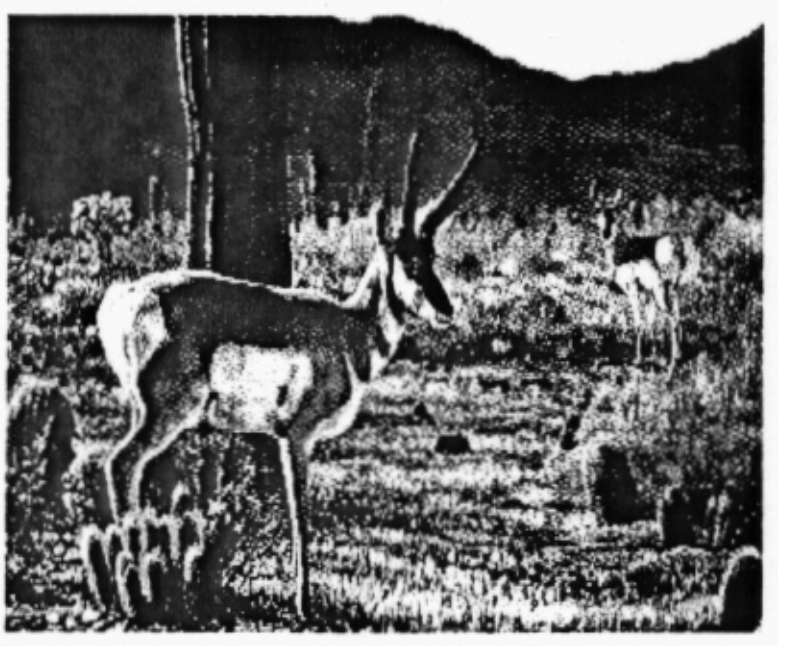
ES

U.S. Fish & Wildlife Service

Final Revised Sonoran Pronghorn Recovery Plan



December 1998

Final Revised Sonoran Pronghorn Recovery Plan
(*Antilocapra americana sonoriensis*)

November 1998
Original plan approved in 1982

Prepared By

Laura A. Thompson-Olais
U.S. Fish and Wildlife Service
Cabeza Prieta National Wildlife Refuge
1611 N. Second Avenue
Ajo, Arizona 85321

With

Arizona Game and Fish Department
Bureau of Land Management
Luke Air Force Base, Resource Management Office
U.S. Marine Corps
National Park Service, Organ Pipe Cactus National Monument
U.S. Fish and Wildlife Service, Arizona Ecological Services Office

For

Region 2
U.S. Fish and Wildlife Service
Albuquerque, New Mexico 87103

Approved: Domenick R. Cicone
Acting Regional Director, U.S. Fish and Wildlife Service

Date: DEC 03 1998

Sonoran Pronghorn Core Working Group

In 1988, after the Sonoran Pronghorn Recovery Team developed the 1982 Recovery Plan and disbanded, the Service Regional Director designated Cabeza Prieta National Wildlife Refuge as the lead office for recovery efforts. The Sonoran Pronghorn Core Working Group was formed in May 1991 to advise the Refuge Manager of Cabeza Prieta National Wildlife Refuge and the Regional Director of the Southwest Region of the U.S. Fish and Wildlife Service regarding recovery efforts for the endangered Sonoran pronghorn. Today, the Service is the ultimate authority in overseeing recovery efforts through the use of Section 7 consultation.

The CWG is made up of one or more representatives from each agency that has a mandate to protect the subspecies and/or that manages land where Sonoran pronghorn inhabit or have inhabited in the past. The following are **current members** of the CWG:

Mike Coffeen, U.S. Fish and Wildlife Service, Phoenix, Arizona
Susanna Henry, Bureau of Land Management, Yuma, Arizona
John Hervert, Arizona Game and Fish Department, Phoenix, Arizona
Dave Hoerath, Bureau of Land Management, Phoenix, Arizona
Johnson Jose, Tohono O'odham Nation, Sells, Arizona
William Miller, Luke Air Force Base, Arizona
Raphaela Paredes, Pinacate Biosphere Reserve, Hermosillo, Sonora, Mexico
Ron Pearce, Marine Corps Air Station, Yuma, Arizona
Laura Thompson-Olais, Cabeza Prieta National Wildlife Refuge, Ajo, Arizona
Tim Tibbitts, Organ Pipe Cactus National Monument, Ajo, Arizona
Don Tiller, Cabeza Prieta National Wildlife Refuge, Ajo, Arizona
Bill Van Pelt, Arizona Game and Fish Department, Phoenix, Arizona

Past members of the CWG include:

Bill Austin, U.S. Fish and Wildlife Service, Phoenix, Arizona
Jim Barnett, Organ Pipe Cactus National Monument, Ajo, Arizona
Robert Barry, Luke Air Force Base, Arizona
Dave Belitsky, Arizona Game and Fish Department, Phoenix, Arizona
Ted Corderey, U.S. Fish and Wildlife Service, Phoenix, Arizona
Gene Dahlem, Bureau of Land Management, Phoenix, Arizona
Dan Friese, Luke Air Force Base, Arizona
Tim Goodman, Bureau of Land Management, Phoenix, Arizona
Carlos Castillo Sánchez, Centro Ecológico de Sonora, Hermosillo, Sonora, Mexico
Lorena Wada, U.S. Fish and Wildlife Service, Phoenix, Arizona

Disclaimer

Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, state agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Some of the techniques outlined for recovery efforts in this revision are completely new regarding this subspecies. Therefore, the cost and time estimates are approximations.

Literature Citations

Literature citations should read as follows:
U.S. Fish and Wildlife Service. 1998. Final Revised Sonoran Pronghorn Recovery Plan. Albuquerque, New Mexico. 70 pp.

Additional copies may be purchased from:
Fish and Wildlife Reference Service:
5430 Governor Lane, Suite 110
Bethesda, Maryland 20814
301/492-6403 or 1/800-582-3421

The fee for the plan varies depending on the number of pages.

Executive Summary

Current Species Status

Sonoran pronghorn are currently listed as endangered and are on Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. It is estimated that there are fewer than 300 individuals in the United States and 200 to 500 individuals in the State of Sonora, Mexico.

Habitat Requirements and Limiting Factors

In the U.S., Sonoran pronghorn habitat is located in the Sonoran Desert in broad alluvial valleys separated by block-faulted mountains. Creosote-bursage flats bordered by washes of palo verde, mesquite, and ironwood are used if forbs are present. Mesquite-creosote habitat bordering palo verde/mixed cacti bajadas are also used. Ephemeral washes are important during summer for thermal protection (Wright and deVos 1986). In Mexico, medaños or fixed dunes with cholla are used in addition to the previously mentioned habitat. Cacti appear to make up a substantial part of Sonoran pronghorn diet. Some of the following appear to be the limiting factors: occurrence and continuance of drought possibly predisposing animals to predation; lack of available succulent cacti for forage, such as jumping cholla; and, possibly, the lack of available free-standing water.

Recovery Objective

The recovery objective is to remove the Sonoran pronghorn from the list of endangered species. This revision addresses first downlisting the subspecies to threatened.

Recovery Criteria

Establish an estimated population of 300 adults in one self-sustaining population in the U.S. for a minimum of 5 years, and establish at least one other self-sustaining population in the U.S. Assist with recovery efforts in Mexico as requested. Criteria for downlisting: maintain a stable population for a minimum of 5 years and protect and secure the necessary habitat.

Actions Needed

1. Enhance present populations of Sonoran pronghorn by providing supplemental forage and/or water.

2. Determine habitat needs. Protect present range.

3. Investigate and address potential barriers to expansion of presently used range. Investigate, evaluate, and prioritize present and potential future reintroduction sites within the historic range.

4. Establish and monitor a new, separate herd(s) to guard against catastrophes decimating the core population. Investigate captive breeding.

5. Continue monitoring populations. Maintain a protocol for a repeatable and comparable survey technique.

6. Examine additional specimen evidence available to assist in verification of taxonomic status.

Estimated Cost of Recovery
(in thousands)

Year	Need 1	Need 2	Need 3	Need 4	Totals
1999	630.0	300.0	200.0	60.0	1,190.0
2000	630.0	450.0	200.0	60.0	1,340.0
2001	590.0	450.0	200.0	60.0	1,300.0
2002	590.0	450.0	200.0	60.0	1,300.0
2003	590.0	450.0	200.0	60.0	1,300.0
2004	590.0	450.0	200.0	60.0	1,300.0
2005	590.0	450.0	200.0	60.0	1,300.0
Totals	4,210.0	3,000.0	1,400.0	490.0	9,030.0

Total Estimated Cost of Recovery: $9,030,000

Date of Recovery

Because some significant aspects of the life history of Sonoran pronghorn are not yet known, a delisting date cannot be projected at this time. Downlisting will be considered in the year 2005, or sooner, if the recovery criteria in this plan are considered viable and have been met. This plan is to be short term (about 7 years) as critical survival information is not sufficiently understood about this animal. Annual updates, rather than a new plan or major revision, will be the concept for maintaining an up-to-date recovery plan. Implementation plans will be written for each major recovery project and will provide necessary details of the project.

Acronyms and Abbreviations

AGFD	Arizona Game and Fish Department
BEC	Barry M. Goldwater Executive Committee
BLM	Bureau of Land Management
Cabeza Prieta NWR	Cabeza Prieta National Wildlife Refuge
CES	Centro Ecológico de Sonora
CFGD	California Fish and Game Department
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CWG	Sonoran Pronghorn Core Working Group
Goldwater AFR	Barry M. Goldwater Air Force Range
Luke AFB	Luke Air Force Base
MCAS	Marine Corps Air Station
MTR	Military Training Route
Organ Pipe Cactus NM	Organ Pipe Cactus National Monument
Service	U.S. Fish and Wildlife Service
U.S.	United States
WMIDD	Wellton Mohawk Irrigation and Drainage District
WTI	Weapons Tactical Instructor Training

Table of Contents

I. Introduction

The Sonoran pronghorn (*Antilocapra americana sonoriensis*) was listed as endangered on March 11, 1967 (32 FR 4001), and is currently recognized as one of five subspecies of pronghorn (Nowak and Paradiso 1983). The subspecies presently inhabits southwestern Arizona in the U.S. and northwestern Sonora in Mexico.

This Recovery Plan revision contains new data collected on habitat use and on the significance of available water and droughts, and an updated population estimate for the U.S. Some of these factors are believed to be critical factors affecting Sonoran pronghorn population numbers. Information pertaining to recovery efforts in Mexico will be so stated; otherwise, information refers to efforts being conducted in the U.S.

A. Description

Pronghorn were first described as *Antelope americana* by George Ord in 1815. Taxonomists recognized that the North American pronghorn was unique and warranted recognition as a distinct family of mammals. Ord proposed a new name, *Antilocapra*, in 1818.

Pronghorn are endemic to North America (O'Gara 1978), where they evolved on the prairies and deserts during the last 20 million years (Frick 1937). Today the total area of suitable pronghorn habitat has been greatly restricted, possibly by more than 75 percent (O'Gara and Yoakum 1992). Some of the causes of habitat loss are agricultural, urban, and mining expansion onto historic rangelands; fencing across routes of seasonal movements; removal of native vegetation by rangeland rehabilitation projects; and heavy livestock grazing.

