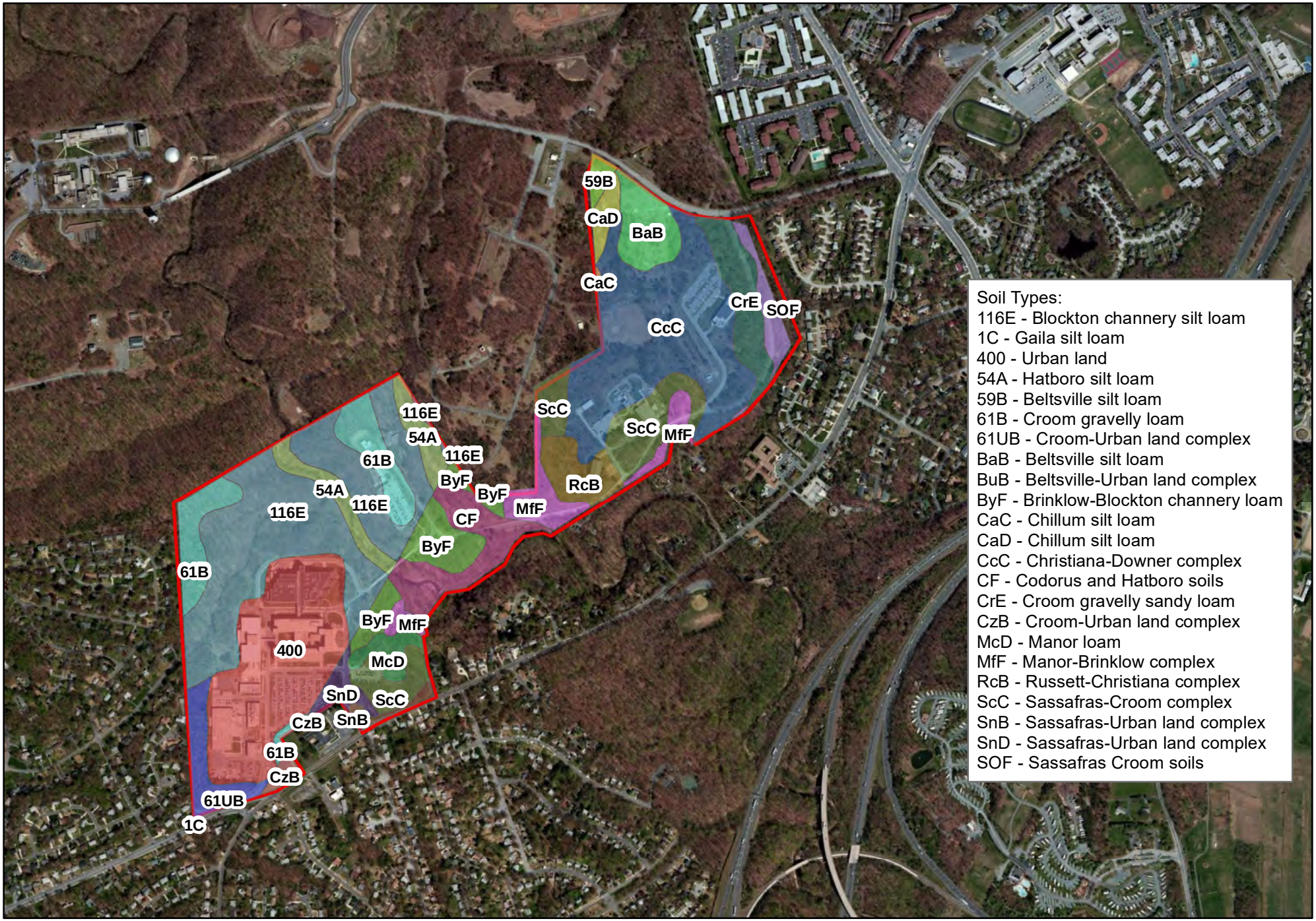
3.8 Soils and Topography

Soils

Twenty-three soil types are present at ALC and are presented in Table 5 and Figure 5. The Blocktown channery silt loam, Christiana-Downer complex, and Sassafras-Croom complex cover a majority of the facility. The Blocktown channery silt loam is found on the slopes along Paint Branch and a tributary, Hillandale Run, on the western portion of the facility and is a well-drained soil. The Christiana-Downer complex is found on the upland, flatter areas on the eastern portion of the site and is a moderately to well-drained soil. The Sassafras-Croom complex is found along 5-10% slopes in a few areas on ALC and are well-drained. Urban land also makes up a good portion of the soils on ALC. Generally, upland areas have deep, very permeable soils, which are moderately to somewhat excessively well-drained, and are subject to severe erosion. Soils on the intermediate elevations and slopes are generally shallower, overlying a dense fragipan, resulting in impeded internal drainage. Soils in the low areas along stream valleys are poorly drained, silty loams.

Table 5. Soil Types on ALC

Soil Key	Soil Type	County	Hydric
116E	Blocktown channery silt loam, 25-40% slopes, very rocky	Montgomery	Yes (5% of map unit)
1C	Gaila silt loam, 8-15% slopes	Montgomery	Yes (5% of map unit)
400	Urban land	Montgomery	



US Army Corps of Engineers
Baltimore District

Figure 5. Adelphi Laboratory Center
Soils
Montgomery and Prince George's Counties, MD

Sources: Aerial Photo, Bing Maps, 2010. Boundary, ALC, 2010. Soils, NRCS Soil Datamart, 2007 & 2009.

1 inch = 1,000 feet

0 375 750 1,500 2,250 3,000 Feet

N

Soil Key	Soil Type	County	Hydric
54A	Hatboro silt loam, 0-3% slopes, frequently flooded	Montgomery	Yes
59B	Beltsville silt loam, 3- 8% slopes	Montgomery	
61B	Croom gravelly loam, 3-8% slopes	Montgomery	
61UB	Croom-Urban land complex, 0-8% slopes	Montgomery	
BaB	Beltsville silt loam, 2- 5% slopes	Prince George's	Yes (5% of map unit)
BuB	Beltsville-Urban land complex, 0-5% slopes	Prince George's	Yes (5% of map unit)
ByF	Brinklow-Blockton channery loams, 25-65% slopes	Prince George's	
CaC	Chillum silt loam, 5-10% slopes	Prince George's	
CaD	Chillum silt loam, 10-15% slopes	Prince George's	
CcC	Christiana-Downer complex, 5-10% slopes	Prince George's	Yes (5% of map unit)
CF	Codorus and Hatboro soils, frequently flooded	Prince George's	Yes (40% of map unit)
CrE	Croom gravelly sandy loam, 15-25% slopes	Prince George's	
CzB	Croom-Urban land complex, 0-5% slopes	Prince George's	
McD	Manor loam, 15-25% slopes	Prince George's	
MfF	Manor-Brinklow complex, 25-65% slopes, very rocky	Prince George's	
RcB	Russett-Christiana complex, 2-5% slopes	Prince George's	Yes (5% of map unit)
ScC	Sassafras-Croom complex, 5-10% slopes	Prince George's	
SnB	Sassafras-Urban land complex, 0-5% slopes	Prince George's	
SnD	Sassafras-Urban land complex, 5-15% slopes	Prince George's	
SOF	Sassafras and Croom soils, 25-40% slopes	Prince George's	Yes (5% of map unit)

Source: USDA Soil Datamart, 2007 and 2009

Topography

The terrain at ALC is hilly, with numerous rock outcroppings, sloping generally towards the Paint Branch valley. Elevations range from 138 to 282 feet above mean sea level (MSL). The highest elevations on ALC are found in the 600 Area, reaching 282 feet above MSL and in the northwest and southwest corners of the Installation ranging from 274 to 278 feet above MSL. The lowest point on ALC is 138 feet above MSL, at Paint Branch where it flows off the installation at the southern boundary. Slopes found within ALC range from 2 to 40 percent and are steepest along the stream valleys. Figure 6 shows the USGS topographic quadrangle and Figure 7 shows the two-foot elevation contours at ALC.

3.9 Management Considerations

While the facility does not contain any federally- or state-listed threatened species, there is forested habitat that is considered Forest Interior Dwelling Bird habitat and should be protected. Paint Branch is classified as Class III – Natural Trout Waters by the State of Maryland and must be protected through a stream protective buffer. A stream protective buffer should be applied to Paint Branch and its tributaries on ALC, at a minimum of 200-feet in width. There are also wetlands scattered throughout ALC. These natural resources must be considered when planning for future construction activities, training and maintenance on the facility to avoid and minimize impacts.

Invasive species and pest management continue to enhance the natural ecosystems and should be continued according to the Invasive Species Management Plan (2017) and the Integrated Pest Management Plan (2020). Invasive species management is recommended within the maintained areas, to include regular mowing and manual removal to limit and prevent the spread of invasive species.



US Army Corps of Engineers
Baltimore District

Figure 6. Adelphi Laboratory Center
USGS Topographic Quadrangle
Montgomery and Prince George's Counties, MD
Sources: USA Topo Maps, 2011. Boundary, ALC, 2010.

1 inch = 1,000 feet

0 375 750 1,500 2,250 3,000 Feet

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US Army Corps of Engineers
Baltimore District

Figure 7. Adelphi Laboratory Center
Two-Foot Contour Map
Montgomery and Prince George's Counties, MD
Sources: Contours, MDNR, 2005. Boundary, ALC, 2010.

1 inch = 750 feet

0 375 750 1,500 2,250 3,000 Feet

N

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PHOTOS

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Photo 1: Southwest stormwater pond



Photo 2: Northern portion of Paint Branch



Photo 3: Cooper's hawk nest with two young fledglings



Photo 4: Juvenile American toad

Natural Resources Management Planning Level Survey

Blossom Point Research Facility
La Plata, Maryland

Submitted to:

Environmental Management Office
Adelphi Laboratory Center
Adelphi, Maryland 20783

Submitted by:

U.S. Army Corps of Engineers, Baltimore District
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March 2021

Natural Resources Management Planning Level Survey

Blossom Point Research Facility
La Plata, Maryland

EXECUTIVE SUMMARY

Blossom Point Research Facility (BPRF) (Latitude 38 -24 -50"N, Longitude 77 5 -50"W) occupies 1,600 acres on Cedar Point Neck in southern Charles County, Maryland. BPRF is approximately 35 miles south of Washington, D.C. The closest town is La Plata, Maryland, which is approximately nine miles northeast of the facility. The Potomac River and Nanjemoy Creek border BPRF on three sides.

BPRF is a satellite installation of Adelphi Laboratory Center (ALC), which is now under the control of the U.S. Army Garrison Aberdeen Proving Ground (APG). Currently, BPRF serves as a test facility for fuses, explosive and pyrotechnic devices, and telemetry systems. These activities include optical (laser) testing and unmanned aerial vehicle (UAV; commonly referred to as drones) testing. In addition, the U.S. Naval Research Laboratory holds a lease permit for 291 acres for the Project Vanguard.

This Natural Resources Management Planning Level Survey (PLS) is intended to identify the biological resources of the installation and to address the potential impacts that installation activities may have on federal and/or state endangered and threatened species or any significant biological resource that may exist on the installation property. As part of the assessment procedure, the PLS included an investigation of not only the presence of threatened and endangered species, but also the evaluation of habitat to support these species.

The assessment methodology included contact with the U.S. Fish and Wildlife Service (USFWS), Maryland Department of Natural Resources (MDNR) and Maryland Natural Heritage Program (NHP) to request information regarding threatened and endangered plants and animal species that may be present on the Installation or adjacent properties.

Background information collection was primarily collected from a previous PLS (2011). Existing Geographic Information System data was used to begin the desktop reconnaissance of BPRF. Maps of the area were developed from several sources including: U.S. Geological Survey (USGS) Quadrangle, U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NCRS) Soil Data Mart, USFWS National Wetland Inventory Map and MDNR Wetlands map. Data from the Maryland Invasive Plant Council (MISC) was obtained to assist in the identification of invasive plant species that may exist on the installation property.

A field survey of BPRF was conducted from July 7-10 and August 5-7, 2020. All areas of the installation were subjected to pedestrian reconnaissance, with the exception of the testing range, and information was recorded to document dominant vegetation species, wetlands and stream areas, and wildlife habitat to facilitate preparation of the natural resource maps. All wildlife seen or heard was noted, as were wildlife signs such as nests, burrows, tracks and scat.

BPRF contains sensitive habitat to include wetlands, streams, shorelines, and forested areas and also consists of Maryland Critical Area. Management personnel of BPRF must consider these features and all natural resources when planning mission activities and any new development. Currently, testing activities are limited to the open field areas and do not impact these resources. Conservation of the Critical Area, wetlands and forested area provides for wildlife habitat, water quality protection, flora habitat, migratory bird habitat and Forest Interior Dwelling (FID) Bird habitat.

Invasive species and pest management continue to enhance the natural ecosystems and should be continued according to the Invasive Species Management Plan (2013) and Integrated Pest Management Plan (2020).

Natural Resources Management Planning Level Survey

Blossom Point Research Facility
La Plata, Maryland

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Natural Resources Management Planning Level Survey

Blossom Point Research Facility
La Plata, Maryland

1.0 INTRODUCTION

Blossom Point Research Facility (BPRF) (Latitude 38 -24 -50"N, Longitude 77 5 -50"W) occupies 1,600 acres on Cedar Point Neck in southern Charles County, Maryland (Figure 1). BPRF is approximately 35 miles south of Washington, D.C. The closest town is La Plata, Maryland, which is approximately nine miles northeast of the facility. The Potomac River and Nanjemoy Creek border BPRF on three sides.

BPRF is a satellite installation of Adelphi Laboratory Center (ALC), which is now under the control of the U.S. Army Garrison Aberdeen Proving Ground (APG). Currently, BPRF serves as a test facility for fuses, explosive and pyrotechnic devices, and telemetry systems. These activities include optical (laser) testing and unmanned aerial vehicle (UAV; commonly referred to as drones) testing. In addition, the U.S. Naval Research Laboratory (NRL) holds a lease permit for 291 acres for the Project Vanguard.

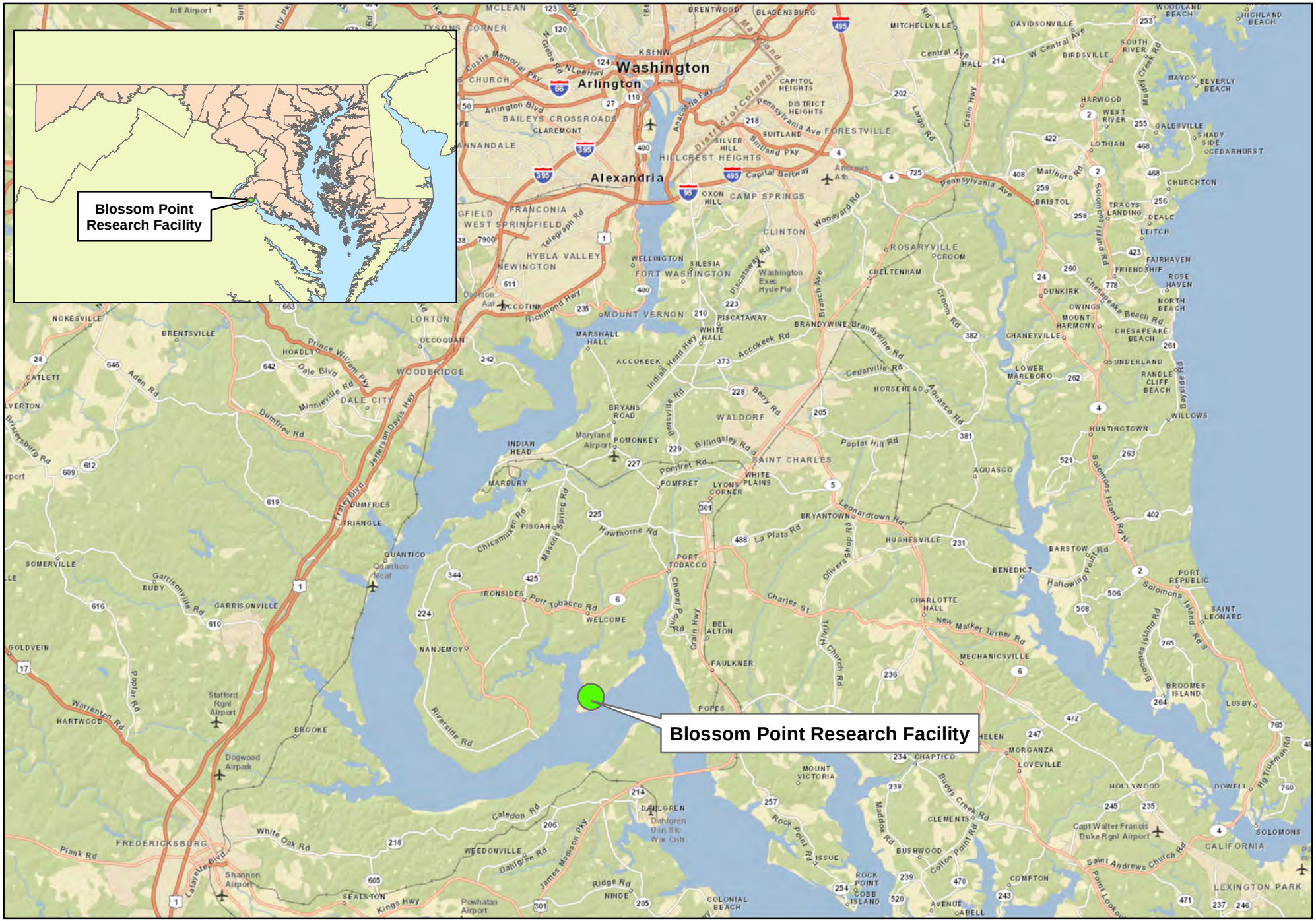
Prior to being acquired by the Army, the site was owned by the Corporation of Roman Catholic Clergymen of Maryland. In November 1942, the National Bureau of Standards (NBS) leased the southern portion of Cedar Point Neck from the Catholic Church for fuse and ordnance testing. This activity was transferred from the NBS to the Department of the Army (DA) in 1953. In June 1980, the DA bought the land from the Catholic Church.

This Natural Resource Management Planning Level Survey (PLS) is intended to identify the biological resources of the installation and to address the potential impacts that installation activities may have on federal and/or state endangered and threatened species or any significant biological resource that may exist on the installation property. As part of the assessment procedure, the PLS included an investigation of not only the presence of threatened and endangered species, but also the evaluation of habitat to support these species.

2.0 METHODS

2.1 Background Information Search

Background information was collected from a variety of sources to prepare this PLS. Contact was initiated with the U.S. Fish and Wildlife Service (USFWS) and Maryland Department of Natural Resources (MDNR) to request information regarding threatened and endangered plant and animal species that may be present on the Installation or adjacent properties. Existing reports, existing Geographic Information System (GIS) data from BPRF and the 2011 PLS were reviewed. Data was collected from several sources including: U.S. Geological Survey (USGS), Topographic Quadrangle, U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NCRS) Soil Data Mart, USFWS National Wetland Inventory (NWI) Map and MDNR wetlands mapping. Data from the Maryland Invasive Species Council (MISC) was obtained to assist in the identification of invasive plant species that may exist on the installation property.



US Army Corps of Engineers
Baltimore District

Figure 1. Blossom Point Research Facility Location
Charles County, MD

2.2 Field Surveys

A field survey of BPRF was conducted from July 7-10 and August 5-7, 2020. All areas of the installation were subjected to pedestrian reconnaissance, with the exception of the testing range, and information was recorded to document dominant vegetation species, wetlands and stream areas, and wildlife habitat to facilitate preparation of the natural resource maps. All wildlife seen or heard was noted, as were wildlife signs such as nests, burrows, tracks and scat.

3.0 RESULTS AND DISCUSSION

3.1 Site Description

BPRF largely consists of wetland and forested areas. Overall, the installation contains 14.7 acres of improved lands, 680.9 acres of semi-improved grounds, and 903.4 acres of unimproved lands. The installation includes 22,172 square feet of building area over the 1,600 acre site. The primary land use category at BPRF is industrial. This classification results from its status as a test facility. Secondary land use categories include administration, explosives storage, NRL forested buffer area, NRL facilities, maintenance, and research, development, and testing areas. BPRF includes a Coastal Zone Management Area and is surrounded by the Potomac River and Nanjemoy Creek on three sides.

3.2 Vegetative Cover Types

There are two main plant communities present on the installation: forested/forest wetland and maintained area. The remaining acreage is emergent wetland or has been developed and includes buildings, paved or graveled parking areas and sidewalks. A habitat map is presented as Figure 2. Table 1 identifies the plants species observed across BPRF during both the 2011 and 2020 PLSs.

Forested/Forested Wetland Area

Much of BPRF is forested, containing both upland forests and wetland forests. The vegetation within the forested areas consist of hardwood, hardwood-pine, and planted pines. Dominant trees in the upland forests include Virginia pine (*Pinus virginiana*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), willow oak (*Quercus phellos*), persimmon (*Diospyros virginiana*), and hickory (*Carya spp*.). Species dominating the shrub layer include saplings such as American holly (*Ilex opaca*), eastern red cedar (*Juniperus virginiana*), mountain laurel (*Kalmia latifolia*), and wax myrtle (*Myrica cerifera*).

BPRF recently implemented forest management techniques to improve the understory of several forests stands. American holly, Virginia Pine, and sweetgum (*Liquidambar styraciflua*) with a diameter breast height (dbh) of five inches or less were removed from parts of stands. Dead and/or leaning trees were also removed from stands. In addition, several key invasive species including Japanese stiltgrass (*Microstegium vimineum*) and tree of heaven (*Ailanthus altissima*) were targeted. The understory of these stands appears to be significantly improved and with maintenance, should give way to higher regeneration rates of native saplings and trees.



Figure 2. Blossom Point Research Facility
Habitat Areas
Charles County, MD

Sources: World Imagery. Boundary, ALC, 2010. Critical Area, ALC, 2010. Wetlands, USACE, 2020.

1:24,000

0 500 1,000 2,000 3,000 4,000 Feet

N

Forested wetlands on BPRF are dominated by red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*), and sweetgum. The shrub layer contains American holly and highbush blueberry (*Vaccinium corymbosum*). Herbaceous species include common cattail (*Typha latifolia*), sedges (*Carex* sp.), soft rush (*Juncus effusus*), and marsh pepper (*Polygonum* sp.). Within wetlands along the Potomac River, common reed and saltmeadow cordgrass (*Spartina patens*) are common. See Table 1 for a complete list of observed species.

Maintained Area

The maintained, landscaped areas are located generally around developed areas, such as buildings, roads and parking lots, and test areas. These areas generally consist of common grasses and ornamental plants. Common herbaceous species observed on BPRF include: Japanese stiltgrass (*Microstegium vimineum*), barnyardgrass (*Echinochloa crus-galli*), common ladyfern (*Athyrium filix-femina*), bluestem broomsedge (*Andropogon virginicus*), Bermuda grass (*Cynodon dactylon*), redtop grass (*Agrostis gigantea*), wingstem (*Verbesina alternifolia*), roundleaf greenbrier (*Smilax rotundifolia*) and summer grape (*Vitis aestivalis*). See Table 1 for a complete list of observed species.

Table 1. Plant Species Observed on BPRF

Common Name	*Scientific Name*
Trees	
American Beech	*Fagus grandifolia*
American Elm	*Ulmus americana*
American Holly	*Ilex opaca*
Black Cherry	*Prunus serotina*
Black Gum	*Nyssa sylvatica*
Black Locust	*Robinia pseudoacacia*
Black Oak	*Quercus velutina*
Black Walnut	*Juglans niagra*
Chestnut Oak	*Quercus prinus*
Devils Walking Stick*	*Aralia spinosa*
Hackberry	*Celtis occidentalis*
Loblolly Pine	*Pinus taeda*
Mockernut Hickory	*Carya tomentosa*
Mountain Laurel	*Kalmia latifolia*
Musclewood	*Carpinus caroliniana*
Northern Red Oak	*Quercus rubra*
Osage Orange	*Naclura pomifera*
Paradise Tree**	*Simarouba glauca*
Persimmon	*Diospyros virginiana*
Pin Oak	*Quercus palustris*
Possumhaw	*Viburnum nudum*
Post Oak	*Quercus stellata*
Princess Tree*	*Paulownia tamentosa*
Red Cedar	*Juniperus virginiana*

Common Name	*Scientific Name*
Trees	
Red Maple	*Acer rubrum*
Southern Red Oak	*Quercus falcata*
Sassafras	*Sassafras albidum*
Shagbark Hickory	*Carya laciniosa*
Sweetgum	*Liquidambar styraciflua*
Sycamore	*Platanus occidentalis*
Tree-of-Heaven**	*Ailanthus altissima*
Tulip Poplar	*Liriodendron tulipifera*
Virginia Pine	*Pinus virginiana*
Wax Myrtle	*Morella cerifera*
White Oak	*Quercus alba*
Willow Oak	*Quercus phellos*
Shrubs	
Allegheny Blackberry	*Rubus allegheniensis*
Autumn Olive*	*Elaeagnus umbellata*
Flowering Dogwood	*Cornus florida*
Highbush Blueberry	*Vaccinium corymbosum*
Japanese Barberry*	*Berberis thunbergii*
Lowbush Blueberry	*Vaccinium angustifolium*
Multiflora Rose*	*Rosa multiflora*
Strawberry Bush	*Euonymus americana*
Wineberry*/**	*Rubus phoenicolasius*
Herbaceous	
Allegheny Monkeyflower	*Mimulus ringens*
American Water Horehound	*Lycopus americanus*
American Water Plaintain	*Alisma subcordatum*
Arrow Arum	*Peltandra virginica*
Barnyard Grass	*Echinochloa crus-galli*
Bedstraw	*Galium mollugo*
Bermuda Grass	*Cynodon dactylon*
Blunt Spike Rush	*Eleocharis ovata obtusa*
Broadleaf Cattail	*Typha latifolia*
Broom Sedge	*Carex scoparia*
Broomsedge	*Andropogon virginicus*
Bush Clover	*Lespedeza virginica*
Bushy Bluestem	*Andropogon glomeratus*
Canada Goldenrod	*Solidago canadensis*
Canada Thistle*	*Cirsium arvense*
Christmas Fern	*Polystichum acrostichoides*
Cinnamon Fern	*Osmunda cinnamomea*
Common Reed*	*Phragmites australis*
Deer-tongue Grass	*Dichanthelium clandestinum*
Duckweed	*Lemna minor*

Common Name	*Scientific Name*
Herbaceous	
Eastern Gamagrass	*Tripsacum dactyloides*
False Nettle	*Boehmeria cylindrica*
Fox Sedge	*Carex crus-corvi*
Frank's Sedge	*Carex frankii*
Grass Rush	*Juncus marginatus*
Ground Pine	*Diphasiastrum digitatum*
Gypsum Weed	*Datura stramonium*
Hog Peanut	*Amphicarpaea bracteata*
Hop Sedge	*Carex lupulina*
Horsenettle	*Solanum carolinense*
Humped Bladderwort	*Utricularia gibba*
Japanese Honeysuckle*	*Lonicera japonica*
Japanese Stiltgrass*	*Microstegium vimineum*
Lady Fern	*Anthyrium filix-femina*
Lizard's Tail	*Saururus cernuus*
Marsh St. John's	*Hypericum virginicum*
Maryland Meadowbeauty	*Rhexia mariana*
Mint species	*Mentha* sp.
Narrow Leaf Cattail	*Typha angustifolia*
Partridgeberry	*Mitchella repens*
Poison Ivy	*Toxicodendron radicans*
Queen Anne's Lace	*Daucus carota*
Redtop Grass	*Agrostis gigantea*
Rice Cutgrass	*Leersia oryzoides*
Rough Barnyardgrass	*Echinochloa muricata*
Royal Fern	*Osmunda regalis*
Saltmeadow Cordgrass	*Spartina patens*
Sensitive Fern	*Onoclea sensibilis*
Shining Panic Grass	*Dichanthelium dichotomum*
Slender Crown Grass	*Paspalum setaceum*
Slender Lady Tresses	*Spiranthes lacera*
Slender Woodoats	*Chasmanthium laxum*
Soft Rush	*Juncus effusus*
Spikerush	*Eleocharis palustris*
Strawcolored Flatsedge	*Cyperus strigosus*
Swamp Rose Mallow	*Hibiscus moscheutos*
Threeway Sedge	*Dulichium arundinaceum*
Tickseed Sunflower	*Bidens polylepis*
Violet species	*Viola* sp.
Virginia Chain Fern	*Woodwardia virginica*
Water Hemlock	*Cicuta douglasii*
Water Lily	*Nymphaea odorata*
Wingstem	*Verbesina alternifolia*

Common Name	*Scientific Name*
Herbaceous	
Wool Grass	*Scirpus cyperinus*
Vines	
Roundleaf Greenbrier	*Smilax rotundifolia*
Summer Grape	*Vitis aestivalis*
Trumpet Creeper	*Campsis radicans*
Virginia Creeper	*Parthenocissus quinquefolia*

*Invasive species
**New species observed only in 2020

3.3 Surface Waters and Wetlands

BPRF is located on the north bank of the Potomac River and the east side of the mouth of Nanjemoy Creek. The Potomac River bounds the south and eastern sides of BPRF while Nanjemoy Creek borders its western side. Kings Creek and Port Tobacco River are located northwest and northeast of the installation, respectively.

The interior of BPRF is dissected by several short streams and drainage-ways, most of which are subject to tidal influences, that drain the upstream farmlands and BPRF. Associated with the streams are small pockets of open water. The largest of these covers several acres near the eastern shore of the facility, Wetland BPRF-1. The pools tend to be shallow and slightly brackish.

There are 25 wetlands located on BPRF, amounting to approximately 263 acres (Figure 3). Most of these wetlands are estuarine emergent wetlands, palustrine forested, estuarine scrub-shrub and palustrine scrub-shrub wetlands. Dominant wetland vegetation includes common cattail, sedges (*Carex* spp. and *Cyperus* spp.), and common reed in marshes, while highbush blueberry, red maple, American holly and sweetgum are dominant in forested wetlands.

3.4 Floodplain

The 100-year flood elevation for BPRF is nine feet above mean sea level (MSL). Substantial portions of the undeveloped areas on the installation lie below the 100-year elevation (Figure 4). Overall, the 100-year floodplain encompasses approximately 388 acres of BPRF. The high tide elevation is one foot MSL.

3.5 Critical Area

Maryland has established the Critical Area Act where a Critical Area is defined as “all land within 1,000 feet of the mean high water line of tidal waters, or the landward edge of tidal wetlands and all waters of and lands under the Chesapeake Bay and Atlantic Coastal Bays and tributaries.” The Critical Area Act establishes the Chesapeake Bay Critical Area and Atlantic Coastal Bays Critical Area Protection Programs and the Critical Area Commission to enable the State and local governments to jointly address the impacts of land development on habitat and aquatic resources.

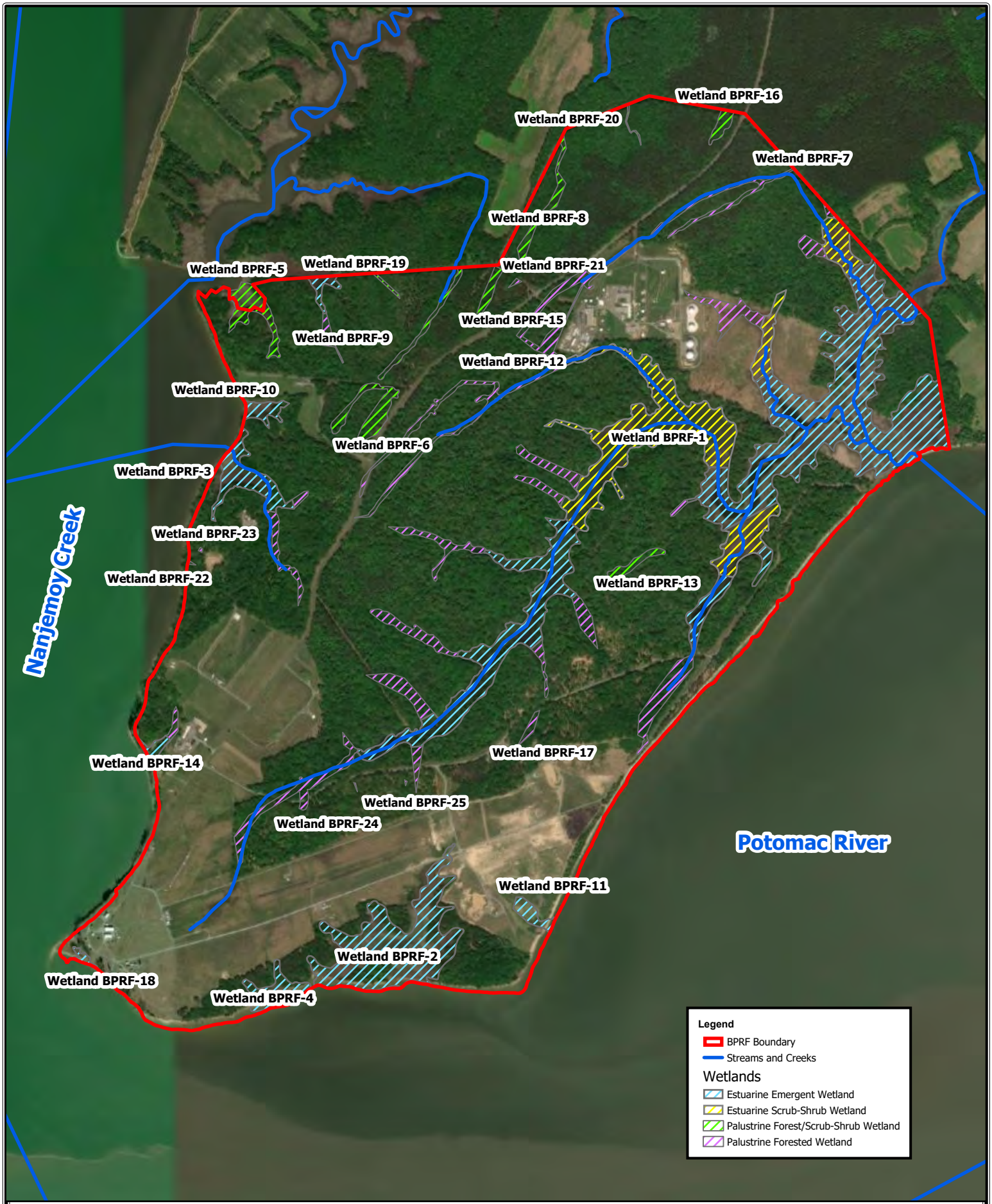


Figure 3. Blossom Point Research Facility
Wetlands and Streams
Charles County, MD

Sources: World Imagery. Boundary, ALC, 2010. Critical Area, ALC, 2010. Wetlands, USACE, 2020.



Figure 4. Blossom Point Research Facility
Floodplains
Charles County, MD

Sources: World Imagery. Boundary, ALC, 2010. Critical Area, ALC, 2010. Wetlands, USACE, 2020.

The goals of the Critical Area Protection Programs are to:

- Minimize adverse impacts on water quality that result from pollutants that are discharged from structures or conveyances or that have run off from surrounding lands;
- Conserve fish, wildlife, and plant habitat in the Critical Area; and
- Establish land use policies for development in the Critical Area that accommodate growth and also address the fact that, even if pollution is controlled, the number, movement, and activities of persons in the Critical Area can create adverse environmental impacts.

The Critical Area Commission devised a set of criteria to minimize the adverse effects of human activities on water quality and natural habitats and foster consistent, uniform and more sensitive development activity within the Critical Area. Much of BPRF is within the Critical Area. Several wetlands and streams, forest habitat and shorelines are within the Critical Area (Figure 5). The western most critical area is highly eroded along the shoreline.

Table 2. Wetlands on BPRF

Wetland Name	Previous Wetland Name	Wetland Class	Acres
Wetland BPRF-1	Adel 23	Estuarine Emergent Wetland	188.065
Wetland BPRF-2	Adel 3	Estuarine Emergent Wetland	30.424
Wetland BPRF-3	Adel 18	Estuarine Emergent Wetland	9.291
Wetland BPRF-4	Adel 4	Estuarine Emergent Wetland	4.838
Wetland BPRF-5	Adel 1	Palustrine Forest/Scrub-Shrub Wetland	4.729
Wetland BPRF-6	Adel 16	Palustrine Forest/Scrub-Shrub Wetland	4.433
Wetland BPRF-7	Adel 10	Palustrine Forest/Scrub-Shrub Wetland	2.693
Wetland BPRF-8	Wet 45	Palustrine Forest/Scrub-Shrub Wetland	2.573
Wetland BPRF-9	Adel 20	Estuarine Emergent Wetland	2.385
Wetland BPRF-10	Adel 19	Estuarine Emergent Wetland	2.104
Wetland BPRF-11	Adel 2	Estuarine Emergent Wetland	1.965
Wetland BPRF-12	Adel 15	Palustrine Forest/Scrub-Shrub Wetland	1.813
Wetland BPRF-13	Adel 8	Palustrine Forest/Scrub-Shrub Wetland	1.687
Wetland BPRF-14	Adel 5	Estuarine Emergent Wetland	1.661
Wetland BPRF-15	Adel 12	Palustrine Forest/Scrub-Shrub Wetland	1.405
Wetland BPRF-16	Adel 9	Palustrine Forest/Scrub-Shrub Wetland	1.298
Wetland BPRF-17	Wet 12	Palustrine Forested Wetland	0.677
Wetland BPRF-18	Adel 21	Estuarine Emergent Wetland	0.581
Wetland BPRF-19	Wet 48	Palustrine Forest/Scrub-Shrub Wetland	0.292
Wetland BPRF-20	Wet 44	Palustrine Forest/Scrub-Shrub Wetland	0.200
Wetland BPRF-21	Wet 47	Palustrine Forested Wetland	0.129
Wetland BPRF-22	Wet 63	Palustrine Forested Wetland	0.056
Wetland BPRF-23	Wet 62	Palustrine Forested Wetland	0.041

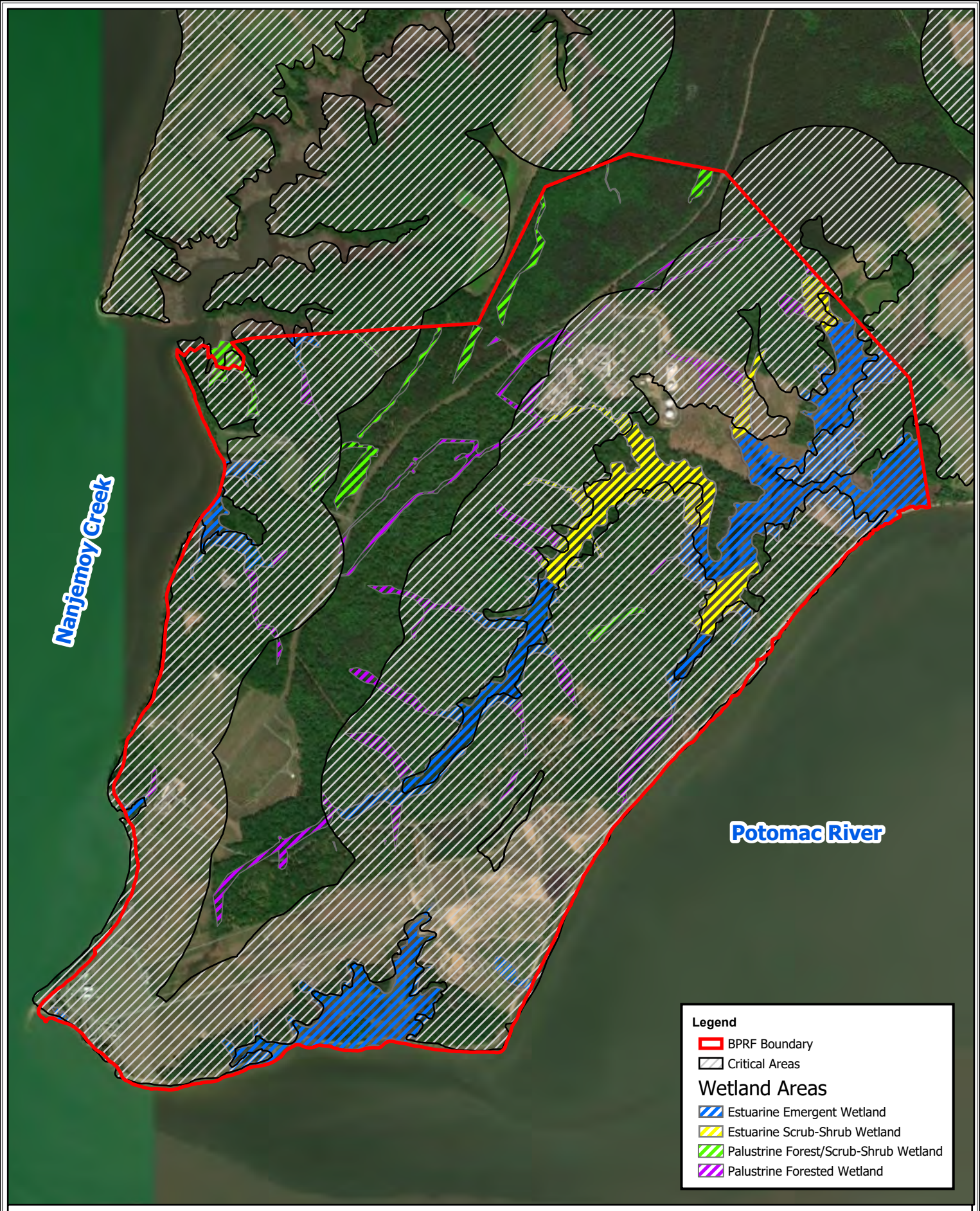


Figure 5. Blossom Point Research Facility
Critical Area
Charles County, MD

Sources: World Imagery. Boundary, ALC, 2010. Critical Area, ALC, 2010. Wetlands, USACE, 2020.

Wetland Name	Previous Wetland Name	Wetland Class	Acres
Wetland BPRF-24	Wet 10	Palustrine Forested Wetland	0.026
Wetland BPRF-25	Wet 11	Palustrine Forested Wetland	0.025
		TOTAL WETLAND ACREAGE	**263.390**

3.6 Wildlife

The wildlife species observed on the installation and adjacent area are representative and typical for forested, wetland and aquatic, and maintained lawn areas. The presence of the chain-link fence around the perimeter of the property and the water surrounding the facility on three sides tends to restrict entry by larger animals. The following sections of the report present the common species and assess the potential for federally- and state-listed plant and animal species. Table 3 identifies the wildlife species observed across BPRF during the 2011 and 2020 PLSs along with the 2018 avian and herpetological surveys.

Amphibians and Reptiles

A box turtle (*Terrapene ornate*), green frog (*Lithobates clamitans*), common eastern toad (*Bufo americanus*), Fowler's toad (*Bufo [Anaxyrus] fowleriand*), and worm snake (*Carphophis amoenus*) were observed during the 2020 PLS. Box turtles are common on the facility. A spotted turtle (*Clemmys guttata*) was observed on BPRF during the 2011 and 2020 PLSs (Table 3). The many wetlands, streams and surrounding water bodies on BPRF provide adequate habitat for these amphibian and reptile species. Beaches on-site may provide terrapin and horseshoe crab spawning habitat, according to MDNR.

Twenty-five species of amphibians and reptiles were observed on BPRF during the 2018 survey, including three species of salamander, one species of newt, eight species of frogs and toads, four turtle species, six snake species and three species of lizard (Table 3).

Birds

The bird species that were observed during the 2020 PLS included bald eagle (*Haliaeetus leucocephalus*), downy woodpecker (*Picoides pubescens*), great blue heron (*Ardea herodias*), osprey (*Pandion haliaetus*), and black vultures (*Coragyps atratus*). All of the species observed are typical for this area. The forested areas, wetlands and streams provide habitat for FID Birds and other common bird species that may not have been observed at the time of the 2020 PLS. The waterfront adjacent to BPRF is a waterfowl concentration and staging area, according to MDNR.

A total of 94 species were observed at BPRF during the 2018 Avian Survey (Table 3).

Mammals

The only mammal observed during the 2020 PLS was a red fox (*Vulpes vulpes*). It is likely that common small mammals could be found on BPRF, though access may be restricted due to the fenceline and the site is mostly surrounded by water.

Fish and Aquatic Species

MDNR noted that the Potomac River in this area is pristine habitat for largemouth bass (*Micropterus salmoides*) as well as spawning habitat for striped bass (*Morone saxatilis*) and anadromous fish species. The Atlantic sturgeon (*Acipenser oxyrinchus*), a potentially federally-protected species, may also use this area for spawning. Natural oyster bars are also found near BPRF.

Table 3. Fauna Observed on BPRF

Common Name	*Scientific Name*
Amphibians and Reptiles	
Black Racer	*Coluber constrictor*
Blackrat Snake	*Pantherophis obsoletus*
Bluetail Skink	*Cryptoblepharus egeriae*
Box Turtle	*Terrapene ornata*
Broad-headed Skink**	*Plestiodon laticeps*
Bull Frog**	*Lithobates catesbeiana*
Common Eastern Toad	*Bufo americanus*
Eastern American Toad**	*Anaxyrus americanus*
Eastern Black Rat Snake	*Pantherophis alleghaniensis*
Eastern Box Turtle	*Hemidactylium scutatum*
Eastern Garter Snake**	*Thamnophis sirtalis*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Eastern Mud Turtle**	*Kinosternon subrubrum*
Five-lined Skink**	*Plestiodon fasciatus*
Fowlers Toad	*Bufo [Anaxyrus] fowleriand*
Gray Treefrog**	*Hyla versicolor*
Green Frog	*Lithobates clamitans*
Little Brown Skink**	*Scincella lateralis*
Marbled Salamander**	*Ambystoma opacum*
Northern Cricket Frog**	*Acris crepitans*
Northern Water Snake**	*Nerodia sipedon*
Painted Turtle**	*Chrysemys picta*
Red-spotted Newt (Red Eft)**	*Notophthalmus viridescen*
Southern Leopard Frog**	*Lithobates sphenocephalus*
Spotted Salamander**	*Ambystoma maculatum*
Spotted Turtle	*Clemmys guttata*
Spring Peeper**	*Pseudacris crucifer*
Worm Snake	*Carphophis amoenus*
Birds	
American Goldfinch**	*Spinus tristis*
American Redstar	*Setophaga ruticilla*
Bald Eagle	*Haliaeetus leucocephalus*
Baltimore Oriole**	*Icterus galbula*

Common Name	*Scientific Name*
Birds	
Black-and-white Warbler	*Mniotilta varia*
Blackpoll Warbler**	*Setophaga striata*
Black-throated green Warbler**	*Setophaga virens*
Brown Thrasher	*Toxostoma rufum*
Brown-headed Cowbird	*Molothrus ater*
Bufflehead**	*Bucephala albeola*
Canada Goose**	*Branta canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Chipping Sparrow	*Spizella passerina*
Common Grackle	*Quiscalus quiscula*
Common Yellowthroat**	*Geothlypis trichas*
Dark-eyed Junco	*Junco hyemalis*
Double-crested Cormorant**	*Phalacrocorax auritus*
Eastern Meadowlark**	*Sturnella magna*
Eastern Towhee	*Pipilo erythrophthalmus*
European Starling	*Sturnus vulgaris*
Golden-crowned Kinglet**	*Regulus satrapa*
Golden-winged Warbler**	*Vermivora chrysoptera*
Grasshopper Sparrow**	*Ammodramus savannarum*
Gray Catbird	*Dumetella carolinensis*
Great Blue Heron**	*Ardea herodias*
Indigo Bunting**	*Passerina cyanea*
Lesser Scaup**	*Aythya affinis*
Long-tailed Duck**	*Clangula hyemalis*
Mallard**	*Aix sponsa*
Northern Cardinal	*Cardinalis cardinalis*
Northern Mockingbird	*Mimus polyglotis*
Northern Parula**	*Parula Americana*
Orchard Oriole**	*Icterus spurius*
Ovenbird**	*Seiurus aurocapillus*
Pine Warbler**	*Setophaga pinus*
Prothonotary Warbler**	*Protonotaria citrea*
Red-breasted Nuthatch	*Sitta canadensis*
Red-winged Blackbird	*Agelaius phoenicius*
Ruby-crowned Kinglet**	*Regulus calendula*
Ruddy Duck**	*Oxyura jamaicensis*
Scarlet Tanager	*Piranga olivacea*
Song Sparrow	*Melospiza melodia*
Summer Tanager	*Piranga rubra*
Swainson's Thrush	*Catharus ustulatus*
White-throated Sparrow**	*Zonotrichia albicollis*
Wood Duck	*Aix sponsa*
Yellow Warbler**	*Setophaga petechia*

Common Name	*Scientific Name*
Birds	
Yellow-rumped Warbler**	*Setophaga coronata*
Yellow-throated Warbler**	*Setophaga dominica*
Mammals	
Red Fox	*Vulpes vulpes*
White-tailed Deer*	*Odocoileus virgianus*

*Observed during 2011 Planning Level Survey
**Observed only in 2018 Avian and Herpetological Surveys

3.7 Threatened and Endangered Species

USFWS and MDNR were contacted for information regarding threatened and endangered species and significant habitats on or in the vicinity of the installation. The response correspondence received from these agencies is presented in Appendix J of this INRMP.

Federally-Listed Species

The response letter from the USFWS stated that there are no Federally-listed species on BPRF. Please see Appendix C of this INRMP for the response letter.

The USFWS did note that there is habitat for the Bald Eagle at BPRF, which is protected under the Bald and Golden Eagle Protection Act, Lacey Act and the Migratory Bird Treaty Act. As a result, starting on August 8, 2007, if your project may cause "disturbance" to the bald eagle, please consult the "National Bald Eagle Management Guidelines" dated May 2007. The locations of Bald Eagle nest areas are depicted on Figure 6.

A herptofaunal survey in 2011 targeted the State-endangered rainbow snake. The rainbow snake is a highly aquatic species, preferring swamps, marshes, and slow-moving streams and can tolerate brackish water. The rainbow snake can also be found on dry land, burrowing in moist soil, muck or a sandy substrate. While habitat exists on BPRF for this species, none were observed during the field survey.

An acoustic bat survey with focus on the NLEB was conducted at BPRF during the summers of 2016 and 2019. The NLEB was recorded at one sample site on BPRF during the 2016 surveys; however no NLEB were detected during the 2019 surveys.

This area of the Potomac River may provide habitat for spawning for the Atlantic sturgeon, a potentially federally protected species. Activities on BPRF are to avoid impact to the in-river habitat; any disturbance to in-river habitat should be both seasonal and minimized. Generally, no instream work likely to result in suspended sediments within the water column is allowed in this area of the Potomac River between 15 February and 15 June, inclusive, of any year.

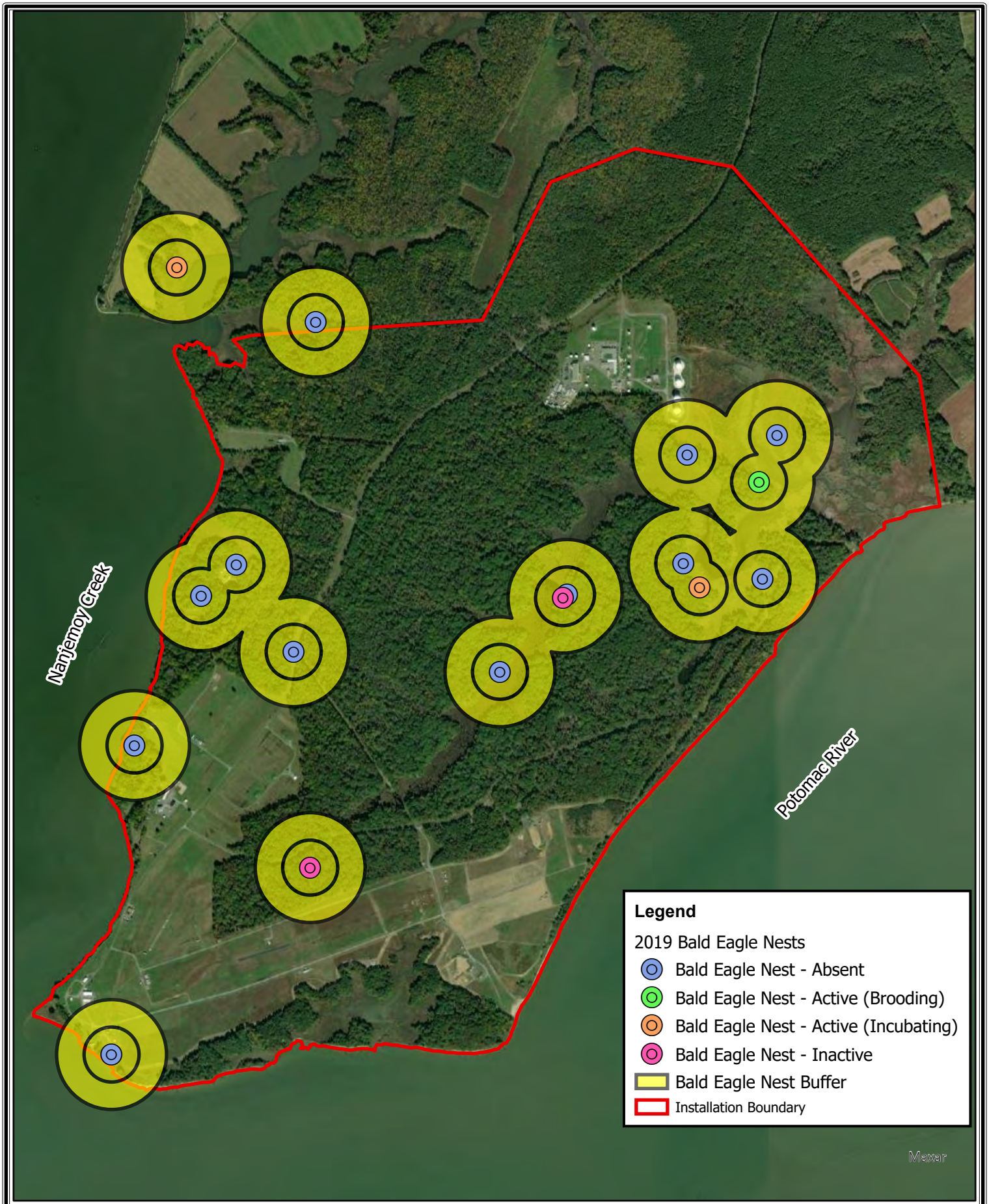


Figure 6. Bald Eagle Nests on Blossom Point Research Facility Charles County, MD

Sources: Aerial Photo, ESRI World Energy, 2020. Boundary, ALC, 2010. Nests, ALC, 2013.

Habitat for the small whorled pogonia (*Isotria medeloides*) exists on BPRF, though this plant is believed to be extirpated from the State of Maryland. The small whorled pogonia habitat is deciduous or deciduous-coniferous forest with light to moderate leaf litter, an open herb layer (occasionally dense ferns), moderate to light shrub layer, and relatively open canopy. This plant has not been observed on BPRF.

State-Listed Species

MDNR listed no federally- or state- listed species on BPRF in their response letter dated September 15, 2020 (Appendix J). Several habitats of concern were noted, however, to include waterfowl habitat and FID Bird habitat. Habitat for the rainbow snake is present on BPRF. Surveys for the presence of the rainbow snake took place during a herptofaunal survey in 2011; however, no rainbow snakes were observed.

Eight species of birds were recorded at BPRF during the 2018 avian surveys, which are state-listed as rare (S2), state watchlist (S3), or state watchlist for breeding (S3B) and/or historically breeding in the state (SHB). This included the bald eagle (*Haliaeetus leucocephalus*) (S3), least flycatcher (*Empidonax minimus*) (S3), brown creeper (S3), red-breasted nuthatch (*Sitta canadensis*) (S3B), golden-crowned kinglet (*Regulus satrapa*) (S3B), Swainson's thrush (*Catharus ustulatus*) (SHB), golden-winged warbler (*Vermivora chrysoptera*) (S2), and dark-eyed junco (S3B).

3.8 Invasive Species

Invasive plants that were observed on the installation during the 2020 PLS include, but are not limited to, multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), autumn olive (*Elaeagnus umbellata*), Japanese barberry (*Berberis thunbergii*), Canada thistle (*Cirsium arvense*), Japanese stiltgrass, and common reed (*Phragmites australis*).

3.9 Soils and Topography

Soils

Fifteen soil series are present at BPRF (Figure 7, Table 4). The soils are generally poorly to moderately well drained and range in texture from fine sand to silty loams and clay to coarse sands and gravels. The majority of the soils found on BPRF are Annemessex silt loam (0-2% slopes), Lenni and Quindocqua soils (0-2% slopes), Liverpool-Piccowaxen complex (5-15% slopes), and Nanticoke and Mannington soils. All of these more dominant soil types are considered hydric soils except for the Liverpool-Piccowaxen complex, which is moderately well drained.

Table 4. Soil Types on BPRF

Soil Key	Soil Type	Hydric
AsA	Annemessex silt loam, 0-2% slopes	Yes (15% of map unit)
AsB	Annemessex silt loam, 2-5% slopes	Yes (10% of map unit)

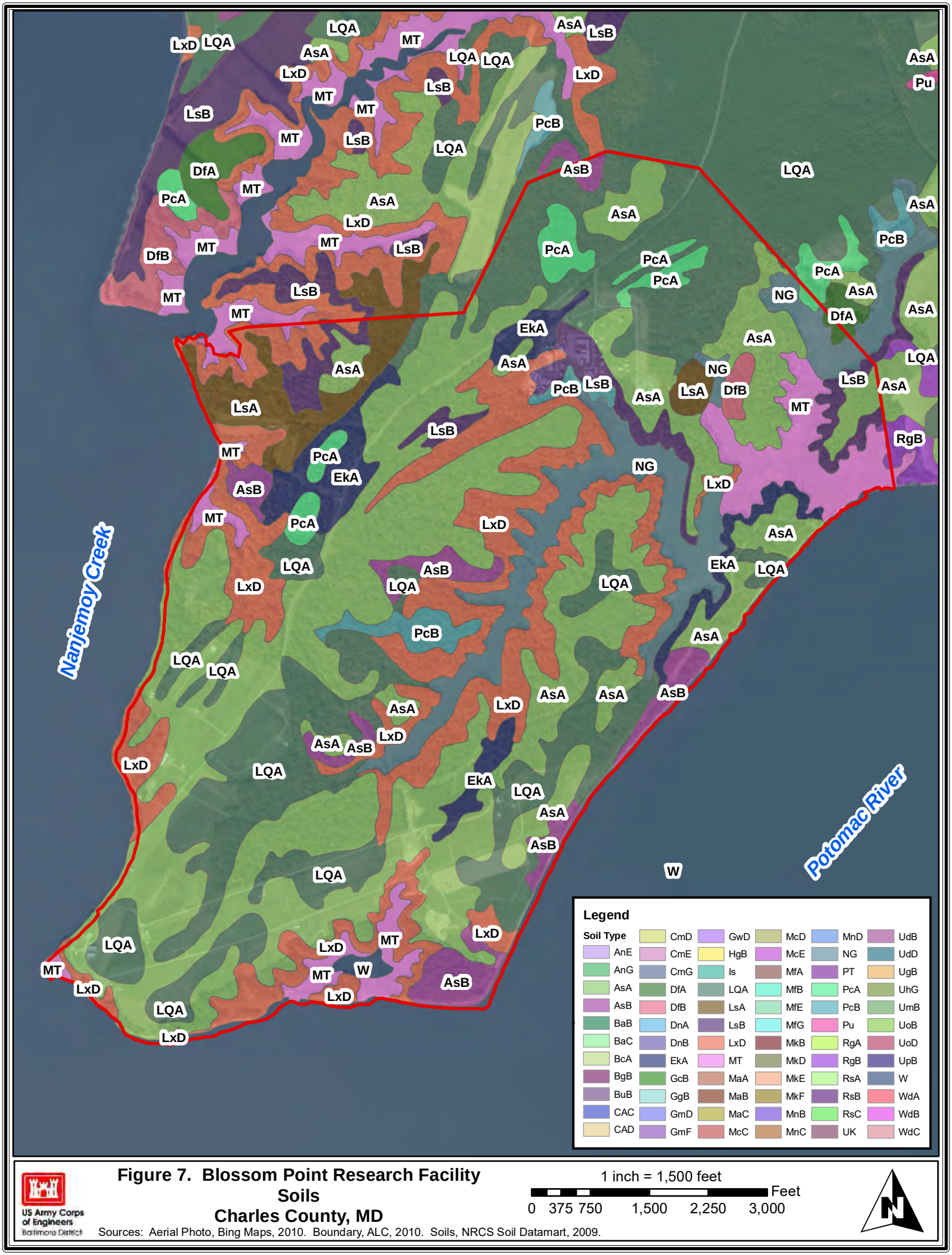


Figure 7. Blossom Point Research Facility
Soils
Charles County, MD

US Army Corps of Engineers
Baltimore District

1 inch = 1,500 feet

0 375 750 1,500 2,250 3,000 Feet

Sources: Aerial Photo, Bing Maps, 2010. Boundary, ALC, 2010. Soils, NRCS Soil Datamart, 2009.

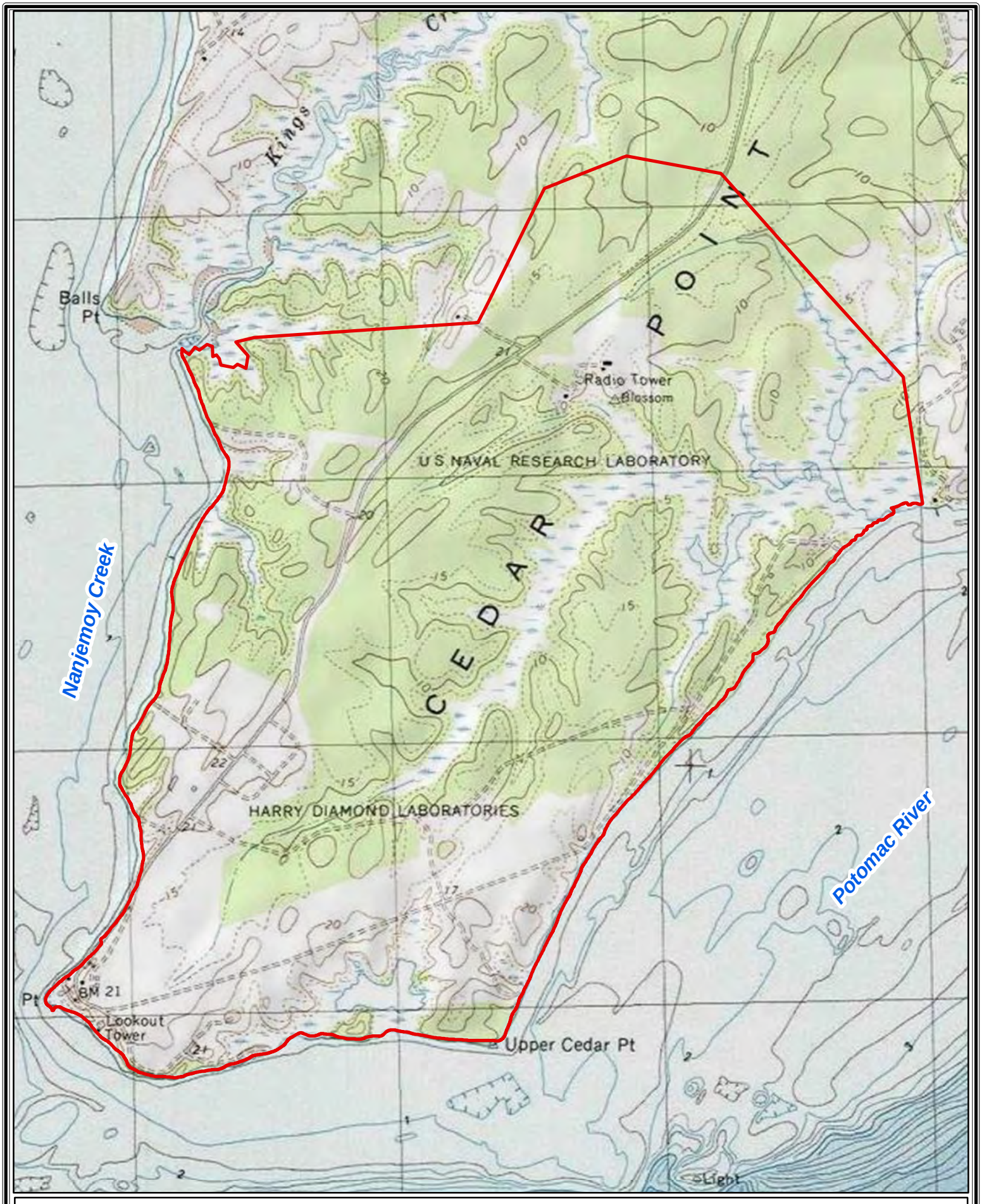
Soil Key	Soil Type	Hydric
DfA	Dodon fine sandy loam, 0-2% slopes	
DfB	Dodon fine sandy loam, 2-5% slopes	
EkA	Elkton silt loam, 0-2% slopes, frequently ponded	Yes
LQA	Lenni and Quindocqua soils, 0-2% slopes	Yes
LsA	Liverpool silt loam, 0-2% slopes	Yes (5% of map unit)
LsB	Liverpool silt loam, 2-5% slopes	Yes (5% of map unit)
LxD	Liverpool-Piccowaxen complex, 5-15% slopes	
MT	Mispillion and Transquaking soils, tidally flooded	Yes
NG	Nanticoke and Mannington soils, frequently flooded	Yes
PcA	Piccowaxen loam, 0-2% slopes	Yes (10% of map unit)
PcB	Piccowaxen loam, 2-5% slopes	Yes (10% of map unit)
RgB	Reybold loam, gravelly subsoil, 2-5% slopes	
W	Water	Yes

Topography

BPRF slopes gently towards the Potomac River and Nanjemoy Creek. The highest elevation is 25 feet above MSL in the north central part of the installation. Lowest elevations, approximately MSL, occur along the Potomac River and Nanjemoy Creek. In general, the installation is relatively flat with slopes of 2 to 5 percent. The shoreline, however, contains steep bluffs with an average elevation of 20 feet above MSL. The shoreline, in general, experiences erosive wave action from the Potomac River and is eroding at an average of 1 to 3 feet per year. The western reach of BPRF is eroding at a quicker pace than others due to wave action. Figure 8 shows the USGS topographic quadrangle and Figure 9 shows the five-foot elevation contours at BPRF.

3.10 Management Considerations

BPRF contains sensitive habitat to include wetlands, streams, shorelines, and forested areas and also consists of Maryland Critical Area. Management personnel of BPRF must consider these



US Army Corps of Engineers
Baltimore District

Figure 8. Blossom Point Research Facility
USGS Topographic Quadrangle
Charles County, MD

Sources: USA Topo Maps, 2011. Boundary, ALC, 2010.

1 inch = 1,500 feet

0 375 750 1,500 2,250 3,000 Feet

N

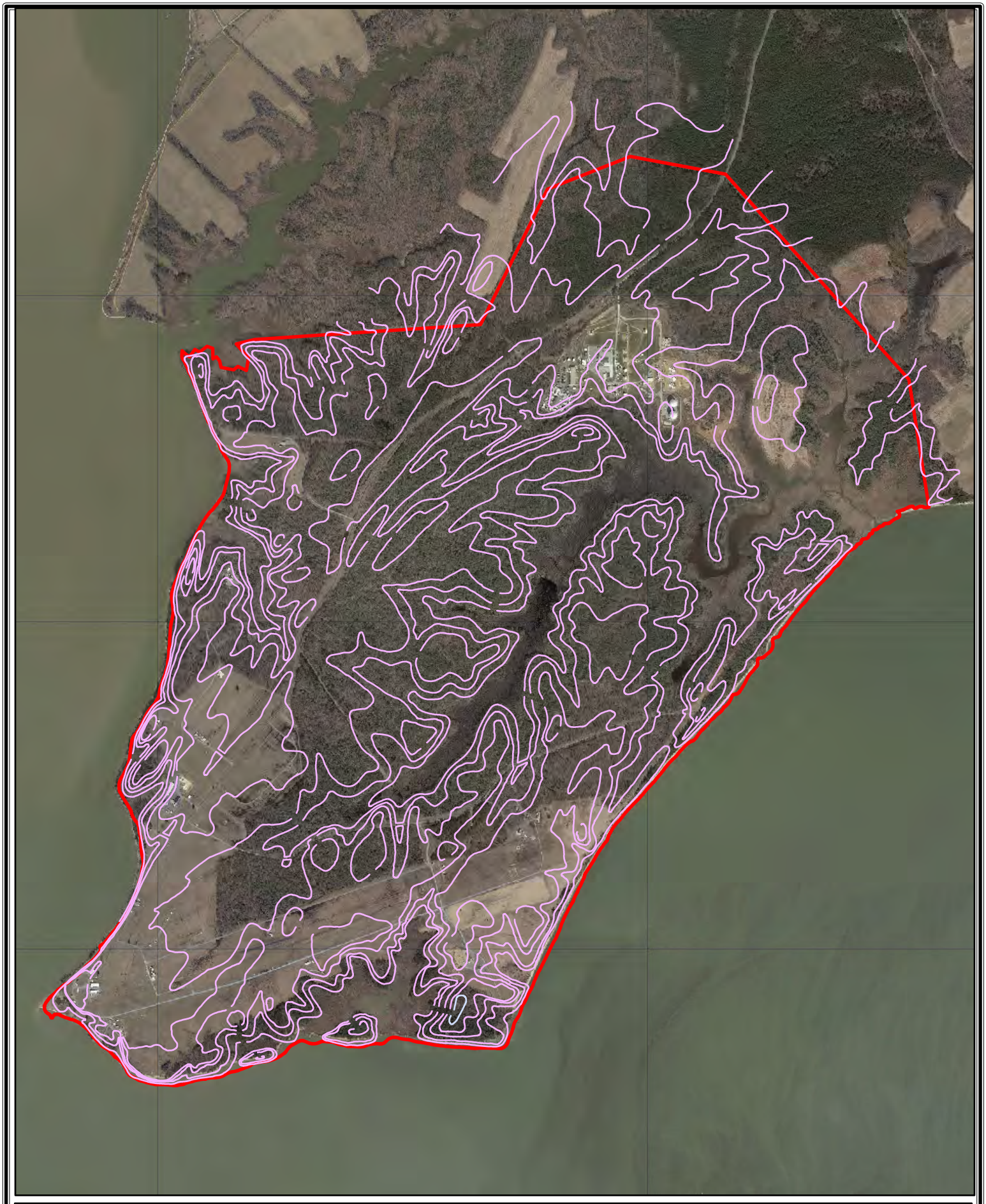


Figure 9. Blossom Point Research Facility
Five-Foot Elevation Contours
Charles County, MD

1:18,000

0 375 750 1,500 2,250 3,000 Feet

N

features and all natural resources when planning mission activities and any new development. Currently, testing activities are limited to the open field areas and do not impact these resources. Conservation of the Critical Area, wetlands and forested area provides for wildlife habitat, water quality protection, flora habitat, migratory bird habitat and FID Bird habitat.

Invasive species and pest management continue to enhance the natural ecosystems and should be continued according to the Invasive Species Management Plan (2013) and the Integrated Pest Management Plan (2020).

The shorelines of BPRF are eroding at a rate of approximately 1- to 3-feet per year, and faster in areas such as the western reach. The western reach of BPRF is eroding at a quicker pace than others due to wave action and is being addressed in an ongoing erosion surveys. BPRF has determined that if shoreline management strategies are not implemented, then the longevity of BPRF at its current location will be jeopardized, and land and critical infrastructure may be lost. The Shoreline Management Plan (2016) should be implemented by constructing stone shoreline protection structures such as sills, brills, spurs, and revetments, along with associated sand nourishment and marsh vegetation planting along approximately 3.5 miles of shoreline.

4.0 REFERENCES

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PHOTOS

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Photo 1: Oak forest understory



Photo 2: Pine forest understory



Photo 3: Tidal marsh with water lilies



Photo 4: Box turtle



Photo 5: Green tree frog

APPENDIX G:
Rare, Threatened and Endangered Surveys
(Bat and RTE Species)

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Results of Bat Survey of Adelphi Laboratory Center, Maryland

Prepared for:

Adelphi Laboratory Center

Prepared by:

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March 2020

Introduction

Bat conservation and management has become a major concern on state, federal, and private lands throughout the United States. Bats represent an important component of many ecosystems and contribute significantly to an area's biodiversity. A greater proportion of bats are considered rare, sensitive, threatened or endangered than for any other group of mammals in North America within some regulatory or assessment frameworks. Reasons for these listings range from loss of roosting and/or foraging habitat, pesticides, persecution, and disturbance of hibernacula (Racey and Entwistle 2003).

Recently, wind energy development (Johnson et al. 2003, Fiedler 2004, Arnett et al. 2008) and White-nose Syndrome (WNS) have emerged as additional threats (USGS 2008). WNS is an emerging disease that is responsible for the death of over 6 million hibernating bats. These declines have resulted in the listing of the once common northern long-eared bat (*Myotis septentrionalis*) as federally threatened in 2015. Mortality rates observed at wind energy production facilities are variable, but at one facility in West Virginia, > 40 bats per turbine per year were killed, including the Lasurine or "tree" species not believed to be impacted by WNS (Arnett et al. 2008). As bat populations continue to experience stress from these sources, understanding bat distributions becomes more important.

Bats in the eastern United States use echolocation to orient to their surroundings and to locate prey. Ultrasonic detectors are now widely available and allows researchers to detect echolocation calls to assist in studies of bat ecology. Research has shown the presence of species-specific echolocation calls exists for many species (Krusic and Neefus 1996, Britzke et al. 2011). Ultrasonic detectors have many advantages over mist netting, including detection of more species at a site than mist nets (Murray et al. 1999, O'Farrell and Gannon 1999), sampling

multiple sites without a researcher present, and sampling habitats that lack a constricted flyway necessary for traditional capture techniques. Use of ultrasonic detectors has the potential to increase detectability of some species, thereby improving the efficiency of bat surveys. This has prompted the U.S. Fish and Wildlife Service to incorporate acoustic surveys into the survey guidance for federally listed bats species in the eastern United States.

In order to inform natural resource personnel at Adelphi Laboratory Center and Blossom Point about bat species presence on their installation, we initiated a bat survey using ultrasonic detectors in June 2019.

Methods

Data Collection

Adelphi Laboratory Center covers approximately 207 acres in Montgomery and Prince George County, Maryland. Blossom Point covers approximately 1,600 acres in Charles County, Maryland. Sampling was conducted for listed bat species following the USFWS 2019 Bat Survey guidance. Bat activity was recorded using the Anabat SD2 bat detector system (Titley Scientific; www.titley-scientific.com) and a directional microphone set at a 45° angle. Settings for the detector were as follows: sensitivity at 6.5, audio division at 16, data division at 8, and output file format to zero crossing files. Prior to initial deployment, units were calibrated using an ultrasonic pest repeller following Larson and Hayes (2000). Sampling was only conducted on nights when temperatures were high enough to maintain bat activity, there was no precipitation, and wind speed was minimal (Appendix A). Stationary units were placed at suitable locations within the forested habitats (Fig. 1, 2) by Dr. Eric Britzke approximately 1m above ground level. These locations include canopy openings, forest edge, linear corridors or flyways, and over water

(Appendix B). Detectors were housed in a weatherproof box on a tripod (Fig. 3) and were set to record from 30 minutes before sunset to 30 minutes after sunrise.

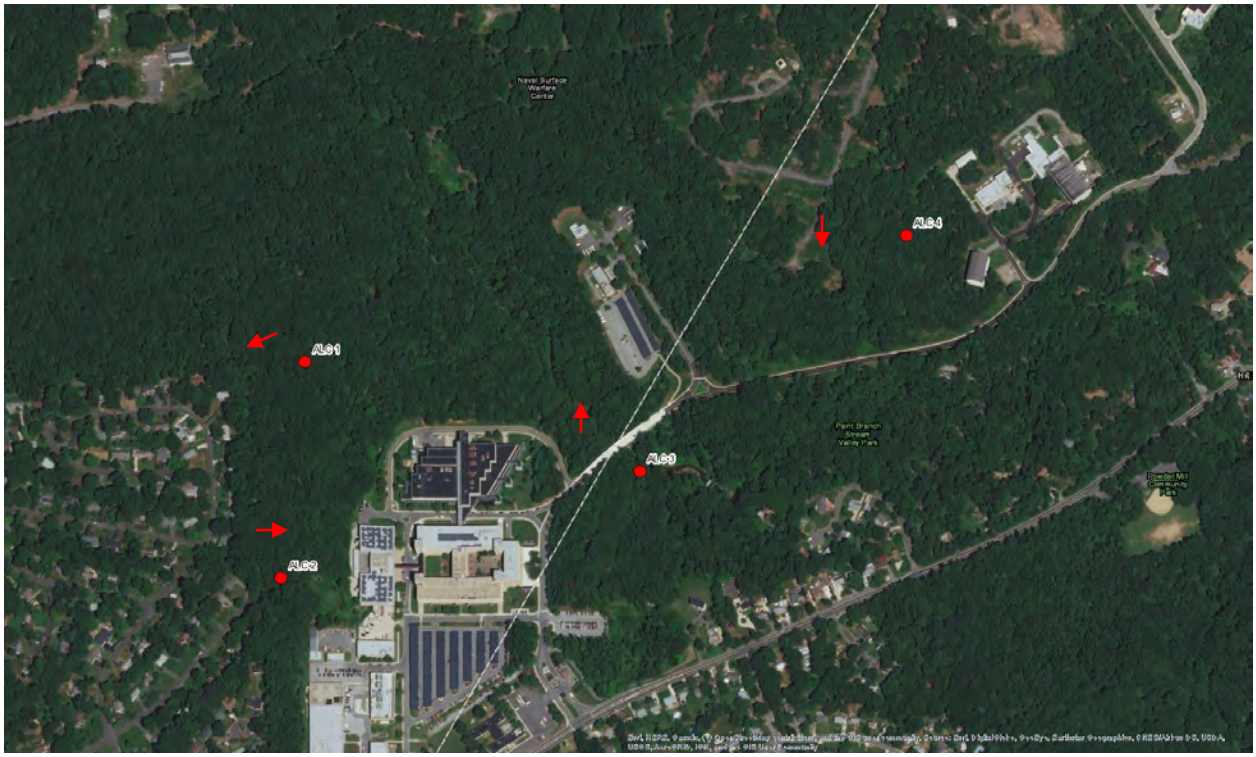


Figure 1. Map showing location of 4 sites sampled with Anabat SD2 detectors at Adelphi Laboratory Center, Maryland in June 2019.



Figure 2. Map showing location of 19 sites sampled with Anabat SD2 detectors at Blossom Point, Maryland in June 2019.



Figure 3. Example of Anabat bat detector setup for recording at Adelphi Laboratory Center and Blossom Point, Maryland during June 2019.

Data analysis

Upon completion of a least 4 nights with suitable weather conditions, equipment was picked up and the CF card was removed. The CFCRead program was used to download the data on a laptop computer for later analysis using settings found in Appendix C. Downloaded files were organized by date within site and analyzed using the Kaleidoscope Pro version 5.1.9g (Wildlife Acoustics, Inc., Maynard, MA). This program filters files, extracts parameters, and classifies files based on statistical comparison to a known call library. The Bats of North America 5.1.0 classifier, which is built into Kaleidoscope Pro, was selected and the following were specified as candidate species: hoary (*Aeorestes cinereus*), big brown (*Eptesicus fuscus*), eastern red (*Lasiurus borealis*), silver-haired (*Lasionycteris noctivagans*), southeastern myotis (*Myotis austroriparius*), little brown (*M. lucifugus*), northern long-eared (*M. septentrionalis*), Indiana (*M. sodalis*), evening (*Nycticeius humeralis*), and tricolored (*Perimyotis subflavus*). Results from Kaleidoscope Pro were manually verified by Dr. Eric Britzke based on expert knowledge of bat species call characteristics.

