COMPREHENSIVE ORYX MANAGEMENT PLAN

DEVELOPED THROUGH COOPERATIVE EFFORT BY WHITE SANDS MISSILE RANGE AND NEW MEXICO DEPARTMENT OF GAME AND FISH

TABLE OF CONTENTS

<u>SECTION</u> PAGE				
LIST C	ABBREVIATION, ACRONYMS, AND UNITS OF MEASUREiv			
EXEC	TIVE SUMMARYv			
SECTI	N 1 MANAGEMENT GOAL AND OBJECTIVES 1			
1.1	GOAL AND OBJECTIVES OF THE COMPREHENSIVE ORYX MANAGEMENT PLAN1			
SECTI	N 2 BACKGROUND AND BASELINE CONDITION			
2.1 WHITE SANDS MISSILE RANGE				
2.2	AGENCY POLICIES AND MISSION STATEMENTS22.2.1 Department of the Army22.2.2 Department of the Airforce32.3 State of New Mexico32.4 Department of Interior42.5 Department of Agriculture42.6 Other Policies4			
2.3	DRYX BIOLOGY4.3.1 Physical Description6.3.2 Habitat Utilization6.3.3 Food Habits6.3.4 Reproduction7.3.5 Predators7.3.6 Behavior7.3.7 Aggression8.3.8 Potential Environmental Impacts8			
2.4	DRYX HUNTING8.4.1Human Benefit.4.2Range Safety Considerations.4.3Oryx Hunting Seasons and Bag Limits.10			
2.5	HISTORY OF MONITORING PROGRAM11			
2.6	CURRENT ORYX POPULATION LEVEL.122.6.1 Criteria for Sex and Age Delineation142.6.2. Survey Results14			

TABLE OF CONTENTS

SECT	ION		PAGE
27	ODVA		1.4
2.1	0 R 1 2 7 1	Management Implications	14 15
	2.7.1	Management implications	13
2.8	DETE	CTING ORYX POPULATION TRENDS	
SECT	ION 3	ORYX MANAGEMENT ISSUES AND STRATEGIES	
3.1	ORYX	X POPULATION MANAGEMENT WITHIN	
	WHIT	E SANDS MISSILE RANGE JURISDICTION	
	3.1.1	Range Jurisdiction Issue 1. Population levels exceeding desired goals	
	3.1.2	Range Jurisdiction Issue 2. Conflict with Range Mission	19
	3.1.3	Range Jurisdiction Issue 3. Controlling Oryx Distribution	
	3.1.4	Range Jurisdiction Issue 4. Determine Trends in the Oryx Population	21
	3.1.5	Range Jurisdiction Issue 5. Maintain Population Levels within	
		Management Objectives	21
	3.1.6	Range Jurisdiction Issue 6. Cancellation of Hunts within the Range	22
3.2	ORYX	X POPULATION MANAGEMENT ON OTHER GOVERNMENT LANI	DS WITHIN
	WHIT	E SANDS MISSILE RANGE	
	3.2.1	Internal Land Management Agencies Issue 1.	
		Oryx Management on White Sands National Monument	
	3.2.2	Internal Land Management Agencies Issue 2.	
		Oryx Management on San Andres National Wildlife Refuge	
	3.2.3	Internal Land Management Agencies Issue 3.	
		Oryx Management on the Jornada Experimental Range	24
2.2	ΜΑΝΙ	ACE FOR MINIMUM NURFERS OF ODVY OUTSIDE THE DANCE	24
5.5	2 2 1	Outside the Dange Issue 1 Minimize Own on PLM Land	
	2.2.1	Outside the Range Issue 1. Minimize Ofyx on BLM Land	
	5.5.2	Duiside the Kange Issue 2. Manage for Zero Oryx on the	25
	222	Outside the Dange Lague 2 Manage for Zore Own on the	23
	5.5.5	Sovillate National Wildlife Pafuga	26
	221	Outside the Pange Issue 4 Manage for Zero Oray on Fort Plice	
	225	Outside the Pange Issue 5. Manage for Zero Oryx on	
	5.5.5	Halloman Air Force Dage	27
	226	Outside the Dange Legue 6 Manage for Zore Own on State Lands	
	3.3.0	Outside the Range Issue 0. Manage for Zero Oryx on State Lands	28
	3.3.7	Oryx on Private Land	
		-	
3.4	MINI	MIZE COMPETITION AND ENVIRONMENTAL IMPACT	29
	3.4.1	Environmental Concern Issue 1. Insufficient information about current a	and potential
		environmental degradation	29
		TABLE OF CONTENTS	

SECTIO	<u>DN</u>		PAGE
3.5 IN	MPA	CTS TO HISTORICAL OR CULTURAL RESOURCES	
3.	.5.1	Potential Impacts to Historical or Cultural Resources Issue 1:	2.0
2	5 2	Off-road Travel	
5.	.3.2	Oryx Damage	
3.6 C	COOP	PERATIVE AGREEMENT	
SECTIO	N 4	REFERENCES	
List of F	igur	es	
2-1		Land Management and Jurisdiction	5
2-2		Historic Oryx Hunt Areas within White Sands Missile Range	9
2-3		Known Harvest and Estimated Oryx Population Growth	12
2-4		Oryx Distribution Map	13
2-5		Projected Oryx Population with an Annual Harvest of 350 Cows and	
		200 Bulls for Four Years Followed by a Gradual Decline in Cow Harve	est 16
2-6		Projected Oryx Population with an Annual Harvest of 350 Cows	
		And 450 Bulls Through 2010	16
List of T	able	S	
Table 2-1	1	Sex and Age Data Recorded for 436 Oryx Observed 15 May	
		to 23 July 1997	14
APPEND	DIX A	U.S. FISH AND WILDLIFE SERVICE REFUGE MANUAL C	CHAPTER 8:
		EXOTIC SPECIES INTRODUCTION AND MANAGEMENT	
APPEND	DIX E	B EXECUTIVE ORDER 13112 – INVASIVE SPECIES	
APPEND	DIX (C MAP DEPICTING SURVEY ROUTES USED FOR SEX AND	O AGE
		DELINEATION OF ORYX	
APPEND	DIX I	O ORYX POPULATION MODEL	

LIST OF ABBREVIATIONS, ACRONYMS, AND UNITS OF MEASURE

ac	acre
ACC	Air Combat Command
AFB	Air Force Base
ATV	all terrain vehicle
BLM	Bureau of Land Management
CA	Cooperative Agreement
ft	feet
HAFB	Holloman Air Force Base
HSTT	high speed test track
in	inch
JER	Jornada Experimental Range
lb	pound
mi	mile
NWR	National Wildlife Refuge
ORC	Oscura Range Center
RC	Red Canyon hunt area
RCN	Rhodes Canyon Hunt Area
SMR	Small Missile Range
SRC	Stallion Range Center
U.S.	United States
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
WSNM	White Sands National Monument
yrs	years

EXECUTIVE SUMMARY

In the early 1960s, the New Mexico Department of Game and Fish (hereafter referred to as Department) and the New Mexico State Game Commission began a program of exotic big game introduction to increase and diversify hunting opportunities. Habitats with low potential for native big game were targeted for exotic introduction (Wood, et. al., 1970). Over a nine-year period beginning in 1969, gemsbok (*Oryx gazella*), or oryx, a native of Africa, were released into creosote and mesquite brush-land areas on White Sands Missile Range (Range).

By the mid - 1970s, a self-sustaining oryx population was established on the Range and limited hunting was initiated. Gradual expansion of the population allowed sport harvest on lands immediately surrounding the Range by 1989.

Wildlife managers realized by the early 1990s that harvest levels were not controlling population growth at an acceptable level. Aerial surveys began to indicate substantial population increases despite increased harvest levels. In 1997, 604 oryx were harvested in New Mexico with no detectable reduction in the population (U.S. Army 1998; New Mexico Department of Game and Fish, 1998). In 1998, the oryx population was estimated between 2,500 and 3,000. Permit levels for the 1998-99 hunt season were targeted at 515 once-in-a-lifetime licenses and a possible 200 to 300 population reduction permits. Permit levels for the 1999-2000 and 2000-2001 hunt season were established at 700 once in a lifetime permits and up to 300 population reduction permits per license year.

The intent of the *Comprehensive Oryx Management Plan* is to consolidate and present information regarding oryx in New Mexico, identify and coordinate Range and Department oryx management objectives, and identify potential strategies to achieve those objectives. The Department will strive to maintain the oryx population at levels socially and biologically acceptable to state and federal agencies while providing the people of New Mexico harvest opportunities.

Range and Department personnel, hunters, citizen groups, land management agencies, and wildlife management professionals have identified management issues and concerns. These issues and concerns will change over time and the plan will evolve as new issues, opportunities, conflicts, and strategies develop. An in-depth review and revision of the plan will occur every five years. Strategies defined in this plan will be evaluated annually to determine their effectiveness. Updates and changes to strategies will be made as new information, changes in policies, and unanticipated developments arise. Flexibility of the plan will help ensure progress toward the management goal.

State and federal agencies involved with development of the plan will prepare a cooperative agreement detailing agency collaboration on oryx management. Detailed instruction regarding authority and responsibilities will be specified in the cooperative agreement. The management intent of the Range and the Department is to maximize sustainable hunter opportunity while maintaining a population of 800-1,200 oryx within the Range and to eliminate oryx outside the Range. The *Comprehensive Oryx Management Plan* is comprised of the following sections; 1) goal and objectives, 2) background and current condition, and 3) oryx management issues and strategies.

SECTION 1 MANAGEMENT GOAL AND OBJECTIVES

1.1 GOAL AND OBJECTIVES OF THE COMPREHENSIVE ORYX MANAGEMENT PLAN

The *Comprehensive Oryx Management Plan* was prepared in a cooperative effort between the Range and the Department. The goal and objectives of oryx management were formulated through careful consideration of biological and sociological complexities associated with current exotic species management in New Mexico. The plan was reviewed by Holloman Air Force Base (HAFB), Fort Bliss, the U.S. Fish and Wildlife Service (USFWS), White Sands National Monument (WSNM), Bureau of Land Management (BLM), Jornada Experimental Range (JER), the New Mexico State Land Office, and interested publics. Each agency contributed to the plan by expressing preferred alternatives for oryx management within their jurisdiction. This effort included summarizing regulations, policies, and executive orders, identifying research needs, and documenting the history of oryx in New Mexico. Current oryx population levels and potential for fluctuations were assessed, and existing and potential conflicts with oryx inside and outside the Range and strategies for resolving them were addressed. The goal and objectives for oryx management in New Mexico are as follows

Goal

Control the oryx population within the Range and eliminate oryx outside the Range while maximizing sustainable hunter opportunity.

Objectives:

- Manage for 800 1,200 individuals within the Range and eliminate oryx outside the Range;
- Bring together information on oryx including hunt data, published literature from New Mexico and the Kalahari Desert (Africa), and available unpublished information;
- Estimate the current number of oryx in New Mexico and develop a monitoring program to detect trends in the oryx population;
- Develop a predictive model to facilitate understanding of oryx population dynamics and potential effects of harvest levels on the oryx population;
- Coordinate Range, state and federal land management agencies, and private landowners to identify specific regulations, policies, and management approaches for oryx management; and
- Implement strategies to reduce the oryx population in order to limit conflicts with the Range mission, native wildlife, and policies and regulations of natural resource management agencies, and private landowners.

Wildlife managers from the Department and the Range agreed upon the population range of 800 - 1,200 individuals. At these levels the propensity for oryx to conflict with the Range mission or to move off of the Range will be minimized while still providing hunting opportunities for the people of New Mexico.