Pronghorn are proportionately long-legged, small-bodied artiodactyls distinguished by large white areas of hair present on the rump, sides of face, two bands on the throat, underparts, and part-way up the sides of the body. They have slightly curved horns, the males with a single prong projecting forward, and have a wooly undercoat overlaid with long, straight, coarse, brittle guard hairs. The color of the animal varies from yellowish to tan, except for blackish on the top of the nose (Hoffmeister 1986). Pronghorn are the swiftest terrestrial mammals in the New World. Kitchen (1974) clocked herds moving at 64 to 72 km per hour with an observed maximum speed of 86.5 km per hour. These speeds can be attained only on hard ground (Nowak and Paradiso 1983).

Sonoran pronghorn differ from the other four recognized subspecies: *A. a. americana*, *A. a. mexicana*, *A. a. oregona*, and *A. a. peninsularis*. The subspecies *A. a. sonoriensis* was first described by Goldman (1945) from a type

specimen taken by Vernon Bailey and Frederick Winthrop on December 11, 1932, at a ranch on the northern side of the Rio de Sonora, southwest of Hermosillo, Sonora, Mexico, and 64 km north of Costa Rica, Sonora. The specimen was described as being the smallest subspecies of *A. americana*. The coloration of *A. a. sonoriensis* was paler and cranial features were distinctively different from other subspecies.

The major cranial features noted to be different in *A. a. sonoriensis* are:

1. Skull narrower in mastoidal, orbital, and zygomatic width.
2. Frontal depression less pronounced.
3. Premaxillae less extended posteriorly along median line.
4. Auditory bullae more flattened, less projecting below level of basioccipital.

In February 1969, Paradiso and Nowak (1971) examined the skulls of three juveniles and one adult male collected near Caborca in northwestern Sonora, Mexico. They also compared the adult doe Sonoran pronghorn previously examined and described by Goldman, and a specimen of a doe from Fort Buchanan (now called Crittenden) in Santa Cruz County, Arizona, plus the four previously mentioned bucks. They believed these six Sonoran pronghorn were more distinctive from the other four subspecies than they were from each other.

The AGFD (1981) questioned the subspecies designation of the Sonoran pronghorn. After examining the four buck skulls, the holotype, and the Crittenden specimen, the authors concluded the measurements all fell within the range of values given for other subspecies by Paradiso and Nowak (1971). They concluded that the subspecies designation was unwarranted and that further data were needed to confirm the Sonoran pronghorn designation. Hoffmeister (1986) stated that the type specimen may be smaller than average for the subspecies and that the distinctiveness of *A. a. sonoriensis* remains to be ascertained, when and if more specimens become available.

Some of the skulls of the following mortalities were examined by Ron Nowak of the Service Office of Scientific Authority in Washington, D.C. He reported six appearing like *sonoriensis* and six appearing like *mexicana* (see Appendix A).

1. 1969: Four Sonoran pronghorn skulls were seized by U.S. Fish and Wildlife Service agents from a Tucson, Arizona, taxidermist and deposited in the National Museum of Natural History. The skulls had been illegally taken and imported by a Mexican hunter for trophy purposes.

2. June 24, 1970: A dead buck was removed from the Wellton-Mohawk Canal south of Interstate 8.

3. July 10, 1972: An adult buck was found along Ajo Mountain Drive at the Organ Pipe Cactus National Monument, east of Highway 85.

4. September 1975: An adult doe was hit by an automobile and killed on Highway 2, 8 km west of Sonoyta, Mexico.

5. November 28-29, 1987: Capture/collaring effort by AGFD in the Mohawk Valley; one doe appeared to have spinal injuries and was euthanized.

6. July 2, 1989: A male pronghorn was recovered from Wellton Canal by AGFD and brought to the Phoenix Zoo, where it died that same day.

7. July 5, 1990: A carcass was found at Bates Well at Organ Pipe Cactus NM. The skull is now at the National Museum of Natural History.

8. In the 1986 Final Report on Sonoran Pronghorn Status in Arizona (Wright and deVos 1986), three mortalities of collared pronghorn were reported, two of unknown causes and one from predation. The specimens were sent to the National Museum of Natural History for taxonomic classification and for accession there.

9. A dead pregnant doe presently located in the office of CES, Hermosillo, Mexico.

Mitochondrial and nuclear DNA and electrophoresis are being pursued by AGFD and Cabeza Prieta NWR to aid in taxonomic verification. Blood samples taken from the population in Arizona and Mexico have been examined at the Service's National Fish and Wildlife Forensics Laboratory in Ashland, Oregon. Samples were analyzed at Cornell University. In 1988, correspondence from Cornell University Director Bernie May to Joan Scott of AGFD indicated that "no differences were found between the Sonoran and Mexican serum proteins which we analyzed last week."

A 1996 memorandum (see Appendix B) by Dr. Steve Fain of the National Fish and Wildlife Forensics Laboratory discussed the mitochondrial DNA analysis completed on 10 individuals (22 individual blood samples) from the 1994 collaring effort in the U.S. The Sonoran and Mexican subspecies were distinguished by less than 1 percent mtDNA sequence divergence (i.e., one substitution per 185 bases compared). Dr. Gene Rhodes at Purdue University began analyzing Sonoran pronghorn blood samples in 1998 collected in Arizona and Mexico.

Consensus among the CWG is that Sonoran pronghorn will continue to be protected under the Isolated Vertebrate Population Policy Act (see Appendix C) within the Endangered Species Act as it meets the requirements of being an isolated distinct vertebrate population. This subspecies occupies a very distinct,

unusual habitat for the species and appears to have distinct adaptations to its environment (two of the three test for an evolutionarily significant unit; U.S. Fish and Wildlife Service 1994, p. 19).

B. Distribution and Abundance

The United States

It was not until 1945 that the subspecies was described; prior to that date, many of the collected specimens had been listed as different subspecies (AGFD 1981). Historically they ranged from Highway 15 to the east; the Altar Valley and the Papago Indian Reservation (now Tohono O'odham Nation) to the north; and the Imperial Valley, California, to the west (see Figure 1, Wright and deVos 1986; and Figure 2, Nelson 1925, Monson 1968, Paradiso and Novak 1971).

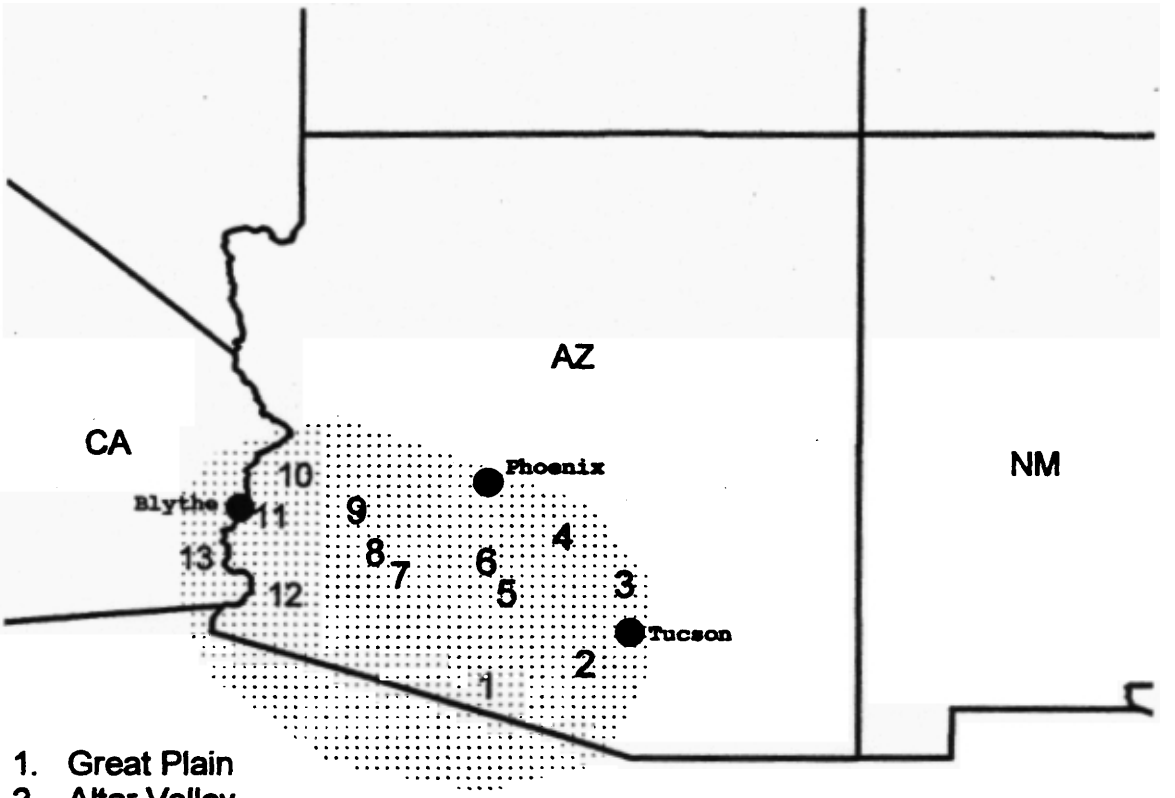
Antelope were found in every open valley along the boundary from Nogales to Yuma (Carr 1971), but by 1907 pronghorn were described by E.A. Mearns as a rare animal in the region (Cabeza Prieta NWR 1980).

Nelson (1925) stated that in 1923, Papago Indians reported that a few antelope were still ranging in the Santa Rosa Valley in Pima County, Arizona. No definite number was given, but Nelson did estimate that there were 105 Sonoran pronghorn in Arizona in 1924.

Nichol (1941) estimated 60 antelope in southwestern Arizona in 1941, not including those found on Organ Pipe Cactus NM. Halloran (1957) said there were probably less than 1,000 Sonoran pronghorn in 1956.

Carr (1970) observed the "sighting of eight antelope near Pisinimo on the Papago Indian Reservation which most likely drifted north from Mexico," and that "there have been numerous rumors of antelope in the Papago country"; however, no recent reliable observations have been made. Carr (1970) also stated that there "is a considerable amount of good Sonoran antelope habitat on the Papago Indian Reservation and particularly in the Great Plains area. However, Indian hunting and grazing practices prohibit a lasting resident antelope population."

Literature and recent telemetry show that Sonoran pronghorn occur most frequently in the following areas (see Figure 3, Carr 1972; and Figure 4): Pinta Sands, Growler Valley, Mohawk Valley, San Cristobal Valley. Wright and deVos (1986) stated that observations in the Growler Valley were frequent and that the Mohawk Valley, San Cristobal Valley, and Goldwater AFR support herds of 10 to 20 animals during most of the year. Also mentioned was a regularly observed herd of 7 to 10 pronghorn in the Cameron tanks area. On Organ Pipe Cactus NM, Sonoran pronghorn are frequently observed during spring and summer west of



1. Great Plain
2. Altar Valley
3. Oracle Area
4. Florence Area
5. Vekol Valley
6. Santa Rosa Valley
7. Oatman Mountain
8. Palomas Mountains
9. Ranegras Plain
10. Cactus Plain
11. Bouse Area
12. Welton Valley
13. Chuckwalla Bench

Figure 1. Historical Sonoran Pronghorn Sites in the Southwest.