Results

A total of 23 points were sampled in June 2019 (Figure 1 & 2; Table 1). Recording resulted in sampling of 202,100 files (mean = 1,304; range 1-17,207 files / night). A total of 5 bat species were detected: hoary, big brown, eastern red, little brown, and tri-colored. Due to the similarity of calls between big brown bats and silver –haired bats, these species were combined and called big brown because they are more common residents of the area during the summer maternity period. Manual analysis revealed presence of eastern reds at 20 sites, big browns were

detected at 13 sites, hoarys were detected at 7 sites, little browns were detected at 20 sites, and tri-coloreds were detected at 9 sites (Table 2).

Table 1. Detector nights per area

Area	Sites/area	Nights/Site	Total detector nights
Adelphi Laboratory Center	4	6	24
Blossom Point	19	6	114

Table 2. Results of the Anabat bat survey conducted in Adelphi Laboratory Center and Blossom Point, Maryland in June 2019.

Location	Date	Total Number of Files	Bat Species Detected
ALC 1	6/4/2019	437	Big brown, Eastern red
	6/5/2019	614	Big brown, Eastern red
	6/6/2019	132	Big brown, Eastern red
	6/7/2019	342	Big brown, Eastern red
	6/8/2019	232	Big brown, Eastern red, Little brown
	6/9/2019	61	Big brown, Eastern red
ALC 2	6/4/2019	1242	Big brown, Eastern red, Tri-colored
	6/5/2019	819	Big brown, Eastern red, Little brown, Tri-colored
	6/6/2019	983	Big brown, Eastern red, Tri-colored
	6/7/2019	761	Big brown, Eastern red, Little brown, Tri-colored
	6/8/2019	904	Big brown, Eastern red, Tri-colored
	6/9/2019	109	Big brown, Eastern red
ALC 3	6/4/2019	22	Big brown
	6/5/2019	55	Big brown, Hoary, Tri-colored
	6/6/2019	22	Big brown, Hoary
	6/7/2019	20	Big brown
	6/8/2019	31	Big brown
	6/9/2019	0	
ALC 4	6/4/2019	141	Big brown, Eastern red, Little brown
	6/5/2019	214	Big brown, Eastern red, Little brown
	6/6/2019	32	Eastern red, Little brown
	6/7/2019	98	Big brown, Little brown
	6/8/2019	528	Big brown, Eastern red
	6/9/2019	27	Big brown, Little brown

Blossom 1	6/7/2019	7	Little brown
	6/8/2019	7	None
	6/9/2019	30	Little brown, Tri-colored
	6/10/2019	0	None
	6/11/2019	114	Eastern red, Little brown
	6/12/2019	0	None
Blossom 2	6/6/2019	1	None
	6/7/2019	2	None
	6/8/2019	0	None
	6/9/2019	0	None
	6/10/2019	1	None
	6/11/2019	0	None
	6/12/2019	0	None
Blossom 3	6/6/2019	150	Eastern red, Hoary, Little brown
	6/7/2019	307	Big brown, Eastern red
	6/8/2019	326	Eastern red, Little brown
	6/9/2019	298	Eastern red, Little brown
	6/10/2019	205	Big brown, Eastern red, Little brown
	6/11/2019	130	Eastern red, Little brown, Tri-colored
	6/12/2019	88	Eastern red, Little brown
Blossom 4	6/6/2019	28	Eastern red, Hoary, Little brown, Tri-colored
	6/7/2019	57	Little brown
	6/8/2019	116	Eastern red, Little brown, Tri-colored
	6/9/2019	60	Eastern red, Little brown
	6/10/2019	3	Tri-colored
	6/11/2019	124	Eastern red, Little brown, Tri-colored
	6/12/2019	44	Eastern red, Little brown
Blossom 5	6/6/2019	40	Eastern red, Little brown
	6/7/2019	57	Eastern red, Little brown
	6/8/2019	141	Eastern red, Little brown
	6/9/2019	112	Eastern red, Little brown
	6/10/2019	52	Hoary, Little brown
	6/11/2019	136	Eastern red, Hoary, Little brown
	6/12/2019	148	Eastern red, Little brown
Blossom 6	6/6/2019	38	Eastern red, Little brown
	6/7/2019	31	Eastern red, Little brown
	6/8/2019	53	Eastern red, Little brown
	6/9/2019	73	Eastern red, Little brown
	6/10/2019	28	Little brown
	6/11/2019	123	Eastern red, Little brown
	6/12/2019	79	Eastern red, Little brown
Blossom 7	6/6/2019	83	Little brown
	6/7/2019	225	Little brown

	6/8/2019	216	Eastern red, Little brown
	6/9/2019	280	Eastern red, Little brown
	6/10/2019	76	Eastern red, Little brown
	6/11/2019	321	Eastern red, Little brown
	6/12/2019	168	Eastern red, Little brown
Blossom 8	6/6/2019	328	Big brown, Eastern red, Little brown
	6/7/2019	554	Eastern red, Big brown
	6/8/2019	619	Big brown, Eastern red, Little brown
	6/9/2019	336	Eastern red, Little brown
	6/10/2019	511	Eastern red, Little brown
	6/11/2019	666	Eastern red, Little brown
	6/12/2019	360	Eastern red, Little brown
Blossom 9	6/6/2019	84	Big brown, Eastern red, Little brown
	6/7/2019	310	Big brown, Eastern red, Little brown
	6/8/2019	376	Big brown, Eastern red, Little brown
	6/9/2019	418	Eastern red, Little brown
	6/10/2019	136	Big brown, Eastern red, Little brown
	6/11/2019	346	Big brown, Eastern red, Little brown
	6/12/2019	244	Big brown, Eastern red, Little brown
Blossom 10	6/6/2019	29	Eastern red, Little brown, Tri-colored
	6/7/2019	23	Eastern red
	6/8/2019	41	Little brown
	6/9/2019	188	Eastern red, Hoary, Big brown, Tri-colored
	6/10/2019	75	Eastern red, Hoary, Little brown, Tri-colored
Blossom 11	6/6/2019	34	Little brown
	6/7/2019	58	Little brown
	6/8/2019	185	Big brown, Little brown
	6/9/2019	157	Eastern red, Little brown
	6/10/2019	118	Eastern red, Hoary, Little brown
	6/11/2019	229	Eastern red, Little brown
	6/12/2019	110	Little brown
Blossom 12	6/6/2019	46	Eastern red, Little brown
	6/7/2019	64	Little brown
	6/8/2019	230	Eastern red, Little brown
	6/9/2019	101	Eastern red, Little brown
	6/10/2019	636	Eastern red, Hoary, Little brown
	6/11/2019	130	Hoary, Little brown
	6/12/2019	74	Little brown
Blossom 13	6/6/2019	57	Big brown, Tri-colored
	6/7/2019	23	Little brown, Tri-colored
	6/8/2019	32	Eastern red, Tri-colored
	6/9/2019	45	Tri-colored
	6/10/2019	60	Eastern red, Tri-colored

	6/11/2019	144	Eastern red, Little brown, Tri-colored
	6/12/2019	33	Little brown, Tri-colored
Blossom 14	6/6/2019	174	Eastern red, Little brown
	6/7/2019	394	Eastern red, Little brown
	6/8/2019	535	Eastern red, Little brown
	6/9/2019	394	Eastern red, Little brown
	6/10/2019	245	Eastern red, Little brown
	6/11/2019	678	Eastern red, Little brown
	6/12/2019	297	Eastern red, Little brown
Blossom 15	6/6/2019	36	Tri-colored
	6/7/2019	21	Little brown
	6/8/2019	36	Eastern red, Tri-colored
	6/9/2019	50	Eastern red, Little brown, Tri-colored
	6/10/2019	20	Little brown, Tri-colored
	6/11/2019	129	Eastern red, Little brown, Tri-colored
	6/12/2019	29	Little brown, Tri-colored
Blossom 16	6/6/2019	400	Eastern red, Tri-colored
	6/7/2019	610	Big brown, Eastern red
	6/8/2019	389	Eastern red
	6/9/2019	444	Eastern red
	6/10/2019	373	Eastern red, Tri-colored
	6/11/2019	496	Eastern red, Big brown
	6/12/2019	416	Eastern red
Blossom 17	6/6/2019	13	Eastern red
	6/7/2019	8	Little brown
	6/8/2019	17	Eastern red, Little brown
	6/9/2019	15	Little brown
	6/10/2019	4	Eastern red, Little brown
	6/11/2019	27	Eastern red, Little brown
	6/12/2019	16	Eastern red, Little brown
Blossom 18	6/5/2019	0	None
	6/6/2019	0	None
	6/7/2019	1	Eastern red
	6/8/2019	227	Eastern red, Big brown, Little brown
	6/9/2019	382	Eastern red, Little brown
	6/10/2019	227	None
	6/11/2019	0	Eastern red, Little brown
	6/12/2019	168	Eastern red, Little brown
Blossom 19	6/6/2019	2	None
	6/7/2019	3	None
	6/8/2019	5	Little brown
	6/9/2019	4	None
	6/10/2019	10	Big brown

	6/11/2019	19	Eastern red
	6/12/2019	6	Little brown

Discussion

Activity levels varied substantially throughout the sites sampled during this project, but in general, activity was very high. As expected, eastern red bats and big brown bats were commonly detected during this sampling event. Some sites had very low bat activity levels and/or no species detected. When the log files and data were checked, the equipment was shown to be functioning during this time period. Thus, the low activity represented true bat activity at the sites. Some of the installation at Blossum Point has been thinned to open up the forested habitats. This has improved bat habitat at these sites. However, areas that have not been thinned have extremely dense forest vegetation and provide low quality bat habitat in these areas.

Manual analysis of the echolocation calls revealed fewer species than documented during the MLE analysis. This was due to extraneous noise which resulted in a large number of files being recorded for some sites. For example, eastern small-footed bats were identified using the automated software but were determined to be eastern red bat files during manual analysis of the echolocation calls. Despite these differences, the manual analysis and the software agreed that both northern long-eared and Indiana bats were absent from the project surveys.

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Appendix

Appendix A – Nighttime weather conditions during bat surveys at Adelphi Laboratory Center and Blossom Point in June 2019.

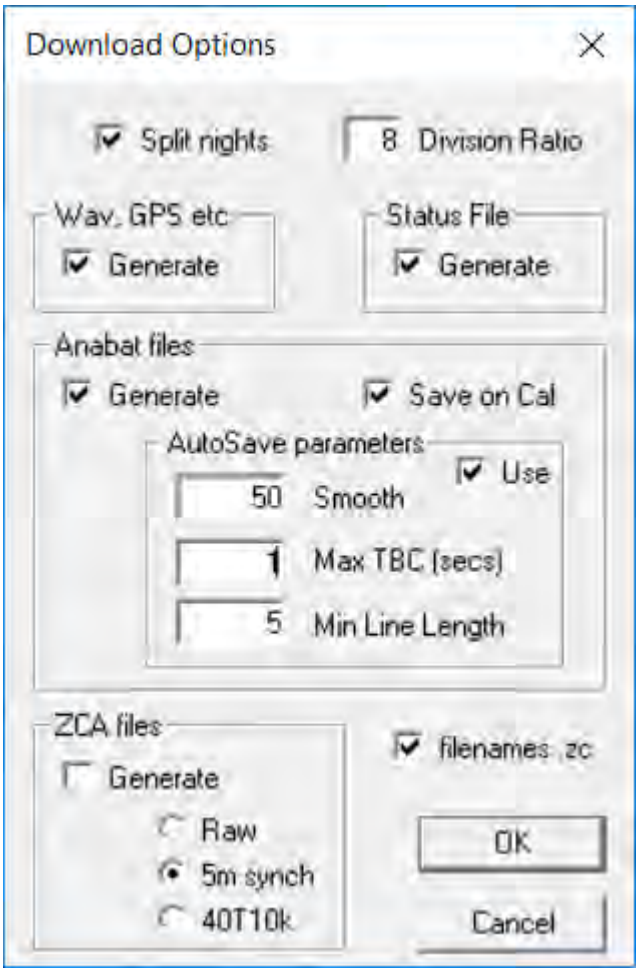
Date	Sunset	Sunrise	Min Temp	Max Temp	Average Temp	Humidity	Precipitation	Duration (Hours)	Wind Direction	Wind Speed	Moon Phase	Moon %
6/4/2019	20:29	5:43	62	65	63.44	75	0.00	-	S	8.44	Waxing Crescent	1.5
6/5/2019	20:30	5:43	70	74	71.84	98	0.02	-	SSW	9.05	Waxing Crescent	5.55
6/6/2019	20:30	5:43	70	77	72.44	92	0.00	-	NNE	3.33	Waxing Crescent	12.01
6/7/2019	20:31	5:42	65	72	68.33	90	0.00	-	NE	4.33	Waxing Crescent	20.55
6/8/2019	20:31	5:42	65	71	67.20	85	0.00	-	NE	7.50	Waxing Crescent	30.65
6/9/2019	20:32	5:42	63	64	63.38	100	0.04	1.33	NE	9.06	Waxing Crescent	41.73
6/10/2019	20:32	5:42	66	72	70.79	100	0.03	0.83	SSE	6.04	Waxing Crescent	53.17
6/11/2019	20:33	5:42	59	66	60.78	83	0.00	-	NNE	2.11	Waxing Crescent	64.36
6/12/2019	20:33	5:42	62	66	64.52	100	0.54	2.33	E	8.64	Waxing Crescent	74.71
6/13/2019	20:34	5:42	61	79	63.40	91	0.00	-	W	5.20	Waxing Crescent	83.73

Appendix B - GPS location of the 23 sites sampled for bats in Adelphi Laboratory Center and Blossom Point during June 2019.

Site	County	Latitude	Longitude	Habitat
ALC 1	Prince George	39.03232	-76.96714	Canopy Opening
ALC 2	Prince George	39.02961	-76.96752	Over Water
ALC 3	Prince George	39.03095	-76.96181	Over Water
ALC 4	Prince George	39.03391	-76.95757	Forest Edge
Blossom 1	Charles	38.42833	-77.09044	Canopy Opening
Blossom 2	Charles	38.42749	-77.09282	Canopy Opening
Blossom 3	Charles	38.42532	-77.0956	Forest Edge
Blossom 4	Charles	38.42219	-77.09578	Flyway
Blossom 5	Charles	38.42163	-77.09492	Over Water
Blossom 6	Charles	38.41701	-77.09582	Flyway
Blossom 7	Charles	38.42257	-77.10081	Flyway
Blossom 8	Charles	38.42508	-77.08555	Canopy Opening
Blossom 9	Charles	38.41965	-77.0864	Canopy Opening
Blossom 10	Charles	38.4342	-77.08283	Canopy Opening
Blossom 11	Charles	38.43201	-77.07886	Forest Edge
Blossom 12	Charles	38.43661	-77.08665	Canopy Opening
Blossom 13	Charles	38.43447	-77.08971	Canopy Opening
Blossom 14	Charles	38.43053	-77.09432	Flyway

Blossom 15	Charles	38.42906	-77.09809	Canopy Opening
Blossom 16	Charles	38.42618	-77.10152	Canopy Opening
Blossom 17	Charles	38.41372	-77.09619	Flyway
Blossom 18	Charles	38.41636	-77.08768	Flyway
Blossom 19	Charles	38.41333	-77.10155	Canopy Opening

Appendix C – Settings used in CFCRead to download data from Anabat SD2 detectors



Appendix D – Maximum likelihood estimator (MLE) results for each site and survey date at ALC and Blossom Point in 2019.

	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
ALC 1	6/4/2019	0	0	1	1	1	0.746628	0.079627	1	0	0.811189
	6/5/2019	0	0	1	1	1	0.929272	1	1	0	1
	6/6/2019	0	0.030625	1	1	1	1	1	1	4.8E-06	0.226617
	6/7/2019	0	0.001227	1	1	1	1	1	1	0	1
	6/8/2019	0	0	1	1	1	0.02808	0.180586	1	0	1
	6/9/2019	0	0	1	1	1	1	1	1	0.305421	1
ALC 2	6/4/2019	0	0	1	1	1	1	1	1	0.961655	0
	6/5/2019	0	0	1	1	1	5E-07	1	1	0.049938	0
	6/6/2019	0	0	1	1	1	0.285937	1	1	0.596136	0
	6/7/2019	0	0	1	1	1	0.006194	1	1	0.000235	0
	6/8/2019	0	0	1	1	1	0.072131	1	1	1.69E-05	0
	6/9/2019	0	0.182488	1	0.412178	1	0.09198	1	1	0	0.96948
ALC 3	6/4/2019	0	0.063101	1	1	1	1	1	1	1	1
	6/5/2019	0	1	0.412837	0.000606	1	1	1	1	1	0.026369
	6/6/2019	0.000148	0.160546	0.045292	0.590451	1	0.359612	1	1	1	1
	6/7/2019	6.01E-05	0.063101	1	0.272451	1	1	1	1	1	1
	6/8/2019	0	0.063101	1	0.898752	1	1	0.023327	1	1	1
	6/9/2019	1	1	1	1	1	1	1	1	1	1
ALC 4	6/4/2019	0	0.008715	1	1	1	3E-07	1	1	1	1
	6/5/2019	0	3.8E-06	1	1	1	0.046729	1	1	1	1
	6/6/2019	0.072421	0.004148	1	0.5941	1	0.045555	1	1	1	1
	6/7/2019	0	0.447161	1	1	1	0.00271	0.004331	1	0.620896	1
	6/8/2019	0	0.005901	1	1	1	0	0.110545	1	1	1
	6/9/2019	0.001897	0.093494	1	1	1	0.000512	1	1	1	1
Blossom 1	6/7/2019	1	1	1	1	1	0.001105	1	1	1	1
	6/8/2019	0.467704	0.063281	0.265471	0.708247	1	1	1	1	1	1
	6/9/2019	1	1	1	1	1	0.014201	1	1	1	0.000853

	6/10/2019	1	1	1	1	1	1	1	1	1	1
	6/11/2019	1	1	1	1	0.026889	0	1	1	1	1
	6/12/2019	1	1	1	1	1	1	1	1	1	1
Blossom 2	6/6/2019	1	1	0.061924	1	1	1	1	1	1	1
	6/7/2019	1	1	1	1	1	0.103397	1	1	1	1
	6/8/2019	1	1	1	1	1	1	1	1	1	1
	6/9/2019	1	1	1	1	1	1	1	1	1	1
	6/10/2019	1	1	0.061924	1	1	1	1	1	1	1
	6/11/2019	1	1	1	1	1	1	1	1	1	1
	6/12/2019	1	1	1	1	1	1	1	1	1	1
Blossom 3	6/6/2019	0.531042	0	0.000751	1	1	0	1	1	1	0.114918
	6/7/2019	0	0	1	1	1	1	1	0.996087	1	1
	6/8/2019	0.073228	0	1	0.593578	1	0.197353	1	0.889685	1	1
	6/9/2019	1	0	1	1	1	0.002347	1	1	1	1
	6/10/2019	5.4E-06	0	0.618214	1	1	2E-07	1	1	1	1
	6/11/2019	0.395728	0	1	0.395635	1	0.00012	0.315005	1	1	0.997273
	6/12/2019	1	0	0.197044	0.62218	1	0	1	1	1	0.895343
Blossom 4	6/6/2019	1	0.001094	0.064361	1	1	0.003745	1	1	1	0.030659
	6/7/2019	1	0.158265	1	1	1	0	1	1	1	0.294989
	6/8/2019	1	0.000028	1	1	1	0	1	1	1	0.023668
	6/9/2019	1	0.001381	1	1	1	0	1	0.999723	1	0.508271
	6/10/2019	1	1	1	1	1	1	1	1	1	0.025272
	6/11/2019	1	0	1	1	1	0	1	1	1	0.046404
	6/12/2019	1	0.00014	1	1	0.02689	1.9E-06	1	1	1	1
Blossom 5	6/6/2019	0.649225	1.2E-06	0.376473	0.245702	1	0.00415	1	1	1	0.457262
	6/7/2019	1	0.000631	0.017277	0.847638	1	2.9E-06	1	1	1	0.005617
	6/8/2019	1	0	0.064371	1	1	0	1	1	1	1
	6/9/2019	1	0	1	1	1	2.6E-06	1	1	1	1
	6/10/2019	1	0.241195	0.004142	1	1	0	1	1	1	0.311124
	6/11/2019	1	0	0.017277	0.847643	1	7.2E-06	1	1	1	0.341397

	6/12/2019	1	0	0.197102	0.622365	1	0	1	1	1	1
Blossom 6	6/6/2019	1	1.4E-06	1	1	1	0.00359	1	1	1	1
	6/7/2019	1	0.004167	1	1	1	1.58E-05	1	1	1	0.31453
	6/8/2019	1	1.19E-05	1	1	1	0.000021	1	0.363546	1	1
	6/9/2019	1	0.001783	1	1	1	0	1	0.5791	1	1
	6/10/2019	1	0.100864	0.064388	1	1	0.000461	1	0.619613	1	1
	6/11/2019	0.133488	3.07E-05	1	1	0.056233	0	1	1	1	0.652851
	6/12/2019	1	0.000816	1	1	1	0	1	1	1	1
Blossom 7	6/6/2019	1	0.135092	1	1	1	0	1	1	0.983076	0.462901
	6/7/2019	1	0.798827	0.06436	1	1	0	1	1	1	0.776272
	6/8/2019	1	3.55E-05	1	1	1	0	1	1	1	0.419036
	6/9/2019	1	1+D70	1	1	1	0	1	1	1	1
	6/10/2019	1	0.012432	0.06436	1	1	0	1	1	1	1
	6/11/2019	1	0	1	1	1	0	1	1	1	1
	6/12/2019	1	7.6E-06	1	1	1	0	0.921216	1	1	1
Blossom 8	6/6/2019	0.016938	0	1	1	1	0	1	1	1	0.9917
	6/7/2019	0.347171	0	1	0.005885	1	0.056092	1	1	1	0.976329
	6/8/2019	0.002492	0	0.459564	0.941584	1	0	1	1	1	0.056725
	6/9/2019	1	0	0.06439	1	1	0	1	1	1	0.988105
	6/10/2019	0.081622	0	1	0.590467	1	0	1	1	1	0.430042
	6/11/2019	0.097874	0	1	1	1	0	1	1	1	0.078345
	6/12/2019	1	0	1	1	1	0	1	1	0.337196	0.051048
Blossom 9	6/6/2019	4E-07	0	1	1	1	8E-07	1	1	1	0.811577
	6/7/2019	0	0	0.989241	1	1	0	1	1	1	1
	6/8/2019	0.012	0	1	0.740043	1	0	1	1	1	1
	6/9/2019	1	0	1	1	1	0	1	1	1	0.906818
	6/10/2019	0.011547	0	1	0.740848	1	0	1	1	1	1
	6/11/2019	0.002047	0	1	1	1	0	1	1	1	1
	6/12/2019	2.96E-05	0	1	1	1	0.002989	1	1	1	1
Blossom 10	6/6/2019	1	0.04241	1	1	1	0.02748	1	1	1	0.011249

	6/7/2019	0.648008	0.024554	0.376536	0.245774	1	0.138986	1	1	1	0.173027
	6/8/2019	1	0.079146	0.065752	1	1	0	1	1	0.946159	1
	6/9/2019	1	0.002095	0	2.75E-05	1	0.059856	1	1	0	0
	6/10/2019	0.892561	0.002735	0.00107	0.357073	1	0.000178	1	1	1	0
Blossom 11	6/6/2019	1	0.220028	0.419785	0.054742	1	1E-07	1	1	1	1
	6/7/2019	0.130146	0.24139	1	1	1	0	1	1	1	0.311148
	6/8/2019	0.018421	0.096986	1	1	1	0	1	1	1	1
	6/9/2019	1	0.000581	1	1	1	0	1	1	1	0.691662
	6/10/2019	0.912208	1E-07	2E-07	0.965323	1	0	1	1	0.145216	1
	6/11/2019	1	0.000233	1	1	1	0	1	1	0.826684	0.914433
	6/12/2019	1	1	1	1	1	0	1	1	1	1
Blossom 12	6/6/2019	1	0.000957	0.06436	1	1	0	1	1	1	0.445505
	6/7/2019	1	0.050181	1	1	1	0	1	1	1	0.444025
	6/8/2019	1	0	1	1	1	0	1	1	1	1
	6/9/2019	1	0.004819	1	1	1	0	1	1	1	0.610497
	6/10/2019	1	0.041822	0	1	1	0.026208	1	1	1	0.180526
	6/11/2019	1	0.555662	0.004142	1	1	0	1	1	1	0.658288
	6/12/2019	1	0.541635	1	1	1	0	1	1	1	0.47052
Blossom 13	6/6/2019	3.5E-06	0.320467	1	1	1	0.057746	0.084546	1	1	0
	6/7/2019	0.123854	1	1	1	1	0.030083	1	1	1	0
	6/8/2019	1	0.001591	1	1	1	0.385844	1	1	1	0
	6/9/2019	1	0.232997	1	1	1	0.219175	1	1	1	0
	6/10/2019	0.254249	1.83E-05	0.165213	1	1	0.184902	1	1	1	0
	6/11/2019	0.131523	0.000278	1	1	1	0	1	1	1	0
	6/12/2019	0.125659	0.637734	1	1	1	3.1E-06	1	0.693305	1	0
Blossom 14	6/6/2019	1	0.000106	1	1	1	0	1	1	1	1
	6/7/2019	1	1E-07	1	1	1	0	1	1	1	0.342773
	6/8/2019	1	0	0.061153	1	1	0	1	1	1	1
	6/9/2019	0.635874	0	1	0.075041	1	0	1	1	1	0.997057
	6/10/2019	0.495482	1E-07	0.26434	0.706078	1	0	0.919918	1	1	1

	6/11/2019	0.528905	0	0.262933	0.703691	1	0	0.900577	1	1	0.964484
	6/12/2019	1	0	1	1	1	0	1	1	1	1
Blossom 15	6/6/2019	1	1	0.070909	1	1	1	1	1	0.144472	0
	6/7/2019	0.124873	0.499075	1	1	1	0.000161	0.142826	1	1	0.120455
	6/8/2019	1	1.24E-05	0.06436	1	1	0.566036	1	1	1	0
	6/9/2019	1	0.011816	1	1	1	0.003215	1	0.615141	1	0
	6/10/2019	1	1	0.067919	1	1	5.42E-05	1	1	0.267663	8.2E-06
	6/11/2019	1	0	1	1	1	0	1	1	1	0
	6/12/2019	1	1	1	1	1	0	1	0.803506	1	0
Blossom 16	6/6/2019	0.072119	0	1	0.594162	1	1	1	1	1	0
	6/7/2019	0.015197	0	1	1	1	1	1	1	1	0.895479
	6/8/2019	1	0	1	1	1	1	1	1	1	0.27376
	6/9/2019	0.647927	0	0.37654	0.245779	1	0.960019	1	1	1	1
	6/10/2019	1	0	1	0.203221	1	1	1	1	1	0
	6/11/2019	1	0	1	0	1	1	1	1	1	0.672016
	6/12/2019	0.390145	0	1	0.396297	1	1	1	1	1	1
Blossom 17	6/6/2019	0.586777	7.7E-06	1	0.076777	1	0.383738	1	1	1	1
	6/7/2019	1	0.34952	0.06436	1	1	0.008304	1	1	1	1
	6/8/2019	1	3.8E-06	1	1	1	0.043122	1	1	1	1
	6/9/2019	1	0.146901	1	1	1	1.11E-05	1	1	1	0.193977
	6/10/2019	1	1	0.06804	1	1	0.127568	1	1	0.213926	1
	6/11/2019	1	0.000415	0.067566	1	1	0.000673	1	1	0.854442	1
	6/12/2019	1	0.011823	1	1	1	0.001387	1	1	1	1
Blossom 18	6/5/2019	1	1	1	1	1	1	1	1	1	1
	6/6/2019	1	1	1	1	1	1	1	1	1	1
	6/7/2019	0.124867	0	1	1	1	0.43385	1	0.537825	1	1
	6/8/2019	1	0	1	0.041299	1	0	1	1	1	0.997163
	6/9/2019	1	0	0.197042	0.622176	1	0	1	1	1	0.296988
	6/10/2019	1	1	1	1	1	1	1	1	1	1
	6/11/2019	0.127754	0	1	1	1	5.17E-05	1	1	1	1

	6/12/2019	1	0	1	0.203222	1	0.031795	1	1	1	1
Blossom 19	6/6/2019	1	1	1	1	1	0.103397	1	1	1	1
	6/7/2019	1	1	1	1	1	0.103397	1	1	1	1
	6/8/2019	1	1	1	1	1	0.000114	1	1	1	1
	6/9/2019	1	1	1	1	1	1	1	1	0.191535	1
	6/10/2019	0.001875	1	1	1	1	1	1	1	1	1
	6/11/2019	1	0.000324	1	1	1	0.076319	1	1	1	1
	6/12/2019	1	1	1	1	1	0.010691	1	1	1	1

Appendix E – Resume for Dr. Eric Britzke

Education

Ph.D., Environmental Sciences with Concentration in Biology, Tennessee Technological University, 2003.
M.S., Biology, Missouri State University, 1998.
B.S., Biology, Missouri State University, 1994.

Work Experience

United States Army Engineer Research and Development Center, 11/08 – Present. Research Wildlife Biologist.
Independent Consultant, 6/05 – 11/08. Biologist.
East Arkansas Community College, 9/04 – 6/05. Environmental Science Specialist.
Clemson University, 9/03 – 8/04. Post Doctoral Fellow.
Tennessee Technological University, 1/01 – 5/01. Instructor.
Tennessee Technological University, 5/99 – 5/03. Graduate Research Assistant.
United States Forest Service, 10/98 – 11/98; 5/99- 8/99. Biological Aid.
Missouri State University, 8/95 – 5/98. Graduate Teaching Assistant
Missouri State University, 2/95–10/95; 1/97 – 12/97; 2/98–10/98. Graduate Research Assistant.

Organizations, Panels, Committees, and Awards

Conservation Research Award, National Military Fish and Wildlife Association, 2014
Achievement Medal for Civilian Service, 2013
DoD representative, WNS National Plan Steering committee
WNS Coordination Team, WNS National Plan
Chair, WNS Disease Surveillance Working Group
National Military Fish and Wildlife Association, 2009- Present
Central Regional Director, 2011-2013
Chair, Bat Working Group, 2012-2014
Southeastern Bat Diversity Network, 1999 – Present.
Member of the Board of Directors 2003-2007
American Society of Mammalogists, 1995 - 2012
Wildlife Society, 2004 – 2012
Student Presentation Award Sigma XI, 1995, 1st place.
Golden Key National Honor Society
Wings Across the Americas Bat Conservation Award, 2008
Wings Across the Americas Bat Conservation Award, 2010

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Appendix F – Photos of bat detector deployment sites taken from the rear and side of the detector

ALC 1




ALC 2




ALC 3




ALC 4




Blossom 1




Blossom 2




Blossom 3




Blossom 4




Blossom 5




Blossom 6




Blossom 7




Blossom 8




Blossom 9




Blossom 10




Blossom 11




Blossom 12




Blossom 13




Blossom 14




Blossom 15




Blossom 16




Blossom 17




Blossom 18




Blossom 19




Bat Survey of Adelphi Laboratory Center and Blossom Point Research Facility, Maryland



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Summary

Several imperiled bat species range across numerous Department of Defense (DoD) properties and their presence presents a challenge for military operations. Given the critical ecological and economic value of bats, it is essential that bat population trends and distributions be monitored to help natural resource managers make informed management decisions on DoD lands. Presently, two species listed endangered (northern long-eared bat, *Myotis septentrionalis*; Indiana bat, *Myotis sodalis*), one proposed endangered (tricolored bat, *Perimyotis subflavus*), and one under review for listing under the Endangered Species Act (little brown bat, *Myotis lucifugus*) potentially occur on Adelphi Laboratory Center (ALC) and Blossom Point Research Facility (BPRF), Maryland. We conducted passive acoustic monitoring from 24 June–9 July 2024 at 23 locations across the installations (4 at ALC, 19 at BPRF). We detected six species: tricolored bat, little brown bat, big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and evening bat (*Nycticeius humeralis*). No northern long-eared bats or Indiana bats were documented. With the impending federal listing of tricolored bat and the potential federal listing of additional species on the horizon, continued future surveys will be critical for documenting population trends and informing potential impacts to military land management.

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Introduction

Bat species are experiencing drastic population declines (Cheng et al. 2021) due to several interacting factors such as disease (white-nose syndrome [WNS]; Blehert et al. 2009, Hoyt et al. 2021), loss of habitat (Racey and Entwistle 2003), climate change (Humphries et al. 2002), and wind energy development (Arnett et al. 2008). Several imperiled species range across numerous Department of Defense (DoD) properties and their presence presents a challenge for military operations. Given the critical ecological and economic value of bats (Boyles et al. 2011), it is essential that bat population trends and distributions be monitored to help natural resource managers make informed management decisions on DoD lands. A higher proportion of bats receive some level of regulatory protection than any other group of mammals in North America. Accordingly, bat conservation efforts are a top environmental priority for the DoD. To address potential regulatory impacts associated with at-risk species and meet management objectives within Integrated Natural Resource Management Plans (INRMP), military bases across the country have recently increased their efforts to inventory and manage for bats on DoD lands.

Ten species of bat are known to occur in Maryland, five of which are federally protected under the Endangered Species Act (ESA) or are a Species of Greatest Conservation Need for the state. The Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septentrionalis*) are federally endangered. The tricolored bat (*Perimyotis subflavus*) was proposed endangered by the U.S. Fish and Wildlife Service (USFWS) in 2022 (USFWS 2022), currently awaiting a final ruling, and is "Critically Imperiled" in Maryland (Maryland DNR 2023). The little brown bat (*Myotis lucifugus*) is under review for federal listing and is "Critically Imperiled" in the state (Maryland DNR 2023). The eastern small-footed bat (*Myotis leibii*) is "Critically Imperiled" in Maryland (Maryland DNR 2023).

An acoustic survey was conducted at Adelphi Laboratory Center (ALC) and Blossom Point Research Facility (BPRF) in June 2019 (Britzke 2019). Over six nights of sampling at each of 23 sites, five species were detected on both installations: little brown bat, tricolored bat, big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), and hoary bat (*Lasiurus cinereus*). No federally listed species were detected.

In June and July 2024, we conducted an acoustic survey to provide ALC and BPRF natural resource managers with an update on bat species occupying the installations so they may proactively prepare for potential regulatory impacts. This survey was conducted at the same sampling locations as in 2019 but for a longer sampling duration at each location. This report documents our findings, which may be incorporated into the INRMP for ALC and BPRF and contributed to larger conservation efforts across the range of these species, such as the North American Bat Monitoring Program (NABat).

Methods

Potentially suitable habitat

We followed the USFWS guidelines for "Phase 2" summer acoustic surveys (USFWS 2024). Based on the following definitions, we considered forest and wetland land cover types on ALC and BPRF as potentially suitable bat habitat.

The USFWS (2024) defines suitable summer habitat for Indiana bat as follows:

> "Suitable summer habitat for Indiana bat consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥ 5 inches dbh (12.7 centimeter) that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat.
>
> Indiana bats have also been observed roosting in human-made structures, such as bridges and bat houses (artificial roost structures); therefore, these structures should also be considered potential summer habitat…
>
> Examples of unsuitable habitat:
>
> - Individual trees that are greater than 1,000 feet from forested/wooded areas;
> - Trees found in highly developed urban areas (e.g., street trees, downtown areas); and
> - A pure stand of less than 3-inch dbh trees that are not mixed with larger trees."

The USFWS (2024) defines suitable summer habitat for northern long-eared bat as follows:

> "Suitable summer habitat for the northern long-eared bat consists of a wide variety of forested/wooded habitats where they roost, forage, and travel. Although they may also traverse habitat adjacent and interspersed with forest habitat, such as emergent wetlands and field edges, they are predominately found in forest/wooded habitat. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥ 3 inches dbh that have exfoliating bark, cracks, crevices, and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Northern long-eared bats are nocturnal foragers and use hawking (catching insects in flight) and gleaning (picking insects from surfaces) behaviors in conjunction with passive acoustic cues (Nagorsen and Brigham 1993, p. 88; Ratcliffe and Dawson 2003, p.

851). Northern long-eared bats often prefer intact mixed-type forests with small gaps (i.e., forest trails, small roads, or forest-covered creeks) in forest with sparse or medium vegetation for foraging and commuting rather than fragmented habitat or areas that have been clear cut (USFWS 2015, p.17992). Individual trees may be considered suitable habitat when they exhibit characteristics of suitable roost trees and are within 1,000 feet of other forested/wooded habitat. The northern long-eared bat has also been observed roosting (although to a lesser degree than forested habitat) in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat.

Northern long-eared bats typically occupy their summer habitat from mid-May through mid-August each year and the species may arrive or leave some time before or after this period. In most areas, roosting habitat is considered suitable summer habitat because northern long-eared bats are only present in forested habitat during the summer active months. In some areas of the southern U.S., northern long-eared bats are present in potential roosting habitat year-round. In these areas, habits and habitat use differ significantly from the rest of the species' range.

Examples of unsuitable habitat:

- Individual trees that are greater than 1,000 feet from forested/wooded areas;
- Trees found in highly developed urban areas (e.g., street trees, downtown areas); and
- A pure stand of less than 3-inch dbh trees that are not mixed with larger trees."

The USFWS (2024) defines suitable summer habitat for tricolored bat as follows:

"Suitable tricolored bat summer habitat consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and include some adjacent and interspersed non-forested habitats such as emergent wetlands, shrublands, grasslands, and forested edges of agricultural fields, old fields, and pastures. Roosting habitat includes forests, woodlots, and linear features (e.g., fencerows and riparian corridors) containing trees with potential roost substrate (e.g., live and dead leaf clusters of live and recently dead deciduous trees, Spanish moss [*Tillandsia usneoides*], and beard lichen [*Usnea trichodea*]). Tricolored bats will roost in a variety of tree species, especially oaks (*Quercus* spp.), and often select roosts in tall, large-diameter trees, but will roost in smaller diameter trees when potential roost substrate is present (e.g., 4-inch [10-centimeter]; Leput 2004). Tricolored bats commonly roost in the mid to upper canopy of trees although males will occasionally roost in dead leaves at lower heights (e.g., < 16 feet [5 meters] from the ground; Perry and Thill 2007) and females will

occasionally roost in Spanish moss of understory trees (Menzel et al. 1999). Tricolored bats seem to prefer foraging along forested edges of larger forest openings, along edges of riparian areas, and over water and avoid foraging in dense, unbroken forests, and narrow road cuts through forests (Davis and Mumford 1962; Kurta 1995; Lacki and Hutchinson 1999; Ford et al. 2005; Menzel et al. 2005; White et al. 2006; Thames 2020; Hantulla and Valdez 2021).

Tricolored bats also roost in human-made structures, such as bridges and culverts, and occasionally in barns or the underside of open-sided shelters (e.g., porches, pavilions); therefore, these structures should also be considered potential summer habitat. Tricolored bats occupy similar forest habitats in the spring, summer, and fall (i.e., non-hibernating seasons) but in the southern portion of the range, where tricolored bats exhibit shorter torpor bouts and remain active and feed year-round, they may roost in culverts, bridges, cavities in live trees, live and dead leaf clusters, and/or Spanish moss during the winter (Sandel et al. 2001; Newman et al. 2021). Tricolored bats may roost and forage in forested areas near anthropogenic structures and buildings (e.g., suburban neighborhoods, parks, etc.) (Helms 2010; Shute et al. 2021). However, highly developed urbanized areas generally devoid of native vegetation (including isolated trees surrounded by expansive anthropogenic development) are considered unsuitable habitat (e.g., parking lots, industrial buildings, shopping centers)."

The USFWS requires a minimum of 14 detector nights in at least two detector locations per 123 acres (0.5 km^2) of suitable summer habitat for northern long-eared bat and tricolored bat, or 10 detector nights for Indiana bat (USFWS 2024). ALC covers 207 acres in Montgomery and Prince George's Counties, Maryland; 120 acres are forested. We sampled four sites on ALC for 15 nights each, thus exceeding the minimum level of effort. BPRF covers 1,600 acres in Charles County, Maryland, of which 1,000 acres are forested and 263 acres are wetland, representing 1,263 acres of potentially suitable habitat. We sampled 19 sites on BPRF for 15 nights each.

Stationary point acoustic surveys

The goal of passive acoustic surveys was to document bat species presence based on the identification of high-quality echolocation call recordings. Stationary point data may not be used to assess abundance because individuals are not uniquely identifiable. We replicated the number and approximate locations of points from the 2019 survey of ALC and BPRF (Britzke 2019). We sampled four sites on ALC (Figure 1) and 19 sites on BPRF (Figure 2) for 15 nights each between 24 June and 9 July. We used Wildlife Acoustics SM4BAT FS units (bat detectors) with SMM-U2 hemispherical ultrasonic microphones (Wildlife Acoustics, Inc., Maynard, MA). At each site, we placed a microphone on an extension pole and attached it to a tree, fence, or other object, with the microphone angled into the flight corridor. Bat detectors were scheduled to turn on 30 minutes before sunset and record when triggered continuously until 30 minutes after sunrise. Bat calls were recorded to wav files in full spectrum format at a sample rate of 384 kHz. We followed recommendations of NABat (Reichert et al. 2017) for other audio settings: gain = 12; 16k high filter off; minimum duration (noise scrubber) = 1.5 ms; maximum duration (noise

scrubber) = 50 ms; minimum trigger frequency = 16 kHz; trigger level = 12 dB; trigger window = 2 s; maximum file length = 15 s. Microphones were calibrated upon deployment and retrieval using a Wildlife Acoustics ultrasonic calibrator to verify sufficient sensitivity (> -47dBV). At each site, we recorded the following measurements: geographic coordinates, habitat type (e.g., forested corridor, forest clearing, near water), microphone orientation (degrees of rotation), microphone height above ground (m), distance to nearest clutter (m), and canopy cover (percentage, measured in the four cardinal directions and averaged). See Appendix D for site locations and descriptions, and Appendix E for photographs of each deployment.

Data analyses

We processed acoustic data using a combination of automated software and qualitative analysis (manual vetting). First, we attributed survey-specific metadata to wav files. Then, we identified bat calls to species using the automated acoustic analysis software, Kaleidoscope Pro 5.6.4, and its "Bats of North America 5.4.0" classifier. This classifier is a USFWS-approved program for the identification of bat calls in the eastern United States. We used a "+1 More Accurate (Conservative)" sensitivity setting to retain only higher quality recordings that were more likely to be identifiable. We specified the following input parameters: frequency range = 8–120 kHz; length of detected pulses = 2–50 ms; minimum number of pulses = 3. We considered a ten-species list for potential classification: big brown bat, silver-haired bat, hoary bat, eastern red bat, evening bat, little brown bat, Indiana bat, northern long-eared bat, eastern small-footed bat, and tricolored bat.

After software analyses, we manually reviewed automated classifications by viewing individual recordings as spectrograms. All files classified by software to the *Myotis* genus or as tricolored bat were manually vetted by a trained, expert reviewer (E. Herrera-Bevan) to confirm species presence or refute classifications decisions made by software. We also reviewed all files for which Kaleidoscope Pro did not reach a classification decision ("NoID") to decrease the chance that calls of species of conservation concern were overlooked (i.e., type II error, false negatives). For all other species, we manually verified at least one file per species per night to establish presence, as recommended (but not required) by NABat (Loeb et al. 2015). There is substantial variation in echolocation call pulses within and among individual bats (Murray et al. 2001), so we only considered files with a minimum of five calls for positive classification decisions, except the hoary bat, which could be confidently identified with as few as three pulses due to its uniquely low minimum frequency. Although this eliminated a portion of recordings from our analysis, it decreased the chance of type I error (false positives). The Indiana bat and little brown bat cannot be reliably differentiated based on acoustic data alone because of significant overlap of echolocation call parameters between these species, and auto-classification software programs frequently confound the two (Szewczak 2011). This was apparent in our analysis, in which hundreds of files received comparable support to be classified as Indiana bat or little brown bat. Rather than assign these cases to a broader "*Myotis*" or "little brown bat/Indiana bat" category, we chose to present these classifications as little brown bat because the Indiana bat has not been reported from ALC or BPRF and both properties are outside the presumed range of the species (USFWS 2024). We stress the need to exercise caution when interpreting presence-absence

determinations for these two species based on acoustic data alone. To classify a file as northern long-eared bat, we required the call sequence to meet the following criteria: 1) a search phase sequence (versus approach phase or terminal phase), 2) at least five call pulses with > 75 kHz bandwidth, and 3) < 5 ms duration for each pulse. There is substantial overlap in big brown bat and silver-haired bat calls; although we were able to distinguish some big brown bat calls (e.g., see Appendix F, Figure F 4), we did not find definitive silver-haired bat calls. Therefore, we report all potential big brown bat or silver-haired bat files as big brown bat.

Our results are presented as the total number of bat call files (determined by auto-classification) and species presence by site (confirmed by qualitative analysis). The acoustic data will be submitted to NABat (https://www.nabatmonitoring.org/) for contribution to continent-wide research and conservation efforts (e.g., USFWS Species Status Assessments).



Figure 1. Locations of four sites sampled with bat detectors from 24 June–8 July 2024 on the Adelphi Laboratory Center, MD.



Figure 2. Locations of 19 sites sampled with bat detectors from 25 June–9 July 2024 on Blossom Point Research Facility, MD.

Results

We surveyed 23 sites between 24 June–9 July for a total of 345 detector nights (one detector night equals one night at one site), resulting in 415,980 audio recordings, 315,465 (75.8%) of which were classified as noise and 100,515 (24.2%) of which were classified by Kaleidoscope Pro as containing bat calls (mean = 4,370 files per site, median = 2,575 files, range = 460–16,162 files). Sites were surveyed for 15 nights each. Overall bat activity was variable across sites, with an average of 291 bat files recorded per night per site (median = 172 files per night, range = 31–1,077 files per night).

Qualitative analysis (manual vetting) confirmed the presence of six species: tricolored bat, little brown bat, big brown bat, eastern red bat, hoary bat, and evening bat (Table 1). Tricolored bat was detected at 14 sites (61%). Little brown bat was detected at 17 sites (74%). Big brown bat was detected at 23 sites (100%). Eastern red bat was detected at 23 sites (100%). Hoary bat was detected at 18 sites (78%). Evening bat was detected at 17 sites (74%).

See Appendices A and B for nightly detections of each species by site, Appendix C for nightly weather conditions, Appendix D for a site information, Appendix E for site photographs, and Appendix F for example spectrograms of echolocation calls for each species detected.

Table 1. Number of nights bat species were detected during acoustic surveys at Adelphi Laboratory Center and Blossom Point Research Facility between 24 June and 9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. Nightly detections were verified by manual review of audio files for at least one file per species per night. See Appendices A and B for nightly detections of each species at each site.

Site	First detector night	Last detector night	Detector nights	Bat files	Big brown	Eastern red	Hoary	Eastern small-footed	Little brown	Northern long-eared	Indiana	Evening	Tri-colored
ALC1	6/24/2024	7/8/2024	15	6,761	15	14	4	0	5	0	0	0	12
ALC2	6/24/2024	7/8/2024	15	16,162	15	15	4	0	4	0	0	7	15
ALC3	6/24/2024	7/8/2024	15	14,300	14	14	14	0	0	0	0	11	10
ALC4	6/24/2024	7/8/2024	15	2,024	13	12	0	0	0	0	0	0	0
BP01	6/25/2024	7/9/2024	15	1,939	9	14	3	0	0	0	0	1	2
BP02	6/25/2024	7/9/2024	15	2,661	14	14	2	0	8	0	0	7	0
BP03	6/25/2024	7/9/2024	15	2,505	13	15	0	0	6	0	0	6	1
BP04	6/25/2024	7/9/2024	15	819	9	13	2	0	6	0	0	1	1
BP05	6/25/2024	7/9/2024	15	2,575	12	14	2	0	7	0	0	6	0
BP06	6/25/2024	7/9/2024	15	8,050	15	15	5	0	0	0	0	4	0
BP07	6/25/2024	7/9/2024	15	578	2	14	0	0	2	0	0	1	0
BP08	6/25/2024	7/9/2024	15	5,209	13	14	2	0	5	0	0	0	1
BP09	6/25/2024	7/9/2024	15	4,632	11	14	0	0	1	0	0	14	0
BP10	6/25/2024	7/9/2024	15	460	4	11	5	0	2	0	0	3	3
BP11	6/25/2024	7/9/2024	15	1,434	1	8	4	0	7	0	0	0	3
BP12	6/25/2024	7/9/2024	15	899	1	13	0	0	0	0	0	0	8
BP13	6/25/2024	7/9/2024	15	1,059	5	12	2	0	1	0	0	0	10
BP14	6/25/2024	7/9/2024	15	4,966	15	14	3	0	9	0	0	4	0
BP15	6/25/2024	7/9/2024	15	2,069	3	13	1	0	7	0	0	3	3
BP16	6/25/2024	7/9/2024	15	6,716	13	15	3	0	0	0	0	6	1
BP17	6/25/2024	7/9/2024	15	2,538	7	14	3	0	5	0	0	5	2
BP18	6/25/2024	7/9/2024	15	7,836	13	15	3	0	1	0	0	10	0
BP19	6/25/2024	7/9/2024	15	4,323	14	14	3	0	5	0	0	6	0

Discussion

We detected six of the 10 species known to occur in Maryland: tricolored bat, little brown bat, big brown bat, eastern red bat, hoary bat, and evening bat. We did not detect the northern long-eared bat, Indiana bat, eastern small-footed bat, or silver-haired bat. Although we did not document any federally listed species (Indiana bat, northern long-eared bat), one species likely to be listed imminently (tricolored bat, proposed endangered) and one species under review for federal listing (little brown bat) were active on both ALC and BPRF. Overall bat activity varied across ALC and BPRF, but was generally high. Big brown bat and eastern red bat were the most prevalent species, detected at every site, while hoary bat, little brown bat, evening bat, and tricolored bat were all encountered at over 60% of sites sampled. Our findings differ from the 2019 survey in that we detected the evening bat while the 2019 survey did not (Britzke 2019).

Manual analysis of echolocation calls revealed fewer species present than suggested by MLE analysis. MLE results suggested the presence of silver-haired bat and northern long-eared bat, but manual identification failed to positively identify either species. This could be due to a variety of factors that influence the accuracy of automated classifications, thus influencing error rates of the classifier and resulting in inaccurate MLE calculations. For example, factors such as ambient noise or multiple bats in the same file can make it difficult to accurately identify individual files to the species level. Multiple sites had statistically significant MLE values for northern long-eared bat, but these recordings were either false positives or were not of sufficient quality to accurately verify the species. The northern long-eared bat, dubbed a “whispering” bat (Griffin 1958), emits lower-amplitude echolocation calls than congeners (Faure et al. 1993, Waters and Jones 1995) that attenuate rapidly in the air (Lawrence and Simmons 1982), making it more difficult to detect acoustically. It is possible bats did not approach our microphones close enough to record sufficient detail of echolocation calls necessary for confident identification. Further, while the northern long-eared bat is a forest interior and clutter specialist (Jung et al. 1999; Lacki and Schwierjohann 2001; Patriquin and Barclay 2003; Broders et al. 2006; Lausen 2009), recording in its preferred habitat can confound acoustic classification because all species vary their echolocation calls in response to different habitats. For example, little brown bats flying in clutter exhibit calls with higher frequencies, shorter durations, and steeper frequency modulation (Wund 2006), which can resemble calls of northern long-eared bats and make species discrimination difficult or impossible. For this reason, recording in more open habitat where bats exhibit consistent search phase call sequences are preferable for collecting species-discriminating calls; however, open habitat is not preferred by foraging northern long-eared bats.

In summary, while no federally listed bats were detected in this survey, we documented the little brown bat and tricolored bat on ALC and BPRF. With the potential listing of these species on the horizon, future surveys will need to strike a balance between choosing suitable habitat for detecting species of interest while maximizing the chance of collecting high-quality recordings for identification. It will be crucial to continue monitoring threatened and endangered species on ALC and BPRF, as well as proactively monitor and manage those species likely to warrant protection in the future.

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Appendix A: Nightly presence-absence as determined by maximum likelihood estimation

Species codes for all tables in this appendix:

EPFU = big brown bat, *Eptesicus fuscus*

LABO = eastern red bat, *Lasiurus borealis*

LACI = hoary bat, *Lasiurus cinereus*

LANO = silver-haired bat, *Lasionycteris noctivagans*

MYLE = eastern small-footed bat, *Myotis leibii*

MYLU = little brown bat, *Myotis lucifugus*

MYSE = northern long-eared bat, *Myotis septentrionalis*

MYSO = Indiana bat, *Myotis sodalis*

NYHU = evening bat, *Nycticeius humeralis*

PESU = tricolored bat, *Perimyotis subflavus*

Table A 1. Maximum likelihood estimates (MLE) of species presence by night at ALC1, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Adelphi Laboratory Center from 24 June–8 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
ALC1	6/24/2024	0	0.0000004	1	1	1	0.0000019	1	1	1	0.4895539
	6/25/2024	0	0.0000055	1	1	1	0.9995543	1	1	1	0.2415713
	6/26/2024	0	0.0009253	1	1	1	1	1	1	1	1
	6/27/2024	0	0	1	1	1	0.4008819	1	1	1	0.0085062
	6/28/2024	0	0	1	1	1	0	1	1	1	1
	6/29/2024	0	0.0000026	0.7914133	1	1	0	1	1	1	0.03645
	6/30/2024	0	0	1	1	1	0.0000007	1	1	1	0.4826082
	7/1/2024	0	0	1	1	1	0	1	1	1	1
	7/2/2024	0	0	1	1	1	0	1	1	1	0.453399
	7/3/2024	0	0.0000011	1	1	1	0	1	1	1	0.0478607
	7/4/2024	0	0.0099027	1	1	1	1	1	1	1	0.5006674
	7/5/2024	0	0	1	1	1	0.0166217	1	1	1	1
	7/6/2024	0	0	1	1	1	0.6994044	1	1	1	1
	7/7/2024	0	0	1	1	1	0.0000217	1	1	1	0.7092241
	7/8/2024	0	0	1	1	1	0.256669	1	1	1	0.3660391

Table A 2. Maximum likelihood estimates (MLE) of species presence by night at ALC2, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Adelphi Laboratory Center from 24 June–8 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
ALC2	6/24/2024	0	0	1	1	1	1	1	1	1	0
	6/25/2024	0	0	1	1	1	1	1	1	1	0
	6/26/2024	0	0	1	1	1	1	1	1	1	0
	6/27/2024	0	0	1	1	1	1	1	1	1	0
	6/28/2024	0	0	0.5548271	1	1	0.9634842	1	1	1	0
	6/29/2024	0	0	1	1	1	1	1	1	1	0
	6/30/2024	0	0	1	1	1	1	1	1	1	0
	7/1/2024	0	0	1	1	1	0.0791058	0.0877065	1	1	0
	7/2/2024	0	0	1	1	1	0.0214117	1	1	1	0
	7/3/2024	0	0	1	1	1	1	0.0000648	1	1	0
	7/4/2024	0	0	1	1	1	0.2712027	0.3733422	1	1	0
	7/5/2024	0	0	1	1	1	1	0.0044874	1	1	0
	7/6/2024	0	0	1	1	1	1	1	1	1	0
	7/7/2024	0	0	1	1	1	0.7431591	1	1	1	0
	7/8/2024	0	0	1	1	1	0	1	1	0.3175996	1

Table A 3. Maximum likelihood estimates (MLE) of species presence by night at ALC3, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Adelphi Laboratory Center from 24 June–8 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
ALC3	6/24/2024	0	0	0.8647039	1	1	1	1	1	1	0
	6/25/2024	0	0	1	1	1	1	1	1	1	0.0562089
	6/26/2024	0	0	0.2138136	0.7282981	1	1	1	1	1	1
	6/27/2024	0	0	0.9885838	1	1	1	0.0246757	1	1	0.0021748
	6/28/2024	0	0	0.2399489	1	1	1	1	1	1	0.0512354
	6/29/2024	0	0	0.9674751	0.0000013	1	1	1	1	1	1
	6/30/2024	0	0	1	0.4440782	1	1	1	1	1	0.016755
	7/1/2024	0	0	1	1	1	1	1	1	1	1
	7/2/2024	0	0	0.4678746	0.6911841	1	1	1	1	1	0.1023451
	7/3/2024	0	0	1	1	1	1	1	1	0.8994691	0.0039466
	7/4/2024	0	0.0009599	0.0000028	0	1	1	1	1	0.0058219	1
	7/5/2024	0	0	1	0.7770775	1	1	1	1	1	1
	7/6/2024	0	0	1	1	1	1	1	1	1	0.0000413
	7/7/2024	0	0	0.0378907	1	1	1	1	1	0.0000365	0.0001063
	7/8/2024	0	0	1	1	1	1	1	1	0.0065981	0

Table A 4. Maximum likelihood estimates (MLE) of species presence by night at ALC4, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Adelphi Laboratory Center from 24 June–8 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
ALC4	6/24/2024	0	0.7574696	1	1	1	0	1	1	1	1
	6/25/2024	0	0	1	1	1	1	0.001497	1	1	1
	6/26/2024	0.0122471	0	1	1	1	1	1	1	1	1
	6/27/2024	0	0	1	1	1	1	0.0000092	0.7002462	1	1
	6/28/2024	0.0000074	0	1	0.7453003	1	0.6175003	1	1	1	1
	6/29/2024	0.0311377	0.0000009	0.0860197	0.6052034	1	1	1	1	1	1
	6/30/2024	0	0.0000004	1	1	1	0.0103673	0.045634	1	1	1
	7/1/2024	0.0013554	0	1	1	1	0.0000002	0.7822273	1	0.1705791	1
	7/2/2024	0.041909	0.0000003	0.0348567	1	1	0.2510672	0.2308235	1	0.9115129	1
	7/3/2024	0	0	1	1	1	0.1949587	0.2364921	1	1	1
	7/4/2024	0.1106554	1	1	1	1	1	0.0265901	1	1	1
	7/5/2024	0	0.0008025	0.9571385	1	1	0.9205624	1	1	0.9885051	1
	7/6/2024	0.0045185	0.1450597	0.0599426	1	1	0.050455	0.224382	1	0.3905233	1
	7/7/2024	0	1	1	1	1	1	1	1	1	1
	7/8/2024	0.004517	1	0.0599409	1	1	1	1	1	0.0266701	1

Table A 5. Maximum likelihood estimates (MLE) of species presence by night at BP01, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP01	6/25/2024	0.0000002	0	1	1	1	1	1	1	0.9878269	1
	6/26/2024	1	0.0000001	0.0518919	1	1	0.9671574	1	1	1	1
	6/27/2024	0	0	0.9360895	1	1	1	1	1	1	1
	6/28/2024	0.0000277	0	0.5697827	1	1	0.3058404	1	1	1	1
	6/29/2024	0.0131689	0	0.0636574	0.9823806	1	1	1	1	0.5252376	1
	6/30/2024	0.0000166	0	0.6235115	1	1	1	1	1	1	1
	7/1/2024	0.0013554	0	1	1	1	0.9350521	0.1624634	1	1	1
	7/2/2024	0.000003	0	0.6405789	1	1	1	1	1	1	1
	7/3/2024	0	0	1	1	1	1	1	1	1	1
	7/4/2024	0.1106668	1	1	1	1	1	1	1	1	1
	7/5/2024	0	0	1	1	1	1	1	1	1	1
	7/6/2024	0.0013554	0	1	1	1	1	1	1	1	1
	7/7/2024	0.0566479	0	1	0.6612413	1	1	1	1	1	1
	7/8/2024	0.1106668	0	1	1	1	1	1	1	1	1
	7/9/2024	0.3267682	0	0.0154642	1	1	0.7927696	1	1	1	1

Table A 6. Maximum likelihood estimates (MLE) of species presence by night at BP02, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP02	6/25/2024	0	0	0.195358	1	1	0	1	1	1	1
	6/26/2024	0.0000018	0.0290105	1	1	1	0.0001534	1	1	0.8976424	1
	6/27/2024	0	0	1	1	1	0.6439165	1	1	1	1
	6/28/2024	0	0	0.6122445	1	1	0.6265225	1	1	1	1
	6/29/2024	0.0000018	0	1	1	1	0.013369	1	1	0.3093337	1
	6/30/2024	0	0	0.9838486	1	1	0.2613565	1	1	1	1
	7/1/2024	0.000003	0	0.6405789	1	1	0.8714714	1	1	1	0.997271
	7/2/2024	0.0000166	0	1	1	1	0.8477233	1	1	1	1
	7/3/2024	0	0	1	1	1	1	1	1	1	1
	7/4/2024	0.00015	1	1	1	1	1	1	1	1	1
	7/5/2024	0.0122976	0	1	1	1	1	1	1	0.0000349	1
	7/6/2024	0.0000002	0	1	1	1	1	1	1	0.0048449	1
	7/7/2024	0.0001503	0	1	1	1	1	1	1	0	1
	7/8/2024	0.0000018	0	1	1	1	0.0007448	1	1	0.328682	1
	7/9/2024	0.0122471	0	1	1	1	1	1	1	1	1

Table A 7. Maximum likelihood estimates (MLE) of species presence by night at BP03, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP03	6/25/2024	0	0	1	1	1	0.718553	1	1	1	1
	6/26/2024	0.0220718	0.0000624	0.2995912	1	1	0.6867761	1	1	0.8145209	1
	6/27/2024	0	0	1	1	1	0.0878775	1	1	0.2696936	1
	6/28/2024	0	0	1	1	1	1	1	1	0.7719665	1
	6/29/2024	1	0	1	1	1	1	1	1	0.5882738	1
	6/30/2024	0	0	1	1	1	0.4883267	1	1	1	1
	7/1/2024	1	0	1	1	1	0.3837814	1	1	1	1
	7/2/2024	0.1106693	0	1	1	1	0.0000225	1	1	1	1
	7/3/2024	0	0	0.9719091	1	1	1	1	1	0.5601878	1
	7/4/2024	0	0.0329121	1	1	1	0.6740972	1	1	0.9941022	1
	7/5/2024	0.0122488	0	1	1	1	1	0.0836819	1	0.0162805	1
	7/6/2024	0	0	1	1	1	0.165484	1	1	0.9904929	1
	7/7/2024	0	0	1	1	1	0.2199058	1	1	0.0018037	1
	7/8/2024	0.0000128	0	1	0.9950268	1	0.8129383	1	1	0	1
	7/9/2024	0.0000057	0	0.1601473	1	1	0.0000071	1	1	0.0033322	1

Table A 8. Maximum likelihood estimates (MLE) of species presence by night at BP04, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP04	6/25/2024	0.0000018	0	1	1	1	0.0005404	1	1	1	1
	6/26/2024	1	1	1	1	1	0.1009151	1	1	1	1
	6/27/2024	0.0013554	0.26666	1	1	1	0.0122404	1	1	0.0825501	1
	6/28/2024	0	0.0001309	1	0.0110415	1	0.0002952	1	1	0.4898066	1
	6/29/2024	0.0000166	0	1	1	1	0.1726286	1	1	1	1
	6/30/2024	0.0122473	0.0011927	1	1	1	0.005297	1	1	1	1
	7/1/2024	0.0122471	0.0125059	1	1	1	0	1	1	1	1
	7/2/2024	0.1106759	0	1	1	1	0.0000275	1	1	1	1
	7/3/2024	0.2047172	0.0000003	0.1866998	1	1	0.2702642	1	1	0.9142208	1
	7/4/2024	1	0.097444	1	1	1	1	1	1	1	1
	7/5/2024	1	0.0310653	1	1	1	1	1	1	0.2675353	1
	7/6/2024	1	0.0000798	1	1	1	0.6098991	1	1	1	0.529378
	7/7/2024	0.0013554	0.0001917	1	1	1	0.1329167	1	1	0.0101357	0.9790701
	7/8/2024	1	0	1	1	1	0.7628653	1	1	0.9736328	1
	7/9/2024	0.1106668	0	1	1	1	1	1	1	1	0.774564

Table A 9. Maximum likelihood estimates (MLE) of species presence by night at BP05, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP05	6/25/2024	0	0	1	1	1	0.5433738	1	0.8279204	1	1
	6/26/2024	0.0000166	0	1	1	1	0.4889756	1	1	1	1
	6/27/2024	0	0	0.9771016	1	1	1	1	1	0.4559599	1
	6/28/2024	0	0	1	1	1	1	1	1	0.7040881	1
	6/29/2024	0	0.0000021	1	1	1	0.4838072	1	1	0.8275372	1
	6/30/2024	0	0.00003	1	1	1	1	1	1	0.9353983	1
	7/1/2024	0	0	1	1	1	0.0013755	1	1	1	1
	7/2/2024	0	0	1	1	1	1	1	1	1	1
	7/3/2024	0	0	1	1	1	1	1	1	0.9994984	1
	7/4/2024	0.1106668	1	1	1	1	1	1	1	1	1
	7/5/2024	0	0.0088075	0.7917425	1	1	0.1699443	1	1	0.2956665	1
	7/6/2024	0	0	1	1	1	0.8651299	1	0.4315743	1	1
	7/7/2024	0.0122488	0.0000003	1	1	1	0.0030797	1	0.3705041	0.0014307	1
	7/8/2024	0	0.0012891	1	1	1	0.3260042	1	0.419998	0.0606145	1
	7/9/2024	0	0	1	1	1	0.9979244	1	1	0.3278008	1

Table A 10. Maximum likelihood estimates (MLE) of species presence by night at BP06, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP06	6/25/2024	0	0	1	1	1	1	1	1	1	1
	6/26/2024	0	0	1	1	1	1	1	1	1	1
	6/27/2024	0	0	1	1	1	1	1	1	1	1
	6/28/2024	0	0	1	1	1	1	1	1	1	1
	6/29/2024	0	0	1	1	1	1	1	1	1	1
	6/30/2024	0	0	1	1	1	1	1	1	1	1
	7/1/2024	0	0	1	1	1	1	1	1	1	1
	7/2/2024	0	0	1	1	1	1	1	1	1	1
	7/3/2024	0	0	1	1	1	1	1	1	1	1
	7/4/2024	0	0.0000065	1	1	1	0.7745571	1	1	0.9158275	1
	7/5/2024	0	0	1	1	1	1	1	1	1	1
	7/6/2024	0	0	1	1	1	1	0.024832	1	0.0545804	1
	7/7/2024	0	0	1	1	1	1	1	1	0.0047311	1
	7/8/2024	0	0	1	1	1	1	1	1	1	1
	7/9/2024	0	0	1	1	1	1	1	1	1	1

Table A 11. Maximum likelihood estimates (MLE) of species presence by night at BP07, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP07	6/25/2024	1	0.0021157	1	1	1	0.2001062	1	1	1	1
	6/26/2024	1	0.00003	1	1	1	1	1	1	0.935464	1
	6/27/2024	1	0	0.0000001	1	1	1	1	1	1	1
	6/28/2024	1	0	0.0026928	1	1	1	1	1	1	1
	6/29/2024	1	0	0.0026928	1	1	1	1	1	1	1
	6/30/2024	1	0.0000001	0.0518919	1	1	1	1	1	1	0.9457208
	7/1/2024	1	0.2481795	0.0514242	1	1	0.0572275	1	1	1	1
	7/2/2024	1	0	0.0000072	1	1	1	1	1	1	1
	7/3/2024	1	0.0000072	0.0001369	1	1	1	1	1	1	0.9696265
	7/4/2024	1	1	1	1	1	1	1	1	1	1
	7/5/2024	1	0.0137687	0	1	1	0.5334137	1	1	1	1
	7/6/2024	0.0000524	0.0009253	0.1234162	1	1	1	1	1	1	1
	7/7/2024	0.0716894	0	0.0030941	1	1	0.6190183	1	1	1	1
	7/8/2024	0.0716875	0.0000001	0.0030939	1	1	1	1	1	1	1
	7/9/2024	1	0.0031168	0.0026383	1	1	0.7878237	1	1	1	1

Table A 12. Maximum likelihood estimates (MLE) of species presence by night at BP08, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on and Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP08	6/25/2024	0.0038892	0	0.5554557	0.5609205	1	0.5757921	1	1	1	1
	6/26/2024	0	0	0.9719263	1	1	1	1	1	1	1
	6/27/2024	0	0	0.7577773	1	1	0.0000025	1	1	1	1
	6/28/2024	0	0	1	1	1	0.000001	1	1	1	1
	6/29/2024	0.0000166	0	1	1	1	0.0722992	1	1	1	1
	6/30/2024	0	0	1	1	1	1	1	1	1	1
	7/1/2024	1	0	1	1	1	0	1	1	1	1
	7/2/2024	0.0000057	0	0.1601355	1	1	0.0000376	1	1	1	1
	7/3/2024	0	0	1	1	1	0.0000005	1	1	1	1
	7/4/2024	0	1	0.805448	1	1	1	1	1	0.0892659	1
	7/5/2024	0.00015	0	1	1	1	0.0000083	1	1	1	1
	7/6/2024	0.000003	0	0.6405789	1	1	0.0150464	0.7359038	1	1	1
	7/7/2024	0	0	1	1	1	0.0000184	1	1	1	1
	7/8/2024	0.0000018	0	1	1	1	0	1	1	1	1
	7/9/2024	0	0	1	1	1	0.1363971	1	1	1	1

Table A 13. Maximum likelihood estimates (MLE) of species presence by night at BP09, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP09	6/25/2024	0	0	1	1	1	1	1	1	1	1
	6/26/2024	0.0000166	0	1	1	1	0.0791838	1	1	1	1
	6/27/2024	0	0	1	1	1	1	1	1	1	1
	6/28/2024	0	0	1	1	1	1	1	1	0.7377273	1
	6/29/2024	0.0000166	0	1	1	1	1	1	1	0.1564362	1
	6/30/2024	0	0	1	1	1	1	1	1	1	1
	7/1/2024	0.0122471	0	1	1	1	0.568962	1	1	1	1
	7/2/2024	0	0	1	1	1	1	1	1	1	1
	7/3/2024	0	0	1	1	1	1	1	1	1	1
	7/4/2024	1	0.1886334	1	1	1	0.9772004	1	1	0.0000009	1
	7/5/2024	1	0	1	1	1	1	1	1	1	1
	7/6/2024	0	0	1	1	1	1	1	1	1	1
	7/7/2024	0	0	1	1	1	1	1	1	1	1
	7/8/2024	0	0	1	1	1	1	1	1	1	1
	7/9/2024	0	0	1	1	1	1	1	1	1	1

Table A 14. Maximum likelihood estimates (MLE) of species presence by night at BP10, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP10	6/25/2024	1	0	0.0026928	1	1	0.3849422	1	1	1	0.0116088
	6/26/2024	1	1	1	1	1	0.1994513	1	1	0.0349796	1
	6/27/2024	0.0000028	0.0157304	0.1882546	1	1	1	1	1	0.5671592	0.8282436
	6/28/2024	0.6337895	0.0094953	0.000006	1	1	1	1	1	1	1
	6/29/2024	1	0.0097517	0.051892	1	1	0.4233216	1	1	0.9586563	0.0222438
	6/30/2024	1	0.0065789	0.1517025	0.5852521	1	0.8756667	1	1	0.9378975	0.8376728
	7/1/2024	0.0122473	0.0130803	1	1	1	0.0327714	1	1	0.936024	0.8431827
	7/2/2024	1	0.0000024	0.0101085	0.8118692	1	1	1	1	0.7070975	1
	7/3/2024	1	0.5361894	1	1	1	1	1	1	0.1467545	1
	7/4/2024	1	1	1	1	1	1	1	1	1	1
	7/5/2024	0.5760659	0.1366003	0.327908	0.2445705	1	0.7585252	1	1	0.2274451	0.8024957
	7/6/2024	0.0566475	0.001817	1	0.6612406	1	0.5349584	1	1	0.841161	0.9395164
	7/7/2024	0.0122498	0.0436682	1	1	1	1	1	1	0.0049081	0.651854
	7/8/2024	0.0023799	0.0310227	0.4002087	1	1	1	1	1	0.2671699	1
	7/9/2024	0.3267663	0.5360928	0.0154634	1	1	1	1	1	0.146725	1

Table A 15. Maximum likelihood estimates (MLE) of species presence by night at BP11, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP11	6/25/2024	1	0.0000012	0.0005606	0.9373672	1	0.021934	1	1	1	1
	6/26/2024	1	1	1	0.1852027	1	0.1009105	1	1	1	1
	6/27/2024	1	0.2842912	0.0000066	1	1	0.4674781	1	1	0.8461276	1
	6/28/2024	1	0.454259	0.1517028	0.5852528	1	0.0006269	1	1	0.8797256	0.4961316
	6/29/2024	1	0.1714062	0.0001397	1	1	0	1	1	0.1681369	1
	6/30/2024	1	1	0	1	1	0.0004685	1	0.558205	0.3547475	1
	7/1/2024	1	1	0.0518919	1	1	0	1	1	1	0.1819354
	7/2/2024	1	0.3609422	0.0001397	1	1	0	1	1	0.9886033	1
	7/3/2024	1	0.2809219	0.0000073	1	1	0	1	1	0.7542449	0.7505759
	7/4/2024	1	1	1	1	1	1	1	1	1	1
	7/5/2024	0.3483334	0.836463	1	0.4499753	1	0	1	1	0.6654215	1
	7/6/2024	1	1	0.1517028	0.5852528	1	0	1	1	1	0.681936
	7/7/2024	0.3267682	0.0005076	0.0154642	1	1	0	1	1	1	1
	7/8/2024	1	0.2463022	0.0000073	1	1	0	1	1	1	1
	7/9/2024	1	0.2275964	1	1	1	0	1	1	0.9734484	1

Table A 16. Maximum likelihood estimates (MLE) of species presence by night at BP12, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP12	6/25/2024	1	0.0000001	0.0000073	1	1	1	1	1	0.046335	1
	6/26/2024	1	0.0000055	1	1	1	1	1	1	0.4830121	1
	6/27/2024	0.6840538	0	0.0000002	1	1	0.9900915	1	1	1	1
	6/28/2024	0.1067775	0	0.0002391	1	1	1	1	1	1	1
	6/29/2024	1	0	0.0000073	1	1	1	1	1	0.6827936	0.2892213
	6/30/2024	0.2048042	0	0.1867792	1	1	1	1	1	0.2295893	1
	7/1/2024	1	0	0	1	1	1	1	1	0.2894982	1
	7/2/2024	1	0	0.0000073	1	1	1	1	1	0.0006789	0.508164
	7/3/2024	1	0.079288	0.0518919	1	1	1	1	1	1	0
	7/4/2024	1	1	1	1	1	1	1	1	1	1
	7/5/2024	1	0	0	1	1	1	1	1	1	0.0004149
	7/6/2024	1	0	0	1	1	1	1	1	1	1
	7/7/2024	1	1	0.0001353	1	1	0.000229	1	1	1	0.0001213
	7/8/2024	1	0	0	1	1	1	1	1	1	0.1076101
	7/9/2024	1	0.3837232	1	1	1	1	1	1	1	0

Table A 17. Maximum likelihood estimates (MLE) of species presence by night at BP13, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP13	6/25/2024	1	0.003384	0.2458921	0.1757923	1	0	1	1	0.9555506	0.2461942
	6/26/2024	1	0.0003018	0.0518888	1	1	1	1	1	1	1
	6/27/2024	1	0.2728003	0.0000067	1	1	0.5202227	1	1	0.8849914	0.4819043
	6/28/2024	0.0220718	0.5855082	0.2995914	1	1	0.0000028	1	1	1	0.3789871
	6/29/2024	1	0.6262612	1	1	1	0.1425794	1	1	0.0903933	0.6664407
	6/30/2024	0.1106715	0.001977	1	1	1	0.7711111	1	1	1	0.0013116
	7/1/2024	1	0.7729991	0.0518919	1	1	0	1	1	1	0.0001451
	7/2/2024	0.0220718	0.012841	0.299592	1	1	0.0001185	1	1	0.5088009	1
	7/3/2024	1	0.0004114	0	1	1	0.0305884	1	1	0.9549161	0.5875287
	7/4/2024	1	1	1	1	1	1	1	1	1	1
	7/5/2024	0.0122471	0.0000031	1	1	1	1	1	1	0.9402562	1
	7/6/2024	0.0220718	0.0000189	0.2995914	1	1	0.0992836	1	1	1	0
	7/7/2024	0.0045185	0.0000029	0.0599426	1	1	0	1	1	1	0
	7/8/2024	1	0	0.0518923	1	1	0	1	1	0.888763	0
	7/9/2024	1	0.0000001	0.1517031	0.5852542	1	0.5939341	1	1	0.4355627	0

Table A 18. Maximum likelihood estimates (MLE) of species presence by night at BP14, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP14	6/25/2024	0	0	1	1	1	0.4451827	1	1	0.1639143	1
	6/26/2024	0	0	1	1	1	1	1	1	0.1253266	1
	6/27/2024	0	0	1	1	1	0.0000004	1	1	1	1
	6/28/2024	0	0	1	1	1	0.0000019	1	1	0.3988361	1
	6/29/2024	0	0	1	1	1	1	1	1	0.0000003	1
	6/30/2024	0	0	0.9679606	1	1	1	1	1	1	1
	7/1/2024	0	0	0.4526631	1	1	0.0347955	1	1	1	1
	7/2/2024	0	0	1	1	1	0	1	1	1	1
	7/3/2024	0	0	1	1	1	1	1	1	1	1
	7/4/2024	0	1	1	1	1	1	1	1	0.0892659	1
	7/5/2024	0	0	1	1	1	0.6354571	1	1	0.7671114	1
	7/6/2024	0	0	1	1	1	0.319599	1	1	1	1
	7/7/2024	0	0	1	1	1	0.0000063	1	1	1	1
	7/8/2024	0	0	1	1	1	0.0004997	0.3356904	1	1	1
	7/9/2024	0	0	1	1	1	0.2994598	1	1	1	1

Table A 19. Maximum likelihood estimates (MLE) of species presence by night at BP15, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP15	6/25/2024	1	0	1	1	1	0	1	1	0.8975342	1
	6/26/2024	0.0122471	0	1	1	1	0.0423824	1	1	1	1
	6/27/2024	1	0.5281202	1	1	1	0.0000523	1	1	0.8383346	1
	6/28/2024	0	0.001457	1	1	1	0.0000307	1	1	0	1
	6/29/2024	1	0.0014359	1	1	1	0.9578502	1	1	0.8419434	0.9384637
	6/30/2024	1	0.4107452	1	1	1	1	1	1	0.3762729	1
	7/1/2024	1	0.0395521	1	1	1	0	1	1	0.286707	1
	7/2/2024	0.0220719	0	0.2995923	1	1	0	0.4867588	1	0.0273637	1
	7/3/2024	1	0	0.0519206	1	1	0.0000008	1	1	0.0000202	1
	7/4/2024	1	0.0009253	1	1	1	1	1	1	1	1
	7/5/2024	1	0	0.0026931	1	1	0.840199	1	1	0.0145731	1
	7/6/2024	1	0	1	1	1	1	0.0365895	1	0.8423358	1
	7/7/2024	1	0	0.0519128	1	1	1	0.0840711	1	0.0000003	1
	7/8/2024	0.0419096	0	0.0348572	1	1	0.0327099	1	1	0.0000011	0.9836322
	7/9/2024	1	0.0095501	1	1	1	0	1	1	0.4991629	0.0000415

Table A 20. Maximum likelihood estimates (MLE) of species presence by night at BP16, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP16	6/25/2024	0	0	1	1	1	1	1	1	0	1
	6/26/2024	0.0122471	0	1	1	1	1	1	1	1	1
	6/27/2024	0.0000997	0	0.0182827	1	1	1	1	1	1	1
	6/28/2024	0	0	1	1	1	1	1	1	1	1
	6/29/2024	0.204744	0	0.1867242	1	1	1	1	1	0.4386628	1
	6/30/2024	0	0	1	1	1	1	1	1	0.0343871	1
	7/1/2024	0	0	0.0802048	1	1	1	1	1	0.2682197	1
	7/2/2024	0	0	1	1	1	1	1	1	0.1836412	1
	7/3/2024	0	0	0.8730106	0.9829652	1	1	1	1	0.038653	1
	7/4/2024	0.0122471	0	1	1	1	1	1	1	1	1
	7/5/2024	0.5312268	0	1	0.0981035	1	1	1	1	0.1413528	1
	7/6/2024	0	0	0.8347305	1	1	1	1	1	0.9906717	1
	7/7/2024	0.0122685	0	1	1	1	1	1	1	0.0048917	1
	7/8/2024	0	0	1	1	1	1	1	1	0.0128542	1
	7/9/2024	0.0000019	0	0.6854351	1	1	1	1	1	0.2733348	1

Table A 21. Maximum likelihood estimates (MLE) of species presence by night at BP17, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP17	6/25/2024	0.1460462	0	0.000017	1	1	0.5679716	1	1	1	1
	6/26/2024	1	0	1	1	1	0.4911555	1	1	1	1
	6/27/2024	1	0.0000962	0.0026632	1	1	0.831235	1	1	1	0.7921333
	6/28/2024	0	0	0.9719041	1	1	0.7451019	1	1	1	1
	6/29/2024	0.0000018	0.0000003	1	1	1	0.0015616	1	1	0.8312796	1
	6/30/2024	0.6717398	0	0.0033678	0.5524818	1	0.0428525	1	1	1	1
	7/1/2024	0.041909	0	0.0348568	1	1	0.0286181	1	1	1	1
	7/2/2024	0.0000001	0	0.0497962	1	1	0.8518258	1	1	0.9708993	1
	7/3/2024	0.0044809	0	0.0373846	0.2325391	1	0.2063819	1	1	1	1
	7/4/2024	1	0.1548171	1	1	1	0.3500626	1	1	1	1
	7/5/2024	1	0.0000305	1	1	1	0.0552894	1	1	0.711812	1
	7/6/2024	0.5287304	0.0000006	0.0000674	1	1	0.0016741	1	1	0.9644479	0.5723375
	7/7/2024	0.1106668	0	1	1	1	0.0165042	1	1	1	1
	7/8/2024	1	0	0.0399761	0.110257	1	0.0000569	1	1	0.0130779	1
	7/9/2024	0.5287308	0	0.0000674	1	1	0	1	1	0.8716426	1

Table A 22. Maximum likelihood estimates (MLE) of species presence by night at BP18, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP18	6/25/2024	0.0000002	0	1	1	1	1	1	1	1	1
	6/26/2024	0	0	1	1	1	1	1	1	1	1
	6/27/2024	0	0	0.1443318	1	1	1	1	1	1	1
	6/28/2024	0	0	1	1	1	1	1	1	1	1
	6/29/2024	0.0000997	0	0.0182827	1	1	1	1	1	1	1
	6/30/2024	0	0	1	1	1	1	1	1	1	1
	7/1/2024	0	0	1	1	1	1	1	1	1	1
	7/2/2024	0	0	0.2669342	1	1	1	1	1	1	1
	7/3/2024	0	0	1	1	1	1	1	1	1	1
	7/4/2024	0	0	1	1	1	1	1	1	0	1
	7/5/2024	0.1106668	0	1	1	1	1	1	1	1	1
	7/6/2024	0	0	0.8874127	1	1	1	0.0678544	1	1	1
	7/7/2024	0	0	0.0000002	1	1	1	0.0344547	1	1	1
	7/8/2024	0	0	0.0011032	1	1	1	1	1	1	1
	7/9/2024	0	0	0.0333843	1	1	1	1	1	1	1

Table A 23. Maximum likelihood estimates (MLE) of species presence by night at BP19, based on automated species classifications and calculation of MLE by Kaleidoscope Pro software, for passive acoustic monitoring conducted on Blossom Point Research Facility from 25 June–9 July 2024. An MLE p <0.05 is considered evidence of presence (highlighted green).