SECTION 2 BACKGROUND AND BASELINE CONDITION

This section includes a description of White Sands Missile Range, agency policy and mission statements, oryx biology, description of hunts and hunt areas, a population estimate, population data, and an oryx population projection.

2.1 WHITE SANDS MISSILE RANGE

White Sands Missile Range is the largest, all overland test range in the western world, encompassing 2.2 million acres (ac) in south central New Mexico. Elevations range from 3,600 feet (ft) at Lake Lucero to 8,854 ft at Salinas Peak (Anderson and Taylor, 1983). The Range, together with adjacent safety buffer call-up and off-range use areas, is physiographically and biologically diverse. Mountain ranges comprise nearly 35 percent of the Range land area (Anderson and Taylor 1983). Dominant vegetation communities on the Range are Chihuahuan desert scrub, coniferous mixed woodland, and desert grassland (Dick-Peddie, 1993). The Range and lands surrounding it are subject to a broad range of land uses and management strategies.

Oryx were introduced to the Range from the late 1960s to mid-1970s to provide hunting opportunities. Since their introduction they have expanded outside the Range onto lands managed by the BLM, the USFWS, HAFB, WSNM, JER (JER), Fort Bliss, and private landowners. Permit levels have increased every year since 1990 but have not been sufficient to cause an observable decrease in the oryx population. Record high numbers of oryx were observed during aerial survey efforts in 1996 and early 1997 within the central and northern portions of the Range. Despite harvesting 604 animals during the 1997-98 hunt season, the number of oryx observed during aerial counts in 1998 was higher than 1997 counts. The estimated rate of increase for the oryx population has grown rapidly since the mid-1980s and the post 1997-98 hunt season population is estimated at over 2,800 animals.

2.2 AGENCY POLICIES AND MISSION STATEMENTS

State and federal agency resource management responsibilities and priorities are established through documents such as mission statements, policies, regulations, executive orders, and management plans. These documents provide guidelines and prioritization pertaining to administration within each agency's jurisdiction. Mission statements reflect the purpose of a given agency and are not necessarily directly associated with natural resources or exotic organisms. The following mission statements, policies, and regulations influence and direct oryx management within the various land jurisdictions where they occur.

2.2.1 Department of the Army - White Sands Missile Range and Fort Bliss

The primary mission of White Sands Missile Range involves developmental tests of U.S. Army, U.S. Navy, and U.S. Air Force air-to-air/surface, surface-to-air, and surface-to-surface weapons systems; instrumentation research and development; dispenser and bomb drop programs; gun system testing; target systems; meteorological and upper atmospheric probes; equipment, component, and subsystem programs; high-energy laser programs; and special tasks.

Army regulatory guidance for natural resources, as stipulated in Army Regulation 200-3, directs the Range management strategy for oryx. Section 2-1 states that it is: "The Army's goal to systematically conserve biological diversity on Army lands within the context of its mission." This section further states that "Natural ecosystems can best be maintained by protecting the biological diversity of native organisms and the ecological processes that they perform and that they are a part of" (U.S. Army, 1995). In order to comply with the National Environmental Policy Act, Oryx management as set forth in this plan will be integrated with the Range's ongoing *Integrated Natural Resources Management Plan* that will tier off of the *White Sands Range - Wide Environmental Impact Statement*.

Due to the requirement to increase safety personnel to ensure hunter safety on the Range, a hunt fee system, as authorized by the Sikes Act (16 U.S.C. §§ 670a-670o 1998) will be initiated. The fee will be set, and collected by the Range in order to offset costs associated with conducting oryx hunts and other oryx management activities. This fee may fluctuate from year to year depending on the number of personnel required to safely conduct hunts.

Fort Bliss is currently investigating alternative oryx management options for the installation. In the *Fort Bliss Programmatic Environmental Impact Statement* (U.S. Army, 1998), there is no discussion of oryx abundance, habitat utilization, or management. Fort Bliss had no official comments on or input to this management plan.

2.2.2 Department of the Air Force - Holloman Air Force Base

HAFB supports national security objectives as directed by the Joint Chiefs of Staff and can rapidly mobilize and deploy Air Combatant Command (ACC) Forces worldwide to meet peacetime and wartime contingencies. In addition, HAFB conducts training for selected allied nation aircrews, and training and fighter weapons instructor courses for German Air Force aircrews. The 49th Fighter Wing provides morale, welfare and administrative support for over 6,000 assigned personnel.

HAFB is dedicated to maintaining and enhancing populations of native plants and wildlife, and their respective habitats. Oryx are considered a hazard to operation of the High Speed Test Track (HSTT) and aircraft operations. There is a strong argument for removing oryx from the base because they pose a threat to military operations, primarily in the vicinity of the HSTT and the airfield.

2.2.3 State of New Mexico - New Mexico Department of Game and Fish

Chapter 17 of the New Mexico Statutes contains the declaration of policy for the Department. The Department's Mission Statement is: "To provide and maintain an adequate supply of wildlife and fish within the state of New Mexico by utilizing a flexible management system that provides for their protection, propagation, regulation, conservation, and for their use as public recreation and food supply."

Non-consumptive uses of oryx are nearly non-existent due to limited public access to the Range. For this reason, the Department's oryx management goal is to control oryx within the Range and to eliminate oryx outside the Range, using public hunting where feasible.

2.2.4 Department of Interior - Fish and Wildlife Service, Bureau of Land Management, and National Park Service

Agencies under the Department of Interior that currently have oryx management issues include: the San Andres National Wildlife Refuge (NWR), Sevilleta NWR, Bosque del Apache NWR, WSNM and BLM. Executive Order 11987 requires that lands under federal jurisdiction: "...restrict the introduction of exotic species into the natural ecosystems on lands and waters which they own, lease, or hold for purposes of administration; and, shall encourage the states, local governments, and private citizens to prevent the introduction of exotic species into natural ecosystems of the United States." (U.S. Government, 1995). The BLM manages the greatest percentage of land contiguous to the Range (Figure 2-1).

As stated in Chapter 8 of the Refuge Manual "The National Wildlife Refuge system exists for the protection and management of plants and animals native to the United States" (U. S. Fish and Wildlife Service, 1982). The USFWS policy is to prevent further introduction of exotic species on National Wildlife Refuges. Objectives within the policy are prevention of further introduction of exotic species and protection of native plants and animals from adverse impacts of competing with exotic species (Appendix A).

White Sands National Monument's policy states that exotic species are prohibited and no hunting is allowed. The management objective for oryx within WSNM is elimination and exclusion.

2.2.5 Department of Agriculture, Jornada Experimental Range

The JER is currently coordinating with the Department to reduce oryx through population reduction hunts. The JER is interested in developing feasible alternatives for future oryx management in support of minimizing oryx numbers on their lands as much as possible (Havstad, pers. com., 1999). The Department and the JER, prior to any changes in current oryx management, will sign an agreement.

2.2.6 Other Policies

Executive Order 13112 states that each Federal agency whose actions may affect the status of invasive species must: (1) prevent the introduction of invasive species, (2) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner, and (3) monitor invasive species populations accurately and reliably (U.S. Government, 1999) (Appendix A).

2.3 ORYX BIOLOGY

A great deal of information on physiology, reproduction, habitat utilization, and behavior is available from studies conducted in the Kalahari (Dieckman, 1980; Knight, 1992; Moller, et. al., 1996; Williamson and Williamson, 1988). In New Mexico studies have been completed describing oryx physiology (Stratton, 1989), food habits (Smith, 1994; Dye, 1998), movements (Jojola, 1998) and behavior (Saiz, 1975). These studies also provide insight to preferred foods, average body sizes, and horn lengths (Saiz, 1975; Stratton, 1989; Smith, 1994).



Figure 2-1. Land Management and Jurisdiction

Oryx studies in New Mexico provide insight to preferred foods, average body sizes, and horn lengths (Saiz, 1975; Stratton, 1989; Smith, 1994). Although these studies contribute to knowledge about oryx in New Mexico, many gaps in information necessary for management still exist. Managers currently rely on data from the Kalahari Desert when estimating breeding potential. Literally nothing is known regarding predation, other natural mortality, recruitment, average life span, interaction with native flora and fauna, and behavior of oryx in New Mexico. Data on sex and age ratios within the New Mexico population have been gathered for development of this management plan. Future management decisions will be influenced by what is learned about population dynamics of oryx in New Mexico.

2.3.1 Physical Description

Both bull and cow oryx typically develop straight horns that may be over 44 inches [in] in length. The lower half of these horns are ringed. Cow's horns tend to be longer and more slender than those of bulls. Bulls commonly weigh up to 450 pounds [lb] while cows are somewhat smaller, rarely exceeding 350 lb. Coloration is characterized by dark halter-like facial markings paired with white patches. Black striping also extends along the sides near the underbelly. A short mane runs from the head to the shoulders. Body color ranges from buff tan to brown and gray, depending on age. Newborn oryx are tan over the entire body and gradually acquire the coloration of adult animals as they reach maturity.

2.3.2 Habitat Utilization

The oryx is a large antelope native to the deserts of southern Africa's Kalahari region. In their native habitat, oryx travel large distances in response to local rain events that provide new plant growth. In the Kalahari, oryx are most common in arid areas, including dry steppe, and brush or tree savannas in flat to moderately hilly areas. They also occur in tropical scrub forest, and tropical savanna and grasslands (Knight, 1992).

When introduced, oryx were expected to use primarily low-lying desert scrub and grassland areas within the Range portions of the Tularosa Basin. Although oryx use the basin areas, their range currently includes all habitats and elevations within the Range. Aerial and ground surveys conducted in 1997 and 1998 indicated that the highest oryx densities were associated with grassy bajada (footslopes) and grassy playa areas (NM Department of Game and Fish, 1998; U.S. Army, 1998). The majority of the inhabited area is dominated by Chihuahuan desert scrub and Chihuahuan desert grasslands (Muldaven and Mehlhop, 1992). Densities appear to be lower in the canyons and upper portions of the Oscura and San Andres Mountains in pinyon/juniper (*Pinus edulus/Juniperus monosperma*) habitats. Oryx infrequently use barren playa lake beds and gypsum dunes. The ability of oryx to use various terrain and habitats at elevations from 3,600 ft to 8,854 ft has facilitated oryx distribution throughout the Range, southern New Mexico, and western Texas.

2.3.3 Food Habits

Oryx are physiologically adapted to extreme conditions and can withstand high temperatures. Surface drinking water is not necessary to sustain body condition as long as adequate forage is available.

Drought conditions on the Range from 1992 - 1996 were likely a contributing factor to the decline of mule deer and desert bighorn sheep whereas oryx numbers simultaneously increased.

Diet studies from the Kalahari Desert describe oryx feeding on grasses, herbs, roots, fruits, melons, leaves, buds, and bulbs. Oryx are skilled at finding water and often dig into dried river beds to access ground water. In dry periods, oryx are known to dig up roots containing water (Knight, 1992).

Investigations of oryx diet show that 11 of the 33 genera of plants consumed by oryx in the Kalahari Desert are found in New Mexico (White, 1967). Saiz (1975) determined that oryx diet on the Range is comprised of nearly equal proportions of forbs (weeds), brush species, and grasses. Smith (1994) determined that oryx on the Range are primarily grazers with 83 percent of their diet consisting of grasses, 16 percent shrubs, and less than 1 percent forbs. Dye (1998) also concluded that oryx on the Range are primarily grazers with diets consisting of 60 percent grasses, 17 percent forbs and 23 percent shrubs.