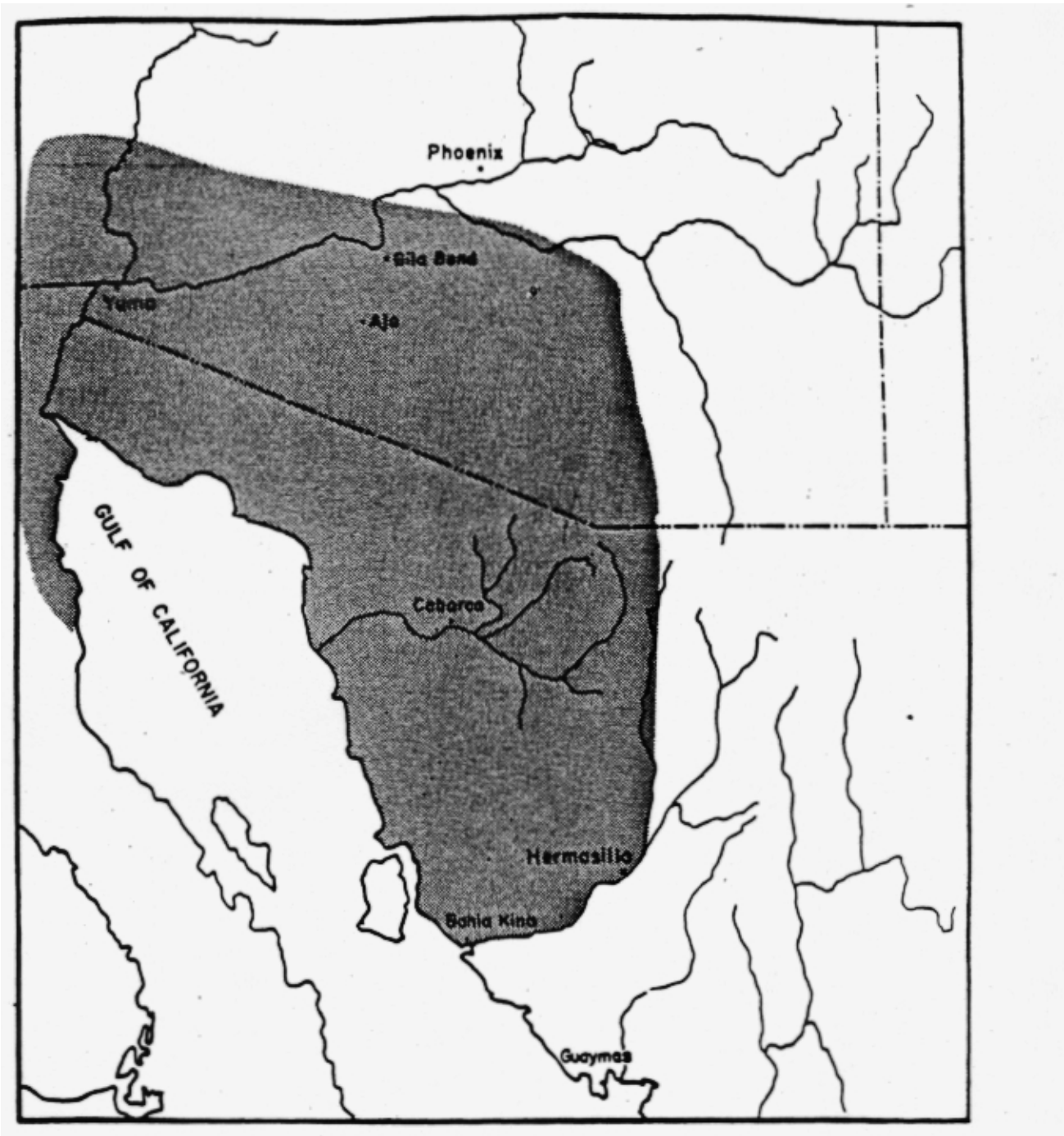


Figure 2. Historic distribution of Sonoran pronghorn in Arizona and Sonora, Mexico.

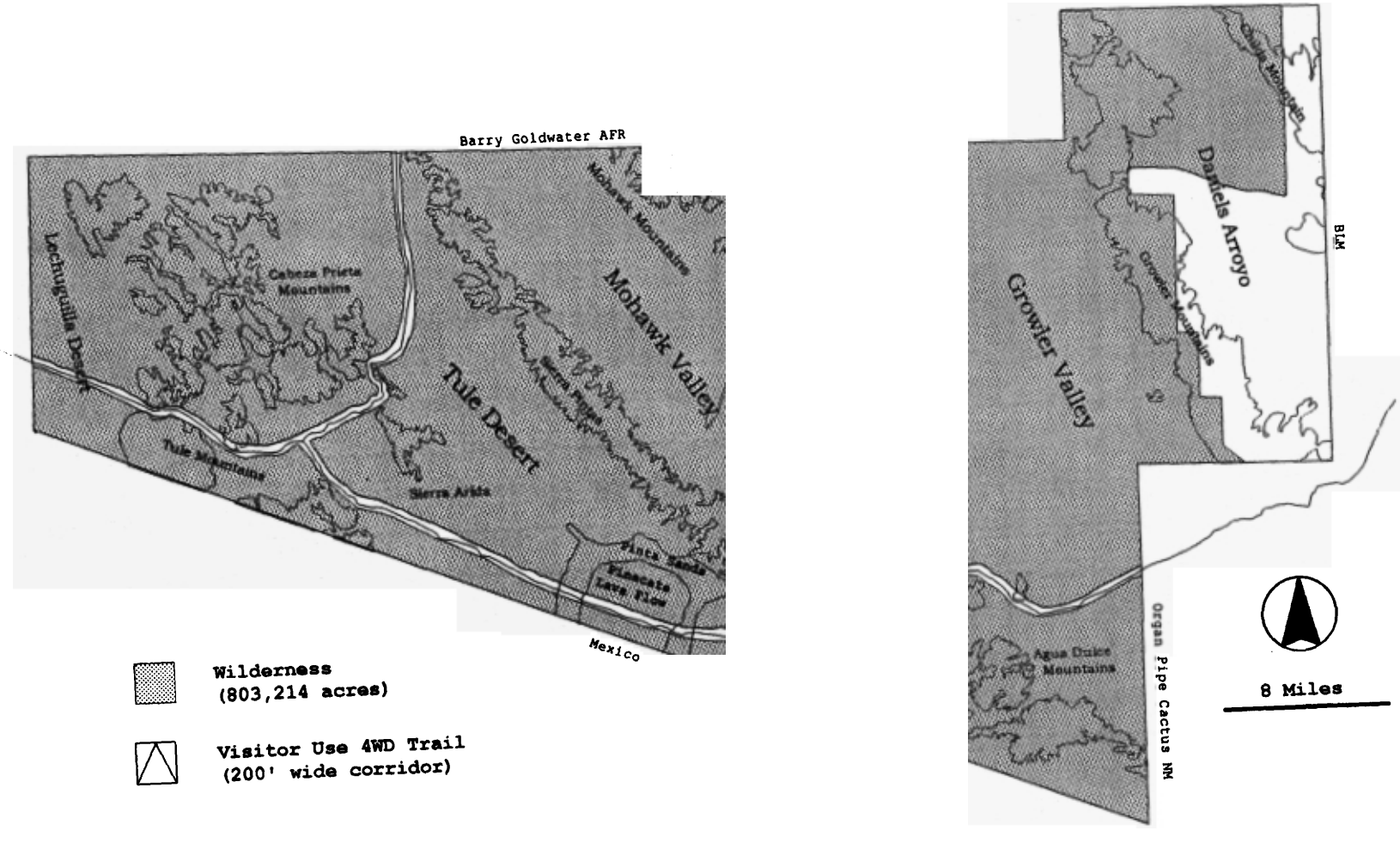


Figure 3. Wilderness within the Cabeza Prieta NWR.

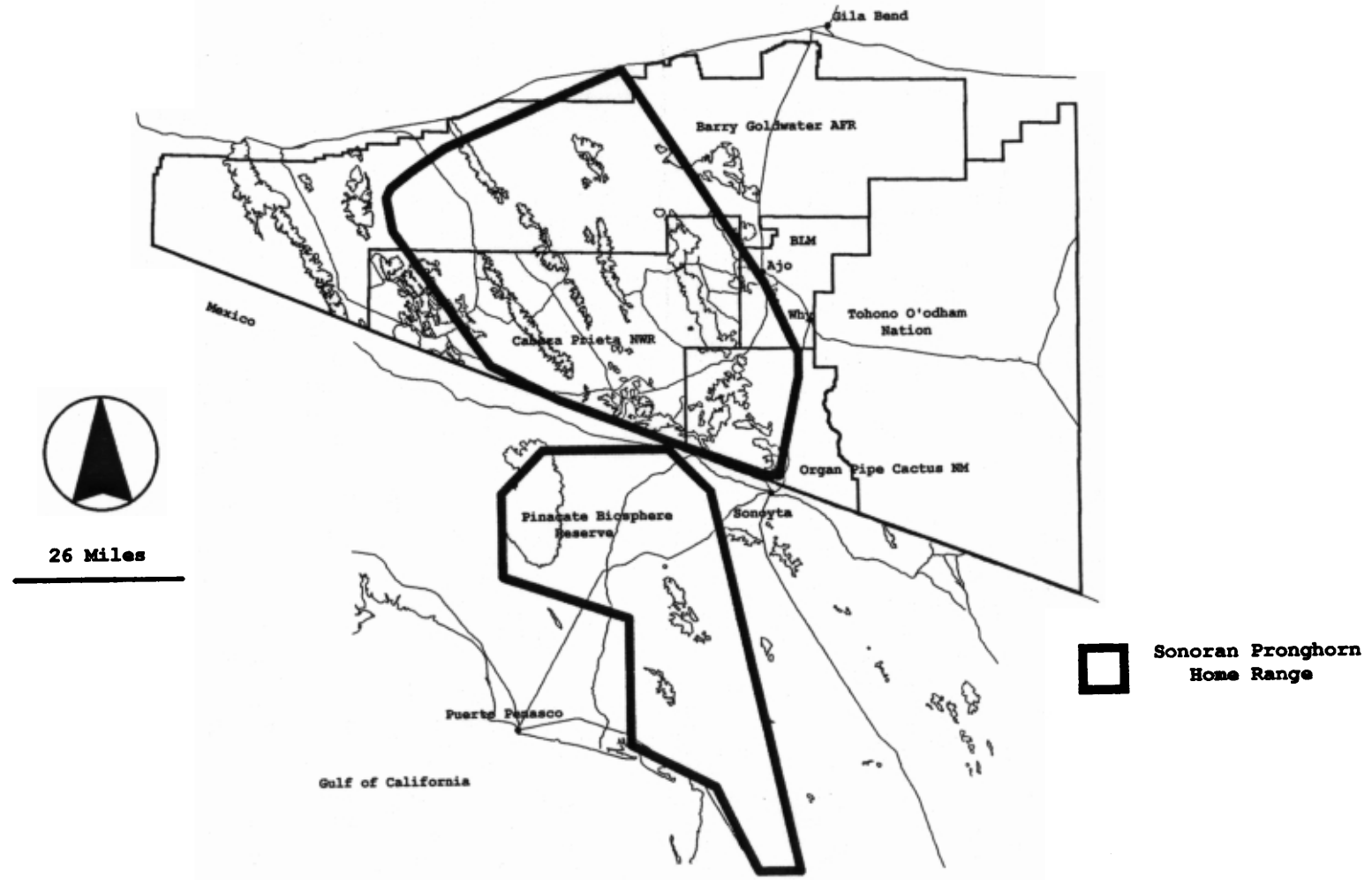


Figure 4. Current Sonoran Pronghorn ranges in Mexico and the United States.