Site	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
BP19	6/25/2024	0.0033012	0	0.3558803	1	1	0.006416	1	1	0.1622278	1
	6/26/2024	0.4049333	0	0.2467206	0.7116107	1	1	1	1	1	1
	6/27/2024	0	0	1	1	1	0.9999961	1	1	1	1
	6/28/2024	0	0	0.0640827	1	1	0	1	1	0.7001286	1
	6/29/2024	0.0045185	0	0.0599426	1	1	1	1	1	1	1
	6/30/2024	0	0	1	1	1	0.9389288	1	1	0.7386467	1
	7/1/2024	0.2047233	0	0.1867054	1	1	1	1	1	0.5146419	1
	7/2/2024	0	0	1	1	1	0.0071315	1	1	0.9852796	1
	7/3/2024	0	0	0.6122461	1	1	0.9241869	1	1	1	1
	7/4/2024	1	0.097444	1	1	1	1	1	1	1	1
	7/5/2024	0.0122473	0	1	1	1	1	1	1	0.9349283	1
	7/6/2024	0	0.0000001	0.9923355	1	1	0.9452546	1	1	0	1
	7/7/2024	0	0	0.7482677	1	1	0.4085939	1	1	0	1
	7/8/2024	0	0	1	1	1	1	1	1	0	1
	7/9/2024	0	0	1	1	1	1	1	1	0.0557148	1

Appendix B: Nightly presence-absence as determined by manual vetting

Species codes for all tables in this appendix:

EPFU = big brown bat, *Eptesicus fuscus*

LABO = eastern red bat, *Lasiurus borealis*

LACI = hoary bat, *Lasiurus cinereus*

LANO = silver-haired bat, *Lasionycteris noctivagans*

MYLE = eastern small-footed bat, *Myotis leibii*

MYLU = little brown bat, *Myotis lucifugus*

MYSE = northern long-eared bat, *Myotis septentrionalis*

MYSO = Indiana bat, *Myotis sodalis*

NYHU = evening bat, *Nycticeius humeralis*

PESU = tricolored bat, *Perimyotis subflavus*

Table B 1. Nightly detections (D) of bat species at ALC1 from 24 June–8 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/24/2024	389	D	D								D
6/25/2024	454	D	D								D
6/26/2024	143	D	D								
6/27/2024	351	D	D	D							D
6/28/2024	553	D	D	D							
6/29/2024	326	D	D				D				D
6/30/2024	450	D	D								D
7/1/2024	374	D	D				D				D
7/2/2024	718	D	D				D				D
7/3/2024	661	D	D	D			D				D
7/4/2024	207	D									D
7/5/2024	583	D	D	D							
7/6/2024	547	D	D				D				D
7/7/2024	491	D	D								D
7/8/2024	514	D	D								D

Table B 2. Nightly detections (D) of bat species at ALC2 from 24 June–8 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/24/2024	1573	D	D								D
6/25/2024	1713	D	D								D
6/26/2024	404	D	D							D	D
6/27/2024	1496	D	D							D	D
6/28/2024	1027	D	D	D						D	D
6/29/2024	778	D	D	D							D
6/30/2024	1142	D	D	D			D				D
7/1/2024	580	D	D				D				D
7/2/2024	900	D	D								D
7/3/2024	1173	D	D								D
7/4/2024	586	D	D	D						D	D
7/5/2024	1229	D	D								D
7/6/2024	1161	D	D				D			D	D
7/7/2024	1083	D	D				D			D	D
7/8/2024	1317	D	D							D	D

Table B 3. Nightly detections (D) of bat species at ALC3 from 24 June–8 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/24/2024	955	D	D	D						D	D
6/25/2024	1419	D	D	D						D	
6/26/2024	234	D	D							D	
6/27/2024	871	D	D	D						D	D
6/28/2024	988		D	D						D	D
6/29/2024	882	D	D	D							
6/30/2024	932	D	D	D							D
7/1/2024	334	D		D						D	
7/2/2024	835	D	D	D						D	D
7/3/2024	1065	D	D	D						D	D
7/4/2024	273	D	D	D							
7/5/2024	1270	D	D	D						D	D
7/6/2024	1239	D	D	D							D
7/7/2024	1433	D	D	D						D	D
7/8/2024	1570	D	D	D						D	D

Table B 4. Nightly detections (D) of bat species at ALC4 from 24 June–8 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/24/2024	142	D	D								
6/25/2024	133	D	D								
6/26/2024	79		D								
6/27/2024	143	D	D								
6/28/2024	291	D	D								
6/29/2024	46	D	D								
6/30/2024	344	D	D								
7/1/2024	208	D	D								
7/2/2024	94	D	D								
7/3/2024	152	D	D								
7/4/2024	18										
7/5/2024	118	D	D								
7/6/2024	106	D	D								
7/7/2024	66	D									
7/8/2024	84	D									

Table B 5. Nightly detections (D) of bat species at BP01 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	255	D	D								
6/26/2024	34		D								
6/27/2024	90	D	D								
6/28/2024	168	D	D								
6/29/2024	120		D	D							
6/30/2024	108		D	D							D
7/1/2024	124	D	D								
7/2/2024	143	D	D								
7/3/2024	171	D	D							D	
7/4/2024	7										
7/5/2024	115	D	D								
7/6/2024	182	D	D								D
7/7/2024	148	D	D								
7/8/2024	158		D								
7/9/2024	116		D	D							

Table B 6. Nightly detections (D) of bat species at BP02 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	532	D	D				D			D	
6/26/2024	55	D	D				D				
6/27/2024	252	D	D				D				
6/28/2024	239	D	D	D			D			D	
6/29/2024	136	D	D				D			D	
6/30/2024	166	D	D	D			D				
7/1/2024	70	D	D				D			D	
7/2/2024	79	D	D								
7/3/2024	121	D	D								
7/4/2024	31	D									
7/5/2024	168		D							D	
7/6/2024	315	D	D							D	
7/7/2024	187	D	D				D			D	
7/8/2024	180	D	D								
7/9/2024	130	D	D								

Table B 7. Nightly detections (D) of bat species at BP03 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	253	D	D							D	
6/26/2024	38	D	D							D	
6/27/2024	173	D	D							D	
6/28/2024	196	D	D							D	
6/29/2024	91		D				D			D	
6/30/2024	98	D	D							D	
7/1/2024	62		D								
7/2/2024	156	D	D				D				
7/3/2024	231	D	D				D				
7/4/2024	50	D	D								
7/5/2024	101	D	D								
7/6/2024	226	D	D				D				D
7/7/2024	250	D	D				D				
7/8/2024	269	D	D				D				
7/9/2024	311	D	D								

Table B 8. Nightly detections (D) of bat species at BP04 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	123	D	D				D				
6/26/2024	3										
6/27/2024	51	D	D								
6/28/2024	93	D	D	D			D				
6/29/2024	36	D	D								
6/30/2024	35	D	D								
7/1/2024	55	D	D				D				
7/2/2024	57		D				D				
7/3/2024	58	D	D	D			D				
7/4/2024	4										
7/5/2024	22		D								
7/6/2024	43		D				D			D	
7/7/2024	70	D	D								D
7/8/2024	76		D								
7/9/2024	93	D	D								

Table B 9. Nightly detections (D) of bat species at BP05 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	359	D	D				D			D	
6/26/2024	86	D	D							D	
6/27/2024	178	D	D	D						D	
6/28/2024	507	D	D							D	
6/29/2024	102	D	D				D				
6/30/2024	81	D	D								
7/1/2024	150	D	D				D				
7/2/2024	245	D	D				D				
7/3/2024	218	D	D	D							
7/4/2024	6										
7/5/2024	66		D								
7/6/2024	141	D	D				D			D	
7/7/2024	160		D				D			D	
7/8/2024	140	D	D				D				
7/9/2024	136	D	D								

Table B 10. Nightly detections (D) of bat species at BP06 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	486	D	D	D							
6/26/2024	137	D	D							D	
6/27/2024	598	D	D								
6/28/2024	682	D	D								
6/29/2024	476	D	D								
6/30/2024	534	D	D								
7/1/2024	516	D	D								
7/2/2024	480	D	D	D						D	
7/3/2024	558	D	D	D						D	
7/4/2024	257	D	D								
7/5/2024	448	D	D								
7/6/2024	869	D	D								
7/7/2024	865	D	D	D							
7/8/2024	749	D	D	D							
7/9/2024	395	D	D							D	

Table B 11. Nightly detections (D) of bat species at BP07 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	64		D								
6/26/2024	19		D								
6/27/2024	80		D								
6/28/2024	64		D							D	
6/29/2024	35		D								
6/30/2024	23		D								
7/1/2024	21		D				D				
7/2/2024	54		D								
7/3/2024	36		D								
7/4/2024	1										
7/5/2024	38		D				D				
7/6/2024	38	D	D								
7/7/2024	41	D	D								
7/8/2024	43		D								
7/9/2024	21		D								

Table B 12. Nightly detections (D) of bat species at BP08 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	374	D	D	D							
6/26/2024	70	D	D								
6/27/2024	257	D	D								
6/28/2024	387	D	D				D				
6/29/2024	165	D	D								
6/30/2024	335	D	D								
7/1/2024	433		D				D				D
7/2/2024	395	D	D								
7/3/2024	505	D	D								
7/4/2024	44	D									
7/5/2024	325	D	D								
7/6/2024	364		D	D							
7/7/2024	461	D	D				D				
7/8/2024	496	D	D				D				
7/9/2024	598	D	D				D				

Table B 13. Nightly detections (D) of bat species at BP09 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	691	D	D				D			D	
6/26/2024	133	D	D							D	
6/27/2024	300	D	D							D	
6/28/2024	423	D	D							D	
6/29/2024	126	D	D							D	
6/30/2024	387	D	D							D	
7/1/2024	271		D							D	
7/2/2024	355	D	D							D	
7/3/2024	320	D	D							D	
7/4/2024	43										
7/5/2024	179		D							D	
7/6/2024	265	D	D							D	
7/7/2024	404	D	D							D	
7/8/2024	330		D							D	
7/9/2024	405	D	D							D	

Table B 14. Nightly detections (D) of bat species at BP10 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	110		D								D
6/26/2024	12										
6/27/2024	36	D	D	D							D
6/28/2024	24		D	D							
6/29/2024	24		D								
6/30/2024	20		D	D							
7/1/2024	39		D				D				
7/2/2024	43		D	D						D	
7/3/2024	20										
7/4/2024	2										
7/5/2024	16	D	D				D			D	
7/6/2024	43										D
7/7/2024	33	D	D								
7/8/2024	26	D	D	D						D	
7/9/2024	12		D								

Table B 15. Nightly detections (D) of bat species at BP11 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	57		D	D			D				
6/26/2024	20										
6/27/2024	32			D							
6/28/2024	32						D				D
6/29/2024	65		D								
6/30/2024	67			D							
7/1/2024	134										D
7/2/2024	136		D				D				
7/3/2024	86		D				D				D
7/4/2024	5										
7/5/2024	185		D				D				
7/6/2024	181			D			D				
7/7/2024	168	D	D								
7/8/2024	141		D				D				
7/9/2024	125		D								

Table B 16. Nightly detections (D) of bat species at BP12 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	56		D								
6/26/2024	26		D								
6/27/2024	34		D								
6/28/2024	58	D	D								
6/29/2024	47		D								D
6/30/2024	69		D								
7/1/2024	97		D								
7/2/2024	78		D								D
7/3/2024	149		D								D
7/4/2024	0										
7/5/2024	58		D								D
7/6/2024	54		D								D
7/7/2024	31										D
7/8/2024	107		D								D
7/9/2024	35		D								D

Table B 17. Nightly detections (D) of bat species at BP13 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	56		D								D
6/26/2024	12		D								
6/27/2024	23										
6/28/2024	46	D	D	D			D				
6/29/2024	22		D								D
6/30/2024	21	D	D								D
7/1/2024	80										D
7/2/2024	47	D	D								
7/3/2024	49		D								D
7/4/2024	1										
7/5/2024	46	D	D								D
7/6/2024	91	D	D								D
7/7/2024	189		D								D
7/8/2024	238		D								D
7/9/2024	138		D	D							D

Table B 18. Nightly detections (D) of bat species at BP14 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	393	D	D				D				
6/26/2024	114	D	D								
6/27/2024	178	D	D								
6/28/2024	312	D	D								
6/29/2024	156	D	D							D	
6/30/2024	161	D	D	D							
7/1/2024	259	D	D				D				
7/2/2024	346	D	D				D			D	
7/3/2024	493	D	D				D			D	
7/4/2024	316	D									
7/5/2024	189	D	D	D			D				
7/6/2024	552	D	D				D				
7/7/2024	552	D	D				D			D	
7/8/2024	543	D	D	D			D				
7/9/2024	402	D	D				D				

Table B 19. Nightly detections (D) of bat species at BP15 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	326		D								
6/26/2024	153		D								
6/27/2024	44						D				
6/28/2024	146	D	D				D			D	
6/29/2024	45		D								
6/30/2024	23										
7/1/2024	165		D				D				
7/2/2024	232	D	D								
7/3/2024	277		D	D			D			D	
7/4/2024	5		D								
7/5/2024	92		D								D
7/6/2024	84		D								
7/7/2024	186		D				D			D	D
7/8/2024	174	D	D				D				
7/9/2024	117		D				D				D

Table B 20. Nightly detections (D) of bat species at BP16 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	612	D	D							D	
6/26/2024	64		D								
6/27/2024	138	D	D	D							
6/28/2024	330	D	D								
6/29/2024	241		D							D	
6/30/2024	392	D	D	D							D
7/1/2024	216	D	D								
7/2/2024	375	D	D							D	
7/3/2024	327	D	D								
7/4/2024	57	D	D								
7/5/2024	553	D	D								
7/6/2024	738	D	D	D						D	
7/7/2024	937	D	D								
7/8/2024	920	D	D							D	
7/9/2024	816	D	D							D	

Table B 21. Nightly detections (D) of bat species at BP17 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	411	D	D				D			D	D
6/26/2024	122		D				D				
6/27/2024	31		D	D							D
6/28/2024	207	D	D				D				
6/29/2024	122	D	D								
6/30/2024	152	D	D							D	
7/1/2024	175	D	D							D	
7/2/2024	207	D	D								
7/3/2024	168	D	D	D							
7/4/2024	10										
7/5/2024	76		D								
7/6/2024	101		D								
7/7/2024	170		D								
7/8/2024	271		D	D			D			D	
7/9/2024	315		D				D			D	

Table B 22. Nightly detections (D) of bat species at BP18 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	530	D	D								
6/26/2024	106		D								
6/27/2024	290		D								
6/28/2024	523	D	D							D	
6/29/2024	175	D	D								
6/30/2024	344	D	D								
7/1/2024	842	D	D							D	
7/2/2024	748	D	D	D						D	
7/3/2024	540	D	D				D			D	
7/4/2024	402	D	D							D	
7/5/2024	486	D	D							D	
7/6/2024	718	D	D	D						D	
7/7/2024	796	D	D							D	
7/8/2024	792	D	D							D	
7/9/2024	544	D	D	D						D	

Table B 23. Nightly detections (D) of bat species at BP19 from 25 June–9 July 2024. Bat files are files identified by Kaleidoscope Pro as containing bat echolocation calls via auto-classification. We confirmed at least one file per species per night by manual review of spectrograms to determine nightly presence.

Date	Bat files	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
6/25/2024	1018	D	D	D			D			D	
6/26/2024	128	D	D				D				
6/27/2024	360	D	D				D				
6/28/2024	389	D	D				D				
6/29/2024	230	D	D	D							
6/30/2024	543	D	D				D			D	
7/1/2024	108	D	D							D	
7/2/2024	225	D	D								
7/3/2024	186	D	D	D							
7/4/2024	3										
7/5/2024	98	D	D							D	
7/6/2024	241	D	D							D	
7/7/2024	298	D	D								
7/8/2024	251	D	D								
7/9/2024	245	D	D							D	

Appendix C: Weather conditions

Table C 1. Weather conditions during bat surveys at Adelphi Laboratory Center from 24 June–8 July 2024.

Location	Date	Sunrise	Sunset	Maximum temperature (F)	Average temperature (F)	Minimum temperature (F)	Humidity (%)	Precipitation (in)	Average wind speed (mph)	Moon phase	Phase (%)
ALC	6/24/2024	5:44 AM	8:38 PM	91	82	69	55	0.00	0.5	Waning gibbous	91.5
ALC	6/25/2024	5:44 AM	8:38 PM	92	79	60	54	0.00	0.3	Waning gibbous	84.1
ALC	6/26/2024	5:44 AM	8:38 PM	100	85	71	62	0.16	0.3	Waning gibbous	74.8
ALC	6/27/2024	5:45 AM	8:38 PM	91	78	69	72	0.13	0.2	Waning gibbous	64.2
ALC	6/28/2024	5:45 AM	8:38 PM	84	76	66	59	0.00	0.7	Waning gibbous	50.0
ALC	6/29/2024	5:45 AM	8:38 PM	93	82	70	74	0.00	0.7	Waning crescent	41.4
ALC	6/30/2024	5:46 AM	8:38 PM	98	85	76	74	0.02	0.3	Waning crescent	30.5
ALC	7/1/2024	5:46 AM	8:38 PM	81	71	62	59	0.00	0.6	Waning crescent	20.7
ALC	7/2/2024	5:47 AM	8:38 PM	89	75	59	59	0.00	0.4	Waning crescent	12.4
ALC	7/3/2024	5:47 AM	8:38 PM	91	78	67	67	0.00	0.6	Waning crescent	6.0
ALC	7/4/2024	5:48 AM	8:38 PM	97	82	70	75	0.01	0.2	Waning crescent	1.9
ALC	7/5/2024	5:48 AM	8:38 PM	101	87	75	73	0.00	0.3	New moon	0.0
ALC	7/6/2024	5:49 AM	8:37 PM	102	90	79	62	0.00	0.3	Waxing crescent	0.6
ALC	7/7/2024	5:49 AM	8:37 PM	99	86	77	54	0.00	0.3	Waxing crescent	3.1
ALC	7/8/2024	5:50 AM	8:37 PM	98	86	72	65	0.00	0.4	Waxing crescent	7.6

Table C 2. Weather conditions during bat surveys at Blossom Point Research Facility from 25 June–9 July 2024.

Location	Date	Sunrise	Sunset	Maximum temperature (F)	Average temperature (F)	Minimum temperature (F)	Humidity (%)	Precipitation (in)	Average wind speed (mph)	Moon phase	Phase (%)
BPRF	6/25/2024	5:42 AM	8:34 PM	90	78	62	58	0	2.6	Waning gibbous	91.5
BPRF	6/26/2024	5:42 AM	8:34 PM	93	81	72	73	0.47	2.3	Waning gibbous	84.1
BPRF	6/27/2024	5:43 AM	8:34 PM	86	77	70	76	0.42	1.4	Waning gibbous	74.8
BPRF	6/28/2024	5:43 AM	8:34 PM	78	75	70	70	0	4.9	Waning gibbous	64.2
BPRF	6/29/2024	5:44 AM	8:34 PM	89	81	72	80	0	3.1	Waning gibbous	50.0
BPRF	6/30/2024	5:44 AM	8:34 PM	90	84	76	80	0.16	2.1	Waning crescent	41.4
BPRF	7/1/2024	5:44 AM	8:34 PM	78	71	63	64	0.32	0.2	Waning crescent	30.5
BPRF	7/2/2024	5:45 AM	8:34 PM	82	73	60	68	0	0.2	Waning crescent	20.7
BPRF	7/3/2024	5:45 AM	8:34 PM	85	77	65	74	0	0.2	Waning crescent	12.4
BPRF	7/4/2024	5:46 AM	8:34 PM	98	79	73	81	0.45	0.4	Waning crescent	6.0
BPRF	7/5/2024	5:47 AM	8:33 PM	94	84	76	83	0	0.1	Waning crescent	1.9
BPRF	7/6/2024	5:47 AM	8:33 PM	93	87	79	70	0	0.1	New moon	0.0
BPRF	7/7/2024	5:48 AM	8:33 PM	92	84	75	65	0	0	Waxing crescent	0.6
BPRF	7/8/2024	5:48 AM	8:33 PM	90	83	74	79	0	0.1	Waxing crescent	3.1
BPRF	7/9/2024	5:49 AM	8:32 PM	93	85	77	70	0	0	Waxing crescent	7.6

Appendix D: Site locations and descriptions

Table D 1. Locations and descriptions of sites sampled for bats at Adelphi Laboratory Center and Blossom Point Research Facility from 24 June–9 July 2024. Coordinates are in the NAD83 Zone 18 datum.

Site code	First night	Last night	Detector nights	Easting	Northing	Mic height (m)	Deployment description
ALC1	6/24/2024	7/8/2024	15	329667	4322212	3.5	Mic placed on fence along small clearing near road.
ALC2	6/24/2024	7/8/2024	15	329695	4321904	3.4	On snag next to water, closed canopy above, open understory.
ALC3	6/24/2024	7/8/2024	15	330277	4322013	7	On broken bridge over Paint Branch. Open air with forest around.
ALC4	6/24/2024	7/8/2024	15	330562	4322363	3.7	Pole placed on fence along forested flight corridor.
BP01	6/25/2024	7/9/2024	15	317531	4255395	3.2	Forest clearing.
BP02	6/25/2024	7/9/2024	15	317329	4255320	3.5	Forest clearing.
BP03	6/25/2024	7/9/2024	15	317070	4255086	3.6	Forested corridor.
BP04	6/25/2024	7/9/2024	15	317045	4254740	3.7	Forested corridor.
BP05	6/25/2024	7/9/2024	15	317122	4254676	3.3	Forested corridor.
BP06	6/25/2024	7/9/2024	15	317032	4254165	3.4	Grassy road.
BP07	6/25/2024	7/9/2024	15	316610	4254803	3.6	Forested corridor.
BP08	6/25/2024	7/9/2024	15	317943	4255044	3.3	Interior forest corridor.
BP09	6/25/2024	7/9/2024	15	317885	4254438	3.8	Forest clearing.

Site code	First night	Last night	Detector nights	Easting	Northing	Mic height (m)	Deployment description
BP10	6/25/2024	7/9/2024	15	318210	4256054	2.9	Forest clearing.
BP11	6/25/2024	7/9/2024	15	318571	4255806	3.2	Interior forest. Closed canopy. Low understory.
BP12	6/25/2024	7/9/2024	15	317876	4256331	3.2	Interior forest. Closed canopy. Open understory.
BP13	6/25/2024	7/9/2024	15	317608	4256090	3.4	Forest interior.
BP14	6/25/2024	7/9/2024	15	317223	4255674	2.9	Forested corridor.
BP15	6/25/2024	7/9/2024	15	316844	4255505	3.6	Forested corridor.
BP16	6/25/2024	7/9/2024	15	316548	4255183	3.7	Forest clearing.
BP17	6/25/2024	7/9/2024	15	316997	4253802	3.7	Forested corridor.
BP18	6/25/2024	7/9/2024	15	317737	4254076	3.1	Forested corridor.
BP19	6/25/2024	7/9/2024	15	316533	4253754	3.8	Interior forest clearing.

Appendix E: Photographs of bat detector deployments



Figure E 1. Acoustic detector deployment at ALC1 on Adelphi Laboratory Center, MD.



Figure E 2. Acoustic detector deployment at ALC2 on Adelphi Laboratory Center, MD.



Figure E 3. Acoustic detector deployment at ALC3 on Adelphi Laboratory Center, MD.



Figure E 4. Acoustic detector deployment at ALC4 on Adelphi Laboratory Center, MD.



Figure E 5. Acoustic detector deployment at BP01 on Blossom Point Research Facility, MD.



Figure E 6. Acoustic detector deployment at BP02 on Blossom Point Research Facility, MD.



Figure E 7. Acoustic detector deployment at BP03 on Blossom Point Research Facility, MD.



Figure E 8. Acoustic detector deployment at BP04 on Blossom Point Research Facility, MD.



Figure E 9. Acoustic detector deployment at BP05 on Blossom Point Research Facility, MD.



Figure E 10. Acoustic detector deployment at BP06 on Blossom Point Research Facility, MD.



Figure E 11. Acoustic detector deployment at BP07 on Blossom Point Research Facility, MD.



Figure E 12. Acoustic detector deployment at BP08 on Blossom Point Research Facility, MD.



Figure E 13. Acoustic detector deployment at BP09 on Blossom Point Research Facility, MD.



Figure E 14. Acoustic detector deployment at BP10 on Blossom Point Research Facility, MD.



Figure E 15. Acoustic detector deployment at BP11 on Blossom Point Research Facility, MD.



Figure E 16. Acoustic detector deployment at BP12 on Blossom Point Research Facility, MD.



Figure E 17. Acoustic detector deployment at BP13 on Blossom Point Research Facility, MD.



Figure E 18. Acoustic detector deployment at BP14 on Blossom Point Research Facility, MD.



Figure E 19. Acoustic detector deployment at BP15 on Blossom Point Research Facility, MD.



Figure E 20. Acoustic detector deployment at BP16 on Blossom Point Research Facility, MD.



Figure E 21. Acoustic detector deployment at BP17 on Blossom Point Research Facility, MD.

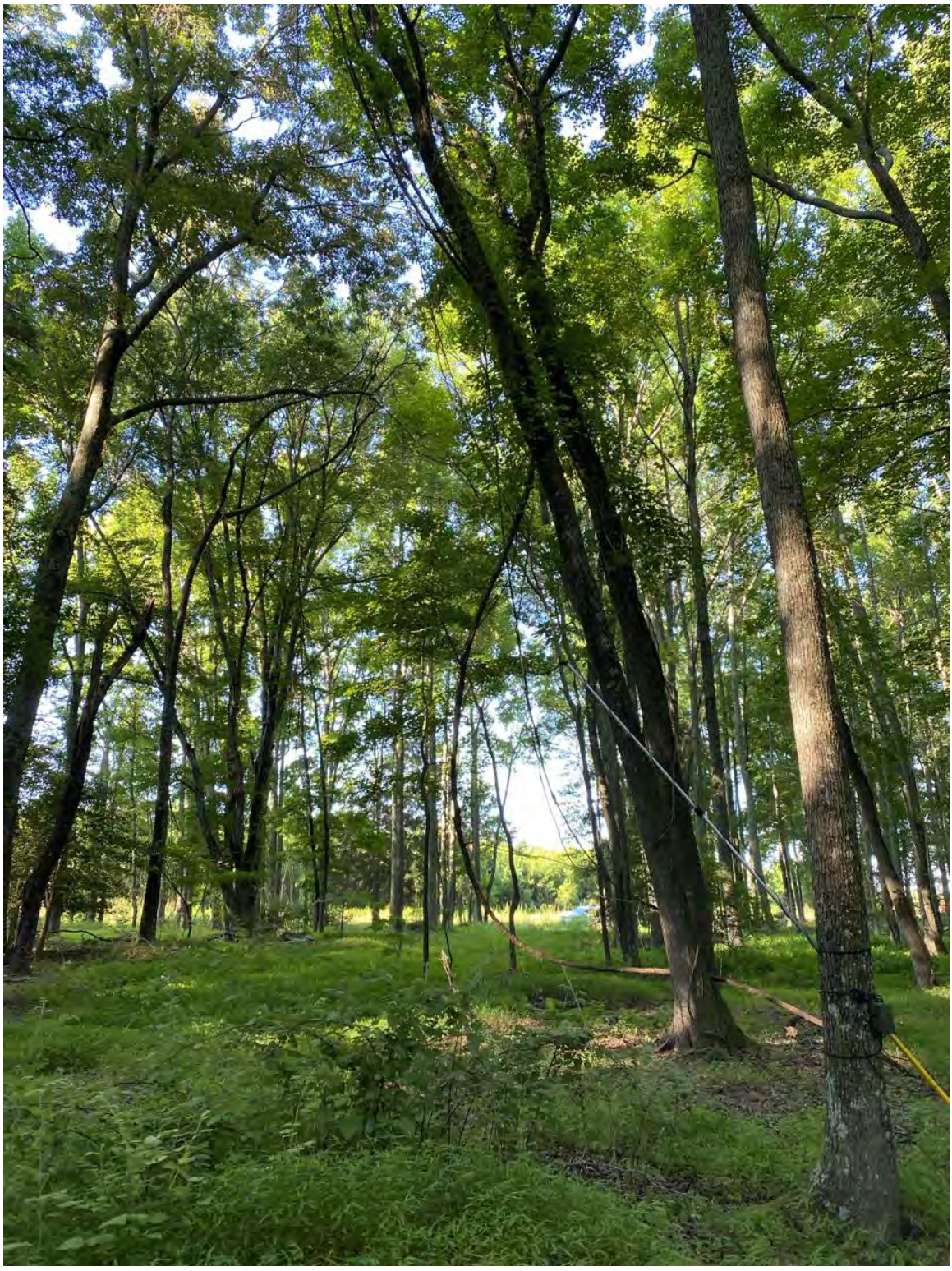


Figure E 22. Acoustic detector deployment at BP18 on Blossom Point Research Facility, MD.



Figure E 23. Acoustic detector deployment at BP19 on Blossom Point Research Facility, MD.

Appendix F: Example spectrograms of species recorded

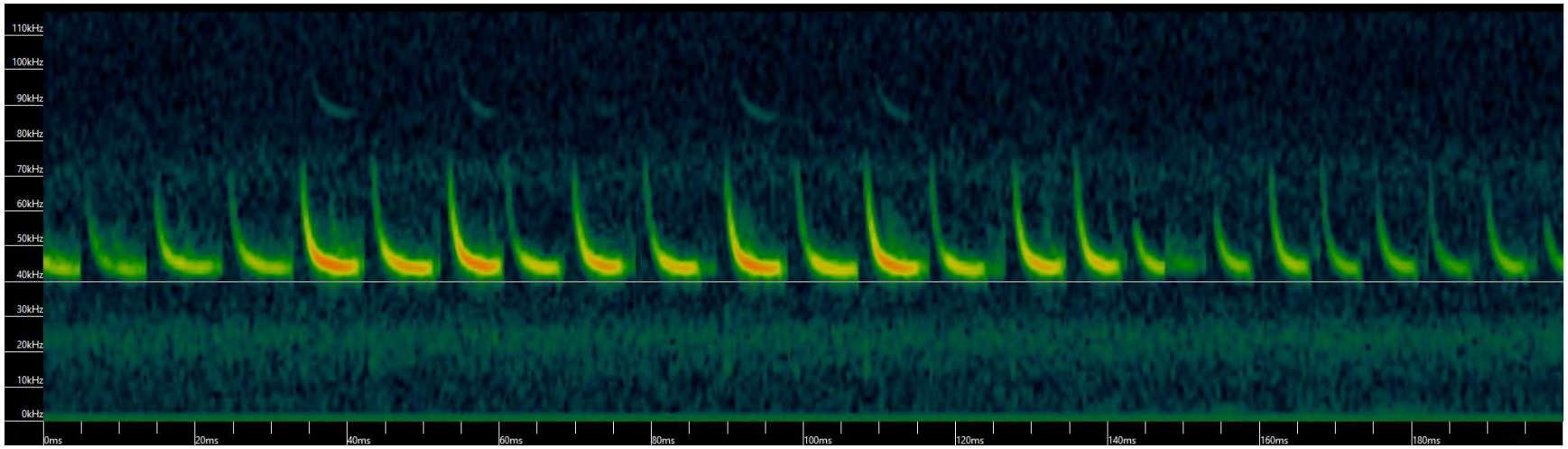


Figure F 1. Spectrogram of an echolocation call sequence of a tricolored bat (*Perimyotis subflavus*) visualized in full spectrum format (amplitude shown in green to red color gradient). Time (ms) is on the x-axis; frequency (kHz) is on the y-axis. A gray reference line is at 40 kHz. Screenshot was taken in Kaleidoscope Pro v 5.6.4.

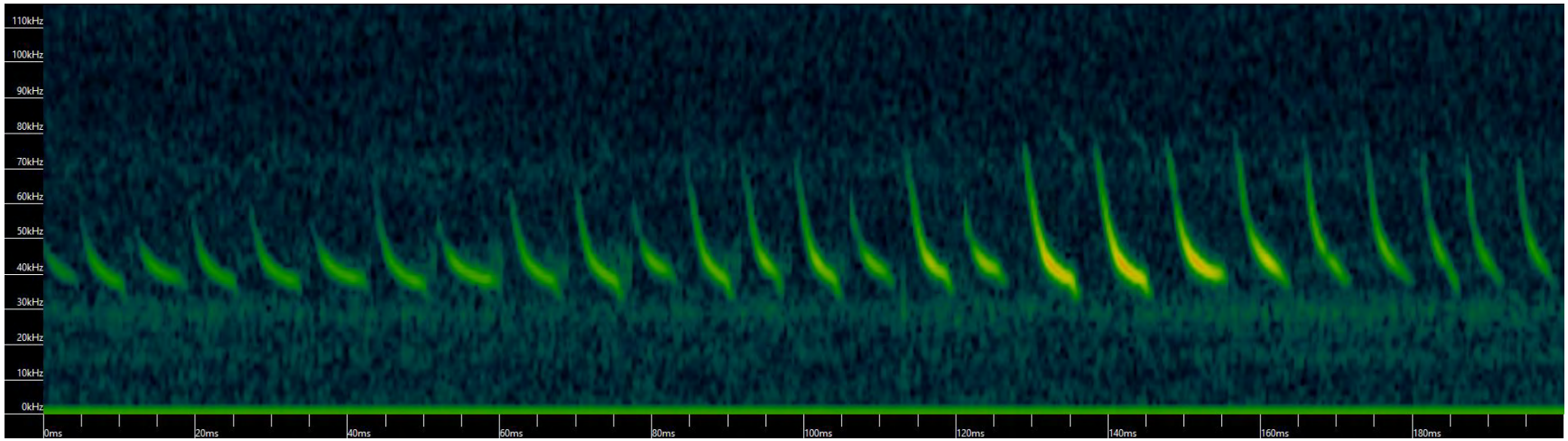


Figure F 2. Spectrogram of an echolocation call sequence of a little brown bat (*Myotis lucifugus*) visualized in full spectrum format (amplitude shown in green to red color gradient). Time (ms) is on the x-axis; frequency (kHz) is on the y-axis. Screenshot was taken in Kaleidoscope Pro v 5.6.4.

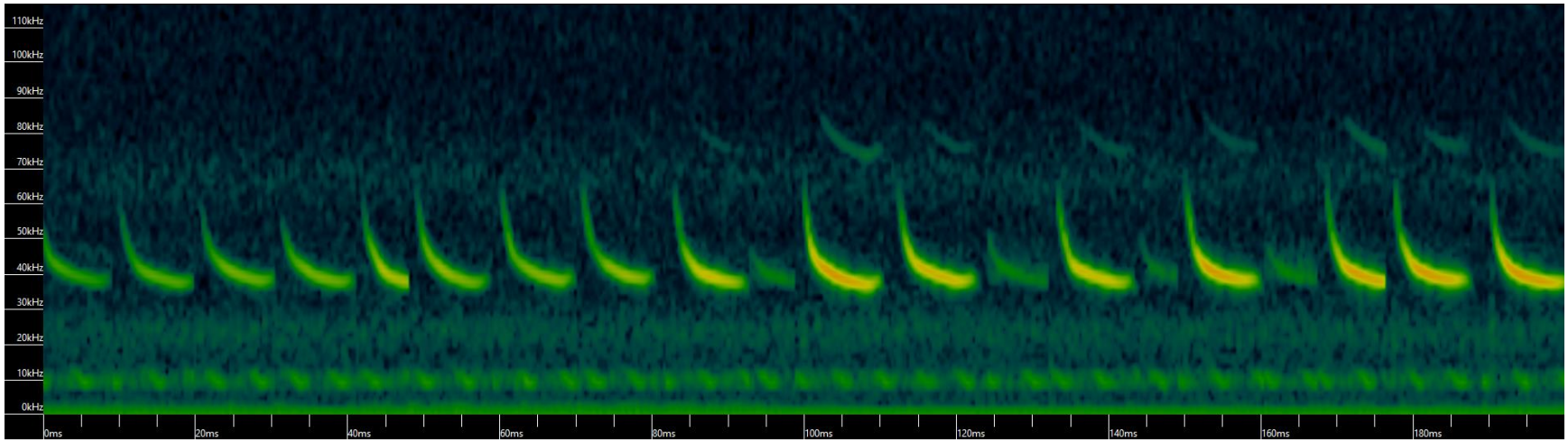


Figure F 3. Spectrogram of an echolocation call sequence of an evening bat (*Nycticeius humeralis*) visualized in full spectrum format (amplitude shown in green to red color gradient). Time (ms) is on the x-axis; frequency (kHz) is on the y-axis. Screenshot was taken in Kaleidoscope Pro v 5.6.4.

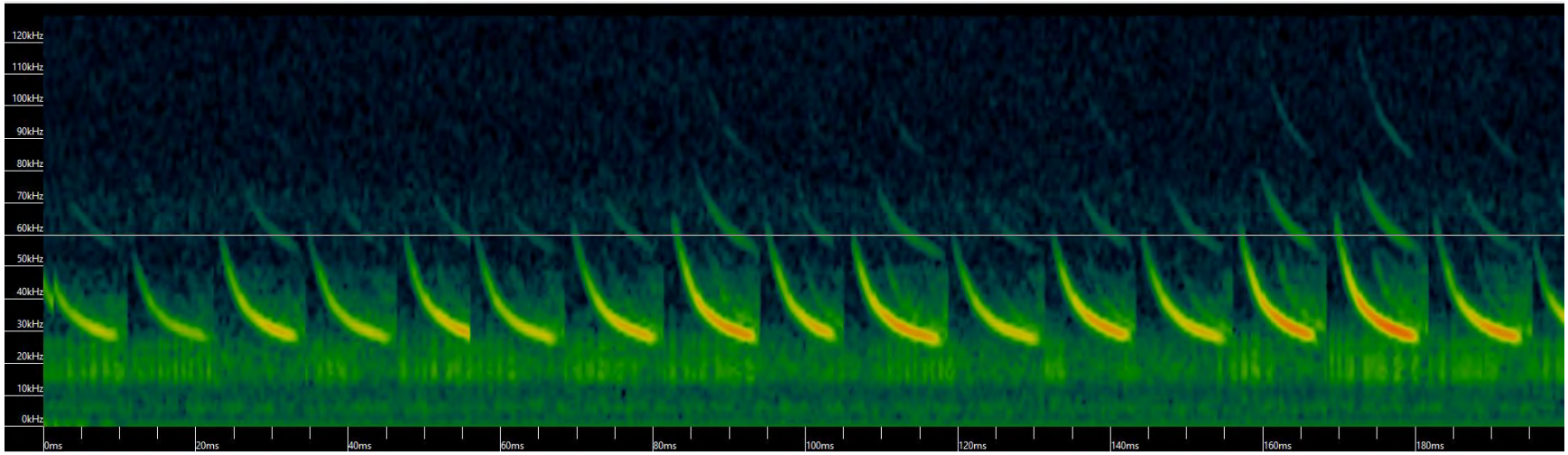


Figure F 4. Spectrogram of an echolocation call sequence of a big brown bat (*Eptesicus fuscus*) visualized in full spectrum format (amplitude shown in green to red color gradient). Time (ms) is on the x-axis; frequency (kHz) is on the y-axis. A gray reference line is at 60 kHz. Screenshot was taken in Kaleidoscope Pro v 5.6.4.

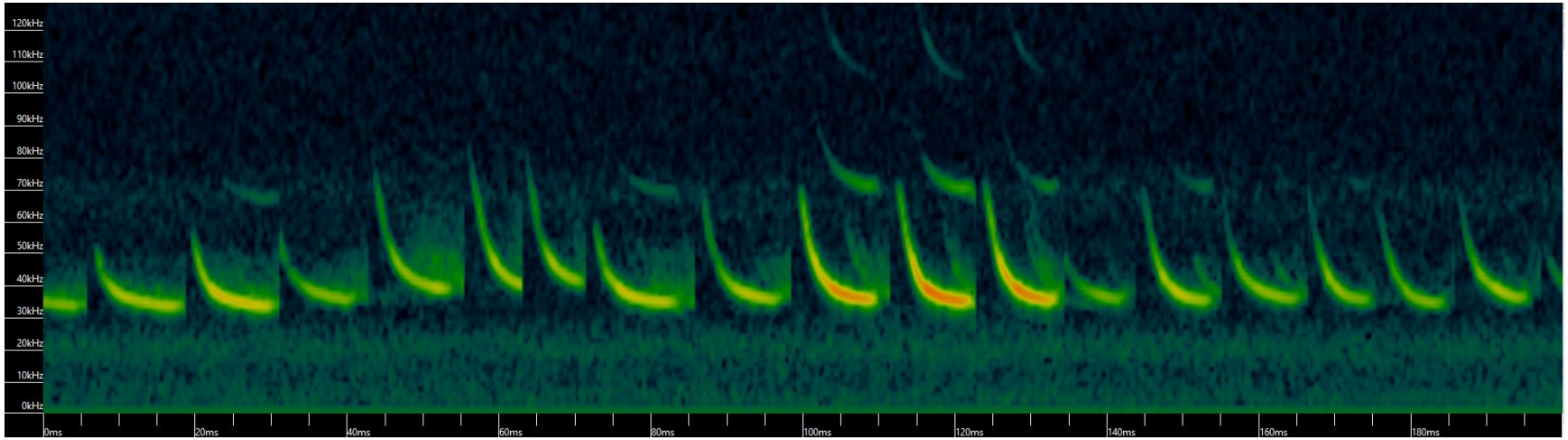


Figure F 5. Spectrogram of an echolocation call sequence of an eastern red bat (*Lasiurus borealis*) visualized in full spectrum format (amplitude shown in green to red color gradient). Time (ms) is on the x-axis; frequency (kHz) is on the y-axis. Screenshot was taken in Kaleidoscope Pro v 5.6.4.

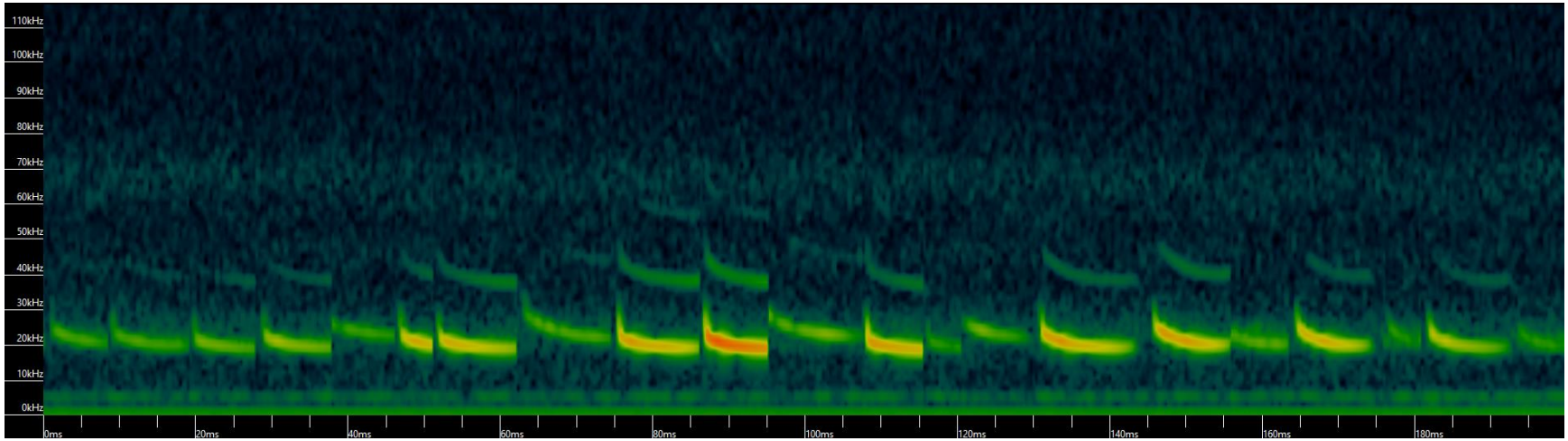


Figure F 6. Spectrogram of an echolocation call sequence of a hoary bat (*Lasiurus cinereus*) visualized in full spectrum format (amplitude shown in green to red color gradient). Time (ms) is on the x-axis; frequency (kHz) is on the y-axis. A gray reference line is at 20 kHz. Screenshot was taken in Kaleidoscope Pro v 5.6.4.

US Army Corps of Engineers
Baltimore District

Rare, Threatened and Endangered Species Surveys

U.S. Army Garrison Adelphi Laboratory Center and Blossom Point Research Facility
Prince Georges and Charles Counties, Maryland



Prepared for: **U.S. Army Garrison Adelphi Laboratory Center,**
Environmental Division
2800 Powder Mill Road
Adelphi, Maryland 20783

Prepared by: **U.S. Army Corps of Engineers, Baltimore District**
10 South Howard Street
Baltimore, Maryland 21201

April 2016

RARE, THREATENED AND ENDANGERED SPECIES SURVEYS

U.S. ARMY GARRISON ADELPHI LABORATORY CENTER AND BLOSSOM POINT RESEARCH FACILITY
Prince Georges and Charles Counties, Maryland

Prepared for:

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1.0 INTRODUCTION

The U.S. Army Corps of Engineers, Baltimore District (USACE) conducted Rare, Threatened and Endangered (RTE) flora and fauna surveys at U.S. Army Garrison Adelphi Laboratory Center (ALC) and Blossom Point Research Facility (BPRF). RTE surveys were conducted at both facilities between 23 June and 12 August 2015 to assess the potential presence of state or federally-listed plant and animal species and/or habitat which could support such species. ALC, headquarters of the Army Research Laboratory, is an active military research and development facility, approximately 202 acres in size, located partly in both Prince Georges and Montgomery Counties, Maryland (Figure 1). BPRF, a satellite installation to ALC, is an active military testing range, approximately 1,600 acres in size, located in Charles County, Maryland (Figure 2).

2.0 STUDY PURPOSE

The purpose of this study was to conduct a one-time survey of ALC and BPRF to note any occurrences of RTE species and habitat types that may potentially support RTE species. This survey is a supplement to the existing Integrated Natural Resource Management Plan (INRMP) and Planning Level Surveys at ALC and BPRF.

An endangered species is defined as any species that is in danger of extinction throughout all or a significant portion of its range. The Endangered Species Act (ESA) of 1973 requires the Department of the Interior to identify and list these species. A threatened species is defined as any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Only species listed by the Department of Interior are protected under the ESA. Due to habitat loss and species fluctuations, the lists of protected species are constantly changing. Species designated as rare, species of concern, or special concern by the federal government or state and local agencies are not legally protected, but populations of species with these designations are tracked by various resource agencies, including the United States Fish and Wildlife Service (USFWS) and the Maryland Department of Natural Resources (MDNR) Natural Heritage Program.

Pursuant to Section 7 of the ESA, information on the potential existence of RTE plant and wildlife species in the project area was researched using the existing INRMP (2014) and the agency correspondence conducted as part of the INRMP.

3.0 METHODS

This study was accomplished through (1) a desktop reconnaissance of available studies conducted on and around the environs of ALC and BPRF; (2) field surveys at the installations to document species and habitat findings; and (3) creation of maps depicting findings.

3.1 Desktop Reconnaissance

Prior to conducting field surveys, USACE reviewed available data from the ALC and BPRF INRMP (2014), the agency coordination associated with the INRMP, and the Planning Level

Adelphi
Laboratory Center
Adelphi
Laboratory Center
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Figure 1. Adelphi Laboratory Center
Location
Montgomery and Prince George's Counties, MD
November 2015

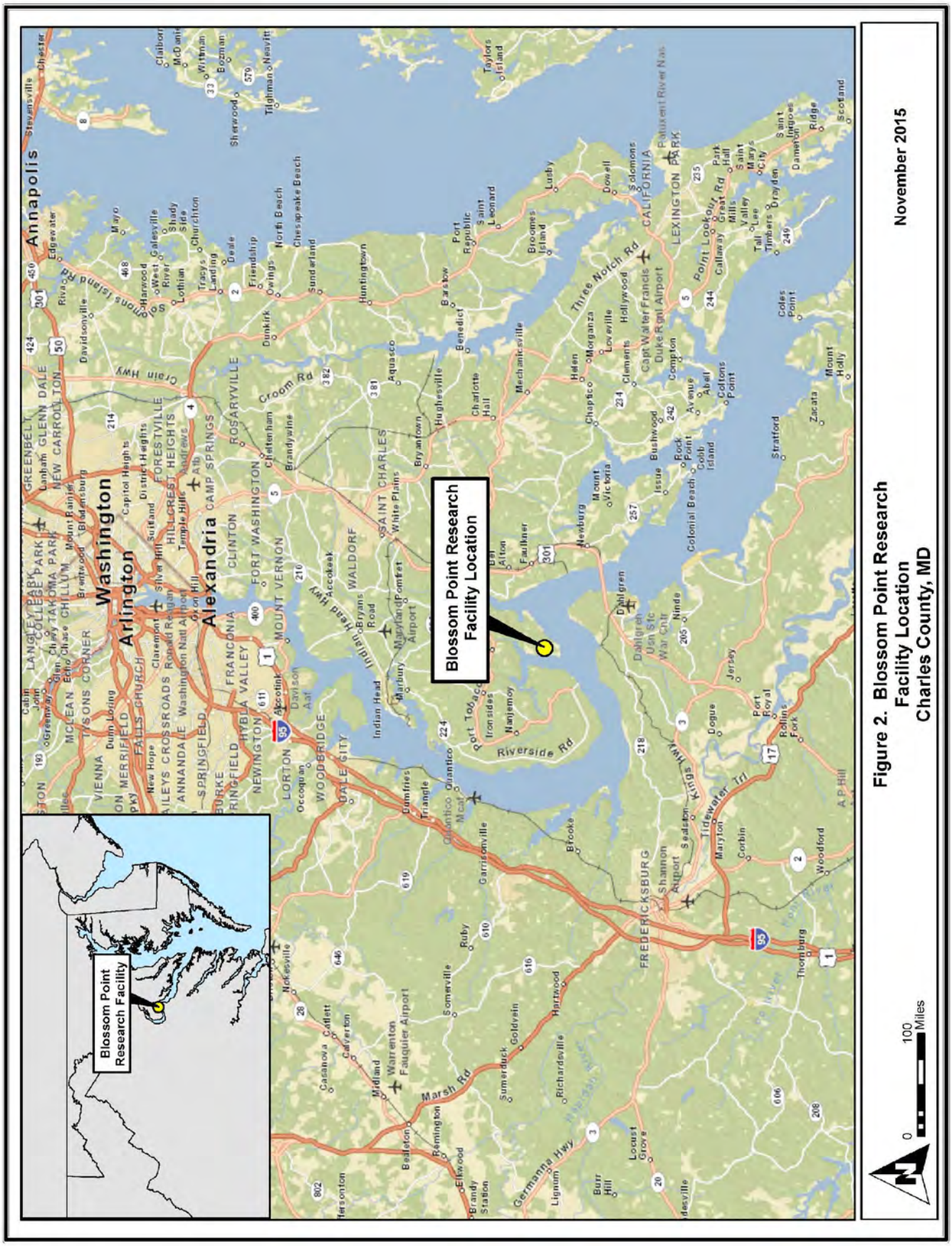


Figure 2. Blossom Point Research Facility Location Charles County, MD

November 2015

Surveys (2011). The review indicated previous records of two state-listed RTE species on ALC, Long's rush (*Juncus longii*) and capitate beaked-rush (*Rhynchospora cephalantha*), and potential habitat for RTE species on both ALC and BPRF.

The USFWS and DNR were contacted during the INRMP update in 2014 for information regarding threatened and endangered species and significant habitats on or in the vicinity of the installations. The response correspondence (dated 2013) received from those agencies can be found in the current INRMP (2014). In brief, the response follows:

Federally-Listed Species
USFWS stated that there are no records of Federally-listed species on ALC or BPRF. Habitat for the Federally-listed small whorled pogonia (*Isotria medeloides*) is present on BPRF, though this plant is believed to be extirpated from the State of Maryland. The area of the Potomac River surrounding BPRF may provide spawning habitat for the Atlantic Sturgeon (*Acipenser oxyrinchus*), a federally endangered fish species. Additionally, sensitive joint-vetch (*Aeschynomene* virginica) is known or believed to occur in both Prince Georges and Charles Counties. The following is a link to federally listed species found in Maryland: http://ecos.fws.gov/tess_public/reports/species-listed-by-state-report?state=MD&status=listed

State-Listed Species
On ALC, MDNR indicated the presence of two state-endangered plant species and one highly state-rare habitat, a fall-line terrace gravel bog, in which the two listed species are found. MDNR stated that there were no records of state-listed RTE species on BPRF. Several species and habitats of concern were noted on BPRF, to include bald eagles, waterfowl habitat, habitat for the state endangered rainbow snake, Forest Interior Dwelling Species (FIDS) habitat, terrapin and horseshoe crab spawning habitat, largemouth bass habitat and striped bass and anadromous fish species spawning habitat in the Potomac River. The following is a link to Maryland's listed species: http://dnr2.maryland.gov/wildlife/Pages/plants_wildlife/rte/espaa.aspx

3.2 Data Collection

The RTE surveys were conducted at ALC from 30 June to 2 July, 2015 and at BPRF from 22-24 June and 10-12 August, 2015. The surveys utilized the Trimble GeoXH handheld GPS system for location data collection yielding sub-meter horizontal accuracy. Photographs and the GPS location of any observed RTE species were taken. GPS data was then downloaded to ArcGIS for mapping. This survey horizontally references the North American Datum of 1983 (NAD83), Geographic Coordinate System, World Geodetic System 1984.

3.3 Survey Methods

The surveys were conducted using visual search along transects. A team of two people followed rough transects, spaced approximately 20-30 feet apart, throughout the sites. At ALC, 6 survey days (3 days per surveyor), 8 hours each, were spent in the survey for a total of 48 hours of survey. At BPRF, 12 survey days (6 days per surveyor), 8 hours each, were spent in the survey for a total of 96 hours of survey.

Observations of avian and other wildlife species were recorded as they were encountered. Wildlife species presence were determined by direct observation of an individual, tracks, scat, calls, dens, nests, or any other means available. Particular attention was paid to habitat types that support the threatened or endangered species that may possibly utilize the survey areas.

4.0 SURVEY RESULTS

4.1 Adelphi Laboratory Center

No state or federally-listed RTE species of flora or fauna were observed during the 2015 survey.

The survey was concentrated in undeveloped areas, including forested areas and stream corridors and wetlands. Special attention was given to the Powder Mill Bog, a Fall-line Terrace Gravel Wetland, which is considered a highly state-rare habitat (Figure 3). Two state endangered plant species, Long's rush and capitate beaked-rush, which were recorded in Powder Mill Bog previously, were not observed during planning level surveys in 2011.

Although, the Powder Mill Bog remnant is still intact, neither of the two state-listed plants, mentioned above, were observed during the 2015 survey. However, this highly state-rare habitat could still provide potential habitat for those species, or other RTE species, in the future. Some encroachment of non-native, invasive species, especially Japanese stiltgrass (*Microstegium vimineum*) was noted in the Powder Mill Bog.

Habitat for FIDS, some of which are listed as RTE, does exist on-site and is contiguous with similar habitat in the surrounding area. These large tracts of forest are important habitat for certain bird species and may also serve as summer foraging and roosting habitat for the federally-listed Northern Long-Eared Bat (*Myotis septentrionalis*) and Indiana Bat (*Myotis sodalis*).

Habitat for the spotted turtle (*Clemmys guttata*) is present on ALC. The spotted turtle is currently under a 12 month review period, as of July 2015, to be considered for listing as threatened or endangered.

Powder Mill Bog Remnant
Adelphi Labratory Center
WASHINGTON
Alexandria
November 2015
Figure 3. Location of Powder Mill
Bog Remnant on ALC
Montgomery and Prince George's Counties, MD
0
16
Miles

4.2 Blossom Point Research Facility

No federally-listed species of flora or fauna were observed; however, one state rare/watchlist species was observed on site. A single American chestnut (*Castanea dentata*) (Figure 4) was located. The tree had a diameter at breast height (DBH) of 6 inches and a height of approximately 30 feet. It exhibited no signs of the chestnut blight. The American chestnut is state-listed as S2/S3 (State rare/watchlist). The tree was associated with a mature mixed forest type of southern red oak (*Quercus falcata*), white oak (*Quercus alba*), bitternut hickory (*Carya cordiformis*), Virginia pine (*Pinus virginiana*), loblolly pine (*Pinus taeda*), highbush blueberry (*Vaccinium corymbosum*), southern arrowwood (*Viburnum dentatum*), and glaucous greenbrier (*Smilax glauca*).

Habitat for the federally-endangered small-whorled pogonia was observed throughout the site within the mature upland hardwood and mixed deciduous/coniferous forests. The site visits were timed to occur during the flowering period of small-whorled pogonia, but no individuals were observed.

Habitat for the state-endangered rainbow snake (*Farancia erytrogramma*) was noted throughout the site. Habitat is listed as streams, swamps and marshes with floating vegetation for cover. A herptofaunal survey in 2011 (Benedict, 2011) did not locate any individuals. No individual rainbow snakes were observed during this survey.

Habitat for FIDS, some of which are listed as RTE, does exist on-site and is contiguous with similar habitat in the surrounding area. These large tracts of forest are important habitat for certain bird species and may also serve as summer foraging and roosting habitat for the federally-listed Northern Long-Eared Bat and Indiana Bat.

The spotted turtle was observed on BPRF during the planning level surveys in April 2012. Suitable habitat for the spotted turtle is common throughout BPRF. The spotted turtle is under a 12 month review period, as of July 2015, to be considered for listing as threatened or endangered.


Location of American Chestnut
Figure 4. Location of American Chestnut on Blossom Point Research Facility
Facility Location: Charles County, MD
November 2015
0
100
Miles

5.0 CONCLUSIONS/RECOMMENDATIONS

The RTE species surveys were conducted between 23 June and 12 August 2015 at Adelphi Laboratory Center and Blossom Point Research Facility, Prince Georges and Charles Counties, Maryland, respectively. The purpose was to survey for the potential presence of RTE species and/or potential suitable habitat for RTE species.

No state or federally-listed species were observed on ALC. The remnant of the Powder Mill Bog, a highly state-rare habitat was observed. Two state-listed species, which were observed in Powder Mill Bog previously, were not observed during this survey. It is recommended that invasive species control measures be performed on a regular basis in order to preserve the native communities on-site, especially the Powder Mill Bog remnant, which is experiencing some invasive growth.

No federally-listed species were observed on BPRF; one state-listed species was observed. A single American chestnut was located, which is listed as S2/S3 (State rare/watchlist). The American chestnut, once a dominant tree species in eastern forests and valuable to wildlife as well as an important timber species, has been almost eliminated by the chestnut blight, caused by the introduced fungus *Endothia parasitica*. American chestnuts in good condition should be reported to the Maryland State Forest Service for possible use in the propagation of a variety that is resistant to the blight.

Potential habitat for the federally-endangered small-whorled pogonia and the state-endangered rainbow snake was regularly encountered on BRPF, but neither of these two species were observed during this survey.

At both sites, surveys for both the northern long-eared bat and Indiana bat should be performed in order to determine the presence or absence of these federally-listed species. Projects requiring the removal of trees and/or forested area should be coordinated with the USFWS in order to determine potential impacts to the two species.

Should the spotted turtle be listed under the ESA in the future, further surveys may be necessary, especially in areas of proposed projects.

The results of this survey should not be interpreted as meaning that no other potential RTE species exist on the sites. For areas proposed for development, a more in-depth study of the specific site should be performed, as well as future periodic surveys of the entire sites to monitor for potential new occurrences of RTE species.

6.0 REFERENCES

Benedict, Lance H. 2011. A Herptofauncal Survey of Blossom Point Research Facility with Emphasis on the Rainbow Snake, *Farancia erytrogramma*. Concord Crossroads, LLC, Woodbridge,Virginia.

Goff, G. 1982. Site examination for threatened and endangered plant species. *Environmental Management* 6(4).

U.S. Army Adelphi Laboratory Center. 2014. U.S. Army Adelphi Laboratory Center Integrated Natural Resources Management Plan. ALC Department of Public Works, Adelphi, Maryland.

U.S. Army Adelphi Laboratory Center. 2011. U.S. Army Adelphi Laboratory Center Planning Level Surveys. ALC Department of Public Works, Adelphi, Maryland.

USDA Natural Resources Conservation Service. Updated frequently. National Plants Database, available at http://plants.usda.gov/index.html

APPENDIX A

Photographs

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General overview of forest at ALC



General overview of Paint Branch at ALC



Powder Mill Bog remnant at ALC



Tributary to Paint Branch at ALC



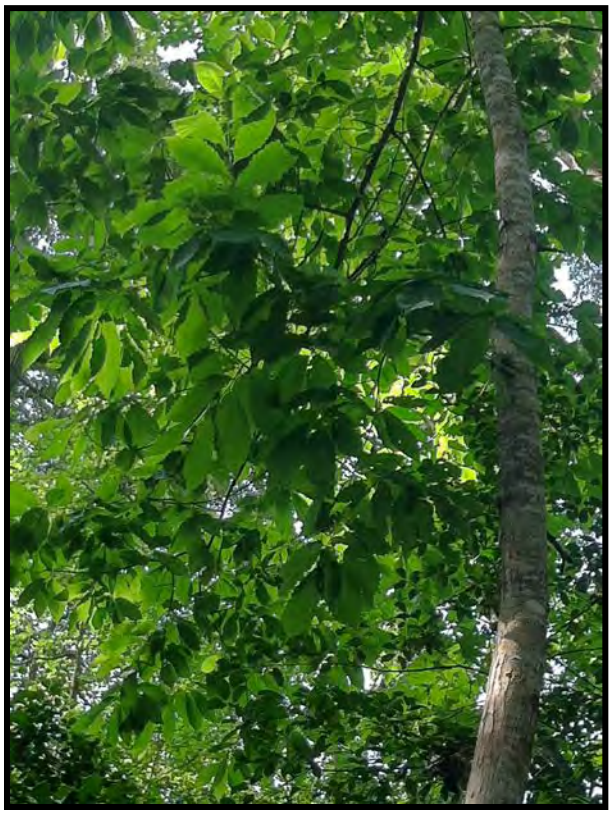
General overview of forested wetland at BPRF



General overview of tidal wetland at BPRF



General overview of forest at BPRF



American chestnut at BPRF-State rare/watchlist

APPENDIX B

Fact Sheets

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FACT SHEET:



Common name: Capitate beakrush or Bunched beaksedge

Scientific name: *Rhynchospora cephalantha*

Status in Maryland: Endangered

Wetland Indicator Status: Obligate (OBL) wetland species

Description: Plants perennial, cespitose, 40–100(–150) cm; rhizomes absent. Culms arching, leafy, obscurely and convexly trigonous, multi-ribbed, slender to stoutish. Principal leaves overtopped by culm; blades linear, flat proximally, 1.5–3 mm wide, apex tapering, trigonous. Inflorescences: spikelet clusters 3–several, widely spaced, often equidistant, mostly hemispheric to globose, occasionally lobed, 1–2 cm thick; bracteal leaves much exceeding subtended inflorescence. Spikelets dark red-brown to dark brown, lance ellipsoid to ellipsoid, 4–5(–6) mm, apex acute; fertile scales elliptic, 3–3.5(–4.5) mm, apex acute, midribs 3, laterals indistinct. Flowers: perianth bristles 6, reaching tubercle tip, retrorsely (rarely antrorsely) barbellate. Fruits 1(–2) per spikelet, 3.5–4(–4.2) mm; body brown with pale center, obovoid distal to stipe, lenticular, 2–2.3 × 1–1.5(–2) mm; tubercle triangular-subulate, (1–)1.5–2 mm, at least 0.5 mm wide at base.

Habitat: Bogs, sandy silts, peaty seeps and shores, and boggy clearings and streams and savanna bogs. Rare, mostly or entirely in the inner Coastal Plain.



Photo courtesy of UCF Arboretum

Fruiting summer—fall. Sandy silts, sands, and peats of shores, boggy streams, seeps, savannas, and savanna bogs; 0—200 m; Ala., Del., Fla., Ga., La., Md., Miss., N.J., N.Y., N.C., S.C., Tex., Va.

Indiana Bat
(Myotis sodalis)

The Indiana bat is an endangered species. Endangered species are animals and plants that are in danger of becoming extinct. Threatened species are those that are likely to become endangered in the foreseeable future. Identifying, protecting, and restoring endangered and threatened species are primary objectives of the U.S. Fish and Wildlife Service's endangered species program.



Photo by Rich Fields

Indiana bats eat up to half their body weight in insects each night.

What is the Indiana Bat?

Description

The scientific name of the Indiana bat is *Myotis sodalis* and it is an accurate description of the species. Myotis means "mouse ear" and refers to the relatively small, mouse-like ears of the bats in this group. Sodalis is the Latin word for "companion." The Indiana bat is a very social species; large numbers cluster together during hibernation. The species is called the Indiana bat because the first specimen described to science in 1928 was based on a specimen found in southern Indiana's Wyandotte Cave in 1904.

The Indiana bat is quite small, weighing only one-quarter of an ounce (about the weight of three pennies). In flight, it has a wingspan of 9 to 11 inches. The fur is dark-brown to black. The Indiana bat is similar in appearance to many other related species. Biologists can distinguish it from similar species by comparing characteristics such as the structure of the foot and color variations in the fur.

Habitat

Indiana bats hibernate during winter in caves or, occasionally, in abandoned mines. For hibernation, they require cool, humid caves with stable temperatures, under 50° F but above freezing. Very few caves within the range of the species have these conditions.

Hibernation is an adaptation for survival during the cold winter months when no insects are available for bats to eat. Bats must store energy in the form of fat before hibernating. During the six months of hibernation the stored fat is their only source of energy. If bats are disturbed or cave temperatures increase, more energy is needed and hibernating bats may starve.

After hibernation, Indiana bats migrate to their summer habitat in wooded areas where they usually roost under loose tree bark on dead or dying trees. During summer, males roost alone or in small groups, while females roost in larger groups of up to 100 bats or more. Indiana bats also forage in or along the edges of forested areas.

Reproduction

Indiana bats mate during fall before they enter caves to hibernate. Females store the sperm through winter and become pregnant in spring soon after they emerge from the caves.

After migrating to their summer areas, females roost under the peeling bark of dead and dying trees in groups of up to 100 or more. Such groups are called maternity colonies. Each female in the colony gives birth to only one pup per year. Young bats are nursed by the mother, who leaves the roost tree only to forage for food. The young stay with the maternity colony throughout their first summer.

Feeding Habits

Indiana bats eat a variety of flying insects found along rivers or lakes and in uplands. Like all insect-eating bats, they benefit people by consuming insects that are considered pests or otherwise harmful to humans. Their role in insect control is not insignificant – Indiana bats eat up to half their body weight in insects each night.

Range

Indiana bats are found over most of the eastern half of the United States. Almost half of all Indiana bats (207,000

in 2005) hibernate in caves in southern Indiana. In 2005, other states which supported populations of over 40,000 included Missouri (65,000), Kentucky (62,000), Illinois (43,000) and New York (42,000). Other states within the current range of the Indiana bat include Alabama, Arkansas, Connecticut, Iowa, Maryland, Michigan, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia. The 2005 population estimate is about 457,000 Indiana bats, half as many as when the species was listed as endangered in 1967.

Why is the Indiana Bat Endangered?

Human Disturbance

Indiana bats, because they hibernate in large numbers in only a few caves, are extremely vulnerable to disturbance. During hibernation, they cluster in groups of up to 500 per square foot. Since the largest hibernation caves support from 20,000 to 50,000 bats, it is easy to see how a large part of the total population can be affected by a single event. Episodes of large numbers of Indiana bat deaths have occurred due to human disturbance during hibernation.

Cave Commercialization and Improper Gating

The commercialization of caves – allowing visitors to tour caves during hibernation – drives bats away. Changes in the structure of caves, such as blocking an entrance, can change the temperature in a cave. A change of even a few degrees can make a cave unsuitable for hibernating bats. Some caves are fitted with gates to keep people out, but improper gating that prevents access by bats or alters air flow, temperature, or humidity can also be harmful. Properly constructed gates are beneficial because they keep people from disturbing hibernating bats while maintaining temperature and other requirements and allowing access for bats.

Summer Habitat Loss or Degradation

Indiana bats use trees as roosting and foraging sites during summer months. Loss and fragmentation of forested habitats can affect bat populations.

Pesticides and Environmental Contaminants

Insect-eating bats may seem to have an unlimited food supply, but in local areas, insects may not be plentiful because of pesticide use. This can also affect the quality of the bats' food supply. Many scientists believe that population declines occurring today might be due, in part, to pesticides and environmental contaminants. Bats may be affected by eating contaminated insects, drinking contaminated water, or absorbing the chemicals while feeding in areas that have been recently treated.

What is Being Done to Prevent Extinction of the Indiana Bat?

Listing

Prompted by declining populations caused by disturbance of bats during hibernation and modification of hibernacula, the Indiana bat was listed in 1967 as "in danger of extinction" under the Endangered Species Preservation Act of 1966. It is listed as "endangered" under the current Endangered Species Act of 1973. Listing under the Endangered Species Act protects the Indiana bat from take (harming, harassing, killing) and requires Federal agencies to work to conserve it.

Recovery Plan

The Endangered Species Act requires that recovery plans be prepared for all listed species. The U.S. Fish and Wildlife Service developed a recovery plan for the Indiana bat in 1983 and is now revising that Plan. The recovery plan describes actions needed to help the bat recover.

Habitat Protection

Public lands like National Wildlife Refuges, military areas, and U.S. Forest Service lands are managed for Indiana bats by protecting forests. This means ensuring that there are the size and species of trees needed by Indiana bats for roosting; and providing a supply of dead and dying trees that can be used as roost sites. In addition, caves used for hibernation are managed to maintain suitable conditions for hibernation and eliminate disturbance.

Education and Outreach

Understanding the important role played by Indiana bats is a key to conserving the species. Helping people learn more about the Indiana bat and other endangered species can lead to more effective recovery efforts.

U.S. Fish & Wildlife Service
1 Federal Drive
Fort Snelling, Minnesota 55111
612/713-5350
http://www.fws.gov/midwest/endangered

December 2006

FACT SHEET:

Common name: Long's Rush

Scientific name: *Juncus longii*

Status in Maryland: Endangered

Wetland Indicator Status: Obligate (OBL) wetland species



Photo courtesy of Kerry Wixted

Description: Stems usually single or sometimes 2-3, 4-10 dm tall, arising from a cordlike stolon up to 2 dm long. Leaves rigid, deep green and narrow. Cyme hemispherical, 1-11 cm long, about half as broad. Flowers 2.5-3.5 mm long, petals olive brown with white margins. Seeds fusiform, yellowish, 8-12 ribbed, white tails unequal.

Flowering-May through September.

Habitat: Early successional seepages with exposed clay or peaty soils, bogs. Rare, endemic to the southeastern United States.

Northern Long-Eared Bat

Myotis septentrionalis

The northern long-eared bat is federally listed as a threatened species under the Endangered Species Act. ***Endangered*** species are animals and plants that are in danger of becoming extinct. ***Threatened*** species are animals and plants that are likely to become endangered in the foreseeable future. Identifying, protecting and restoring endangered and threatened species is the primary objective of the U.S. Fish and Wildlife Service's Endangered Species Program.



Photo by Steve Taylor, University of Illinois

This northern long-eared bat, observed during an Illinois mine survey, shows visible symptoms of white-nose syndrome.

What is the northern long-eared bat?

Appearance: The northern long-eared bat is a medium-sized bat with a body length of 3 to 3.7 inches and a wingspan of 9 to 10 inches. Their fur color can be medium to dark brown on the back and tawny to pale-brown on the underside. As its name suggests, this bat is distinguished by its long ears, particularly as compared to other bats in its genus, *Myotis*.

Winter Habitat: Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible.

Summer Habitat: During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. They rarely roost in human structures like barns and sheds.

Reproduction: Breeding begins in late summer or early fall when males begin to swarm near hibernacula. After copulation, females store sperm during hibernation until spring. In spring, females emerge from their hibernacula, ovulate and the stored sperm fertilizes an egg. This strategy is called delayed fertilization.

After fertilization, pregnant bats migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies of females and young generally have 30 to 60 bats at the beginning of the summer, although larger maternity colonies have also been observed. Numbers of bats in roosts typically decrease from the time of pregnancy to post-lactation. Most bats within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth. Maximum lifespan for the northern long-eared bat is estimated to be up to 18.5 years.

Feeding Habits: Like most bats, northern long-eared bats emerge at dusk to feed. They primarily fly through the understory of forested areas feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation or by gleaning motionless insects from vegetation.

Range: The northern long-eared bat's range includes much of the eastern and north central United States, and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. The species' range includes 37 States and the District of Columbia: Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming.

Why is the northern long-eared bat in trouble?

White-nose Syndrome: No other threat is as severe and immediate as

this. If this disease had not emerged, it is unlikely that northern long-eared bat populations would be experiencing such dramatic declines. Since symptoms were first observed in New York in 2006, white-nose syndrome has spread rapidly from the Northeast to the Midwest and Southeast; an area that includes the core of the northern long-eared bat's range, where it was most common before this disease. Numbers of northern long-eared bats (from hibernacula counts) have declined by up to 99 percent in the Northeast. Although there is uncertainty about the rate that white-nose syndrome will spread throughout the species' range, it is expected to continue to spread throughout the United States in the foreseeable future.

Other Sources of Mortality:
Although no significant population declines have been observed due to the sources of mortality listed below, they may now be important factors affecting this bat's viability until we find ways to address WNS.

Impacts to Hibernacula: Gates or other structures intended to exclude people from caves and mines not only restrict bat flight and movement, but also change airflow and microclimates. A change of even a few degrees can make a cave unsuitable for hibernating bats. Also, cave-dwelling bats are vulnerable to human disturbance while hibernating. Arousal during hibernation causes bats to use up their energy stores, which may lead to bats not surviving through winter.

Loss or Degradation of Summer Habitat: Highway construction, commercial development, surface mining, and wind facility construction permanently remove habitat and are activities prevalent in many areas of this bat's range. Many forest management activities benefit bats by keeping areas forested rather than converted to other uses. But, depending on type and timing, some forest management activities can cause mortality and temporarily remove or degrade roosting and foraging habitat.

Wind Farm Operation: Wind turbines kill bats, and, depending on the species, in very large numbers. Mortality from windmills has been documented for northern long-eared bats, although a small number have been found to date. However, there are many wind projects within a large portion of the bat's range and many more are planned.

What Is Being Done to Help the Northern Long-Eared Bat?

Disease Management: Actions have been taken to try to reduce or slow the spread of white-nose syndrome through human transmission of the fungus into caves (e.g. cave and mine closures and advisories; national decontamination protocols). A national plan was prepared by the Service and other state and federal agencies that details actions needed to investigate and manage white-nose syndrome. Many state and federal agencies, universities and non-governmental organizations are researching this disease to try to control its spread and address its affect. See www.whitenosesyndrome.org/ for more.

Addressing Wind Turbine Mortality: The Service and others are working to minimize bat mortality from wind turbines on several fronts. We fund and conduct research to determine why bats are susceptible to turbines, how to operate turbines to minimize mortality and where important bird and bat migration routes are located. The Service, state natural resource agencies, and the wind energy industry are developing a Midwest Wind Energy Habitat Conservation Plan, which will provide wind farms a mechanism to continue operating legally while minimizing and mitigating listed bat mortality.

Listing: The northern long-eared bat is listed as a threatened species under the federal Endangered Species Act. Listing a species affords it the protections of the Act and also increases the priority of the species for funds, grants, and recovery opportunities.

Hibernacula Protection: Many federal and state natural resource agencies and conservation organizations have protected caves and mines that are important hibernacula for cave-dwelling bats.

What Can I Do?

Do Not Disturb Hibernating Bats: To protect bats and their habitats, comply with all cave and mine closures, advisories, and regulations. In areas without a cave and mine closure policy, follow approved decontamination protocols (see http://whitenosesyndrome.org/topics/decontamination). Under no circumstances should clothing, footwear, or equipment that was used in a white-nose syndrome affected state or region be used in unaffected states or regions.

Leave Dead and Dying Trees Standing: Like most eastern bats, the northern long-eared bat roosts in trees during summer. Where possible and not a safety hazard, leave dead or dying trees on your property. Northern long-eared bats and many other animals use these trees.

Install a Bat Box: Dead and dying trees are usually not left standing, so trees suitable for roosting may be in short supply and bat boxes may provide additional roost sites. Bat boxes are especially needed from April to August when females look for safe and quiet places to give birth and raise their pups.

Support Sustainability: Support efforts in your community, county and state to ensure that sustainability is a development goal. Only through sustainable living will we provide rare and declining species, like the northern long-eared bat, the habitat and resources they need to survive alongside us.