2.3.4 Reproduction

Reproduction information for free-ranging oryx is currently available only from studies in the Kalahari Desert. Females have no particular breeding season with births spaced at approximately 9 month intervals. Dieckmann (1980) reported that 94 percent of cows between the ages of 22 months and 10 years have 1.2 calves per year. Gestation lasts approximately 8.5 months and young weigh between 20 to 33 lb at birth. Offspring are weaned after 3.5 months, and sexual maturity is reached between 1.5 and 2 years of age (Dieckmann, 1980).

2.3.5 Predators

Other than man, oryx appear to have no natural predators in New Mexico that can effectively reduce the adult population. A few instances of mountain lion (*Puma concolor*) predation on oryx have been recorded but are rare (Weisenberger, pers. com., 1998). Newborn oryx likely fall prey to coyotes (*Canis latrans*) but mortality rates are unknown. Approximate mortality rates for newborn oryx were derived through interpolation for the oryx population model.

2.3.6 Behavior

Oryx in the Kalahari are gregarious, usually living in groups of 30-40 individuals, but they can be found in groups of hundreds in the wet season or during migration. Herds usually consist of one dominant male with several females and subadults. Bachelor herds also form with established dominance hierarchies (Dieckmann, 1980). Male-male interactions are aggressive but rarely result in blood-letting or severe injury. Displays are common where males show their size by standing broadside to one another with horns pointed over their shoulders in a threatening posture. Often, males will defend small territories in which they attempt to mate with and control all the females. On the Range, herds of 75 animals or more are rare but observations of groups this size have increased noticeably since the early 1990s (Anderson, pers. com., 1998; Kamees, pers. com., 1998; Morrow, pers. com., 1998,).

2.3.7 Aggression

Anecdotal reports about oryx aggression toward humans are popular lore on and around the Range. Stories about oryx attacking, and even goring cars, are widespread despite the fact that the few authenticated cases have occurred only when oryx have been trapped against fences with no opportunity to retreat. Other popular anecdotes include people being mauled or run through by oryx horns. Only cornered or wounded oryx have been documented exhibiting outright aggression toward humans. Wildlife personnel studying and working among oryx for years on the Range generally consider them to be no more prone to aggression toward humans than mule deer (*Odocoileus hemionus*) or pronghorn (*Antilocapra americana*) under normal circumstances (Anderson, 1998, pers com.; Dye, 1998, pers com.; Jojola, 1998, pers com.; Morrow, 1998, pers com.). Under normal circumstances oryx flee at the first sign of a human approaching. Oryx likely perceive humans as a potential predator. As with any other large ungulate, oryx should be treated with caution, especially when cornered or wounded.

2.3.8 Potential Environmental Impacts

Data have not been gathered concerning competition between oryx and native ungulates. Food habit studies (Smith, 1994; Dye, 1998) suggest that oryx diets overlap extensively with domestic cattle. Competition with native species for space and water has not been analyzed but wildlife managers on the Range recognize a potential for displacement of native ungulates. Social displacement of ungulates and effects on vegetation also have not been studied.

Large congregations of oryx have the potential to degrade habitats. Natural surface waters and riparian areas may be at substantial risk to degradation. Studies have not been conducted to ascertain oryx influence on native systems.

2.4 ORYX HUNTING

The success of oryx in New Mexico currently provides harvest opportunities for over 600 people annually. Over 4,000 oryx have been harvested in New Mexico since the first hunt in 1974. Traditionally, hunts for oryx have been conducted within four major hunt areas within the Range. (Figure 2-2). In addition, the Department conducts population reduction hunts throughout the year within and outside Range boundaries. Oryx population reduction hunts are conducted when the animals' presence conflicts with Range activities, and to reduce the number of oryx outside of the Range. Hunt areas within the Range are designated within Game Management Unit 19.

The four traditional internal hunt areas include Rhodes Canyon, Small Missile Range, Red Canyon, and Stallion hunt areas. The Small Missile Range hunt area consists of approximately 73,655 acres (ac) with a hunter check station located at the Small Missile Range gate. The Rhodes Canyon hunt area is the largest at 470,066 ac located in the central and portions of the northern sections of the Range with a hunter check station located at Rhodes Canyon Range Center. The Red Canyon hunt area encompasses 69,976 ac with a hunter check station, located at a single entry and exit at Oscura Range Camp. The Stallion Range hunt area, is approximately 407,794 ac with a hunter check station located at Stallion Range Center (Figure 2-2). Additional areas, such as the Tularosa hunt area, are periodically designated inside the boundaries of the four traditional hunt areas.

Figure 2-2. Historic Oryx Hunt Areas within White Sands Missile Range.

2.4.1 Human Benefit

Hunters directly benefit from oryx hunting as recreation, supply of meat, and prized trophy harvest. Funds generated through hunting license sales go to the Department. Taxidermists and meat processors make money from mounting heads, tanning hides, and processing harvested animals. Benefit through non-consumptive use is limited on the Range due to restricted public access.

2.4.2 Range Safety Considerations

Range hunting activities were delayed in 1998 due to unexploded ordinance hazards. The Range is in the process of conducting extensive safety evaluations. Future hunting, and oryx management initiatives, must take into account increased safety procedures including in-depth hunter education, increased security personnel, and signing and/or fencing known hazard areas.

2.4.3 Oryx Hunting Seasons and Bag Limits

Hunters are selected for oryx hunts through special draws. Trophy and non-typical hunts are conducted within the four special hunt areas previously described. Non-typical and trophy hunts normally occur between September and February. The number of oryx harvested by population reduction hunts is determined by the number of oryx detected outside hunt areas and availability of personnel to coordinate hunts. Population reduction hunts are conducted at various times throughout the year.

Annually, up to three trophy hunts are scheduled in each hunt area, depending on total permit requirements. The bag limit for all hunts is one oryx of either sex. All trophy and non-typical licenses are "once in a lifetime" and only individuals who have never held a trophy or non-typical oryx license may apply. Hunters on trophy hunts are allowed to harvest any oryx. Hunters on non-typical hunts must harvest an oryx with at least one broken horn, or non-typical horns. A brokenhorned oryx is defined as having at least one horn broken off half as long as the unbroken one. Non-typical oryx are also those which have at least one horn with deformed growth including curled, bent, or growing from the base at an extremely odd angle (i.e., directly forward or sideways).

The bag limit for population reduction hunts is one oryx per hunter. Population reduction hunts may be authorized to remove oryx when animals interfere with Range operations or to control oryx off the Range. When needed, hunts may be held on a few days' notice, may involve small areas, and may be limited to a few resident and/or nonresident hunters. Applications for population reduction hunts are by mail only and must be on the form provided by the Department. A random drawing places applicants on a stand-by hunter list that is used when the need for a population reduction hunt is justified. Department officials contact hunters to notify them of hunt areas, dates, and any special restrictions which may apply for their particular oryx hunt area. If a hunter cannot participate in a hunt, their name is moved to the bottom of the list and another hunter contacted. Oryx population reduction hunts are not once-in-a-lifetime, nor do they prevent any hunter from applying for a trophy or non-typical oryx hunt.

For private land hunts the Department would coordinate public hunts, with a staff member contacting hunters on the public oryx depredation list and offering them the opportunity to hunt on

the private land. The hunter's depredation license, issued in the spring of the year, would be authorized when the hunter inscribes the validation number provided by the Department.

A private hunt would require that the landowner contact hunters to hunt on the private land. The appropriate number of authorizations would be sent to the landowner from the appropriate Department Area Office. These are then given to the landowner to hunters (in essence, the money charged by the landowner is a trespass fee). Each hunter then brings the authorization into any Department Area Office or the Department Santa Fe Office to purchase the oryx license.

Natural resource managers now face the challenge of controlling oryx population expansion within and outside the Range. Recent increases in harvest levels were inadequate to reduce the population. Further increases in annual harvest may soon exceed the capacity of agency personnel and scheduling alternatives to conduct hunts. Hunt days are limited by Range testing activities and the number of hunters that can be adequately monitored is limited by the availability of Department and Range personnel.

Policies regarding oryx management are as diverse as the jurisdictions in which they occur. Land management agencies dealing with oryx management decisions other than the Range include San Andres NWR, Sevilleta NWR, WSNM, HAFB, JER, and BLM. Oryx are currently the most common ungulate inhabiting the Range and show the potential for quickly exceeding numbers that can be controlled through existing hunting practices.

2.5 HISTORY OF MONITORING PROGRAM

Efforts to monitor oryx on the Range have fluctuated widely over the last 28 years. Initially, aerial counts were relatively easy to conduct since the oryx stayed in close proximity to their release point and population levels were relatively low. A population model developed by Saiz predicted a potential hunt of up to 95 animals by the year 2000 with a stabilized population of 490 (New Mexico Department of Game and Fish, 1978). A harvest of 613 oryx in 1997 reflects the gross underestimation of oryx population growth potential. Even though the population was greatly surpassing expectations, inadequate monitoring failed to detect the increase. Aerial surveys conducted during June and July 1989 recorded 245 oryx. Observers estimated a minimum of 80 percent of the animals in the survey areas had been counted. It was estimated that a maximum of 307 oryx inhabited the surveyed areas which encompasses 95 percent of the present oryx distribution (New Mexico Department of Game and Fish, 1989). In comparison, the oryx model presented in Section 3 estimates a population of 1,100 oryx in 1989. This estimate more closely represents the number of oryx necessary to reach estimated population levels in 1998 (Figure 2-3).

Until the early 1990s, aerial surveys were extremely inconsistent. Some years the surveys were conducted during summer months and others in the winter. Distances between flight grids varied from 0.5 to 1.5 miles. Surveys were conducted at different times of the day, and in different areas from year to year. These inconsistencies made it impractical to compare data and project trends in the population. Future aerial survey data must follow a prescribed, structured protocol in order to be useful (Section 2.8).

Figure 2-3. Known Harvest and Estimated Oryx Population Growth.

2.6 CURRENT ORYX POPULATION LEVEL

Total counts of wide-ranging wild ungulates are impossible to obtain by any practical methods. Managers, therefore, rely on estimates generated through various sampling methods. On the Range, oryx population sampling methods that generate statistically verifiable population estimates have not yet been implemented.

To derive an estimate of current minimum population size for this management plan, the known range of oryx was delineated on a map and divided into nine sections within the Range and seven sections outside the Range. Sections were defined by topographic features and political boundaries (Figure 2-4). Minimum population estimates for each section were then formulated by utilizing aerial survey data, rancher observations, ground truthing, and interviews with resource personnel familiar with each section. Personnel from the Department and the Range conferred and agreed upon minimum, best guess estimates for each section. Based on this best guess approach it is estimated that the minimum oryx population after the 1997-98 hunt season is approximately 2,530 animals.

To aid in assessment of population trends and formulation of an oryx population model, a survey to classify age class and sex ratios was conducted. Sex and age data were recorded for oryx observations throughout the Range from 15 May to 23 July 1997. A single observer used ten-power binoculars and a thirty-power spotting scope to examine all oryx detected while driving paved, dirt, and unimproved roads throughout the Range. No animals were counted in areas where previous counts had been made during the observation period in order to reduce the potential for double-counting individuals.

Oryx were counted during daylight hours, primarily from 0530 to 1030 Mountain Daylight Time, while driving routes primarily located in the central and northwestern portions of the Range. Small portions of these routes went through the San Andres Mountains but were primarily within the Tularosa Basin and southern half of Stallion Range in the Jornada Basin (Appendix C). Data recorded included: date, location, group size, sex (for adult and subadult only), and age (adult, subadult, or juvenile). Sex and age were recorded only when animals were positively identified.