Highway 85. No Sonoran pronghorn have been confirmed east of Highway 85 in Organ Pipe Cactus NM since the 1972 mortality noted in this plan.

Unconfirmed sightings were reported in 1987 by a Border Patrol agent (S. Shelly, pers. commun.) on the Tohono O'odham Reservation. Sightings have also been reported north of Highway 8. Tim Hughes of the BLM stated as a possible sighting, several animals approximately 3.7 km east of Aztec on the north side of Interstate 8. No sightings have been reported north of Highway 8 since 1990. Two adults were sighted by a BLM employee, approximately 8 km southeast of Mohawk Pass (on Highway 8; T8S, R13W, Sec 31) in February 1990 (T. Goodman, pers. commun.).

Population estimates from literature citings for Sonoran pronghorn in the U.S. are:

1925	-	Nelson estimated 105 in Arizona (Nelson 1925)
1941	-	Nichol estimated 60 in southwestern Arizona, excluding Organ Pipe Cactus NM (Nichol 1941)
1957	-	Halloran - less than 100 (Halloran 1957)
1968	-	Monson - 50 in Arizona (Monson 1968)
1968 to 1974	-	Carr's ground observations; he estimated 50-150 (Carr 1974)
1981	-	Estimate of 100-150 Sonoran pronghorn in Arizona (AGFD 1981)
1992	-	Line transect aerial survey estimate of 246 for the U.S. (121 observed; Snow 1994)
1994	-	Line transect aerial survey estimate of 184 for the U.S. (109 observed; Snow 1994)
1996	-	Line transect aerial survey estimate of 216 for the U.S. (82 observed; Hervert et al. 1997a)
1996	-	Using a different method of mark-recapture on the same 1996 survey, estimate of 164 (Hervert et al. 1997a)

Mexico

Historically, Sonoran pronghorn ranged from Hermosillo south to Kino Bay (see Figure 2). Nelson (1925) reported that a few herds in northwestern Sonora, Mexico, moved back and forth across the Arizona border. On January 4, 1925, Ben Tinker, representing the Permanent Wild Life Protection Fund along the Sonora-Arizona border, reported that he had counted 595 pronghorn in Sonora in November 1924 (Carr 1974). The herds ranged from the southern end of the Sierra Rosario, south and east to the Sierra Blanca and the Rio Sonoyta, to the eastern side of the Sierra de San Francisco. Villa (1958) estimated there were over 100 antelope in northwestern Sonora in 1957.

On the basis of sightings and confiscated specimens, Monson (1968) stated that the Sonoran pronghorn persisted in some localities along the east side of the Pinacate Lava Flow in Mexico southward to about 300 km south of Puerto Libertad in Mexico.

In Mexico, Sonoran pronghorn have been sighted just to the east of Sonoyta, directly south of Lukeville on the border; northeast, east, and southeast of Puerto Peñasco; and on all sides of the Sierra Pinacate. A number of Sonoran pronghorn were sighted east of Puerto Peñasco during the March 1993 aerial survey. Surveys to be conducted in Mexico should include regions with suitable habitat from Kino Bay, north through the historic range, to the southern extent of the recent aerial surveys (see Figure 4). This would provide coverage of all areas with historic records for this subspecies (J. deVos, pers. commun.). In Mexico, Sonoran pronghorn range near the Pinacate Lava flow, in the open valley between the lava flow and Caborca, and south to possibly near Kino Bay.

Population estimates from literature citings for Sonoran pronghorn in Mexico are:

1925 - Nelson reported 595 in Sonora (Nelson 1925)
1957 - More than 1,000 in northwestern Sonora (Villa 1958)
1981 - Estimates in Mexico 200-350 (AGFD 1981)
1993 - Line transect survey estimate for Mexico of 313 (242 observed; Snow 1994)

Aerial Surveys

The line transect method was used for aerial surveys (Johnson et al. 1991). Population estimates were derived from the DISTANCE program (Laake et al. 1992). This baseline data will be compared with future population estimates if range-wide aerial surveys, using the same methods, are completed at regular intervals.

The 1992 U.S. range-wide aerial survey observed 121 pronghorn in 30 to 38 groups in Arizona; the population estimate was 246 animals. Not included in the 1992 aerial surveys were two locations north of Black Gap on the Goldwater AFR, immediately west of Highway 85, and the entire Lechuguilla Desert to the west and northwest side of Cabeza Prieta NWR. The March 1994 U.S. aerial survey observed 109 pronghorn with 16 groups observed; the population estimate was 184 (Snow 1994). The December 1996 U.S. aerial survey observed 71 pronghorn in 12 groups; the population estimate was 216. Mark-recapture, using collared pronghorn, was also used in the December 1996 survey. The sighting rate of these marked pronghorn provided an independent population estimate of 164 animals (Hervert et al. 1997a). The mark-recapture method cannot be compared with the line transect method.

In Mexico just south of the U.S. border, 220 animals were observed in a March 1993 aerial survey, giving a population estimate of 313 (Snow 1994).

Johnson et al. (1991) and Hervert et al. (1997a) felt that pronghorn observed on transects provide a better figure for evaluation of population trends. The number of pronghorn observed on transects declined from 99 and 100 on the previous two surveys to 71 on the 1996 survey. High fawn mortality in 1995 and 1996 and a loss of 8 of 16 radio-collared adult pronghorn during the previous 13 months indicate that the decline was real. Five consecutive below-normal seasons of precipitation (summer 1994 through summer 1996) throughout most of the Sonoran pronghorn range were likely responsible (Hervert et al. 1997a).

Potential Barriers to Distribution

Increased use of highways, fences, railroad, and canals could be a deterrent to expanding pronghorn populations. Highway 2 in Mexico runs parallel to the south boundary of Cabeza Prieta NWR in the vicinity of refuge pronghorn habitat at Pinta Sands. This highway receives a considerable amount of fast-moving vehicular traffic. The question of whether to modify the fence along the south boundary of the refuge to allow for pronghorn passage has not yet been answered. Organ Pipe NM also has a boundary fence along the border.

In 1991, AGFD collared 16 pronghorn with radio telemetry collars in northwestern Sonora, Mexico. There was one report of a Sonoran pronghorn radio collared in the U.S. moving between Mexico and the U.S. in 1989; the U.S. collars ceased operating in 1991. Twenty-two animals collared in 1994 in the U.S. have not shown any evidence of travel from the U.S. to Mexico, although there have been frequent observations of Sonoran pronghorn next to the Cabeza Prieta NWR border fence. Refuge personnel and Border Patrol personnel occasionally report tracks leading under the fence in washes where it appears pronghorn have passed under. In 1996, AGFD collared 12 pronghorn in Sonora, Mexico, but data on border crossings have been unavailable due to inconsistent locational data.

Modifying the fence could aid genetic diversity if sufficient pronghorn movement did occur, but it might also lead to increased pronghorn fatalities from motorized traffic on Highway 2. Mexico has been asked to participate in this decision because any fence modifications could affect pronghorn populations in both countries. The refuge south-boundary seven-strand livestock fence is a partial barrier.

Over past years, the refuge south boundary fence has repeatedly been down in a few places due to weather or illegal alien traffic. In 1993, refuge staff checked the boundary fence by helicopter. The fence had been down in two locations on the west side of Pinta Sands, but was repaired. As of June 1993, the fence was down for about 33 m in one location south of the Tule Mountains where there is a flat,

narrow valley leading through to Mexico. Cabeza Prieta NWR, BLM, and MCAS will be constructing a wildlife-passable cattle fence from Cabeza Prieta NWR's southwest corner (along the international border) to Tinajas Altas to prevent future cattle trespass on the refuge.

Observations of pronghorn were supposedly not uncommon along and east of Highway 85 many years ago. A lack of recent observations east of the highway, however, indicates that this heavily used road currently poses a barrier to eastward movement. On June 12, 1996, however, an adult doe Sonoran pronghorn was observed crossing Highway 85 (east to west) on the north end of the Crater Range (R. Barry, pers. commun.). There also exists an unconfirmed report of four Sonoran pronghorn attempting to cross Highway 85 in August 1993 about 1.5 km north of the Organ Pipe Cactus NM visitor center. A juvenile crossed the highway (two lanes) to the east, then heard an oncoming vehicle and ran back across the road to join the other three pronghorn (T. Ramon, pers. commun.). Highway 85 appears to be a strong barrier to Sonoran pronghorn movement eastward. Traffic volume and probably average speeds have increased substantially over the last 30 years as international trade and tourism have increased. This highway corridor is unfenced in Organ Pipe Cactus NM but has livestock fencing on both sides for most of the remaining mileage between Interstate 8 and Organ Pipe Cactus NM. Interstate 8 and adjacent agriculture act as barriers for northward movement of Sonoran pronghorn.

Presently, there is no information about plans to develop any new major highways in Sonoran pronghorn habitat, although an expansion of Highway 2 in northwest Sonora, Mexico, is underway (C. Castillo, pers. commun.).

C. Habitat

Brown (1982) discussed seven subdivisions of the Sonoran Desert, two of which encompass the habitat of Sonoran pronghorn. These are the Lower Colorado River Valley and the Arizona Upland. Creosote (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*) make up a major portion of the Lower Colorado River Valley subdivision. Species along major water courses include ironwood (*Olneya tesota*), blue palo verde (*Cercidium floridum*), and mesquite (*Prosopis* spp.). Species in the Arizona Upland include foothill palo verde (*Cercidium microphyllum*), catclaw acacia (*Acacia greggii*), along with jumping cholla (*Opuntia fulgida*), and teddy bear cholla (*O. bigelovii*).

Critical habitat has yet to be designated for Sonoran pronghorn. Data collected from radio-collared animals have provided the beginning of an understanding of types of necessary habitat used by Sonoran pronghorn. Although most of the habitat is within federally protected lands, different uses of these lands are being addressed regarding effects on Sonoran pronghorn.

Climate

The Sonoran desert climate is characterized by extreme aridity and heat. Average temperatures range from 19 to 32 °C annually. Minimum temperatures in winter rarely drop below 0 °C, and maximum temperatures can exceed 43 °C and can approach 50 °C during July and August (Sellers and Hill 1974). Such temperatures are even achieved as far east as Organ Pipe Cactus NM (unpubl. data). Average annual precipitation is about 127 mm in a bimodal pattern occurring from December to February and during monsoons, which occur any time from July until September.