Spread the Word: Understanding the important ecological role that bats play is a key to conserving the northern long-eared and other bats. Helping people learn more about the northern long-eared bat and other endangered species can lead to more effective recovery efforts. For more information, visit www.fws.gov/midwest/nleb and www.whitenosesyndrome.org

Join and Volunteer: Join a conservation group; many have local chapters. Volunteer at a local nature center, zoo, or national wildlife refuge. Many state natural resource agencies benefit greatly from citizen involvement in monitoring wildlife. Check your state agency websites and get involved in citizen science efforts in your area.

FACT SHEET:

Common Name: Rainbow Snake

Scientific Name: *Farancia erytrogramma erytrogramma*



Photo courtesy of Lance Benedict

Size:
36 inches – 44 inches. Record: 60 inches.

Appearance:

- This beautiful glossy iridescent snake is like no other in Maryland.
- It has 3 red stripes on a blue-black background running the length of its body.
- The belly is primarily red with paired rows of black spots.
- The tail is short and ends in a sharp tip, which it may use to probe the ground.
- The scales are usually keelless but there may be some keeled scales above the vent.
- The anal plate is usually divided, but may also be single.

Habitats:

This is a highly aquatic species, preferring swamps, marshes, and slow-moving streams. They tolerate brackish water. They will also be found on dry land, burrowing in moist soil, muck or a sandy substrate.

How to Find:

This is a highly rare species in Maryland. These snakes are swimmers and burrowers. Young may be found by looking under boards or other cover near streams. This snake is state listed as Endangered in Maryland. If you find one, please contact the MD DNR Wildlife and Heritage Service.

Distribution in Maryland:

Found infrequently on the western portion of the Coastal Plain and possibly in the Potomac valley into Montgomery County.



Information for Fact Sheet Courtesy of Maryland Department of Natural Resources Website.

Small Whorled Pogonia

Isotria medeoloides



States where the small whorled pogonia, an orchid, is found.



Photos by USFWS; Sarena Selbo (right) and Susi vonOettingen (left)

The small whorled pogonia is a threatened species. Threatened species are animals and plants that are likely to become endangered in the foreseeable future. Endangered species are animals and plants that are in danger of becoming extinct. Identifying, protecting, and restoring endangered and threatened species is the primary objective of the U.S. Fish and Wildlife Service's endangered species program.

What is the small whorled pogonia?

Appearance - The small whorled pogonia is a member of the orchid family. It usually has a single grayish-green stem that grows about 10 inches tall when in flower and about 14 inches when bearing fruit. The plant is named for the whorl of five or six leaves near the top of the stem and beneath the flower. The leaves are grayish-green, somewhat oblong and 1 to 3.5 inches long. The single or paired greenish-yellow flowers are about 0.5 to 1 inch long and appear in May or June. The fruit, an upright ellipsoid capsule, appears later in the year.

Range - Although widely distributed, the small whorled pogonia is rare. It is found in 17 eastern states and Ontario, Canada. Populations are typically small with less than 20 plants. It has been extirpated from Missouri, New York, Vermont, and Maryland.

Habitat - This orchid grows in older hardwood stands of beech, birch, maple, oak, and hickory that have an open understory. Sometimes it grows in stands of softwoods such as hemlock. It prefers acidic soils with a thick layer of dead leaves, often on slopes near small streams.

What is the small whorled pogonia? (continued)

Reproduction - This pogonia flowers from mid-May to mid-June, with the flowers lasting only a few days to a week. It may not flower every year but when it does flower, one or two flowers are produced per plant. If pollinated, a capsule forms that contains several thousand minute seeds. The pogonia appears to self-pollinate by mechanical processes. The flower lacks both nectar guides and fragrance and insect pollination has not been observed.

Why is the small whorled pogonia threatened?

Habitat Loss and Degradation - The primary threat to the small whorled pogonia is the past and continuing loss of populations when their habitat is developed for urban expansion. Some forestry practices eliminate habitat. Also, habitat may be degraded or individual plants lost because of recreational activities and trampling.

Collection - As with all rare orchids, the small whorled pogonia is vulnerable to collecting for commercial or personal use.

What Is being done to prevent extinction of the small whorled pogonia?

Listing - The small whorled pogonia was added to the U.S. List of Endangered and Threatened Wildlife and Plants in 1982 as an endangered species. In 1994 it was reclassified to threatened.

Recovery Plan - The U.S. Fish and Wildlife Service prepared a recovery plan and revised that plan in 1992. The Recovery Plan describes and prioritizes actions needed to help recover the species.

Research - Many small whorled pogonia populations are being monitored to determine long-term population trends. Habitat management techniques, such as reducing shade through selected tree removal are being investigated.

Habitat Protection - A variety of government and private conservation agencies are working to preserve the small whorled pogonia and its habitat. Voluntary protection agreements have also been made with some private landowners.

What can I do to help prevent extinction of species?

Learn - Learn more about the small whorled pogonia and other endangered and threatened species. Understand how the destruction of habitat leads to loss of endangered and threatened species and our nation's plant and animal diversity.

Volunteer - Volunteer at your local zoo, wildlife refuge or nature center. Work with their staff or other community members to maintain and restore local habitat.

Protect – Protect native plants by cleaning your shoes after hiking to avoid spreading invasive plants seeds and staying on trails if you are hiking in an area with rare plants in the the understory.

Grow Natives - Grow native plants in your lawn and garden but obtain the plants from local nurseries, do not dig up native plants from natural areas. Avoid using invasive, non-native plants in landscaping, such as purple loosestrife, bush honeysuckles and burning bush.

U.S. Fish & Wildlife Service
1 Federal Drive
Fort Snelling, Minnesota 55111
612/713-5350
http://www.fws.gov/midwest/endangered

January 2008

Fact Sheet: Spotted Turtle
Clemmys guttata



Description:

- Length (carapace): 3-5 in (7.5-12.5 cm)
- Sexual dimorphism: Males tend to have brown eyes and chin and a slightly concave plastron (lower shell), females have orange eyes, a yellow chin and a flat plastron. Females are slightly larger than males on average.
- Physical Description: a very small turtle. The carapace is smooth, without obvious growth ridges on the scutes. The plastron has visible growth ridges, but these are not a reliable way to age the individual.
- Coloration: As the name suggests, spotted turtles have yellow spots on their carapace, which is dark brown or black. Older individual's spots may be faded, and some individuals lack spots. The plastron is yellow or orange, and has a large black spot in each scute that grows larger with age. The head is black, with varying amounts of yellow spots, and a yellow or orange blotch on either side. The underside of the neck is reddish- orange to pink.

Habitat and Range:

- Geographic range: Great Lakes region and Atlantic seaboard, from southern Canada to Florida
- Preferred Habitat: Shallow wetlands, including wet meadows, bogs, swamps, ponds, ditches, and other small, calm bodies of water.

Diet:

- Omnivorous
    - Animal diet includes invertebrates, small fish, small frogs and tadpoles. Will also occasionally feed on carrion.
    - Plant diet includes algae and aquatic plants, especially the seeds of water lilies.

Adaptations:

- Have a shell for protection
- Flattened shell and webbed feet aid in swimming
- Can slow their heartbeat so they need less oxygen when under water
- Like other cold-blooded creatures, they will bask in the sun for warmth, but retreat into

the water if they need to cool off
- No teeth, but jaws have tough, horny plates for gripping food
- During the winter, the turtles will hibernate by burying themselves in the mud. In the peak heat of summer they are also known to become dormant, seeking shelter from the heat on land, under tree roots.

Lifespan:

- 30+ years

Ecosystem relationships:

- Predators: Preyed on by a wide variety of species, but most common predators are raccoons and muskrats.
- Interspecies competitors: Spotted turtles compete with other aquatic turtles, wading birds, predatory fish and some mammals for prey items.
- Role/ Niche: Spotted turtles fit an important role as both predators of invertebrates and other spall prey, and as a source of food for larger predators.

Reproduction:

- Breeding season: courtship and mating occurs in early spring, and females lay eggs in late spring.
- Behavior: Males pursue females in the water, where breeding takes place. Females find nesting spots in sunny locations with moist, well drained soil.
- Incubation: 11 weeks, faster with warmer temperatures. Sex of offspring dependent on temperature during the middle of the incubation period, with cooler temperatures producing more males, and warmer temperatures producing more females.
- Offspring: 3-4 eggs per clutch on average, usually only one clutch per year, but multiple clutches possible, especially in captivity.
- Maturation: Spotted turtles reach reproductive maturity at about 7-14 years old.

Activity:

- Diurnal

Conservation Status and Threats:

- Listed on the IUCN Red List as Endangered.
- Threats
    - The biggest threat to spotted turtles is habitat loss and degradation.
    - The species currently survives in sporadic localized populations, many of which are in decline. This population fragmentation makes them vulnerable to extinction, since the genetics of isolated populations tends to become stagnant.
- Conservation efforts:
    - As an endangered species, spotted turtles are protected from the pet trade and from killing by local and federal regulations.
    - Further habitat protection and restoration is needed to ensure the survival of this species.

US Army Corps of Engineers
Baltimore District

Rare, Threatened, and Endangered Species Surveys

U.S. Army Garrison Aberdeen Proving Ground
Adelphi Laboratory Center and Blossom Point Research Facility
Prince George's and Charles Counties, Maryland

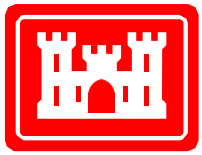


Prepared for: **U.S. Army Garrison Adelphi Laboratory Center,**
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September 2025

RARE, THREATENED, AND ENDANGERED SPECIES SURVEYS
U.S. ARMY GARRISON ABERDEEN PROVING GROUND
ADELPHI LABORATORY CENTER AND
BLOSSOM POINT RESEARCH FACILITY
PRINCE GEORGE'S AND CHARLES COUNTIES, MARYLAND



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September 2025

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1.0 INTRODUCTION

The U.S. Army Corps of Engineers, Baltimore District (USACE), conducted Rare, Threatened, and Endangered (RTE) flora and fauna surveys at U.S. Army Garrison (USAG) Aberdeen Proving Ground (APG) Adelphi Laboratory Center (ALC) and USAG APG Blossom Point Research Facility (BPRF). RTE surveys were conducted at both facilities over several periods of 2024 and 2025 to assess the potential presence of state- or federally-listed plant and animal species and habitat which could support such species. USAG APG ALC, headquarters of the Army Research Laboratory, is an active military research and development facility, approximately 207 acres in size, located partly in both Prince George's and Montgomery Counties, Maryland (**Figure 1**). USAG APG BPRF, a satellite installation to USAG APG ALC, is an active military testing range, approximately 1,600 acres in size, located in Charles County, Maryland (**Figure 1**).

1.1 Study Purpose

The purpose of this study was to conduct spring, summer, and fall surveys of USAG APG ALC and USAG APG BPRF to note any occurrences of RTE species and habitat types that may potentially support RTE species. The study was a follow-up to surveys conducted in 2018 and to supplement the existing Integrated Natural Resources Management Plan (INRMP) and Planning Level Surveys at USAG APG ALC and USAG APG BPRF.

An endangered species is defined as any species that is in danger of extinction throughout all or a significant portion of its range. The Endangered Species Act (ESA) of 1973 requires the Department of the Interior to identify and list these species. A threatened species is defined as any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Only species listed by the Department of the Interior are protected under the ESA. Due to habitat loss and species fluctuations, the lists of protected species are constantly changing. Species designated as rare, species of concern, or special concern by the federal government or state and local agencies are not legally protected, but populations of species with these designations are tracked by various resource agencies, including the United States Fish and Wildlife Service (USFWS) and the Maryland Department of Natural Resources (MDNR) Natural Heritage Program.

Pursuant to Section 7 of the ESA, information on the potential existence of RTE plant and wildlife species in the project area was researched using the existing 2021 INRMP and the agency correspondence conducted as part of the INRMP.

2.0 METHODS

This study was accomplished through (1) a desktop reconnaissance of available studies conducted on and around USAG APG ALC and USAG APG BPRF; (2) field surveys at the installations to document species and habitat findings; and (3) creation of maps depicting findings.

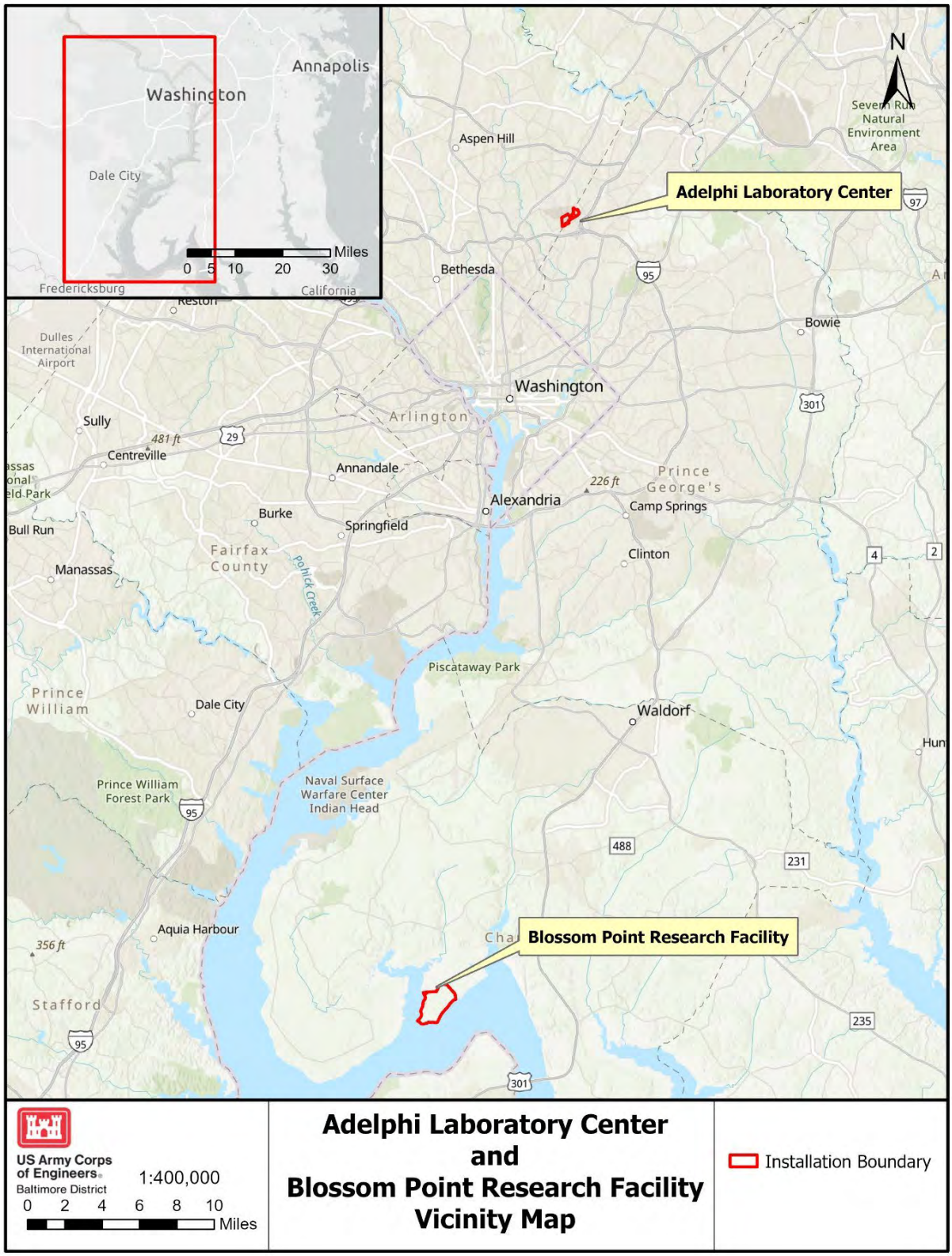


Figure 1: Location of US APG ALC and US APG BPRF

2.1 Desktop Reconnaissance

Prior to conducting field surveys, USACE reviewed available data from the USAG APG ALC and USAG APG BPRF INRMP; the agency coordination associated with the INRMP and the Planning Level Surveys; the 2018 USAG APG ALC and US APG BPRF Amphibian and Reptile Species Surveys; the 2015 RTE Species Survey; and the 2011 report, *A Herpetofauna Survey of Blossom Point Research Facility with Emphasis on the Rainbow Snake, Farancia erytrogramma*. The review indicated previous records of two state-listed RTE species on USAG APG ALC - Long's rush (*Juncus longii*) and capitate beaked-rush (*Rhynchospora cephalantha*), a potential habitat for RTE species on both USAG APG ALC and USAG APG BPRF, the previous presence of endangered and proposed endangered bats at USAG APG BPRF, and the presence of the proposed threatened monarch butterfly (*Danaus plexippus*) at USAG APG ALC.

The USFWS and MDNR were contacted during the 2021 INRMP update regarding RTE species and significant habitats on or in the vicinity of USAG APG ALC and USAG APG BPRF. Correspondence (dated 2020) received from those agencies can be found in the current INRMP.

Federally-Listed Species

USFWS stated that there are no records of federally-listed species on USAG APG ALC or USAG APG BPRF. Habitat for the federally-listed small whorled pogonia (*Isotria medeloides*) is present on USAG APG BPRF, though this plant is believed to be extirpated from the State of Maryland. The area of the Potomac River surrounding USAG APG BPRF may provide spawning habitat for the Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*), a federally endangered fish species. Shortnose sturgeon (*Acipenser brevirostrum*) also has the potential to occur at or near USAG APG BPRF according to the National Oceanic and Atmospheric Administration National Marine Fisheries Section 7 Mapper. Additionally, sensitive joint-vetch (*Aeschynomene virginica*) is known or believed to occur in both Prince George's and Charles Counties. Northern long-eared bats (*Myotis septentrionalis*) (NLEB) were uplisted to federally endangered on March 31, 2023. No critical habitat was designated during the 2021 INRMP coordination. However, a 2016 bat acoustic survey at USAG APG BPRF detected one NLEB. The 2019 and USAG APG ALC 2024 bat acoustic survey did not detect any NLEBs. Tricolored bats (*Perimyotis subflavus*) were proposed to be listed as federally endangered in September 2022. The USAG APG BPRF 2016 survey detected tricolored bats at two (2) sites and the 2019 survey detected tricolored bats at nine (9) different sites. A 2024 acoustic monitoring survey detected tricolored bats at three (3) sites at USAG APG ALC and 10 sites at USAG APG BPRF. No bat surveys were conducted during the RTE 2024/2025 surveys. In addition, the monarch butterfly was proposed to be listed as threatened on December 10, 2024. No monarch habitat was shown during the USFWS coordination; however, it has been documented at USAG APG ALC at the pollinator garden. The USAG APG ALC Pollinator Garden was certified as a Monarch Waystation (monarch habitat) by Monarch Watch in July 2016. The following is a link to federally listed species found in Maryland: https://ecos.fws.gov/ecp/report/species-listings-by state?stateAbbrev=MD&stateName=Maryland&statusCategory=Listed.

State-Listed Species

On USAG APG ALC, MDNR indicated the presence of two state-endangered plant species and one highly state-rare habitat, a fall-line terrace gravel bog, in which the two listed species are found. MDNR stated that there were no records of state-listed RTE species on USAG APG BPRF. Several species and habitats of concern were noted on USAG APG BPRF, to include bald eagles (*Haliaeetus leucocephalus*), waterfowl habitat, habitat for the state endangered rainbow snake (*Farancia erytrogramma*), Forest Interior Dwelling Species (FIDS) habitat, terrapin and horseshoe crab (*Limulidae* spp.) spawning habitat, largemouth bass (*Micropterus salmoides*) habitat and striped bass (*Morone saxatilis*), and anadromous fish species spawning habitat in the Potomac River. However, only one state rare/watchlist species was observed on site. A single American chestnut (*Castanea dentata*) was observed during a 2015 RTE survey. The American chestnut is state-listed as S2/S3 (state rare/watchlist). USAG APG ALC also contains some FIDS habitat and has at least nine (9) species recorded that are FIDS. The following is a link to Maryland's listed species: https://dnr.maryland.gov/wildlife/pages/plants_wildlife/rte/espaa.aspx. The ranking system of species can be found here: https://safe.menlosecurity.com/doc/docview/viewer/docN8848EDF85666f7910f7d14a1c005de8bd53d4bc5efbdf049f64c36615eae32ddd1dd214234ff.

2.2 Data Collection

The RTE surveys were conducted at USAG APG ALC and USAG APG BPRF facilities over several periods in 2024 and 2025. The surveys utilized the Trimble GeoXH 650 handheld Global Positioning System (GPS) system for location collection yielding sub-meter horizontal accuracy. Photographs and the GPS location observed RTE species were taken. GPS data was then downloaded to ArcGIS for mapping. This survey horizontally references the North American Datum of 1983 (NAD83), Geographic Coordinate System, World Geodetic System 1984.

Survey Methods

The surveys were conducted using visual searches along transects. A team of two people followed rough transects, spaced approximately 20 to 30 feet apart, throughout the sites. The entirety of USAG APG ALC and USAG APG BPRF was surveyed, with some special focus on wetland areas, vernal pools, and marsh habitat.

For herpetofauna RTE species, Amphibian and Reptile Visual Encounter Surveys (ARVES) is a standard survey method, which does not utilize ground intrusive techniques, such as pit fall traps and drift fences (Heyer et al. 1994). Based on previous surveys and documents, focal areas on each installation were selected (**Figures 2** and **3**), which had the optimal habitat for both early season amphibian breeding and later season habitat for reptiles and non-breeding amphibians. Focal areas included natural and man-made vernal pools, wetlands, floodplains, stormwater management ponds, and other habitats with food, cover and water. Dip-net surveys were used on natural vernal pools, other pools (e.g. man-made, tree falls, road ditches), streams, and wetlands on USAG APG BPRF. Dip-netting consists of conducting sweeps of near shore aquatic habitat using a pole with a mesh net on one end. Egg-mass surveys were conducted at the vernal pools to determine the presence/absence of amphibian reproduction.

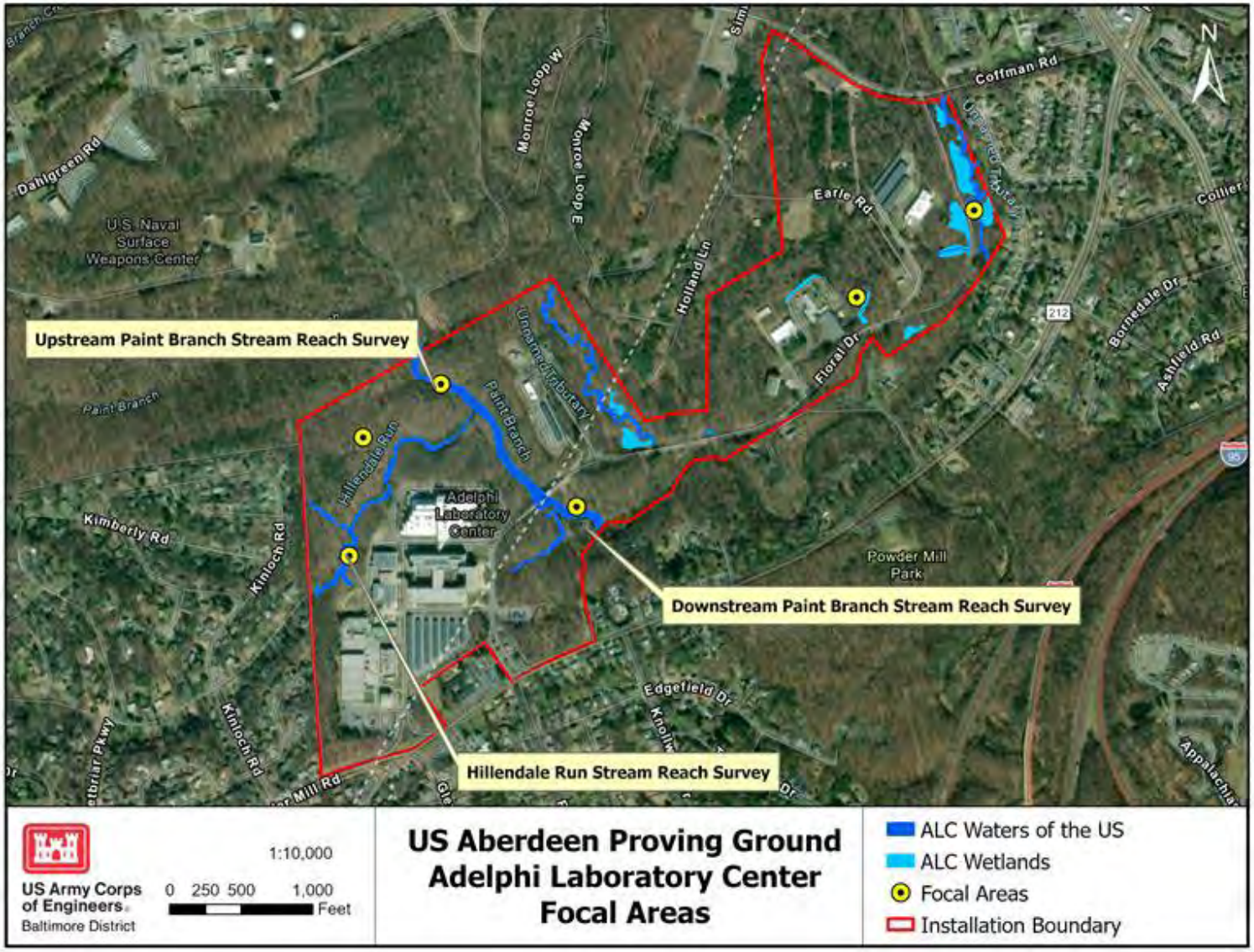


Figure 2: Location of USAG APG ALC Amphibian, Fish, and Reptile Surveys Focal Areas

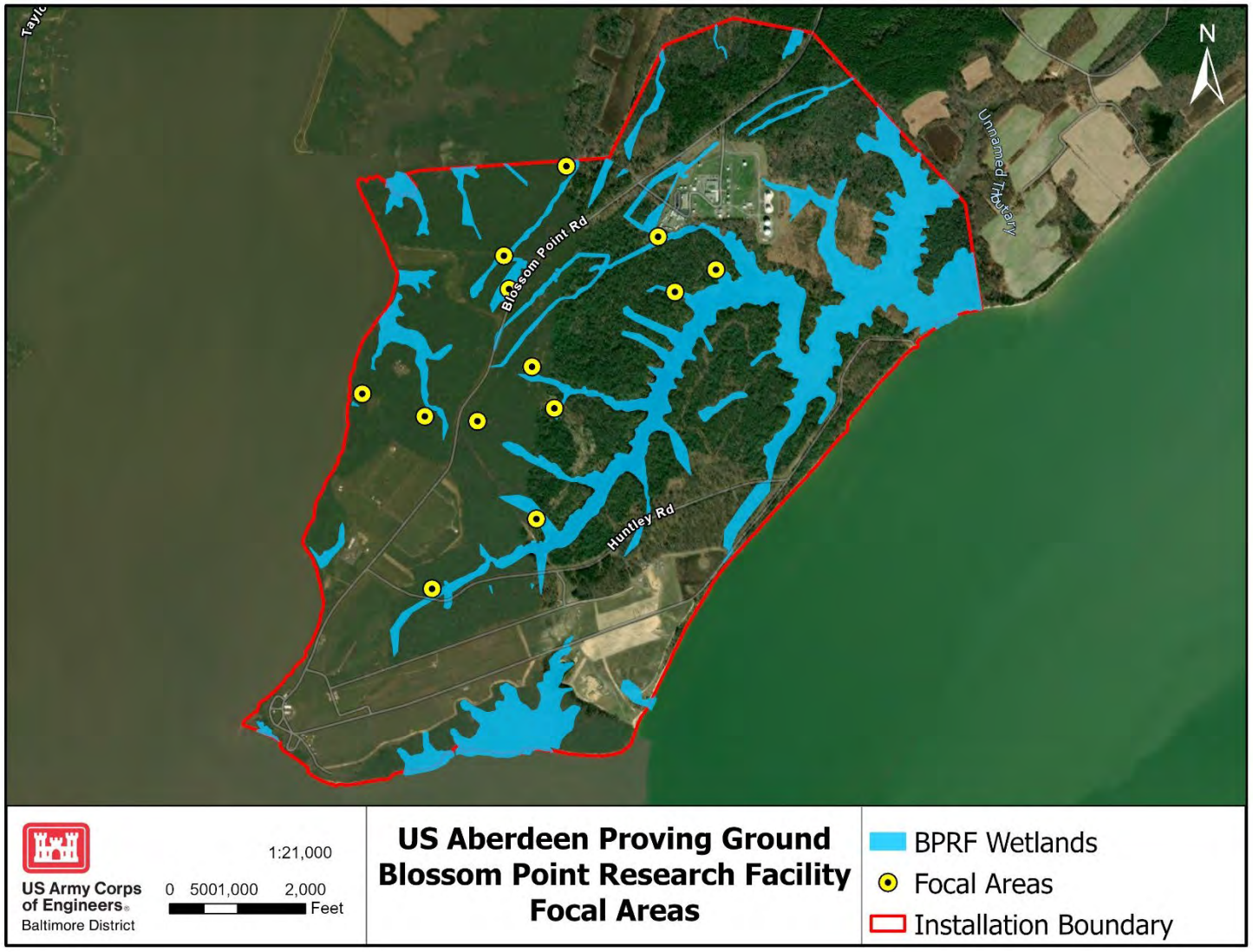


Figure 3: Location of USAG APG BPRF Amphibian and Reptile Focal Area

Fish surveys were conducted in April 2024 as part of a separate stream study at USAG APG ALC. Smith-Root model LR-20b backpack electrofishing units were used to collect the sample specimens over a 75-meter stream reach. Samples that were collected were stored in an aerated holding tank and released once identified and documented. The surveys were conducted at Hillendale Run, an upstream Paint Branch location, and a downstream Paint Branch location (USAG APG ALC, 2025). These locations are shown in **Figure 3**.

Observations of avian and other wildlife species were recorded as they were encountered. Wildlife species presence was determined by direct observation of an individual, tracks, scat, calls, dens, nests, or any other means available. Particular attention was paid to habitat types that support the threatened or endangered species that may possibly utilize the survey areas., such as wetlands and the fall-line gravel terrace bog.

3.0 SURVEY RESULTS

3.1 USAG Aberdeen Proving Ground Adelphi Laboratory Center

No state- or federally-listed RTE species of flora or fauna were observed during the 2024/2025 survey.

The survey was concentrated in undeveloped areas, including forested areas and stream corridors and wetlands. Special attention was given to the Powder Mill Bog, a Fall-line Terrace Gravel Wetland, which is considered a highly state-rare habitat (**Figure 4**). Two state-endangered plant species, Long's rush and capitate beaked-rush, which were recorded in Powder Mill Bog previously, were not observed during planning level surveys in 2011.

Although, the Powder Mill Bog remnant is still intact, neither of the two state-listed plants, mentioned above, were observed during the 2024/2025 survey. However, this highly state-rare habitat could still provide potential habitat for those species, or other RTE species, in the future. Some encroachment of non-native, invasive species, especially Japanese stiltgrass (*Microstegium vimineum*) and Asiatic Bittersweet (*Celastrus orbiculatus*) was noted in the Powder Mill Bog.

Habitat for FIDS, some of which are listed as RTE, does exist on-site and is contiguous with similar habitat in the surrounding area. These large tracts of forest are important habitat for certain bird species and may also serve as summer foraging and roosting habitat for the federally-listed NLEB, tricolored bat, and Indiana Bat (*Myotis sodalis*).

Habitat for the spotted turtle (*Clemmys guttata*) is present on USAG APG ALC. The spotted turtle underwent an uplisting review in 2015, to be considered for listing as threatened or endangered. This review determined it may be necessary to uplist the turtle. No conclusions for the federal listing have been made as of the date of this report.

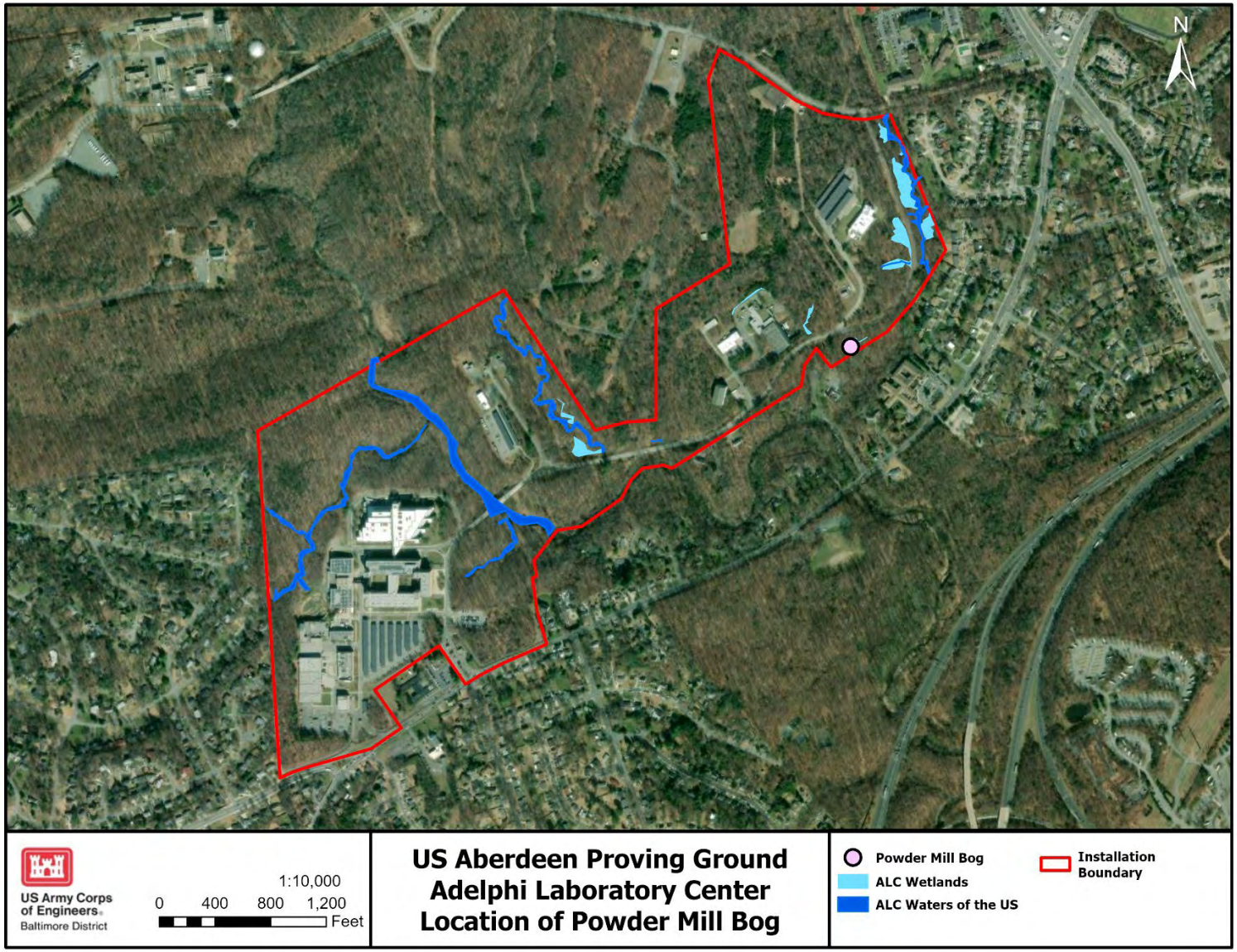


Figure 4: Location of Powder Mill Bog at USAG APG ALC

3.2 USAG Aberdeen Proving Ground Blossom Point Research Facility

No federally-listed species of flora or fauna were observed. However, bald eagles were heard and observed, although the presence of these birds is well documented at USAG APG BPRF. Bald eagles are listed as S3/S4 (watchlist/state apparently secure) in Charles County, Maryland.

Habitat for the federally-endangered small-whorled pogonia was observed throughout the site within the mature upland hardwood and mixed deciduous/coniferous forests, but no individuals were observed.

Habitat for the state-endangered rainbow snake was noted throughout the site. Habitat is listed as streams, swamps, and marshes with floating vegetation for cover. A herpetofauna survey in 2011 (Benedict, 2011) did not locate any individuals. No individual rainbow snakes were observed during this survey.

Habitat for FIDS, some of which are listed as RTE, does exist on-site and is contiguous with similar habitat in the surrounding area. These large tracts of forest are important habitat for certain bird species and may also serve as summer foraging and roosting habitat for the federally-listed NLEB, tricolored bat, and Indiana Bat.

The spotted turtle was observed on USAG APG BPRF during the planning level surveys in April 2012 as well as in 2018, and 2025. Suitable habitat for the spotted turtle is common throughout USAG APG BPRF. The spotted turtle underwent an uplisting public review in 2015, to be considered for listing as federally threatened or endangered. This review determined it may be necessary to uplist the turtle. No conclusions for the federal listing have been made as of the date of this report.

The American chestnut was not observed during the 2024/2025 surveys, but its previous location is show in **Figure 5**. However, the individual tree still has potential to be at USAG APG BPRF. The American chestnut, once a dominant tree species in eastern forests and valuable to wildlife as well as an important timber species, has been almost eliminated by the chestnut blight, caused by the introduced fungus *Endothia parasitica*. American chestnuts in good condition should be reported to the Maryland State Forest Service for possible use in the propagation of a variety that is resistant to the blight.

No Atlantic or shortnose sturgeon were observed during surveys; however, the survey methods were not conducive to the observation of these fish. Further in-water surveys would need to be conducted to determine the presence or absence of these fish around USAG APG BPRF.



Figure 5: Location of America Chestnut at USAG APG BPRF

4.0 CONCLUSIONS/RECOMMENDATIONS

The RTE species surveys were conducted over multiple periods of 2024 and 2025 at USAG APG ALC and USAG APG BPRF, Prince George's and Charles Counties, Maryland, respectively. The purpose was to survey for the potential presence of RTE species and/or potential suitable habitat for RTE species.

No state- or federally-listed species were observed on USAG APG ALC. The remnant of the Powder Mill Bog, a highly state-rare habitat was observed. Two state-listed species, which were observed in Powder Mill Bog previously, were not observed during this survey. It is recommended that invasive species control measures be performed on a regular basis in order to preserve the native communities on-site, especially the Powder Mill Bog remnant, which is experiencing invasive growth.

No federally-listed species were observed on USAG APG BPRF and one (1) state-listed species was observed.

Potential habitat for the federally-endangered small-whorled pogonia and the state-endangered rainbow snake was regularly encountered on USAG APG BPRF, but neither of these two species were observed during this survey.

Tricolored bats were detected at USAG APG ALC and USAG APG BPRF during the 2024 stationary acoustic bat monitoring. At both sites, surveys for both the NLEB, tricolored bat, and Indiana bat should be performed in order to determine the presence or absence of these federally-listed species. Projects requiring the removal of trees and/or forested area should be coordinated with the USFWS in order to determine potential impacts to the two species. There is FIDS habitat for these bats present at USAG APG BPRF.

Should the spotted turtle be listed under the ESA in the future, further surveys may be necessary, especially in areas of proposed projects. There is a known presence of spotted turtle at USAG APG BPRF.

Guidelines and recommendations provided in the USAG APG ALC and USAG APG BPRF INRMP, Habitat Management Plan, Forest Management Plan, and the DoD Strategic Plan for conservation and management should continue to be followed for the protection and management of known and potential RTE species and their habitats.

The results of this survey should not be interpreted as meaning that no other potential RTE species exist on the sites. For areas proposed for development, a more in-depth study of the specific site should be performed, as well as future periodic surveys of the entire sites to monitor for potential new occurrences of RTE species.

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APPENDIX A
Photographs

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General overview of forest at USAG APG ALC



General overview of Paint Branch at USAG APG ALC



Powder Mill Bog remnant at USAG APG ALC



Tributary to Paint Branch at USAG APG ALC



General overview of tidal wetland at USAG APG BPRF



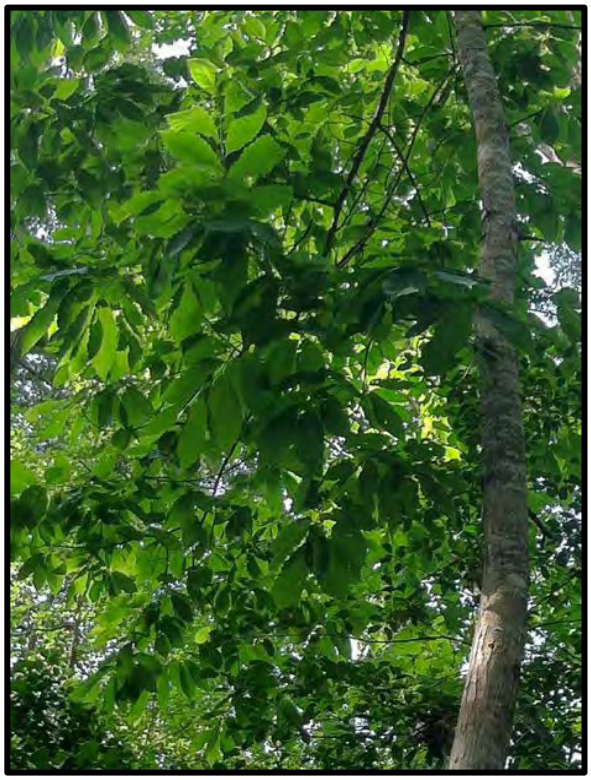
General Overview of a vernal pool at USAG APG BPRF



General Overview of a forest with vernal pool at USAG APG BPRF



Spotted Turtle at USAG APG BPRF



American Chestnut at USAG APG BPRF

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APPENDIX B
Fact Sheets

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FACT SHEET:



Common name: Capitate beakrush or Bunched beaksedge

Scientific name: *Rhynchospora cephalantha*

Status in Maryland: Endangered

Wetland Indicator Status: Obligate (OBL) wetland species

Description: Plants perennial, cespitose, 40–100(–150) cm; rhizomes absent. Culms arching, leafy, obscurely and convexly trigonous, multi-ribbed, slender to stoutish. Principal leaves overtopped by culm; blades linear, flat proximally, 1.5–3 mm wide, apex tapering, trigonous. Inflorescences: spikelet clusters 3–several, widely spaced, often equidistant, mostly hemispheric to globose, occasionally lobed, 1–2 cm thick; bracteal leaves much exceeding subtended inflorescence. Spikelets dark red-brown to dark brown, lance ellipsoid to ellipsoid, 4–5(–6) mm, apex acute; fertile scales elliptic, 3–3.5(–4.5) mm, apex acute, midribs 3, laterals indistinct. Flowers: perianth bristles 6, reaching tubercle tip, retrorsely (rarely antrorsely) barbellate. Fruits 1(–2) per spikelet, 3.5–4(–4.2) mm; body brown with pale center, obovoid distal to stipe, lenticular, 2–2.3 × 1–1.5(–2) mm; tubercle triangular-subulate, (1–)1.5–2 mm, at least 0.5 mm wide at base.

Habitat: Bogs, sandy silts, peaty seeps and shores, and boggy clearings and streams and savanna bogs. Rare, mostly or entirely in the inner Coastal Plain.



Photo courtesy of UCF Arboretum

Fruiting summer—fall. Sandy silts, sands, and peats of shores, boggy streams, seeps, savannas, and savanna bogs; 0—200 m; Ala., Del., Fla., Ga., La., Md., Miss., N.J., N.Y., N.C., S.C., Tex., Va.

Indiana Bat
(Myotis sodalis)

The Indiana bat is an endangered species. Endangered species are animals and plants that are in danger of becoming extinct. Threatened species are those that are likely to become endangered in the foreseeable future. Identifying, protecting, and restoring endangered and threatened species are primary objectives of the U.S. Fish and Wildlife Service's endangered species program.



Photo by Rich Fields

Indiana bats eat up to half their body weight in insects each night.

What is the Indiana Bat?

Description

The scientific name of the Indiana bat is *Myotis sodalis* and it is an accurate description of the species. Myotis means "mouse ear" and refers to the relatively small, mouse-like ears of the bats in this group. Sodalis is the Latin word for "companion." The Indiana bat is a very social species; large numbers cluster together during hibernation. The species is called the Indiana bat because the first specimen described to science in 1928 was based on a specimen found in southern Indiana's Wyandotte Cave in 1904.

The Indiana bat is quite small, weighing only one-quarter of an ounce (about the weight of three pennies). In flight, it has a wingspan of 9 to 11 inches. The fur is dark-brown to black. The Indiana bat is similar in appearance to many other related species. Biologists can distinguish it from similar species by comparing characteristics such as the structure of the foot and color variations in the fur.

Habitat

Indiana bats hibernate during winter in caves or, occasionally, in abandoned mines. For hibernation, they require cool, humid caves with stable temperatures, under 50° F but above freezing. Very few caves within the range of the species have these conditions.

Hibernation is an adaptation for survival during the cold winter months when no insects are available for bats to eat. Bats must store energy in the form of fat before hibernating. During the six months of hibernation the stored fat is their only source of energy. If bats are disturbed or cave temperatures increase, more energy is needed and hibernating bats may starve.

After hibernation, Indiana bats migrate to their summer habitat in wooded areas where they usually roost under loose tree bark on dead or dying trees. During summer, males roost alone or in small groups, while females roost in larger groups of up to 100 bats or more. Indiana bats also forage in or along the edges of forested areas.

Reproduction

Indiana bats mate during fall before they enter caves to hibernate. Females store the sperm through winter and become pregnant in spring soon after they emerge from the caves.

After migrating to their summer areas, females roost under the peeling bark of dead and dying trees in groups of up to 100 or more. Such groups are called maternity colonies. Each female in the colony gives birth to only one pup per year. Young bats are nursed by the mother, who leaves the roost tree only to forage for food. The young stay with the maternity colony throughout their first summer.

Feeding Habits

Indiana bats eat a variety of flying insects found along rivers or lakes and in uplands. Like all insect-eating bats, they benefit people by consuming insects that are considered pests or otherwise harmful to humans. Their role in insect control is not insignificant – Indiana bats eat up to half their body weight in insects each night.

Range

Indiana bats are found over most of the eastern half of the United States. Almost half of all Indiana bats (207,000

in 2005) hibernate in caves in southern Indiana. In 2005, other states which supported populations of over 40,000 included Missouri (65,000), Kentucky (62,000), Illinois (43,000) and New York (42,000). Other states within the current range of the Indiana bat include Alabama, Arkansas, Connecticut, Iowa, Maryland, Michigan, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia. The 2005 population estimate is about 457,000 Indiana bats, half as many as when the species was listed as endangered in 1967.

Why is the Indiana Bat Endangered?

Human Disturbance

Indiana bats, because they hibernate in large numbers in only a few caves, are extremely vulnerable to disturbance. During hibernation, they cluster in groups of up to 500 per square foot. Since the largest hibernation caves support from 20,000 to 50,000 bats, it is easy to see how a large part of the total population can be affected by a single event. Episodes of large numbers of Indiana bat deaths have occurred due to human disturbance during hibernation.

Cave Commercialization and Improper Gating

The commercialization of caves – allowing visitors to tour caves during hibernation – drives bats away. Changes in the structure of caves, such as blocking an entrance, can change the temperature in a cave. A change of even a few degrees can make a cave unsuitable for hibernating bats. Some caves are fitted with gates to keep people out, but improper gating that prevents access by bats or alters air flow, temperature, or humidity can also be harmful. Properly constructed gates are beneficial because they keep people from disturbing hibernating bats while maintaining temperature and other requirements and allowing access for bats.

Summer Habitat Loss or Degradation

Indiana bats use trees as roosting and foraging sites during summer months. Loss and fragmentation of forested habitats can affect bat populations.

Pesticides and Environmental Contaminants

Insect-eating bats may seem to have an unlimited food supply, but in local areas, insects may not be plentiful because of pesticide use. This can also affect the quality of the bats' food supply. Many scientists believe that population declines occurring today might be due, in part, to pesticides and environmental contaminants. Bats may be affected by eating contaminated insects, drinking contaminated water, or absorbing the chemicals while feeding in areas that have been recently treated.

What is Being Done to Prevent Extinction of the Indiana Bat?

Listing

Prompted by declining populations caused by disturbance of bats during hibernation and modification of hibernacula, the Indiana bat was listed in 1967 as "in danger of extinction" under the Endangered Species Preservation Act of 1966. It is listed as "endangered" under the current Endangered Species Act of 1973. Listing under the Endangered Species Act protects the Indiana bat from take (harming, harassing, killing) and requires Federal agencies to work to conserve it.

Recovery Plan

The Endangered Species Act requires that recovery plans be prepared for all listed species. The U.S. Fish and Wildlife Service developed a recovery plan for the Indiana bat in 1983 and is now revising that Plan. The recovery plan describes actions needed to help the bat recover.

Habitat Protection

Public lands like National Wildlife Refuges, military areas, and U.S. Forest Service lands are managed for Indiana bats by protecting forests. This means ensuring that there are the size and species of trees needed by Indiana bats for roosting; and providing a supply of dead and dying trees that can be used as roost sites. In addition, caves used for hibernation are managed to maintain suitable conditions for hibernation and eliminate disturbance.

Education and Outreach

Understanding the important role played by Indiana bats is a key to conserving the species. Helping people learn more about the Indiana bat and other endangered species can lead to more effective recovery efforts.

U.S. Fish & Wildlife Service
1 Federal Drive
Fort Snelling, Minnesota 55111
612/713-5350
http://www.fws.gov/midwest/endangered

December 2006

FACT SHEET:

Common name: Long's Rush

Scientific name: *Juncus longii*

Status in Maryland: Endangered

Wetland Indicator Status: Obligate (OBL) wetland species



Photo courtesy of Kerry Wixted

Description: Stems usually single or sometimes 2-3, 4-10 dm tall, arising from a cordlike stolon up to 2 dm long. Leaves rigid, deep green and narrow. Cyme hemispherical, 1-11 cm long, about half as broad. Flowers 2.5-3.5 mm long, petals olive brown with white margins. Seeds fusiform, yellowish, 8-12 ribbed, white tails unequal.

Flowering-May through September.

Habitat: Early successional seepages with exposed clay or peaty soils, bogs. Rare, endemic to the southeastern United States.

Northern Long-Eared Bat

Myotis septentrionalis

The northern long-eared bat is federally listed as an endangered species under the Endangered Species Act. ***Endangered*** species are animals and plants that are in danger of becoming extinct. Identifying, protecting and restoring endangered species is the primary objective of the U.S. Fish and Wildlife Service's Endangered Species Program.



Photo by Steve Taylor, University of Illinois

This northern long-eared bat, observed during an Illinois mine survey, shows visible symptoms of white-nose syndrome.

What is the northern long-eared bat?

Appearance: The northern long-eared bat is a medium-sized bat with a body length of 3 to 3.7 inches and a wingspan of 9 to 10 inches. Their fur color can be medium to dark brown on the back and tawny to pale-brown on the underside. As its name suggests, this bat is distinguished by its long ears, particularly as compared to other bats in its genus, *Myotis*.

Winter Habitat: Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible.

Summer Habitat: During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. They rarely roost in human structures like barns and sheds.

Reproduction: Breeding begins in late summer or early fall when males begin to swarm near hibernacula. After copulation, females store sperm during hibernation until spring. In spring, females emerge from their hibernacula, ovulate and the stored sperm fertilizes an egg. This strategy is called delayed fertilization.

After fertilization, pregnant bats migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies of females and young generally have 30 to 60 bats at the beginning of the summer, although larger maternity colonies have also been observed. Numbers of bats in roosts typically decrease from the time of pregnancy to post-lactation. Most bats within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth. Maximum lifespan for the northern long-eared bat is estimated to be up to 18.5 years.

Feeding Habits: Like most bats, northern long-eared bats emerge at dusk to feed. They primarily fly through the understory of forested areas feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation or by gleaning motionless insects from vegetation.

Range: The northern long-eared bat's range includes much of the eastern and north central United States, and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. The species' range includes 37 States and the District of Columbia: Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming.

Why is the northern long-eared bat in trouble?

White-nose Syndrome: No other threat is as severe and immediate as

this. If this disease had not emerged, it is unlikely that northern long-eared bat populations would be experiencing such dramatic declines. Since symptoms were first observed in New York in 2006, white-nose syndrome has spread rapidly from the Northeast to the Midwest and Southeast; an area that includes the core of the northern long-eared bat's range, where it was most common before this disease. Numbers of northern long-eared bats (from hibernacula counts) have declined by up to 99 percent in the Northeast. Although there is uncertainty about the rate that white-nose syndrome will spread throughout the species' range, it is expected to continue to spread throughout the United States in the foreseeable future.

Other Sources of Mortality:
Although no significant population declines have been observed due to the sources of mortality listed below, they may now be important factors affecting this bat's viability until we find ways to address WNS.

Impacts to Hibernacula: Gates or other structures intended to exclude people from caves and mines not only restrict bat flight and movement, but also change airflow and microclimates. A change of even a few degrees can make a cave unsuitable for hibernating bats. Also, cave-dwelling bats are vulnerable to human disturbance while hibernating. Arousal during hibernation causes bats to use up their energy stores, which may lead to bats not surviving through winter.

Loss or Degradation of Summer Habitat: Highway construction, commercial development, surface mining, and wind facility construction permanently remove habitat and are activities prevalent in many areas of this bat's range. Many forest management activities benefit bats by keeping areas forested rather than converted to other uses. But, depending on type and timing, some forest management activities can cause mortality and temporarily remove or degrade roosting and foraging habitat.

Wind Farm Operation: Wind turbines kill bats, and, depending on the species, in very large numbers. Mortality from windmills has been documented for northern long-eared bats, although a small number have been found to date. However, there are many wind projects within a large portion of the bat's range and many more are planned.

What Is Being Done to Help the Northern Long-Eared Bat?

Disease Management: Actions have been taken to try to reduce or slow the spread of white-nose syndrome through human transmission of the fungus into caves (e.g. cave and mine closures and advisories; national decontamination protocols). A national plan was prepared by the Service and other state and federal agencies that details actions needed to investigate and manage white-nose syndrome. Many state and federal agencies, universities and non-governmental organizations are researching this disease to try to control its spread and address its affect. See www.whitenosesyndrome.org/ for more.

Addressing Wind Turbine Mortality: The Service and others are working to minimize bat mortality from wind turbines on several fronts. We fund and conduct research to determine why bats are susceptible to turbines, how to operate turbines to minimize mortality and where important bird and bat migration routes are located. The Service, state natural resource agencies, and the wind energy industry are developing a Midwest Wind Energy Habitat Conservation Plan, which will provide wind farms a mechanism to continue operating legally while minimizing and mitigating listed bat mortality.

Listing: The northern long-eared bat is listed as an endangered species under the federal Endangered Species Act. Listing a species affords it the protections of the Act and also increases the priority of the species for funds, grants, and recovery opportunities.

Hibernacula Protection: Many federal and state natural resource agencies and conservation organizations have protected caves and mines that are important hibernacula for cave-dwelling bats.

What Can I Do?

Do Not Disturb Hibernating Bats: To protect bats and their habitats, comply with all cave and mine closures, advisories, and regulations. In areas without a cave and mine closure policy, follow approved decontamination protocols (see http://whitenosesyndrome.org/topics/decontamination). Under no circumstances should clothing, footwear, or equipment that was used in a white-nose syndrome affected state or region be used in unaffected states or regions.

Leave Dead and Dying Trees Standing: Like most eastern bats, the northern long-eared bat roosts in trees during summer. Where possible and not a safety hazard, leave dead or dying trees on your property. Northern long-eared bats and many other animals use these trees.

Install a Bat Box: Dead and dying trees are usually not left standing, so trees suitable for roosting may be in short supply and bat boxes may provide additional roost sites. Bat boxes are especially needed from April to August when females look for safe and quiet places to give birth and raise their pups.

Support Sustainability: Support efforts in your community, county and state to ensure that sustainability is a development goal. Only through sustainable living will we provide rare and declining species, like the northern long-eared bat, the habitat and resources they need to survive alongside us.

Spread the Word: Understanding the important ecological role that bats play is a key to conserving the northern long-eared and other bats. Helping people learn more about the northern long-eared bat and other endangered species can lead to more effective recovery efforts. For more information, visit www.fws.gov/midwest/nleb and www.whitenosesyndrome.org

Join and Volunteer: Join a conservation group; many have local chapters. Volunteer at a local nature center, zoo, or national wildlife refuge. Many state natural resource agencies benefit greatly from citizen involvement in monitoring wildlife. Check your state agency websites and get involved in citizen science efforts in your area.

FACT SHEET:

Common Name: Rainbow Snake

Scientific Name: *Farancia erytrogramma erytrogramma*



Photo courtesy of Lance Benedict

Size:
36 inches – 44 inches. Record: 60 inches.

Appearance:

- This beautiful glossy iridescent snake is like no other in Maryland.
- It has 3 red stripes on a blue-black background running the length of its body.
- The belly is primarily red with paired rows of black spots.
- The tail is short and ends in a sharp tip, which it may use to probe the ground.
- The scales are usually keelless but there may be some keeled scales above the vent.
- The anal plate is usually divided, but may also be single.

Habitats:

This is a highly aquatic species, preferring swamps, marshes, and slow-moving streams. They tolerate brackish water. They will also be found on dry land, burrowing in moist soil, muck or a sandy substrate.

How to Find:

This is a highly rare species in Maryland. These snakes are swimmers and burrowers. Young may be found by looking under boards or other cover near streams. This snake is state listed as Endangered in Maryland. If you find one, please contact the MD DNR Wildlife and Heritage Service.

Distribution in Maryland:

Found infrequently on the western portion of the Coastal Plain and possibly in the Potomac valley into Montgomery County.



Information for Fact Sheet Courtesy of Maryland Department of Natural Resources Website.

Small Whorled Pogonia

Isotria medeoloides



States where the small whorled pogonia, an orchid, is found.



Photos by USFWS; Sarena Selbo (right) and Susi vonOettingen (left)

The small whorled pogonia is a threatened species. Threatened species are animals and plants that are likely to become endangered in the foreseeable future. Endangered species are animals and plants that are in danger of becoming extinct. Identifying, protecting, and restoring endangered and threatened species is the primary objective of the U.S. Fish and Wildlife Service's endangered species program.

What is the small whorled pogonia?

Appearance - The small whorled pogonia is a member of the orchid family. It usually has a single grayish-green stem that grows about 10 inches tall when in flower and about 14 inches when bearing fruit. The plant is named for the whorl of five or six leaves near the top of the stem and beneath the flower. The leaves are grayish-green, somewhat oblong and 1 to 3.5 inches long. The single or paired greenish-yellow flowers are about 0.5 to 1 inch long and appear in May or June. The fruit, an upright ellipsoid capsule, appears later in the year.

Range - Although widely distributed, the small whorled pogonia is rare. It is found in 17 eastern states and Ontario, Canada. Populations are typically small with less than 20 plants. It has been extirpated from Missouri, New York, Vermont, and Maryland.

Habitat - This orchid grows in older hardwood stands of beech, birch, maple, oak, and hickory that have an open understory. Sometimes it grows in stands of softwoods such as hemlock. It prefers acidic soils with a thick layer of dead leaves, often on slopes near small streams.

What is the small whorled pogonia? (continued)

Reproduction - This pogonia flowers from mid-May to mid-June, with the flowers lasting only a few days to a week. It may not flower every year but when it does flower, one or two flowers are produced per plant. If pollinated, a capsule forms that contains several thousand minute seeds. The pogonia appears to self-pollinate by mechanical processes. The flower lacks both nectar guides and fragrance and insect pollination has not been observed.

Why is the small whorled pogonia threatened?

Habitat Loss and Degradation - The primary threat to the small whorled pogonia is the past and continuing loss of populations when their habitat is developed for urban expansion. Some forestry practices eliminate habitat. Also, habitat may be degraded or individual plants lost because of recreational activities and trampling.

Collection - As with all rare orchids, the small whorled pogonia is vulnerable to collecting for commercial or personal use.

What Is being done to prevent extinction of the small whorled pogonia?

Listing - The small whorled pogonia was added to the U.S. List of Endangered and Threatened Wildlife and Plants in 1982 as an endangered species. In 1994 it was reclassified to threatened.

Recovery Plan - The U.S. Fish and Wildlife Service prepared a recovery plan and revised that plan in 1992. The Recovery Plan describes and prioritizes actions needed to help recover the species.

Research - Many small whorled pogonia populations are being monitored to determine long-term population trends. Habitat management techniques, such as reducing shade through selected tree removal are being investigated.

Habitat Protection - A variety of government and private conservation agencies are working to preserve the small whorled pogonia and its habitat. Voluntary protection agreements have also been made with some private landowners.

What can I do to help prevent extinction of species?

Learn - Learn more about the small whorled pogonia and other endangered and threatened species. Understand how the destruction of habitat leads to loss of endangered and threatened species and our nation's plant and animal diversity.

Volunteer - Volunteer at your local zoo, wildlife refuge or nature center. Work with their staff or other community members to maintain and restore local habitat.

Protect – Protect native plants by cleaning your shoes after hiking to avoid spreading invasive plants seeds and staying on trails if you are hiking in an area with rare plants in the the understory.

Grow Natives - Grow native plants in your lawn and garden but obtain the plants from local nurseries, do not dig up native plants from natural areas. Avoid using invasive, non-native plants in landscaping, such as purple loosestrife, bush honeysuckles and burning bush.

U.S. Fish & Wildlife Service
1 Federal Drive
Fort Snelling, Minnesota 55111
612/713-5350
http://www.fws.gov/midwest/endangered

January 2008

Tricolored Bat
Perimyotis subflavus

The tricolored bat is proposed federally endangered under the Endangered Species Act. ***Endangered*** species are animals and plants that are in danger of becoming extinct. Identifying, protecting and restoring endangered species is the primary objective of the U.S. Fish and Wildlife Service's Endangered Species Program.



What is tricolored bat?

Appearance: The tricolored bat is a with a body length of 3 to 3.5 inches and a wingspan of 8 to 10 inches. They are distinguished by unique tricolored fur that appears dark at the base, lighter in the middle and dark at the tip. Tricolored bats often appear yellowish, varying from pale yellow to nearly orange, but may also appear silvery-gray, chocolate brown or black. Newly flying young are much darker and grayer than adults.

Winter Habitat: Tricolored bats spend winter hibernating in caves and mines called hibernacula. Although, in the southern United States, where caves are sparse, tricolored bats often roost in road-associated culverts and trees, and remain active and feed throughout winter. Tricolored bats exhibit high site fidelity with many individuals returning year after year to the same hibernaculum.

Summer Habitat: Tricolored bats primarily roost among live and dead leaf clusters of live or recently dead deciduous hardwood trees. In the southern and northern portions of the range, tricolored bats will also roost in Spanish moss and *Usnea trichodea* lichen, respectively. They have been observed roosting during summer among pine needles, within artificial roosts like barns, beneath porch roofs, bridges, concrete bunkers, and rarely within caves. Female tricolored bats exhibit high site fidelity, returning to the same summer roosting locations. Female tricolored bats form maternity colonies and switch roost trees regularly. Males roost singly.

Reproduction: Male and females converge at cave and mine entrances between mid-August and mid-October to swarm and mate. Adult females store sperm in their uterus during the winter and fertilization occurs soon after spring emergence from hibernation. Females typically give birth to two young, rarely one or three between May and July. Young grow rapidly and begin to fly at 3 weeks of age and achieve adult-like flight and foraging ability at 4 weeks. Adults often abandon maternity roosts soon after weaning, but young remain longer. Tricolored bats are considered juveniles, called subadults, when entering their first hibernation and most probably do not mate their first fall. The oldest tricolored bat on record is a male captured 14.8 years, after it was originally captured and banded.

Range: Tricolored bats are known from 39 States: Alabama, Arkansas, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, Wisconsin, West Virginia, Wyoming, as well as Washington D.C. and four Canadian Provinces: Ontario, Quebec, New Brunswick, Nova Scotia. They also known to live in Guatemala, Honduras, Belize, Nicaragua and Mexico.

Why is the tricolored bat in trouble?

White-nose Syndrome: No other threat is as severe and immediate as this. It has led to 90 to 100% declines in tricolored bat winter colony abundance at sites impacted by the disease. Since white-nose syndrome was first observed in New York in 2006, it has spread rapidly across the majority of the tricolored bat range.

Fact Sheet: Spotted Turtle
Clemmys guttata



Description:

- Length (carapace): 3-5 in (7.5-12.5 cm)
- Sexual dimorphism: Males tend to have brown eyes and chin and a slightly concave plastron (lower shell), females have orange eyes, a yellow chin and a flat plastron. Females are slightly larger than males on average.
- Physical Description: a very small turtle. The carapace is smooth, without obvious growth ridges on the scutes. The plastron has visible growth ridges, but these are not a reliable way to age the individual.
- Coloration: As the name suggests, spotted turtles have yellow spots on their carapace, which is dark brown or black. Older individual's spots may be faded, and some individuals lack spots. The plastron is yellow or orange, and has a large black spot in each scute that grows larger with age. The head is black, with varying amounts of yellow spots, and a yellow or orange blotch on either side. The underside of the neck is reddish- orange to pink.

Habitat and Range:

- Geographic range: Great Lakes region and Atlantic seaboard, from southern Canada to Florida
- Preferred Habitat: Shallow wetlands, including wet meadows, bogs, swamps, ponds, ditches, and other small, calm bodies of water.

Diet:

- Omnivorous
    - Animal diet includes invertebrates, small fish, small frogs and tadpoles. Will also occasionally feed on carrion.
    - Plant diet includes algae and aquatic plants, especially the seeds of water lilies.

Adaptations:

- Have a shell for protection
- Flattened shell and webbed feet aid in swimming
- Can slow their heartbeat so they need less oxygen when under water
- Like other cold-blooded creatures, they will bask in the sun for warmth, but retreat into

the water if they need to cool off
- No teeth, but jaws have tough, horny plates for gripping food
- During the winter, the turtles will hibernate by burying themselves in the mud. In the peak heat of summer they are also known to become dormant, seeking shelter from the heat on land, under tree roots.

Lifespan:

- 30+ years

Ecosystem relationships:

- Predators: Preyed on by a wide variety of species, but most common predators are raccoons and muskrats.
- Interspecies competitors: Spotted turtles compete with other aquatic turtles, wading birds, predatory fish and some mammals for prey items.
- Role/ Niche: Spotted turtles fit an important role as both predators of invertebrates and other spall prey, and as a source of food for larger predators.

Reproduction:

- Breeding season: courtship and mating occurs in early spring, and females lay eggs in late spring.
- Behavior: Males pursue females in the water, where breeding takes place. Females find nesting spots in sunny locations with moist, well drained soil.
- Incubation: 11 weeks, faster with warmer temperatures. Sex of offspring dependent on temperature during the middle of the incubation period, with cooler temperatures producing more males, and warmer temperatures producing more females.
- Offspring: 3-4 eggs per clutch on average, usually only one clutch per year, but multiple clutches possible, especially in captivity.
- Maturation: Spotted turtles reach reproductive maturity at about 7-14 years old.

Activity:

- Diurnal

Conservation Status and Threats:

- Listed on the IUCN Red List as Endangered.
- Threats
    - The biggest threat to spotted turtles is habitat loss and degradation.
    - The species currently survives in sporadic localized populations, many of which are in decline. This population fragmentation makes them vulnerable to extinction, since the genetics of isolated populations tends to become stagnant.
- Conservation efforts:
    - As an endangered species, spotted turtles are protected from the pet trade and from killing by local and federal regulations.
    - Further habitat protection and restoration is needed to ensure the survival of this species.

Endangered Species Act - Section 7 Conference

CONFERENCE OPINION

U.S. Fish and Wildlife Service Reference:
2025-0024332

Department of Defense's 7(a)(1) Conservation Strategy for the Monarch Butterfly (*Danaus plexippus*) for Mission and Sustainment Operations within the Continental United States

Federal Action Agency: Department of Defense

Conference Conducted By: U.S. Fish and Wildlife Service

Catherine T. Phillips
Assistant Regional Director,
Ecological Services

Date

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APPENDICES

Appendix A. DOD's 7(a)(1) Conservation Strategy for Monarch - INRMP Stage Consistency Check
Appendix B. DOD Installations in Continental U.S. with INRMPs with Estimated Grassland Acres

1 ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AFCEC	Air Force Civil Engineer Center
AFPMB	Armed Forces Pest Management Board
ATV	all-terrain vehicle
BASH	Bird Aircraft Strike Hazard
BMPs	Best Management Practices
CARCD	California Association of Resource Conservation Districts
CCAA/CA	Candidate Conservation Agreement
CDL	Cropland Data Layer
CEC	Commission for Environmental Cooperation
CEMML	Center for Environmental Management of Military Lands
CFR	Code of Federal Regulations
CI	confidence interval
CRP	Conservation Reserve Program
CS	tear gas (a chemical used in riot control)
CSLO	Camp San Luis Obispo
DAF	Department of Air Force
DISDI	Defense Installation Spatial Database Infrastructure
DOD	Department of Defense
DOD PCRG	DOD's Pollinator Conservation Reference Guide
DODI	DOD Issuance
DODM	DOD Manual
DOI	U.S. Department of Interior
DZ	drop zone
EFTA	Environment for the Americas
ENA	Eastern North America population
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESTCP	Environmental Security Technology Certification Program
FY	Fiscal year
ha	hectare
HC/TA	hexachloroethane/terephthalic acid smoke
IMMP	Integrated Monarch Monitoring Program
INRMP	Integrated Natural Resources Management Plan
IPMPs	Integrated Pest Management Plans
ISR	intelligence, surveillance and reconnaissance
LZ	landing zone
MAFWA	Midwest Association of Fish and Wildlife Agencies
MCAS	Marine Corps Air Station
MCB	Marine Corps Base

MCU	Monarch Conservation Units
MJV	Monarch Joint Venture
MOSI	Western Monarch Overwintering Science Initiative
NAVFAC	Naval Facilities Engineering Systems Command
NLCD	National Landcover Dataset
NPLD	National Public Lands Day
NRCS	Natural Resources Conservation Service
NRM	DOD Natural Resource Manager
NSA	Naval Support Activity
NWS	Naval Weapons Station
OE	*Ophryocystis elektroscirrha*
PAZ	Priority Action Zone
pE	probability of extinction
PZ	pickup zone
RASP	Recovery and Sustainment Partnership Initiative
RCDs	resource conservation districts
REPI	Readiness and Environmental Protection Integration
SAIA	Sikes Act Improvement Act
SAP	Species Action Plan
SERDP	Strategic Environmental Research and Development Program
SERPPAS	Southeast Regional Partnership for Planning and Sustainability
SFB	Space Force Base
SRTA	short-range training ammunition (low-velocity plastic bullets)
SSA	Species Status Assessment
U.S.	United States of America
UAS	Unmanned Aerial Systems
UAV	Unmanned Aerial Vehicles
USC	U.S. Code
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFSIP	U.S. Forest Service International Program
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
UTV	utility task vehicle
WAFWA	Western Association of Fish and Wildlife Agencies
WASH	Wildlife Aircraft Strike Hazard
WMC	Western Monarch Count

2 INTRODUCTION

This document represents the U. S. Fish and Wildlife's (USFWS) Conference Opinion (Opinion) based on our review of the Department of Defense's 7(a)(1) Conservation Strategy for the Monarch Butterfly (Conservation Strategy or Strategy) and military mission and sustainment actions. The Opinion addresses effects to species in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA).

This document complies with section 7 of the ESA, and 50 CFR §402 of the USFWS's interagency regulations governing section 7 of the ESA, as amended. The monarch butterfly (*Danaus plexippus*) is a candidate for listing as threatened or endangered. There are no requirements under section 7(a)(2) or 7(a)(4) of the ESA to consult or confer, respectively, on actions due to their effects on candidate species. This is a voluntary conference, proactively requested by the Action Agency, to help ensure compliance of the Proposed Action with section 7 of the ESA in the event the USFWS were to propose listing of the species under its authorities of the ESA.

The Conservation Strategy was developed pursuant to section 7(a)(1) of the ESA, as amended, which requires all federal agencies to carry out programs within their authorities to advance the recovery of endangered and threatened species. The Conservation Strategy describes how the Department of Defense (DOD) will use their authorities to conserve monarch within the continental United States (i.e., the lower 48 states; U.S.). Through implementation of its Strategy, which includes ecosystem management and proactive conservation policies and programs, DOD will continue to have a meaningful positive impact on the status of monarch. The Strategy was developed in collaboration with the USFWS to ensure the program will serve the purposes of advancing monarch conservation and continuing to fulfill DOD's responsibilities under 7(a)(1). The Strategy describes ecosystem management across its more than 22 million acres of land subject to the Sikes Act (16 U.S.C. 670 *et seq.*), implementation of existing policies and procedures, and conservation programs that may affect monarch, over 25 years.

The primary intent of the Strategy is to identify, document, and highlight the contributions of DOD's actions to monarch conservation and describe how DOD's policies and programs proactively abate the impacts of many threats to monarch on military installations across the U.S. Given the monarch butterfly's occurrence in a wide variety of habitats and its near ubiquitous distribution throughout the U.S., its listing under the ESA could result in substantial impacts to the DOD and military readiness. Considering this, another intent of the Strategy is to promote regulatory predictability and flexibility, decrease potential regulatory conflict, and streamline monarch consultation requirements for all DOD activities under ESA section 7(a)(2) across all military installations if the species were to become listed under the ESA. Accordingly, additional information on mission and sustainment actions was provided as supplemental information to the Strategy so that those effects could be considered as part of this programmatic conference. Military mission and mission sustainment includes all activities needed to support the mission of the military, including military training, readiness, and operations activities.

The conference was carried out in accordance with the implementing regulations (50 CFR 402.10(d) under 7(a)(2). This conference opinion may be adopted as the USFWS's biological opinion should the species be listed. Prior to adoption as the biological opinion, the USFWS will incorporate any significant new information (including new information from the rulemaking process on the proposed listing or proposed critical habitat designation) into the biological opinion and will include the addition of an incidental take statement, if appropriate (see Reinitiation Notice).

2.1 Conference History

This Opinion is based on information provided in the Strategy, several virtual meetings, emails, and other sources of information shared between agencies. A previous version of a Conservation Strategy was received by the USFWS on January 3, 2024. Although preliminary technical comments were sent in May 2024, the USFWS provided additional feedback including a suggested outline on September 3, 2024. The Conservation Strategy was revised to align with the USFWS's proposed outline. Through several meetings in September through early December 2024, the USFWS and DOD representatives worked collaboratively to develop the updated Strategy, which was finalized on December 9, 2024, along with this Conference Opinion.

3 Conference Opinion

3.1 Programmatic Conference/Consultation Approach

This is a programmatic conference with the intention of increasing efficiency and streamlining the conference (and consultation) process. The intent of this approach is to add predictability and allow the agency to take a landscape approach to avoid the "piecemeal" effect, such that DOD can establish and monitor the effectiveness of their Conservation Strategy across all Military Services. The programmatic nature of the Strategy lends itself to a programmatic conference/consultation approach. Ultimately, consulting on this programmatic action through this programmatic Opinion will produce better conservation outcomes for the monarch than installation-by-installation consultations.

This Opinion evaluates the potential effects of implementation of the Strategy and provides a jeopardy analysis. It serves as the analytical framework and establishes the specific conditions that future projects must adhere to and operate within to remain consistent with the Opinion's scope and analysis.

Under the Sikes Act, the DOD is required to develop and implement Integrated Natural Resources Management Plans (INRMPs) in cooperation with the USFWS and the respective State fish and wildlife agency for installations with significant natural resources. The plans represent the mutual agreement of the three parties and are reviewed for operation and effect at least every 5 years. In addition to these processes under the Sikes Act, USFWS and DOD conduct section 7 consultation under the ESA on INRMP projects implemented in the furtherance of the INRMP, when appropriate to ensure DOD installations are not likely to

jeopardize the continued existence of any listed or proposed species, or adversely modify or destroy designated or proposed critical habitat. Refer to Next Steps and INRMP Integration for additional details on how the Strategy and this Opinion will be stepped down to the installation level; refer to Appendix A for an example draft form that may be used or adapted to assist USFWS Field Offices and installations with this process.

This Opinion covers the future implementation of continuing/ongoing activities for which DOD has discretionary control. Actions that have occurred in the past, or continuing activities for which DOD does not have discretionary control, are considered as part of the baseline. As described in the Effects of the Action section, we consider all consequences to listed species that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action, and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

If the monarch is proposed for listing, DOD must consider whether any action not considered under this conference is likely to jeopardize the continued existence of the monarch (50 CFR 402.10). If a final rule were published, effects to monarch from any DOD actions not considered in this conference will require a separate consultation, unless this Opinion is amended or another programmatic consultation that covers those actions is established in the meantime.

Finally, no other federally threatened or endangered species that occur on DOD installations are covered by this Opinion. However, previous consultations do exist that have addressed the effects of many of the Strategy's activities on other listed species and critical habitats. Based on those prior consultations, many of these activities are anticipated to benefit many other species, including other at-risk pollinator species. In the event that such effects on other species or critical habitats have not been addressed by a prior consultation, a separate consultation will occur prior to implementing that particular activity.

3.2 Description of the Proposed Action

A federal action means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the U.S. or upon the high seas (50 CFR 402.02).

There are two parts to the Proposed Action: 1) DOD's approval and implementation of their 7(a)(1) Conservation Strategy and 2) future implementation of ongoing military mission and sustainment actions.

3.2.1 7(a)(1) Conservation Strategy

The goal of the Strategy is to continue to effectively conserve monarch butterfly on DOD lands, while executing all military missions and sustainment actions.

The Strategy includes three main approaches to ensuring conservation of monarch (Figure 1):

1) ecosystem management across ~22 million acres throughout the U.S. on installations with an INRMP,

2) future implementation of existing policies and procedures to promote conservation of monarch and other at-risk pollinators, and

3) future implementation of existing conservation programs (e.g., outreach, partnerships, research funding) to benefit monarch (contingent upon appropriations).

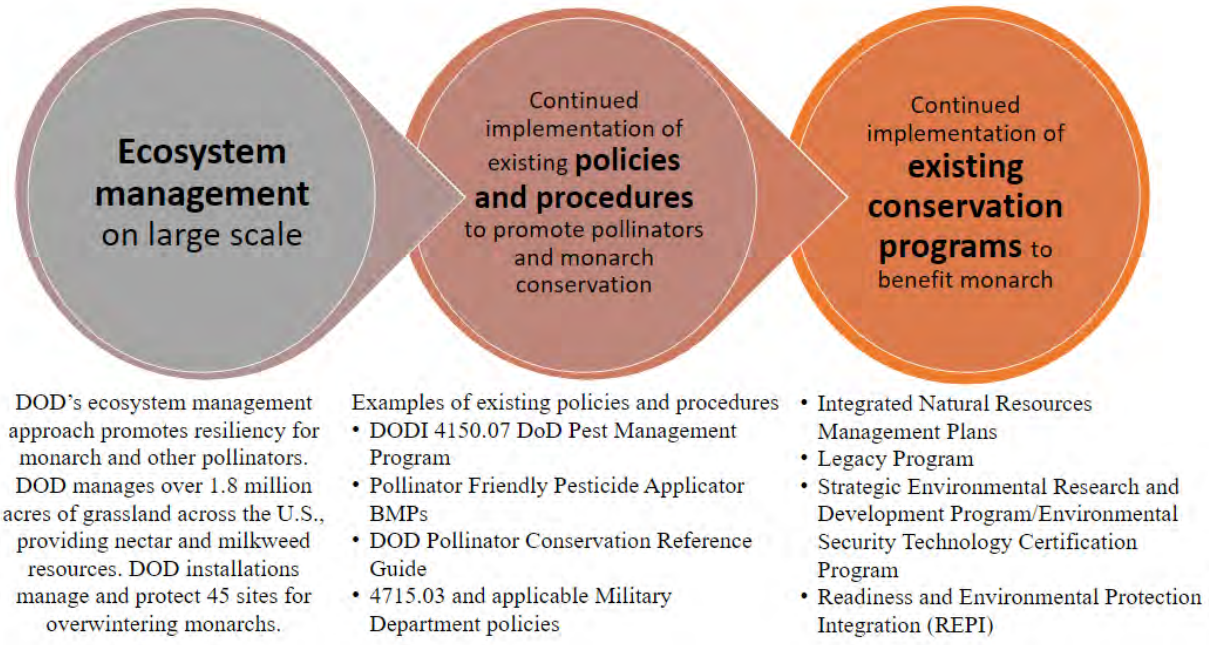


Figure 1. General three-pronged approach for conservation of monarch.