2.6.1 Criteria for Sex and Age Delineation

Sex was recorded only for adult and subadult animals based primarily on presence/absence of penile sheath or secondarily by the presence/absence of testicles. Horn growth (basal girth and overall mass) and musculature were also noted. Although all four criteria aided in determining sex, a final determination was based solely on observation of primary and/or secondary indicators. A wide range of musculature development and horn mass was observed between and among sexes. In general, mature bulls have more well-developed musculature and thicker horns, particularly at the base, than mature females. Differences are less distinct in subadult animals.

Animals were categorized as adult (estimated at > 2.0 years [yrs]) if they appeared to be at or near maximum body weight, had adult pelage color (well developed black flank stripes and overall grayish color), and typical horns estimated to be \geq 33 in.

Animals were categorized as subadult (6 months to 2 yrs) if they appeared to weigh 100 to 275 lb, had brownish tinges, often without well defined flank striping, and typical horns estimated to be 14 to 32 in.

Animals were categorized as juvenile if they appeared to weigh less than 100 lb, had predominantly brown pelage, and typical horns less than 14 in.

2.6.2 Survey Results

Sex and age data were recorded for 436 oryx during the survey period. Adult animals comprised 67 percent of the total. Adult sex ratio was 50.3 percent male/49.6 percent female. Juveniles comprised only 7.1 percent of the counted population (Table 2-1).

	Number	% of Adults	% of Subadults	% of Total
Adult Male	147	50.6		33.7
Adult Female	145	49.4		33.3
Subadult Male	47		41.6	11.0
Subadult Female	66		58.4	15.1
Juvenile	31			7.1
Total	436			

 Table 2-1. Sex and Age Data Recorded for 436 Oryx Observed 15 May to 23 July 1997.

2.7 ORYX POPULATION PROJECTION

Observability of juvenile animals is much lower than adults due to their small size and hiding behavior. This factor likely influences the low percentage of juveniles counted. Previous attempts to model oryx population growth have proven inadequate due to a lack of knowledge regarding key variables. It is believed that early attempts at projecting population levels underestimated natality rates and overestimated mortality rates. The Range developed an oryx population model for this management plan incorporating data from surveys, and past and current research. A detailed explanation of the model is presented in Appendix D. Future population trends predicted by the

model should be reviewed, and the model refined as additional data are gathered regarding unknown variables. Accuracy of the model will be tested in the future against trend data compiled from aerial surveys.

The oryx population model is a problem-solving tool designed to aid in understanding variables affecting the oryx population. It serves as a quantifiable projection of the oryx population based on data that are known, have been researched, and uninvestigated (unknown) variables. The model provides a prediction of how the oryx population will respond to changes in harvest levels. Methods that provide statistically validated population data are needed. A specific, repeatable survey protocol will provide managers with more adequate information for assessing population trends.

This model does not purport to precisely estimate oryx numbers but attempts to illustrate trends in the population. The model assumes the primary factor regulating population growth is harvest level. This assumption is based on the apparent ineffectiveness of environmental factors and predators to curb population growth.

2.7.1 Management Implications

The model suggests that manipulating cow harvests can regulate the population, and that bull harvest, unless extremely high, has very little effect. Based on the results of the model, a minimum of 350 female oryx must be harvested for six consecutive years to effectively reduce the oryx population. The fact that harvesting 300 cows over the same time period does not cause a reduction indicates the importance of closely monitoring the population to ascertain whether harvest levels are adequate. If 350 cows are harvested, the number of bulls harvested can be reduced from 400 (expected 1999 harvest) to 200 over the next 12 years and still achieve a net reduction in the population (Figure 2-5). Conversely, harvesting 550 bulls per year does not reduce the population if only 300 cows are harvested (Figure 2- 6). Population estimates determined through aerial surveys will be incorporated into the model. Estimates can then be used to set permit levels for the next hunt season.

Oryx population increases predicted by the model are supported through recent aerial surveys. In 1999, the model was used to predict the population within the Stallion hunt area based on the assumption that the previous years aerial count represented 100 percent of the population in the area. Following a harvest of 49 animals since the previous aerial survey, the model predicted a population of 611 oryx. A total of 607 oryx were counted during aerial surveys in the Stallion hunt area (New Mexico Department of Game and Fish, 1999). In this case the model predicted the number of oryx counted (assumed total population) in the Stallion hunt area within.65 percent.

Only 245 cows were harvested during 1997-98 hunt season on and off the Range. The model estimates a net recruitment of 70 oryx at the end of 1997 following this harvest level (Appendix D). It is believed that instituting much higher cow oryx harvest strategies, as the model suggests, is necessary to achieve the management goal.

Figure 5. Projected Oryx Population with an Annual Harvest of 350 Figure 2-5. Projected Oryx Population with an Annual Harvest of 350 Cows and 200 Bulls Cows and 400 Bulls for 6 Years then Tapering Down. for Six Years Followed by a Gradual Decline in Cow Harvest.

Figure 6. Projected Oryx Population with an Annual Harvest of 300 Figure 2-6. Projected Oryx Population with an Annual Harvest of 300 Cows and 450 Bulls Cows and 450 Bulls Through 2010.

If the model is accurate, managers must initiate specific strategies to reduce the oryx population before a population explosion makes control a much more difficult task. If the model is inaccurate, and the oryx population suffers a dramatic decline, oryx reproductive capabilities, and exceptional population growth potential will ensure that oryx populations are not irrevocably affected over the long term.

2.8 DETECTING ORYX POPULATION TRENDS

Aerial surveys are the most efficient means of counting oryx. In order to obtain comparable data from year to year a strict prescription must be followed. Trends identified through surveys will be used to establish annual harvest level requirements. Harvest levels will be increased if oryx counts in core survey areas increase. Harvest levels will be reduced as aerial counts in core areas decrease. Population estimates will be generated on an annual basis via methods used to determine the current oryx population (Section 2.6). Acquiring population trend data requires consistency in timing, area surveyed, intensity of survey, and observers. Specific survey requirements to standardize data collection include:

- Conduct surveys during the same time period for all survey areas;
- Conduct surveys from a fixed-wing aircraft;
- Conduct surveys during December, January, or February when oryx are most active for longer portions of the day, and foliar vegetative cover is minimal;
- Conduct surveys on days with good visibility, wind speeds less than 15 miles per hour, and cloud cover of no more than 25 percent;
- Use trained observers, preferably the same observers, each year;
- Use the same aircraft type, and preferably the same pilot, each year;
- Cover the same areas within each survey area each year; and
- Use Global Positioning System navigation and maps of previous survey routes to ensure consistency.

SECTION 3 ORYX MANAGEMENT ISSUES AND STRATEGIES

Hunters, various land management agencies, and private landowners, currently dealing with oryx control, identified oryx management issues. Specific strategies and alternative actions to manage oryx were developed in coordination with resource managers on and around the Range. Strategies and alternatives are listed in priority order based on the most feasible and cost effective management option available. In situations where the listed priority strategy or alternative action is not the most cost effective, decisions on which alternatives to use will be based on the specific management situation, prevailing policies of the management agencies, safety and security concerns, funding availability, and unforeseen factors. Each alternative provided in this section has the potential to be implemented.

3.1 ORYX POPULATION MANAGEMENT WITHIN WHITE SANDS MISSILE RANGE JURISDICTION

3.1.1 Range Jurisdiction Issue 1: Population levels exceeding desired goal

The Department and the Range have specified a management goal of regulating the Oryx population for 800 - 1,200 individuals within the Range and 0 outside the Range. It is believed that this population level will minimize: potential habitat degradation, potential competition with native wildlife, and conflicts with Range testing while providing the people of New Mexico harvest opportunities.

<u>Strategy 1.</u> Utilize hunter harvest options to reduce current oryx populations. The Department and the Range prefer alternatives supporting this strategy. Current population estimates predict a harvest of 350 cow oryx is required to reduce the population. Based on past harvest selection rates of 60 percent bulls versus 40 percent cows, a harvest of 880 oryx is required.

Alternative Action 1: Increase Permit Levels

The annual oryx harvest would be increased to levels sufficient to approach the management goal. Although achievable, harvest of over 800 oryx during a single hunt season is difficult due to hunt coordination, safety issues, and personnel availability. Due to the requirement to increase security personnel to ensure hunter safety on the Range, a hunt fee system, as authorized by the Sikes Act (16 U.S.C., 670a-670o 1998) will be initiated. The fee will be set, and collected by the Range in order to offset costs associated with conducting oryx hunts and other oryx management activities. This fee may fluctuate from year to year depending on current oryx management issues.

Alternative Action 2: Cow Harvest Incentive Hunts

The Department would offer the opportunity to draw an additional hunt to hunters taking a cow oryx on their trophy or non-typical hunt. A special hunt available to hunters would be drawn from a pool of those who harvest a cow during their trophy or non-typical hunt. This alternative would likely increase the percentage of cows harvested.

Alternative Action 3: Implement Cow Only Hunts

A bag limit would be set for harvest of an adult cow only. This action would mandate that each hunter be instructed on how to differentiate the sex of oryx, or that personnel capable of verifying sex of oryx escort each hunter.

<u>Strategy 2.</u> Reduce oryx populations through management harvest conducted by the Department. This strategy would only be utilized in situations where safety issues, or Range testing activities eliminate other hunter harvest options.

Alternative Action: Agency Oryx Removal

Department personnel, and/or appointed Range personnel, would coordinate and conduct harvest of oryx within the Range. Harvested animals would be sold to the public as mandated by state policy.

<u>Strategy 3.</u> Remove oryx through trap and transplant or roundup efforts. This strategy would only be used in situations where aerial trap and transplant, or roundup and removal of oryx, are economically feasible, and optional strategies have been exhausted. Determining where to place oryx removed by this strategy would be mandatory prior to initiating alternative actions. Costs of capture and removal will be assumed by the requesting agency. Other agencies involved may provide technical support based on funding and manpower availability.

Alternative Action 1: Oryx Round-up

The Range and the Department would coordinate and conduct oryx round-ups where harvest alternatives are not viable. Helicopters, fixed wing aircraft, horses, and all terrain vehicles would potentially be used to herd oryx into holding areas, or drive them outside of designated boundaries.

Alternative Action 2: Capture and Remove

Straggler oryx not removed from areas during roundup operations, or small groups that need to be moved would be captured and moved to a designated drop-off point.

3.1.2 Range Jurisdiction Issue 2: Conflict with Range Mission

Strategy 1. Coordinate hunts with Range Scheduling to avoid conflict with testing activities.

Alternative Action 1: Schedule Hunt Dates in Advance

Department and Range personnel would closely coordinate planned hunt dates and hunt areas in order to minimize conflicts with Range testing. The Department would propose and receive verification on hunt dates prior to publication of the big game hunt proclamation. Conflicts with range missions would be avoided by changing dates or designation of no hunt zones within the hunt area as specified by Range Scheduling and Range Control. Unforeseen, unavoidable changes in testing activities would take precedence over hunts.

<u>Strategy 2.</u> Remove oryx from sensitive test areas. Removal of oryx may be necessary from areas where there are prevailing conflicts or a high potential for conflict with Range testing activities.

Alternative Action 1: Population Reduction Hunts

The Range would request the Department to coordinate and conduct population reduction hunts as needed.