Topography

The habitat of the Sonoran pronghorn in the U.S. consists of broad alluvial valleys separated by block-faulted mountain and surface volcanics. Elevations in these valleys vary from 122 m near the Mohawk Valley in the west to 488 m in the Valley of the Ajo to the east. Major drainages run north and south. The mountains are of two major types: a sierra type, composed of metamorphic and granitic rock; and a mesa type, typically of basaltic composition. Only the Ajo Mountains exceed 1,219 m in elevation. The mountain ranges run northwest to southeast with valleys draining to the north towards the Gila River and to the south towards Rio Sonoyta in Mexico. These valleys are fairly level and are dominated by creosote and white bursage. In December 1984, 40 percent of the pronghorn observed during a telemetry flight were in the Growler Valley, from the Aguila Mountains to the international border. AGFD (1985) reported that pronghorn used flat valleys and isolated hills to a greater degree than other topographic features.

Washes flow briefly after rains during the monsoon season and after sustained winter rains. The network created by these washes provides important thermal cover for Sonoran pronghorn during the hot summer season. Drainages and bajadas are used during spring and summer. Bajadas are used in spring as fawning areas. Pronghorn were observed using palo verde, ironwood, and mesquite for cover during weekly AGFD telemetry flights, which started in 1994 and have continued through 1998.

Pronghorn were observed in playas in April and May of 1988 and 1989 when forbs were abundant, later vacating these areas when desiccation of forbs occurred (Hughes and Smith 1990). In good rain years, some playas produce abundant forbs as a result of water collection through its inability to percolate through the hardpan.

Some of the sandy areas within Sonoran pronghorn habitat such as Pinta Sands, the Mohawk Dunes west of the Mohawk Mountains, and the west side of the Aguila Mountains, provide a greater variety of seasonal vegetation. The openness of these areas appears to be attractive for pronghorn as the annuals,

grasses, and shrubs provide good forage species, particularly in the spring. These areas have long been considered significant Sonoran pronghorn habitat in the U.S. Carr (1972) reported seeing Sonoran pronghorn frequently in the Pinta Sands area. These dunes are important in the spring when annuals are present. Due to the more arid nature of valley and dune habitats, annuals dry and cure with decreased palatability as summer approaches. Also, these habitats lack sufficient woody vegetation to satisfy pronghorn requirements for nutrition and thermal protection. These factors limit the temporal suitability of these areas and most pronghorn have moved to bajada habitat in the southeast portion of the range by early summer.

Livestock

Cattle were removed from Cabeza Prieta NWR in 1983, from Organ Pipe Cactus NM by 1978, and from Goldwater AFR by 1986 (Luke AFB 1986). Livestock has contributed to the changing vegetation composition of the desert region, but may not have been the primary agent of change. It seems likely that cattle have influenced changes in the desert grassland more than in other zones (Hastings and Turner 1980). In Organ Pipe Cactus NM and other arid southern Arizona lands, livestock overgrazing resulted in severe (and continuing) soil erosion, which in turn has changed site-potential for vegetation (McAuliffe 1998, Rutman 1998). Also, current Sonoran pronghorn radio telemetry locations (AGFD data) are commonly in portions of the Valley of the Ajo and Growler Valley where perennial grasses such as *Hilaria rigida* are now becoming reestablished after livestock grazing. These grasses are also favored foodplants for domestic livestock. These observations support speculation that livestock grazing may have competed with, or excluded, Sonoran pronghorn (T. Tibbitts comments to 1998 Draft Recovery Plan revision). Literature references, such as AGFD Special Report #10 (AGFD 1981), were from an era of high livestock numbers in the eastern section of pronghorn range. It seems possible that pronghorn might have been displaced from preferred habitat by livestock, given that the distribution of sightings seems to have shifted to the east with cattle removal (J. deVos, pers. commun.).

Water

Sonoran pronghorn use of permanent, free-standing water is not clearly understood. Monson (1968) stated that there is no evidence that pronghorn drink water even though it may be available. This trait is shown by Arabian and African ungulates, as well as with mule deer of Lower California. Seton (1937) and O'Connor (1939) ascribed such ability to the consumption of succulent plants, plus various physical and physiological adaptations that conserve the water obtained. Phelps (1974) commented that Sonoran pronghorn may not drink water from May to August. Habitat manipulation, particularly water development, designed to increase population density may actually have the opposite effect (AGFD 1981). Livestock may be injured by drinking water that contains

excessive dissolved solids, and this may also apply to pronghorn (O'Gara and Yoakum 1992). If water is available, pronghorn will drink freely, but, if necessary, they can derive sufficient moisture from plants (Nowak and Paradiso 1983).

Beale and Smith (1970) found that water consumption by American pronghorn varied inversely with the quantity and succulence of the plants consumed. Pronghorn did not drink water, even if available, when moisture content of the plants was 75 percent or more. When the driest conditions prevailed, the animals drank about 3.3 liters per day, consuming different amounts between the extreme temperatures. Reynolds (1984), in a study in southeastern Idaho, recorded no directional movement by pronghorn to water sources. He commented that vegetative moisture provided sufficient water for metabolic maintenance.

Wright and deVos (1986) observed pronghorn at water troughs in November, January, and August. Tracks were documented at seasonal potholes during the monsoon season, indicating a seasonality in their use of troughs. Cabeza Prieta NWR maintains up to eight artificial water sources near and in areas used by Sonoran pronghorn (see Figure 5): Jose Juan and Redtail charcos; Antelope and Mohawk Valley parabolic collectors; and Jack's, Little Tule, Charlie Bell, and Adobe guzzlers (Cabeza Prieta NWR 1986). Charcos are manmade water reservoirs containing up to about 2,000 gallons of water and usually situated in a major drainage in a valley.

A Sonoran pronghorn was photographed on July 23, 1987, drinking at the Charlie Bell guzzler on Cabeza Prieta NWR. Six pronghorn were observed at Jack's well in September 1987 (S. Van Riper pers. commun. with L. Heathington). In July 1995, up to 15 Sonoran pronghorn were videotaped drinking free-standing water in a crater at High Explosive Hill on Luke AFB just north of Growler Mountains on the Cabeza Prieta NWR. In August 1997, a buck was photographed drinking from a tinaja in Kino Valley at Organ Pipe Cactus NM but pronghorn have not been documented there since and the remote camera system has been maintained continuously. Water remained in the tinajas through September 1998; the pronghorn photographed appeared at the tinijas the first time they held water from the summer rains, but never again. Remote sensors at Charlie Bell, Jack's and Adobe guzzlers, Antelope parabolic collector, and Cameron's charco did not reveal any Sonoran pronghorn within these vicinities during the drought summer of 1995. Sonoran pronghorn were photographed within several meters of Little Tule guzzler on Cabeza Prieta NWR, but they were not drinking water. In July and August 1998, Luke AFB recorded with a video camera three Sonoran pronghorn drinking from Halliwill tank on the South Tactical Range.

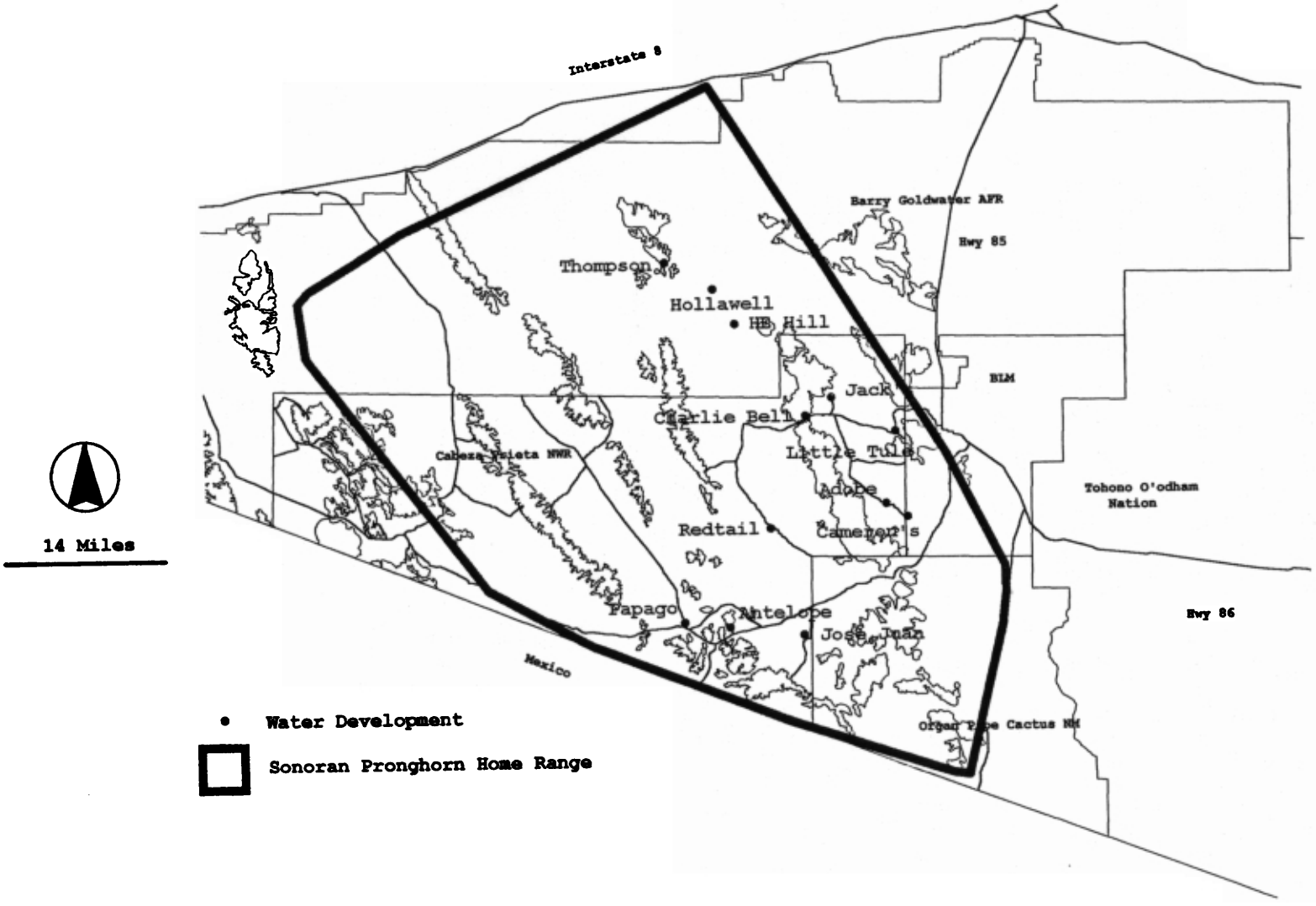


Figure 5. Water developments within the Sonoran Pronghorn home range.

The Marine Corps funded a study in 1995 that described year-round vertebrate use of Jose Juan and Redtail charcos on Cabeza Prieta NWR, which had been created in the 1950s specifically for use by Sonoran pronghorn. Cutler et al. (1996) concluded that the Jose Juan and Redtail charcos were not frequented by Sonoran pronghorn in 1994 and 1995. These sites may not be used by pronghorn due to the dense vegetation, which could present a risk from predation, and/or because both sites are creosote flats, thought to be avoided by pronghorn during the summer dry season. Evidence indicates that pronghorn move to the bajadas during the hot summer months and do not inhabit the creosote flats where Jose Juan charco is located due to the lack of summer forage there.