The Sikes Act Improvement Act (SAIA), passed in 1997, made it mandatory that all military installations, including state-owned army national guard sites with significant natural resources prepare and implement, when resources and staff are available, their INRMPs in cooperation with the USFWS, relevant state wildlife agency. DOD policy also recommends coordination with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service where appropriate. INRMPs are required to support the preparedness of the armed forces by providing for no net loss to the military mission coupled with the management of natural resources.

According to the Defense Installation Spatial Database Infrastructure (DISDI) Fiscal Year (FY) 21 *DOD_Site_Locations_Boundaries* shapefile, the DOD owns and manages approximately 25 million acres within the lower 48 U.S. (not including Alaska, Hawaii, and the commonwealths), with just over 22 million of those acres (~90%) being subject to the Sikes Act (16 USC 670a-670f). Just under 3 million acres (~10% of DOD owned land) in the lower 48 U.S. are not covered by an INRMP, because the installations have been determined to not have significant natural resources to warrant an INRMP. Even installations that are not required to have an INRMP adhere to applicable federal and state laws as well as the same DOD policies and guidance required of installations with INRMPs. Furthermore, DOD natural resources policy –

including but not limited to DOD Instruction (DODI) 4715.03 *Natural Resources Conservation Program*, DOD Manual (DODM) 4715.03 *INRMP Implementation Manual*, and each Military Service Component's Policies – guide and direct installations on how to develop, implement, monitor, and report on INRMPs.

INRMPs focus on principles of ecosystem management and include management of threatened, endangered, and at-risk species. See Section 3.2.1.1.1 for additional discussion on INRMPs and consideration of pollinators on military lands.

The unique authorities and strong conservation programs on installations and across the DOD promote a land management ethic that prioritizes resilience within and across ecosystems. The scale of the DOD and its focus on climate resilience, partnerships, and conservation has and will continue to significantly contribute to conservation of monarch and other at-risk pollinators.

3.2.1.1 Ecosystem Management under the Sikes Act

Ecosystem management includes all land management activities, such as timber management and forest thinning; prescribed fire; use of pesticides; use of insecticides and herbicides; outdoor recreation; planting and seeding; nuisance wildlife control (trapping/removal); agricultural outlease (row crop production, grazing, haying); and management for monarch (planting host plants and nectar resources, managing overwintering sites, removing invasive species in suitable habitat).

Milkweed (*Asclepias* spp.) and nectaring resources have been declining across the U.S., largely due to conversion of grasslands to developed or agriculture areas (USFWS 2020). In the last ten years, the U.S. has lost more than 50 million acres of grasslands with 5.7 million acres being lost to agriculture between 2008 and 2012 (Lark et al. 2015). Grasslands on DOD installations are not faced with the same pressures from conversion, with only 0.15 and 0.07% change from grassland to developed and agriculture areas, respectively, occurring from 2014 to 2022 (see the Strategy's Appendix C). In addition, existing habitat and vegetation management actions on military installations currently maintain, enhance, and promote the availability and quality of monarch habitat. Positive management outcomes are accomplished largely through proper ecosystem management that can be achieved by implementing regionally appropriate and site-specific management regimes such as prescribed burning, mowing or haying, and invasive/noxious species control, among others, which are outlined in each installation's INRMP.

3.2.1.1.1 Integrated Natural Resources Management Plans

As described above, Congress requires the DOD to prepare and implement INRMPs to outline how military installations with significant natural resources will manage those resources. INRMPs are prepared in cooperation with the USFWS, appropriate state wildlife agency, and National Oceanic and Atmospheric Administration, when appropriate. The Sikes Act requires that the USFWS formally review INRMPs before they are implemented. In April 2018, the USFWS added an addendum to their Guidelines for Coordination on Integrated Natural Resource Management Plans that provided guidance for addressing pollinator needs and management in

INRMPs. In turn, INRMPs provide an excellent opportunity to encourage pollinator conservation on military lands.

Many DOD Natural Resource Managers (NRMs) have taken proactive approaches to monarch and pollinator conservation at their installations and have included sections within their INRMPs that address monarchs and other pollinators. For example, DOD contracted with Texas A&M's Natural Resources Institute to review INRMPs and found that just over 200 of the more than 300 INRMPs reviewed indicated that their installations either actively conduct or plan to conduct invertebrate surveys at their sites, with more than 100 indicating that they currently conduct or plan to conduct monarch or pollinator-specific surveys. Many of these same installations also provide information within their INRMPs on a wide variety of management activities that may affect monarchs or other pollinators and the best management practices (BMPs) and conservation actions they are implementing to avoid, minimize, or mitigate their impacts. Management activities addressed in current INRMPs that may affect monarchs or other pollinators include but are not limited to pesticide, insecticide, and herbicide use; prescribed burning; invasive/noxious species control; mowing; and tree removal.

Furthermore, many installations already manage for other threatened, endangered, or at-risk pollinator species such as the rusty patched bumble bee (*Bombus affinis*), Karner blue butterfly (*Lycaeides melissa samuelis*), and the regal fritillary (*Argynnis* [Speyeria] *idalia*), among others. In many cases management activities, conservation actions, and protocols intended for one species often benefit sympatric species. One such example is the regal fritillary, which both Fort Riley, Kansas, and Fort Indiantown Gap, Pennsylvania, have been managing, surveying, and implementing conservation actions that benefit the species for over a decade. Both installations indicated in their INRMPs that much of the work they do for the regal fritillary would also benefit the monarch. Subsequently, they folded the monarch and its host plant into existing protocols and management strategies and had been doing so long before the monarch was petitioned for listing.

3.2.1.2 Policies and Procedures

Existing DOD policies and procedures promote conservation of monarch through limiting pesticide exposure and utilizing pollinator-friendly BMPs for pest management to protect pollinators including butterflies, and adoption of the DOD Pollinator Conservation Reference Guide (DOD PCRG) which contains helpful references and additional BMPs.

3.2.1.2.1 Limiting Pesticide Exposure

Installations are required to develop and implement Integrated Pest Management Plans (IPMPs) under DODI 4150.07 *DOD Pest Management Program*. IPMPs identify how, when, and where pest species are treated while also focusing on and striving for the continued reduction in reliance on pesticides, insecticides, and herbicides.

These policies explicitly direct the DOD to minimize the use of pesticides, including herbicides, particularly in sensitive habitat sites or where listed species may occur. Then when doing so, it must be applied with care and precision by a Certified Pest Management Applicator. The DOD's position on Integrated Pest Management is one of early detection and rapid response as opposed

to continual treatment. There must be an identified pest before a treatment method is implemented.

In addition to DODI 4150.07 *DOD Pest Management Program*, the "Pollinator Friendly Pesticide Applicator Best Management Practices" fact sheet developed by Naval Facilities Engineering Systems Command (NAVFAC) Applied Biology instructs applicators on proper pesticide use to avoid harming pollinators, their food sources, water, and habitat. The instructions in the fact sheet are now the guidance found within all Navy and Marine Corps IPMPs. The DOD PCRG, which serves as the current DOD guidance for monarch and other related pollinator BMPs, also contains an entire section dedicated to informing land managers how they can reduce pesticide use and adverse impacts of pest control on pollinators, including monarch. Guidance includes:

- Eliminating or reducing the use of pesticides.
- If pesticides are used:
    - Select pesticides that are specific to the pest;
    - Time applications to avoid monarch activity periods;
    - Minimize drift to non-target areas by direct ground applications;
    - Establish buffers.

INRMPs for more than 100 installations discuss pesticides, insecticides, and herbicides as they relate to monarchs and other pollinators, as well as the conservation actions the installations currently take to reduce monarch and other pollinator exposure. For instance, at Camp San Luis Obispo (CSLO) in California, spatial buffers are in place at various distances depending on application method when deploying systemic insecticides in order to minimize exposure, limit transmission, and reduce drift. The National Guard Marseilles in Illinois restricts the use of glyphosate in all areas within their installation to limit pollinator exposure. Several other installations reduce pollinator exposure to pesticides when removing invasive species by using alternative methods of control such as aptly timed mowing.

DOD has standard operating procedures that reduce the influence that agricultural-related activities may have on monarchs and other pollinators. Outleases (i.e., row crop agriculture, haying, and grazing) are subject to the same existing rules and regulations listed under the installation's IPMP. Therefore, the lessee is contractually obligated to abide by the same rules and guidance that are followed for activities on the rest of the installation (including pesticide use).

The overall footprint of row crop agriculture on the DOD is relatively small. Currently there are <50,000 acres of row crops on DOD managed lands, which accounts for approximately 0.20% of the total DOD footprint. Like row crops, haying is also a relatively minor activity on DOD properties with approximately 50,000 acres of hay ground located within installations. Of the agricultural related activities that occur on DOD lands, grazing is the most significant with approximately 500,000 acres of livestock grazing occurring on DOD managed lands. Although

grazing related activities account for substantially more acres than row crops or haying, grazing only accounts for just over 2% of the total DOD footprint. Given the small number of agricultural outleases on DOD properties and their relatively small size in the context of their overall footprint across the entire DOD enterprise, the influence of agricultural outlease-related impacts to monarchs on DOD-managed lands is minimal.

3.2.1.2.2 2014 Presidential Memorandum

The DOD has enacted numerous pollinator-specific policies, strategies, and conservation efforts in response to the Presidential Memorandum issued in June 2014 entitled Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators. The 2014 memorandum established an interagency Pollinator Health Task Force that developed a national strategy promoting the health of bees, butterflies, other pollinating insects, birds, and bats that outlined goals and federal actions that needed to be taken to achieve those goals. The memorandum also directed the Department of Energy and other federal agencies to take immediate measures to support habitat restoration projects for pollinators, use pollinator-friendly native landscaping, and minimize the use of pesticides harmful to pollinators when possible (79 FR 35903). In response, the Office of the Under Secretary of Defense distributed a memorandum that expanded DOD Policy to use current BMPs, when applicable, to specifically "protect pollinators (e.g., bees, birds, bats, butterflies, moths) and their habitats." Subsequently, the U.S. Department of Agriculture (USDA) and U.S. Department of Interior (DOI) released the Pollinator-Friendly Best Management Practices for Federal Lands document while the USDA and U.S. Environmental Protection Agency (EPA) transmitted the National Strategy to Promote the Health of Honey Bees and Other Pollinators on behalf of the Pollinator Health Task Force. This report provides a dedicated DOD Pollinator Protection Plan, direction to other federal agencies, and recommends BMPs. In response to the memoranda and other agency actions, NAVFAC Applied Biology put together the Pollinator Friendly Pesticide Applicator Best Management Practices fact sheet, discussed above.

3.2.1.2.3 DOD Pollinator Conservation Reference Guide

In 2017, the Department of Air Force (DAF) in collaboration with the USFWS developed the DAF Pollinator Conservation Reference Guide. In 2018, Air Force Civil Engineer Center (AFCEC) and the USFWS allowed the Armed Forces Pest Management Board (AFPMB) to adopt their guide for DOD-wide distribution and this became the DOD Pollinator Conservation Reference Guide (DOD PCRG). The AFPMB is a directorate within the Office of the Secretary of Defense Energy, Installations, and Environment that recommends policies and procedures, provides guidance, and coordinates the exchange of information related to pest management throughout the DOD. The AFPMB also provides DOD-specific certification training to personnel to further conserve pollinators across military lands with respect to insecticide and herbicide use. Informed by existing agency policy, guidance, instructions, and business rules, the DOD's PCRG provides technical information, resources for implementation, and builds on existing guidance documents (e.g., the Pollinator-Friendly Best Management Practices for Federal Lands document). The DOD PCRGP is separated into six overarching sections that include an introduction; conserving pollinator species of concern; conserving and enhancing pollinator habitat; reducing pesticide use and adverse impacts of pest control; promoting pollinator

conservation through education and outreach; and partnerships for pollinator conservation off-installation. The DOD PCRFG highlights threatened, endangered, candidate, and at-risk pollinator species, provides links to helpful outside resources, offers recommended conservation actions, and serves as the current DOD reference for monarch and other related pollinator BMPs.

3.2.1.3 Conservation Programs

In addition to implementation of INRMPs, DOD will continue to implement (contingent on sufficient appropriation and prioritizing mission fulfillment) conservation programs for monarch across the nation. In the past, these efforts included a large interagency agreement, implemented under the Legacy Program, that covers multiple monarch conservation-focused projects; extensive overwintering habitat protection efforts; and large-scale conservation programs and initiatives (funding, research, outreach, and leveraging partnerships). Implementation of the installation-level programs will continue into the future but will vary by location and activity based on appropriations, interest, and opportunities. DOD's efforts to protect overwintering habitat and other large-scale conservation programs and initiatives are also described in this section. See the Strategy for examples of recently completed projects and their contributions to monarch conservation across the continental U.S., considered as part of the Environmental Baseline in this Opinion.

3.2.1.3.1 Overwintering Habitat Protection

The major threats to overwintering sites in the U.S. include urban development, disease and pests, improper tree management, and increased threat of drought and fire due to changing climate. The BMPs described below, and those included in other relevant guidance documents produced either by or for the DOD for overwintering habitat, will reduce or eliminate many of these threats on military lands. These actions primarily include reducing disturbance when monarchs are present, implementing vegetation management activities that minimize destruction or disturbance of monarchs, and enhancing nectar resources near overwintering sites and along the coast. Current BMPs in the DOD PCRFG include:

- Reducing human disturbance at overwintering site when monarchs are present.
- Avoiding tree removal and tree trimming at monarch overwintering sites unless trees pose a human health and safety risk.
- Developing long-term management plans at overwintering sites that include (in many instances) the planting of native trees and nectar plants.
- Consulting with a monarch expert and an arborist prior to any cutting or thinning within tree stands known to support overwintering monarchs. Schedule tree thinning or cutting outside of the November to February overwintering season.

For additional discussion on efforts to protect overwintering habitat, refer to Availability of Overwintering habitat section.

3.2.1.3.2 Large-scale Conservation Programs and Initiatives

3.2.1.3.2.1 Strategic Environmental Research and Development Program/Environmental Security Technology Certification Program

The Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) are programs that fund research that seek to harness the latest science and technology to improve DOD's environmental performance, reduce costs, and enhance and sustain mission capabilities. These programs promote partnerships and collaboration among academia, industry, and the Military Services, and other Federal agencies. SERDP invests in broad topics of basic and applied research and ESTCP focuses on DOD's environmental, resilience, and installation energy and water technology and validation, mainly by promoting the transfer of innovative technologies that have successfully established proof of concept to field or production use. Funding for these programs occurs annually and has included funding for projects that investigated development of environmental DNA (eDNA) as a management tool for at-risk pollinators on military lands, evaluation of the impacts of multiple stressors on at risk species, ecosystem resilience research, assessing pollinator communities via eDNA, and the impact of non-native predators on pollinators and native plant production.

3.2.1.3.2.2 Readiness and Environmental Protection Integration Program

Beginning in 2003, DOD has been partnering with private conservation groups as well as state and local governments under the Readiness and Environmental Protection Integration (REPI) Program. REPI is an important tool for combating encroachment that can limit or restrict military training, testing, and operations by helping remove or avoid land-use conflicts near installations while simultaneously addressing regulatory restrictions that inhibit military activities. While REPI's mission is to protect military readiness, REPI also benefits the environment by conserving land near military installations and ranges. The partnerships formed under the REPI program work across boundaries, often with the goal of enhancing and protecting wildlife habitat and other natural spaces. REPI is continually advancing innovations in new financing techniques, endangered species crediting, and use of other authorities while encouraging partners to accelerate the rate and pace of protection. To give a sense of scale of this program, from 2003 to 2023, DOD leveraged over $1.4 billion with nearly $1.3 billion in non-DOD partner contributions to protect, enhance, or restore over 1.2 million acres of land across the U.S. There are clear benefits to the ecosystems and species that live within them, including monarch, that are achieved by protecting and managing landscapes around military lands. In 2016, for example, $1.5 million in REPI funds were combined with $2.2 million in partner funding to protect 1,015 acres around Fort Cavazos which is within the key migration route and breeding grounds for the eastern monarch population.

Outside of direct funding of projects that protect and restore the ecosystems that monarchs rely on, the REPI Program seeks to prioritize landscape-scale initiatives through partnerships by participating in the Sentinel Landscape Partnership, the Southeast Regional Partnership for Planning and Sustainability (SERPPAS), and the Western Regional Partnership. Each of these partnerships prioritizes supporting and funding of large-scale restoration, management, and protection of ecosystems including the promotion of sustainable land uses, wildlife corridors, and research, to name a few. These partnerships promote resilient landscapes that can support their individual, population, and species needs, initiatives that promote landscape-level solutions like the ones listed above are essential to the sustainment and recovery of monarch in the future.

3.2.1.3.2.3 DOD Legacy Resource Management Program

The DOD Legacy Resource Management Program (Legacy Program) provides financial assistance to regional or national efforts to protect and enhance natural and cultural resources while simultaneously enabling military readiness. This program provides coordinated, department-wide, and partnership-based integration of military mission readiness with the conservation of irreplaceable natural and cultural resources. This program provides an opportunity for installations to work with experts in the field of monarch conservation and obtain technical assistance, site-specific monarch guidance, assistance with INRMP updates, help with monitoring efforts, habitat restoration activities, and more. Although the extent of future funding for this program is contingent upon appropriations, the program is one example of conservation programs that have benefited monarch and are likely to continue to benefit conservation of the species.

3.2.1.3.2.3.1 National Public Lands Day

National Public Lands Day (NPLD) is the nation's largest, single day volunteer effort for public lands. The DOD joined the NPLD partnership in 1999. Through the Legacy Program, DOD provides funding to support natural and cultural resources projects on military installations. Since 1999, the Legacy Program has awarded just over $3 million to fund nearly 600 NPLD projects that have directly benefited military lands across the U.S. Included among the Legacy Program-funded NPLD projects are several that have been specifically geared towards pollinators. From 2009-2014, the DOD funded approximately 150 pollinator-related NPLD projects and continues to support these small-scale projects. For example, a project conducted in 2021 at Fort Belvoir included the removal of invasive species and shrubs which were replaced by a pollinator garden with native wildflowers to promote pollinator habitat. Among the ten total grantees awarded for their 2023 NPLD projects, four installations including Eglin Air Force Base, Fort Cavazos, Joint Base Lewis-McChord, and Camp Shelby were awarded funds for pollinator specific projects.

3.2.1.3.2.4 Recovery and Sustainment Partnership

After years of ESA collaboration and innovation, the DOD and DOI formalized the Recovery and Sustainment Partnership (RASP) Initiative through a Memorandum of Understanding in 2018 (renewed in February 2024). The purpose of the RASP is to develop effective ecosystem and species conservation and recovery initiatives while promoting increased flexibility for military mission activities. The RASP's high-level coordination and collaboration between the DOD and DOI has facilitated the achievement of multiple objectives that have advanced species conservation and recovery while simultaneously meeting DOD mission-related needs. In 2021, the USFWS and DOD agreed to explore the development of a nationwide Species Action Plan (SAP) for the monarch under the RASP. The draft monarch SAP outlines a conservation approach to conserve monarchs nationwide that focuses on helping installations implement the following preliminary goals: 1) develop a streamlined and programmatic section 7 process for monarchs resulting in efficient and predictable ESA consultation coverage for all applicable DOD installations; 2) identify BMPs for DOD installations that will contribute to the conservation of the monarch, streamline the DOD and USFWS' future consultation requirements, and minimize any potential mission restrictions due to compliance with the ESA;

3) improve conservation status of monarchs; and 4) develop recommendations on standards and protocols for monarch inventory, monitoring, and data collection specific to eastern and western populations. DOD's 7(a)(1) Strategy helps meet several of the goals outlined in the draft monarch SAP.

3.2.2 Military Mission and Sustainment Actions

The Strategy briefly addresses impacts to monarch from implementation of military mission:

> Implementation of the military's mission may occasionally result in adverse effects to monarch or monarch habitat. DOD installations consist of working lands that, first and foremost, support the military's mission: to provide the military forces needed to deter war and ensure our nation's security. As discussed in Section III [of the Strategy], installations are also managed to support sustainment of the natural resources within their boundaries. Military training operations, which include a wide variety of activities (e.g., troop and wheeled maneuvers, live munitions training, demolitions), are likely to impact monarchs and their habitat; however, the impacts of these activities are limited in size in comparison to the benefits provided by the comprehensive and extensive nature of the DOD's general conservation strategy. In addition, when impacts occur outside of regularly utilized areas, it is DOD procedure that these areas are repaired and restored. When evaluating impacts on monarchs from military training operations and other activities that are done to manage and maintain installations, existing BMPs, ongoing natural resource management practices, and additional large-scale funded programs provide overall benefits to monarch populations and a significant contribution to the conservation of monarchs.

Additional information on mission and sustainment actions was provided as supplemental information to the Strategy. Military mission and sustainment includes all activities needed to support the mission of the military, including military training and operations activities.

3.2.2.1 Military Mission and Mission Sustainment Activities

In addition to the land management, policies and procedures, and conservation programs detailed in the Strategy, the Proposed Action includes the following routine mission and mission sustainment activities that may affect monarch habitat and/or individuals. These activities can be categorized generally as 1) ground-based training, 2) aviation training, 3) impact areas, and 4) construction and maintenance. The following sections provide a general description of each of these categories. Additional details on the scope, extent, and timing of the various activities that fall under these activities are not available at the programmatic level. At the INRMP development/review stage, installations will consider the site-specific details (timing, extent, duration, etc.) to ensure the effects analysis in this Opinion is consistent with those effects that occur to monarch as a result of carrying out mission and mission sustainment activities.

3.2.2.1.1 Ground-based Training

Ground-based training events occur predominantly on the ground but may involve an aircraft component (typically helicopters) for troop and/or equipment transportation. The following are the basic types of ground-based training. Note that a training event may involve one or more of these basic training types.

Maneuver Training. Maneuver training may be mounted (movement by vehicle) or dismounted and may involve unit sizes varying from tens to thousands of personnel. Maneuver training may include offensive operations, defensive operations, bivouac, assembly area operations (see below), and specialized training. It may also involve the use of smoke and obscurants, noise, and simulated nuclear, biological, and chemical conditions to replicate combat conditions as closely as possible.

Mounted maneuvers involving a variety of light, medium, and heavy wheeled tactical and logistical vehicles which are used to transport troops, equipment, and supplies, tracked vehicles and construction equipment (e.g., bulldozers and track hoes) that may be used in designated areas, and/or a variety of rotary aircraft. These maneuvers may occur on roads, trails, and off-road where the terrain, vegetation density, slope, and administrative factors are favorable to the vehicle type.

Dismounted (on foot) maneuvers may occur anywhere that safety or administrative restrictions permit and may include the use of defensive fighting positions, which ranges from lying in concealed positions, to digging individual fighting positions using hand tools, to large crew-served weapons emplaced using heavy equipment excavators. Where permitted, units may use blank ammunition and pyrotechnics to provide sound and visual effects simulating the battlefield environment.

Live-fire Training. Live-fire training includes many types of munitions, including ball and tracer rounds, high-explosives, rockets, mines, grenades, artillery and mortar rounds, short-range training ammunition (low-velocity plastic bullets, a.k.a. SRTA), explosives (e.g., for demolitions), and practice and training-practice ammunition. Training units vary from an individual gunner, a crew of a weapon system, or a collective unit firing at predetermined targets from designated firing positions on a range facility. Live-fire may also be incorporated into maneuver training within established safety zones.

Live-fire training also includes the following:

- Demolition training: Use of explosive materials to remove obstacles, clear hazardous areas, or eliminate unexploded ordnance.
- Mine training: Use and removal of anti-personnel or anti-tank land mines. Both training types occur within designated training locations.
- Aviation live-fire training: Firing at designated ground targets with guns, rockets, missiles, or bombs from aircraft.
- Pyrotechnics: Various items that are used for signaling, illumination, marking targets, or obscuring/screening movement. Pyrotechnic items include, but are not limited to, grenade and artillery simulators (flash/bang), flares, smoke grenades, HC/TA (hexachloroethane/terephthalic acid) smoke, CS (riot control/tear gas) grenades, and fog oil smoke.

Bivouacking and Assembly. Bivouacking and assembly involve setting up field areas for rest, resupply, maintenance, storage, communications, command post, medical facilities, or meal preparation. Bivouacking and assembly areas may consist of a number of tents, temporary

structures, and equipment. Supplies and equipment may be positioned on site with heavy machinery. Such areas vary depending on unit size and mission, ranging from less than 2 acres to more than 20 acres and are usually located in relatively level areas with vehicle access.

3.2.2.1.2 Aviation Training

Aviation training may be included in maneuver training and live-fire training, as described above. It also includes fixed wing and helicopter aircrew training, such as aviation flight skills (e.g., takeoff and landings), contour and low-level flights (50 feet to 500 feet above ground), confined and high-altitude area landing/takeoff, and navigation. Most takeoffs and landings take place in designated landing zones (LZs).

Unmanned Aerial Systems (UAS)/Unmanned Aerial Vehicles (UAV). UAS/UAV are aircraft that support land warfare operations and are typically engaged in intelligence, surveillance and reconnaissance (ISR); battle damage assessment; targeting; and convoy protection missions. UAS/UAV are transported to and from launch/recovery sites by vehicles with trailer and require a ground support crew (typically three personnel).

Pickup Zone, Landing Zone, and Drop Zone Training. Pickup zones (PZs) and landing zones are geographic locations utilized for tactical personnel movement training. The number and type of aircraft will vary depending on the unit size but typically involves from 1 to 26 helicopters. Drop zones (DZs) are used for parachute drops of troops, equipment, and/or vehicles. PZs and LZs are often utilized during dismounted maneuver training.

3.2.2.1.3 Impact Areas

Impact areas are designated areas within installations where live munitions can be used. Impact areas are further designated as "dudded" and "non-dudded." Dudded impact areas are areas within which all ordnance that may produce "duds" (those that fail to completely function at the target after being fired/initiated) will detonate or impact. This area may include targets, such as vehicle bodies, for artillery/mortar fire. Because of the potential for the unexploded ordnance (duds) to be present, dudded impact areas cannot be used for maneuver training. Non-dudded impact areas are mainly within the safety fans for small arms ranges where ordnance that may impact the area does not produce duds. Non-dudded areas may be used for maneuver training, but only when the adjacent weapons ranges are not in use.

3.2.2.1.4 Construction and Maintenance

Construction and maintenance may occur throughout the installation and include a variety of activities including, but not limited to the following:

- Construction, repair, or replacement of interior or exterior structures (e.g., clearing, grading, fill; staging areas, parking areas, etc.)
- Portable or permanent lighting
- Utilities installation, infrastructure, and maintenance (vegetation removal with rights-of-way)
- Demolition
- Borrow pits
- Pest management (through manual or mechanical means; use of chemicals)

- Erosion and sediment control
- Ground maintenance (e.g., mowing)
- Culvert installation, repair and replacement
- Dams and water control structures
- Drainage ditches (construction, maintenance, etc.)
- Bridges and roads (construction, repair and maintenance)
- Runways (constructions, maintenance, Bird/Wildlife Aircraft Strike Hazard [BASH/WASH] actions)
- Geotechnical investigations (seismic surveys, radar, core sampling, pit or trench digging)
- Fence installation and maintenance
- Vehicle use (on and off road)

3.3 CONSERVATION MEASURES

Conservation measures are measures that the Action Agency has agreed to implement to minimize or avoid adverse effects. DOD included four overarching conservation measures for their Strategy, as well as several land management-specific BMPs, which are contemplated as conservation measures by this Opinion. These programmatic conservation measures and BMPs are expected to be implemented contingent upon sufficient appropriations and prioritizing mission fulfillment (i.e., consistent with their authorities under Sikes Act, implementation of conservation measures or BMPs cannot result in a loss of the capability of military installation lands to support the mission of the installation). The overarching conservation measures are:

- DOD will continue to maintain, enhance, and/or increase monarch habitat and will limit habitat loss in instances where the mission requires permanent loss of habitat.
- DOD will conduct land management practices that provide resilient native ecosystems in accordance with the Sikes Act, DOD, and Military Service Policies and will directly consider conservation benefits for monarchs.
- DOD will implement applicable BMPs (as identified below) in suitable habitat for monarchs (see section 5.1).
- DOD will continue to contribute to monarch conservation by conducting outreach activities, participating in partnerships, and contributing to research.

3.3.1 Best Management Practices

The DOD BMPs are provided to NRMs to aid them in ensuring land management is conducted in ways to enhance monarch habitat by identifying best practices. If implementation of these BMPs conflict with another species on the installation, DOD will consult with their local field office separately. BMPs do not apply outside of monarch habitat, in areas where surveys demonstrate probable absence, or in areas where it interferes with their mission (e.g., during military training activities) (see Strategy for more details). Although there may be some instances where installations cannot implement conservation measures or BMPs because doing so would result in a loss of the capability of military installation lands to support the mission of the installation, we generally expect installations will implement them and consider them to be reasonably certain to occur for purposes of this Opinion.

The following is an excerpt taken from the Strategy:

Best Management Practices for DOD Conservation Strategy

Best Management Practices (BMPs) in **bold** are included in current policy and procedure guidance (with source indicated). Additional context and BMPs are provided here to help Natural Resource Managers identify best practices. For more information, refer to these regional guides and resources: Xerces, Monarch Joint Venture, and Overwintering recommendations.

Mowing

- **Adjust management activities (including timing of mowing) so as not to interfere with breeding or nectaring by following recommended timing windows (**DOD PCRG). (See [Strategy] Figure 6 [Recommended Management Timing Window map]; late winter mowing is best) so long as it does not impact mission, safety, or security.
    - Additional context (from Monarch Joint Venture): Avoid mowing monarch habitat when monarchs are present (see [Strategy] Figure 6, Recommended Management Timing map). Mowing milkweed mid-summer in areas where there is a lull in monarch activity, such as the Southern Great Plains, may promote milkweed growth and late summer or early fall breeding (Baum and Mueller 2015; Fischer et al. 2015).
- Avoid mowing the entire habitat. Leaving refuge areas for wildlife will allow for recolonization of the mowed site. Leave areas that may be good nesting or overwintering sites (leaf litter, dead stems, other ground cover) for pollinators or other wildlife.
- Mow after native plants finish blooming and dispersing seed (i.e., schedule mowing to enhance floral resources). For weed control, time mowing for periods before noxious and/or invasive weeds flower.
- Use a minimum cutting height of 10-12 inches (shorter may be needed for early establishment mowing). This effectively removes seed producing parts of most invasive plants and minimizes wildlife impact.
- Instead of mowing or haying consider alternative management actions that encourage forbs and increase plant species diversity such as grazing or prescribed burning. If alternative methods are not possible, try to only mow once or twice per year, as mowing too frequently disrupts growth and the ability of flowering plants to compete with grass.

Mowing Rights-of-Way

- Maintain a regularly mown clear zone as needed for sight distance and safety, but limit mowing of vegetation beyond this zone when possible (Xerces Society 2018; McKnight et al. 2021).
- Avoid mowing patches of milkweed, especially during the monarch breeding season when eggs and larvae are present.

Grazing

- **Adjust management activities (including amount of grazing) so as not to interfere with breeding** (DOD PCRG).

- **If an area is grazed, control the amount of grazing to avoid eliminating flowering plants, reduce soil compaction, and prevent overgrazing** (DOD PCRG.
- **Include native flowering plants used by pollinators when grazing areas are re-seeded unless inconsistent with grazing practices** (DOD PCRG).
- Strive to achieve heterogeneous grazing intensities with ungrazed refugia across the landscape via rotational grazing practices or patch-burn grazing (Xerces Society 2018, McKnight et al. 2021).
    - Aim to graze only one-third of an area per year
    - Avoid grazing the same area every year

Row Crop Production

- Incorporate monarch-friendly planting into hedgerows, orchard understories, pivot corners, crop margins, riparian buffer strips and corridors, or other out-of-production areas (Xerces Society 2018).

Prescribed Fire

- **Conduct prescribed burns when monarchs are absent from the habitat** (using timing recommendations in [Strategy] Figure 6) (DOD PCRG).
- **Leave unburned patches (at least one-third the area of the proposed burn footprint) that provide refugia (nectar and breeding sites) for butterflies that can then re-colonize the burned area the next season** (DOD PCRG).
- For post-wildfire restoration and rehabilitation, see Grassland Restoration Activity planting BMPs (Xerces Society 2018; McKnight et al. 2021).

Application of Herbicides, Pesticides and Insecticides

- **Use pesticides in accordance with DOD Policy and by following label directions explicitly.**
- **Eliminate or reduce the use of pesticides in areas with monarchs** (DOD PCRG). Limit insecticide exposure where possible.
    - Avoid the use of neonicotinoids or systemic insecticides, or coated seeds any time of the year in monarch habitat (Xerces Society 2018; McKnight et al. 2021; USFWS 2023).
    - Do not plant milkweeds or other pollinator nectar plants in areas where neonicotinoids were applied in the last 2 years (Xerces Society 2018; McKnight et al.2021)
- Apply pesticides using methods that are targeted and reduce drift into non-target areas (Xerces Society 2018; McKnight et al. 2021; USFWS 2023).
- If herbicides are used, apply when plants are more responsive to treatment and when monarchs and other pollinators are less likely to be nectaring on the plants. Plants should not be sprayed in bloom or after they have gone to seed (USFWS 2023; [Strategy] Figure 6).
- Ensure staff and contractors are adept at plant identification. The ability to recognize native plants as well as invasive weeds will reduce unintended damage to non-target plants (Xerces Society 2018; McKnight et al. 2021).

Grassland Restoration Activities

- **Increase native milkweed and other flowering plants in monarch breeding areas** (DOD PCRG).
    - **Plant locally appropriate milkweed (*Asclepias* spp.)** and incorporate native, habitat-appropriate milkweed species into plantings.

- **Increase native flowering plants along migration routes that bloom during the time of migration** (DOD PCRG).
    - **Plant native flowering plants so nectar is available during the times monarchs are present in the area.**
        - Maximize native flowering plant diversity across bloom periods.
- Seed mixes should include a minimum of nine total species of native flowering plants including three species per blooming periods of April-June, June-July, and August-October (McKnight et al. 2021).
- Source seeds as locally as possible
    - Regional/Ecoregional-specific planting and native plants guides: NRCS, Xerces, Monarch Joint Venture
- Seed mixes will seek to be free of invasive or aggressive nonnative species that inhibit diversity when established, and these seed mixes will not be treated with insecticides.
- **Eliminate invasive plants, especially nonnative milkweed.**
    - **Do not plant nonnative milkweed like tropical milkweed (*Asclepias curassavica*) or balloon plant (*Gomphocarpus physocarpus*)** (DOD PCRG).
    - **Eliminate invasive plants and nonnative tropical milkweed, which is believed to promote the spread of disease (e.g., *Ophryocystis elektroscirrha* also known as OE) in migratory monarchs** (DOD PCRG).

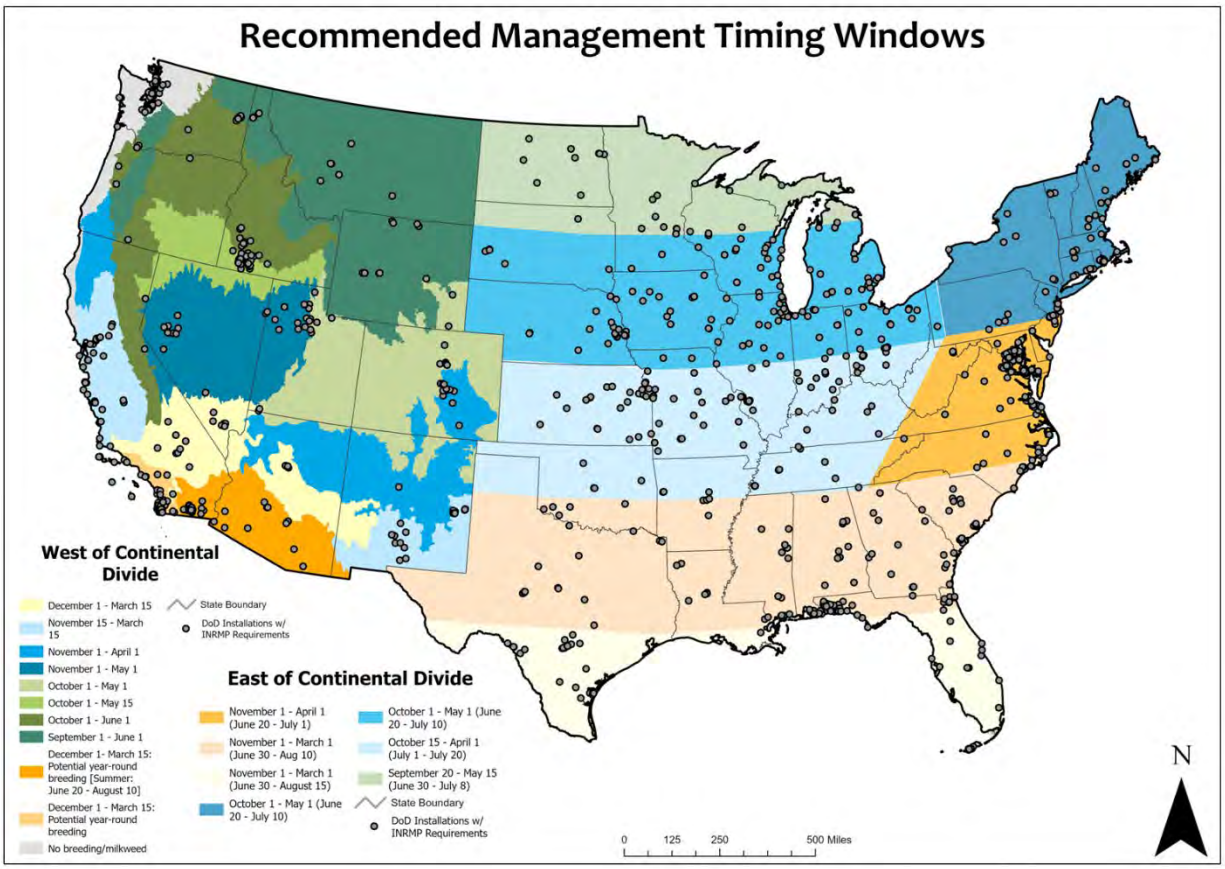
Overwintering site management (including tree removal or forest management)

- **Reduce human disturbance at overwintering sites when monarchs are present** (DOD PCRG).
- **Avoid tree removal and tree trimming at monarch overwintering sites unless trees pose a human health and safety risk** (DOD PCRG).
- **Develop long-term management plans at overwintering sites that include (in many instances) the planting of native trees and nectar plants** (DOD PCRG).
- **Consult with a monarch expert and an arborist prior to any cutting or thinning within tree stands known to support overwintering monarchs** (DOD PCRG).
- Enhance habitat within overwintering sites and within 500 feet (support zone) of sites by planting tree species where monarchs are known to cluster (USFWS 2023).
- Avoid the removal of living trees or shrubs within 500 feet of overwintering sites except for specific grove enhancement purposes and or safety concerns for dead trees (USFWS 2023).
- Reduce fuel loads and minimize risk of catastrophic wildfire within overwintering habitat through selective thinning of small diameter trees in the support zone and maybe the shelter zone.
- Conduct management activities (tree trimming, mowing, burning, and grazing) in overwintering sites from March 1-September 30. Planting trees, shrubs, or forbs for restoration is acceptable during overwinter season (USFWS 2023).

- Avoid pesticide applications within 500 feet of overwintering sites, especially when monarchs are present, and use non-chemical weed and pest prevention. If pesticides are used in or adjacent to overwintering habitat, then conduct applications from March 1-September 30, when possible (USFWS 2023).
- Enhance nectar sources by planting fall/winter/early spring blooming native forbs within overwintering sites and within 5 miles of the coast (USFWS 2023); however, it is discouraged to plant milkweed in areas where it did not occur historically, including near monarch overwintering sites, to avoid disrupting monarchs' natural behavior (Xerces Society).

Recommended Timing Windows

The management windows presented in [Strategy] Figure 6 illustrate timeframes when management activities are least likely to have negative effects on monarchs. The recommendation is to use the management windows described in Figure 6 in conjunction with recommendations for other species to inform the best timing of management in your area. It is important to note that the management timing windows depicted in Figure 6 represent approximate recommendations of timeframes to conduct management activities. Summer management intervals may still cause some mortality. In Arizona, summer management windows are only recommended for low elevation areas with high summer temperatures.



[Strategy] Figure 6. Map of recommended management timing windows for monarchs (Danaus plexippus) east and west of the Continental Divide. Dots represent Department of Defense (DoD) military installations that have Integrated Natural Resource Management Plan (INRMP) requirements. Management during the dates in paratheses should occur only if necessary (if cannot be done in the recommended window).

[End excerpt from Strategy]

3.4 ACTION AREA

The Action Area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The Action Area under consultation includes all DOD military installations within the continental 48 states and does not include Alaska, Hawaii, and the commonwealths, totaling approximately 25 million acres of land and water (Figure 2). Also included in the Action Area is the reach of conservation programs (e.g., funding research, outreach efforts, strategic partnerships) across the continental U.S. The Action Area also includes air space above and beyond installation boundaries used for aviation training.

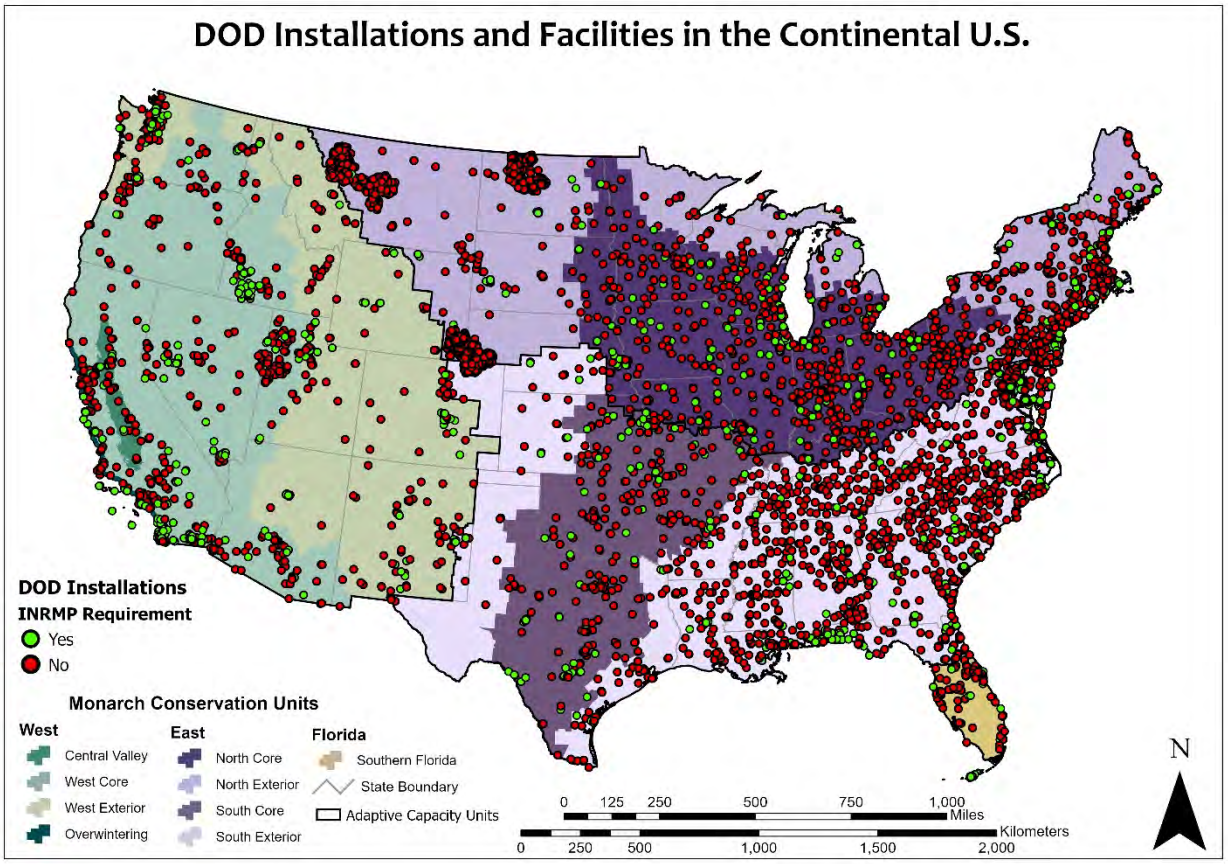


Figure 2. Map showing all DOD installation/sites. Point does not reflect size of installation. Color of point reflects whether or not the installation has an INRMP. Also shown are the Monarch Conservation Units.

Although monarchs are found in Hawaii, they are not native to the islands; therefore, Hawaii was not included in DOD's Strategy. Because Hawaii is outside the historical range of the species, and was not included in the Strategy, we do not consider it further in this Opinion.

Table 1. Number of installations and respective total acres of Department of Defense (DOD) military installations within Monarch Conservation Units (MCU). Number of installations and installations acreages were derived using Defense Installation Spatial Data Infrastructure (DISDI) FY 21 DOD_Site_Locations_Boundaries shapefile.

Department of Defense Military Installations within Monarch Butterfly Conservation Units				
	INRMP		No INRMP	
MCU	No. Installations†	Acres	No. Installations †	Acres
North Core	33	554,191	67	41,707
North Exterior	49	626,699	67	445,788
South Core	32	844,857	32	90,836
South Exterior	98	4,182,406	114	171,013
West Core	59	12,951,102	46	1,663,598
West Exterior	27	4,135,599	29	297,286
Central Valley	7	60,481	9	11,145
Overwintering	9	243,819	9	3,663
Southern Florida	8	140,273	9	10,295

† Some DOD installations are comprised of geographically separated units (GSU). GSUs can be located hundreds of miles apart. As such there are instances when an installation and its GSUs are located in multiple Monarch Conservation Units (MCU).

3.5 ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

3.5.1 Jeopardy Determination

In accordance with our regulations (see 50 CFR 402.02, 402.14(g)), the jeopardy determination in this Opinion relies on the following four components:

1. The *Status of the Species* evaluates the species' current range-wide condition relative to its reproduction, numbers, and distribution; the factors responsible for that condition; and its survival and recovery needs.

2. The *Environmental Baseline* section of this Opinion refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from federal agency activities or existing federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

3. The *Effects of the Action* section of this Opinion analyzes all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

4. The *Cumulative Effects* section of this Opinion evaluates effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation.

5. In accordance with policy and regulation, the USFWS is required to "[a]dd the effects of the action and cumulative effects to the environmental baseline and in light of the status of the species and critical habitat, formulate the USFWS's opinion as to whether the action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat," 50 CFR 402.14(g)(4).

6. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

4 STATUS OF THE SPECIES

4.1 SPECIES DESCRIPTION

The monarch is a species of butterfly in the order Lepidoptera (family Nymphalidae) that occurs in North, Central, and South America; Australia; New Zealand; islands of the Pacific and

Caribbean; and elsewhere (Malcolm et al. 1993). Adult monarch butterflies are large and conspicuous, with bright orange wings surrounded by a black border and covered with black veins. The black border has a double row of white spots, present on the upper side and lower side of forewings and hindwings (Bouseman and Sternburg 2001). Adult monarchs are sexually dimorphic, with males having narrower wing venation and scent patches (Secretariat of the Commission for Environmental Cooperation (CEC) 2008). The bright coloring of a monarch serves as a warning to predators that they can be toxic.

4.2 LIFE HISTORY

In this section, we summarize the general life history and resource needs for the monarch. Resource needs are features that may be essential for the monarch to fulfill its life cycle.

4.2.1 Monarch Migration

There are three monarch butterfly populations in North America. Two of these populations migrate - eastern (east of the Rocky Mountains) and western (west of the Rocky Mountains). The eastern population overwinters in central Mexico and breeds throughout the U.S. and southern Canada. The western population overwinters along the California coast and breeds across the western states and southern Canada. A non-migratory population of monarch butterflies live in Florida year-round.

In eastern North America, monarchs travel north in the spring, from Mexico to Canada, over two to three successive generations, breeding along the way (Flockhart et al. 2013) (Figure 3). Individual monarchs disperse as far north as they can physiologically tolerate based on climatic conditions and available vegetation; the most specific predictors of the distribution of individual monarchs are monthly mean temperature, precipitation, and land use (Flockhart et al. 2013; Flockhart et al. 2017; Kesler and Bunch 2020). The number of generations of monarchs produced in a given year can vary between three and five and is dependent upon environmental conditions (Brower 1996). While a majority of the eastern monarchs shift to the more northern reaches of their range, western monarchs continue to occupy and breed in warmer climates throughout the summer, while also expanding to include the farther reaches of their range. In the spring in western North America, monarchs migrate north and east over multiple generations from coastal California toward the Rockies and to the Pacific Northwest (Urquhart and Urquhart 1977; Nagano et al. 1993) (Figure 3). In the southwestern states, migrating monarchs tend to occur more frequently near water sources such as rivers, creeks, roadside ditches, and irrigated gardens (Morris et al. 2015).

In the fall, in both eastern and western North America, monarchs begin migrating to their respective overwintering sites. This migration can take monarchs distances of over 3,000 km (Urquhart and Urquhart 1978) and last for over two months (Brower 1996). Migratory individuals in eastern North America predominantly fly south or southwest to mountainous overwintering grounds in central Mexico, and migratory individuals in western North America generally fly shorter distances south and west to overwintering groves along the California coast and northern Baja California (Solensky 2004) (Figure 3). Data from monarchs tagged in the southwestern states in the fall suggest that those in Nevada migrate to California, those in New

Mexico migrate to Mexico, and those in Arizona migrate to either Mexico or California (Southwest Monarch Study Inc. 2018). In early spring (February–March), surviving monarchs break diapause and mate at the overwintering sites before dispersing (Leong et al. 1995; van Hook 1996). The same individuals that undertook the initial southward migration begin flying back through the breeding grounds and their offspring start the cycle of generational migration over again (Malcolm et al. 1993).

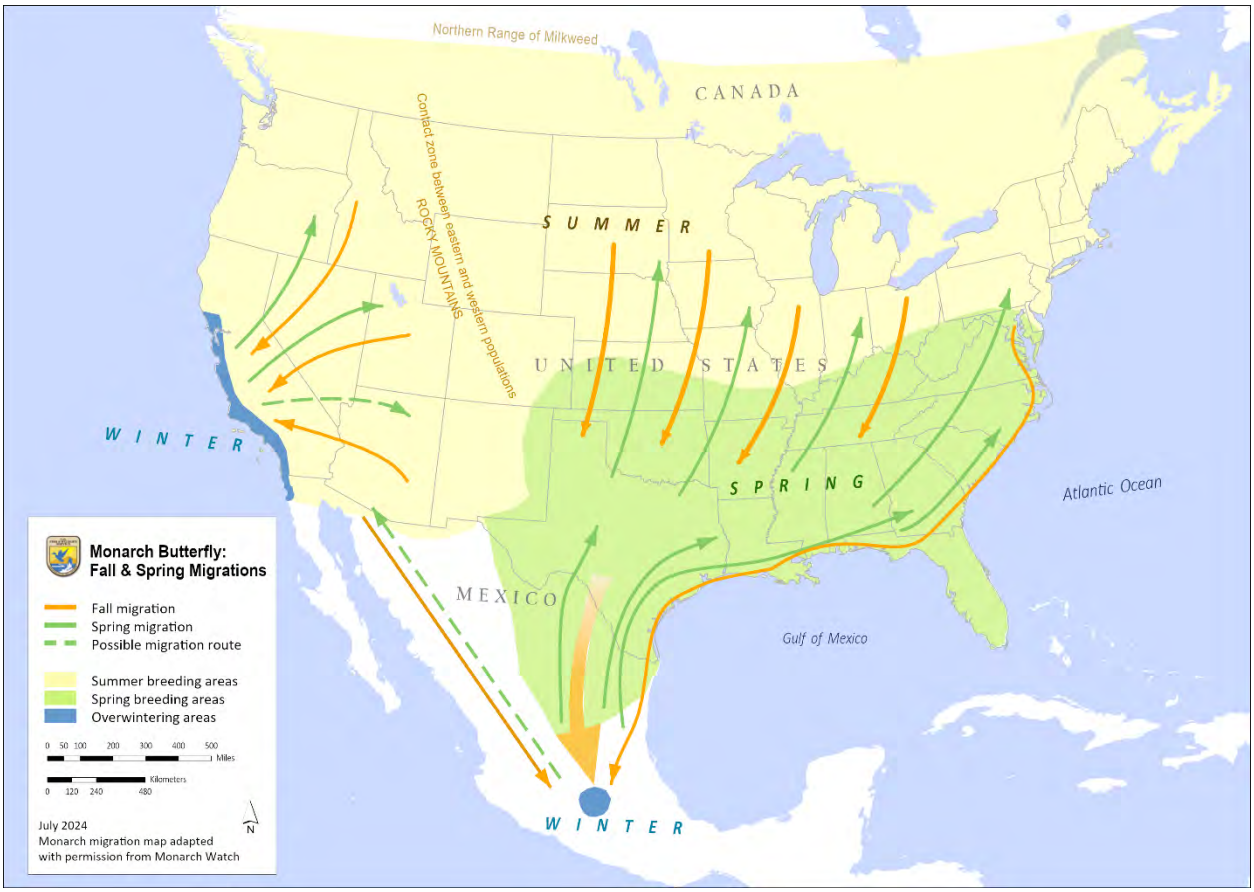


Figure 3. North American monarch migration map.

4.2.2 Monarch life cycle

During the breeding season, monarchs lay their eggs on their obligate milkweed host plant (primarily *Asclepias* spp.), and larvae (caterpillars) emerge after two to five days (Zalucki 1982; CEC 2008). Larvae develop through five larval instars (intervals between molts) over a period of 9 to 18 days, feeding on milkweed and sequestering toxic cardenolides as a defense against predators (Parsons 1965). The larva then pupate into chrysalis before eclosing 6 to 14 days later as an adult butterfly. There are multiple generations of monarchs produced during the breeding season, with most adult butterflies living approximately two to five weeks; in migratory populations the overwintering adults enter into reproductive diapause (suspended reproduction) and live six to nine months (Cockrell et al. 1993; Herman and Tatar 2001) (Figure 4). The number of generations of monarchs produced in a given year can vary between three and five

and is dependent upon environmental conditions (Brower 1996). Monarchs cannot develop in temperatures lower than 12°C (53°F) or higher than 33°C (91°F) (Zalucki 1982). Monarchs at all life stages are impacted by diseases and natural enemies (see the Monarch Species Status Assessment [SSA] for more information, USFWS 2020). The protozoan parasite *Ophryocystis elektroscirrha* (*OE*) is especially well-studied and infection rates among migratory and non-migratory monarchs in different areas are further discussed in the monarch SSA (USFWS 2020).

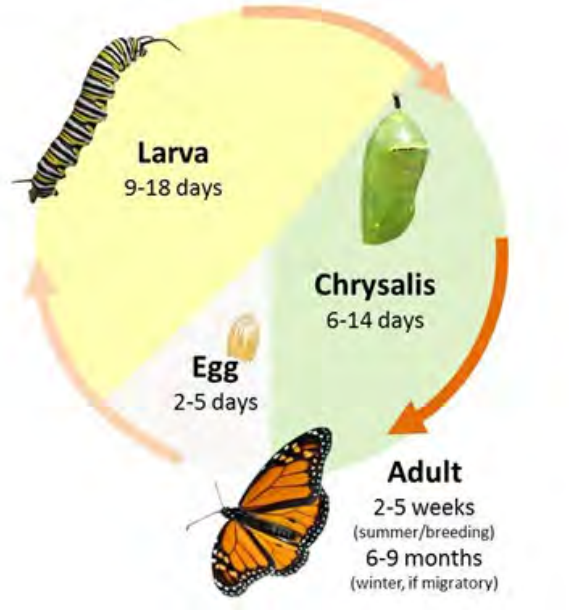


Figure 4. Monarch life cycle. Development times calculated from Zalucki (1982) based on temperatures ranging from 22°–32°C (72°–91°F). Adult life span based on Herman and Tatar (2001).

In a few parts of North America and in most areas outside North America, monarchs breed year-round, repeatedly following the above-referenced life cycle throughout the year. However, monarchs in temperate climates such as in eastern and western North America undergo long-distance migration, where the migratory generation of adults enters reproductive diapause and lives for an extended period of time (Herman and Tatar 2001). In the fall, in both eastern and western North America, monarchs begin migrating to their respective overwintering sites. This migration can take monarchs distances of over 3,000 km (Urquhart and Urquhart 1978) and last for over two months (Brower 1996).

4.3 RESOURCE NEEDS

This section summarizes the resource needs by life stage, geographic region, and time of year for the monarch butterfly.

Table 2. Monarch butterfly resource needs by life stage.

Life Stage	Requirements	Description	Geographic Location
Eggs, Larvae, and Adults – breeding	Milkweed resources	Healthy and abundant milkweed is needed for oviposition and larval consumption.	Breeding habitat throughout the continental U.S.
Chrysalis/Pupae	Roosting sites	Vegetation where pupae can develop with protection from direct sunlight.	Breeding habitat throughout the continental U.S.
Adult – breeding and migration	Nectar resources	Sufficient quality and quantity of nectar from flowers is needed for adult feeding throughout the breeding and migration seasons.	Breeding and migratory habitat throughout the continental U.S.
Adult – overwintering	Suitable habitat for overwintering	Habitat that provides a specific roosting microclimate for overwintering: protection from the elements (e.g., rain, wind, hail, excessive radiation) and moderate temperatures that are warm enough to prevent freezing yet cool enough to prevent lipid depletion. Nectar and clean water sources located near roosting sites.	California coast; some small overwintering sites exist in inland valleys in SE California and in areas of Arizona
Adult – migration	Connectivity & phenology	Nectar and milkweed resources along the migration route when butterflies are present; the size and spatial arrangement of habitat patches are generally thought to be important aspects but are not fully understood. Roosting sites may also be important for monarchs along their fall migration route.	Migratory habitat throughout the continental U.S.
All	Suitable climatic conditions	Temperatures, precipitation levels, and other climatic conditions supportive of life processes (e.g., breeding, migrating, and overwintering).	Migratory, breeding, and overwintering habitat throughout the continental U.S..

Figure 5 shows recommended timing windows for management actions across the range, showing times when management actions like burning, mowing, and grazing are less likely to harm monarchs (see www.monarchjointventure.org for more information) by avoiding breeding and migration windows.

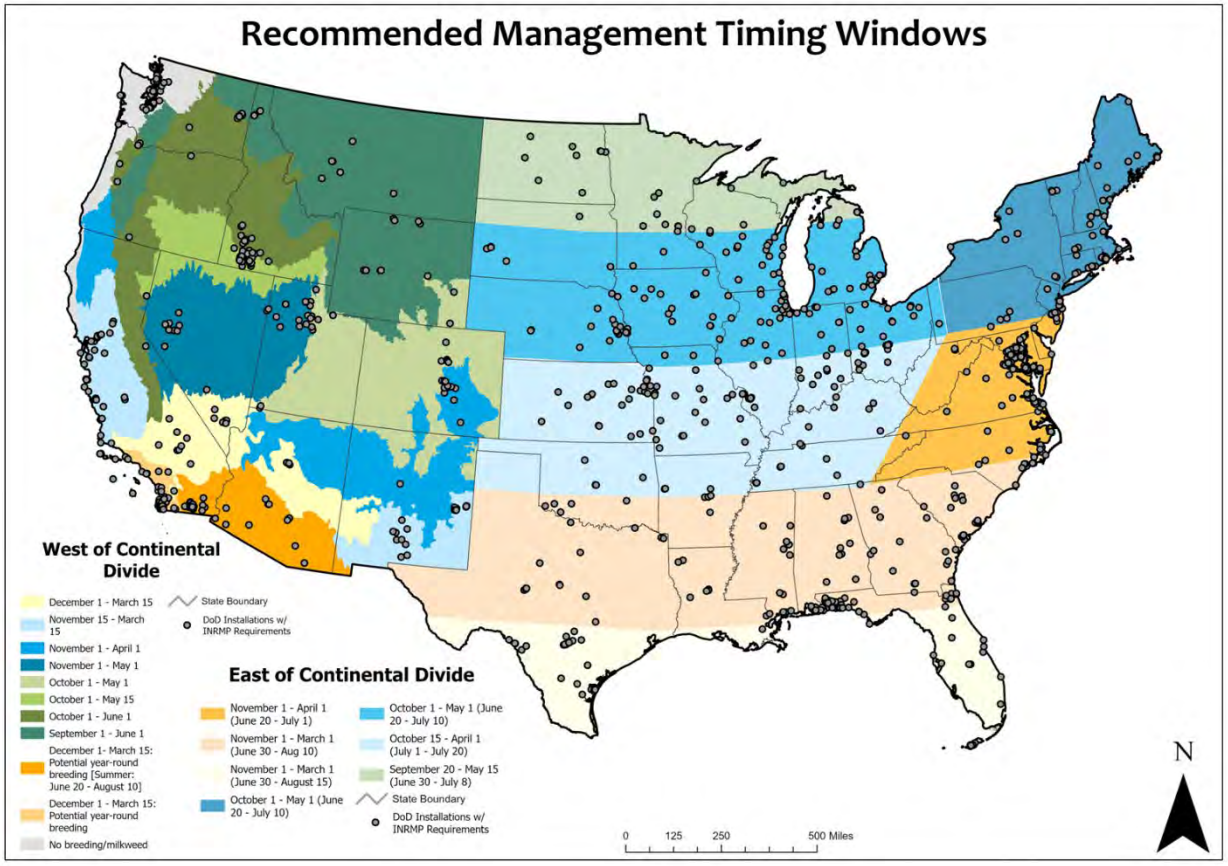


Figure 5. Recommended Management Timing Windows for Monarch (Danaus plexippus) east and west of the Continental Divide. In this figure dots represent Department of Defense (DOD) military installations that have Integrated Natural Resource Management Plan (INRMP). Dates are based on breeding and migration dates across the species range. Dates in parentheses are recommended only if necessary. Adapted from Monarch Joint Venture.

4.4 Breeding and Migratory Habitat

This section summarizes reproduction and migration of monarch throughout its range in the U.S.

4.4.1 Milkweed Diversity and Distribution

In the U.S., there are around 90 species of native milkweed (including subspecies and varieties) that are distributed in nearly every county, in every state, except Alaska and Hawaii.

In the western U.S., there are around 44 species of milkweed that occur in a variety of habitat types, and at least 20 species have been documented as larval hosts for the monarch butterfly. Areas in the west where milkweed didn't historically occur include coastal areas of the Pacific Northwest, and areas above 9,000 feet elevation (Xerces 2018).

4.4.2 Milkweed Abundance and Monarch Productivity

Monarch productivity generally increases with milkweed abundance until other factors take effect. In the range of common milkweed (*A. syriaca*), egg and larval density may increase with milkweed density up to about 6,000 milkweed stems per hectare (~2,428 stems per acre) and high milkweed abundance may also lead to higher survival rates of both eggs and larvae (Nail et al. 2015; Kasten et al. 2016).

High milkweed stem densities may boost productivity by reducing starvation of larvae, which typically require multiple stems during development. Monarch larvae feed and grow the fastest on young milkweed plants, especially early in development, and can consume entire plants (Yang and Cenzer 2020). Single larvae typically leave the stem on which they hatched after 6-7 days without consuming all available leaf tissue and search randomly for other milkweed stems (Fisher 2021). Isolated milkweed stems are unlikely to support larvae to pupation and large patches of milkweed and high stem densities could reduce the number of larvae that die by starvation (Yang and Cenzer 2020). Figure 6 shows counties across the U.S. that are more or less likely to have monarchs based on estimated milkweed abundance and density using a model (see Monarch Conservation Opportunities Tool v1 for more information).

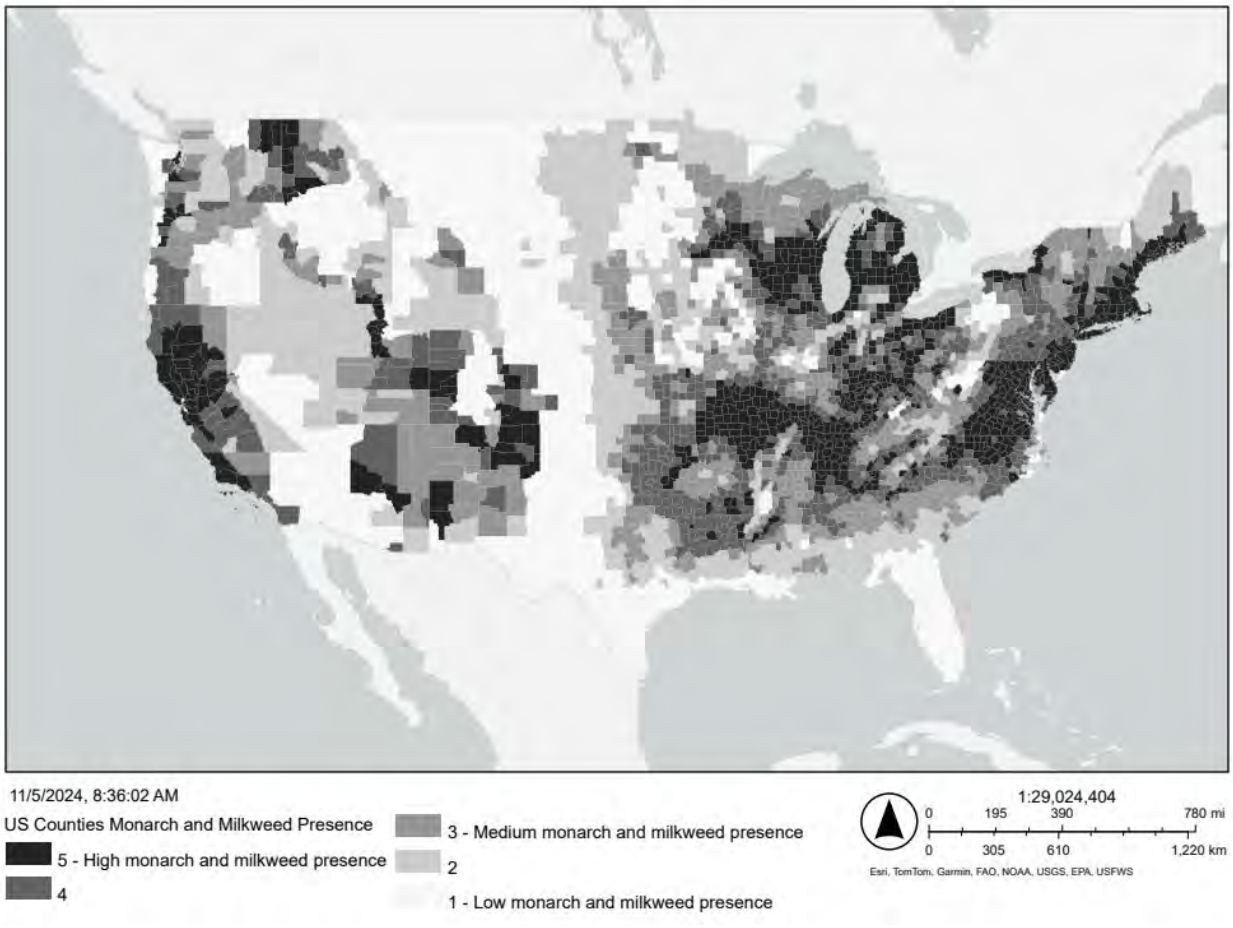


Figure 6. US counties and modeled milkweed presence (from the MCOT tool). Darker shade shows greater predicted abundance of milkweed (and monarch).

Density and diversity of milkweed may be higher in remnant natural habitats, but common milkweed readily colonizes habitat restoration sites. In Iowa, milkweed densities were highest in remnant (never plowed) prairie preserves (8,705 stems/ha), intermediate in roadside plantings (1,274 stems/ha), and lowest in non-linear "conservation" plantings (212 stems/ha) (Kaul and Wilsey 2019). Milkweed was included in the seed mix at only three of the 93 planting sites. Remnant prairies also contained the highest diversity of milkweed species. Lukens et al. (2020) studied 61 sites in Iowa, Minnesota, and Wisconsin about six years after seeding. Common milkweed was present at 96-100% of sites whether it was included in the seed mixes or not and present at high densities (1,218 – 1,526 stems per ha).

Inclusion of milkweed species unlikely to colonize naturally in seed mixes is likely to increase milkweed abundance and diversity, at least in the Upper Midwest. At the 61 restoration sites studied by Lukens et al. (2020), swamp milkweed (*A. incarnata*) and butterfly milkweed (*A. tuberosa*) colonized some sites where they were not included in seed mixes. Mean densities of the species, however, were higher where they were seeded – 1-2 plants per hectare versus 367 and 132 plants per acre, for swamp milkweed and butterfly milkweed, respectively.

Monarch breeding during the fall can be an important contributor to overwintering numbers in years when milkweed availability is high in the southern U.S. (Scott et al. 2022). During what may typically be regarded as the fall migration period, monarchs breed in some years during September and October on native milkweeds in west Texas (Brym et al. 2018; 2020). In 2018, for example, a high quantity and quality of milkweed stems after high precipitation led to a local peak abundance of eggs and larvae on milkweed that preceded the peak migration through the study area by about 26 and 16 days, respectively (Brym et al. 2018; 2020). The authors speculated that high temperatures may have also contributed to later-than-normal reproductive activity and were unsure whether breeding adults originated locally or had migrated from further north.

4.4.3 Effects of Milkweed Species and Diversity on Monarch Egg-Laying and Larval Growth

4.4.3.1 Egg-Laying Preferences

Increased milkweed diversity and inclusion of certain milkweed species in midwestern restoration plantings could ensure monarchs' preferred species for egg laying are available and could increase numbers of eggs laid. Among the nine milkweed species that occur in Iowa, females appear to prefer swamp milkweed for egg laying and they laid more eggs when able to choose among four milkweed species than when only one species was available (Pocius et al. 2018a, b).

Studies have demonstrated that swamp milkweed was preferred for oviposition (egg laying)in direct tests against both common milkweed and butterfly weed (Ladner and Altizer 2005, Potter et al. 2020).

Oviposition preferences between milkweed species have also been noted in the Southwest. In a comparison of two southwestern U.S. milkweed species that are commonly available for

planting, monarchs were more likely to lay eggs on Arizona milkweed (*A. angustifolia*) than on pineneedle milkweed (*A. linaria*) (Pegram and Melkonoff 2020).

Oviposition preferences between milkweed taxa in some situations may contrast with differences in larval growth rates and adult cardenolide levels. When laying eggs, monarchs preferred the subspecies *A. incarnata* pulchra in some circumstances despite slower larval growth rates and lower adult concentrations of cardenolides than in the group that fed on *A. incarnata incarnata* (Jones and Agrawal 2019). The authors speculated that this preference could be related to the higher predator defenses afforded by the denser trichomes on *A. i. pulchra*. Trichomes on *A. i. pulchra* are dense, like those on butterfly milkweed, and it exudes high amounts of latex, a plant defense against herbivory (Jones and Agrawal 2019).

4.4.3.2 Larval Growth Rates, Cardenolide Content, and Predator Defense Across Milkweed Species

Larval growth rates can vary substantially across milkweed species. In a study of 53 milkweed species, growth of early-stage monarch larvae was almost five times faster on the five "best" host plants than on the five "worst" (Agrawal et al. 2015). In Arizona, monarch larvae were more likely to be found on Arizona milkweed in the field and larval survival and growth as well as adult size were higher among monarchs reared on Arizona milkweed (Pegram and Melkonoff 2020).

In a comparison between two other western species, larvae that fed on narrow-leaved milkweed (*A. fascicularis*) grew faster, had higher survivorship, and were larger than larvae that fed on showy milkweed (*A. speciosa*) (Yang et al. 2020). Larvae generally grew faster when they fed on young plants of both species (see Seasonal Changes, below). The differences in larval performance between the two milkweed species was more pronounced on older plants. As both species senesced, the relative value to larvae of narrow-leaved milkweed increased, possibly due to an increase in traits useful for defending against herbivory in showy milkweed (Yang and Cenzer 2020).

4.4.3.3 Milkweed Host Plant Suitability – Seasonal Changes

The suitability of milkweeds for monarchs declines as plants age (Zalucki and Kitching 1982). Monarchs prefer young plants over mature plants for egg laying until they have already laid many eggs and become less "choosy", and larvae grow faster on young plants (Zalucki and Kitching 1982; Urquhart 1987; Bergstrom et al. 1994; Yang et al. 2020). The faster growth of larvae that fed on young versus old plants of narrow-leaved milkweed and showy milkweed – two western milkweed species – was due mostly to large differences during the first 24 hours of development when larvae are especially small (Yang et al. 2020).

As summer progresses monarchs may be "left with increasingly poor options" for egg laying, but still lay eggs on young leaves around the flower heads or on a cluster of buds on fully grown milkweed plants (Bergstrom et al. 1994; Haan and Landis 2019). Egg-laying also declines after insect damage on at least some clonal milkweed species, e.g., common milkweed and whorled milkweed (*A. verticillata*, He and Agrawal 2020). Avoidance of insect-damaged plants may be an adaptation to select plants that maximize larval fitness. Larvae that fed on insect-damaged

common milkweed, for example, were 20% smaller than those that fed on undamaged plants (Zandt and Agrawal 2004).

4.4.3.4 Milkweed Species and Parasite Defense

The milkweed species that larvae consume could affect their longevity when infected by parasites or parasitoids. Monarchs infected by the protozoan parasite, *OE*, lived longer when reared on milkweeds with an "intermediate concentration, diversity, and polarity of cardenolides" (Sternberg et al. 2012). Infected monarchs that fed on common milkweed lived longer than those that fed on swamp milkweed despite apparent preferences for egg-laying on the latter (see above) (Sternberg et al. 2012).

Conversely, after exposure to the parasitoid tachinid fly, *Lespesia archippivora*, monarch larvae that fed on common milkweed were more frequently parasitized and marginally more likely to die than those fed on swamp milkweed (Oberhauser et al. 2007, 2015). Estimated incidence of parasitism by tachinid flies on monarch larvae can be high – for example, 90% in some milkweed stands, 30% at conservation sites in Nebraska, and 13% among sites in Wisconsin, Michigan, and North Carolina – and "the vast majority of monarchs infected by tachinids die" (Oberhauser et al. 2007, Altizer and de Roode 2015, Geest et al. 2019).

4.4.4 Nectar

Adult monarch butterflies during breeding and migration require a diversity of blooming nectar resources, which they feed on throughout their migration routes and breeding grounds (spring through fall). Adults also require nectar at overwintering sites (fall through spring). Adult monarchs are generalists and will nectar on a wide variety of flowering plants.

4.4.4.1 Adults – Spring Migration and Spring-Fall Breeding and Migration

After breaking diapause and mating at overwintering sites, monarchs in migratory populations require sources of nectar to fuel flight and reproduction as they disperse to spring- and summer-breeding areas (Leong et al. 1995; Hook 1996). The same butterflies that undertook the autumn migration lay eggs as they encounter milkweed to restart the cycle of generational migration (Malcolm et al. 1993). Monarchs in the eastern migratory population move as far north as Canada over two to three successive generations and require nectar resources throughout their breeding range (Flockhart et al. 2013). In western North America, monarchs move north and east over multiple generations from coastal California toward the Rockies and to the Pacific Northwest (Urquhart and Urquhart 1977; Nagano et al. 1993). Abundant floral resources can typify habitats that are important for reproduction, and the presence of immature monarchs in some studies is positively associated with floral abundance (Keele et al. 2023).

As monarchs return to overwintering sites in the late summer and early fall, they require abundant sources of nectar to fuel flight and to build up lipid reserves to survive the winter months in reproductive diapause.

4.4.4.2 Eastern North America

Nectar availability for fall migrating monarchs in the Eastern North America (ENA) population can affect the size of the wintering population in Mexico (Inamine et al. 2016; Saunders et al. 2019). Monarchs in the ENA population store fat to increase the odds of surviving winter by nectaring extensively during migration. They store more fat when migrating than during breeding and low nectar availability due to drought or other factors could result in fewer monarchs on the wintering grounds (Saunders et al. 2019).

Nectar resources for migrating monarchs may be important throughout the Great Plains but may be especially critical in the "Central Funnel" in Oklahoma, Texas, and Mexico (Tracy et al. 2019). Monarchs begin to store fat early in migration but may undergo a behavioral shift and increase time nectaring when they reach Texas (Brower et al. 2006; Tracy 2018). Broad distribution of nectar resources throughout the Central Funnel may be critical because migratory routes shift up to 200 km east to west (Tracy et al. 2019).

Some plant species stand out as important nectar sources. In North Dakota, for example, milkweeds, native thistles (*Cirsium* spp.) and blazing stars (*Liatris* spp.) are "particularly important" nectar sources (Antonsen et al. 2021). The important of species in these groups was consistent throughout the state and across the three years of the study. Monarch abundance at a site was also consistently and positively related to the availability of flowering milkweed (Antonsen et al. 2021). At least nine species in the aster family are especially important as sources of nectar for migrating monarchs in Texas, especially frostweed (*Verbesina virginica*) (Brower et al. 2015).

Multiple factors, including the reduction in extent of natural areas and effects of widespread herbicide use, have reduced nectar resources for migrating monarchs (Brower et al. 2006; Tracy et al. 2019). In some areas, disruption of natural processes, especially fire, has also played a role. Fire suppression in the forested portions of the Ouachita Mountains Physiographic Region in northern Arkansas, for example, appears to have restricted nectar resources during fall migration to disturbed areas like road and utility rights-of-way (Rudolph et al. 2006a).

4.4.4.3 Western North America

In the West, nectar and milkweed are often associated with riparian corridors and milkweed may function as a principal nectar source (Dingle et al. 2005; Dilts et al. 2018; Xerces 2018; Waterbury and Potter 2018). Nectaring resources in migratory corridors in the western U.S. may be especially important for monarchs in the Western North America migrating population.

4.4.5 Fall Roosting Habitat

Monarchs use a variety of roosting trees along the fall migration route, where they aggregate on trees overnight. These roost sites have been documented more extensively in the eastern population, and little is known about roosting sites used during migration in the western population.

4.5 OVERWINTERING HABITAT

Migratory individuals of eastern and western North America require a very specific microclimate at overwintering sites. The eastern population of monarchs overwinter in Mexico, where this microclimate is provided by forests primarily composed of oyamel fir trees (*Abies religiosa*), on which the monarchs form dense clusters (Williams and Brower 2015). The sites used for overwintering occur in mountainous areas west of Mexico City located between elevations of 2,900 and 3,300 m (Slayback and Brower 2007). The temperature must remain cool enough to prevent excessive lipid depletion (Alonso-Mejía et al. 1997), while at the same time staying warm enough to prevent freezing (Anderson and Brower 1996). Exposure to these cooler temperatures also helps orient the monarchs northward in the spring (Guerra and Reppert 2013). The oyamel fir forest provides essential protection from the elements, including rain, snow, wind, hail, and excessive solar radiation (Williams and Brower 2015). Many overwintering sites also provide a source of hydration via nectar plants or a water source (Brower et al. 1977). Most of the observed overwintering sites are located within the Monarch Butterfly Biosphere Reserve, which covers over 56,000 ha (Vidal and Rendón-Salinas 2014; Ramírez et al. 2015).

Migratory monarchs in the western population primarily overwinter in groves along the coast of California and Baja California (Jepsen and Black 2015). There are approximately 400 groves that have been occupied, but only a portion of these sites is occupied in any given year. These sites, typically close to the coast, span approximately 1,225 km of coastline (COSEWIC 2010). These groves are populated by a variety of tree species, including blue gum eucalyptus (*Eucalyptus globulus*), Monterey pine (*Pinus radiata*), and Monterey cypress (*Hesperocyparis macrocarpa*) (Griffiths and Villablanca 2015), all of which act as roost trees. These groves provide indirect sunlight for the overwintering monarchs, sources of moisture for hydration, defense against freezing temperatures, and protection against strong winds (Tuskes and Brower 1978; Leong 1990; Leong 1999). The close proximity to the coast (average distance of 2.37 km ± 0.39 SE) also provides a mild winter climate (Leong et al. 2004). There are also some small overwintering sites in the Saline Valley of California, and areas of Arizona, although these sites only host a small number of adults each winter.