Alternative Action 2: Agency Oryx Removal

Commissioned officers for the Department would coordinate and conduct harvest of oryx within the Range. Harvested animals would be sold to the public as mandated by state policy. This alternative would only be implemented if other alternatives cannot be used due to safety, scheduling, or access complications.

<u>Strategy 3.</u> Remove oryx through trap and transplant or roundup efforts. This strategy would only be used in situations where aerial trap and transplant, or roundup and removal of oryx, are economically feasible, and optional strategies have been exhausted. Determining where to place oryx removed by this strategy would be mandatory prior to initiating alternative actions. Costs of capture and removal will be assumed by the requesting agency. Other agencies involved may provide technical support based on funding and manpower availability.

Alternative Action 1: Oryx Roundup

The Range and the Department would coordinate and conduct oryx roundups where harvest alternatives are not viable. Helicopters, fixed-winged aircraft, horses, and all terrain vehicles would potentially be used to herd oryx into holding areas, or drive them outside of designated boundaries. Oryx would be relocated within Range boundaries and none would be located on other lands.

Alternative Action 2: Capture and Remove

Straggler oryx not removed from areas during roundup operations, or small groups that need to be moved would be captured and moved to a designated drop-off point.

3.1.3 Range Jurisdiction Issue 3: Controlling Oryx Distribution

<u>Strategy 1.</u> Conduct population reduction hunts within the Range to strategically remove oryx from areas where there is a high probability of population expansion off of the Range.

Alternative Action 1: Harvest Oryx South of U.S. Highway 70

In an effort to curtail southward oryx distribution, internal population reduction hunts would be conducted south of U.S. Highway 70 pursuant to the management goal. Range personnel would contact the appropriate Department Area Office to coordinate timing and number of animals to be harvested. The Department would then inform the appropriate number of hunters from the population reduction list of hunt dates, areas, and meeting place. Records of the sex and age of animals killed would be recorded by the Department field officer in charge of each population reduction hunt. All information gathered would be shared with Range wildlife personnel.

Alternative Action 2: Harvest Oryx From Peripheral Areas Within the Range In an effort to curtail oryx expansion off-Range, internal population reduction hunts would be periodically conducted within the Range along peripheral boundary areas.

When groups of oryx are detected near boundary fences, Range personnel would initiate the appropriate procedures for conducting the hunt (Alternative Action 1 above).

Alternative Action 3: Agency Removal

Department personnel would coordinate and conduct harvest of oryx within the Range. Harvested animals would be sold to the public. This alternative would only be implemented if other alternatives cannot be used due to safety, scheduling, or access complications.

<u>Strategy 2.</u> Remove oryx through trap and transplant or roundup efforts. This strategy would only be used in situations where aerial trap and transplant, or roundup and removal of oryx, are economically feasible, and optional strategies have been exhausted. Determining where to place oryx removed by this strategy would be mandatory prior to initiating alternative actions. Costs of capture and removal will be assumed by the requesting agency. Other agencies involved may provide technical support based on funding and manpower availability.

Alternative Action 1: Oryx Round-up

The Range and the Department would coordinate and conduct oryx round-ups where harvest alternatives are not viable. Helicopters, fixed wing aircraft, horses, and all-terrain vehicles would potentially be used to herd oryx into holding areas or drive them outside of designated boundaries.

Alternative Action 2: Capture and Remove Oryx

Straggler oryx not removed from areas during roundup operations, or small groups that need to be moved would be captured and moved to a designated drop-off point.

3.1.4 Range Jurisdiction Issue 4: Determine Trends in the Oryx Population

<u>Strategy.</u> Determine trends in the oryx population through established aerial survey methods that provide managers with reliable data. It is imperative that population trends are understood in order to set harvest levels necessary to reach the goal.

Alternative Action 1: Conduct Prescribed Aerial Surveys

In order to obtain comparable data from year to year the prescription provided in Section 2.8 must be followed. Trends identified through surveys will be used to establish annual harvest level requirements.

Alternative Action 2: Establish Core Survey Areas

Core survey areas would be flown annually with additional areas flown as funding and time allow. The entire Stallion hunt area and the western portion of the Rhodes Canyon hunt area are recommended as core survey areas. This alternative would provide a sub-sample of the population and be representative of the overall population.

3.1.5 Range Jurisdiction Issue 5: Maintain Population Levels Within Management Objectives

<u>Strategy.</u> Manipulate oryx harvest levels commensurate with the management objective. Initially harvest levels will be very high in order to reduce the population. Harvest levels will gradually

decrease as the population stabilizes within the target of 800-1,200 oryx. Estimates derived from the population model indicate a population in this range would support annual sustainable harvest of 250-350 oryx.

Alternative Action: Manipulate Hunter Harvest Levels Aerial survey data will be used to set annual harvest levels required to approach the management goal. Alternative harvest options discussed under Section 3.1.1 will be used.

3.1.6 Range Jurisdiction Issue 6: Cancellation of Hunts Within the Range

<u>Strategy.</u> Rearrange the hunt schedule to meet harvest goals. Hunts may be periodically canceled due to unforeseen testing, scheduling, or other conflicting Range actions or policies.

Alternative Action 1: Reschedule Canceled Hunts

The Department would be responsible for notifying hunters that the hunt has been canceled. Arrangements would be made with hunters to refund money, or reschedule the hunt for a later date during the same hunt season.

Alternative Action 2: Increase Subsequent Season Harvest

If another hunt date cannot be scheduled within the same hunt season, an effort would be made to make up the discrepancy in necessary harvest level during the next hunt season. This would be accomplished through alternative actions listed under Section 3.1.1.

3.2 ORYX POPULATION MANAGEMENT ON OTHER GOVERNMENT LANDS WITHIN THE RANGE

Three federal land management agencies administer property within the boundaries of the Range. The 146,500 ac White Sands National Monument, administered by the National Park Service, exists entirely within the Range. The San Andres NWR, administered by the Fish and Wildlife Service, encompasses 57,215 square acres (ac²⁾ within the Range. Portions of the JER, administered by the Department of Agriculture, are co-use areas within Range boundaries.

3.2.1 Internal Land Management Agencies Issue 1: Oryx Management on White Sands National Monument

The WSNM policy states that exotic species are prohibited and no hunting is allowed. The management objective for oryx within the WSNM is elimination.

Strategy 1. Prevent oryx movement onto the Monument.

Alternative Action: Fence Oryx Out.

A fence impedes movement of oryx onto WSNM but occasional breaks or gaps periodically allow oryx to enter. WSNM personnel will repair and monitor the fence especially after each heavy rainstorm.

<u>Strategy 2.</u> Remove oryx through trap and transplant or roundup efforts. This strategy would only be used in situations where aerial trap and transplant, or roundup and removal of oryx, are

economically feasible, and optional strategies have been exhausted. Determining where to place oryx removed by this strategy would be mandatory prior to initiating alternative actions. Costs of capture and removal will be assumed by the requesting agency. Other agencies involved may provide technical support based on funding and manpower availability.

Alternative Action 1: Drive Oryx off of the Monument

The National Park Service is currently implementing a non-lethal oryx removal plan with the Department to include driving oryx off of the WSNM onto the Range using aircraft and wing fences.

Alternative Action 2: Capture and Remove Oryx

Oryx that can not be removed through aerial drive tactics would be captured and moved from WSNM to the Range.

Strategy 3. Agency removal.

Alternative Action: Management Harvest

Department personnel would coordinate and conduct harvest of oryx within the WSNM. Harvested animals would be sold to the public. This alternative would only be implemented if non-lethal removal alternatives fail.

3.2.2 Internal Land Management Agencies Issue 2: Minimize Oryx on the San Andres National Wildlife Refuge

Strategy 1. Manage oryx population on the refuge through hunter harvest.

Alternative Action: Conduct Population Reduction Hunts on San Andres NWR. The Refuge manager would develop an oryx removal program in cooperation with the Department. The refuge manager would request the Department to coordinate and help conduct population reduction hunts within the refuge as needed.

<u>Strategy 2.</u> Implement an Agency oryx removal program for oryx on San Andres NWR. If population reduction hunts fail to adequately limit oryx on San Andres NWR, this strategy may be used.

Alternative Action: Agency Oryx Removal

The NWR Manager, designated Refuge Biologist, and Department personnel would have authority to eliminate oryx within refuge boundaries. Harvested animals would be provided to the Department for sale as mandated by State policy. Prior to initiation of a shoot-on-sight policy, the San Andres NWR and the Department must sign a written agreement.

<u>Strategy 3.</u> Remove oryx through trap and transplant or roundup efforts. This strategy would only be used in situations where aerial trap and transplant, or roundup and removal of oryx, are economically feasible, and optional strategies have been exhausted. Determining where to place oryx removed by this strategy would be mandatory prior to initiating alternative actions. Costs of capture and removal will be assumed by the requesting agency. Other agencies involved may provide technical support based on funding and manpower availability.

Alternative Action: Capture and Remove Oryx

Oryx that can not be removed through alternative strategies may be darted from the ground and removed from the Refuge. This alternative would only be considered after consultation with the Refuge Manager.

3.2.3 Internal Land Management Agencies Issue 3: Oryx Management on the Jornada Experimental Range

Strategy 1. Manage oryx through population reduction hunts.

Alternative Action: Conduct Population Reduction Hunts

Natural Resource managers for the Jornada Experimental Range would coordinate population reduction hunts with the appropriate Department Area Office. Jornada Experimental Range personnel would request population reduction hunts when oryx are detected. The Department would coordinate and conduct hunts as often as practical pursuant to the management goal.

Strategy 2. Implement an agency removal policy for oryx on the Jornada Experimental Range.

Alternative Action: Agency Removal

The Manager, designated JER personnel, and Department personnel would have authority to eliminate oryx within JER boundaries. Harvested animals would be provided to the Department for sale as mandated by State policy. Prior to initiation of any such policy, the JER and the Department must sign a written agreement.

<u>Strategy 3.</u> Remove oryx through trap and transplant or roundup efforts. This strategy would only be used in situations where aerial trap and transplant, or roundup and removal of oryx, are economically feasible, and optional strategies have been exhausted. Determining where to place oryx removed by this strategy would be mandatory prior to initiating alternative actions. Costs of capture and removal will be assumed by the requesting agency. Other agencies involved may provide technical support based on funding and manpower availability.

Alternative Action 1: Drive Oryx off the Jornada Experimental Range. The JER Manager would develop and implement a non-lethal oryx removal plan with the

Department to include driving oryx off using aircraft and wing fences. Oryx would be driven onto the Range.

Alternative Action 2: Capture and Remove Oryx Oryx that cannot be removed through aerial drive tactics would be captured and moved from the JER to the Range.

3.3 MANAGE FOR MINIMUM NUMBERS OF ORYX OUTSIDE THE RANGE

Oryx outside of the Range exist in five New Mexico counties and El Paso County, Texas. Although the Department has authority and responsibility for oryx within New Mexico, various agencies and private landowners administer lands surrounding the Range. Management policies vary depending on the governing body. Properties surrounding the Range are a mixture of public lands, managed by federal agencies, state lands, and private land. The BLM manages the greatest percentage of land contiguous to the Range.

3.3.1 Outside the Range Issue 1: Minimize Oryx on BLM Land

Strategy 1. Manage oryx through hunter harvest.

Alternative Action 1: Conduct Population Reduction Hunts

Natural resource managers for BLM would coordinate population reduction hunts with the appropriate Department Area Office. BLM personnel would request population reduction hunts when oryx are detected. The Department would coordinate and conduct hunts as often as practical in an effort to reach the management goal.