The unnatural amount of cover and the presence of water itself may provide a lush habitat, resulting in a higher number of coyotes, bobcats, mountain lions, or golden eagles than would naturally be present. A Sonoran pronghorn carcass was discovered within sight of Antelope parabolic collector on Cabeza Prieta NWR in July 1996, and a live pronghorn was observed within 50 meters of the parabola the next day. Coyotes being harassed by pronghorn have been observed at the High Explosive Hill water site (J. Hervert, pers. commun.).

In a study to determine if Sonoran pronghorn could meet water and mineral requirements through forage consumption, Fox et al. (1997) concluded it was theoretically possible although environmental and physiological stresses were not included in her evaluation. She found that plants consumed by Sonoran pronghorn were higher in moisture and nutrients than nonforage species.

Wright and deVos (1986) reported distances of an average of 5.1 km (4.6 for six females and 6.8 for four males). Hughes and Smith (1990) reported >6.1 km observed to water sources, and found no significant difference in average distance to water between the dry and wet seasons in either year of their 2-year study, which covered the period between March and August. No evidence (sightings, scat, or tracks) of pronghorn frequenting water sources was seen during this study.

Diet

Hughes and Smith (1990) observed Sonoran pronghorn eating triangle-leaf bursage, chain fruit cholla, mesquite, and mistletoe (*Phoradendron* spp.). Pronghorn were observed eating cholla fruits 70 percent of the time. Evidence of foraging on the following species was reported: false filaree (*Erodium texanum*), poverty weed (*Monolepis nuttalliana*), wooly plantain (*Plantago insularis*), wild carrot (*Daucus pusillus*), and Arizona blanket-flower (*Gaillardia arizonica*). Foraging on ocotillo leaves (*Fouquieria splendens*) has been documented on video in Sonora, Mexico.

Fecal analysis completed from 1974 to 1977 by AGFD indicated that the Sonoran pronghorn diet consisted of 69 percent forbs, 22 percent shrubs, 7 percent cacti, and 0.4 percent grasses. Hughes and Smith (1990) reported that cacti were the major diet component (44 percent) with forbs (33 percent), shrubs (11 percent), trees (11 percent), and grasses (0.4 percent) shown as lesser components. Carr (1970) observed pronghorn feeding on brittle bush (*Encelia farinosa*), plantain (*Plantago* spp.), and palo verde. Monson (1968) reported pronghorn feeding on ironwood. Other forage species are ratany (*Krameria grayi*), silverbush (*Ditaxis* spp)., *Lotus* spp., spurge (*Euphorbia* spp.), marigold (*Baileya* spp.), noseburn (*Stillingia linearifolia*), wire-lettuce (*Stephanomeria pauciflora*), bursage (*Frauseria dumosia*), and blazing star (*Mentzelia* spp.).

Preliminary results of 59 samples of fecal pellets collected from July 1996 to June 1997 indicate that the following species are heavily used: careless weed (*Amaranthus palmeri*), ragweed (*Ambrosia* spp.), *Astragalus* spp., brome (*Bromus* spp.), broom snakeweed (*Guterrezia sarothrae*), and jumping cholla (*Opuntia fulgida*). Fruits of the chain fruit cholla have been found to be a major source of water during hot, dry conditions (Hervert et al. 1997b).

In 1993, AGFD began investigating vegetation species present within and around core areas used by pronghorn, testing the hypothesis that areas were selected because of vegetative differences between core areas, home ranges, and nonuse areas. Transects were used, and nonuse areas were defined as areas not included within any home ranges known from radio telemetry data. Data collected included vegetation structure (height and density) and species composition.

D. Life History

Productivity, Recruitment, and Mortality

Pronghorn does become sexually mature at 16 months and bucks at 1 year of age (Kitchen and O'Gara 1982). Gestation for all *A. americana* subspecies is about 240 days. Sonoran pronghorn does have been observed with newborn fawns from February through May. Parturition occurs from February through May and rut during July, August, and September. Parturition appears to coincide with spring forage abundance.

Bucks congregate in summer for breeding and to pursue females. Does break off from groups to search for fawning areas. Does usually have twins, and fawns appear to suckle for about 2 months, feeding on vegetation soon thereafter. Does gather with fawns, and fawns sometimes form nursery groups.

Sonoran pronghorn recruitment (survival of fawns) was 45 fawns per 100 does as of June 26, 1995, indicating a then growing population (Hervert et al. 1995). In

1995, 15 fawns (including 4 sets of twins) were observed among 15 collared does. In 1996, productivity was estimated at 0.33 fawns per doe (Hervert et al. 1996). Recruitment of fawns as of June 23, 1996, was 6 fawns per 100 does. Recruitment of fawns into December was apparently 0 in 1996 and 0.12 per doe in 1995 (Hervert et al. 1997a). In 1997, a single fawn was observed with 3 of 6 (50 percent) collared does, compared to 3 of 9 (33 percent) in 1996. Recruitment (survival) of fawns was 0.15 per doe as of June 23, 1997. This estimate was based on a sample of 2 fawns and 13 does among 6 marked groups of pronghorn. Continued below-average precipitation is thought to be a major factor reducing fawn recruitment, and productivity varies with rainfall and habitat conditions.

Fawning areas have been documented in the Mohawk Dunes and the bajadas of the Sierra Pintas, Mohawk, Bates, and Growler Mountain ranges. Hervert et al. (1995) reported a high rate of adult mortality since November 1995. From a sample of 16 Sonoran pronghorn, 8 mortalities were documented. Coyote predation, connected with drought conditions, was a suspected cause in the population decline.

Group Size

Hughes and Smith (1990) found an average group size of 2.5 animals during their 2-year study on Sonoran pronghorn. Wright and deVos (1986) found an average group size of 5.1, with the largest group observed being 21 animals; they also observed seasonality in the group sizes. Groups of 6 to 15 were observed during the late fall and winter. Groups or herds began to splinter during the late winter, and solitary pronghorn were more common during the spring. During summer and early fall, herd size was five to six animals.

Group Composition

Hughes and Smith (1990) reported group composition for bucks, does, and fawns to be 84:100:30. The first fawn observed in 1988 was on May 4. The first fawn observed in 1989 was on April 22 having been born sometime between April 14 and April 22. Observations associated with collared pronghorn were made 57 times. Wright and deVos (1986) reported a ratio of 60:100:50, which was calculated from an aerial location of 56 collared and uncollared pronghorn on December 22, 1984. They reported that buck:doe ratios were most narrow during winter and July (68:100 and 63:100) and widest during the fall (24-44:100). The first fawn observed was in March 1984. During a 5-year period on Cabeza Prieta NWR, Carr (1973) estimated the composition to be 56:100:28 (n = 493).

Movement

Hot and dry seasonal movements from the north to the south are similar to those reported by Wright and deVos (1986). Movements correlate with high temperatures and are most likely motivated by the need for preformed water available in succulent cactus such as chain fruit cholla (Hervert et al. 1997b).

Sonoran pronghorn tend to occupy valley floors and bajadas in their western U.S. range in winter, but tend to move south and east and upslope so that some individuals are found in foothill locations by midsummer.

On June 12, 1996, an adult doe Sonoran pronghorn was observed crossing Highway 85 from east to west at the north end of Crater Range, approximately 24 km north of Ajo (R. Barry, pers. commun.). This is the first confirmed sighting of a Sonoran pronghorn crossing a paved road.

Home Ranges

A radio-collared female moved about 17.6 km from the Growler Valley into Daniel's Arroyo between March 30 and April 2, 1989. She moved in a somewhat circular pattern of shorter distances in Daniel's Arroyo until mid-August (Hughes and Smith 1990). Wright and deVos (1986) reported, from results of aerial telemetry efforts, that movements of males ranged from 30 to 42 km and for some females ranged around 42 km. Home range size of males varied from 64.5 km^2 to 1,213.6 km^2 and for females ranged from 40.7 km^2 to 1,143.7 km^2.

Social Behavior

Males associated loosely with female groups in the late summer. Males chased, herded, and moved females from their bedding areas. Adult males were observed to be more aggressive toward females and juveniles than towards each other. Adult males postured aggressively towards one another but did not make physical contact, such as sparring or butting, on a frequent basis. Juvenile males were aggressive towards one another and towards females. Juvenile males were observed sparring and posturing aggressively, and adult males were observed marking shrubs and void-marking the ground (Hughes and Smith 1990).

Disease Testing

The University of Montana completed disease testing on blood collected from the 1994 collaring effort with Sonoran pronghorn. Slightly high levels of albumin, antibodies against epizootic hemorrhagic disease and bluetongue, were present in many of the animals. Normal values have yet to be established for Sonoran pronghorn (E. Williams, pers. commun.).

Predation

Some of the Sonoran pronghorn radio-collared in 1994 were evidently killed by coyotes, a mountain lion, and a bobcat in the months following collaring. Subsequent mortalities in 1995, 1996, and 1997 may have been influenced by the drought, which predisposed animals to predation. The CWG plans to investigate causes of predation on adult and fawn pronghorn.

No comprehensive studies regarding coyotes and Sonoran pronghorn have yet been done in Sonoran pronghorn habitat. Mountain lion predation on adult

pronghorn likely occurs wherever their distributions overlap in heavily vegetated, rugged terrain (Ockenfels 1994). Of 580 coyote scats examined by Simmons (1969) on Cabeza Prieta NWR, only five contained antelope remains.

Influence of Disturbance

Studies of captive pronghorn other than Sonoran, have shown that they are sensitive to disturbance such as human presence and vehicular noise. Human traffic, such as a person walking past pronghorn in an enclosed pen, running past, a motorcycle driving past, a truck driving past, a truck blowing its horn and driving past, and a person entering the pen, cause an increased heart rate response in pronghorn. In a study in Ogden, Utah, various types of disturbance were correlated with changes in heart rate on American pronghorn, which were in half-acre holding pens (Workman et al. 1992). The highest heart rate responses occurred with female pronghorn when a person entered their pen or a truck was driven past their pen while sounding the horn. The lowest response occurred when a motorcycle or truck was driven past their pen. Other investigators have shown that heart rate increases in response to auditory or visual disturbance in the absence of overt behavioral changes (Thompson et al. 1968, Cherkovich and Tatoyan 1973, Moen et al. 1978).

During an aerial reconnaissance, one herd of Sonoran pronghorn was observed 1½ hours later and 18 km away from the initial observation location (Wright and deVos 1986). Hughes and Smith (1990) found that pronghorn ran immediately from the vehicle to about 400 to 500 m distant and that military low-level flights over three pronghorn caused them to move about 100 m from their original location.

E. Reasons for Listing and Other Factors Affecting Recovery

The following are thought to be reasons for the population decline of Sonoran pronghorn:

- Lack of recruitment;
- Insufficient forage and/or water;
- Drought coupled with predation;
- Difficulties for population expansion due to barriers to historical habitat;
- Illegal hunting (isolated incidents may occur as there is an unconfirmed report of a pronghorn taken in the Tohono O'odham Nation in 1992, and in 1984, Secretaria de Desarrollo Urbano y Ecología reported 11 pronghorn taken by hunters in Mexico);
- Degradation of habitat from livestock grazing (Rutman 1997);
- Diminishing size of the Gila and Sonoyta Rivers; and,
- Human encroachment (aerial gunning of wildlife occurred as late as the 1980s (J.Keeler, pers. commun.).