Additionally, there are other, smaller overwintering areas for the eastern and western North American population that exist with monarchs overwintering in diapause. For the eastern population, these include small colonies east of Mexico City (e.g., a site with small aggregations along western slopes of the Popocatépetl volcano; Calvert and Brower 1986), and along the coast of South Carolina (McCord and Davis 2010; Kendrick and McCord 2023). For the western population, these include several small inland California and Arizona overwintering sites (Morris et al. 2015; Pelton et al. 2016). Because of the relatively small number of monarchs at these sites and their transient nature, the Mexico and California overwintering sites and counts represent the large majority of the eastern and western migratory monarch populations, respectively.

4.6 POPULATION STATUS

4.6.1 Eastern North American Population

Annual winter population estimates of the ENA monarch population have been conducted in Mexico since the winter of 1993-1994 (Vidal and Rendón-Salinas 2014) (Figure 7). These estimates are determined by identifying and measuring the area occupied by wintering colonies of monarchs in and near the Monarch Butterfly Biosphere Reserve in Mexico and assuming a density of 21.1 million monarch/hectare (Vidal and Rendón-Salinas 2014; Thogmartin et al. 2017a). The monarchs are so densely clustered that we measure the area of forest occupied by monarch covered trees as a surrogate for overall population numbers. Because the area occupied by overwintering monarchs is a surrogate for overall population numbers, there have been several attempts to come up with the number of monarchs present in one hectare of occupied land to translate into overall number of monarchs present at the overwintering sites each year. The Thogmartin et al. (2017) paper examined the range of estimates from all of these studies, and found a median density of 21.1 million monarchs per hectare.

Although varying year-to-year, estimates consistently numbered in the hundreds of millions throughout the 1990s and early 2000s and survey data suggest that monarch numbers were as high or higher in the two decades before standardized monitoring began at the Mexican overwintering sites (Calvert and Brower 1986; Vidal and Rendón-Salinas 2014). The latest survey in 2022-2023 indicated there were approximately 46.6 million monarchs present in the reserve.

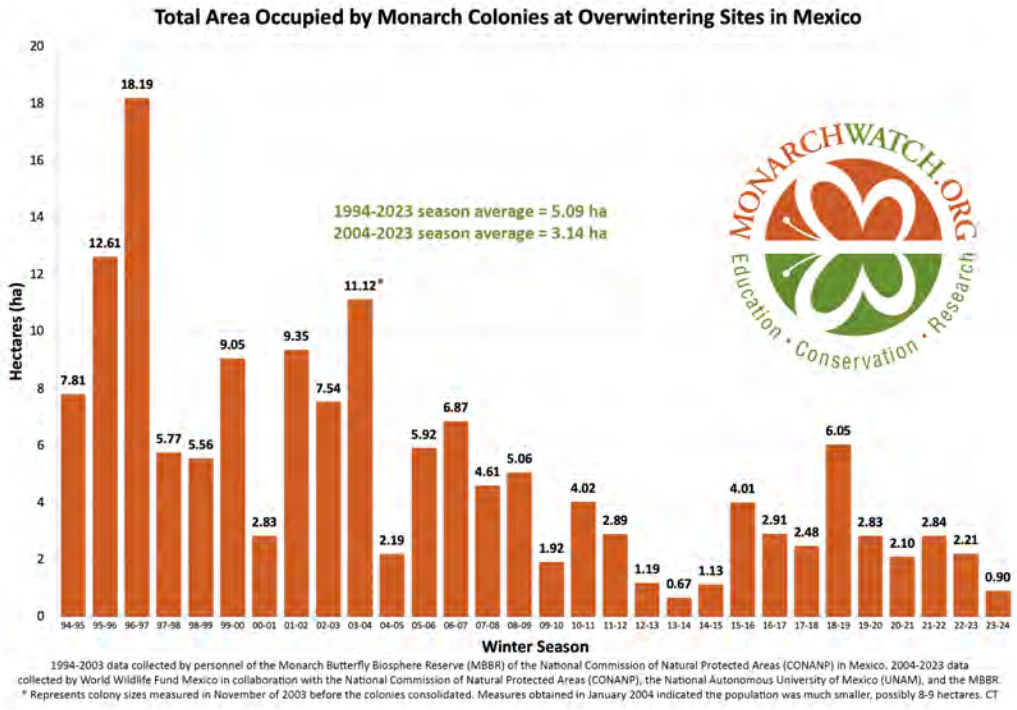


Figure 7. Area occupied (in hectares) by eastern North American monarch butterflies at overwintering sites in Mexico (actual hectare measurement displayed above each bar).

Based on genomic data to reconstruct demographic histories for monarch and common milkweed (*A. syriaca*), monarchs and milkweed experienced significant population expansion roughly 10,000–20,000 years ago, aligning with the most recent period of North American glacial recession, then increased again roughly 200 years ago, aligning with extensive human-caused landcover change predominated by deforestation and agricultural expansion (Boyle et al. 2023). However, genomic analyses did not detect effective population declines over the past 40 years.

Based on the past annual censuses, the eastern North American migratory monarch population has been generally declining over the last 29 years (Figure 8). Although the numbers at the overwintering sites have declined, we did not find a corresponding change in the spatial extent of the population during the breeding season. Given its current population size and population growth rate, the estimated probability of extinction (*pE)* over the next 60 years is 61% (48%–69%; confidence interval [CI] 50%) (Figure 8).

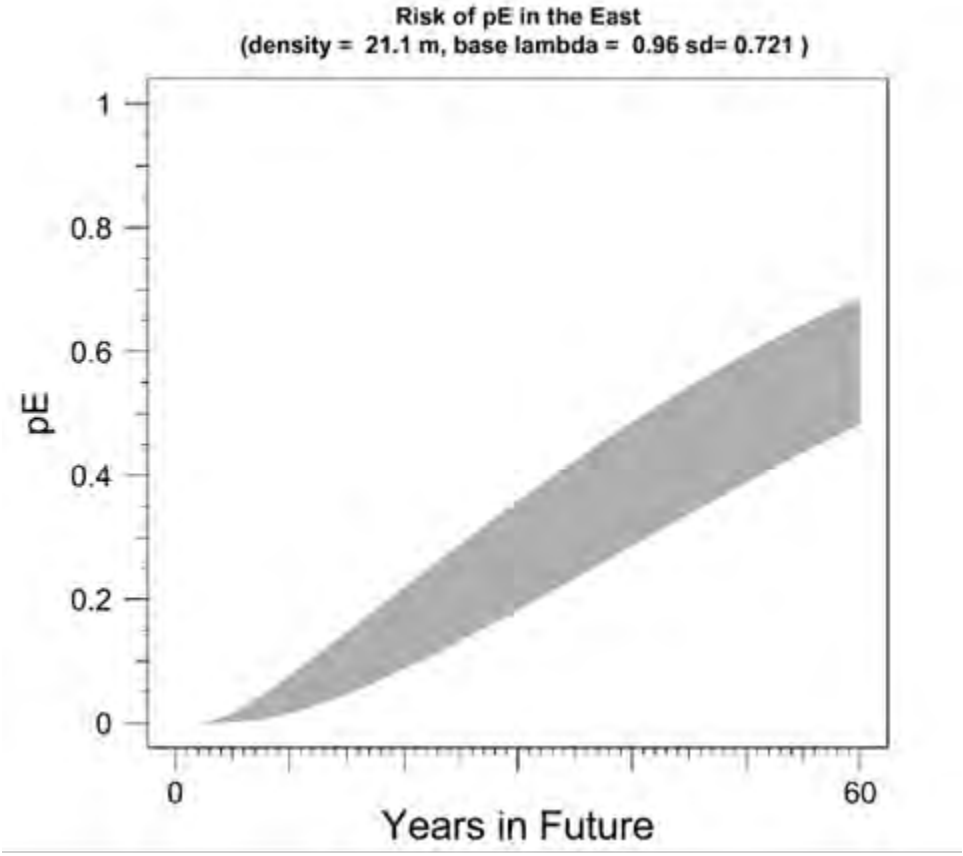


Figure 8. pE for the eastern North American monarch population over time, represented by 50% confidence interval (gray space). Probability based on current trend in growth.

4.6.2 Western North American Population

The western North American population has been censused annually since 1997, providing an estimate of annual population size (Figure 9). Recent work, using past survey data, gives estimates of millions of butterflies in the mid-1980s (Schultz et al. 2017). These estimates were

for overwintering abundance in coastal California from 1981–2015. The researchers used state-space models to estimate the western monarch population growth rate from spatially and temporally erratic sampling data going back to the early 1980s and found annual abundance estimates were high in the 1980s, fluctuating in the 1990s, and low in the 2000s.



Figure 9. Thanksgiving counts showing the number of western North American monarch butterflies observed at overwintering sites (green bars). Blue line shows the number of sites monitored (survey effort) for a given year (Xerces 2024)

Based on the past annual censuses, the western North American migratory population has been generally declining over the last 26 years, despite an increasing number of sites being counted (Figure 9). Modeling conducted for the SSA indicated that under current conditions the risk of extinction over time is predicted to increase sharply, with the estimated *pE* over 60 years reaching 99% (98%–99%, CI 50%) (Figure 10).

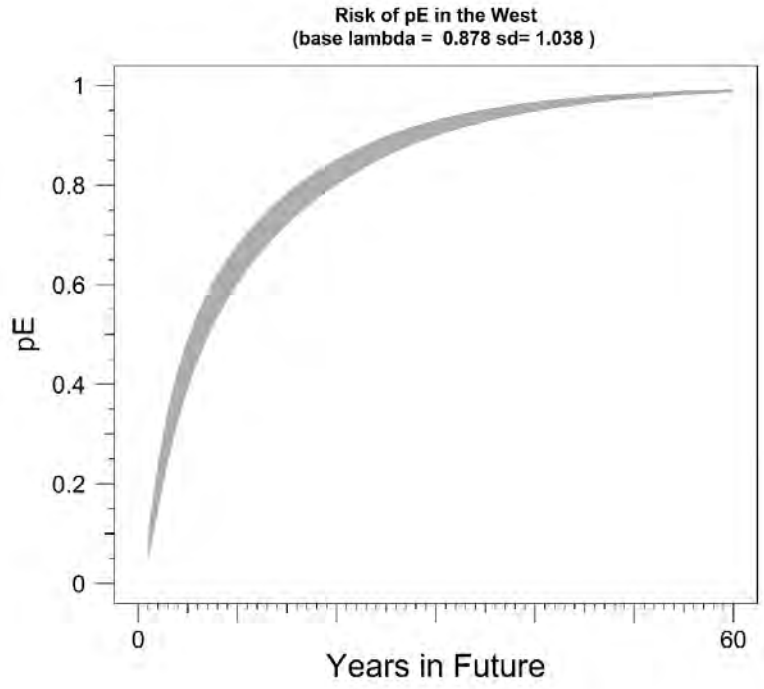


Figure 10. pE for the western North American monarch population over time, represented by 50% confidence interval (gray space). Probability based on current trend in growth.

4.7 THREATS AND PRIMARY INFLUENCES

The primary drivers affecting the health of the two North American migratory populations are changes in breeding, migratory, and overwintering habitat (due to conversion of grasslands to agriculture, urban development, widespread use of herbicides, logging/thinning at overwintering sites, unsuitable management of overwintering groves, and drought), continued exposure to insecticides, and effects of climate change. The Monarch SSA provides detailed information on each of the primary drivers affecting the monarch butterfly (USFWS 2020).

4.7.1 Limited Availability, Distribution, and Quality of Milkweed

The availability of milkweed is essential to monarch reproduction and survival. Reduction in milkweed is cited as a key driver in monarch declines (Brower et al. 2012; Pleasants and Oberhauser 2013; Inamine et al. 2016; Thogmartin et al. 2017b; Waterbury and Potter 2018; Saunders et al. 2019; Solis-Sosa 2021).

A majority of the milkweed loss has occurred in agricultural lands, where intensive herbicide usage for weed control has resulted in widespread milkweed eradication. Pleasants (2017), for example, estimated that over 860 million milkweed stems were lost in the Midwest between 1999 and 2014, a decline of almost 40%. Currently, approximately 89% and 94% of corn and soybean crop acreage, respectively, are planted as glyphosate (herbicide)-tolerant crops (USDA 2023). Glyphosate use in western agricultural lands has also increased dramatically since the 1990s, especially within the Central Valley of California, Snake River Plain of Idaho, and the Columbia River Basin, which spans the border between Washington and Oregon (USGS 2017; Waterbury and Potter 2018). As weed species develop increasing resistance to glyphosate, other herbicide (e.g., dicamba) tolerant crops are developed, which can lead to a corresponding increase in herbicide use. Accordingly, herbicide impacts to milkweed and nectar plants are expected to continue to impact monarch resources.

Milkweed is also lost on the landscape through development and conversion of grasslands (Lark et al. 2015, pp. 3–4). Between 2008 and 2016, a total of 4.9 million acres of grassland were converted to new cropland, including up to 3 million acres of Conservation Reserve Program (CRP) land between 2008 and 2012 (Zhang et. al. 2021; Lark et al. 2015). Pleasants and Oberhauser (2013) estimate that the loss of agricultural milkweeds in the Midwest has resulted in an 81% decline in monarch production, in part because monarch egg densities were higher on milkweed in agricultural fields (3.89 times more eggs than on non-agricultural milkweed). This particularly impacts the eastern monarch population because more Mexico overwintering monarchs originate from the Midwest crop belt region than any other region (with estimates ranging from 38% to over 85% of all overwintering monarchs originating from the Midwest; Wassenaar and Hobson 1998; Flockhart et al. 2017). Accordingly, herbicide impacts to milkweed and nectar plants will continue to impact monarch resources available in agricultural lands.

4.7.2 Limitations in Breeding and Nectar Resources

Losses of nectar sources during migration have also been particularly implicated as a potential key driver in monarch declines (Inamine et al. 2016; Thogmartin et al. 2017b; Saunders et al. 2019). Losses of nectar resources are due to same stressors identified above for milkweed resources. Additionally, with a warming climate, drought impacts may become more important, especially in the western population and in the migratory bottleneck for the eastern population.

4.7.3 Availability and Quality of Overwintering Habitat

Both western and eastern monarchs rely on the microclimate provided by the trees at their overwintering sites (Leong et al. 2004; Williams and Brower 2015).

Loss of trees occurs at overwintering sites in Mexico primarily through small- and large-scale logging, storms, and an increasingly unsuitable climate (see 4.7.5 Climate Change section below for more details). Most overwintering sites used by eastern monarchs occur within the Monarch Butterfly Biosphere Reserve (Reserve), a 56,259-ha protected area. Within this area, there is a logging ban within the 13,551-ha core zone (Ramírez et al. 2015). However, recent logging has occurred both legally (including salvage logging allowed after storms) and illegally at multiple colonies (Vidal et al. 2014; Brower et al. 2016). Some conversion of forest to avocado plantations has also occurred in the Reserve buffer.

Western monarch overwintering habitat along the Pacific Coast has been subject to loss through various forms of development, particularly urban development (Sakai and Calvert 1991; Frey and Schaffner 2004). Habitat alteration, both natural and anthropogenic, can also alter the microclimate of the western overwintering sites, leading to less suitable habitat conditions (Jepsen et al. 2015). There are many other stressors that can work alone or in tandem on the western overwintering sites, including disease and pests that impact the trees used for overwintering, as well as senescence and improper grove management. Fire is also a threat, both indirectly through habitat loss and directly to overwintering monarchs (Pelton et al. 2016). Drought in the West can further exacerbate the stressors on the western overwintering sites (see *Climate Change* section below).

4.7.4 Insecticides

Insecticides are pesticides with chemical properties that are designed to kill insects, and most are non-specific and broad-spectrum in nature. That is, insects exposed to these insecticides are susceptible to mortality and/or sub-lethal effects. Furthermore, the larvae of many Lepidopterans are considered major pest species and insecticides are tested specifically on this taxon to ensure that they will effectively kill individuals at application rates indicated on product labels. Even though monarchs are not the target species of these products, they may be exposed to insecticides where they are applied and in areas beyond the insecticide application sites due to drift (Olaya-Arenas and Kaplan 2019; Halsch et al. 2020).

The monarch butterfly is widely distributed across the U.S., occurring in a variety of urban and rural habitat types that include milkweed plants and other flowering forbs. Insecticide impacts to monarchs are primarily influenced by the extent to which monarchs are exposed to insecticides throughout their range. Although insecticide use is most often associated with agricultural production (for example, between 2005 and 2012, 60% of insecticide applied occurred on agricultural lands, USEPA 2017), any habitat where monarchs are found may be subject to insecticide use.

4.7.5 Climate Change

Climate change can affect monarchs both directly and indirectly (Nail and Oberhauser 2015) on both the overwintering, breeding, and migratory grounds. Direct effects of climate change, particularly increasing temperatures, may impact monarch fecundity (Oberhauser 1997), mating success (Solensky and Oberhauser 2009), and survival during migration and while overwintering (Masters et al. 1988; Alonso-Mejía et al. 1997). Laboratory studies indicate optimal temperatures for monarch range from 27–29°C with sublethal effects beginning around 30–36°C range and an upper lethal thermal limit of 42°C (Zalucki 1982; York and Oberhauser 2002; Zalucki and Rochester 2004; Nail et al. 2015). Nighttime temperatures of 34°C during periods with daytime temperatures of 38°C resulted in lower survival, showing that respites from elevated temperatures are important in allowing monarchs to survive temperature stress (Nail et al. 2015). Temperatures consistently above 33°C to 35°C are unsuitable for monarchs and may account for their general absence from southern U.S. states after spring (Malcolm et al. 1987; Zalucki and Rochester 1999).

4.7.5.1 *Overwintering sites*

Monarchs need a very specific microclimate at their overwintering sites not just to avoid storm mortality, but also to avoid early lipid depletion.

Increasing storm frequency in the Mexican overwintering colonies can lead to catastrophic (up to 80%) mortality through the freezing temperatures that accompany these storms (Anderson and Brower 1996; Brower et al. 2004). Severe storms may become more frequent with precipitation predicted to increase during the winter when monarchs are present in Mexico (Oberhauser and Peterson 2003). In addition to the impact climate change may have on overwintering monarchs directly, the Mexico overwintering sites are predicted to be less suitable for oyamel fir trees, the predominant monarch roosting tree, as climate change progresses. Current modeling of the monarch's fundamental niche predicts the loss of 38.6% to 69.8% of current suitable habitat within the Monarch Butterfly Biosphere Reserve by 2050 (Zagorski 2016).

In western North America, climate change is predicted to cause a significant change in the distribution of overwintering monarchs in coastal California. Results from climatic niche modeling by Fisher et al. (2018) suggest that climate change will result in an inland and upslope displacement of suitable overwintering conditions. The probability of occurrence of suitable overwintering conditions becomes roughly proportional to elevation. However, we do not have

evidence that monarchs would move to or use these upslope areas. Widespread drought is likely to impact trees in the western overwintering areas both directly and indirectly due to increased susceptibility to pests (Paine and Millar 2002).

4.7.5.2 Breeding and Migratory Habitat

A warming climate may influence breeding habitat by altering suitable locations for both monarchs (Batalden et al. 2007) and their milkweed host plant (Lemoine 2015). Saunders et al. (2019) suggested that nectar resources during migration may be reduced under climate conditions (decreased precipitation) projected for south-central Texas. Drought may also influence the amount and availability of nectar needed for migrating butterflies (Brower et al. 2015; Stevens and Frey 2010; Espeset et al. 2016). The coastal non-migratory population may also be impacted by loss of habitat through rising sea levels due to climate change (TBCSAP 2015). While drought and increased temperatures may reduce monarch habitat in some areas, the climatically suitable niche for monarchs may increase, potentially increasing their summer breeding grounds if both monarchs and milkweed are able to adapt (Lemoine 2015).

Climate change may additionally impact monarchs in ways that are more difficult to measure. This may include phenological mismatch (e.g., timing of milkweed and nectar sources not aligning with monarch migration; Thogmartin et al. 2017b) or range mismatch with associated species (e.g., changed environmental suitability of monarch natural enemies; McCoshum et al. 2016). Furthermore, recent research suggests that carbon dioxide may impact the medicinal properties of some milkweed species, potentially leading to increased *OE* parasite virulence and decreased monarch tolerance of *OE* infections (Decker et al. 2018).

4.8 CONSERVATION EFFORTS

Protection, restoration, enhancement and creation of habitat is a central aspect of recent monarch conservation strategies, thus highlighting the importance of restoring and enhancing milkweed and nectar resources (Oberhauser et al. 2017; Pleasants 2017; Thogmartin et al. 2017b; MAFWA 2018; Pelton et al. 2019; WAFWA 2019). Improved management at overwintering sites in California has also been targeted to improve the status of western North American monarch butterflies (Pelton et al. 2019; WAFWA 2019).

Major conservation plans and efforts include the Mid-America Monarch Conservation Strategy developed by the Midwest Association of Fish and Wildlife Agencies (MAFWA), the Western Monarch Butterfly Conservation Plan developed by the Western Association of Fish and Wildlife Agencies (WAFWA), and the Nationwide Candidate Conservation Agreement for Monarch Butterfly on Energy and Transportation Lands (CCAA/CCA) developed by entities from the energy and transportation sectors and the Energy Resources Center at the University of Illinois – Chicago. The Mid-America Monarch Conservation Strategy established a goal of adding 1.3 billion stems of milkweed on the landscape by 2038 (MAFWA 2018). The 1.3 billion stem goal is an estimated goal for adding enough habitat to support 6 hectares of overwintering population for the eastern North American population, per Pleasants (2017) and Thogmartin et

al. (2017b). A full description of these conservation efforts is in the Monarch SSA (USFWS 2020).

4.8.1 Importance of Milkweed Geographic Location in the West

For the population of monarchs that overwinter in California coastal areas and then migrate inland to breed, availability of milkweed may be especially important in areas where the first generation of monarchs are produced each spring. Pelton et al. (2019) suggest increasing the availability of three early emerging native milkweed species to support monarch reproduction in these areas and a few later emerging species that could also be beneficial. The important geographic zones, or Priority Action Zones (PAZs) for western monarchs are shown in Figure 11.

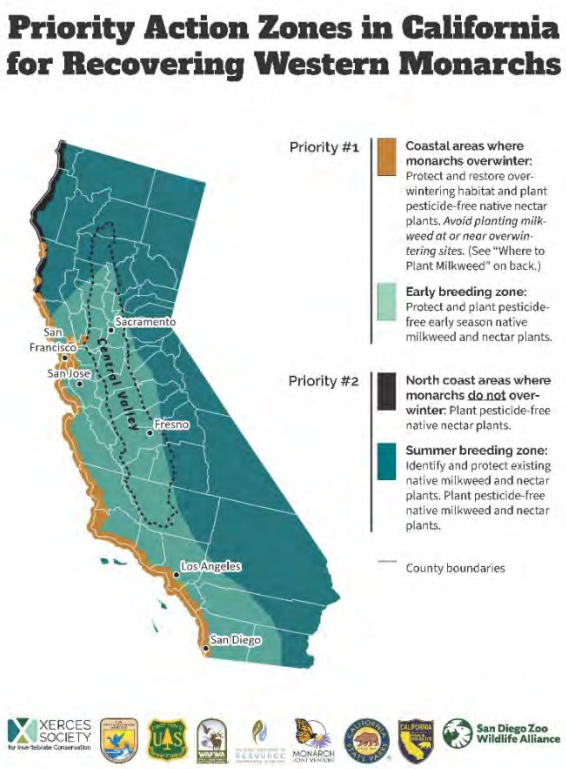


Figure 11. Priority Action Zones in California

4.8.2 Monarch Conservation Units

Monarch Conservation Units (MCUs) were created to delineate the approximate boundaries of areas important to monarch butterfly populations across the continental U.S. (Figure 12). These boundaries were created as part of the monarch SSA development. Different monarch populations, or different portions a population's range, may have different conservation needs. Differences in biology, available data, and scientific uncertainties across monarch populations may require variable conservation approaches. As new information becomes available, the boundaries of the MCUs may shift. The Strategy acknowledges this: *This section* [Conservation Unit description] *will be updated as new information becomes available regarding what areas*

are most important to monarchs in all conservation units. These updates will be incorporated into the overall Strategy to ensure priorities are being addressed in the future.

Current MCUs can be found in the online Monarch Conservation Opportunities Toolkit.

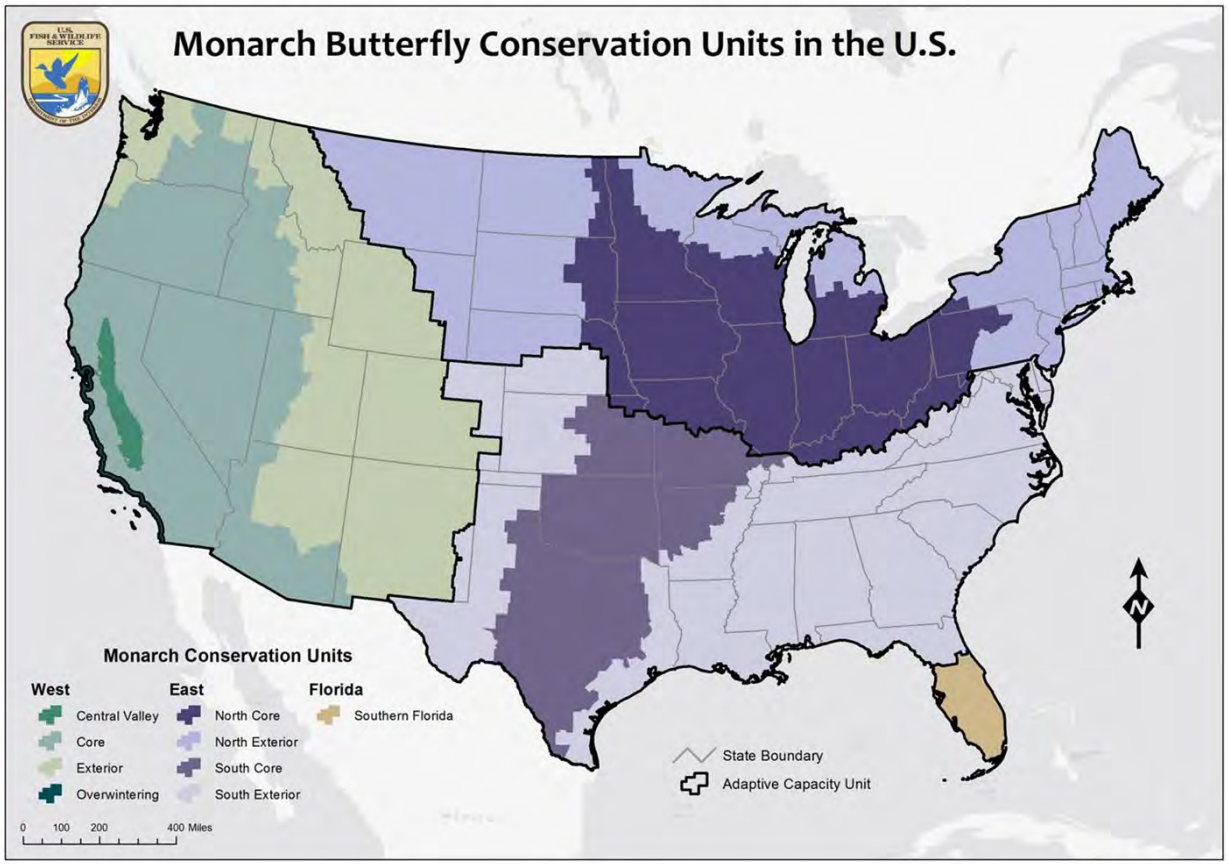


Figure 12. Map of monarch butterfly conservation units in the U.S.

5 ENVIRONMENTAL BASELINE

Environmental baseline refers to the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat caused by the Proposed Action. The environmental baseline includes the past and present impacts of all federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed federal projects in the Action Area that have already undergone formal or early section 7 conference, and the impact of State or private actions which are contemporaneous with the conference in process. The impacts to listed species or designated critical habitat from federal agency activities or existing federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline. [50 CFR 402.02 "Environmental baseline"]

5.1 CURRENT CONDITION OF THE SPECIES IN THE ACTION AREA

The best available information on trends in monarch numbers, reproduction, and distribution are discussed in the SSA (USFWS 2020), and it is likely that they reflect the current condition of the species within the Action Area. Over the long-term, census data show a decline in population abundance for both eastern and western populations of monarch (although numbers fluctuate year-to-year).

The Strategy defines monarch breeding and migratory habitat as "grassland and other areas that have nectar resources and/or milkweed present at the time of year monarchs are present on the landscape. This could include forested areas, wetlands, or shrub/scrub areas, among others. Unsuitable habitat in the Strategy is defined as developed areas that include but are not limited to some cantonment areas, some housing areas, industrial areas, highly developed training sites, and developed testing facilities."

Monarch may occur in suitable habitat throughout the Action Area. For the purpose of the Strategy, DOD used landcover data (grasslands and exotic herbaceous) to estimate the extent of monarch habitat on DOD lands (see section 5.1.1 below for additional discussion and support of this approach).

The Strategy used the MCUs to organize information across its over 24 million acres of land, spanning the lower 48 states, estimating roughly 1,800,000 acres of monarch habitat (summarized in Table 3, Figure 13). Additional detail with grassland acres by installation is provided in Appendix B.

Table 3. Number of installations and estimated monarch habitat by Monarch Conservation Unit, both for installations with INRMPs and those without INRMPs. For this table, installations with less than one acre of grassland were not included.

Department of Defense Military Installations within Monarch Butterfly Conservation Units - suitable habitat for monarch as estimated by grassland acres				
	INRMP		No INRMP	
MCU	No. Installations	~Acres	No. Installations	~Acres
North Core	33	38,200	67	3,500
North Exterior	49	111,000	67	14,000
South Core	32	244,000	32	5,000
South Exterior	98	336,000	114	6,500
West Core	59	484,700	46	12,000
West Exterior	27	480,000	29	8,800
Central Valley	7	18,903	9	50
Overwintering	9	55,000	9	100
Southern Florida	8	16,500	9	50
totals		**1,784,100**		**50,000**

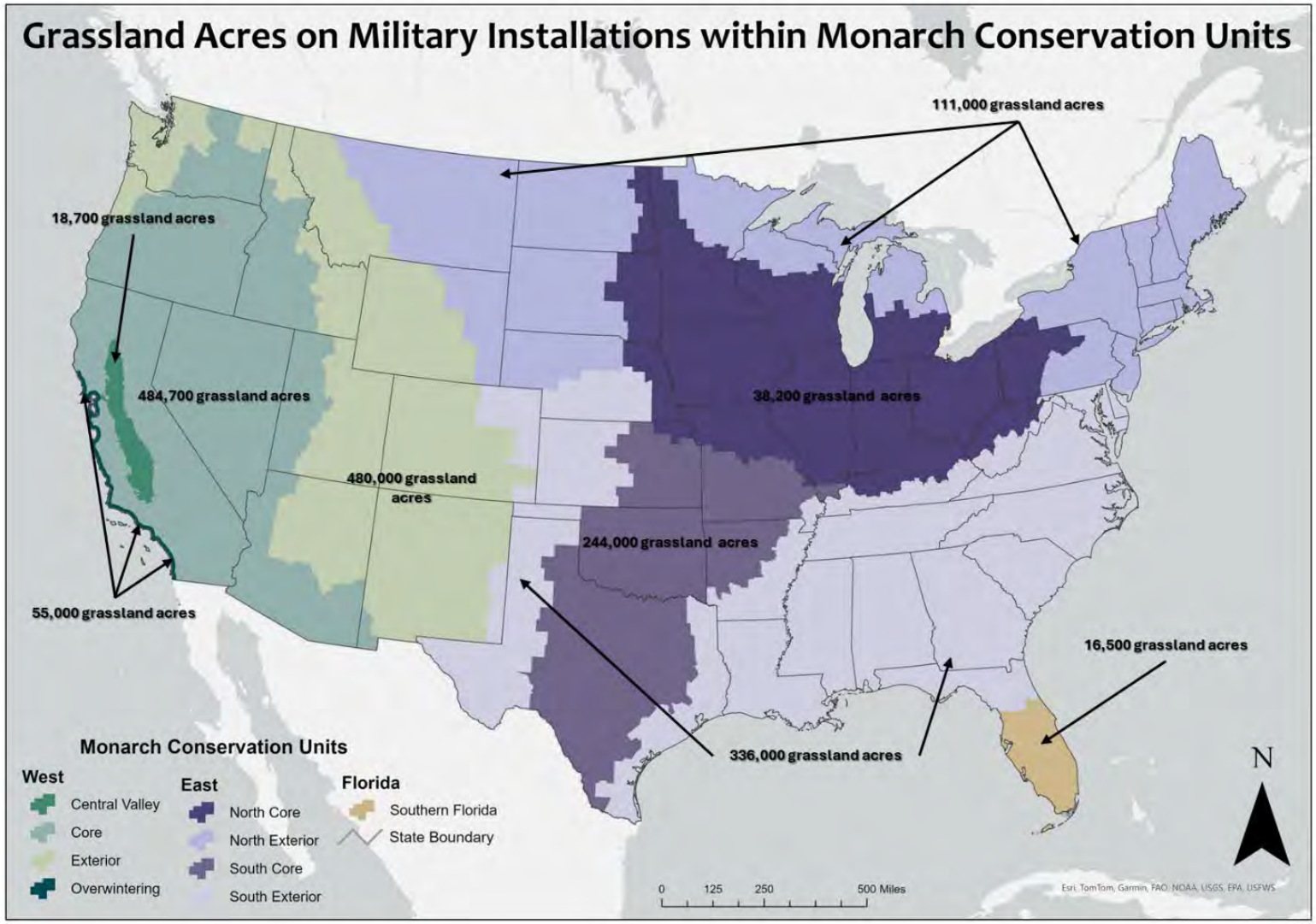


Figure 13. Grassland acres within Monarch Conservation Units across DOD lands

5.1.1 Support for Using Grassland Landcover to Estimate Monarch Habitat at a Landscape Scale

The USFWS used published literature to identify landcover types that may represent high quality for both milkweed and blooming nectar plants to determine the amount of potential habitat for monarchs currently on the landscape across its range. Although this effort was not related to this conference, we describe the process here to provide support for DOD's approach of using grassland landcover to estimate monarch habitat at a landscape scale. As we develop new resources and tools, there may be a better approach in the future for other agencies developing conservation strategies for monarch. Using grassland landcover for DOD's Strategy, however, is the best approach at the time of the Strategy's development. Because of the proactive nature of the Strategy (i.e., ahead of the species being listed), it was developed before USFWS consultation guidance has been developed.

> Koh et al. (2016) used expert elicitation to apply floral resource production scores (from 0.05 to 0.95) to 45 landcover types derived from the National Landcover Dataset (NLCD) and Cropland Data Layer (CDL) (Koh et al. 2016). Similarly, Thogmartin et al. (2017b) used expert elicitation to estimate baseline and potential densities of milkweed plants for 42 landcover types, also derived from NLCD and CDL, although this study was biased towards the Upper Midwest (Thogmartin et al. 2017b). Lukens et al. (2024) measured milkweed density and floral frequency and richness in the field using the standardized Integrated Monarch Monitoring Protocol, however only 5 landcover types were sampled enough to make inferences about suitability for milkweed and nectar. We also considered suitability models developed by Dilts et al. (2019) for both monarch adults, larvae, and eggs as well as 13 species of milkweed. However, we chose not to include these suitability models in our assessment as many older records of monarch and milkweed occurrence were included in the model and the results may represent formerly suitable habitat as opposed to currently suitable habitat. We then grouped similar landcover types together into broad categories (e.g. agriculture, developed, forest etc.) and assigned a classification of high, moderate, and low potential quality for milkweed and nectar plants based on relative rankings or scores found in the published literature.
>
> After identifying broad groups of landcover types that may represent high to moderate quality for milkweed and nectar resources, we calculated the total acreage of each landcover type within each Conservation Unit to estimate how much potential high to moderate quality habitat currently exists on the landscape. Expert elicitation and field surveys indicate that rights-of-way, grasslands, shrublands, wetland, pasture, and developed landcover types have relatively high to moderate densities of milkweed while wetlands, grasslands, shrublands, forests, and developed landcover types are relatively high to moderate in floral resources. Grassland was the only landcover type we anticipate will be high quality for both milkweed and nectar resources, and thus monarch.

Because grassland was the only landcover type that was estimated to be high quality for both milkweed and nectar resources, we use it for this conference as a way to estimate monarch habitat across the Action Area at the landscape level of the Strategy.

Natural resource managers will refine areas of suitable monarch habitat based on site-specific data for their installations during INRMP review (see Next Steps and INRMP Integration section). This will allow for greater specificity at the Strategy's implementation stage for the vast majority of DOD installations. Not every installation has an INRMP; the installation must have significant natural resources (e.g., wetlands; listed, rare or at-risk species; forestry; agriculture) to have a plan. In terms of scale of potential monarch habitat, there are approximately 1,784,100 acres of grassland covered under INRMPs compared to roughly 50,000 acres that are not covered under INRMPs (Table 3).

5.1.2 Availability, Spatial Distribution, and Quality of Milkweed in the Action Area

The availability of milkweed is essential to monarch reproduction and survival. Reduction in milkweed is cited as a key driver in monarch declines (Brower et al. 2012; Pleasants and Oberhauser 2013; Inamine et al. 2016; Thogmartin et al. 2017b; Waterbury and Potter 2018; Saunders et al. 2019; Solis-Sosa 2021).

As described previously, much of the milkweed loss across the range of monarch has occurred in agricultural lands, where intensive herbicide usage for weed control has resulted in widespread milkweed eradication. Given the small number of agricultural outleases on DOD properties, and their relatively small size in the context of their overall footprint across the DOD enterprise in continental U.S. (i.e., <0.2% of DOD land), the influence of agricultural outlease-related impacts to monarchs on DOD managed lands is minimal.

Similarly, although milkweed is also lost on the landscape through development and conversion of grasslands throughout the range of monarch (Lark et al. 2015), this is not the case throughout the Action Area. Grasslands on DOD installations are not faced with the same pressures from conversion, with only 0.15 and 0.07% change from grassland to developed and agriculture areas, respectively, occurring from 2014 to 2022 (see Strategy's Appendix C).

In addition, on military installations with INRMPs that include pollinators, existing habitat and vegetation management actions currently maintain, enhance, and promote the availability and quality of monarch habitat. Positive management outcomes are accomplished largely through proper ecosystem management that can be achieved by implementing regionally appropriate and site-specific management regimes such as prescribed burning, mowing or haying, and invasive/noxious species control, among others, which are outlined in each installation's INRMP.

5.1.3 Native Milkweed

5.1.3.1 Influence of Non-native Milkweed

Establishment of the nonnative tropical milkweed in the U.S., where it is not killed by winter freezes, has increased the prevalence of parasitic infections and has facilitated the establishment of newly resident monarch populations (Altizer et al. 2000; Satterfield et al. 2016; Crone and Schultz 2021). Tropical milkweed does not deteriorate in the winter when native milkweed does and becomes a supplemental year-round foliage source for breeding and oviposition when

monarchs would otherwise be in a state of reproductive diapause (Ducat 2020). Migration decreases incidence of the parasite *OE*, in populations. Migratory monarchs leave breeding areas where *OE* prevalence is typically high and migration culls infected individuals (Satterfield et al. 2015; 2016). Moreover, high larval densities in year-round resident populations can exacerbate the spread of *OE* (Lindsey et al. 2009; Satterfield et al. 2015). In California, *OE* infection rates were nine times higher in non-migratory monarchs than in migratory monarchs sampled at overwintering sites (Satterfield et al. 2016). Migratory monarchs can also suffer from increased infection rates when they interact with resident populations. In Texas, migrant sites with resident monarchs were 13 times more likely to be infected by *OE* (Satterfield et al. 2018).

Monarch use of tropical milkweed may also directly reduce migratory success and larval survival and may cause additional adverse effects at increased temperatures that may result from climate change. Monarchs fed on the tropical milkweed had shorter, wider, and thinner forewings than those that fed on swamp milkweed and common milkweed, which have low and intermediate levels of cardenolides, respectively (Decker et al. 2019; Soule et al. 2020). Shorter and wider forewings are considered poorer for the gliding flight that is used during migration. At elevated temperatures designed to reflect future conditions caused by climate change, cardenolide levels increased in tropical milkweed (Faldyn et al. 2018). In addition to shorter forewings, monarchs that fed on the tropical milkweed grown under the simulated warming scenarios had lower adult survival and mass (Faldyn et al. 2018).

The DOD PCRG's monarch BMPs include "eliminate invasive plants and nonnative tropical milkweed, which is believed to promote spread of disease in migratory monarchs"; thus, installations have been advised to remove tropical milkweed where monarch occur throughout the Action Area, since the DOD PCRG's publication in 2018. For installations implementing the DOD PCRG, we expect the prevalence of tropical milkweed in the Action Area to be less than elsewhere in the range of monarch.

5.1.4 Availability, Distribution, and Quality of Breeding Range Nectar Resources in the Action Area

Reductions in nectar resources are also cited as a potential key driver in monarch declines (Thogmartin et al. 2017b). Losses of nectar resources are due to the same stressors identified above for milkweed resources (conversion of grassland to agriculture and development, herbicide use), and are lesser in the Action Area than elsewhere due to DOD's commitment to land management under Sikes Act (see discussion above in 5.1.2 Availability, Spatial Distribution, and Quality of Milkweed in the Action Area section related to conversion of grassland to agriculture) and commitment to limiting herbicides (discussed in more detail below in Insecticide Exposure in the Action Area section).

5.1.5 Availability, Quality, and Spatial Distribution of Migration Resources in the Action Area

Losses of nectar sources during migration have also been implicated as a potential key driver in monarch declines (Inamine et al. 2016; Thogmartin et al. 2017b; Saunders et al. 2019). Losses of nectar resources are due to same stressors identified above for milkweed resources. Additionally,

with a warming climate, drought impacts may become more important, especially in the western population and in the migratory bottleneck for the eastern population.

Similar to milkweed, a driver of nectar plant loss at the landscape scale is through development and conversion of grasslands (Lark et al. 2015). Grasslands on DOD installations, however, are not faced with the same pressures from conversion, with only 0.15 and 0.07% change from grassland to developed and agriculture areas, respectively, occurring from 2014 to 2022 (see Strategy's Appendix C). In addition, existing habitat and vegetation management actions on military installations currently maintain, enhance, and promote the availability and quality of monarch habitat, including nectar resources during migration.

5.1.6 Availability and Quality of Overwintering Habitat in the Action Area

DOD NRMs have been working with the Xerces Society and U.S. Forest Service (USFS), among others, to protect and restore overwintering sites on and near DOD lands in the west (California). As described in the Description of the Proposed Action, DOD applies BMPs for overwintering habitat that reduce or eliminate many threats to overwintering habitat that occurs on military lands. These actions primarily include reducing disturbance when monarchs are present, implementing vegetation management activities that minimize destruction or disturbance of monarchs, and enhancing nectar resources near overwintering sites and along the coast. See Figure 14 for a map of overwintering sites managed by DOD.

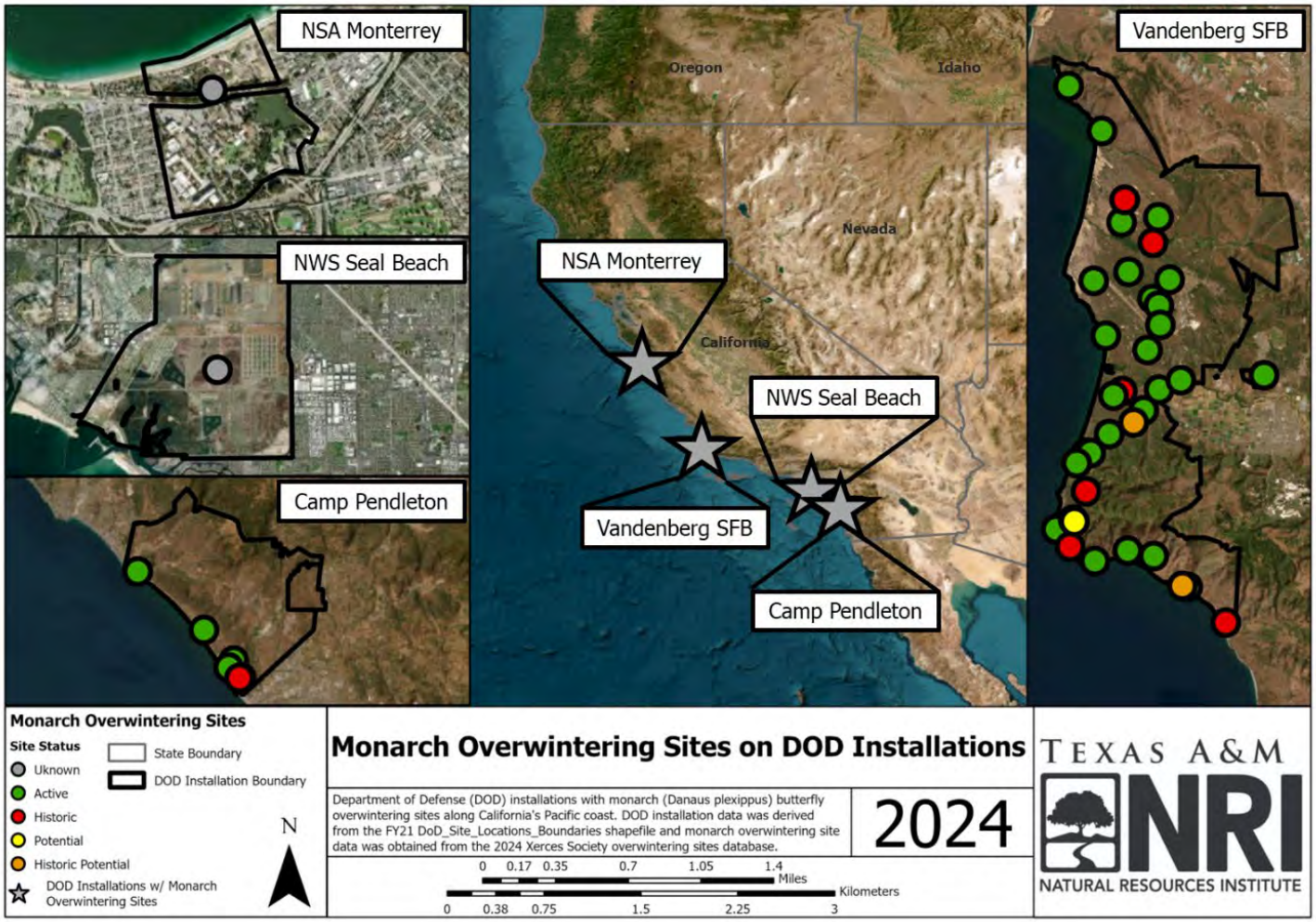


Figure 14. Monarch overwintering sites on DOD installations.

5.1.6.1 Vandenberg Space Force Base

Vandenberg Space Force Base (SFB), formerly Vandenberg Air Force Base, is a military installation located in Santa Barbara County, California that consists of >99,000 acres of largely undeveloped habitat and 42 miles of Pacific coastline. According to the Western Monarch Count (WMC) Overwinter Sites database, Vandenberg SFB has a total of 37 monarch overwintering sites widely distributed throughout the installation. Of the 37 sites, 31 are active or potential overwintering sites. The first documented overwintering counts were conducted by Calvert during the 1989 overwintering period. Overwintering surveys were conducted sporadically following Calvert's 1989 survey, and no overwintering surveys were performed during the 1991-1994, 2002-2004, and 2008-2010 overwintering seasons. Two overwintering sites on Vandenberg SFB were identified in the top 50 overwintering site priority list (Pelton et al. 2016). This top 50 list was developed to identify sites that are most critical for protection and active management when dealing with limited resources. These sites were identified based on their percent decline from the 1997-2001 count average versus the 2010-2014 count average coupled with the proportion of the remaining total population in 2010-2014 at the site. In short, sites were ranked higher if they had undergone the greatest declines yet still hosted the largest proportion of the remaining population. The two sites identified on Vandenberg SFB were the only sites from the list located on DOD property.

Recognizing its importance to western overwintering monarchs, Vandenberg SFB has cooperated with the USFWS, California Department of Fish and Wildlife, Xerces Society, and other organizations for many years to survey and monitor monarch utilization of the installation. Although no breeding surveys for monarchs have occurred, many of the overwintering sites are monitored annually by Vandenberg SFB biologists, interns, students, as well as Xerces Society staff and volunteers. In March 2017, the Colorado State University's Center for Environmental Management of Military Lands (CEMML) prepared and distributed a Monarch Butterfly Report for Vandenberg SFB (CEMML 2017). The report summarizes the past efforts and current status of monarchs on Vandenberg and provides habitat management and survey recommendations as well as suggestions for INRMP updates. In addition to the report generated by CEMML in 2017, two additional reports were produced in 2023 by Xerces Society staff. The purpose of these visits was to assist the DOD in cataloging and documenting the current quality of overwintering habitat for migratory monarchs.

Furthermore, Vandenberg SFB is a participant in the Western Monarch Overwintering Science Initiative (MOSI) a new, evolving and highly collaborative group of people and partners interested in exploring what overwintering monarchs need to thrive, where and when the butterflies move, and how to more meaningfully engage the diversity of Californians in community science efforts as well as applied research projects. Funding for MOSI's two current projects is provided by the U.S. Forest Service International Program (USFSIP) and the Legacy Program. The first initiative is the Forest Structure and Cluster Location project which is a multi-phased project that aims to address how forest structure affects wind attenuation at overwintering sites, how monarchs respond to disturbances like strong winds, whether monarchs respond to vibration events due to military operations, and how knowledge of cluster location and wind

attenuation can be applied to management at overwintering sites. On Vandenberg SFB modified infrared cameras and wind sensors will be installed to track monarch cluster location and movement over the season. Additionally, a drone-based LiDAR sensor will be used to build a model of forest structure at the pilot locations. The second initiative is the Movement Ecology and Motus project, which aims to address the following questions: how can the Motus network benefit migratory insect studies; how do different radiotags impact monarch movement and survival; how can radiotags, telemetry, and Motus be used to answer questions about western monarch migratory and overwintering movement and; how can movement ecology studies using this technology inform habitat management actions at overwintering sites. In the late fall and winter of 2024-2025, Xerces Society and Point Blue will work with Vandenberg SFB staff and Environment for the Americas (EFTA) interns to study if and when monarchs move among numerous overwintering sites at Vandenberg SFB. Up to 60 monarchs will be tagged and tracked throughout the overwintering season.

5.1.6.2 Marine Corps Base Camp Pendleton

Marine Corps Base (MCB) and Marine Corps Air Station (MCAS) Camp Pendleton collectively occupy approximately 125,488 acres in northwestern San Diego County of southern California. In October 2023, Xerces Society staff, MCB Camp Pendleton personnel, Vandenberg SFB biologists, and others met to visit monarch overwintering sites within the boundaries of the installation. The purpose of this visit was to share cross-installation knowledge between base biologists and Xerces Society staff to identify priority areas for management of monarch overwintering habitat on MCB Camp Pendleton. Six overwintering sites have been identified on MCB Camp Pendleton, two of which were determined by Xerces Society staff to be unlikely to support overwintering monarchs. However, four winter roosts have been documented and surveyed annually as part of the WMC regional monitoring program for overwintering monarchs. MCB Camp Pendleton biologists continue to collaborate with Xerces Society biologists to improve and refine surveys for monarchs and discuss maintenance of tree groves to benefit overwintering monarchs.

5.1.6.3 Naval Support Activity Monterrey

Naval Support Activity (NSA) Monterrey is a military installation comprised of an assemblage of properties totaling 563 acres located in Monterey County, California. One of the properties that comprises NSA Monterrey is known as the Dune/Research Area and encompasses 55 acres. This site harbors a grove of blue gum eucalyptus and likely provides overwintering habitat for monarchs.

5.1.6.4 Camp San Luis Obispo and Camp Roberts

Camp Roberts and CSLO are two military installations located in California occupying 42,784 and 5,612 acres, respectively. While CSLO is located entirely within San Luis Obispo County, Camp Roberts is in both Monterrey and San Luis Obispo counties. While both Camp Roberts and CSLO have conducted surveys for overwintering monarchs, none were observed at either site, despite CSLO having an apparently suitable grove of blue gum eucalyptus. Overwintering surveys conducted at Camp Roberts determined that there was no suitable overwintering habitat

on site, but they did find 30 low to high density milkweed patches that represent important breeding habitat to the species (Althouse and Meade 2021a, 2021b).

Several locations on CSLO have previously been identified as potential habitat for overwintering monarchs to cluster. An assessment of overwintering habitat on CSLO found one grove of blue gum eucalyptus offered potential overwintering habitat, however no overwintering monarchs were observed (CSLO 2022). Additionally, a natal habitat assessment and breeding survey were completed on CSLO in 2021 (Althouse and Meade 2021b). A low density of narrow leaved milkweed was detected, and no breeding monarchs were observed. In the fall of 2023, the Xerces Society surveyed four locations for monarch activity and overwintering habitat assessments at each site. Of the four sites surveyed, the Colusa and Tehama Ave site was determined to be the grove most likely to support overwintering monarch habitat. As such, it was recommended by the Xerces Society to prioritize monitoring at this location over other potential sites, particularly if resources are limited. If possible, it was recommended that the San Benito site continue to be monitored as well. The remaining two sites were determined less likely to be monarch overwintering sites based on the condition of the groves and monarch activity observed. As such, these sites are a lower priority for monitoring. Nonetheless, continued surveys for the next few years may help establish true absence (or presence) of clustering monarchs at these locations. It is common for some overwintering locations to have no monarchs some years and then have clusters appear at a later date.

Despite the lack of observed overwintering monarchs on both Camp Roberts and CSLO in recent surveys, both installations have received funding to conduct a monarch butterfly conservation project. Both Camp Roberts and CSLO fall within a Priority 1 PAZ as delineated by the Xerces Society (see Figure 11). The primary goals for this PAZ are to protect and restore overwintering and breeding habitat with an emphasis on planting pesticide-free native nectar plants. As such, the overall objectives of the monarch conservation project on these installations is to: 1) establish baseline conditions for restoration sites, 2) enhance and revegetate monarch overwintering and breeding sites through plantings of native roost trees, insecticide-free native milkweed as well as nectar resources, and 3) monitor restoration sites upon project completion for monarch presence to evaluate success of restoration and efforts and provide recommendations to improve monarch conservation efforts on both Camp Roberts and CSLO.

5.1.6.5 Naval Weapons Station Seal Beach

Historic records from overwintering surveys obtained and maintained by the Xerces Society indicated an overwintering grove on Naval Weapons Station (NWS) Seal Beach. A single record for NWS seal beach from the Western Monarch Thanksgiving Count in November of 1998 reported 200 monarch butterflies, but the exact location for this report is unspecified. In November 2018, a WMC volunteer visited NWS Seal Beach from the visitor parking lot. The volunteer did not observe any monarch butterflies in the eucalyptus and canary island pine (*Pinus canariensis*) trees near the visitor center. In 2022 during the mid-season count, another volunteer was granted access onto NWS Seal Beach but did not observe overwintering monarchs. This volunteer also noted the eucalyptus trees near the entrance at the intersection of Seal Beach Blvd and Forrestal Lane. Recent surveys have been focused near this intersection, as it appears to be the only area on NWS Seal Beach with trees. However, based on aerial imagery

these trees do not appear to be suitable for monarch overwintering habitat. As a result of the single original observation from November 1998 not specifying the exact location the overwintering grove was observed the resulting Western Monarch Overwintering Site polygon delineating this site is quite large. In turn, it is plausible that the location of the overwintering monarchs was not on NWS Seal Beach, but a grove of trees nearby such as the USFWS Seal Beach Wildlife Refuge.

5.1.7 Insecticide Exposure in the Action Area

Insecticides are pesticides with chemical properties that are designed to kill insects, and most are non-specific and broad-spectrum in nature. That is, insects exposed to these insecticides are susceptible to mortality and/or sublethal effects. Furthermore, the larvae of many Lepidopterans are considered major pest species and insecticides are tested specifically on this taxon to ensure that they will effectively kill individuals at labeled application rates. Monarchs may also be exposed to insecticides in areas beyond the insecticide application points due to drift (Olaya-Arenas and Kaplan 2019; Halsch et al. 2020).

The monarch is widely distributed across the U.S., occurring in a variety of urban and rural habitat types that include milkweed plants and other flowering forbs. Insecticide impacts to monarchs are primarily influenced by the extent to which monarchs are exposed to insecticides throughout their range. Although insecticide use is most often associated with agricultural production (for example, between 2005 and 2012, 60% of insecticide applied occurred on agricultural lands, EPA 2017), any habitat where monarchs are found may be subject to insecticide use. Insecticides can be used for insect pest control anywhere there is a pest outbreak or for general pest prevention. Homeowners may treat yards and gardens to protect plants from pests or purchase plants from nurseries that sell neonicotinoid-treated plants as ornamentals. Natural areas, such as forests and parks, may be treated to control for insects that defoliate, bore into wood, or otherwise damage trees. Outbreaks of pests such as gypsy moths, Mormon crickets, or grasshoppers may trigger insecticide treatments over larger areas to control populations. Use of insecticides in vector control, especially pyrethroids and organophosphates, may be significant in areas of the country where mosquitoes pose a public health threat or reach nuisance levels. The use of insecticides in the U.S. is ubiquitous; in 2012 for example, expenditures on insecticides topped $5 billion in the U.S., with 64 million pounds used for agriculture, home and garden, and other purposes (USEPA 2017).

The most widely used classes of insecticide include organophosphates, pyrethroids, and neonicotinoids. Neonicotinoids entered the market in the mid- to late-1990s, and because of their high insecticidal activity at low application rates, they are now the most used class of insecticides in the world (Braak et al. 2018). By 2008, for example, neonicotinoid insecticides accounted for 80% of global seed treatment sales (Jeschke et al. 2011), and by 2011, >79% of the corn hectares and 34% to 44% of soybean acreage in the U.S. were planted with neonicotinoid-treated seeds (Douglas and Tooker 2015). Neonicotinoid insecticides are absorbed into plants and distributed throughout their tissues to their stems, leaves, roots, fruits, and flowers. They kill and injure insects by attacking their central nervous system.

Studies looking specifically at dose-response of monarchs to neonicotinoids, organophosphates and pyrethroids have demonstrated monarch toxicity (Krischik et al. 2015; James 2019; Bargar et al. 2020; Krishnan et al. 2020). Moreover, the magnitude of risk posed by insecticides may be underestimated, as research usually examines the effects of the active ingredient alone, while many of the formulated products contain more than one active insecticide (Krishnan et al. 2020) – e.g., Swagger contains bifenthrin and imidacloprid (Krishnan et al. 2020), but see Oberhauser et al. (2009). The additional risk posed from compounds added to improve the kill rate (referred to as synergists) are often not assessed. The use of synergists is not uncommon. Olaya-Arenas and Kaplan (2019), for example, reported that fungicides (often used as a synergist) were most commonly detected on milkweed samples (e.g., 98% of the milkweed sample in one year contained the fungicide, Propiconazole) and, in many of these cases, co-occurred with insecticides like deltamethrin and thiamethoxam.

Within the Action Area, existing DOD policy limits use of pesticides, reducing the risks associated with this stressor when compared to elsewhere within the range of the species. DOD policy and guidance includes the following BMPs:

- Minimize the use of pesticides, including herbicides, in sensitive habitat sites (DODI 4150.07, DOD Pest Management Program). IPMPs identify how, when, and where pest species are treated while striving for continued reduction and reliance on pesticides, herbicides, and insecticides across all DOD lands.
- Eliminate or reduce the use of pesticides in areas that support monarch (DOD PCRG).
- If pesticides are used, select pesticides to reduce risks to non-target species; time applications to avoid monarch activity periods; minimize drift to non-target areas; and use targeted application (e.g., ground applications instead of aerial applications) ("Pollinator Friendly Pesticide Applicator Best Management Practices", developed by NAVFAC).

5.1.8 Climate Change

A significant portion of the discussions below is adapted from the 2020 SSA (USFWS 2020).

Projected changes in the breeding-season climate threaten to decrease abundance of the monarch in the eastern U.S. (Zylstra et al. 2022). Climate change can affect monarchs both directly and indirectly on both the overwintering and breeding grounds (Nail and Oberhauser 2015). In the Action Area, eastern monarchs overwinter in some coastal U.S. areas (Kendrick and McCord 2023) and western monarchs overwinter in both Arizona and coastal California. In California, climate change is predicted to cause a significant change in the distribution of overwintering monarchs. Results from climatic niche modeling by Fisher et al. (2018) suggest that climate change will result in an inland and upslope displacement of suitable overwintering conditions.

Climate change impacts, particularly increasing temperatures and heatwaves, may impact monarch fecundity (Oberhauser 1997), mating success (Solensky and Oberhauser 2009), caterpillar success (Yang et al. 2022), survival during migration and while overwintering (Masters et al. 1988, Alonso-Mejia et al. 1997), and may cause monarchs to cease fall migration and to instead reproduce (James 2024).

Laboratory studies indicate optimal temperatures for monarch range from 27–29°C with sublethal effects beginning around 30–36°C range, with an upper lethal thermal limit of 42°C (Zalucki 1982; York and Oberhauser 2002; Zalucki and Rochester 2004; Nail et al. 2015). Nail et al. (2015) found nighttime temperatures of 34°C during periods with daytime temperatures of 38°C resulted in lower survival, indicating that respites from elevated temperatures are important in allowing monarchs to survive temperature stress (Nail et al. 2015). Temperatures consistently above 33°C to 35°C are unsuitable for monarchs and may account for their general absence from southern U.S. states after spring (Malcolm et al. 1987; Zalucki and Rochester 1999). High temperatures and drought conditions may be particularly impactful during the crucial spring migration (Chip Taylor, pers. comm. 2020).

A warming climate may influence breeding habitat by altering suitable locations for both monarchs and their milkweed host plant (Batalden et al. 2007; Lemoine 2015; Zylstra et al. 2022). Drought may also influence the amount and availability of nectar needed for migrating butterflies and the supply of nectar in key areas like south-central Texas (Stevens and Frey 2010; Brower et al. 2015; Espeset et al. 2016; Saunders et al. 2019). The coastal non-migratory population may also be impacted by loss of habitat through rising sea levels due to climate change (Tampa Bay Climate Science Advisory Panel 2015). While drought and increased temperatures may reduce monarch habitat in some areas, the climatically suitable niche for monarchs may increase, potentially increasing their summer breeding grounds if both monarchs and milkweed are able to adapt while also negatively impacting monarchs by lengthening fall migration distances (Lemoine 2015).

Climate change may additionally impact monarchs in ways that are more difficult to measure. This may include phenological mismatch (e.g., timing of milkweed and nectar sources not aligning with monarch migration; Thogmartin et al. 2017) or range mismatch with associated species (e.g., changed environmental suitability of monarch natural enemies; Mccoshum et al. 2016).

5.1.9 Conservation Efforts

While many factors have been implicated in the decline in monarch populations, the loss of milkweed and nectar resources (i.e., breeding and migratory habitat) has been targeted as the threat that can be most easily addressed through conservation efforts. Protection, restoration, enhancement and creation of habitat is a central aspect of recent monarch conservation strategies, thus highlighting the importance of restoring and enhancing milkweed and nectar resources (Oberhauser et al. 2017, Pleasants 2017, Thogmartin et al. 2017b, MAFWA 2018, Pelton et al. 2019, WAFWA 2019). Improved management at overwintering sites in California has also been targeted to improve the status of western North American monarch butterflies WAFWA 2019).

In the Action Area, DOD has conducted targeted conservation efforts for monarch and other pollinators for more than a decade. Efforts include ecosystem management resulting in habitat protection, restoration, and enhancement for monarch across millions of acres; protection of overwintering sites in California; research; outreach efforts; and strategic partnerships that leverage conservation of monarch within and beyond DOD lands. Monarch populations have

benefited from DOD efforts and will continue to benefit through implementation of the Strategy. Some examples of prior conservation efforts that are part of the Baseline are highlighted here:

5.1.9.1 Legacy Program

Dating back to 1991, the Legacy Program has funded approximately 70 pollinator-related projects totaling nearly $17 million. Of those 70 projects, six of them totaling just over $12 million have focused specifically on monarch conservation. In fiscal years 2022 and 2023 alone, the Legacy Program contributed nearly $10 million in funding to support monarch conservation projects through an Interagency Agreement with the USFSIP that has and will continue to increase the efficiency and effectiveness of managing habitat for monarchs on DOD, tribal, federal, state, and private lands. The purpose of this collaboration is to advance a coordinated and comprehensive approach for DOD's participation and leadership in monarch conservation.

5.1.9.2 Interagency Agreement with U.S. Forest Service: Monarch Butterfly Conservation Projects

Initiated in Fiscal Year 2022, the DOD entered into an ongoing Interagency Agreement with the USFS to support six focal monarch butterfly conservation projects under the Legacy Program. The aim of these programs was to increase knowledge and data to enhance military readiness by enabling DOD managers to balance habitat protection with training activities and other land uses. Projects included:

- Research to determine seasonal timing of western monarch butterflies in locations across the west, and to use this information to increase the efficiency and effectiveness of managing habitat for monarchs on DOD lands in the west. As of FY 2023, the project had supported field research across five western states including working with installation staff to conduct research at Beale Air Force Base (CA), Fallon Naval Air Station (NV), Mountain Home Air Force Base (ID), Naval Weapons Systems Training Facility Boardman (OR), Vandenberg SFB (CA), and Yakima Training Center (WA). Data and research collected in and around these installations includes breeding phenology, larval performance, monarch movements (Motus tagging), and native bee monitoring.
- DOD NRMs have been working with the Xerces Society and USFS, among others, to protect and restore overwintering sites and restore habitat where monarchs breed on and near DOD lands in the west. The multi-year grant is working towards 1) developing management guidance for monarch overwintering habitat on DOD installations, 2) developing site-specific management guidance for monarch breeding habitat on DOD installations in western states, 3) identifying and funding priority research, monitoring, and habitat enhancement projects to advance western monarch conservation, and 4) expanding western monarch community science programs.
- Monarch Joint Venture (MJV), a partnership of federal and state agencies, non-government organizations, businesses and academic programs that work together to protect the monarch migration across the U.S., has been working since 2022 to increase monitoring, conservation, and connectivity of DOD lands with other public and private lands. This effort focused on three key activities: data collection and monitoring, the provision of training and educational resources for DOD staff and partners, and technical

assistance for habitat management for pollinators. Through robust monitoring efforts and educational opportunities that fostered collaboration to improve and increase monarch habitat across the landscape, the MJV has made great progress in safeguarding monarch butterfly populations. As such, the MJV's efforts during this period have not only strengthened partnerships but also laid a solid foundation for future initiatives aimed at conservation of monarch on military lands.

- EFTA implements an internship program that places people from diverse backgrounds in conservation fields. Through this partnership, EFTA is expanding their internship program to focus on monitoring and habitat assessment for monarch butterflies on and near military installations and DOD lands. In addition, EFTA has launched outreach, education, and training programs along the western and eastern flyways that connect military families and community level groups to monarch conservation. A special emphasis is placed on connectivity of habitat, promoting conservation actions, and boosting awareness of monarchs and other pollinators. As of FY 2023, EFTA had directly engaged with Vandenberg SFB with plans to expand their reach.
- California Association of Resource Conservation Districts (CARCD) is an organization that provides technical support, funding, and coordination for conservation work implemented by the 95 resource conservation districts (RCDs) in California. In this partnership, CARCD provides support to RCDs for planning and implementation of monarch and pollinator habitat restoration projects on or near DOD lands in Early Breeding Priority Action Zone 1 (see map in section 4.8.1). CARCD is working closely with five military installations focusing on various aspects of monarch conservation and management including habitat restoration and pollinator-friendly resource management.
- Deschutes Land Trust and Western Monarch Advocates implemented flood plain restoration and community education and engagement projects in both central and western Oregon. Additionally, they have expanded the distribution of native milkweed and other native pollinator-friendly plants throughout central Oregon to build western monarch migration corridor connectivity, increase monarch conservation awareness, and inspire community engagement. The objectives of the floodplain restoration projects are to expand the native plant palette of large-scale floodplain restoration projects in central Oregon to include more native milkweed and other native pollinator-friendly plants to better support western monarchs, hummingbirds, bats, and bees. Community education and engagement have also occurred through a variety of events with central Oregon communities and Tribes.

Refer to Description of the Action for ongoing conservation programs.

6 EFFECTS OF THE ACTION ON THE MONARCH BUTTERFLY

Regulations implementing section 7 (50 CFR §402.02) define effects of the action as all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the

proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

The regulations for section 7(a)(2) note that "a conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available" [50 CFR § 402.17(a)]. When considering whether activities caused by the proposed action (but not part of the proposed action) or activities reviewed under cumulative effects are reasonably certain to occur, we consider factors such as 1) past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action; 2) existing plans for the activity; and 3) any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

The Proposed Action includes 1) approval and implementation of the DOD's 7(a)(1) Conservation Strategy, including land management activities (i.e., ecosystem management under Sikes Act authorities), future implementation of existing policies and procedures (e.g. to reduce use of pesticides), and its various conservation program actions for monarch and other pollinators (to include strategic partnerships, outreach events, funding for pollinators including monarch), and 2) future (i.e., continuation of current) military mission and sustainment actions.

For the purpose of this Opinion's contemplation, land management includes timber management and forest thinning; prescribed fire; use of pesticides; use of insecticides and herbicides; planting and seeding; invasive species control, agricultural outlease (row crop production, grazing, haying), and efforts to manage overwintering habitat. Land management also includes conservation actions targeting monarch and other pollinators, such as planting milkweed and nectar resources, managing overwintering sites, and removing invasive species in suitable habitat.

Also included is DOD's non-land management based efforts include participation in research to support monarch and pollinator conservation; outreach and environmental education (e.g., promotional videos and social media, events); research funding (Legacy, Strategic Environmental Research and Development Program/Environmental Security Technology Certification Program [SERDP/ESTCP]); volunteer efforts (NPLD); pollinator gardens; and partnership work (Sentinel Landscapes, RASP). We include Motus tracking as part of research efforts funded by DOD.

Each action can include multiple components, or sub-activities, that may cause stressors to monarch. For example, mowing can result in the obvious changes to vegetation structure but can also result in less obvious effects to individuals from noise. If using heavy equipment, mowing can result in ground disturbance or soil compaction which could indirectly affect vegetation. For the purpose of this analysis, we consider impacts to monarch as a result of land management and conservation programs using the following high-level sub-activities: 1) human induced, unintentional disturbance (including noise and vehicle mortality), 2) vegetation management (including soil amendments, seeding/planting, mowing, prescribed fire, forestry management, grazing, brush management, use of herbicides), 3) pesticide exposure, 4) ground disturbance, and

5) wholly beneficial activities. Table 4 crosswalks the DOD activity with the potential sub-activities described below.

Table 4. High level activity and corresponding sub-activities for land management and conservation programs

High-level Activity under 7(a)(1) Strategy with corresponding sub-activities	**Vegetation Management**	**Ground disturbance**	**Human induced, unintentional disturbance**	**Pesticide exposure**	**Unlikely to generate stressors**
Land Management					
Forest/brush management (cut/remove woody veg)	x	x	x	x	
Mowing (cut and remove herbaceous veg)	x	x	x		
Prescribed fire	x	x	x		
Invasive species control	x	x	x	x	
Planting and seeding	x	x	x		
Agricultural outlease - grazing	x	x	x		
Agricultural outlease - haying	x		x		
Agricultural outlease - row crop	x	x		x	
Vehicles and site access			x		
Overwintering habitat management	x	x	x	x	
Conservation Programs					
Outreach and education					x
Funding for research					x
Partnership and volunteer efforts					x
Pollinator gardens					x

In addition to the land management, policies and procedures, and conservation programs detailed in the Strategy, the Proposed Action also includes routine mission and mission sustainment activities that may affect monarch habitat and/or individuals, to include ground-based training, aviation training, impact areas, and construction and maintenance (see 6.2 Military Mission and Sustainment Activities).

6.1 LAND MANAGEMENT

6.1.1 Human-induced, Unintentional Disturbance – Including Noise and Vehicle Mortality

Many of the proposed land management actions have the potential to produce, either directly or indirectly, some level of noise and physical disturbance because they involve the presence of humans and/or associated equipment, vehicles, or machinery if they are applied in/near occupied habitats. Sources that generate noise and disturbances might include the use of both motorized (e.g., vehicles, chainsaw, weed trimmer) or nonmotorized (e.g., machete) equipment/ tools as well as heavy equipment (e.g., skid-steer, tractor, all- terrain vehicle [ATV], utility task vehicle [UTV], bulldozer), or any pull-behind or mounted equipment (e.g., bush hog or mulcher).

Monarch caterpillars respond to sounds between 50 and 900 Hz (Taylor and Yack 2019) by freezing, contracting, falling to the ground, flicking their thorax in a vertical direction (Minnich 1936), releasing volatile chemicals (Rothschild and Bergström 1997), and increased heart rate (Davis et al. 2018). The primary "sound" receptors on caterpillars are a pair of long hairs on upper thorax (i.e., upper thoracic trichoid sensilla) (Taylor and Yack 2019). Repeated or chronic exposure of traffic noise causes habituation was shown to not result in significant obvious physiological responses in caterpillars (Davis et al. 2018). Adults lack auditory-sensing structures, so it is unlikely that noise causes physiological responses in adult monarchs.

Vehicle use as part of implementation of the Strategy could have impacts to monarch in addition to noise. Vehicles kill millions of monarchs every year, with especially high mortality seen during migration where they concentrate into "funnels" in the eastern and central U.S. (Tracy et al. 2019). In a recent unpublished preprint (prior to undergoing peer review), Momeni-Dehaghi (2024) contend that roadkill is a major factor in monarch population declines. This study acknowledges a high degree of uncertainty. The SSA (USFWS 2020) found that the best available information is insufficient to conclude that the threat of vehicle collision was increasing or is a primary driver in monarch declines but that it "warrants future attention." As the SSA was peer reviewed and included expert elicitation on the subject, it represents the best available information on the risks related to vehicle mortality.

Implementation of the Strategy will involve some use of vehicles for site access to and during land management and travel during conservation program activities, but it is not likely to result in large numbers of road collision of monarchs within the Action Area. The noise associated with use of equipment may cause stress in monarch caterpillars if it occurs when they are present on the landscape and not habituated to the noise. BMPs identified in the Strategy and described below will be applied to vegetation management activities and will reduce the risks associated

with this adverse effect by encouraging the timing of management to avoid when monarchs are present.

6.1.2 Vegetative Management

6.1.2.1 Soil amendments

The addition of soil amendments sometimes occurs before planting during habitat restoration or enhancement work. Because the land would be devoid of suitable vegetation, assuming that vegetation removal occurs before soils are amended, there would be no appropriate habitat for monarchs, therefore no effects. If soil amendments or nutrients were applied before vegetation were removed, then any monarch eggs, larvae, or pupae that are present could be crushed by equipment resulting in injury or mortality. Adults could be disturbed or displaced.

6.1.2.2 Actions which Establish, Seed or Otherwise Plant Vegetation

With prepared land (pre-existing vegetation removed and soils amended, if required), there would be no effects to monarchs from seeding or plantings, as no suitable habitat for monarch butterflies is likely to be present. If there were a case of seeding that occurred before vegetation were removed, or in cases when vegetation removal is incomplete, then any monarch eggs, larvae, or pupae that are present could be crushed by equipment resulting in injury or mortality. Adults could be disturbed or displaced.

6.1.2.3 Actions which Temporarily Affect Vegetative Structure and Composition

Maintenance and management activities include light disking; interseeding; vegetation management using mowing, prescribed burning, grazing, haying, and spot use of pesticides (herbicides).

The effects of these activities to monarchs are similar and are described below. Monarchs may be present depending on the cover, location, and time of year (Figure 5). Direct mortality to all monarch life stages could occur during management activities. As with establishment activities, some vegetation management takes place when monarchs are not present. Prescribed fire is sometimes carried out, for example, before monarchs have returned in the spring. DOD's Strategy includes several BMPs related to timing of management to minimize adverse effects to monarch by adjusting seasonal timing of implementation.

Light disking and interseeding typically are linked activities as disking sometimes occurs prior to interseeding to prepare soil for seeding and to increase germination and seed survival. Light disking and interseeding could employ tractors or other similar equipment. This could lead to effects on all life stages present at the time of disking and interseeding when monarchs may be present. Direct effects could include crushing, collisions, displacement, and general disturbance. Stressors would be from disturbance of any milkweed or nectar sources present.

6.1.2.3.1 Effects of mowing and cutting herbaceous vegetation (including haying)

Cutting and mowing herbaceous vegetation is the removal of above-ground parts of nonwoody plants. The scale of activities and equipment used can vary, from removal over a large area using large mowers to removal in smaller areas with a push mower or weed eater.

Cutting and mowing herbaceous vegetation can crush, injure, and kill early life stages (eggs, caterpillars, and pupae) by direct contact with parts of equipment (e.g., wheels, mower blades, weed eater strings). The potential for killing early life stages vary by type of equipment and equipment adjustments. Bar mowers (blades on a non-rotating bar) contact fewer caterpillars, and presumably fewer pupae, than rotary mowers (multiple rotating blades); and adding a conditioner to a mower (a device that crushes grass after cutting) increases the potential for contact (Humbert et al. 2010). Steidle et al. (2022) found significantly fewer adult *Lepidoptera* in roadside grassland after mowing with a conventional mowing head compared to the use of an 'arthropod friendly' mowing technique.

Several BMPs can reduce adverse effects associated with mowing. Using mowers designed to minimize effects to insects or mower additions such as flushing bars can decrease the potential for effects to adult *Lepidoptera* (Oppermann et al. as cited in Steidle et al. 2022; Steidle et al. 2022). Setting a higher cutting height may avoid some caterpillars and pupae. Mowing during warmer times of the day when monarchs are more active may allow for them to flee. Vegetation removal using push mowers and weed eaters would occur in smaller areas, minimizing the chances of removing vegetation occupied by caterpillars and pupae. Cutting and mowing with small mowers and weed eaters has lower potential to harm monarchs due to the slower speeds of the equipment and the opportunity for the operator to identify and avoid milkweed.

Effects on Milkweed Resources

Cutting and mowing milkweed reduces the surface area of milkweed plants available on the landscape. This could reduce the area available for eggs and larvae. The likelihood and magnitude of effects depends on the amount of plant removed (i.e., height of mowing or cutting), the timing of cutting and mowing relative to presence of monarchs, and the frequency of cutting and mowing.

It is difficult to evaluate the effect that a reduction of milkweed surface area in a single location would have on monarchs. Several studies have cited loss of milkweed on a landscape-level as a potential key driver in monarch declines (Brower et al. 2012; Pleasants and Oberhauser 2013; Inamine et al. 2016; Thogmartin et al. 2017; Waterbury and Potter 2018; Saunders et al. 2019). The effects of milkweed reduction in a specific area likely depends on the size and quality of the milkweed patch and the availability of milkweed in surrounding areas. Based on the biology of the monarch, when suitable milkweed becomes less available on the landscape, female monarchs will have to travel further to find sites to lay eggs. If milkweed becomes too scarce or difficult to access, reproduction could decrease.

Cutting and mowing could also potentially improve milkweed for monarch reproduction, though this depends on timing and likely varies by milkweed species. Effects on monarch reproduction from mowing common milkweed, a clonal species, have been mixed. Fischer et al. (2015) and Knight et al. (2019) both found significantly more eggs in mowed than in unmowed plots. However, He and Agrawal (2020) reported no differences in egg-laying in mowed versus unmowed common milkweed plots. Haan and Landis (2020) also found higher survival of second instar larvae on regenerating stems than on uncut controls of common milkweed. Additionally, mowing milkweed may reduce predation risk to monarchs by removing aphid-

infested stems that attract predators (e.g., ants) and by promoting earlier phenologies that typically host lower predator densities (Haan and Landis 2019). Cutting and mowing to improve monarch reproductive success would have to be strategically timed to produce a net benefit to monarch productivity.