Alternative Action 2: Sell Off-Range Oryx Permits

The Department would begin selling over-the-counter permits for oryx outside the Range on BLM lands. The Department would designate special seasons and boundaries for these hunts.

3.3.2 Outside the Range Issue 2: Manage for Zero Oryx on the Bosque del Apache National Wildlife Refuge

Strategy 1. Manage oryx through population reduction hunts.

Alternative Action: Conduct Population Reduction Hunts

Natural resource managers for the Bosque del Apache NWR (Bosque) would coordinate population reduction hunts with the appropriate Department Area Office. Bosque personnel would request population reduction hunts when oryx are detected.

The Department would coordinate and conduct hunts as often as practical pursuant to the management goal.

Strategy 2. Implement an Agency removal policy for oryx on the Bosque.

Alternative Action: Agency Oryx Removal

The Bosque Manager may implement a shoot-on-sight alternative. The Bosque Manager, designated Bosque personnel, and Department personnel would have authority to eliminate oryx within refuge boundaries. Harvested animals would be provided to the Department for sale as mandated by State policy. Prior to initiation of a shoot-on-sight policy, the Bosque and the Department must sign a written agreement.

<u>Strategy 3.</u> Remove oryx through trap and transplant or roundup efforts. This strategy would only be used in situations where aerial trap and transplant, or roundup and removal of oryx, are economically feasible, and optional strategies have been exhausted. Determining where to place oryx removed by this strategy would be mandatory prior to initiating alternative actions. Costs of capture and removal will be assumed by the requesting agency. Other agencies involved may provide technical support based on funding and manpower availability.

Alternative Action: Capture and Remove Oryx

Oryx would be captured using dart gun and rocket - net capture techniques from a fixed wing aircraft or helicopter, and transported to the Range for release.

3.3.3 Outside the Range Issue 3: Manage for Zero Oryx on the Sevilleta National Wildlife Refuge

Strategy 1. Manage oryx through population reduction hunts.

Alternative Action: Conduct Population Reduction Hunts Natural resource managers for the Sevilleta NWR (Sevilleta) would coordinate population reduction hunts with the appropriate Department Area Office. Sevilleta personnel would request population reduction hunts when oryx are detected. The Department would coordinate and conduct hunts as often as practical pursuant to the management goal.

Strategy 2. Implement an Agency removal policy for oryx on the Sevilleta.

Alternative Action: Agency Removal

The Sevilleta Manager, designated Sevilleta personnel, and Department personnel would have authority to harvest oryx within refuge boundaries. Harvested animals would be provided to the Department for sale as mandated by State policy. Prior to initiation of removal, the Sevilleta and the Department must sign a written agreement.

<u>Strategy 3.</u> Remove oryx through trap and transplant or roundup efforts. This strategy would only be used in situations where aerial trap and transplant, or roundup and removal of oryx, are economically feasible, and optional strategies have been exhausted. Determining where to place oryx removed by this strategy would be mandatory prior to initiating alternative actions. Costs of capture and removal will be assumed by the requesting agency. Other agencies involved may provide technical support based on funding and manpower availability.

Alternative Action: Capture and Remove Oryx Oryx would be captured using dart gun and rocket net capture techniques from a fixed wing aircraft or helicopter, and transported to the Range for release.

3.3.4 Outside the Range Issue 4: Manage for Zero Oryx on Fort Bliss

<u>Strategy 1.</u> Reduce oryx immigration onto Fort Bliss through hunter harvest. Managers strive to curtail the spread of oryx to all off-Range areas.

Alternative Action: Harvest Oryx South of U.S. Highway 70

Conduct population reduction hunts south of U.S. Highway 70. Fort Bliss personnel would contact the appropriate Department Area Office to determine when a population reduction hunt can be scheduled and the number of animals to be harvested. The Department would coordinate and conduct hunts as often as practical pursuant to the management goal

Strategy 2. Remove Oryx from Fort Bliss through non-lethal means.

Alternative Action 1: Drive Oryx off Fort Bliss

Coordinate a non-lethal oryx removal plan with the Department to include driving oryx off of Fort Bliss back to the Range using helicopters and wing fences.

Alternative Action 2: Capture and Remove Oryx

Oryx that can not be removed through aerial drive tactics may be captured and transported from Fort Bliss to the Range.

<u>Strategy 3.</u> Remove oryx from Fort Bliss through harvest alternatives. Hunter harvest on Fort Bliss is difficult to employ due to the presence of live ordnance and testing activities.

Alternative Action 1: Conduct Population Reduction Hunts.

Natural resource managers from Fort Bliss would coordinate population reduction hunts with the appropriate Department Area Office. Fort Bliss personnel would request population reduction hunts when oryx are detected. The Department would coordinate and conduct hunts as often as practical pursuant to the oryx management goal. *Alternative Action 2: Management Harvest*

Department personnel and/or designated Fort Bliss personnel would coordinate and conduct harvest of oryx within Fort Bliss. The Department would sell harvested animals to the public as mandated by state policy.

3.3.5 Outside the Range Issue 5: Manage for Minimum Numbers of Oryx on Holloman Air Force Base

Strategy 1. Reduce oryx movements onto HAFB through hunter harvest.

Alternative Action: Harvest Oryx Near HAFB

Conduct population reduction hunts within the Range in areas close to HAFB. Range personnel would contact the appropriate Department Area Office to determine when a population reduction hunt can be scheduled and the number of animals to be harvested. The Department would coordinate and conduct hunts as often as practical pursuant to the oryx management goal.

Strategy 2. Remove oryx from HAFB.

Alternative Action 1: Conduct Population Reduction Hunts.

Natural resource managers from HAFB would coordinate population reduction hunts with the appropriate Department Area Office. HAFB personnel would request population reduction hunts as needed when oryx are detected. The Department would coordinate and conduct hunts as often as practical pursuant to the oryx management goal. When possible hunts will target specific groups of animals that have been identified as potential threats to mission activities.

Alternative Action 2: Agency Oryx Removal

HAFB natural resource personnel may develop a shoot-on-site removal policy with the Department Southeast Area Office. This strategy would be employed when oryx are in areas that may pose an imminent threat to human life, testing activities, and/or airfield operations. Specific protocol for these actions would be outlined in the *draft HAFB Integrated Natural Resource Management Plan* (HAFB,1998).

Alternative Action 3: Implement Permit Hunts

Under authority of the Sikes Act (16 U.S.C. 670a – 670o, 1998), HAFB would initiate a hunt fee system. Fees will be set by, collected by, and administered by HAFB. Fees would be used to implement game management objectives in the HAFB Integrated Natural Resources Management Plan. The number of permits and type of hunt would be coordinated with the Department.

<u>Strategy 3.</u> Remove oryx through trap and transplant or roundup efforts. This strategy would only be used in situations where aerial trap and transplant, or roundup and removal of oryx, are economically feasible, and optional strategies have been exhausted. Determining where to place oryx removed by this strategy would be mandatory prior to initiating alternative actions. Costs of capture and removal will be assumed by the requesting agency. Other agencies involved may provide technical support based on funding and manpower availability.

Alternative Action 1: Drive Oryx Off of HAFB

Wildlife managers for HAFB would develop and implement a non-lethal oryx removal plan with the Department to include driving oryx off using aircraft and wing fences.

Alternative Action 2: Capture and Remove Oryx

Oryx that can not be removed through aerial drive tactics would be captured and moved off of HAFB.

Strategy 4. Restrict movement of oryx onto HAFB

Alternative Action: Fence Construction

Install "oryx proof" fences in areas where oryx are: 1) in greatest conflict with mission activities, such as the High Speed Test Track and airfield, or 2) around the perimeter of the installation. These actions would help exclude oryx from mission-sensitive areas.

3.3.6 Outside The Range Issue 6: Manage for Zero Oryx on State Lands

Strategy 1. Manage oryx through hunter harvest.

Alternative Action 1: Conduct Population Reduction Hunts

Natural Resource managers for the State would coordinate population reduction hunts with the appropriate Department Area Office. The Department would coordinate and conduct hunts as often as practical in an effort to reach the management goal.

Alternative Action 2: Sell Off-Range Oryx Permits

The Department would begin selling over-the-counter permits for oryx outside the Range on State lands. The Department would designate special seasons and boundaries for these hunts.

3.3.7 Outside the Range Issue 7: Manage for Minimum Numbers of Oryx on Private Land

Strategy. Manage oryx through hunter harvest on private lands.

Alternative Action: Conduct Population Reduction Hunts

Private land owners would coordinate population reduction hunts with the appropriate Department Area Office. The first step would involve the Department, in coordination with the landowner, in estimating the number of oryx on the land. Private land owners would then have the option of having either a public or private hunt on their land to harvest the oryx. The Department would then issue an appropriate number of either authorizations (for private hunts) or licenses (for public hunts) required for harvesting some or all of the oryx on the land.

The Department would coordinate public hunts, with a staff member contacting hunters on the public oryx depredation list and offering them the opportunity to hunt on the private land. The hunter's depredation license, issued in the spring of the year, would be authorized when the hunter inscribes the validation number provided by the Department.

A private hunt would require that the landowner contact hunters to hunt on the private land. The appropriate number of authorizations would be sent to the landowner from the appropriate Department Area Office. These are then given or sold by the landowner to hunters (in essence, the money charged by the landowner is a trespass fee). Each hunter then brings the authorization into any Department Area Office or the Department Santa Fe Office to purchase the oryx license.

3.4 MINIMIZE COMPETITION AND ENVIRONMENTAL IMPACT

Oryx have the potential to compete with native wildlife and domestic animals, and to cause environmental degradation or habitat destruction through over-use. The potential for competition and environmental impact increases as oryx distribution and populations expand.

3.4.1 Environmental Concern Issue 1: Insufficient information about current and potential environmental degradation

Strategy 1. Identify and conduct research necessary for future oryx management.

Alternative Action: Coordinate Research

The Department and the Range would coordinate with other federal and state agencies, research institutions, and private consultants, to define research needs and develop proposals for investigations.

Strategy 2. Implement scientific investigations relating to oryx competition with native wildlife.

Alternative Action 1: Conduct Habitat Utilization Studies

In order to gain an understanding of potential competition with native wildlife and domestic livestock, the Department and the Range would promote and encourage studies designed to quantify utilization of different habitats and resources including food, water, and space. Competition studies would investigate forage overlap with native wildlife and livestock, and habitat utilization and cohabitation with native ungulates.

Alternative Action 2: Study Potential Effects on Threatened or Endangered Species The Range and the Department would promote and encourage research to determine potential effects of oryx on listed threatened and endangered species.

Alternative Action 3: Study Effects on Sensitive Habitats

The Range and the Department would promote and encourage research to determine potential effects of oryx on sensitive habitats including natural springs, associated riparian areas, and others.

Strategy 3. Determine potential for oryx to spread disease.

Alternative Action: Conduct Disease Vector Potential Studies The Range and the Department would promote and encourage research to determine potential spread of disease to native wildlife and domestic livestock.

3.5 IMPACTS TO CULTURAL RESOURCES

Oryx have the potential to cause damage to cultural resources by trampling artifacts (e.g. pottery sherds and lithic materials), and entering or rubbing on historic wooden and stone buildings. Control of expansion and overpopulation through increased harvest strategies listed in Section 3.1.1 would curtail oryx damage to cultural resources. Humans also may damage cultural resources through oryx hunting activities.

3.5.1 Potential Impacts to Historical or Cultural Resources Issue 1: Off-road Travel

Strategy 1. Reduce human impacts of off-road driving to retrieve oryx.