Relative to historic observations, pronghorn numbers in Arizona and Mexico were low and declining by the late 1800s and 1900s (Mearns 1907). The 1982 Sonoran Pronghorn Recovery Plan (U.S. Fish and Wildlife Service 1982) stated the most likely reason for decline to be over-hunting. But with protection from hunting for over 50 years, pronghorn would have recovered if hunting was one of the primary factors. Much of the habitat has been protected as public land withdrawals since the early 1940s. Degradation of forage species has been reduced on much of the prime habitat as a result of the removal of cattle in 1983.

Predation

Predation is more significant on marginal pronghorn rangelands or other areas where numbers of predators are high in relation to pronghorn numbers. Most fawns killed are between 1 and 3 weeks of age, and while separated from their dams (O'Gara and Yoakum 1992). Trainer et al. (1983) reported that, in their study area in Oregon, 87 percent of fawn mortality occurred during the first 3 weeks of life.

If suitable habitat is not available for a prey species, no amount of predator control will bring about flourishing populations of that prey species (Hornocker 1970). Also, controlling one species of predator may be compensated for by increased predation by other species, as happened on the National Bison Range when coyotes were reduced and predation by bobcats and golden eagles increased (Corneli et al. 1984). Coyotes and lions have been documented to take collared pronghorn in Arizona and in Mexico. Coyote predation was the suspected cause of most of the 8 mortalities from the sample of 16 collared pronghorn documented since November 1995 (Hervert et al. 1996).

The influence of predation on pronghorn population numbers is not fully understood. Pronghorn are often restricted in their movements by agricultural areas, highways, and fences; thus some herds may remain relatively small and localized. Under such artificial circumstances, predators may keep pronghorn populations from increasing or eliminate them (Udy 1953). Control of predators to benefit a big game population often involves reduction of predators over a large area. Even if desirable, this type of control is seldom economically feasible, and when terminated, conditions may revert back to pre-control conditions.

Gila and Sonoyta Rivers

There have been considerable changes in the Gila River in Arizona and the Sonoyta River in Mexico due to agricultural and human development in these areas. The drying of the Gila River in Arizona and other rivers in Sonora may have been a significant cause of the species becoming endangered (Carr 1972). These rivers were potentially important in the historic survival of Sonoran pronghorn. Historic descriptions of these rivers suggest a greenbelt that could have contributed to Sonoran pronghorn survival, not from a drinking water

resource standpoint, but by providing green forage during a time of year when this resource was limited in the rest of the range. This could have been important to reproductive females (J. deVos, pers. commun.). Dated records indicated substantial observations of Sonoran pronghorn in the Santa Rosa Valley in the Tohono O'odham Nation east of Ajo. There is sign of habitat changes, possibly due to over-grazing and agriculture on the Tohono O'odham Reservation.

Grazing

All factors affecting pronghorn survival need to be considered separately and in concert with other factors. Such is the case with cattle grazing. Livestock grazing is administered by the BLM on active allotments around Ajo (see Figure 6). For a number of reasons, these allotments in recent years have been stocked well below allowable numbers and forage conditions are good with a general upward trend (1995 BLM comments to the Draft 1994 Recovery Plan revision). The BLM is analyzing the impacts of livestock grazing on public lands associated with Sonoran pronghorn habitat and began consultations with the Service in 1996. The 1997 Service consultation with BLM found grazing as described in the Biological Opinion as not likely to jeopardize the continued existence of the Sonoran pronghorn. Rangelands can be altered rapidly by livestock (Wagner 1978; Kindschy et al. 1982; Wald and Alberswerth 1989; Yoakum and O'Gara, in prep.). These changes can affect both the quality and quantity of preferred forage needed to sustain healthy pronghorn herds (Ellis 1970, Howard et al. 1990).

F. Conservation Measures

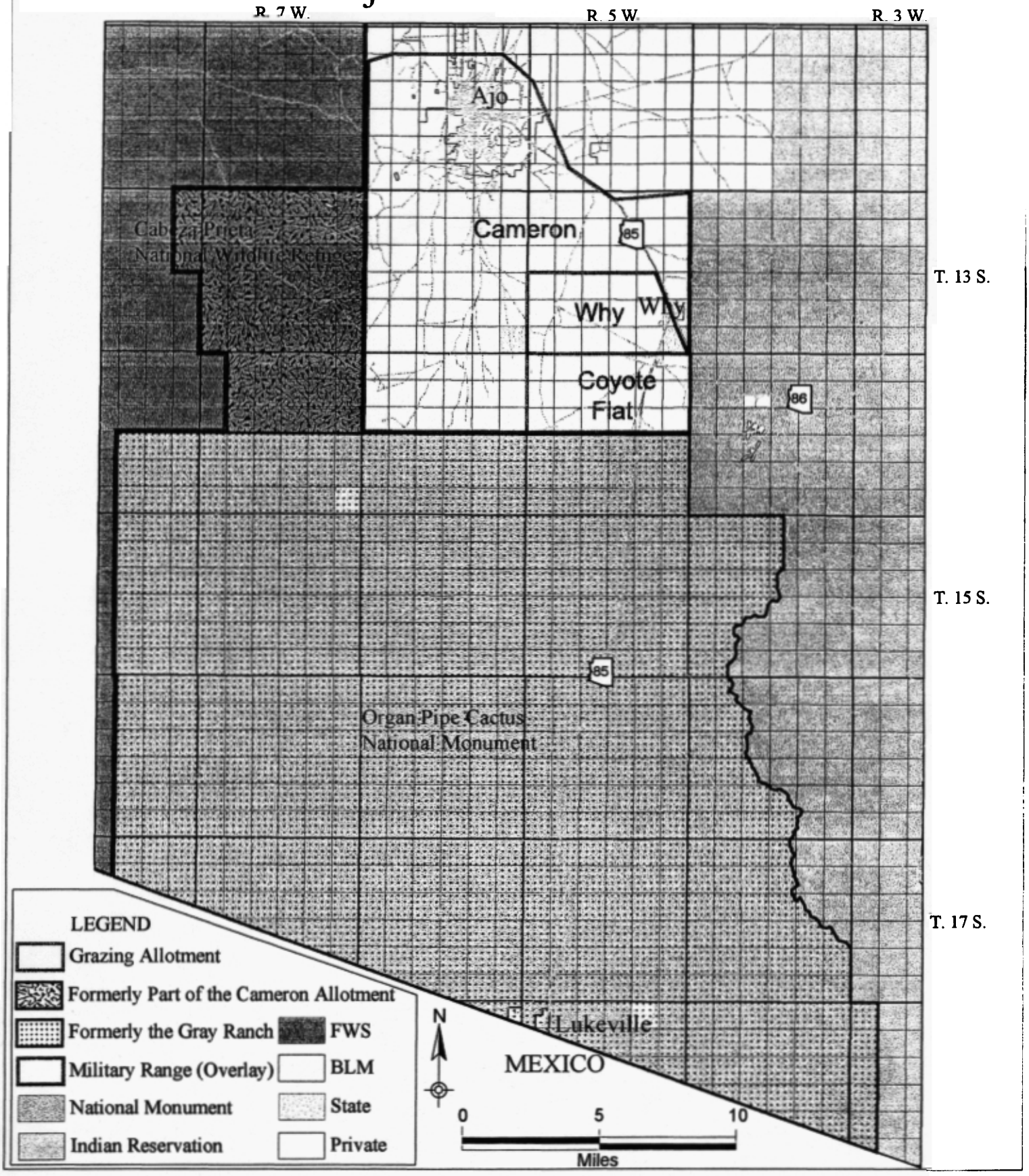
Past Recovery Efforts

Recovery efforts officially began in 1975 with the first meeting of the Sonoran Antelope Recovery Team. The Sonoran Pronghorn Recovery Plan, dated December 30, 1982, was prepared for the Service by the Recovery Team (John S. Phelps, Leader; Roger DiRosa; Ted Corderey; and Terry Peters). After the plan was approved by the Southwest Regional Director of the Service, the Recovery Team was disbanded.

Research

Since1969, AGFD has investigated many parameters of Sonoran pronghorn ecology including population numbers, sex and age composition, and seasonal distribution. Beginning in 1983, AGFD began investigating life history, population movements, and dynamics. Ten pronghorn were collared in 1983 and nine more in 1987. These pronghorn were monitored during the period 1983 to 1991 by AGFD and the Service. Funding assistance was provided by the BLM and the U.S. Air Force.

Ajo Area Allotments



Cabeza Prieta NWR considered an enclosure to study effects of low-level military flights on Sonoran pronghorn. The proposal was prompted by the Air Force F15E Lantirn (Low-altitude night-time infrared navigation) activities at 100 ft above ground level (AGL) over pronghorn range. After review by the involved agencies (Luke AFB, Cabeza Prieta NWR, the Service's Ecological Services office, AGFD, and BLM), the enclosure proposal was discarded in January 1990. It was thought the enclosure would provide an unacceptable level of disturbance to the pronghorn.

From January 1987 to May 1990, Keith Hughes and Norman Smith investigated the following: habitat use relative to distribution of water and to vegetational characteristics, life history observations, and reactions to human disturbance (Hughes and Smith 1990). Also in 1990, Cabeza Prieta NWR hired the first full-time ecologist position for the refuge and acquired a Geographic Information System to assist recovery efforts.

Other areas of needed information have been pursued. Since 1986, AGFD has been working with the CES in Sonora, Mexico, on recovery efforts. In 1990, AGFD completed a study entitled "Evaluation of Sonoran Pronghorn Movements Around Military Activity Areas and Habitat Use Patterns On Barry M. Goldwater Air Force Range, Cabeza Prieta National Wildlife Refuge, and Organ Pipe Cactus National Monument." The purpose of the study was to document movement patterns of pronghorn and evaluate whether these patterns were influenced by military activities (bombing and low-level flights). The conclusion drawn from this study indicated that military activity observed did not negatively impact Sonoran pronghorn. Topography and vegetation type were suggested as being the most important factors in determining movement patterns. Additional analysis of the effect of military activities on Sonoran pronghorn was suggested to aid interpretation of this study.

Aerial Surveys

Aerial surveys have been completed since 1992. Results are previously listed in this plan. The Air Force funded the 1998 infrared aerial survey.

Radio Tracking

Beginning on November 8, 1994, the MCAS funded radio collaring of 22 Sonoran pronghorn, four of which were satellite collars (placed on bucks). The CWG members agreed that satellite collars would not be used in the immediate future. Aerial radio telemetry tracking (at 1,000 ft AGL to minimize disturbance) began in 1994 on a weekly basis and is continuing through 1998. Even though the captures went according to plans, as of January 3, 1995, six mortalities had occurred. Though it was not possible to correlate factors to the cause of death, it was thought capture myopathy was part of the reason. As opposed to the mortalities that occurred within the first few months after collaring, the

remaining mortalities were thought to be results of drought and predation combined.

In December 1997, seven Sonoran pronghorn were captured and fitted with radio telemetry collars as a part of the 1994 collaring permit. The 1997 permit allowed for collaring of nine Sonoran pronghorn, but adverse weather prevented the capturing of two additional animals. Modifications of capture techniques agreed upon after the 1994 collaring effort were used, and saline fluids and oxygen were administered. (AGFD had collared 11 Sonoran pronghorn in northern Sonora, Mexico, just south of Cabeza Prieta NWR using saline and oxygen with initially good results.) Some fecal pellets were collected, blood was only collected for disease testing through AGFD, and ear tissue samples were collected for DNA testing. Three pronghorn were captured on tactical ranges on Luke AFB as part of the monitoring efforts listed in the August 1997 Biological Opinion. Apple mash bait was used for 3 weeks on Luke AFB to determine if Sonoran pronghorn could be netted without having to use helicopters. Pronghorn did not respond to the bait.