Effects of Mowing on Nectar Resources

Cutting and mowing flowering plants, including milkweed, can reduce the number of flowers available on the landscape. This could reduce nectar resources available for breeding, migrating, and overwintering adult monarchs. The likelihood and magnitude of effects depends on the number of flowers removed; the species of flowers removed and the quality, quantity, and availability of their nectar; the timing of removal relative to presence of monarchs; and the frequency of cutting and mowing.

It is difficult to evaluate the effect that the reduction of nectar resources in a single area would have on monarchs. Several studies have cited loss of nectar resources on a landscape-level as a potential key driver in monarch declines (Inamine et al. 2016; Thogmartin et al. 2017; Saunders et al. 2019). The effects of the loss of flowers in a specific area likely depends on the size of area, the quality of the nectar resources, and the availability of nectar resources in surrounding areas. Based on the biology of the monarch, when suitable nectar resources become less available on the landscape, monarchs will have to travel further to find nectar to support all phases of their life cycle. If milkweed becomes too scarce or difficult to access, survival will decrease.

Cutting and mowing during the flowering period will remove some flowers and may result in plants producing fewer flowers in the short-term (Haan and Landis 2020). However, mowing could extend the blooming season of plants (Haan and Landis 2020), which, depending on the species of plant and timing of monarchs presence, could potentially offer monarchs more nectar resources during a specific timeframe. Cutting and mowing to benefit monarchs depends on plant species and would have to be optimally timed.

An analysis of monarch occurrence records in the eastern U.S. (Inamine et al. 2016) found that the threats driving the decline in abundance occur during the migratory phase and are not driven by milkweed abundance but by the importance of nectar resources during migration.

Effects of Mowing on Predator Avoidance

Disturbance (e.g., mowing) may reduce predation pressure on caterpillars indirectly by removing aphid-infested stems that attract predators (e.g., ants) and by resetting milkweed phenology (Haan and Landis 2019). Regenerating milkweed stems host lower predator densities (Haan and Landis 2020).

Mowing BMPs

DOD's Strategy includes BMPs that advise adjusting timing of mowing to not interfere with monarch breeding or nectaring and recommends additional mowing practices that further reduce the potential for adverse effects (See BMP section).

6.1.2.3.2 Effects of Prescribed Fire

Habitat responses to fire are complex and highly varied, with numerous past studies investigating the effects of fire on butterflies and other invertebrates (Dana 1991, Swengel and Swengel 1999, Panzer 2002). While some studies have noted negative outcomes following prescribed burns others have found fire produces positive results in the long-term. Flowering may be reduced among species that would typically bloom in the first phenoperiod immediately following a fire (Miller et al. 2019; Pavlovic et al. 2011). After a March fire, for example, flowering of species that typically bloom in Midwestern oak savannas in April or May might be reduced in the year of the burn, whereas summer and fall blooming species may be unaffected (Pavlovic et al. 2011). Mid-summer fires are likely to decrease forage availability immediately after the fire within the affected growing season, but then increase blooming of early-season species the following spring (Pavlovic et al. 2011). Overall, prescribed burning has been shown to have positive impacts to health and biodiversity in systems where fire was present historically while also decreasing the risk of catastrophic wildfires that would extensively damage vegetation and seed banks.

Mason et al. (2021) conducted a meta-analysis of the effects of fire and responses of bees, butterflies, and ground beetles with over 100 pyroentomology studies evaluated. The main conclusions were as follows:

- For butterflies, fires that occurred in coniferous forests significantly increased richness, but significantly decreased abundance. Mason et al. (2021) attributed this to fires eliminating individuals, but also creating a more open environment where other, non-forest specialist butterflies can colonize (Kwon et al. 2013).
- High severity fire significantly decreased butterfly abundance, but low severity fires had positive effects, with the authors concluding that this might be due to more plant species surviving lower severity fires compared to higher severity fires thus increasing food availability, and surviving plants creating refugia for individuals, regardless of their developmental stage.
- Lastly, even though the 0 year and 1–5-year post fire characteristics showed no statistically significant effect for species richness, the mean effects for each grouping increased. This suggests that butterfly species richness does not benefit from fires in the short term but can gradually increase over time.

It is largely accepted and understood that North American grassland ecosystems were historically shaped and maintained by processes such as pyric herbivory which is the combination of fire and grazing by large native ungulates (Fuhlendorf and Engle 2001). In turn, modern disturbances such as prescribed fire, grazing, and haying play an important role in maintaining native prairie by thwarting invasive species spread, preventing woody encroachment, and promoting overall productivity (Vogel 1974; Shuey 1997). Moreover, research has indicated that fire can encourage the growth of forbs (Moranz et al. 2014), control woody vegetation (Bragg and Hulbert 1976; Abrams and Hulbert 1987; Briggs et al. 2002; 2005; Lett and Knapp 2005), and promote the growth of dominant warm-season grasses, particularly big bluestem (*Andropogon gerardii*) (Collins 1990).

Studies conducted on the regal fritillary (*Argynnis* [*Speyeria*] *idalia*), a large prairie-obligate butterfly also in the family Nymphalidae have found that prescribed burning, particularly rotational burning and/or patch-burn grazing can be a compatible management strategy for the species (Huebschman and Bragg 2000; Powell et al. 2007; Moranz et al. 2014; Henderson et al. 2018; McCullough et al. 2019). Many studies have found that adult regal fritillary can and do recolonize sites following burns, and numbers can reach pre-burn levels or greater in relatively short time spans (Huebschman and Bragg 2000; Henderson et al. 2018). Likewise, studies on monarch butterflies have found their abundance to be higher in burned sites versus sites that were grazed, particularly those grazed with high stocking rates (Leone et al. 2019). Additionally, green milkweed typically senesces in August but after summer fires in Oklahoma, monarchs continued to lay eggs on the species into late August and September (Baum and Sharber 2012). At the Konza Prairie Biological Station in Kansas, Ricono et al. (2018) found that burning increased milkweed abundance overall, especially common milkweed.

The timing, intensity, and frequency of prescribed burns and supporting actions (e.g., fire lines, staging equipment), can have detrimental effects on monarchs through the killing of eggs, larvae, pupa or adults. Monarchs, especially at the egg, larval, and pupal stages have limited mobility and likely would not escape from the fire. However, research on the regal fritillary documented observations of larvae in areas that had been burned ≤61 days post burn. This suggests prescribed fire does not result in complete mortality of eggs and larvae (McCullough et al. 2017). Monarchs at the immature stages may also be crushed by equipment, burned during the prescribed fire itself, or trampled by human presence in the affected area.

Prescribed fire BMPs

Prescribed burning is used frequently and extensively on DOD installations to maintain native ecosystems and reduce wildfire risk. DOD's Strategy includes BMPs for prescribed fire including timing fire when monarchs are absent from suitable habitat to avoid direct impacts and leaving unburned patches (of at least 1/3 the area) to leave refugia (nectar and breeding resources) for monarch. In addition, post-fire restoration and rehabilitation will include native monarch nectar plants and milkweed species.

6.1.2.3.3 Effects of Forestry Management

Forested areas are not currently considered a landcover type containing extensive monarch resource needs (Bhowmik and Bandeen 1976; Hartzler and Buhler 2000; USFWS 2020). However, some studies have documented forested land uses as migratory stopover habitat (Rudolph et al. 2006a). Importance or use of forested habitats and related forest management stressors are not available but are anticipated to be minor and infrequent across the Action Area. Inferences from other pollinators and other butterflies to ascertain stressors are summarized below.

As a group, pollinators are generally more abundant in open forests (i.e., more sunlight reaching the ground) relative to closed forests (i.e., limited sunlight reaching the ground) (Fye 1972; Hanula et al. 2016), although information on forest-obligate species remains limited (Winfree 2010). Methods used to create these open forest habitats include prescribed fire (Grundel et al. 2010; Taylor and Catling 2011), harvesting or thinning (Fye 1972; Fultz 2005; Romey et al.

2007; Taki et al. 2010; Proctor 2012; Neill and Puettmann 2013), shrub removal (Hanula and Horn 2011a, 2011b; Hudson et al. 2013), or a combination (Rudolph and Ely 2000; Campbell 2005; Campbell et al. 2007a; Campbell et al. 2007b; Rudolph et al. 2006a, 2006b). Dense shrub layers negatively impact herbaceous plant cover and diversity (e.g., Woods 1993; Baker and Van Lear 1998; Collier et al. 2002; Gerber et al. 2008; Hudson et al. 2014) and, in turn, pollinators (McKinney and Goodell 2010; Hanula et al. 2011a, 2011b; Hudson et al. 2013; Hanula et al. 2015).

Forest actions similar to those described above which focus on forest management that benefit other pollinators (prescribed fire, forest stand improvement, thinning actions) are expected to also benefit butterflies, including monarch. Restored sites of fire-maintained shortleaf pine-bluestem communities in the Ouachita Mountains in west Arkansas support a higher abundance of the monarch during migration than un-restored, fire-suppressed controls (Rudolph et al. 2006b). Similar results were found for fire-maintained pine communities in eastern Texas (Rudolph and Ely 2000) and within longleaf pine ecosystems of the North Carolina sandhills (Moylett et al. 2020). In northern hardwood forests, group-selection silviculture in hardwood forests is beneficial to native pollinating insects by increasing nectar plant composition in the resulting forest canopy gaps (Procter et al. 2011).

Forestry management actions can adversely affect the monarch by altering the abundance of flora resources, disturbing and removing migratory staging and concentration areas, and disturbance to adults during all seasons when present in the immediate vicinity of a treatment area. The most plausible and significant effects that occur because of forest management in the Action Area, however, come from overwintering habitat management, discussed below.

6.1.2.3.4 Effects of Grazing

Given the small number of agricultural outleases on DOD properties and their relatively small size in the context of their overall footprint across the DOD enterprise in continental U.S., the influence of agricultural outlease-related threats to monarchs on DOD managed lands is minimal.

The specific literature on the effects of grazing livestock on monarchs is limited. Much more research is available on the effects of grazing management systems on floristic resources, focused on other species of butterflies and moths, other pollinators, and in the context of specific vegetative communities. The literature on the effects of grazing on other pollinators can provide insight to help evaluate the effects of grazing on monarch butterflies.

Positive, neutral, and negative effects from grazing on pollinators have been reported in the literature (Thapa-Magar et al. 2022; Hanberry et al. 2021; Glenny et al. 2022). Response of pollinators to grazing include life history of the specific pollinator, type of grazers, grazing intensity and duration (stocking rate), plant and pollinator community composition, climate, and interactions with other disturbances (Vogel et al. 2007; Kimoto et al. 2012; Moranz et al. 2014; Cutter et al. 2022). In addition, both the direct and indirect effects from grazing on butterflies varies across ecoregions (Bussan 2022). Most of the research on the effects of grazing on milkweed and monarchs has occurred in the Midwest (Poynor 2019; Dickson et al. 2023).

The presence of livestock may create physical disturbances to monarch and its habitat. Livestock grazing may adversely impact butterfly populations directly by trampling during immobile life stages (egg, larvae, and pupae) or when weather conditions restrict adult movement (Warren 1993). Grazing may also adversely impact butterfly populations indirectly by altering plant community composition (Stoner and Joern 2004), removing adult nectar resources, introducing invasive weeds (Hayes and Holl 2003), and changing hydrology in mesic/hydric habitats (Belsky et al. 1999). Grazing can also result in benign or even beneficial effects on butterflies, depending upon stocking densities and location. Light rotational grazing has been shown to maintain vegetation heights and habitat heterogeneity favorable to some butterflies (Ravenscroft 1994).

Effects on milkweed resources

Grazing can directly reduce milkweed abundance as some species of *Asclepias* are palatable forage by cattle.

- In Nebraska, Poynor (2019) found that even when cattle grazed grasses less in some burn patches, they still grazed milkweed the same amount, suggesting preferential milkweed grazing. Further, it was concluded that experimental removal of flowers did not significantly affect monarch egg laying or milkweed growth but clipping of stems had large effects. These results suggest spring cattle grazing causes declines in milkweeds and monarch egg laying.
- Leone et al.(2019) found that in Minnesota tallgrass prairie, monarchs were more abundant at sites managed with prescribed fire than with grazing, but found no difference in milkweed and forb frequency between burned and grazed prairies. A subsequent study by Leone et al. (2022) also found that monarch abundance was higher in areas managed with fire when compared to those that were grazed. In this follow-up study, the stocking rate and the number of years a site was grazed were not correlated with butterfly abundance, but the authors acknowledge that there may be indirect effects of grazing that they were not able to quantify. For example, fire may increase nectar availability while grazing could reduce the amount or quality of floral resources.
- Johnson (2023) found that modified twice-over rest-rotation grazing led to higher milkweed abundance than patch-burn or season-long grazing and that milkweed is highly correlated with both monarch adult and juvenile abundances. As with other accessed literature, the species of milkweed in the area was important because cattle disproportionately grazed common (*A. syriaca*) and showy (*A. speciosa*) milkweed more than oval-leaf (*A. ovalifolia*). Overall, the conclusion was that rangelands may benefit monarchs, but the outcome likely depends on selected management, milkweed species, and time of season (Johnson 2023).
- Dickson et al. (2023) summarized that milkweed abundance was significantly higher in ungrazed than grazed grassland units, with average milkweed abundance across the growing season ranging from 34- to 185-fold higher in ungrazed than grazed grassland units. Conclusions were that cattle grazing on common/showy milkweed has adverse consequences to monarch reproductive success.

Although monarchs utilize a variety of milkweed species as obligate host plants (Mattila and Otis 2003), common milkweed (*A. syriaca*) may be more important for the species than other *Aslepias* species (Malcolm and Zalucki 1996). Varied responses of individual species of milkweed from management actions such as grazing and fire appear to be specific and thus have consequences to monarch reproduction success and utilization. For example, grazing and use of fire was assessed over a 27-year period within the tallgrass prairies in the Flint Hills Region of Kansas (Ricono et al. 2018) on eight (8) species of milkweed and results indicate that:

- Grazers were found to have a negative effect on abundance for most milkweeds. However, 2 species of milkweed did not decrease in cover (*A. stenophylla* and *A. viridis*); these species have higher cardenolide content and are considered more toxic to livestock.
- *Asclepias* species overall increased in the presence of burning (alongside grazing) but individual species' response varied as follows:
    - *A. viridiflora* and *A. viridis* decreased in abundance when burning without grazing was applied, although *A. tuberosa* and *A. stenophylla* increased at relatively low rates compared to other milkweeds studied.
    - *A. syriaca, A. languinosa*, and *A. verticillata* all dramatically increased in abundance in burned plots that were not grazed, while *A. verticillata* also increased at a similar rate in plots that were not burned.
    - Decline in *A. syriaca* abundance in the presence of grazing and burning was stronger than declining patterns observed in other *Asclepias* species studied.

Effects on Nectar Resources

Grazing can affect forb abundance (Collins et al. 1998) and cover (Davies et al. 2009), though the outcome strongly depends on stocking rate (Wallis DeVries et al. 2007) and spatial and temporal variation in grazing patterns (Whitt and Wallander 2022) as well as ecotype. Within California's mesic grasslands, Hayes and Holl (2003) found that native grass cover and species richness did not differ in grazed and ungrazed sites but cover and species richness of native perennial forbs were higher in ungrazed sites.

Within North Dakota (Missouri Coteau Region), Patton and Nyren (2015) presented results from a study ongoing since 1989 (27 years) on the effects of grazing intensity on plant species and the sustainability of forage production in pasture landuses. Five treatments were included: no grazing; light (65% forage retention), moderate (50% forage retention), heavy (35% forage retention) and extreme (20% forage retention) grazing. For each intensity treatment, plant density and composition of shrubs, forbs and bunch grasses were assessed. Conclusions and recommendations specific to forbs (and thus relevant to monarch) from this study are:

- Total forb density was highest on the extreme treatment and lowest on the light and ungrazed treatments.
- Forb production – expressed in pounds/acre – was highest in the moderate grazing treatments but not significantly different than the heavy grazing treatments.

- Prior-year condition of these pastures and adapting to weather trends early in the grazing season are key management metrics in optimizing plant-grazer relationships as temperature and precipitation affects available forage conditions throughout the utilization period.

Research in central IA in oak-hickory dominated woodlands found strong differences in vegetation between plots in currently and recently grazed woods compared to plots in ungrazed woods (Mary 2002). Specifically:

- All species associated with ungrazed plots were native, and there were a high number of perennial herbs, and herbs with fleshy roots associated with these plots. They also had more species characteristic of moist forests with closed canopies and habitats with little human disturbance, and with ranges restricted to the eastern U.S. hardwoods.
- Conversely, 30% of species associated with grazed plots were exotic. Species associated with grazed sites were also more likely to be annuals, have fibrous roots, occur in a wide variety of habitats, and to have a cosmopolitan distribution.

A meta-analysis on grazing within California grasslands found that exotic forbs showed a dramatic uniform increase in cover with grazing – especially on dry sites, but that native forb increased in cover and richness when grazed during the wet season (Stahlheber and D'Antonio 2013). These results lend support to the use of grazing to enhance native forb richness and native grass cover in some settings although this must be weighed against increases in the cover of exotic forbs. Evans et al. (2023) also concluded from an 8-year study on California grasslands that targeted grazing strategies produced greater cover of native annual forbs and simultaneously controlled invasive grasses. Alternatively, Lesage et al. (2022) found over a 15-year period that although grazed prairies continued to have greater native annual forb richness than ungrazed sites, native annual forb richness declined and concluded that drought and increasing aridity may be driving declines in native annual forb richness instead of grazing pressure.

Light to moderate levels of grazing usually result in a richer diversity of plant species than do heavy levels of grazing or no grazing at all, especially in the more humid grasslands such as the tallgrass prairie in the U.S. (Risser et al. 1981; Hartnett et al. 1996; Collins et al. 1998; Thacker et al. 2012). In the sand sage brush grasslands in the southern Great Plains, one study found that richness in annual forb was not affected by stocking rates, including heavy grazing, and forb populations were more responsive to weather (Gillen and Sims 2004). Moderate grazing by cattle also increased plant biodiversity on tallgrass (Collins 1987), mixed-grass prairie (Biondini et al. 1998), and shortgrass steppe (Milchunas et al. 1990, 1992). However, very heavy grazing that removed 90% of above-ground biomass reduced diversity on mixed-grass prairie (Biondini et al. 1998).

Direct effects of grazing include effects on life functions, including ovipositing, incubation, larval foraging, nectaring, and pupation. Further, grazing when the monarch is present creates a hazard to all life stage(s) from crushing or accidental ingestion, but data are lacking on this stressor.

In summary, stressors created from grazing include alteration of blooming flower abundance and diversity, changes in physical structure of vegetation, changes in the composition and availability of milkweeds, alteration of soil characteristics, and negative effects on microhabitat temperature and moisture (see Hanberry et al. 2021; Fleischner 1994; DeBano 2006; Kimoto et al. 2012; Schmalz et al. 2013; Moranz et al. 2014; Buckles and Harmon-Threatt 2019). However, depending on location as well as grazing intensity and timing, grazing can have positive impacts on quantity and quality of nectaring resources for monarch. It is important to note that there are some variations in reported plant species response – ranging from adverse to benign, to beneficial.

Generally, Hatfield et al. (2015) recommended that grazing periods compatible with butterfly persistence should be short with relatively long recovery periods for the habitat, and grazing should not take place during the adult flight period since butterflies are utilizing nectar sources and looking for oviposition sites during this time.

BMPs for Grazing

Despite the relatively small area exposed to grazing on DOD lands, BMPs for grazed lands were included in the Strategy. Specifically, if an area is grazed then land managers will control the amount of grazing to avoid eliminating flowering plants, reduce soil compaction, and prevent overgrazing. In addition, they will include native flowering plants used by pollinators when grazing areas are re-seeded, unless inconsistent with grazing practices. See BMP section for additional recommended BMPs.

6.1.2.3.5 Effects of Brush Management

Brush management is the practice of removing, reducing, or manipulating woody vegetation to achieve a desired plant community condition (structure and composition). Unwanted brush can be managed by chemical or mechanical methods, fire, or improved grazing management. Vegetative treatments involving brush management generally involve more intensive mechanical methods (larger equipment, more vegetative and earth disturbances) than previously outlined and many include grubbing, mastication (i.e., grinding, shredding, or chopping) and mulching.

Brush management includes removal of invasive, exotic, or aggressive woody plants. Removal may be done by hand with motorized (e.g., chainsaw, weed trimmer) or nonmotorized (e.g., machete) tools, heavy equipment (e.g., skidder, tractor, ATV, UTV, bulldozer) and any pull-behind or mounted equipment (e.g., bush hog, mulcher), bush hog and stump spray (i.e., cutting down vegetation with the bush hog, then applying herbicide to stumps), and/or herbicide application (including basal, hack-and-squirt injection, cut stump, foliar, or soil treatment). Herbicides may be applied manually (e.g., stem injection, hack-and-squirt injection, direct streamline stem spray, or direct foliar spray from backpack applicators) or mechanically from the ground (e.g., sprayers mounted to an ATV or tractor). Manual application methods are more precise and can be used to spot treat in an area to avoid exposure of nontarget plants.

Limited information is available on specific effects to monarchs. We reviewed existing literature on forb responses and similar species responses (e.g., pollinators/other Lepidoptera) and draw the following inferences:

- Control of honey mesquite (*Prosopis glandulosa*) using herbicide treatments concluded that annual forbs responded favorably to herbicide treatments of mesquite (Ansley et al. 2021).
- After chaparral (*Calystegia* sp.) dominated plant communities were masticated, they tended to have an expansion of nonnative grasses and a reduction in native forbs 3 to 7 years after treatment (Perchemlides et al. 2008; Potts et al. 2010; Potts and Stephens 2009).
- Harrington et al. (2021) concluded that directed foliar spray was the most effective treatment for achieving many of the desired understory characteristics of a longleaf pine woodland in South Carolina, including a diverse understory dominated by herbaceous vegetation, although shredding, stem injection, basal spray, and directed foliar treatments increased herbaceous species richness by 7 to 11 species over that observed in the non-treated control. Further, collateral damage to the herbaceous community from several of the herbicide treatments (e.g., vegetation gaps around trees in the stem injection and directed foliar treatments, bare-ground conditions in first year after the broadcast foliar treatment) appeared to be short term, and recovery of herbaceous species richness in these treatments was evident by the second year.
- Reinhardt et al. (2017) evaluated the effectiveness of oak savanna restoration and management involving mechanized strategies (bulldozing, masticating, and shear cutting) in combination with prescribed burning and native seed treatments and vegetative response in context with the needs of the Karner blue butterfly (*Lycaeides melissa samuelis*) on 13 sites in Michigan. All of the mechanical methods were effective for promoting management goals of higher herbaceous plant cover, higher wild lupine cover, reduced woody plant cover, and lower invasive species cover. Further, follow-up actions such as prescribed fire and seeding appears to be effective for furthering these management goals by reducing woody plant cover, creating more exposed soil for plant colonization, and promoting desired cover types, while minimizing undesired cover types.
- Within degraded woodlands in New Mexico, Kleintjes et al. (2004), evaluated the effects of an overstory reduction and slash mulching treatment over a 2-year period upon butterfly abundance and species richness between a pair of treated and control watersheds. They found that that butterfly abundance and species richness were significantly greater on the treated watershed in both years, and these measures were correlated with significant increases in forb and grass cover in the treated watershed.
- McIver and Macke (2014) evaluated the response of butterflies to sagebrush steppe restoration treatments (16 sites in the states of CA, ID, NV, OR, UT, and WA over 7 years) that involved a combination of prescribed fire, mechanical and herbicide methods. Among their conclusions:
    - Spatial (among-site) and temporal (among-year) variation in butterfly community structure was very high and tended to overwhelm patterns of treatment response;

  - When species and species groups did respond to treatment, response was generally positive regardless of treatment type, with response to prescribed fire versus its mechanical surrogates (clear-cutting, mastication) more similar than expected;
  - Similarity in response among treatments was likely due to the fact that woody vegetation removal, whether by fire or by machine, enhanced grass and forb production in turn provided more resources for butterfly larvae (host plants) and adults (nectar);
  - When a positive response was found, these positive effects generally persisted through 4-years posttreatment, indicating that the mechanisms behind treatment response are long lasting.

- Shinneman et al. (2023) completed a meta-analysis of the ecological effects of various vegetative treatments on six widespread pinyon and juniper tree species of the interior western U.S. that primarily occupy semi-arid environments. The authors assessed and summarized the potential effects of pinyon and juniper removal on plant and wildlife communities, as well as several non-living ecosystem components and processes (for example, bare ground, hydrologic, litter). This included results from 48 studies conducted between 2014 and 2021 (treatment studies and results on federal lands) in the states of AZ, CO, ID, MT, NM., NV, OR, UT, WA, and WY). This meta-analysis included the work of McIver and Macke (2014) summarized above on butterflies. The following summarize the relevant conclusions from this analysis:
  - Abundance of native herbaceous plant species was found to increase more often after mastication than following cutting;
  - Consistently more positive than negative responses for general understory vegetation (that is, including both native and exotic species) among nearly all treatment types (except pile burning);
  - Cutting and mastication without secondary treatments resulted in more positive than negative responses for perennial plant species abundance (However, depending on the abundance and composition of exotic species, such understory responses may also result in enhanced fire risk, loss of native diversity, and inadequate wildlife habitat conditions.)

In conclusion, the effects of brush management methods on the monarch will be dependent upon the treatment method, location, the amount of plant material removed, as well as the presence of monarch during the treatment(s) as well as the distribution and abundance of milkweed and floristic resources within the treated areas. Some specific vulnerability of soils to erode or compact was noted as a consequence of mastication (Jain et al. 2018), thus some aspects of brush management may generate long term adverse effects on site recovery and associated loss of use by monarchs. Generally, brush management can adversely affect the monarch by changes in availability and abundance of milkweed resources, changes in nectar resources, and direct

mortality of instars, eggs, and caterpillars. Brush management can result in a positive response in available forbs and nectar resources, inferring an overall benefit to the monarch.

6.1.2.3.6 Effects of the Use of Herbicides to Support Vegetation Management

Generally, herbicides may be used to support implementation of vegetative management objectives (i.e., suppress shrubs and hardwoods to control understory/midstory conditions in forested landscapes; suppress select weedy, invasive, or aggressive undesirable plant species associated with a habitat management objective) and are used in conjunction with physical or mechanized treatments to generate a desired vegetative condition and structure in all land uses.

Effects to monarchs may include exposure to herbicides in all land use types through both direct contact (spray drift/ residues) or ingestion of plant material and through possible runoff into water resources . However, specific studies on the monarch from the effects of herbicides were not discovered in the available literature. In evaluating the literature, several inferences can be drawn from systematic literature reviews specific to either established effects on changes in vegetative structure (and specifically to effects on forb or nectar resources) or where available responses of other butterfly/pollinator species. Results were especially concentrated in southern pine systems.

In Forested Systems

Forestry land uses throughout the Action Area may rely upon herbicides to assist in achieving desired conservation outcomes, including improve forest productivity, facilitate regeneration, and restore ecological function (Society of American Foresters 2019). Toxicity and risk data suggest that the many herbicides used for forested lands (e.g., glyphosate, triclopyr) are generally safe to mammals, birds, and other wildlife if used in accordance with the manufacturer label (USFS 2011a; 2011b). Additionally, risk and exposure of these compounds is reduced as treatments involving the use of herbicides are generally infrequent during a typical stand rotation. For example:

- Within southern pine (Pinus spp.), specific conditions always dictate treatment schedules, but generally herbicides are generally applied a maximum of 3–4 times (in many stands only 1–2 times) over the life of a southern working pine stand managed for sawtimber (~25–35-year rotations) (Briggs et al. 2024). In these pine forests, applications are typically made on 1) recently clearcut sites for site preparation before planting to reduce woody vegetation such as trees, shrubs, and vines; 2) newly planted seedlings (1–2 years) to reduce competition from herbaceous (grass or broadleaf weeds) vegetation; 3) juvenile (2–4 years) stands to control woody competitors not controlled during site preparation; and 4) mid-rotation (> 14 years) stands to reduce competing hardwood trees (Fox et al. 2007; Shepard et al. 2004).
- In Northern Forests, such as within the State of Washington, current guidance indicates that herbicides are typically applied once or twice in the 40–65-year life span of managed conifer stands (Washington State Department of Natural Resources 2024).

- Within hardwood forests in Pennsylvania, guidance indicates that only one application is made over an 80- to 100-year rotation for hardwood regeneration establishment (Jackson and Finely 2007).

A review of available information on the effects of forest herbicide in working pine (*Pinus* spp.) forests in the southern U.S. on insects including butterflies concluded that: 1) herbicides have few reported long-term impacts on understory herbaceous cover and species richness/diversity when applied according to labeled uses and application rates; 2) the method of chemical treatment (e.g., broadcast spray or banded application) may influence understory plant structure and composition; 3) responses of insects to herbicides were species- and taxa-specific and highly variable given their forage/habitat requirements and life histories; and 4) long-term research is needed to evaluate the effects of herbicides on vegetation-associated insects to provide a comprehensive profile of herbicide nontarget impacts (Briggs et al 2024).

Within shortleaf pine-oak-hickory forests in LA, Kohlman (2023) evaluated restoration efforts using three different management regimes: 1) prescribed burning with active herbicide treatments for non-desirable plant species, 2) burning only, and 3) no active management on pollinators. Greater diversity, evenness, and richness where burning occurred was greater compared to no management; and the combination of burning and herbicide treatment produced ~1.5 times higher diversity than no management sites.

A literature review was completed for the effects of forest herbicides on wildlife taxa on Pacific Northwest Ecosystems (National Council for Air and Stream Improvement 2009). The authors concluded that: 1) studies have shown that herbicides have low toxicity to wildlife, tend to dissipate quickly, have limited mobility (rapidly fixed in environments), and do not bioaccumulate; 2) forest herbicides can enter aquatic ecosystems via accidental runoff or drift, but this riparian contact is minimized through the use of vegetation buffers, drift prediction models, application timing, and droplet size; and 3) when herbicides are applied at recommended rates in managed forests, direct toxic effects on wildlife and fish – including insects – are not expected.

In Grassland and other non-Forested Land Uses

The Proposed Action includes the use of herbicides to treat woody plant species and inhibit succession, control and eliminate invasive species, and to accelerate restoration and management objectives within non-forested land uses.

Spot pesticide applications to control invasive plants or pests may be used on suitable vegetative cover for monarch. Application can be accomplished using backpack applicators, cutting and dab the cut stems, hoses from vehicle mounted spray tanks, or other spot treatment methods as needed.

Herbicides can have indirect negative effects on pollinators (Bohnenblust et al. 2016; Abraham et al. 2018; Latty and Dakos 2019; Iriart et al. 2020). However, when used in combination with other restoration techniques, such as supplemental plantings, grazing, and prescribed fire, herbicides are a necessary component of management actions that can result in long term benefits in restoring and managing grassland systems, including enhancing nectar resources for

the monarch and other pollinators (D'Antonio and Meyerson 2002; Kelley et al. 2013; Reid et al. 2009; Kyser et al. 2013; Davies et al. 2020; Espinoza et al. 2020; Miller 2021).

Most herbicides used in rangeland applications have low toxicity for insects (DiTomaso et al. 2010); however, rangeland herbicides may reduce pollinator insects through indirect toxic effects such as insects feeding on treated plants (Bohnenblust et al. 2013) and by killing plants important to insects (Black et al. 2011).

The direct impacts of herbicide exposure to the monarch butterfly could result in sublethal to lethal effects depending on the exposure pathway (contact or dietary) and life stage exposed. Herbicide use could directly reduce milkweed and nectar resources. Such direct interactions and effects to resources could affect all monarch life stages.

BMPs for herbicide use

If herbicides are used, the Strategy includes BMPs to ensure DOD will apply when plants are more responsive to treatment and when monarchs and other pollinators are less likely to be nectaring on the plants. DOD policy requires installations to minimize use of herbicides see 3.2.1.2.1 Limiting Pesticide Exposure, and all application will follow label requirements.

6.1.2.3.7 Synthesis - Species Response to Vegetative Manipulation Actions

Various vegetative management actions as described above include targeted use of herbicides, removal of dense woody vegetation, mowing, prescribed burning, brush management, seeding of native species and associated site preparation, control of invasive or defined noxious or undesirable species, prescribed grazing, and enhancement of species-specific life history conditions.

If monarchs (of any life stage) are present, the following adverse effects could occur: disturbance; injury or death to eggs, larvae, and pupae from trampling, vehicles, or equipment; harassment of adults due to smoke and fire; incineration of caterpillars and instars from fire; ingestion of all limited mobility life stages by livestock; mortality or injury from the effects of human presence; and lethal and sublethal effects from herbicides. These activities may also disrupt essential behaviors such as feeding and resting. These stressors would not immediately manifest when the species is not present on the site, but latency impacts may occur.

Additional stressors to monarchs include removal or disturbance of changes in the characteristics or suitability of vegetative cover - potentially including adverse effects on milkweed and nectar sources. Latency effects are likely variable but could result in both acute and chronic effects. For individual monarchs, vegetation removal could result in mortality, displacement, disturbance, reduced reproduction and decreased egg laying, pupation, and foraging success. Both long- and short-term effects on certain life stages are expected, but absolute trend and scope cannot be surmised. Many positive impacts to monarch in the long term are expected from these vegetation management activities. Those benefits are summarized in Section 6.2.1.

6.1.3 Pesticides

Direct effects include lethal and sublethal toxicity of monarchs exposed to pesticides as well as the uptake and accumulation of insecticides by milkweed and nectar plants, leading to exposure by foraging larvae and adults.

6.1.3.1 Types of Exposure to Insecticides

Insecticide exposure pathways to both monarch adults and larvae include the ingestion of insecticide on or within plant tissue and direct contact with airborne insecticides. Specifically, exposure can result from direct contact with insecticides or uptake via dietary pathways.

Pesticide drift off the application site as droplets, vapor, or dust can cause direct or dietary exposure. Exposure to drift is influenced by atmospheric conditions, application equipment, and application best practices. This makes testing the effects of the full range of scenarios difficult (H. Zhu et al. 1994, Teske et al. 2002, Hanna and Schaefer 2009). Increasingly, pesticide labels require drift reduction measures such as setbacks from natural areas, installing vegetated filter strips or buffers, avoiding applications near pollinators or flowering plants, and use of drift controls.

Systemic exposure from plants taking up some insecticides into their tissues, resulting in dietary exposure to adults and larvae. Neonicotinoid insecticides are taken up by plant tissues (Goulson 2013). Monarchs may be routinely exposed to one or more neonicotinoid insecticides in milkweed near corn and soybean fields, but maximum concentrations may be below levels that would adversely affect monarch larvae (Hall et al. 2022).

6.1.3.2 Effects of Insecticides

Once monarchs are exposed to insecticides, the effects could result in lethal and sublethal effects, depending on the degree of exposure and toxicity of the pesticide. Several studies indicate that certain pesticides cause harm to monarchs at various life stages. Described here are recent peer-reviewed papers that have examined the exposure and effects of pesticides. It is important to note that toxicity studies are designed to determine the level or "dose" of a substance that will produce measurable undesirable effects. In the case of pesticides, such studies are used to inform label requirements, legally enforceable instructions on how to safely handle and use pesticides.

A laboratory study by Barger et al. (2020) examined the transfer of the neonicotinoid clothianidin from soil to milkweed to larvae and to adult. At label application rates approved for greenhouse use (9.4 to 881.7 grams of active ingredient per acre), concentrations in leaves, larvae, and adult monarchs were not detectable and no significant effects to larval growth and survival, pupae and adult mass were observed. However, at application rates greatly exceeding label requirements (ranging from 228 to 3,553.8 grams of active ingredient per acre) this study did demonstrate for the first time, the transfer of clothianidin from soil to milkweed to adult monarchs. At these higher application rates, consumption of exposed leaves negatively affected both larval growth and adult survival.

Krishnan et al. (2021) conducted contact and dietary toxicity tests on monarch butterfly larvae at each life stage for five insecticides registered for foliar application on maize and soybean: a pyrethroid (beta-cyfluthrin), an anthranilic diamide (chlorantraniliprole), an organophosphate

(chlorpyrifos), and two neonicotinoids (imidacloprid and thiamethoxam). Contact and dietary effects differed among larval stages with first instars being the most sensitive followed by third and fifth instars. Beta-cyfluthrin – the pyrethroid – and chlorantraniliprole were the most toxic insecticides across all instars. For the neonicotinoids, clothianidin was more toxic to larvae than both imidacloprid and thiamethoxam.

Grant et al. (2021) used the larval dose-response curves generated from the Krishnan et al. (2021) toxicity studies to model monarch mortality rates caused by insecticide drift exposure downwind from sprayed crop fields. Two scenarios were modeled - predicted spraying for soybean aphid and true armyworm (a corn pest). For aerial applications using beta-cyfluthrin and chlorantraniliprole for the soybean aphid management, models predicted larval mortality between 100 and 32 percent at distances 0-60 meters downwind based on contact toxicity. Dietary toxicity data predicted larval mortality was between 100 and 10 percent at 0-60 meters downwind. Larval mortality for chlorpyrifos, imidacloprid, and thiamethoxam, (using contact toxicity data) was 99, 91, and 67 percent. For the same insecticides, larval mortality was 96, 80, and 83 percent based on dietary toxicity data. Modeling for high ground boom applications produced similar predictions; however, lower mortality was predicted at distances 15, 30, and 60 meters downwind compared to aerial applications. Across the scenarios, the mortality rates were generally highest for the first instars and lowest for fifth instars. The lowest percentage of monarch mortality was modeled at 60 meters downwind from the crop edge. Although Grant et al. (2021) estimated high monarch larval mortality rates downwind of maize and soybean fields treated with foliar insecticide applications, they noted that changes in wind speed and direction could mean different field edges will experience different levels of insecticide exposure.

Monarch larvae "exposed to the highest dose of clothianidin (51–70 ng/g) experienced pupal deformity, low survival to eclosion, smaller body size, and weaker adult grip strength. This effect was most evident for monarchs reared on the lowest cardenolide milkweed in the study – swamp milkweed. Although neonicotinoid residues are ubiquitous on milkweeds in agricultural and ornamental settings, commonly encountered doses below 50 ng/g are unlikely to cause substantial declines in monarch survival or migratory performance (Prouty et al. 2021) Results show that adult monarchs tolerate field-relevant doses as high as 54 ng/mL for imidacloprid and 75 ng/mL for clothianidin, with minimal lethal or sub-lethal effects until much higher doses are supplied. Prouty et al. (2023) concluded that adult monarchs are more tolerant of ingested clothianidin and imidacloprid than indicated by previous research. Monarchs are also able to adjust egg laying and foraging behaviors "based on which pesticides are present on their host-plants", a behavior that has been demonstrated at field-relevant pesticide concentrations (Olaya-Arenas et al. 2020). In Iowa restored prairies in or near corn and soybean fields, Hall et al. (2022) detected noenicitinoids in 80% of milkweed samples, but at concentrations 10-130-fold below levels indicative of chronic adverse effects to monarch larvae.

6.1.3.3 Pesticide Effects Summary

Krishnan et al. (2021) and Grant et al. (2021) found that multiple pesticides pose risks to the monarch based on laboratory toxicity tests. When these effects were incorporated into a model to predict risk from drift, all pesticides resulted in mortality up to 60 meters of a field, as described

above in section 6.1.3.2. Despite this, the authors suggest that establishing monarch habitat in agricultural landscapes could still benefit the monarch because of its population dynamics and vagile behavior – i.e., females will lay eggs after spraying and larvae will develop when residual insecticide concentrations have fallen below adverse levels. The authors state that monarch production would be maximized if measures were employed to reduce initial losses due to drift, but that the conservation of North America's eastern monarch butterfly population will require the establishment of milkweed and nectar plants in agricultural landscapes.

In summary, lab toxicity testing is important to discern levels of toxicity of pesticides on the tested species and can result in dose-response information. Linking lab toxicity data to in-field exposure can present challenges. Often lab tests involve use of pesticides at rates that far exceed label requirements to produce measurable responses. Additionally, a range of environmental factors influence pesticide application and drift including weather conditions (humidity, temperature, wind), topography, surrounding vegetation, application methods, and employed BMPs. Studies that utilize toxicity data to project biologically relevant exposures utilize various modeling and in-field research. Understanding drift is a key component to estimating exposure potential for monarch butterflies. With a focus on factors that are manageable through conservation actions directly related to land use practices – managing insecticide exposure can reduce risk to the monarch.

BMPs for Pesticide Use

The Strategy includes BMPs for use of pesticides that limit their use. If they are used, the application is targeted and timed to minimize impacts (i.e., by establishing buffers, minimizing non-target drift, and timing applications to avoid monarch activity).

6.1.4 Ground Disturbance and Habitat Loss

For this section, we consider effects of land management where temporary or permanent habitat removal occurs.

In many cases, ground disturbance (e.g., grading, fill) will be temporary and will be followed by restoration to include native plants. If the habitat prior to the earth work was suitable for monarch, this would result in a short-term loss of suitable habitat. If monarch were present during the ground disturbance, eggs, caterpillars or pupae could be crushed by equipment. Ground disturbance will result in the loss of vegetation of the impacted area, which could include milkweed. This would reduce available food resources for monarch caterpillars, thus resulting in lower numbers of successfully eclosing adults by reducing oviposition opportunities and caterpillar fitness (Pleasants and Oberhauser 2013).

Some land management actions include the placement of water control structures, which could result in inundation of monarch habitat. Inundation of lands can injure and kill caterpillars by drowning eggs, caterpillars, or pupae. This will result in direct mortality to any early life stages within the project footprint. Inundation could result in the reduction, loss, or occlusion of vegetation in the impacted area, which could include milkweed. Further, this would reduce available food resources for monarch caterpillars, thus resulting in lower numbers of successfully eclosing adults by reducing oviposition opportunities and caterpillar fitness (Pleasants and

Oberhauser 2013). Lastly, inundation could also result in the loss of migration resources such as nectar resources.

Similarly, land management actions could result in other changes in hydrology – including using dewatering techniques or involving water diversions from previously used areas by monarchs, e.g., actions involving restoration and management of riparian and aquatic habitats. Dewatering and diversion activities may result in collateral, incidental, or accidental inundation of adjacent areas. Dewatering activities have the potential to change the local hydrology upon which milkweed plants depend. In cases where milkweed plants are deprived of the necessary water for physiological processes, they may experience wilting, reduced growth, or mortality. Diversion activities also have the potential to change local hydrology. These changes can include increasing or decreasing the soil moisture content such that it exceeds the tolerances of milkweed plants.

Dewatering and diversion can injure and kill caterpillars by changing the hydrological conditions such that areas occupied by caterpillars are changed that could result in milkweed loss or inundation of caterpillar habitat.

Changes to local hydrology could result in changes to existing vegetation, runoff, and waterways. Hydrological impacts that change vegetation could impact both milkweed and nectar plant availability, density, and vigor in adjacent areas, which would impact monarch at all stages. Changes to runoff patterns may increase the amount of toxins associated with the purpose of the hardscaping (e.g., petroleum products used in machinery), which could result in lethal or sublethal toxicity to caterpillars that consume plants absorbing these toxins (Bohnenblust et al. 2016; Gove et al. 2007; Halsch et al. 2020; Oberhauser et al. 2009; Olaya-Arenas et al. 2020). Waterway changes may impact caterpillars by changing the vegetation community such that it no longer supports milkweed or creates local flooding which would drown eggs, caterpillars, or pupae resulting in mortality.

Synthesis of Expected Habitat Losses and Associated Earth Disturbances

If land management actions are conducted when monarch adults, pupae, larvae, or eggs are present, they could be directly affected. Direct interactions would include crushing, drowning, collisions, burning, disturbance, displacement, or sublethal toxicity (in the case of herbicide application (Olaya-Arenas et al. 2020)). Additional effects to resources upon which monarchs depend could include loss of vegetative cover, potentially including milkweed and nectar sources. These direct interactions and stressors could affect ovipositing, incubation, foraging by larvae, pupation, and nectaring. For any individual monarch that may be present, vegetation removal could result in mortality, displacement, avoidance, decreased dispersal, disturbance, reduced reproduction, and decreased foraging success.

For land management activities that result in temporary habitat losses and earth disturbance actions which may be associated with the restoration or rehabilitation of areas – any resources that may be present for the monarch before vegetation removal would likely be replaced within few or several months, resulting in short-term loss of resources rather than permanent loss.

6.1.5 Overwintering Habitat Management

Although the sub-activities of the work conducted to manage overwintering habitat are discussed above, it is worth additional discussion to add additional information on the contribution of overwintering habitat management to conservation of monarch. Overwintering sites benefit from DOD's active management to address issues of grove senescence, disease, and pest infestations, and ensure tree regeneration or replacement (Xerces 2018). BMPs in existing guidance (i.e., reducing disturbance when monarchs are present; avoid tree removal and trimming at overwintering sites unless they pose a human safety risk; develop long-term management plans to include planting native trees and nectar resources; and consulting with monarch expert and arborist prior to cutting or thinning where monarch overwinter and conduct when they are not present) ensure long-term benefits to the species by maintaining suitable overwintering habitat (via improved roosting success and thermoregulation).

BMPs for Overwintering Habitat

DOD has agreed to implement several additional BMPs through the Strategy that will further improve overwintering success of monarch on DOD lands (see BMP section). Reducing fuel loads helps to minimize risk of catastrophic wildfire within overwintering habitat. Use of pesticides will be avoided within 500 feet of overwintering sites when monarchs are present. Further, planting nectar resources to include fall/winter/early spring blooming native forbs within overwintering sites and within 5-miles of the coast will reduce distances needed to move for foraging and, in turn, increase foraging success. Surveys and research of overwintering monarch sites support overall understanding of the western population's status. Collectively, efforts over the overwintering sites managed by DOD provide significant contribution to the conservation of monarch.

6.2 Beneficial Effects to Monarch as a Result of Land Management

Land management activities can have short-term effects on populations through the loss of individual eggs, caterpillars, pupae, or adults, as discussed above. With implementation of BMPs, those effects are greatly minimized. In this section, we describe the long-term benefits of maintaining, enhancing, and increasing monarch habitat on the landscape throughout DOD lands.

6.2.1 Benefits Associated with Vegetative Management of Grassland

The disturbance components of vegetative management actions such as burning, grazing, mowing, and brush management are expected to be beneficial to the monarchs' conservation needs primarily through enhancements of the migratory and nectar resources by removing or reducing unwanted invasive woody vegetation, replanting desired plant species, and by generating a compatible disturbance regime on these land uses.

Temporary adverse effects are possible from all the actions that affect vegetative structure and composition, especially when monarchs are present on the treated area(s). Alternatively, some studies have documented large numbers of eggs and larvae on regenerating milkweed stems as many milkweed species regrow after disturbances from mowing, haying, and burning (Baum and Sharber, 2012; Fischer et al. 2015; Alcock et al. 2016; Haan and Landis 2019; Knight et al. 2019). Taken together, this evidence suggests growing season disturbance could potentially be

used to enhance monarch breeding habitat and help stabilize the population (Hann and Landis 2020). It is, however, unclear if this landscape and population level expression(s) of benefit compensates or effectively nullifies adverse effects if the activities are conducted when the monarch is present. Further, establishing specific associations between these anthropogenic sources of stressors is difficult to parse from factors such as precipitation and longer phase influences such as drought and soil conditions (Hernández et al. 2021; Liang et al. 2018; Souther et al. 2020; Orr et al. 2022).

Restoration and planting actions are also expected to enhance reproductive success of monarchs. Cutting and Tallamy (2015) found that areas planted and designed specifically to cultivate milkweed and nectar producing species of flowers enhanced monarch ovipositing as compared to unmanaged sites (monarchs oviposited at 2.0 and 6.2 times more eggs per plant per observation in the two-year study).

An assessment of managed and unmanaged sites in Nebraska concluded that by choosing a diverse seed mix of native plants with a milkweed component and undertaking conservation-based management practices, a land manager increases the chances of providing monarch breeding habitat (Manzanares et al. 2022). Similarly, a study in Illinois reported that agricultural areas that were not managed for pollinators had fewer milkweeds than natural areas (e.g., grasslands, wetlands, and forests) and that sites planted with low-diversity seed mixes or those frequently mowed or sprayed with herbicides, as well as those that are overgrazed, provide poor monarch habitat (Zaya et al. 2017). In West Texas' arid rangelands, restoration strategies that maximize the first-year survival of milkweed may be the most effective at maintaining plant numbers over time and should be prioritized (Brym et al. 2021).

Lastly, there is data that monarchs can benefit from growing-season disturbance to grassland habitats in their breeding range, with regenerating stems of milkweed host plants supporting more oviposition and lower densities of arthropod predators (Haan and Landis 2020). Milkweed that regrows after disturbance is very attractive to ovipositing monarchs; several studies have documented large numbers of eggs and larvae on regenerating stems (Fischer et al. 2015; Alcock et al. 2016; Haan and Landis 2019; Knight et al. 2019). These stems also contain fewer predatory arthropods for the first several weeks of regeneration (Haan and Landis 2019). Since predation rates on early-stage monarchs are quite high (Prysby 2004; Oberhauser et al. 2015; Myers et al. 2019), the reduction in predators following disturbance could provide them with enemy-free space.

6.2.2 Benefits Associated with Marginal Areas

Even semi-natural areas (e.g., rights-of-way, parks, yards, crop fields) with planted forbs and other flowering plants can provide resources for monarch. For example, incorporating prairie strips into corn and soybean fields can reduce erosion and nutrient loss while increasing biodiversity (Shulte et al. 2017). Modeling suggests that isolated patches of milkweed distributed at low density across the landscape could profoundly increase the number of eggs that a monarch lays during its lifetime (Zalucki and Lammers 2010).

Butterfly biodiversity increases with restoration actions that increase planting diversity for both habitat generalists and specialized species of conservation concern (Farhat et al. 2014). While marginal grasslands associated with agriculture are not equivalent to lands managed specifically for conservation, these areas may still remain valuable to butterfly conservation, which includes the intrinsic value they provide as corridors and stepping stones for migration and dispersal (Farhat et al. 2014; Panzer et al. 2010; Dover and Settele 2009). Small, linear grasslands have conservation value, even beyond their roles as connective corridors (Saarinen 2002; Tscharntke et al. 2002; Davis et al. 2007; Hopwood 2008).

DOD has BMPs in their Strategy to incorporate monarch-friendly planting into hedgerows, orchard understories, pivot corners, crop margins, riparian buffer strips and corridors, or other out-of-production areas, which can have benefits over a relatively small area of land.

6.2.3 Benefits Associated with Forest Management

Forested habitats offer some support to migratory monarchs. Land management actions such as forest thinning, patch-cut, shelterwood cut, gap creation, brush management, and uses of prescribed fire and other methods to manage forest succession, reduce fuel loads, suppress the shrub layers, or target tree selection strategies are all expected to generate benefits to the forb and floristic resources within the range of the monarch and therefore support the monarch resource needs. A summary on forest management activities and expected benefits to pollinators is provided in Hanula et al. (2016). Responses of pollinators that appear to be consistent across forest types are as follows:

- In New York state, results from 30, 60, and 100% overstory tree removal indicated that the greater the forest cover removed, the higher the bee abundance and diversity in the openings (Romey et al. 2007).
- Within the Ponderosa Pine forest of the southwestern U.S., forest thinning and prescribed burning actions nearly doubled native cover and increased native species richness by about 50% relative to untreated controls (Springer et al. 2023). These effects persisted for over a decade after treatment, even under the influence of significant and persistent drought.
- An examination of seven forest types typical of the Piedmont region of the southern U.S. indicated that lower leaf area index (i.e., more light) resulting from lower stand densities (basal area) was associated with greater numbers and species richness of bees (Hanula et al. 2015).
- Higher butterfly species diversity was found in burned forests compared to unburned conifer forests in Oregon and California (Huntzinger 2003). These results were attributed to higher total areas of sunlit patches in burned forests.
- Within southern Appalachian hardwood forests, removal of a native understory shrub through prescribed burning and shrub removal followed by burning resulted in increased butterfly use of the area (Campbell et al. 2007a).
- Wagner et al. (2003) stressed the need for prescribed fire, mechanical cutting, or a combination of both for maintaining the open-canopy shrubland barrens required by rare butterfly and moth species in northeastern U.S. forests.

Operational components of timber harvests within larger forested landscapes also create valuable foraging areas to monarchs and other pollinators, including landing sites. For example, timber harvests created open conditions with high floral abundance which serve as concentrated resource hubs for bees and butterflies (including monarchs specifically identified in this research) (Lee et al. 2021). Further, forest thinning and other timber harvest actions provides increased sunlight penetration and corresponding understory plant diversity, including forbs and nectaring plants. Within the longleaf pine ecosystem in the southeastern U.S., management actions such as prescribed fire, forest thinning, control of mid-story hardwood and/or invasive understory plant species are expected to benefit monarchs and other pollinators by sustaining or facilitating understory conditions conducive to the species (Sheehan and Klepzig 2022). While southern pine forests are not presently considered significant areas for migrating monarchs, efforts to create and sustain open understory conditions will enhance forbs and other floristic resources important to the monarch's migration and nectar resources.

6.2.4 Benefits Associated with Brush Management

In the southern Great Plans, especially Texas, Kansas, Oklahoma, and New Mexico, control of aggressive and invasive species such as mesquite (*Prosopis* spp), eastern red cedar (*Juniperus virginiana*), and buffelgrass (*Pennisetum ciliare*) is crucial to restoring and maintaining areas that were historically open grassland. An estimated 25% of Texas' grasslands have brush encroachment and 16 million acres (6.5 million hectares) are so invaded that it is suppressing the majority of grass/forb production (Brown and Archer 1989) and native plant diversity (Murray et al. 2021). The geographic extent of the affected area overlaps with the monarch migration concentration area in southern Texas. Strategies to decrease brush and woody encroachment including seeding of native species, uses of herbicide, prescribed fire, and high-intensity, short-duration grazing have been all been found to restore diverse, native warm season perennial grasslands and create better habitat for native grassland bird species and pollinators (Murray et al. 2021). Gowdy et al. (2022) documented increases in butterfly species richness and relative abundance – including monarch - over an 8-year grassland restoration effort in southern Texas using prescribed fire, multiple discing and herbicide applications, and native-plant seeding. DOD has been an example of how to maintain open grasslands and combat woody encroachment through prescribed burning and other brush management control techniques. Maintaining these open areas is essential for ensuring military training can continue in these areas and, consequently, simultaneously benefiting monarchs and other pollinator species that rely on open grassland habitat.

6.3 CONSERVATION PROGRAMS

We separate "Conservation Programs" from "Land Management" to aid in organization of this Opinion, though we want to emphasize the land management under the Sikes Act clearly and significantly contributes to the conservation of the species.

In this section, we discuss the effects to monarch of the Proposed Action's non-land management actions, which we are calling "Conservation Programs". These programs contribute substantially to the conservation of monarch and other pollinators through research and funding; strategic

partnerships; and outreach and volunteer efforts. This section discusses the effects of continued implementation of these programs on monarch.

The Strategy describes DOD's efforts to support our collective understanding of monarch's conservation needs, as described in the Conservation Programs section. Research and funding efforts support conservation projects that aim to increase knowledge and data to enhance military readiness by enabling DOD managers to balance habitat protection with training activities and other land uses. These efforts also provide information to help NRMs understand western monarch butterflies and improve efficiency and effectiveness of habitat management on DOD lands. Ongoing research projects contribute to the conservation of the species by increasing the scientific understanding of high priority monarch areas in California and providing monitoring and habitat assessment for monarch on military installations and DOD lands. Efforts also seek to increase monitoring, conservation, and connectivity of DOD lands with other public and private lands via data collection and monitoring, provision of training and educational resources for DOD staff and partners, and technical assistance for habitat management. Ongoing efforts have clear and considerable benefits to monarch populations.

In addition, DOD continues to implement large-scale conservation programs and initiatives that benefit monarchs and a variety of other species and ecosystems. Implementation of the RASP, for example, supports ongoing natural resource management and partnership efforts to address imperiled species, important habitats, invasive species, and other key natural resources, which in turn helps avoid or minimize mission impacts while enhancing species conservation and increasing habitat connectivity.

The REPI program provides direct funding for projects that protect and restore the ecosystems outside of military installation boundaries that monarchs rely on while simultaneously combatting encroachment that could otherwise limit or restrict military training actions. In addition, REPI seeks to prioritize landscape-scale initiatives by participating in the Sentinel Landscape Partnership, a coalition of federal agencies, state and local governments, and non-governmental organizations that work with willing landowners and land managers to advance sustainable land use practices around military installations and ranges. Each of these partnerships prioritizes supporting and funding of large-scale restoration, management, and protection of ecosystems including the promotion of sustainable land uses, wildlife corridors, and research, to name a few. These partnerships promote resilient landscapes that can support their individual, population, and species needs, creating synergy and significant contributions to monarch conservation.

The DOD Legacy Resource Management Program also continues to fund monarch-related research and conservation projects. In 2022 and 2023 alone, this program contributed nearly $10 million in funding to support monarch conservation. Through continued implementation of these funding programs and partnerships, installations continue to work with experts in the field of monarch research and conservation while obtaining technical assistance, site-specific monarch guidance, assistance with INRMP updates, support with monitoring efforts, and implementation of habitat restoration activities.

Monarch research, funded through DOD conservation programs, could include monitoring effort that could have impacts to monarchs via stress or injury to individuals. Handling individuals

(e.g., for mark-recapture studies) and using radio telemetry (e.g., Motus tagging) to study monarch migration could result in injury, reduced fitness, or mortality. For example, the full effects of significant weight transmitters on long-distance travel are not well understood, but attaching a transmitter to a monarch could affect its ability to fly and behavior (Kissling et al. 2014). Fisher et al. (2020) found monarchs with transmitters weighing 31-73% of an individual's body weight exhibited more resting behavior than those without transmitters, but their behavior following environmental stimulus was similar to untagged monarchs. Lighter transmitters are likely to have a lesser effect on individuals. In studies of butterflies and moths with attached transmitter weight equaling up to 15% of their body weight, flight ability was not affected (Srygley and Kingsolver 2000, Liegeois et al. 2016). In a study of bumblebees (Bombus sp.), heavier transmitters (66–100% body weight) resulted in increased resting, fewer flower visitations, and more time spent on a single flower (Hagen et al. 2011). The ability to use radio telemetry contributes to conservation of the species by providing important details about movement and migration that can help with conservation planning. DOD partners with leading scientists and conservation organizations to ensure the benefits of research outweigh the risks related to attaching transmitters or handling. If monarch is listed, researchers must obtain and follow USFWS 10(a)(1)(A) permit conditions, as appropriate.

The Legacy Program also provides support for National Public Lands Day efforts with programs that are specifically geared towards pollinators. Efforts include invasive species removal and adding pollinator gardens with native wildflowers to promote pollinator habitat.

DOD has exceptional capacity to reach the public through social media, promotional videos, and other outreach efforts. They have unique ability to create and maintain influential partnerships that increase their footprint of conservation actions and impacts at large landscape scales. Their funding efforts ensure better understanding of monarch needs so that conservation efforts can be informed by the best science possible. In total, the conservation programs have a significant benefit to monarch.

6.4 SUMMARY OF SCOPE OF BENEFICIAL EFFECTS

Monarch butterflies can be found throughout almost the entire continental U.S. during the breeding season (Jepsen et al. 2015), with most monarch breeding east of the Rocky Mountains appearing to occur in a region stretching from Texas to Ohio (Flockhart et al. 2013).

DOD's ecosystem management approach under the Sikes Act, coupled with policies like the DOD PCRG, a 2014 Presidential Memorandum that led to the National Strategy to Promote the Health of Honey Bees and Other Pollinators and the "Pollinator-Friendly Pesticide Applicator BMPs", and DODI 4150.07 DOD Pest Management Program, together provide for habitat for monarch and other pollinators on a landscape-scale. The Strategy furthers DOD's commitment to conservation of monarch. Implementation of the Strategy will have continuous beneficial effects to monarch populations. The primary benefit comes from the actions that promote vegetation management, including plantings, removing/halting exotic species degradation of native habitats, and establishing and maintaining appropriate disturbance regimes in grasslands, that create and maintain monarch resource needs. Forest management actions conducted by DOD include prescribed fire, thinning, re-planting, brush management, maintaining early successional forest

stand conditions, and general forest health actions such as patch cuts and other techniques that create open canopies or improve understory conditions. Such treatments are expected to produce forest conditions that are beneficial to the monarch by opening forest canopies, and directly or indirectly increasing the availability of native forb and nectar plant sources. We expect benefits to the monarch will be generated through forest management actions which control invasive species and promote early successional forest stand conditions. Although on a relatively smaller scale, similar benefits can occur in rangelands where grazing practices control brush and implement BMPs to maintain a diversity of flowering plants that are resources for monarch and other pollinators.

Managing over a million acres of grasslands, and other suitable areas of habitat for monarch, will have large scale impacts which are important to monarch. Without active management (e.g., mowing, prescribed fire), grasslands can become degraded through increase in woody vegetation or invasive species, resulting in loss of suitable monarch habitat. Further, BMPs ensure the minimization of adverse effects to monarch as a result of implementing management actions and, in some instances, result in increases to habitat quality.

Further, implementation of conservation programs significantly contributes to conservation of monarch and other pollinators through outreach efforts, building strategic partnerships, funding to support monarch conservation, and contributions to knowledge of monarch through research.

6.5 MILITARY MISSION AND SUSTAINMENT ACTIVITIES

In conducting the effects analysis for the Proposed Action, several key assumptions are necessary due to 1) the large geographic scope of the Action Area, 2) acknowledgment that utilization of DOD-managed lands changes over time to meet the evolving military mission needs, and 3) inability to quantify the location, timing, frequency, duration, extent, and intensity of mission and mission sustainment activities at the programmatic level. The key assumptions are as follows:

1. Outside of the critically important monarch overwintering sites, all areas (i.e., fence line to fence line) within DOD-managed lands within the Action Area may be utilized for carrying out mission and mission sustainment activities at any given time. However, it is highly unlikely that conducting the military mission on DOD-managed installations, individually or collectively, in any given year would result in harm to a significant proportion of existing natural resources. Moreover, by maintaining and restoring native ecosystems on installations, the DOD creates the tactical environments necessary for mission readiness by providing realistic training environments. As such, ensuring installations have healthy ecosystems is paramount for effective military testing, training, and operations. Subsequently, it is not beneficial to the DOD to conduct mission and mission sustainment activities that degrade all or significant portions of the native ecosystems in which installations are located.
2. Impacts from many military training activities are temporary, and the most destructive training activities are usually confined to repeatedly used impact areas. Even in these repeatedly used impact areas, vegetative cover remains largely intact. Therefore, it is not guaranteed that areas where military training activities are carried out will result in long-

term negative consequences to monarch habitat or have any impact to existing monarch habitat. In fact, monarch host and nectar plants often thrive in areas that have been disturbed, including areas where military training activities take place.

3. Implementation of the Strategy will ensure that monarch habitat on DOD lands continues to be maintained, enhanced, and/or increased and, in instances where the mission requires permanent loss of habitat, it will be limited.
4. The DOD mission is being conducted in what is considered a managed landscape, the vast majority (approximately 25 million acres or 90%) of which is covered under the Sikes Act, which over the years has been significantly strengthened, and its scope expanded, such that it now represents a comprehensive law mandating the conservation of all aspects of natural resources on military lands. DOD complies not only with this law but numerous other affirmative laws, regulations, and programs in addition to the Strategy to sustain and enhance these managed landscapes.
5. As the utilization of DOD-managed land changes to meet the evolving military mission needs, the extent of effects to monarch and its habitat can also change; these effects will vary across installations and over time.

Decades of implementation demonstrate the compatibility of military mission implementation and conservation (Boice 2006; Rabung and Toman 2022). Installations manage their lands to provide realistic environments for training and testing, as healthy and well-managed natural ecosystems play an essential role in maintaining the readiness of military troops (to ensure access to those realistic environments). While it is important to reemphasize the mission comes first, in practice, DOD has a long and successful history of managing natural resources on its lands to support military mission requirements, while at the same time conserving biodiversity (Stein 2021). In theory, any land could be needed for training at any time, as mission implementation shifts and changes over time. But as has been demonstrated over recent decades, and as directed under the Sikes Act, lands are managed for ecosystem function; as a result, many species and species groups benefit, including pollinators. In fact, DOD has the highest density of species listed as threatened and endangered under the ESA of any federal land management agency. DOD is responsible for managing approximately 550 threatened and endangered species and more than 550 species at-risk of needing listing protections on its installations and ranges. Of those, 54 listed species and 74 at-risk species exist only on DOD lands.

Some of the finest remaining examples of rare wildlife habitats are found on military installations because DOD property is protected from extensive development and habitat loss (Stein et al. 2008). Even mission and mission sustainment activities can provide benefits to species from temporary disturbance (e.g., fire, vegetation removal for line of sight, disturbance from mounted and dismounted maneuvers, among others) and/or rely on early successional habitats. For example, a study conducted at Fort McCoy, Wisconsin, investigated the effects of disturbance by military maneuver training on the density of wild lupine and Karner blue butterfly, and suggested that maintenance of lupine habitat can be achieved in tandem with military training (Smith et al. 2002). Specifically, Smith et al. (2002) found that both the abundance of lupine and nectar resources was greater in areas where military vehicles had traveled than where they had not. Additionally, they found the proportion of lupine stems with Karner blue butterfly larvae feeding sign was greater in areas where military vehicles had

traveled versus areas where they had not. Lastly, their findings demonstrated that the proportion of lupine stem density was also positively correlated to the occurrence of prior bivouacs and fires caused by military munitions. Similarly, the Fort Indiantown Gap National Guard Training Center in Pennsylvannia, is home to one of the last remaining populations of eastern regal fritillary (*Argynnis* [*Speyeria*] *idalia idalia*) butterflies. Research conducted on Fort Indiantown Gap indicated that training activities involving mounted and dismounted maneuvers likely led to frequent disturbances that favored early successional grassland that may have contributed to the species stability on the installation (Zografou et al. 2017). Another study investigating the role of disturbance in habitat restoration and management for the eastern regal fritillary found that mounted maneuver training activities maintained populations of the species larval host plant (*Viola* spp.) more effectively than combinations of light soil scarification, mowing, and removal of mowed biomass (Latham et al. 2007). Like the aforementioned Lepidoptera examples, and mentioned previously specific to land management for monarch, there are clear benefits to monarch in regeneration of milkweed and nectar resources post-management and restoration. It is also worth noting that recent research identifying migratory habitats essential to western monarchs found that despite the U.S. federal government managing 53% of the land in the western U.S., nearly 85% of spring and more than 70% of fall migratory habitat is located on privately managed lands (McIntyre et al. 2024).

DOD's request for voluntary conference included high-level details about military training and operations to help us assess effects to monarch as a result of those activities. Table 5 includes the high-level military training and operations actions and corresponding stressors under consideration. Some of the effects of military mission and sustainment actions are discussed above (see 6.1 Land Management).

Table 5. High level activity and corresponding subcomponents/stressors for military mission and sustainment

Mission and Mission Sustainment Activities	**Noise and Vibration**	**Light**	**Smoke, Fog Oil, and Obscurants**	**Introduction of Invasive Species**	**Introduction of Pollutants**	**Soil and/or Ground Disturbance**	**Change in Vegetation Composition and/or Structure**	**Wildfire**	**Rotor Wash**	**Collisions/Strikes/Crushing**
Ground-based Training										
Mounted Maneuver Training	X	X		X	X	X	X	X	X	X
Dismounted Maneuver Training	X			X	X	X	X			X
Live-Fire Training	X		X				X	X	X	X
Bivouacking and Assembly	X	X				X	X			X
Communications	X									
Digging				X	X	X	X			X
Aviation Training										
Fixed Wing	X			X	X		X		X	X
Helicopter	X			X	X		X		X	X
Unmanned Aerial System (UAS)/ Unmanned Aerial Vehicle (UAV)	X			X	X		X		X	X
Pickup Zone, Landing Zone, and Drop Zones	X			X	X	X	X		X	X
Impact Areas										
Dudded	X		X			X	X	X		X
Non-Dudded	X		X			X	X	X		X
Construction and Maintenance	X	X		X	X	X	X			X

Because the full details on the extent, timing, and duration of these actions are not known at the programmatic level, details on these impacts will be provided during INRMP review. For the jeopardy analysis in this Opinion, we consider extent of training based on our understanding of current and recent history of military mission and operations implementation. This extent can and will change over time for individual installations and varies widely among installations. We are not providing a limit or ceiling. Rather, we are basing our jeopardy analysis on the current proposed action and current level of extent of military mission. Because decades of implementation have occurred and been compatible with creation of grassland habitats suitable for monarch, we expect monarch habitat to continue to be available across the Action Area at relatively consistent levels. If this changes to the extent that our analysis is no longer valid, reinitiation of this voluntary conference may be requested. NRMs will have detailed site- and activity- specific details on the effects of mission and mission sustainment activities for a given installation and will confirm their non-jeopardy conclusion for all operations at the INRMP stage (see Appendix A).

6.5.1 Effects of Military Operations

Implementation of military mission may result in adverse effects to monarch through some of the same stressors described above, such as ground disturbance/habitat loss, noise, and vehicle mortality. This section describes stressors that occur as a result of military operations, including vibration and noise; lighting; smoke; fog oil and obscurants; introduction of invasive species; introduction of pollutants; soil and/or ground disturbance; changes in vegetation composition and/or structure; wildfire; rotor wash; and collisions/strikes/crushing.

6.5.1.1 Vibration and Noise

Military mission can cause noise through various activities including ground-based and aviation training, detonations and live-fire, and noise generated during rocket launches. This type of noise is temporary (lasting the duration of the training activities). The noise generated during rocket launches or re-entry, for example, creates noise lasting up to several minutes and a sonic boom lasting less than a second, similar to thunder (Department of Defense 2021). The amplitude of the launch noise is dependent on the thrust of the vehicle and the proximity of the receptor (monarchs) to the launch site (Department of Defense 2021). Close to the launch site (within half a mile), the noise generated by a launch vehicle could cause changes in hearing sensitivity and could provoke strong behavioral reactions in some species of wildlife (Department of Defense 2021). Effects to monarchs depend on the life stage present and proximity to the source of the noise.

Nymphalidae, the group that monarchs belong to, have been shown to detect sounds, particularly at low frequencies (Mikhail et al. 2018). While recent research indicates monarch larvae can hear and exhibited responses to sounds (Taylor and Yack 2019), adult monarchs do not have any known auditory sensory structures and are thought to be unable to hear. Because adult monarch butterflies apparently cannot hear, the effects of noise is not likely to adversely affect monarchs at this life history stage. In contrast, Taylor and Yack (2019) found that fourth and fifth instar larvae responded to sounds by freezing, contracting, and flicking their thorax. These behavioral responses were measured following a playback of 200 Hz to increasing sound levels (72, 75, 78,

81, 84, 87, 89, 92 dB SPL). For context, 45 dB would be equivalent to a quiet library while 75 dB would be like standing next to a busy freeway. Additionally, when presented with a consistent 200 Hz sound, larvae appeared to become habituated and no longer exhibited a response to the sound. This study is consistent with others that have found that monarch larvae responded to the presence of passing aircraft (Rothschild and Bergström 1997) and traffic noise (Davis et al. 2018). It is suspected that hearing in monarch larvae serves as a defensive reaction against aerial insect predators and parasitoids (Taylor and Yack 2019). The ability for monarch larvae to become habituated to sound after repeated exposure suggests that larvae exposed to anthropogenic noise may be at a greater risk of parasitism (Taylor and Yack 2019). The effects of noise on monarch larvae from mission and mission sustainment activities are expected to be minimal because noise disturbance will be temporary and the likelihood that it will intersect with the larvae stage is expected to be low.

Another type of "noise" that may affect monarch is anthropogenic electromagnetic noise. The increasing use of electromagnetic fields for communication technologies may have subtle effects to insects (reviewed in Thill et al. 2023 and Balmori 2021). Examples of anthropogenic sources of high frequency electromagnetic fields include radar and 5G, used for communication. Monarchs use an internal magnetic compass for navigation, and anthropogenic electromagnetic fields could alter their ability to orient themselves under certain conditions. The extent to which electromagnetic noise could affect monarch migration or other behaviors is not well understood.

6.5.1.2 Lighting

Artificial lighting at night can influence monarch biological cues. Artificial lighting at night may arise from a variety of sources, including streetlights, buildings, and temporary activities (e.g., construction), and include short-term pulses (e.g., from passing vehicle headlights) or persistent night-long emissions (e.g., streetlights) (Gaston et al. 2017). There is no anticipated effect of artificial lighting at night on milkweed or other nectar resources (Haynes et al. 2023). Monarch larvae, however, increased feeding frequency when exposed to artificial light at night. Despite this effect on feeding frequency, there were no significant effects on speed of development (i.e., the time it took to go from second instar to pupation), or pupal mass (Haynes et al. 2023). Effects appear to be life-stage specific. Negative effects as a result of artificial lighting have been reported in adult monarchs due to changes to circadian-clock mediated migratory behaviors (Parlin et al. 2022).

6.5.1.3 Smoke, Fog Oil, and Other Obscurants

A variety of smokes and obscurants are used in military training and operations (e.g., for screening, signaling, etc.) (National Academy Press 1997). Smokes are produced by burning or vaporizing various products (e.g., diesel, hexachloroethane), and obscurants are particles suspended in the air that block or weaken transmission of parts of the electromagnetic spectrum (e.g., infrared radiation or microwaves). Fog, dust, and mist are examples of obscurants that may be used in training. Fog oil is a type of oil smoke generated by heating severely refined mineral oil.

6.5.1.3.1 Smoke

Research of painted lady butterflies (*Vanessa cardui*) examined the impacts of smoke on flight behavior (Liu et al. 2021). Fine particulate matter in the air (a component of smoke) had a strong negative correlation with flight speed (i.e., as particulate matter increased, there as a linear decrease in flight speeds); however, at very high levels of particulate matter (above ~3.4 mg m^{-3}), painted lady butterflies increased speed possibly to escape the polluted conditions. The longer the exposure, the more obviously their flight behaviors were impacted (in terms of speed, duration, and distance). These effects could be more consequential during migration. It is possible that decreased flight behavior could be caused by closure of the insect spiracle valves (Liu et al. 2021). Sweat bees (Halictidae spp.) exposed to a polluted environment demonstrated reduced flight activity compared to those exposed to clean air (Tan et al. 2018). Poor air quality could cause insects to close their spiracle valves longer, decrease oxygen intake, and reduce metabolism (Tan et al. 2018). Toxic compounds found in haze smoke (from fire) may also negatively influence butterfly flight performance by affecting insects' body functions. Cecropia moths (*Hyalophora cecropia*) are sensitive to changes in concentrations of carbon dioxide and oxygen levels, resulting in spiracle closures (Burkett and Schneiderman 1974).

There are several types of chemical smoke used in military training, for example hexachloroethane/terephthalic acid smoke (HC/TA). HC/TA smoke mixtures may differ in composition depending on manufacturer and use; some are generated with zinc oxide and others with titanium dioxide, and toxicity varies depending on the mixture (with zinc-containing products having greater toxicity than titanium-containing mixtures (National Academy Press 1997). Once applied and smoke has formed, 5% or less of the HC remains in the air (von Stackleberg et al. 2004). Much of the toxicology research focuses on effects to mammals. We were unable to find literature on the effects of HC/TA mixtures on Lepidoptera, but HC does not appear to accumulate in terrestrial food webs (von Stackleberg et al. 2004). There are effects to aquatic invertebrates (*Daphnia*) primarily due to zinc toxicity (Fisher et al. 1990), but it is unclear whether similar effects would be seen in Lepidoptera.

Similarly, little information was found on the effects of CS (tear gas) on Lepidoptera. CS has been shown to cause contact damage to terrestrial plants but did not cause appreciable damage at typical field concentrations (Keller et al. 1986).

6.5.1.3.2 Fog Oil and Other Obscurants

To evaluate the effects of fog oil on prey species, Driver et al. 2007 performed a series of screening tests exposing five species from different orders (a moth, roach, mosquito, ant and beetle) to a wind tunnel that replicated fog oil exposure in various simulated field conditions. Adults and larvae were exposed to simulated worst-case scenario (i.e., fixed location, 4-hour exposure duration at twice the field levels near the fog oil generator, and canopy density and wind speeds that would be worst case for the species) and another exposure with near-source (high) concentrations. No adverse effects from exposure to high concentrations of aerosolized fog oil were observed in either the larval or adult forms of the wood roach and beetle. Adult geometrid moths (Geometridae) were also unaffected by fog oil exposure at near-source concentrations. At twice the highest near-source concentration (916 mg/m3), however, activity,

flight, and response to touch stimuli were greatly reduced (this was for the "worst case" exposure scenario, which may be unrealistic in real field conditions in terms of exposure duration and concentration) (Driver et al. 2007). Getz et al. (1995), for example, indicates most smoke training exercises last 30 to 90 minutes – as opposed to the 4-hour exposure of the Driver et al. 2007 study. We were unable to find other studies evaluating the effects of fog oil on Lepidoptera. In terms of environmental fate, Getz et al. (1995) found that smoke dissipates within a few minutes under usual atmospheric conditions. Most of the fog oil evaporates rather than deposits onto the surface of plants, and any that does deposit on plants rapidly evaporates. Additional research is needed to fully understand the potential effects to monarch from exposure to fog oil.

Obscurants such as dust and mist are likely to have minimal impacts to monarch. For all types of smoke and obscurants, the effects would be localized and likely temporary, although the environmental fate of each varies depending on its chemical composition.

6.5.1.4 Introduction of Invasive Species

The movement of equipment, supplies, and people can unintentionally spread invasive plant seeds (transported by equipment or the soles of boots) or other invasive species (e.g., zebra mussels in ballast water). When areas are disturbed during training, it can increase the spread of invasive plants that could out-compete native nectar and host plant resources. Through restoration following training, NRMs use methods described previously to control invasive species.

As discussed previously, invasive milkweed can increase spread of disease in monarch. Through the DOD PCRG and the Strategy, NRMs work to eliminate invasive plants and nonnative tropical milkweed. Refer to Vegetative Management and Benefits Associated with Vegetative Management above.

6.5.1.5 Introduction of Pollutants

Use of vehicles and training procedures can result in the introduction of pollutants to the environment. For example, fuel spills or oil leaks could result in exposure of these chemicals to monarch at any life stage as well as the host plants and nectar resources they rely on. Potential impacts of spills include degradation of soils and vegetation, exposure of monarchs to chemicals or compounds that kill them directly, decreased survival, or reduced reproduction. Alteration of soils can also increase the likelihood of the establishment of invasive species. Policies and protocols are in place to avoid spills, and training is provided to ensure proper response in the event a spill happens. Spills have different regulatory definitions and requirements depending on the type and quantity of the chemical involved. Each installation has a local response protocol they must follow to ensure proper clean up and reporting. Many types of hazardous materials may be used, and it is beyond the scope of this Opinion to review all potential substances that could be used on installations across the nation.

6.5.1.6 Soil and/or Ground Disturbance

Many types of mission and sustainment actions could cause soil and/or ground disturbance including ground training; pick up, landing and drop zones; impact areas; and construction and maintenance. If monarch were present during the ground disturbance, eggs, caterpillars or pupae

could be crushed/trampled by vehicles or equipment. Ground disturbance could also result in the loss of vegetation of the impacted area, which could include milkweed or nectar resources. This would reduce available food resources for monarch caterpillars, thus resulting in lower numbers of successfully eclosing adults by reducing oviposition opportunities and caterpillar fitness (Pleasants and Oberhauser 2013). See also the effects described above in 6.1.5 Ground Disturbance and Habitat Loss.

6.5.1.6.1 Permanent hardscaping

Permanent hardscaping may be necessary for mission and sustainment through creation of infrastructure to support troops and training activities. Permanent hardscaping includes, but is not limited to the use of tarmac, asphalt, concrete, gravel, bricks, paving stones, and compacted soils to replace native or existing surfaces.