Alternative Action 1: Utilize All Terrain Vehicles (ATVs)

Hunters driving off-road to retrieve oryx would, whenever possible, use ATVs for retrieving oryx. Range and Department personnel would provide ATV assistance to hunters as much as possible.

Alternative Action 2: Harvest Animals Near Roads.

Use existing improved and unimproved roads to get as close to harvested animals as possible.

Alternative Action 3: Manual Retrieval

In areas where oryx are long distances from roads and can not easily be dragged to a vehicle, hunters would cut up the oryx into manageable pieces and carry the pieces to the vehicle.

Alternative Action 4: Designate Off-Limits Areas

Range archaeologists would determine areas of historical and/or other cultural resources concern and designate them as off-limit areas to off-road vehicle use.

3.5.2 Potential Impacts to Cultural Resources Issue 2: Oryx Damage

<u>Strategy 1.</u> Reduce the oryx population through increased harvest in order to minimize potential for damage.

Alternative Action: Reduce Current Oryx Population Utilize alternative actions listed under section 3.1.1 to reduce the current oryx population to levels commensurate with the desired goal.

Strategy 2. Maintain oryx populations at the target goal of 800 to 1,200 animals.

Alternative Action: Manipulate Harvest Levels Aerial survey data will be used to set annual harvest levels required to approach the management goal. Alternative harvest options discussed under Section 3.1.1 will be used.

Strategy 3. Protect cultural resource sites from potential degradation by preventing oryx access.

Alternative Action 1: Fence Archaeological Sites and Historic Structures In situations where known archaeological sites or historic structures are in heavy oryx use areas fencing would be used to exclude oryx.

Alternative Action 2: Board up Entrances to Historic Structures Personnel trained in preservation of historic structures would place doors or other barriers in entrances to exclude oryx entry.

3.6 COOPERATIVE AGREEMENT

The Range will prepare an interagency Cooperative Agreement (CA) for implementation of the *Comprehensive Oryx Management Plan.* Specific cooperating agencies involved will include those with issues identified within this management plan. The format of the CA will be consistent with previous agreements between the Range and cooperating agencies (e.g., protection and maintenance of the White Sands pupfish). The CA will clearly designate management authority and responsibility for oryx control within all land management jurisdictions involved.

- Anderson, D.L., 1998. Personal communication. Discussion regarding oryx behavior on 23 February 1998.
- Anderson, W.D. and Taylor, D.E., 1983. Natural Resources Management Plan. Department of the Army, White Sands Missile Range, New Mexico.
- Dick-Peddie, W.A., 1993. *New Mexico Vegetation: Past, Present, and Future*. University of New Mexico Press, Albuquerque, New Mexico.
- Dieckman, R.C., 1980. The Ecology and Breeding Biology of the Gemsbok in the Hester Malan Nature Reserve. M.S. Thesis. University of Pretoria. Pretoria, South Africa.
- Dye, J., 1998. Personal Communication. Discussion regarding oryx behavior on 12 February 1998.
- Dye, J., 1998. *Gemsbok and Mule Deer Diets in Southern New Mexico*. M.S. Thesis. New Mexico State University. Las Cruces, New Mexico.
- Havstad, K. 1999. Personal communication. Discussion regarding oryx management on the Jornada Experimental Range.
- Holloman Air Force Base, 1998. Draft Integrated Natural Resource Management Plan.
- Jojola, S.M. 1998. Personal communication. Discussion regarding oryx behavior on 3 February 1998.
- Jojola, S.M., 1998. Applicability of Satellite Telemetry in Monitoring Gemsbok Movements on White Sands Missile Range, New Mexico. M.S. Thesis. New Mexico State University. Las Cruces.
- Kamees, L.K. 1998. Personal Communication. Discussion regarding oryx behavior on 26 February 1998.
- Knight M.H. 1992, Population Dynamics of Gemsbok and Blue Wildebeest of the Kalahari Gemsbok National Park. Ph.D. Dissertation. University of Pretoria. Pretoria, South Africa.
- Moller, A.P., J.J. Cuervo, J.P. Soler, C. Sora-Munoz. 1996. Horn asymmetry and fitness in gemsbok. Behav. Ecol. 7(3):247-253.
- Muldavin, E. and Melhop P., 1992. A Vegetation Classification and Map for the White Sands Missile Range and San Andres National Wildlife Refuge, New Mexico. Interim Report 2. New Mexico Natural Heritage Program. The Nature Conservancy. Albuquerque.
- Morrow, P. 1998. Personal Communication. Discussion regarding oryx behavior on 26 February 1998.

- New Mexico Department of Game and Fish, 1978. Internal memorandum dated 25 May 1978 regarding oryx ground and aerial surveys, and growth potential of the heard.
- New Mexico Department of Game and Fish, 1989. Internal memorandum dated 5 July 1989 regarding oryx and antelope surveys on White Sands Missile Range.
- New Mexico Department of Game and Fish, 1998. Unpublished harvest and aerial survey data.
- Saiz, R.S., 1975. Ecology And Behavior of the Gemsbok on the White Sands Missile Range, New Mexico. M.S. Thesis, New Mexico State University, Las Cruces, New Mexico.
- Smith J.C., 1994. Microhistilogical Analysis of Diets of Exotic and Native Ungulates in Southcentral New Mexico. M.S. Thesis, New Mexico State University, Las Cruces, New Mexico.
- Stratton. J., 1989. Morphological Comparisons, Weight Estimation, and Annuli Deposition of Oryx on White Sands Missile Range, New Mexico. M.S. Thesis. New Mexico State University, Las Cruces, New Mexico.
- U.S. Army, 1988. Army Regulation 200-2. *Environmental Effects of Army Actions*. Headquarters, Department of the Army, Washington, DC. December 1988.
- U.S. Army, 1995. Army Regulation 200-3. Natural Resources Land, Forest and Wildlife Management. Headquarters, Department of the Army, Washington, DC.
- U.S. Army, 1998. Unpublished oryx harvest data from White Sands Missile Range.
- U.S. Government Executive Order 13112, 1999. *Invasive Species*. Stated policies for exotic organisms on properties managed by executive agencies.
- U.S. Fish and Wildlife Service, 1982. Refuge Manual. Chapter 8. *Exotic Species Introduction and Management.*
- Weisenberger, M. 1998. Personal Communication. Discussion regarding mountain lion predation on oryx on the San Andres National Wildlife Refuge.
- White, R.J., 1967. Preliminary Investigation of the Factors Involved in Stocking Greater Kudu and Gemsbok in New Mexico. M.S. Thesis, New Mexico State University, Las Cruces, New Mexico.
- Williamson, D. and J.W Williamson. 1988. *Habitat Use and Ranging Behavior of Kalahari Gemsbok*. Conservation and Biology of Desert Antelopes.
- Wood, J.E., White R.J., and Durham J. L., 1970. Investigations Preliminary to the Release of Exotic Ungulates in New Mexico. New Mexico Department of Game and Fish. Bulletin No. 13. New Mexico State University, Agriculture Experiment Station.

APPENDIX A

U.S. FISH AND WILDLIFE SERVICE REFUGE MANUAL CHAPTER 8: EXOTIC SPECIES INTRODUCTION AND MANAGEMENT THIS PAGE INTENTIONALLY LEFT BLANK

POPULATIONS MANAGEMENT

8. Exotic Species Introduction and Management

8.1 <u>Policy.</u> The National Wildlife Refuge System exists for the protection and management of plants and animals native to the United States. The policy of the Service is to prevent " further introduction of exotic species on national wildlife refuges except where an exotic species would have value as a biological control agent and would be compatible with the objectives of the refuge. The continued existence, or management of exotic plants and animals on refuge lands will be permitted only if:

A. An exotic species has become established and its elimination, while desirable, is no longer practicable, or

- B. An exotic species has become established and maintained on a non-augmented basis for at least 25 years and does not conflict with refuge objectives. (See 7 RM 1 for definition of established exotics.)
- 8.2 <u>Objectives.</u> The objectives for exotic species introduction and management are:
 - A. To prevent further introduction of exotic species except as noted in Section 8.1, above.
 - B. To protect native plants and animals from adverse impacts of competing with exotic species.
- 8.3 <u>Authority.</u> The authority to implement procedures and to regulate introduction of exotic species into the natural ecosystems of refuge lands and waters in embodied in the Lacey Act and the National Environmental Policy Act. This authority is delegated to the Secretary of the Interior by Executive Order 11987. The order states that Federal executive agencies shall, to the extent permitted by law, restrict the Introduction of exotic species into the natural ecosystem on lands and waters which they own, lease, or hold for purposes of administration (Section 2(a)). It further states that this order does not apply if the Secretary of Agriculture or the Secretary of the Interior find that such introduction will not have an adverse impact on natural ecosystems (Section 2(d)). (See 1 RM 5 for complete citations.)
- 8.4 Definitions.
 - A. <u>Exotic species</u>. All species of plants or animals (including fish) not native to the United States and not presently or historically occurring in the United States except through the intervention of man, intentional or otherwise. A non-indigenous species.

Release:

003

NATIONAL WILDLIFE REFUGE SYSTEM

March 12, 1982

POPULATIONS MANAGEMENT

8. Exotic Species Introduction and Management

- B. <u>Native species.</u> All species of plants or animals (including fish) having originated in and being produced, growing, or living in a particular region or environment of the particular region or environment of the United States. An indigenous species.
- C. <u>Natural ecosystem.</u> Any unconfined area which permits unrestrained movement of the species in question. This would include naturally confined areas such as islands and some mountain valleys.
- D. <u>Introduction</u>. Release, escape, or establishment of an exotic species into a natural ecosystem.
- 8.5 <u>Relationship to native species.</u> Since each native species has evolved to fill its own ecological niche, an introduced species should not be placed in direct competition with a presently 9ccurring species. In situations In which there is no immediate or recognizable direct competition, there is still the threat of future population expansion and danger of the introduced species transmitting parasites or disease to susceptible native species.

The great mobility of avian species assures that most existing niches for these are filled. Most successful bird introductions have been either at the expense of native species or the introduced species has filled a niche artificially created by man through land use changes and settlement. With the exception of the mobility factor, the same principles apply to the introduction of many exotic plants.

8.6 <u>Proposals for Introductions.</u>

A. <u>Purpose</u>. The purpose of a proposal to introduce exotic species is to fully document the biological need for the Introduction and to clearly show compliance with the policies of the Service.

<u>Preparation.</u> When an exotic species has been identified for introduction or management on a refuge through an appropriate planning process, the manager may submit a proposal in memo form to the regional director requesting approval of the introduction of such species. Prior to submitting this proposal, the refuge manager must be sure that the resulting actions would fall-within policy outlined in this chapter and prepare an environmental assessment (EA).

When planning for the possible introduction and management of an exotic species, the refuge manager must remember that its relationship to presently occurring

Release:

NATIONAL WILDLIFE REFUGE SYSTEM

003

March 12, 1982

POPULATIONS MANAGEMENT

8. Exotic Species Introduction and Management

species is of critical Importance. During the initial planning and assessment, such factors as suitability of available habitat, possible areas of competition, disease potential, and predation spread potential must be completely evaluated .

- C. Content. The proposal will contain the following information:
 - (1) A description of the need for a biological control agent and of how this agent will benefit high priority refuge objectives.
 - (2) The species involved and its particular suitability as. a biological control agent.
 - (3) Source of the stock, how it will be obtained, and the numbers involved.
 - (4) Duration of the proposed program.
 - (5) Habitat requirements of the species to be introduced.
 - (6) Potential threats to existing habitat or wildlife populations, including,
 - (a) competition with existing populations, and
 - (b) potential disease transmissions (document consultation with National Health Laboratory.)
 - (7) Facilities available or needed.
 - (8) Plans for monitoring and evaluation.
 - (9) Coordination and consultation with others.
 - (10) Permits required.
 - (11) Cost-of project.
 - (12) Environmental assessment (EA).
- D. <u>Review and approval.</u> The regional director may concur with or reject the proposal following his evaluation based on official policy and available research data. The regional

Release:

003

NATIONAL WILDLIFE REFUGE SYSTEM

March 12, 1982

POPULATIONS MANAGEMENT

8. Exotic Species Introduction and Management

director will assure compliance with all applicable laws and regulations of the U.S. Department of the Interior, U.S. Department of Agriculture, and provisions of the National Environmental Policy Act.

The ultimate authority to approve the introduction and management of an exotic species rests with the Director. Ibis authority may be redelegated to the regional director.

8.7 Management considerations.

- A. Exotic species that were previously established in a given habitat but have been extirpated because of land use changes, competition from other species, or other factors will not be reintroduced.
- B. Research on exotic species which are expanding their range through natural dispersal should be encouraged to determine if the Invading species will cause a detrimental effect on native species or approved exotic species and to evaluate the long-term implications.
- C. All established exotic birds And mammals will be managed in accordance with the appropriate chapters of the Refuge Manual, provided that such actions meet the policy requirements of Section 8.1, above.
- D. Release of exotic birds in the vicinity of the refuge will be prevented or discouraged, where possible.
- E. Established exotic plants are often now difficult to distinguish from natives. Such plant species may be utilized if their management to consistent with policy (7 RM 8) and 1t has been demonstrated that they are better adapted than native species to the accomplishment of approved objectives.
- 8.8 <u>Cooperative responsibilities.</u> Refuge managers will be responsible for documenting and reporting to the regional office Information about Intentional or accidental releases of exotics or introduced native wildlife species that come to their attention. Each refuge should maintain a current list of State and local regulations governing exotic species. Each refuge should also maintain an appropriate list of contacts to report detection of exotic species and sources of assistance to deal with control.

March 12, 1982

Release:

NATIONAL WILDLIFE REFUGE SYSTEM

003

APPENDIX B

EXECUTIVE ORDER 13112 – INVASIVE SPECIES

THIS PAGE INTENTIONALLY LEFT BLANK

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release

February 3, 1999

EXECUTIVE ORDER 13112 INVASIVE SPECIES

By the authority vested in me as President by the Constitution and the laws of the United states of America, including the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 et seq.), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa et seq.), Federal Noxious Weed Act of 1974, as amended (16 U.S.C. 1531 et seq.), and other pertinent statutes, to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause, it is ordered as follows:

Section 1. Definitions.

(a) "Alien species" means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

(b) "Control" means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.

(c) "Ecosystem" means the complex of a community of organisms and its environment.

(d) "Federal agency" means an executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104.

(e) "Introduction" means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

(f) "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

(g) "Native species" means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

(h) "Species" means a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.

(i) "Stakeholders" means, but is not limited to, State, tribal, and local government agencies, academic institutions, the scientific community, nongovernmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners.

(j) "United states" means the 50 States, the District of Columbia, Puerto Rico, Guam, and all possessions, territories, and the territorial sea of the United States.

Sec. 2. Federal Agency Duties.

(a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law,

(1) identify such actions;

(2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them; and

(3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(b) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.

Sec. 3. Invasive Species Council.

(a) An Invasive Species Council (Council) is hereby established whose members shall include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the Environmental Protection Agency. The Council shall be Co-Chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council may invite additional Federal agency representatives to be members, including representatives from subcabinet bureaus or offices with significant responsibilities concerning invasive species, and may prescribe special procedures for their participation. The Secretary of the Interior shall, with concurrence of the Co-Chairs, appoint an

Executive Director of the Council and shall provide the staff and administrative support for the Council.

(b) The Secretary of the Interior shall establish an advisory committee under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council, and shall, after consultation with other members of the Council, appoint members of the advisory committee representing stakeholders. Among other things, the advisory committee shall recommend plans and actions at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order. The advisory committee shall act in cooperation with stakeholders and existing organizations addressing invasive species. The Department of the Interior shall provide the administrative and financial support for the advisory committee.

Sec. 4. Duties of the Invasive Species Council. The Invasive Species Council shall provide national leadership regarding invasive species, and shall:

(a) oversee the implementation of this order and see that the Federal agency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective, relying to the extent feasible and appropriate on existing organizations addressing invasive species, such as the Aquatic Nuisance Species Task Force, the Federal Interagency Committee for the Management of Noxious and Exotic Weeds, and the Committee on Environment and Natural Resources;

(b) encourage planning and action at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the management Plan in section 5 of this order, in cooperation with stakeholders and existing organizations addressing invasive species;

(c) develop recommendations for international cooperation in addressing invasive species;

(d) develop, in consultation with the Council on Environmental Quality, guidance to Federal agencies pursuant to the National Environmental Policy Act on prevention and control of invasive species, including the procurement, use, and maintenance of native species as they affect invasive species;

(e) facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health;

(f) facilitate establishment of a coordinated, up-to-date information-sharing system that utilizes, to the greatest extent practicable, the Internet; this system shall facilitate access to and exchange of information concerning invasive species, including, but not limited to, information on distribution and abundance of invasive species; life histories of such species and invasive characteristics; economic, environmental, and human health impacts; management techniques, and laws and programs for management, research, and public education; and

(g) prepare and issue a national Invasive Species Management Plan as set forth in section 5 of this order.

Sec. 5. Invasive Species Management Plan.

(a) Within 18 months after issuance of this order, the Council shall prepare and issue the first edition of a National Invasive Species Management Plan (Management Plan), which shall detail and recommend performance -oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species. The Management Plan shall recommend specific objectives and measures for carrying out each of the Federal agency duties established in section 2(a) of this order and shall set forth steps to be taken by the Council to carry out the duties assigned to it under section 4 of this order. The Management Plan shall be developed through a public process and in consultation with Federal agencies and stakeholders.

(b) The first edition of the Management Plan shall include a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying pathways by which invasive species are introduced and for minimizing the risk of introductions via those pathways, and shall identify research needs and recommend measures to minimize the risk that introductions will occur. Such recommended measures shall provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. If recommended measures are not authorized by current law, the Council shall develop and recommend to the President through its Co-Chairs legislative proposals for necessary changes in authority.

(c) The Council shall update the management Plan biennially and shall concurrently evaluate and report on- success in achieving the goals and objectives set forth in the Management Plan. The Management Plan shall identify the personnel, other resources, and additional levels of coordination needed to achieve the Management Plan's identified goals and objectives, and the Council shall provide each edition of the Management Plan and each report on it to the Office of Management and Budget. Within 18 months after measures have been recommended by the Council in any edition of the Management Plan, each Federal agency whose action is required to implement such measures shall either take the action recommended or shall provide the Council with an explanation of why the action is not feasible. The Council shall assess the effectiveness of this order no less than once each 5 years after the order is issued and shall report to the office of Management and Budget on whether the order should be revised.

Sec. 6. Judicial Review and Administration.

(a) This order is intended only to improve the internal management of the executive branch and is not intended to create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any other person.

(b) Executive Order 11987 of May 24, 1977, is hereby revoked.

(c) The requirements of this order do not affect the obligations of Federal agencies under 16 U.S.C. 4713 with respect to ballast water programs.

(d) The requirements of section 2(a) (3) of this order shall not apply to any action of the Department of State or Department of Defense if the Secretary of State or the Secretary of Defense finds that exemption from such requirements is necessary for foreign policy or national security reasons.

WILLIAM J. CLINTON

THE WHITE HOUSE, February 3, 1999.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX C

MAP DEPICTING SURVEY ROUTES USED FOR SEX AND AGE DELINEATION OF ORYX

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix C. Survey Routes for Oryx Sex and Age Delineation

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX D ORYX POPULATION MODEL

THIS PAGE INTENTIONALLY LEFT BLANK

MODEL OBJECTIVES

The following objectives directed development of the oryx model.

- use available information to produce a quantified estimate of unknown variables influencing the oryx population;
- develop a purposeful illustration of the potential for oryx population expansion; and
- predict effect of harvest levels on oryx population growth.

VARIABLES

Values for variables in the model are derived from data which are known (hard data), unknown (no data and no research), or derived by research (validated through studies) (Table 1). Values of unknown variables are estimated through relationships with known and researched data.

Variable	Known	Unknown	Research
Breeding cows	4		4
Calving rate			4
Natural calf mortality		4	
Natural adult mortality		4	
Harvest by sex	4		

Table 1. Source of Variables Driving the Oryx Population Model.

The number and sex of oryx initially introduced on the Range begins the model. Calving rate, recruitment, additional animals released into the population, harvest rates, and natural mortality rates determine subsequent numbers. The number of breeding cows is a known (number introduced) and researched (number produced and recruited) variable. Additional variables in the model are calculated from the five listed in table. Unknown variables are manipulated in order to approach the estimated population level generated through using a "best guess" approach (Section 2).

MODEL DESIGN

Linear equations based on the interrelationships of variables drive the model. The number of breeding cows initially introduced to the Range starts the model. During the third year following introduction, the number of breeding cows is estimated by the equation:

.94X((B+L-H)-.50XG) = Total number of breeding cows in population

where:
$$B = previous years breeding cows$$

 $L = calf cow recruitment from 2 years prior$
 $H = previous year cow harvest$
 $G = one year previous natural adult mortality$

This equation assumes 94 percent of cows between 22 months and 10 years of age will calve each year (Dieckmann, 1980). The number of breeding cows in the population is dependent on calf survival and recruitment as well as adult mortality. Assumptions within this equation are: 1) natural adult mortality occurs at equal rates regardless of sex; 2) sex ratio of calves is 1:1, as found in Kalahari Desert populations; and 3) cows reach sexual maturity by 24 months of age. Breeding cow recruitment is dependent upon recruitment of cow calves derived by the equation:

.50X(BXC)-(.50XE)=number of cows recruited into the breeding cow population

where: B = number of breeding cows C = calf rate E = natural calf mortality

This equation assumes calves are born at a 1:1 sex ratio (Dieckmann, 1980). This number is added to the breeding cow population 2 years later when the calves reach sexual maturity.

Net recruitment into the population is derived by the equation:

 $(B \bullet C) - (E + G + J) =$ Net recruitment into the population

where:	B = number of breeding cows
	C = calf rate
	E = natural calf mortality
	G = natural adult mortality
	J = total harvest (including crippling loss)

UTILITY OF THE MODEL

The model provides a practical estimation of past and present trends, and a reasonable forecast of future harvest level effects on the population. The model provides a quantifiable hypothesis about trends in the oryx population. It increases understanding of relationships between the variables and how each variable influences the population. Regardless of the accuracy in

projecting absolute oryx numbers, the model shows that the number of adult cows currently being harvested must be increased significantly if the population is to be reduced (Figures 2-5 and 2-6). To date, predictions based on the model are substantiated through increasing numbers of oryx observed during aerial surveys following annual harvests.

UNKNOWN VARIABLES

Natural calf mortality is the unknown variable with the greatest potential influence on oryx population trends. Future research on calf mortality and natality rates is required to provide information for more accurate predictions of oryx population levels and growth potential. Quantification of these variables will allow for more accurate determination of harvest levels that are needed to sustain the population at desired levels.