Permanent hardscaping can injure and kill caterpillars by direct contact with heavy machinery, paving substrate, staged materials, and associated preparatory measures. This will result in direct mortality to any caterpillars within the project footprint. Permanent hardscaping will result in the loss of vegetation within the impacted area, which could include milkweed or other nectaring resources. This would reduce available food resources for both adult monarchs and caterpillars, thus resulting in lower numbers of successfully eclosing adults by reducing oviposition opportunities and caterpillar fitness (Pleasants and Oberhauser 2013).

Changes from natural or other existing surfaces to permanent hardscaping will impact local hydrology that could result in changes to existing vegetation, runoff, and waterways. Hydrological impacts that change vegetation could impact milkweed availability, density, and vigor in adjacent areas, which would impact caterpillars by reducing the foodplant. Changes to runoff patterns may increase the amount of toxins associated with the purpose of the hardscaping (e.g., petroleum products used in machinery), which could result in lethal or sublethal toxicity to caterpillars that consume plants absorbing these toxins (Najar-Rodríguez et al. 2008). Waterway changes may impact caterpillars by changing the vegetation community such that it no longer supports milkweed or creates local flooding that would drown caterpillars.

Permanent hardscaping eliminates or severely inhibits vegetation growth within and in areas surrounding the footprint of the hardscaped area, including milkweed and nectar resources. Any milkweed within the project footprint will be eliminated by the hardscaping. Defects in the hardscaping may allow for milkweeds to germinate, however, it is unlikely that these plants would provide sufficiently dense or healthy populations of milkweed to allow for recruitment of migratory adults into the population. Runoff and hydrological impacts associated with reduced permeability could impact milkweed outside the hardscaped area by increasing toxins and altering seasonal water regimes, thus reducing nectar plant and milkweed expanse, density, and vigor (Hall et al. 2022; Najar-Rodríguez et al. 2008). As described previously, access to nectar resources may be especially important during the migratory phase. Analysis of monarch occurrence records in the eastern U.S. found that the threats driving the decline in abundance occurred during the migratory phase, which could be a result of a decrease in nectar plant availability (Inamine et al. 2016). Finally, removal of vegetation could affect adult predator avoidance by removing vegetation that could provide shelter from predators.

In instances where hardscaping eliminates vegetation cover or results in darkening of the existing surface (e.g., tarmac, asphalt), higher local temperatures could occur, which could affect larval

development such that physiological processes are interrupted or shifted to non-optimal conditions (York and Oberhauser 2002; Zalucki 1982).

An overarching conservation measure for the Strategy indicates permanent loss of monarch habitat will be limited (i.e., "• DOD will continue to maintain, enhance, and/or increase monarch habitat and will limit habitat loss in instances where the mission requires permanent loss of habitat" [emphasis added]).

6.5.1.7 Changes in Vegetation Composition and/or Structure

Training and operations may require vegetation removal or management to a desired composition or structure (e.g., for line of sight, cover). The effects of changes in vegetation composition and/or structure are described above in 6.1.2.3 Actions which Temporarily Affect Vegetation Structure and Composition.

6.5.1.8 Wildfire

Long-term fire suppression across the country has led to fuel buildup on and near installations, and climate change may result in weather conditions conducive to wildfire. Wildfire ignitions primarily come from civilian activities, lightning, and military operations (Beavers et al. 2017). Some types of military training (i.e., live-fire, impact areas) increase the risk of wildfire under certain conditions. Installations consider wildfire risk to protect infrastructure and reduce risks to their mission. Many installations, through their Sikes Act authorities, conduct management to reduce risks of wildfire, including vegetation management and prescribed fire. Military installations conduct risk assessments and evaluate the risks of wildfire in an effort to reduce risks to their installations and neighboring lands. Under REPI, for example, installations prepare for increased wildfires to increase installation resilience. Wildfires are generally much hotter than prescribed fires due to uncontrolled fuel buildup and weather conditions and have the potential to impact a much greater footprint. The effects to monarchs at all life stages from wildfires and wildfire suppression are expected to be similar to those described above in 6.1.2.3.2 Prescribed Fire but more severe. The extensive amount of prescribed burning (i.e, simulating historical fire regimes) that occurs on installations significantly decreases the potential of severe impacts caused by catastrophic wildfires to monarchs.

Reducing fuel load through prescribed fire or creating fire breaks could affect monarch; refer to 6.1.2 Vegetation Management and 6.1.5 Ground Disturbance for additional discussion.

Wildfire in overwintering areas could be significantly harmful to the western population of monarch. DOD's BMPs for overwintering areas include fuel reduction to reduce the risk of wildfire: reduce fuel loads and minimize risk of catastrophic wildfire within overwintering habitat through selective thinning of small diameter trees in the support zone and the shelter zone.

6.5.1.9 Rotor Wash

Rotor wash is the vertical displacement of air from a helicopter rotor. The rotor wash effect occurs out to a distance approximately three times the rotor diameter (DOI 1998). For example, a Chinook-47D has a rotor diameter of 60 feet, therefore, the rotor wash effect may occur in a

radius of 180 feet from the helicopter when landing, taking off, or hovering close to the ground. As rotor wash nears the surface, it spreads laterally as sidewash along the ground (Slijepcevic and Fogarty 1998). Rotor wash can cause saplings, decaying trees, and loose debris from treetops to fall and can create hazardous conditions from dust and flying debris under the helicopter (WCB 2005). The intensity of rotor wash is influenced by the helicopter's height above ground, forward speed, mass, and rotor span (Slijepcevic and Fogarty 1998). For example, a Bell 205A helicopter that is hovering 50 feet above ground level generates rotor wash wind speeds of approximately 60 mph at the surface. The same helicopter hovering at 100 feet above the ground would generate a rotor wash of approximately 35 mph at the ground level (Slijepcevic and Fogarty 1998). Large helicopters, such as the Chinook-47D, can generate rotor wash in excess of 120 mph directly below the helicopter (www.globalsecurity.org, 2010). Rotor wash can affect monarch both indirectly (plants and habitat) and directly (eggs, larvae, pupae, and adults).

Rotor wash can affect the vegetation in monarch habitat, and subsequently fitness of individual monarchs, by bludgeoning vegetation, particularly milkweed and nectar resources with wind speeds of up to 120 mph. Based on the continued existence of open habitats such as grasslands on military installations where helicopters land and hover frequently, it is unlikely that this activity completely removes the vegetation. However, there is no information to determine whether rotor wash removes flower heads or damages stems to nectar resources and monarch host plants. Without further information to analyze this potential effect, it is impossible to determine whether this activity has a significant effect on the vegetative community. Similarly, analyzing the effects of rotor wash on eggs, larvae, and pupa is difficult because of their inconspicuous nature. However, there is peer-reviewed published research attesting to the incredible strength of insects to hold on to even smooth surfaces (e.g., Federle and Endlein 2004; Van Griethuijsen and Trimmer 2014). Rotor wash may displace adult monarch butterflies, force them to land, or cause injury and/or mortality by thrusting them into objects. Due to their small size and large footprint of the Action Area it is not feasible to estimate the number of adult monarchs that could be injured or killed by rotor wash.

6.5.1.10 Collisions/Strikes/Crushing

Various military training operations could result in collisions or strikes of adult butterflies, including use of vehicles on the ground or in the air. Early life stages could be crushed through activities including ground training, impact areas, and construction and maintenance activities as described above in 6.5.1.6 Soil and/or Ground Disturbance. For adults, the risks associated with monarch collision with vehicles is described above in 6.1.1. Human-induced, Unintentional Disturbance – Including Noise and Vehicle Mortality and 6.5.1.9 Rotor Wash.

6.5.1.11 Digging

Digging is a stressor that can occur during many different mission and mission sustainment activities, including defensive fighting positions (foxholes), containment clean-up response, utility line placement, etc. All digging requires dig permits, which are reviewed for activities in areas where they may affect threatened and endangered species. Additionally, it is generally standard operating procedure to repair and revegetate areas that are dug up with native plants. Digging has the potential to affect monarchs both directly by killing or injuring eggs, larvae, and

pupa and indirectly by unearthing and killing or injuring nectar resources and host plants that could have been used by monarchs during various life history stages.

6.5.2 Summary of Effects from Military Mission and Sustainment Activities

Consistent with their authorities under the Sikes Act, implementation of the Strategy (including all conservation measures and BMPs) cannot result in a loss of the capability of military installation lands to support the mission of the installation. An overarching conservation measure of the Strategy is to continue to maintain, enhance, and/or increase monarch habitat and will limit habitat loss in instances where the mission requires permanent loss of habitat [emphasis added]. Training can result in the loss of habitat or direct interaction (e.g., crushing, collision), depending on the activity, but training often occurs in regularly utilized areas. When habitat loss happens in other areas, it is DOD procedure to repair and restore the land following its use. Further, these impacts are limited in terms of size compared with the extensive habitat that remains intact. Disturbance and restoration can result in creation and maintenance of habitat for many species, including monarch. Decades of implementation demonstrate the compatibility of military mission implementation and conservation.

6.6 IMPORTANCE OF ADAPTIVE MANAGEMENT

The Strategy includes principles of adaptive management to ensure it meets its goal to continue to conserve the monarch butterfly on DOD lands, while ensuring no net loss in the capabilities of the military missions and sustainment actions, through current and ongoing ecosystem management on a large scale, funding research, conducting outreach, and developing strategic partnerships.

From the DOD Strategy:

> (From the Strategy's Timeline and Revision section)
>
> Future and ongoing research will continue to modify the understanding of the needs of monarchs at the individual, population, and species levels as well as how these populations interact (i.e., genetics) and the factors that can influence monarchs during breeding, migration, and overwintering. It is imperative that new information and data is incorporated into this Strategy so DOD can adjust activities and, if needed, locations of emphasis to ensure that DOD conservation efforts maximize outcomes for monarch.
>
> To ensure this happens, DOD will regularly reevaluate this Strategy to ensure it continues to meet the standards of 7(a)(1). DOD will revise the guidelines in this Strategy, as necessary, to be consistent with the final listing rule of the monarch butterfly, future Recovery Plans, or incorporation of the latest and best scientific data available. This Strategy will cover a period of 25 years but will be reviewed every five years, per the adaptive management process (Section IX) for applicability and continued alignment between DOD and USFWS on its content. During the review to determine whether updates are needed under 7(a)(1), if there is significant new information, DOD and the USFWS will also consider whether to reinitiate conference/consultation under 7(a)(2).

(From the Strategy's Adaptive Management Section)

The agencies will employ adaptive management principles, including monitoring and evaluation of appropriate information to accomplish the following objectives:

- Monitor and evaluate the conservation results of the Strategy and its implementation
- Adapt the implementing strategies as necessary to accomplish identified conservation outcomes in light of:
  - Military mission conflicts with Strategy implementation,
  - Changes in military mission needs, and
  - Changes to information regarding monarch population or species needs or threats
- If the regulatory status of monarch at the installation changes due to either an improvement or decline in species condition (which may be as a result of species condition changes on or off installation), adaptive management will be used to support adaptation of the Strategy as appropriate when the Strategy is reviewed every five years.

Adaptive management is crucial for this successful implementation of this long-term (25 years) Strategy because it allows for continuous learning and provides flexibility in response to changing environmental conditions and new scientific understanding. Given the complexities and uncertainties related to a wide-ranging migratory species, conservation strategies will need to adjust over time. Adaptive management involves monitoring the effectiveness of the Strategy's implementation, assessing outcomes, and adjusting actions based on new information on priority needs of the species. This iterative process helps ensure that conservation efforts remain relevant and effective, optimize resources, and increase the likelihood of successful conservation of the species in the long-term. By accommodating change and uncertainty, the Strategy can adapt as we learn more.

DOD is on the leading edge on conservation efforts for monarch by implementing decades of conservation efforts and developing and implementing their 7(a)(1) Strategy before the species is listed under ESA. The USFWS is developing resources for monarch as a candidate species, but many are still under development at the time of this Opinion's writing. As new information becomes available, we will work collaboratively with DOD to ensure we consider the new information and adjust as needed.

6.7 MONITORING AND REPORTING

The Strategy includes monitoring and reporting. Monitoring efforts targeted at assessing occupancy by monarchs or specific habitat information (e.g., milkweed surveys, nectaring plant surveys) will continue on installations where existing monarch conservation efforts or monitoring is currently taking place subject to availability of funds and as practicable. Monitoring and reporting on DOD installations for the purposes of gauging Strategy effectiveness will focus on 1) high level geospatial monitoring of grasslands across DOD installations in each MCU, 2) qualifying when and where management of potential habitat or implementation of BMPs is occurring, and 3) assessing status and trends of monarch butterflies

and/or their habitat in high priority areas (i.e., overwintering habitat and the Central Valley). The information collected from these efforts, along with new any new data and information about monarchs or their habitat needs, will be gathered and used during the Strategy review that will take place every five years during the 25-year duration of the Strategy.

6.7.1 Geospatial Monitoring of Grasslands

Prior to the five-year review, DOD will analyze remotely sensed geospatial data to assess changes in grassland to other landcover types within DOD installation boundaries in each MCU.

6.7.2 Monitoring of Monarch, Monarch Habitat, or other Pollinator Projects

Participation in the Strategy and high-level metrics about grasslands will be reported annually by the Military Services to the Office of the Secretary of Defense through Environmental Management Review data calls. Installation-specific monarch projects and implementation of BMPs will be shared via the INRMP Stage Consistency Check form (Appendix A) that will be shared by installation NRMs and USFWS during existing INRMP review meetings that already occur at least every five years.

6.7.3 Monitoring of High Priority Sites

Within the western MCUs, overwintering sites along the southern California coast serve as a critical area for maintaining the monarch population (USFWS 2020). The Central Valley is also important to the health of the western monarch population because it is limited in size compared to other areas and serves as a critical location for the first generation of monarchs each spring. In addition, a large proportion of the monarch habitat has been lost in the region (Pelton et al 2019; USFWS 2020). The installations that occur within these high priority areas in the west will be the priority of monitoring for monarch and their habitats. Installations in these areas will conduct both habitat and monarch surveys each year as practicable and subject to the availability of funds.

Breeding and Migratory

Installations within the Central Valley in the west, and conducting surveys for monarch or monarch habitat, will focus on collecting habitat metrics within general land types that have been identified by Monarch Conservation Science Partnership and the Integrated Monarch Monitoring Program (IMMP) as potential habitat for monarchs (unclassified grassland, rights-of-way, developed areas) and, when necessary, outside of these land types to monitor changes in vegetation from conservation efforts (Thogmartin et al. 2017; Cariveau et al. 2019). If not already involved, these installations will implement an IMMP monitoring program that was begun through MJV (see Strategy's Section VII(A)(7)) and will conduct sampling and reporting for a variety of metrics including:

- Milkweed density and diversity
- Flowering plant abundance and richness
- Monarch egg and larval densities
- Milkweed species preferences
- Adult monarch presence/absence
- Adult nectaring preferences

- Impact of conservation actions on habitat quality

Overwintering

Installations with either confirmed or suspected groves of overwintering monarchs who choose to survey will follow the survey methods and protocols outlined in the Xerces Society's WMC and Monarch Overwintering Habitat Assessment (https://westernmonarchcount.org/downloads/). Adherence to the recommended protocols outlined in the Strategy will help facilitate data collection and reporting and ensure consistency among results within and among sites and across years.

7 CUMULATIVE EFFECTS

Cumulative effects are those effects of future State or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area of the federal action subject to conference. [50 CFR 402.02 "Cumulative effects"]

The USFWS is not aware of any future State, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated. Future federal actions, unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Because all lands within the action area are administered by the Department of Defense, no cumulative effects are expected to occur.

8 INTEGRATION AND SYNTHESIS FOR THE MONARCH BUTTERFLY

The Integration and Synthesis section is the final step in assessing the risk posed to species and critical habitat because of implementing the Proposed Action. In this section, we add the effects of the action and the cumulative effects to the status of the species and critical habitat, and the environmental baseline, to formulate our opinion as to whether the Proposed Action is likely to: 1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or 2) result in the destruction or adverse modification of critical habitat. As monarch is a candidate for listing, there is no critical habitat to consider.

8.1.1 Status of the Species

The monarch butterfly in North America is generally in decline, with a particularly severe decline in the western U.S. Loss of breeding habitat (milkweed) from conversion of natural habitat into agricultural lands, loss of landscape wide nectar resources, loss of overwintering habitat in Mexico, exposure to pesticides, and climate change have led to declines of monarch numbers since detailed records began being kept in the mid-1990s. The recent SSA from the USFWS estimated a probability of extinction of 48 to 69 percent for migratory monarchs in eastern North America over the next 60 years, under current conditions (USFWS 2020). Low

abundance of monarchs along with important and unpredictable variations in abundance in eastern North America increase the risk of quasi-extinction (Thogmartin 2024). For monarchs in the west, modeled probability of extinction was 60 to 68 percent within the next 10 years, and 99 percent over the next 60 years under current conditions. See Status of the Species section for further details on Status.

8.1.2 Baseline

Baseline numbers of monarchs vary widely across the Action Area, as do estimates of milkweed stems across the Action Area. Baseline estimates using habitat as a surrogate estimate approximately 1,800,000 acres of potential monarch habitat (grasslands) within the Action Area.

8.1.3 Action Effects

Adverse effects from land management activities would be to individuals in the form of mortality through loss of eggs, larvae, and pupae, as well as displacement, disturbance, and mortality of adults. These effects would occur where activities described above take place during the time of year when monarchs are present. Land management efforts ensure monarch resources (e.g., milkweed, nectar plants) are available across DOD lands and protect overwintering habitat within the Action Area. With implementation of the BMPs in the Strategy and continued implementation of existing DOD policies (e.g., related to limited use of pesticides), effects to monarch at the population level are expected to be beneficial overall and contribute to conservation of the species through creation and maintenance of suitable breeding, migration, and overwintering habitat across the continental U.S. range of the species. Long-term adverse population-level impacts are not anticipated from activities undertaken to establish, maintain, and manage grassland and other habitats occupied by monarch on DOD lands. Based on DOD's commitment to the Strategy and its goals, we anticipate maintaining or increasing the extent and quality of available habitat for monarch on DOD lands through the 25-year duration of the Strategy. DOD's extensive conservation programs provide additional lift to the conservation of monarch across the U.S. (both on installations and off-installations) through funding, outreach efforts, and strategic partnerships, in addition to the benefits from land management activities under the Sikes Act.

Military mission and sustainment activities (training and operations) were considered as part of this Opinion. The nature and extent of these activities vary widely across installations, within installation boundaries over time, and based on the mission requirements, which change as military preparedness requirements change. Loss of monarch habitat will be limited to when necessary for mission fulfillment. When monarch habitat loss is necessary to fulfill mission requirements, it is DOD procedure to repair and restore the land following its use, when possible. The extent of these impacts is limited in terms of size when compared with the extensive habitat that remains undisturbed by military training across the DOD land base, and restoration of monarch habitat following use will ensure loss of habitat is likely short term. When considered in the context of the last decades of implementation of the military mission across the Action Area, the extent of military mission training and operations activities are small when compared to the totality of lands owned by DOD, ensuring vast areas of suitable grasslands exist spatially and temporally across the Action Area. For the duration of the 25-year Strategy, we anticipate the

extent of training and nature of activities to be consistent with past efforts and our analysis in this Opinion. The future of national defense and efforts necessary for military training and testing, however, are never certain and could change at any time; reinitiation of conference/consultation will follow 50 CFR 402.16 (required if monarch is listed).

8.1.4 Cumulative Effects

We did not anticipate any cumulative effects because all lands within the Action Area are administered by DOD and subject to future section 7 consultation should monarch be listed.

8.2 CONCLUSION

After reviewing the current status of the monarch, the environmental baseline for the Action Area, the effects of the Proposed Action and the cumulative effects, it is the USFWS's opinion that the action, as proposed, is ***not likely to jeopardize the continued existence*** of the monarch. We base our conclusion on the following:

- Monarch is currently a candidate species. Based on the past annual censuses, the eastern migratory population has been generally declining over the last 29 years. Similarly, the western migratory population has also been generally declining over the same number of years, despite an increasing number of sites being surveyed.
- Baseline numbers of monarchs vary widely across the Action Area, as do estimates of milkweed stems across the Action Area. Baseline estimates using habitat as a surrogate estimate approximately 1,800,000 acres of potential monarch habitat (grasslands) within the Action Area.
- We did not anticipate any cumulative effects because all lands within the Action Area are administered by DOD and subject to future section 7 consultation should monarch be listed.
- DOD committed to maintaining, enhancing, or increasing the extent and quality of available habitat for monarch through the 25-year duration of the Strategy, contingent upon appropriations and when consistent with their mission.
- Short-term impacts to monarch as a result of natural resource management efforts are expected to be minimal due to implementation of BMPs that minimize potential adverse effects and often lead to improved habitat quality over time:
    - Adhering to timing windows for management activities to avoid when monarchs are likely present.
    - Control extent of the management actions that will negatively impact monarch when present to allow for areas of refugia.
    - Reduce or eliminate use of pesticides in areas with monarch.
    - Increase, by planting or land management activities, native milkweed in breeding areas and nectar plans when monarchs are present to provide needed resources.
    - Extensive monitoring, protection, and management efforts within overwintering and Central Valley areas of California.
- Long-term benefits are expected through maintaining and enhancing monarch habitat on a landscape scale (approximately 1,800,000 acres of grasslands across the Action Area).

- Mission sustainment and operations efforts vary widely and are hard to quantify. Decades of implementation, however, demonstrate the compatibility of military mission implementation and conservation. DOD has a long and successful history of managing natural resources on its lands to support military mission requirements, while simultaneously conserving and maintaining biodiversity.
- Loss of monarch habitat as a result of mission and mission sustainment activities will be limited. When monarch habitat loss is necessary to fulfill mission requirements (e.g., use for training), it is DOD procedure to repair and restore the land following its use, to the greatest extent practicable.
- The extent of mission and mission sustainment activity impacts are limited in terms of size when compared with the extensive habitat that remains intact across the DOD land base, and restoration of monarch habitat following use will ensure loss of habitat is likely short term.
- Mission and mission sustainment activities do not always result in negative outcomes for species and their habitats, including the monarch. In many instances military training activities mimic traditional and/or historic ecosystem processes such as pyric herbivory. While these processes often result in some loss of vegetation quality or quantity, these losses are generally short-term and eventually result in a net gain through increases in open grassland habitat, reduction in woody vegetation, and increases in native forbs including milkweed and other important nectar resources for monarch.

In summary, DOD's extensive land management action under Sikes Act; implementation of existing policies and procedures that benefit pollinators, including monarch; and commitment to conservation programs (e.g., funding, outreach efforts, and strategic partnerships) all contribute to the conservation of monarch. Through their 7(a)(1) Strategy, DOD commits to measures to benefit monarch over the next 25 years. These commitments are proactive and voluntary (i.e., for a candidate species, not required by regulations) and extensive in geographic area. Effects resulting from activities associated with mission and mission sustainment activities are difficult to estimate or quantify at the programmatic level, but are not expected to result in significant permanent loss of habitat in the long term.

9 INCIDENTAL TAKE STATEMENT

In a conference opinion, the USFWS provides its finding as to whether the proposed action is likely to jeopardize the continued existence of a proposed species (or the destruction or adverse modification of proposed critical habitat). ESA take prohibitions do not apply to candidate or proposed species. An opinion issued at the conclusion of the conference may be adopted as the biological opinion when the species is listed or critical habitat is designated, but only if no significant new information is developed (including that developed during the rulemaking process on the proposed listing or critical habitat designation) and no significant changes to the federal action are made that would alter the content of the opinion. An incidental take statement provided with a conference opinion does not become effective unless the USFWS adopts the opinion once the listing is final.

For this conference, we are not providing an incidental take. If the monarch is listed, we will develop an incidental take statement as part of the process of adopting the Conference Opinion as a Biological Opinion or explain how incidental take will be addressed via a stepdown consultation process for individual INRMPs or projects (see also Reinitiation Notice).

10 NEXT STEPS AND INRMP INTEGRATION

Under the Sikes Act, the DOD is required to develop and implement INRMPs in cooperation with the USFWS and the respective State fish and wildlife agency for installation with significant natural resources. The plans represent the mutual agreement of the three parties and are reviewed for operation and effect at least once every 5 years. In addition to these processes under the Sikes Act, USFWS and DOD conduct section 7 consultation under the ESA on INRMP projects implemented in the furtherance of the INRMP, when appropriate, to ensure DOD installation activities are not likely to jeopardize the continued existence of any listed or proposed species, or adversely modify or destroy designated or proposed critical habitat. The Strategy will be integrated into DOD's exiting ESA, Sikes Act, or other applicable procedures (e.g., INRMP or NEPA review) and the process may vary based on the branch of Military Service and whether or not an installation has an INRMP. DOD will work with USFWS over the next 3 months to develop a process by which their Strategy will be delivered to installations, both with and without INRMP requirements, for implementation. Appendix A is an example draft form that USFWS and DOD may use or adapt to assist with this step-down process, or an alternative may be developed. The process will be documented and appended to this Opinion.

USFWS and DOD worked collaboratively to develop the Strategy and this Conference Opinion, and will continue to work together to ensure implementation of the Strategy contributes to conservation of monarch through a strong commitment to adaptive management. If the status of monarch changes, both agencies are committed to continued revision, or reinitiation as applicable (see Reinitiation), to include future adoption of this conference opinion as a biological opinion covering the Strategy and military mission and sustainment, upon listing of monarch as threatened or endangered. This proactive voluntary conference assists both agencies by continuing DOD's contributions to recovery of monarch while simultaneously ensuring necessary flexibility and sustainability for military actions through streamlining ESA procedures.

It was not practical to consider effects to other listed species as part of this Opinion, given the large extent of DOD lands and potential monarch habitat (and corresponding number of listed species) across the country. DOD will continue to follow existing ESA procedures for other listed species and will document their review as appropriate.

11 CONSERVATION RECOMMENDATIONS

Secion7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an Action Agency may

undertake to avoid or minimize the adverse effects of a Proposed Action, implement recovery plans, or develop information that is useful for the conservation of listed species. The USFWS offers the following recommendation that is relevant to the candidate species addressed in this CO and that is consistent with the authorities of the DOD:

1) Monitoring of monarch

The Strategy's monitoring plan focuses on the Central Valley and overwintering MCUs within the Western Population. While monitoring of these highest priority areas is imperative, monitoring within other parts of the range of monarch is also important to the collective understanding of the species' status. Many installations are already monitoring and should continue to do so when resources allow. Any reporting is valuable to our understanding of monarch distribution and status (e.g., when you see an adult monarch, report through Journey North).

For the Western Population, in addition to the Strategy's monitoring plan of the Central Valley and Overwintering MCUs, monitoring within the West Core and West Exterior MCUs is also recommended, when possible. Similarly, additional data on monarchs in the Eastern Population will contribute to our understanding of the species. Monarchs have been observed utilizing multiple behavioral strategies in the eastern U.S. including migratory, summer breeding, winter breeding, and resident, non-migratory populations (Satterfield et al. 2015; Kendrick and McCord 2023; Steele et al. 2023). These shifts in migratory strategies in the eastern U.S. population are still being investigated, but interactions between populations have important implications for disease dynamics, habitat restoration, and understanding future conditions that may impact the resiliency and long-term persistence of the eastern monarch population.

Consider collecting habitat metrics within general land types that have been identified by Monarch Conservation Science Partnership and the IMMP as potential habitat for monarchs (unclassified grassland, rights-of-way, developed areas) and, when necessary, outside of these land types to monitor changes in vegetation from conservation efforts (Thogmartin et al. 2017; Cariveau et al. 2019). If not already involved, installations should implement an IMMP monitoring program that was begun through MJV and conduct sampling and reporting for a variety of metrics including:

- Milkweed density and diversity
- Flowering plant abundance and richness
- Monarch egg and larval densities
- Milkweed species preferences
- Adult monarch presence/absence (including winter occurrences in southeast) reporting through Journey North
- Adult nectaring preferences
- Impact of conservation actions on habitat quality

12 REINITIATION NOTICE

This concludes the voluntary conference for DOD's approval and implementation of their 7(a)(1) Conservation Strategy and military activities. DOD may ask USFWS to adopt the conference opinion as a biological opinion if the species is listed. The request must be in writing. If USFWS determines there have been no significant changes in the action as planned or in the information used during the conference, USFWS will confirm the conference opinion as the biological opinion for the project and no further section 7 consultation will be necessary.

Because this Opinion does not include critical habitat, if critical habitat is proposed or designated, that represents new information for which we will need to address effects in any future biological opinion. In addition, USFWS is not providing an incidental take statement with this conference opinion, so an incidental take statement will need to be added to the updated biological opinion, as appropriate. If the monarch is listed, the USFWS can work with DOD to address these matters, in addition to the normal factors that the USFWS considers when determining whether it will adopt a conference opinion as a biological opinion [see 50 CFR 402.10(d)]. If we are unable to estimate take for a DOD action covered under the updated biological opinion at the programmatic level, additional, action-specific consultation may be necessary for certain activities in order to provide incidental take exemptions for them.

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Appendix A.

As described in the Conference Opinion, the Strategy will be integrated into DOD's exiting ESA, Sikes Act, or other applicable procedures (e.g., INRMP or NEPA review) and the process may vary based on the branch of Military Service and whether or not an installation has an INRMP. DOD will work with USFWS over the next 3 months to develop a process by which their Strategy will be delivered to installations, both with and without INRMP requirements, for implementation. This appendix is an example draft form that USFWS and DOD may use or adapt to assist with this step-down process, or an alternative may be developed.

DOD's 7(a)(1) Conservation Strategy for Monarch – DRAFT INRMP Stage Consistency Check

Purpose: This form documents consistency with Department of Defense's (DOD's) 7(a)(1) Conservation Strategy (Strategy) [add hyperlink] for monarch butterfly (*Danaus plexippus*), and the associated Conference Opinion (Opinion) [add hyperlink]. The Strategy and Opinion covers all land management under Sikes Act authorities and monarch conservation programs (outreach, funding, research, partnerships) as outlined in the Strategy. The intent of this form, along with the Natural Resource Manager Monarch Screening Criteria (Appendix D in Strategy) is to assist Natural Resource Managers in documenting consistency with the Strategy and to aid in communication regarding installation-level details with their local U.S. Fish and Wildlife Service (USFWS) Field Office during the Integrated Natural Resource Management Plan (INRMP) review process.

The goal of the Strategy is to continue to conserve monarch butterfly on DOD lands, while ensuring no net loss in the capabilities of the military missions and mission sustainment activities, through current and ongoing ecosystem management on a large scale, funding research, conducting outreach, and developing strategic partnerships.

To achieve these goals, the Strategy includes four overarching conservation commitments, as well as Best Management Practices (BMPs) that can be found here [add link].

Strategy overarching conservation efforts:

- DOD will continue to maintain, enhance, and/or increase monarch habitat and will limit habitat loss in instances where the mission requires permanent loss of habitat.
- DOD will conduct land management practices that provide resilient native ecosystems in accordance with the Sikes Act, DOD, and Military Service Policies and will directly consider conservation benefits for monarchs.
- DOD will implement applicable BMPs in suitable habitat for monarchs.
- DOD will continue to contribute to monarch conservation by conducting outreach activities, participating in partnerships, and contributing to research.

Background on voluntary conferencing for candidate or proposed species:

Conference requirements: A conference is a procedure under section 7(a)(4) of the Endangered Species Act (ESA) related to a proposed species or proposed critical habitat. An Action Agency can voluntarily conference for candidate species and conference when the action is not likely to result in jeopardy. Having a conference opinion can help the Action Agency (DOD) and the USFWS gain efficiencies in the consultation process and expedite consultation requirements for when a species is listed or critical habitat is designated.

ESA section 7(a)(4): Each agency shall confer with the Secretary on any agency action which is likely to jeopardize the continued existence of any species proposed to be listed under section 4 or result in the destruction or adverse modification of critical habitat proposed to be designated for such species.

Jeopardy: To engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing reproduction, numbers, or distribution of that species [50 CFR 402].

This form is valid while monarch is a candidate or proposed species. An updated form will be needed upon publication of a final rule listing monarch as threatened or endangered.

Name of installation: _____

1. **Determine potential for monarch habitat and presence. Does your installation have breeding, migratory, and/or overwintering monarch habitat present?**

The Strategy defines monarch breeding and migratory habitat as "grassland and other areas that have nectar resources and/or milkweed present at the time of year monarchs are present on the landscape." This could include forested areas, wetlands, or shrub/scrub areas, among others. Unsuitable habitat in the Strategy is defined as "developed areas that include but are not limited to some cantonment areas, some housing areas, industrial areas, highly developed training sites, and developed testing facilities." The installation also has the option to verify the absence of monarch habitat by utilizing the Integrated Monarch Monitoring Protocol (IMMP) sampling procedures for evaluating milkweed and blooming plant surveys once per month during the months when monarchs can be present (Monarch Joint Venture 2024; https://monarchjointventure.org/mjvprograms/science/integrated-monarch-monitoring-program/field-activities-protocols).

Overwintering habitat in the U.S. occurs along the Pacific coast of California. Overwintering sites have specific characteristics and the microclimate, location, and structure provided by these sites are necessary for overwintering monarch survival. The species composition of overwintering groves includes blue gum eucalyptus (*Eucalyptus globulus*), Monterey pine (*Pinus radiata*), and Monterey cypress (*Hesperocyparis macrocarpa*). For a more detailed description of monarch overwintering habitat see Section IV(B)(1) of the Strategy.

☐ Yes, potential habitat is present. *If your installation is in California, continue to question 2. Everywhere else in continental U.S., continue to number 6.*

☐ No, there is no monarch habitat on my installation. *Go to number 11 (conservation programs).*

2. **In California: Determine if your installation falls within potential overwintering areas or within the Central Valley (see Figure 1 or Monarch Conservation Opportunities Tool v.1).**

☐ My installation is within overwintering area: *Go to number 3.*

☐ My installation is within the Central Valley: *Go to number 5.*

☐ My installation is in California but outside of overwintering and Central Valley areas: *Go to number 6.*

3. Do you have overwintering habitat?

☐ No, my installation does not have overwintering habitat. *Go to number 6.*

☐ Yes, my installation has overwintering monarch habitat: *Go to number 4.*

4. Overwintering sites are especially important to monarch conservation. Can you implement the following BMPs and monitoring to be consistent with the Strategy, (as practicable and subject to the availability of funds?):

> **Strategy BMPs:** See Overwintering Management BMPs in Screening Criteria (Appendix D of Strategy) [Add Link to BMPs from Strategy here for easy access].
>
> **Strategy Monitoring:** Installations with either confirmed or suspected groves of overwintering monarchs who choose to survey will follow the survey methods and protocols outlined in the Xerces Society's Western Monarch Count (WMC) and Monarch Overwintering Habitat Assessment (https://westernmonarchcount.org/downloads/). Adherence to the recommended protocols outlined within the Strategy and other supporting documents will help facilitate data collection and reporting, ensure consistency among results within and among sites as well as across years.

☐ No, my installation cannot implement BMPs or monitoring and is not consistent with the Strategy or Opinion. Consult with your local USFWS Field Office.

☐ Yes, my installation is consistent with the Strategy for overwintering site management (BMPs) and monitoring. *Continue to number 6.*

5. Monitoring in early breeding zones in the Central Valley (Figure 1) is a priority in the Strategy. Can you implement the following, as practicable and subject to the availability of funds?

> **Strategy Monitoring:** Within the western Monarch Conservation Units (MCUs), overwintering sites along the southern California coast serve as a critical area for maintaining the monarch population (Figure 1). The Central Valley is also important to the health of the western monarch population because it is limited in size compared to other areas and serves as a critical location for the first generation of monarchs each spring. In addition, a large proportion of the monarch habitat has been lost in the

region). The installations that occur within the Central Valley and overwintering MCUs in the west (see Figure 1, and Appendix A in the Strategy) will be the highest priority for monitoring monarch and their habitats. Installations in these areas will conduct both habitat and monarch surveys each year as practicable and subject to the availability of funds.

Breeding and Migratory

Installations that fall within the Central Valley in the west (Figure 1) and are conducting surveys for monarch or monarch habitat will focus on collecting habitat metrics within general land types that have been identified by Monarch Conservation Science Partnership and the IMMP as potential habitat for monarchs (unclassified grassland, rights-of-way, developed areas) and, when necessary, outside of these land types to monitor changes in vegetation from conservation efforts. If not already involved, these installations will implement an IMMP monitoring program (see Section VII(A)(7)) and will conduct sampling and reporting for a variety of metrics including:

- Milkweed density and diversity
- Flowering plant abundance and richness
- Monarch egg and larval densities
- Milkweed species preferences
- Adult monarch presence/absence
- Adult nectaring preferences
- Impact of conservation actions on habitat quality

☐ No, my installation cannot implement monitoring and is not consistent with the Strategy or Opinion. Consult with your local USFWS Field Office.

☐ Yes, my installation is consistent with the Strategy. *Continue to number 6.*

6. **Using your site-specific knowledge of your installation, estimate the acres of monarch habitat on your installation.** See definition of monarch habitat from the Strategy in number 1. It is okay to estimate using remote landcover data if that represents the best available information for your installation. (See Conference Opinion Appendix A for an estimate of grassland landcover on your installation). *Continue to number 7.*

_____

7. **Identify actions that could impact monarch under the Strategy and estimate acres of each land management activity in potential monarch habitat on your installation.** Enter N/A if not applicable to your installation. *Continue to number 8.*

Activity	Conducted on your installation? (Y/N)	Estimated acres of activity in monarch habitat, if applicable
Mowing and haying grasslands		
Grazing		
Row crop production		
Prescribed fire		
Invasive species control including herbicides		
Application of pesticides and insecticides		
Grassland restoration activities		

8. **For each action you identified in the above table as an activity conducted on your installation, review the corresponding BMP list [add hyperlink for easy access].** Per the Strategy, these BMPs are to be implemented to the greatest extent practicable contingent on sufficient appropriations and prioritization of mission fulfillment. If you cannot implement BMPs per the Strategy, provide details here (enter details below or attach).

☐ My installation is able to implement some of the BMPs but not all due to insufficient appropriations or conflicts with mission fulfillment; provide details below.

☐ My installation is not able to implement BMPs due to insufficient appropriations or conflicts with mission fulfillment; provide details below.

☐ Yes, my installation is consistent with the Strategy. *Continue to number 9.*

9. **USFWS recommends monitoring throughout the range to contribute to our understanding of the species.** Although not required as part of the Strategy, monitoring is a conservation recommendation for all areas within the range of monarchs to provide important information on the species distribution and habitat availability. If feasible, Natural Resource Managers should consider the following recommended monitoring protocols to aid in recovery of the species. Any reporting is valuable to our understanding of monarch distribution (e.g., when you see an adult monarch, report through Journey North). *Continue to number 10.*

Conference Opinion Conservation Recommendation:

The Strategy's monitoring plan focuses on the Central Valley and overwintering MCUs within the Western Population. While monitoring of these highest priority areas is imperative, monitoring within other parts of the range of monarch is also important to the collective understanding of the species' status. Many installations are already monitoring and should continue to do so when resources allow. Any reporting is valuable to our understanding of monarch distribution (e.g., when you see an adult monarch, report through Journey North).

For the Western Population, in addition to the Strategy's monitoring plan of the Central Valley and overwintering MCUs, monitoring within the West Core and West Exterior MCUs is also recommended, when possible. Similarly, additional data on monarchs in the Eastern Population will contribute to our understanding of the species. Monarchs have been observed utilizing multiple behavioral strategies in the eastern U.S. including migratory, summer breeding, winter breeding, and resident, non-migratory populations (Satterfield et al. 2015; Kendrick and McCord 2023; Steele et al. 2023). These shifts in migratory strategies in the eastern U.S. population are still being investigated, but these interactions between populations have important implications for disease dynamics, habitat restoration, and understanding future conditions that may impact the resiliency and long-term persistence of the eastern monarch population.

Consider collecting habitat metrics within general land types that have been identified by Monarch Conservation Science Partnership and the IMMP as potential habitat for monarchs (unclassified grassland, rights-of-way, developed areas) and, when necessary, outside of these land types to monitor changes in vegetation from conservation efforts (Thogmartin et al. 2017; Cariveau et al. 2019). If not already involved, these installations should implement an IMMP monitoring program that was begun through MJV and conduct sampling and reporting for a variety of metrics including:

- Milkweed density and diversity
- Flowering plant abundance and richness
- Monarch egg and larval densities
- Milkweed species preferences
- Adult monarch presence/absence (including winter occurrences in southeast) reporting through Journey North
- Adult nectaring preferences
- Impact of conservation actions on habitat quality

10. **Consider other listed species separately**. Effects to other listed species must be considered pursuant to section 7 of the ESA via a separate consultation. *Continue to number 11*.

11. **Provide additional details about monarch conservation activities on your installation, e.g., conservation program actions (outreach, partnerships, research, funding) that**

benefit monarch and other pollinators. Enter details below or attach. *Continue to number 12.*

12. Consider military training and operations actions that may affect monarch (i.e., occur in monarch habitat on your installation during the time of year monarch is present in your area) that occur outside of regularly utilized training areas. Are the effects to monarch consistent with the effects analyzed in the Conference Opinion (i.e., ground-based training, aviation training, impact areas, and construction and maintenance) (see section 6.5 of the Conference Opinion [link])?

    ☐ Yes, military mission and sustainment actions are consistent with analysis of potential effects in Conference Opinion and are not at the level of jeopardy. *Continue to number 13.*

    ☐ No, military mission and sustainment actions are not consistent with Conference Opinion but do not rise to the level of jeopardy. *Continue to number 13.*

    ☐ No, military mission and sustainment actions are not consistent with Conference Opinion and are significant enough to need to closely evaluate jeopardy standard. Confer with local Field Office.

13. Participation in the Strategy and high-level metrics about grasslands will be reported annually by the Military Services to Office of the Secretary of Defense (OSD) through Environmental Management Review (EMR) data calls. Installation-specific monarch projects and implementation of BMPs will be shared via this INRMP Stage Consistency Check form that will be shared between installation Natural Resource Managers and USFWS during existing INRMP review meetings.

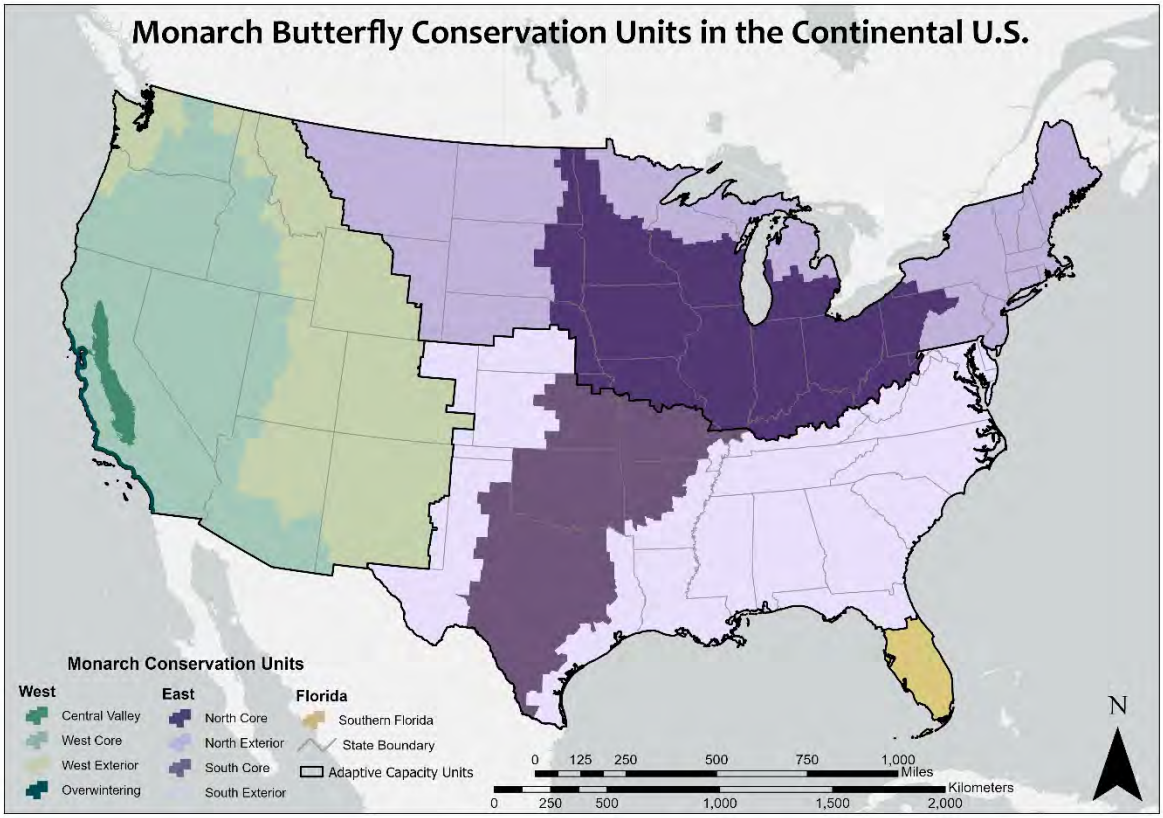


Figure 1: Monarch Conservation Units delineated by U.S. Fish and Wildlife Service to display approximate boundaries of areas important to monarchs (*Danaus plexippus*) and to aid in prioritizing needs across the species range in the continental U.S. Specifically, overwintering and Central Valley are the highest priority for the western population; "Core" areas have higher priority across the range than "Exterior" areas, although all areas can contribute to monarch conservation.

Appendix B. DOD installations in continental U.S. with estimated grassland acres

The following table shows Department of Defense (DOD) installations in the continental United States with Integrated Natural Resource Management Plan (INRMP) requirements. It includes the INRMP name, branch of service, state the installation is covered under the INRMP is located, approximate installation acreage followed by approximate grassland acres in parentheses, and the monarch conservation unit (MCU) the installation falls within. Approximate installation acreages were derived using the FY 2021 Defense Installation Spatial Data Infrastructure (DISDI) DOD_Site_Locations_Boundaries shapefile. Likewise, approximate grassland acres were calculated using the 2022 LANDFIRE Existing Vegetation Type data layer, specifically the EVT_PHYS attribute. After review of the LANDFIRE data, it was determined that the landcover types 'Grassland' and Exotic Herbaceous' best estimated grasslands in the continental United States and on installations. In turn, the landcover types 'Grassland' and Exotic Herbaceous' were combined to generate estimates of grassland acres. It is important to note that some installations are not contiguous and are comprised of geographically separated units (GSUs). For example, 88th Readiness Division installations are comprised of hundreds of GSU's that are dispersed across multiple states and subsequently have GSUs in more than one MCU. These installations are denoted by an (*) in the table. While the 88th Readiness Division installations are an extreme example, other installations with fewer GSUs and/or GSUs within the same state still had the potential to fall within different MCUs. These installations were placed into one of the nine MCUs. Additionally, some installations were missing from the DOD_Site_Locations_Boundaries shapefile such as Camp Peary. In these instances, approximate installation acres and grassland acres are not provided and denoted by a (-) in the table. Finally, the last row in the table contains the approximate installation acres as well as grassland acres for sites **NOT** covered by an INRMP. These installations were located within all MCUs and distributed across the continental United States in many different states. The branch of service of these installations is denoted by (***) in the table and the different branches of service are outlined in the Key at the end of the table.

INRMP Name	Branch of Service	State	~ Acres	MCU
102IW INRMP Otis Department of Air Force Base	Department of Air Force	MA	3,600 (2)	North Exterior
179AW Mansfield LAHM Department of Air Force Base	Department of Air Force	OH	300 (13)	North Core
Cannon Air Force Base and Melrose Air Force Range	Department of Air Force	NM	75,400 (65,900)	South Exterior
Barry M. Goldwater Range	Department of Air Force	AZ	1,050,300 (5,500)	West Core
Camp Adair Training Site	Army National Guard	OR	530 (25)	West Exterior
Camp Curtis Guild Training Site	Army National Guard	MA	700 (6)	North Exterior
Camp Grayling Maneuver Training Center	Army National Guard	MI	147,100 (11,100)	North Exterior
Camp Rilea Training Site	Army National Guard	OR	1,900 (200)	West Exterior
Camp Ripley Training Site	Army National Guard	MN	52,800 (4,000)	North Core
Camp Roberts	Army National Guard	CA	42,600 (24,000)	West Core
Camp San Luis Obispo	Army National Guard	CA	5,500 (2,000)	West Core
Clarks Hill Training Center	Army National Guard	SC	900 (20)	South Exterior
Department of the Air Force USAF Academy	Department of Air Force	CO	19,400 (4,500)	West Academy
Department of the Air Force Space Launch Delta 45	Department of Air Force	FL	19,000 (1,500)	Southern Florida
Department of the Air Force Arnold Engineering Development Complex	Department of Air Force	TN	38,900 (4,300)	South Exterior
Department of the Air Force Buckley - Cape Cod Space Force Station	Department of Air Force	MA	100 (0)	North Exterior
Department of the Air Force Davis-Monthan	Department of Air Force	AZ	10,600 (150)	West Core
Department of the Air Force Plan FE Warren	Department of Air Force	WY	5,900 (3,600)	North Exterior
Department of the Air Force MacDill	Department of Air Force	FL	5,700 (100)	Southern Florida
Department of the Air Force Scott Air Force Base	Department of Air Force	IL	3,000 (50)	North Core
Department of the Air Force Sheppard Air Force Base	Department of Air Force	TX	4,600 (1,000)	South Core
U.S. Army Garrison Fort Belvoir	U.S. Army	VA	9,200 (150)	South Exterior
Alpena Combat Readiness Training Center Department of Air Force Base	Department of Air Force	MI	700 (15)	North Exterior
Bangor Department of Air Force Base	Department of Air Force	ME	300 (<1)	North Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Fort Walker (formally Fort A.P. Hill)	U.S. Army	VA	74,600 (2,500)	South Exterior
Fort Custer Training Center	Army National Guard	MI	7,500 (300)	North Core
Fort Cavazos (formally Fort Hood)	U.S. Army	TX	219,350 (43,000)	South Core
Fort Indiantown Gap National Guard Training Center	Army National Guard	PA	18,000 (650)	North Exterior
Fort Leavenworth	U.S. Army	KS	5,700 (200)	South Core
Fort McCoy	U.S. Army Reserve	WI	59,700 (10,000)	North Core
Fort Wolters	Army National Guard	TX	4,100 (800)	South Core
Hill Air Force Base	Department of Air Force	UT	967,700 (18,500)	West Core
Volk Field Combat Readiness Training Center and Hardwood Weapons Range	Department of Air Force	WI	9,500 (300)	North Core
Fort Novosel (formally Fort Rucker)	U.S. Army	AL	58,150 (1,500)	South Exterior
Columbus Air Force Base	Department of Air Force	MS	5,300 (75)	South Exterior
Camp Ravenna Joint Military Training Center	Army National Guard	OH	21,700 (250)	North Core
Barnes Department of Air Force	Department of Air Force	MA	90 (<1)	North Exterior
Burlington Department of Air Force Base	Department of Air Force	VT	300 (2)	North Exterior
Camp Blanding	Army National Guard	FL	73,900 (13,000)	South Exterior
Fogarty Training Site	Army National Guard	RI	400 (5)	North Exterior
Camp Williams	Army National Guard	UT	24,150 (700)	West Exterior
Sparta Training Area	Army National Guard	IL	2,700 (1,000)	North Core
Fort Campbell	U.S. Army	TN	104,700 (7,200)	South Exterior
Fort Carson and the Pinon Canyon Maneuver Site	U.S. Army	CO	373,450 (282,000)	West Exterior
Gulfport Combat Readiness Training Cetner	Department of Air Force	MS	400 (0)	South Exterior
Jacksonville Department of Air Force Base	Department of Air Force	FL	550 (6)	South Exterior
Pease Department of Air Force Base	Department of Air Force	NH	220 (<1)	North Exterior
Pittsburgh Department of Air Force	Department of Air Force	PA	200 (<1)	North Core

INRMP Name	Branch of Service	State	~Acres	MCU
Portland Department of Air Force Base	Department of Air Force	OR	225 (0)	West Exterior
Smoky Hill Department of Air Force Range	Department of Air Force	KS	34,000 (27,100)	South Core
177th Fighter Wing Warren Grove Bombing Range, Coyle Field, and Atlantic City Department of Air Force	Department of Air Force	NJ	10,500 (1,300)	North Exterior
182nd Airlift Wing Department of Air Force Base	Department of Air Force	IL	400 (10)	North Core
Anniston Army Depot	U.S. Army	AL	15,600 (150)	South Exterior
Battle Creek Department of Air Force Base	Department of Air Force	MI	320 (20)	North Core
Bradley Department of Air Force Base and Orange Department of Air Force Station	Department of Air Force	CT	170 (2)	North Exterior
Brigadier General Thomas B. Baker Training Facility	Army National Guard	MD	-	South Exterior
Camp Atterbury Joint Maneuver Training Center	Army National Guard	IN	35,000 (3,000)	North Core
Camp Bowie	Army National Guard	TX	9,000 (2,600)	South Core
Camp Dawson Army Training Site	Army National Guard	WV	8,500 (200)	North Core
Camp Edwards Training Site	Army National Guard	MA	20,600 (800)	North Exterior
Camp Gruber Training Center	Army National Guard	OK	33,500 (4,300)	South Core
Plan Camp Maxey	Army National Guard	TX	6,500 (650)	South Core
Plan Camp Swift	Army National Guard	TX	11,750 (2,000)	South Core
Camps Beauregard, Minden, and Villere	Army National Guard	LA	32,000 (1,800)	South Exterior
Center for Security Forces Detachment Kittery (SERE East)	U.S. Navy	ME	12,500 (35)	North Exterior
Channel Islands Department of Air Force Station	Department of Air Force	CA	200 (20)	West Core
Command Sergeant Major Harold L Disney Training Center	Army National Guard	KY	550 (<1)	South Exterior
Defense Distribution Depot San Joaquin	U.S. Army	CA	1,000 (3)	Central Valley
Defense Fuel Support Point San Pedro	U.S. Navy	CA	350 (100)	West Core
Delaware Army National Guard Bethany Beach Training Site	Army National Guard	DE	100 (<1)	South Exterior
Delaware Army National Guard River Road Training Site	Army National Guard	DE	200 (15)	South Exterior

Devens Reserve Forces Training Area	U.S. Army Reserve	MA	5,100 (360)	North Exterior
INRMP Name	Branch of Service	State	~Acres	MCU
Eastern Kentucky Training Site	Army National Guard	KY	550 (5)	North Core
Fires Center of Excellence and Fort Sill	U.S. Army	OK	93,750 (66,000)	South Core
Naval Observatory Flagstaff Station	U.S. Navy	AZ	300 (0)	West Exterior
Integrated Natural Resources Management Plan for Camp Guernsey	Army National Guard	WY	78,900 (49,700)	North Exterior
Camp Murray	Army National Guard	WA	250 (0)	West Exterior
Defense Distribution Center Susquehanna	U.S. Army	PA	850 (<1)	North Exterior
Edwards Air Force Base	Department of Air Force	CA	308,500 (2,400)	North Core
Facilities in IL, IN, IA, MI, MN, MO, OH, and WI (USFWS Region 3)	U.S. Army Reserve	*	1,800 (1,400)	*
Fort Chaffee Maneuver Training Center	Army National Guard	AR	65,150 (9,700)	South Core
Homestead Air Reserve Base	Department of Air Force Reserve	FL	1,300 (40)	Southern Florida
Marine Corps Base Quantico	U.S. Marine Corps	VA	59,050 (500)	South Exterior
Marine Corps Logistics Base Albany	U.S. Marine Corps	GA	3,350 (100)	South Exterior
Naval Air Station Key West	U.S. Navy	FL	5,600 (60)	Southern Florida
Naval Air Station Patuxent River Complex's, Naval Air Station Patuxent River, Webster Field Annex, and Minor Properties in Maryland	U.S. Navy	MD	13,150 (250)	South Exterior
Naval Base Ventura County Point Mugu and Special Areas	U.S. Navy	CA	14,100 (1,300)	Overwintering
Naval Base Ventura County San Nicolas Island	U.S. Navy	CA	17,500 (1,050)	West Core
Research Laboratory Installations Washington, D.C., Chesapeake Bay Detachment, and Pomonkey	U.S. Navy	MD	200 (10)	South Exterior
Naval Weapons Station Seal Beach	U.S. Navy	CA	4,850 (100)	Overwintering
Naval Weapons Station Seal Beach Detachment Fallbrook	U.S. Navy	CA	9,000 (3,800)	West Core
Integrated Navy Operational Support Center Sacramento	U.S. Navy Reserve	CA	20 (0)	Central Valley
Presidio of Monterey	U.S. Army	CA	400 (2)	Overwintering
Sites in CO, KS, MT, NE, ND, SD, UT, and WY (USFWS Regions 5/7)	U.S. Army Reserve	*	1,650 (20)	*

INRMP Name	Branch of Service	State	~Acres	MCU
Sites in WA, ID, and OR (USFWS Region 9)	U.S. Army Reserve	*	200 (<1)	*
Camp Butner Training Site	Army National Guard	NC	5,000 (60)	South Exterior
The Camp Dodge Johnston Joint Maneuver Training Center	Army National Guard	IA	33,100 (3,000)	North Core
Maine Army National Guard Caswell-Loring Training Facility	Army National Guard	ME	1,100 (10)	North Exterior
Marine Corps Air Station Beaufort	U.S. Marine Corps	SC	7,400 (6,000)	South Exterior
Military Ocean Terminal, Sunny Point, North Carolina	U.S. Army	NC	11,550 (700)	South Exterior
Missouri Army National Guard	Army National Guard	MO	10,700 (200)	South Core
New Hampshire Army National Guard Training Site	Army National Guard	NH	400 (20)	North Exterior
Wyoming Military Department Local Training Areas in Lander, Lovell, and Sheridan	Army National Guard	WY	8,900 (3,000)	West Exterior
Fort Moore (formally Fort Benning)	U.S. Army	GA	181,900 (13,100)	South Exterior
Fort Liberty (formally Fort Bragg) and Camp Mackall	U.S. Army	NC	162,900 (24,500)	South Exterior
Fort Harrison Training Area and Limestone Hills Training Area	Army National Guard	MT	27,900 (700)	West Exterior
Fort Huachuca	U.S. Army	AZ	81,000 (18,000)	West Core
Fort McClellan Army National Guard Training Center	Army National Guard	AL	22,750 (500)	South Exterior
Fort Riley	U.S. Army	KS	101,800 (61,700)	South Core
Fort Smith Department of Air Force Base	Department of Air Force	AR	150 (<1)	South Core
Fort Stewart and Hunter Army Airfield	U.S. Army	GA	285,000 (12,200)	South Exterior
Great Pond Outdoor Adventure Center	U.S. Navy	ME	450 (15)	North Exterior
Hancock Field Department of Air Force Base and the Eastern Air Defense Sector Site	Department of Air Force	NY	400 (5)	North Exterior
Harvey Point Defense Testing Activity	U.S. Navy	NC	-	South Exterior
Hawthorne Army Depot	U.S. Army	NV	146,100 (705)	West Core
Jefferson Range Department of Air Force	U.S. Army	IN	52,800 (3,400)	North Core
Joint Base Langley Eustis - Langley	Department of Air Force	VA	4,000 (30)	South Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Joint Expeditionary Base Little Creek - Fort Story	U.S. Navy	VA	2,200 (100)	South Exterior
Joint Readiness Training Center and Fort Johson (formally Fort Polk)	U.S. Army	LA	240,300 (13,205)	South Exterior
Kingsley Department of Air Force Base	Department of Air Force	OR	350 (3)	West Core
Letterkenny Army Depot	U.S. Army	PA	18,000 (150)	North Exterior
Maine Army National Guard Hollis Training Site	Army National Guard	ME	450 (40)	North Exterior
Maine Army National Guard Training Facility Auburn	Army National Guard	ME	200 (5)	North Exterior
Marine Air Ground Task Force Training Command Marine Corps Air Ground Combat Center Twentynine Palms	U.S. Marine Corps	CA	761,600 (1,000)	West Core
Marine Corps Base Camp Lejeune	U.S. Marine Corps	NC	127,700 (6,400)	South Exterior
Marine Corps Mountain Warfare Training Center Bridgeport, California	U.S. Marine Corps	CA	61,900 (4,300)	West Core
Marine Corps Recruit Depot Parris Island	U.S. Marine Corps	SC	10,250 (200)	South Exterior
Maryland Department of Air Force Base Martin State Airport	Department of Air Force	MD	200 (<1)	South Exterior
McAlester Army Ammunition Plant	U.S. Army	OK	45,000 (10,200)	South Core
McEntire Joint National Guard Base	Department of Air Force	SC	2,400 (200)	South Exterior
Mississippi Army National Guard Camp McCain	Army National Guard	MS	13,000 (200)	South Exterior
Mississippi Army National Guard Camp Shelby Joint Forces Training Center	Army National Guard	MS	138,450 (5,000)	South Exterior
Moffett Department of Air Force Base	Department of Air Force	CA	150 (0)	West Core
Naval Air Facility El Centro	U.S. Navy	CA	60,500 (10)	West Core
Naval Air Station Corpus Christi	U.S. Navy	TX	6,000 (450)	South Exterior
Naval Air Station Fallon	U.S. Navy	NV	243,200 (6,200)	West Core
Naval Air Station Kingsville	U.S. Navy	TX	15,250 (1,000)	South Exterior
Naval Air Station Oceana and Naval Auxiliary Landing Field Fentress	U.S. Navy	VA	8,300 (50)	South Exterior
Naval Air Station Oceana Dam Neck Annex	U.S. Navy	VA	2,000 (155)	South Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Naval Air Station Pensacola Complex	U.S. Navy	FL	8,350 (300)	South Exterior
Naval Air Station Whidbey Island	U.S. Navy	WA	9,150 (55)	West Exterior
Naval Air Station Whiting Field Complex	U.S. Navy	FL	11,850 (800)	South Exterior
Naval Air Weapons Station China Lake	U.S. Navy	CA	1,141,200 (13,900)	West Core
Naval Auxiliary Landing Field San Clemente Island	U.S. Navy	CA	36,100 (1,300)	West Core
Naval Base Coronado	U.S. Navy	CA	13,500 (20)	Overwintering
Naval Base Kitsap	U.S. Navy	WA	10,150 (20)	West Exterior
Naval Base Point Loma	U.S. Navy	CA	1,850 (2)	Overwintering
Naval Base San Diego	U.S. Navy	CA	2,650 (15)	West Core
Naval Radio Transmitter Facility Dixon	U.S. Navy	CA	1,250 (100)	Central Valley
Naval Radio Transmitter Facility Lamoure	U.S. Navy	ND	850 (<1)	North Exterior
Naval Recreation Center Solomons	U.S. Navy	MD	325 (5)	South Exterior
Naval Research Laboratory Midway Research Center	U.S. Navy	VA	175 (<1)	South Exterior
Naval Research Laboratory Washington DC	U.S. Navy	DC	150 (0)	South Exterior
Naval Station Great Lakes	U.S. Navy	IL	1,900 (6)	North Core
Naval Station Mayport	U.S. Navy	FL	4,000 (100)	South Exterior
Naval Station Newport and Outlying Parcels	U.S. Navy	RI	1,850 (50)	North Exterior
Naval Submarine Base New London	U.S. Navy	CT	1,400 (5)	North Exterior
Naval Support Activity Annapolis	U.S. Navy	MD	2,000 (60)	South Exterior
Naval Support Activity Bethesda	U.S. Navy	MD	250 (0)	South Exterior
Naval Support Activity Crane	U.S. Navy	IN	62,500 (1,050)	North Core
Naval Support Activity Cutler	U.S. Navy	ME	3,100 (1,000)	North Exterior
Naval Support Activity Hampton Roads Lafayette River Annex, Northwest Annex, and Portsmouth Annex	U.S. Navy	VA	4,700 (20)	North Exterior
Naval Support Activity Mid-South	U.S. Navy	TN	1,500 (20)	South Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Naval Support Activity Monterey	U.S. Navy	CA	1,000 (10)	Overwintering
Naval Support Activity Panama City	U.S. Navy	FL	700 (20)	South Exterior
Naval Support Facility Carderock	U.S. Navy	MD	200 (<1)	South Exterior
Naval Support Facility Dahlgren	U.S. Navy	VA	4,300 (200)	South Exterior
Naval Support Facility Indian Head	U.S. Navy	MD	3,200 (100)	South Exterior
Naval Surface Warfare Center Acoustic Research Detachment Bayview Idaho	U.S. Navy	ID	50 (<1)	West Exterior
Naval Weapons Station Earle	U.S. Navy	NJ	11,900 (200)	North Exterior
Naval Weapons Station Seal Beach Detachment Norco	U.S. Navy	CA	250 (50)	West Core
Naval Weapons Station Yorktown	U.S. Navy	VA	13,150 (200)	South Exterior
Naval Weapons Systems Training Facility Boardman	U.S. Navy	OR	63,850 (22,000)	West Core
Navy Information Operations Command Sugar Grove	U.S. Navy	WV	500 (3)	South Exterior
Nebraska National Guard	Army National Guard	NE	5,950 (3,000)	North Core
New Jersey Army National Guard Sea Girt National Guard Training Center	Army National Guard	NJ	200 (20)	North Exterior
New York Army National Guard Camp Smith Training Site	Army National Guard	NY	1,600 (15)	North Exterior
New York Army National Guard Youngstown Local Training Area	Army National Guard	NY	900 (10)	North Exterior
Armed Forces Experimental Training Activity Camp Peary	U.S. Navy	VA	-	North Exterior
Orchard Combat Training Center	Army National Guard	ID	143,450 (86,600)	West Core
Picatinny Arsenal	U.S. Army	NJ	6,600 (50)	North Exterior
Port Hueneme	U.S. Navy	CA	1,650 (0)	Overwintering
Pueblo Chemical Depot	U.S. Army	CO	22,825 (18,700)	West Exterior
Red River Army Depot	U.S. Army	TX	15,000 (1,000)	South Exterior
Robinson Maneuver Training Center	Army National Guard	AR	33,150 (305)	South Core
Selfridge Department of Air Force Base	Department of Air Force	MI	3,100 (150)	North Core

INRMP Name	Branch of Service	State	~Acres	MCU
Snake Creek Weekend Training Site	Army National Guard	FL	350 (50)	Southern Florida
South Dakota Army National Guard	Army National Guard	SD	1,150 (400)	North Core
State Military Reserve City of Virginia Beach	Army National Guard	VA	350 (5)	North Exterior
Stone's Ranch Military Reservation and East Haven Rifle Range	Army National Guard	CT	2,000 (30)	North Exterior
Tooele Army Depot	U.S. Army	UT	42,400 (4,700)	West Core
U.S. Army Dugway Proving Ground	U.S. Army	UT	800,500 (32,700)	West Core
U.S. Army Garrison Aberdeen Proving Ground - Adelphi Laboratory Center and Blossom Point Research Facility	U.S. Army	MD	1,800 (100)	South Exterior
U.S. Army Garrison Fort Drum	U.S. Army	NY	108,900 (10,200)	North Exterior
U.S. Army Garrison Fort Eisenhower (formally Fort Gordon)	U.S. Army	GA	56,800 (7,020)	South Exterior
U.S. Army Garrison Fort Hunter Liggett	U.S. Army Reserve	CA	160,750 (25,700)	West Core
U.S. Army Garrison Fort Jackson	U.S. Army	SC	51,400 (3,600)	South Exterior
U.S. Army Garrison Fort Knox	U.S. Army	KY	109,100 (4,500)	North Core
U.S. Army Garrison Fort Gregg-Adams (formally Fort Lee)	U.S. Army	VA	5,700 (150)	South Exterior
U.S. Army Garrison George G. Meade	U.S. Army	MD	5,125 (50)	South Exterior
U.S. Army Maneuver Support Center of Excellence Fort Leonard Wood	U.S. Army	MO	62,025 (2,000)	South Core
U.S. Army Garrison - Redstone	U.S. Army	AL	38,200 (205)	South Exterior
U.S. Army Garrison West Point	U.S. Army	NY	15,900 (250)	North Exterior
Vermont Army National Guard Ethan Allen Firing Range	Army National Guard	VT	11,100 (100)	North Exterior
Volunteer Training Site - Catoosa	Army National Guard	GA	1,650 (5)	South Exterior
Volunteer Training Site - Milan	Army National Guard	TN	2,500 (115)	South Exterior
Volunteer Training Site - Smyrna	Army National Guard	TN	900 (10)	South Exterior
White Sands Missile Range	U.S. Army	NM	2,271,100 (71,310)	West Exterior
Chocolate Mountain Aerial Gunnery Range	U.S. Marine Corps	CA	458,350 (40)	West Core
Kansas Training Center	Army National Guard	KS	3,600 (0)	South Core

INRMP Name	Branch of Service	State	~Acres	MCU
Naval Submarine Base Kings Bay	U.S. Navy	GA	45,000 (1,650)	South Exterior
Townsend Bombing Range	U.S. Marine Corps	SC	79,100 (10,200)	South Exterior
U.S. Army Aberdeen Proving Ground - Aberdeen Area and Edgewood Area	U.S. Army	MD	72,625 (2,600)	South Exterior
Wendell H. Ford Regional Training Center	Army National Guard	KY	11,250 (1,250)	North Core
Fort Barfoot (formally Fort Pickett)	Army National Guard	VA	41,100 (1,100)	South Exterior
Naval Station Norfolk and Craney Island Fuel Terminal	U.S. Navy	VA	5,425 (50)	South Exterior
Naval Air Station Lemoore	U.S. Navy	CA	18,800 (1,600)	Central Valley
Naval Air Station Meridian	U.S. Navy	MS	13,800 (1,200)	South Exterior
Naval Air Station Jacksonville Complex	U.S. Navy	FL	11,400 (300)	South Exterior
Joint Base Langley-Eustis Fort Eustis	Department of Air Force	VA	7,900 (150)	South Exterior
Joint Base Lewis-McChord	U.S. Army	WA	91,400 (9,800)	West Exterior
Marine Corps Base and Marine Corps Air Station Camp Pendleton	U.S. Army Reserve	CA	126,000 (0)	Overwintering
Laughlin Air Force Base	Department of Air Force	TX	4,600 (55)	South Core
Little Rock Air Force Base	Department of Air Force	AR	6,500 (25)	South Core
Luke Air Force Base	Department of Air Force	AZ	4,200 (100)	West Exterior
Manchester Fuel Department	U.S. Navy	WA	350 (<1)	West Exterior
Marine Corps Air Station Cherry Point	U.S. Marine Corps	NC	25,900 (700)	South Exterior
Marine Corps Air Station Miramar	U.S. Marine Corps	CA	23,100 (700)	West Core
Marine Corps Air Station Yuma Installation Overview	U.S. Marine Corps	AZ	-	West Core
Marine Corps Logistics Base Barstow	U.S. Marine Corps	CA	5,500 (<1)	West Core
Marseilles Training Area	Army National Guard	IL	2,900 (400)	North Core
McCrady Training Center	Army National Guard	SC	-	South Exterior
Naval Air Station Joint Reserve Base New Orleans	U.S. Navy	LA	5,000 (75)	South Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Naval Construction Battalion Center (NCBC) Gulfport Stennis Western Maneuver Area Stennis Space Center	U.S. Navy	MS	5,300 (150)	South Exterior
Naval District Washington	U.S. Navy	DC	225 (<1)	South Exterior
Naval Magazine Indian Island	U.S. Navy	WA	3,050 (20)	West Exterior
Naval Radio Station (Transmitter) Jim Creek	U.S. Navy	WA	2,000 (30)	West Exterior
Naval Station Everett	U.S. Navy	WA	650 (0)	West Exterior
Naval Support Activity Orlando, LEFAC/BUGG Spring Facility	U.S. Navy	FL	100 (0)	Southern Florida
North Dakota Army National Guard Camp Grafton North	Army National Guard	ND	11,300** (2,600)	North Exterior
North Dakota Army National Guard Camp Grafton South	Army National Guard	ND	11,300** 2,600)	North Exterior
North Dakota Army National Guard Douglas Creek Local Training Area	Army National Guard	ND	700 (500)	North Exterior
Pacific Beach Annex Naval Station Everett	U.S. Navy	WA	150 (0)	West Exterior
St. George Armory	Army National Guard	UT	75 (0)	West Core
Department of Air Force Joint Base McGuire-Dix-Lakehurst	Department of Air Force	NJ	42,200 (2,500)	North Exterior
Department of Air Force Nellis Air Force Base, Creech Air Force Base and Nevada Testing and Training Range	Department of Air Force	NV	3,056,325 (11,600)	West Core
Department of Air Force Fairchild Air Force Base	Department of Air Force	WA	4,500 (200)	West Core
Department of Air Force Hurlburt Field	Department of Air Force	FL	6,400 (105)	South Exterior
Department of Air Force Altus Air Force Base	Department of Air Force	OK	8,025 (1,100)	South Core
Department of Air Force Avon Park Air Force Range	Department of Air Force	FL	108,200 (15,000)	Southern Florida
Department of Air Force Barksdale Air Force Base	Department of Air Force	LA	22,000 (500)	South Exterior
Department of Air Force Beale Air Force Base and Lincoln Receiver Site	Department of Air Force	CA	33,800 (14,500)	Central Valley
Department of Air Force Buckley Space Force Base	Department of Air Force	CO	3,325 (1,000)	South Exterior
Department of Air Force Dare County Range	Department of Air Force	NC	46,650 (20)	South Exterior
Department of Air Force Dobbins Air Reserve Base	U.S. Army Reserve	GA	1,800 (10)	South Exterior
Department of Air Force Dyess Air Force Base	Department of Air Force	TX	5,400 (160)	South Core

INRMP Name	Branch of Service	State	~Acres	MCU
Department of Air Force Eglin Air Force Base	Department of Air Force	FL	459,400 (49,100)	South Exterior
Department of Air Force Ellsworth Air Force Base	Department of Air Force	SD	5,250 (2,100)	North Exterior
Department of Air Force Goodfellow Air Force Base	Department of Air Force	TX	1,400 (10)	South Core
Department of Air Force Grand Forks Air Force Base	Department of Air Force	ND	5,600 (60)	North Core
Department of Air Force Holloman Air Force Base	Department of Air Force	NM	186,000 (1,800)	West Exterior
Department of Air Force Joint Base Anacostia Bolling	Department of Air Force	DC	1,000 (<1)	South Exterior
Department of Air Force Plan Joint Base Andrews	Department of Air Force	MD	7,000 (150)	South Exterior
Department of Air Force Plan Joint Base Charleston	Department of Air Force	SC	22,550 (600)	South Exterior
Department of Air Force Plan Joint Base San Antonio	Department of Air Force	TX	46,150 (2,600)	South Core
Department of Air Force Keesler Air Force Base	Department of Air Force	MS	1,700 (2)	South Exterior
Department of Air Force Kirtland Air Force Base	Department of Air Force	NM	50,225 (10,200)	West Exterior
Department of Air Force Malmstrom Air Force Base	Department of Air Force	MT	3,300 (1,000)	North Exterior
Department of Air Force March Air Reserve Base	U.S. Army Reserve	CA	2,800 (1,650)	West Core
Department of Air Force Maxwell Air Force Base	Department of Air Force	AL	2,900 (15)	South Exterior
Department of Air Force McConnell Air Force Base	Department of Air Force	KS	13,800 (3,000)	South Core
Department of Air Force Minot Air Force Base	Department of Air Force	ND	5,000 (1,000)	North Exterior
Department of Air Force Moody Air Force Base	Department of Air Force	GA	11,600 (350)	South Exterior
Department of Air Force Mountain Home Air Force Base, Saylor Creek Air Force Range, and Other Mountain Home Range Complexes	Department of Air Force	ID	133,100 (49,250)	West Core
Department of Air Force New Boston Air Force Station	Department of Air Force	NH	2,900 (30)	North Exterior
Department of Air Force Offutt Air Force Base	Department of Air Force	NE	3,300 (120)	North Core
Department of Air Force Peterson Air Force Base	Department of Air Force	CO	1,650 (500)	West Exterior
Department of Air Force Pillar Point Air Force Station	Department of Air Force	CA	75 (5)	Overwintering
Department of Air Force Robins Air Force Base	Department of Air Force	GA	6,700 (75)	South Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Department of Air Force Schriever Air Force Base	Department of Air Force	CO	5,425 (4,800)	West Exterior
Department of Air Force Shaw Air Force Base	Department of Air Force	SC	16,050 (420)	South Exterior
Department of Air Force Tinker Air Force Base	Department of Air Force	OK	5,800 (525)	South Core
Department of Air Force Travis Air Force Base	Department of Air Force	CA	6,600 (1,500)	Central Valley
Department of Air Force Tyndall Air Force Base	Department of Air Force	FL	29,100 (2,520)	South Exterior
Department of Air Force Westover Air Reserve Base	Department of Air Force Reserve	MA	2,400 (100)	North Exterior
Department of Air Force Wright-Patterson Air Force Base	Department of Air Force	OH	7,650 (25)	North Core
Department of Air Force Cheyenne Mountain Space Force Station	Department of Air Force	CO	550 (50)	West Exterior
Department of Air Force Vandenberg Space Force Base	Department of Air Force	CA	99,450 (17,200)	Overwintering
Vance Air Force Base	Department of Air Force	OK	3,400 (700)	South Core
Yakima Training Center Cultural and Natural Resources Management Plan	U.S. Army	WA	327,125 (70,520)	West Core
Army Reserve 63rd Readiness Division – Sgt. James Witkowski	U.S. Army Reserve	CA	75 (0)	West Core
Badlands Air Force Range	Department of Air Force	SD	2,500 (2,300)	North Exterior
Blue Grass Army Depot	U.S. Army	KY	14,600 (400)	North Core
Camp Navajo	Army National Guard	AZ	28,350 (2,000)	West Exterior
Camp Rapid	Army National Guard	SD	100 (0)	North Exterior
Carlisle Barracks	U.S. Army	PA	450 (0)	North Exterior
Florence Military Reservation	Army National Guard	AZ	19,200 (100)	West Core
Fort Bliss	U.S. Army	TX	1,116,925 (65,000)	South Exterior
Holston Army Ammunition Plant	U.S. Army	TN	6,200 (5)	South Exterior
National Training Center and Fort Irwin	U.S. Army	CA	869,400 (4,700)	West Core
U.S. Army Garrison Miami	U.S. Army	FL	150 (0)	Southern Florida
Iowa Army Ammunition Plant	U.S. Army	IA	21,525 (800)	North Core

INRMP Name	Branch of Service	State	~Acres	MCU
Milan Army Ammunition Plant	U.S. Army	TN	22,400 (1,000)	South Exterior
Military Ocean Terminal Concord	U.S. Army	CA	5,800 (1,200)	Central Valley
Parks Reserve Forces Training Area	U.S. Army Reserve	CA	2,300 (1,600)	West Core
Pine Bluff Arsenal	U.S. Army	AR	13,025 (225)	South Exterior
Radford Army Ammunition Plant	U.S. Army	VA	4,050 (165)	South Exterior
San Diego Air Force Space Surveillance Station	Department of Air Force	CA	5 (0)	West Core
Sierra Army Depot	U.S. Army	CA	26,000 (350)	West Core
Seymour Johnson Air Force Base	Department of Air Force	NC	3,250 (50)	South Exterior
Yuma Proving Ground	U.S. Army	AZ	837,120 (400)	West Core
Whiteman Air Force Base	Department of Air Force	MO	5,300 (50)	South Core
Vermont Army National Guard Camp Johnson	Army National Guard	VT	720 (2)	North Exterior
Sites Not Covered by INRMP	***	Lower 48	2,731,110 (50,000)	All

- Sites were missing from Defense Installation Spatial Data Infrastructure (DISDI) FY2021 DOD_Site_Locations_Boundaries_Shapefile.

*INRMP covers installations in multiple states. States where sites are located are included in the INRMP Name for these entries.

**Camp Grafton North and South have two separate INRMPs, however the installation boundaries for these features are combined in the DISDI FY2021 DOD_Site_Locations_Boundaries shapefile. Installation acreage and grassland acre estimates within this table are for Camp Grafton North and South combined.

***Sites not covered by INRMPs include U.S. Army, U.S. Army Reserve, Army National Guard, Department of Air Force, Department of Air Force Reserve, Department of Air Force, U.S. Marine Corps, U.S. Marine Corps Reserve, U.S. Navy, U.S. Navy Reserve, and White House Services.