In January 1998, two more Sonoran pronghorn were net-gunned and fitted with radio telemetry collars, one in the Las Playas on Cabeza Prieta NWR and one in the South Tactical Range on Luke AFB.

Population Viability Assessment

In September 1996, a Population Viability Assessment workshop was coordinated by Defenders of Wildlife and held in the Phoenix Zoo. Three models, VORTEX, RAMAS, and GAPPS, were used. The modeling efforts suggested that the Sonoran pronghorn is at serious risk of extinction. The most severe threats to the continued survival of this subspecies, according to the VORTEX results, include population fluctuation, periodic decimation during droughts (especially of fawns), small present population size, limited habitat preventing expansion to a more secure population size, and expected future inbreeding depression.

Actions that result in a decrease in mortality rates for adults and juveniles would be expected to provide the most drastic benefits for Sonoran pronghorn. This may be extremely important in times of drought. Increasing the amount of habitat available, either through changes in current land use practices or through establishment of a second U.S. population, would be expected to greatly benefit this species. Genetic interchange between the U.S. population and the Mexico population would most likely be beneficial. Although a carrying capacity of 300 individuals might be as likely to ensure simple survival as a carrying capacity of 500, only at carrying capacities at or above 500 would the long-term genetic diversity goal be likely to be achieved (Defenders of Wildlife 1998).

In terms of stochastic problems, larger vertebrates will almost certainly need population sizes of several hundred animals to remain viable (Ballou et al. 1989). Dispersion of populations is also important to guard against catastrophes.

Military Activities

In 1993, The Wilderness Society and the Sierra Club filed suit against the U.S. Fish and Wildlife Service regarding the compatibility of secondary uses. Cabeza Prieta NWR was named for permitting military low-level flights over the refuge (see Figure 7). An Environmental Impact Statement was prepared that addressed the impact of military activities on Sonoran pronghorn at the Arizona portion of the Yuma Training Range Complex, which encompasses the western half of Cabeza Prieta NWR.

A March 28, 1997, Interim Biological Opinion for "Monitoring High Explosive Hills of North and South Tactical Ranges of Barry M. Goldwater Range (BMGR) Associated With Continued Use of Ground Surface and Airspace for Military Training Activities Which May Affect the Endangered Sonoran Pronghorn Until September 1, 1997," found the effects of the proposed action not likely to jeopardize the continued existence of the Sonoran pronghorn. Reasonable and prudent measures addressed were:

- minimizing impacts of military activities on Sonoran pronghorn;
- minimizing habitat loss, degradation, or fragmentation; and,
- monitoring incidental take resulting from the proposed action.

Terms and conditions addressed were:

- designating a point of contact;
- briefing range users;
- collecting and analyzing contaminants;
- restricting vehicle operations;
- limiting new surface disturbance;
- minimizing erosion;
- preventing pollution;
- low speed limits; and,
- submitting an annual report (U.S. Fish and Wildlife Service 1997a).

In August 1997 a Biological Opinion by the Phoenix Ecological Services Field Office of the Service, issued a "not likely to jeopardize the continued existence of the Sonoran pronghorn" determination for the "use of ground-surface and airspace for military training on the Barry M. Goldwater range which may affect the endangered Sonoran pronghorn." This opinion stemmed from the discovery of Sonoran pronghorn drinking water and spending considerable time on South and North Tactical Ranges of the Goldwater AFR where high explosive bombs

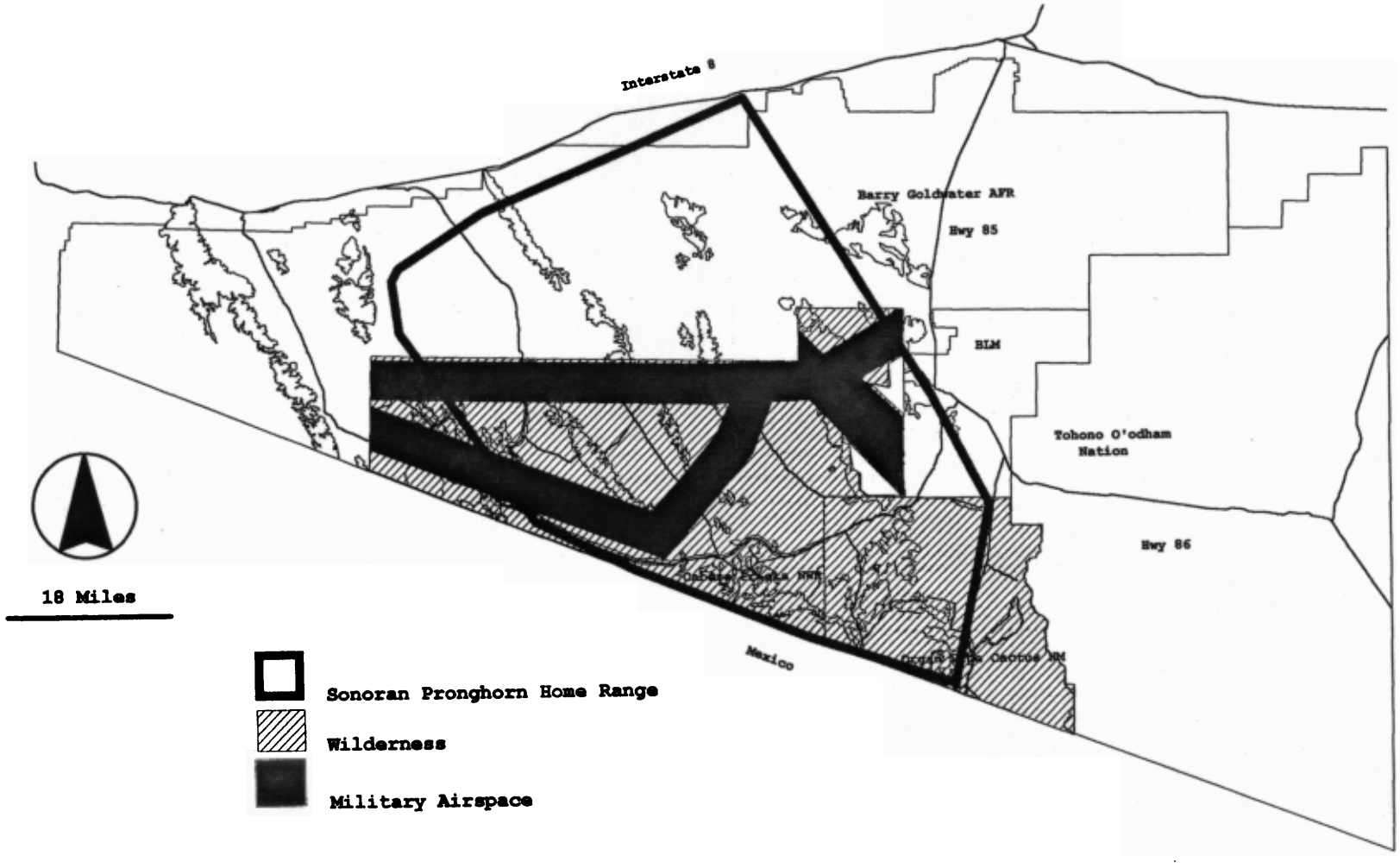


Figure 7. Sonoran Pronghorn home range in relation to wilderness and military airspace use.

are dropped. Air Force biologists clear the North and South Tactical Ranges by checking for pronghorn. If any pronghorn are sighted on the tactical ranges before missions, then those missions are either relocated or rescheduled. The reasonable and prudent measures included were:

- to minimize impacts of Air Force activities on Sonoran pronghorn;
- to minimize habitat loss, degradation, and fragmentation of Sonoran pronghorn habitat;
- to monitor and study reactions of Sonoran pronghorn to military activities on the Goldwater AFR; and,
- the Air Force will provide a means to determine the level of incidental take that actually results from the project (U.S. Fish and Wildlife Service 1997b).

In compliance with the above-mentioned 1997 Biological Opinion, the Air Force began contracting a noise study project. The October 1997 draft Noise Study Work Plan was developed to evaluate the long-term effects of military aircraft noise on the Sonoran pronghorn, including reproductive effects and effects on fawn survival. The noise study began in 1998. The CWG is overseeing this contract with Luke AFB and Lt. Col. Bob Kull of Randolph AFB, who has an extensive background in investigating wildlife/military noise interactions.

Water

Artificial waters should be evaluated to determine their potential use by Sonoran pronghorn. Factors for consideration include, but are not limited to, design and construction, placement and utilization in terms of seasonal distribution, accessibility in relation to surrounding habitat, and likelihood of attracting other competing ungulates and predators such as coyotes, mountain lions and bobcats. An Environmental Assessment on an experimental, temporary water development (at the southwest corner of the Sierras Pintas on Cabeza Prieta NWR) was distributed in 1996 to evaluate the relationship between Sonoran pronghorn and free-standing water. Recruitment data is to be collected from collared pronghorn and also from aerial survey data. The Environmental Assessment will be released for public scoping after it is revised.

Fence Removal

By 1989, Cabeza Prieta NWR removed all livestock fencing around drinkers/guzzlers on the refuge as literature review suggested pronghorn are wary of small enclosures. Approximately 20 km of the fence separating Cabeza Prieta NWR and Organ Pipe Cactus NM has been removed to facilitate pronghorn passage. In 1997-1998, Organ Pipe Cactus NM modified its northern boundary fence (bordering BLM) to be more pronghorn passable with an unbarbed lower strand set at 45-50 cm above the ground.

Mexico

One of two problems discussed in the 1982 plan was the economic development and consequent degradation of pronghorn habitat in Mexico. The CES (1990) reported that extensive cattle raising caused damage to Sonoran pronghorn habitat as well as to habitat for other herbivorous mammals, such as deer.

Biologists from CES work with the local population throughout Sonoran pronghorn habitat and in surrounding areas in efforts to deter illegal hunting. These biologists reported that within the last 3 years, illegal hunting has decreased due to the presence of CES biologists in these areas. Population estimates on Sonoran pronghorn in Mexico are not available to evaluate Sonoran pronghorn response to decreases in hunting.

International Sonoran Antelope Foundation

In November 1990, the International Sonoran Antelope Foundation was established by the Camp Fire Conservation Fund based in Phoenix, Arizona. This was created to "retrieve from the edge of extinction a subspecies of the American pronghorn antelope." In an attempt to assist with funding recovery efforts in the U.S. and Mexico, wildlife artist Paul Bosman donated a pastel picture of Sonoran pronghorn that was made available for sale to the public through the Foundation and by other means. Public education, through media and printed matter, about Sonoran pronghorn has been discussed by the Foundation.

Phoenix Zoo

In 1989, AGFD and the Phoenix Chapter of the Safari Club International discussed providing funding to construct a Sonoran pronghorn facility at the Phoenix Zoo for purposes of captive breeding. The zoo expressed interest in developing a Sonoran pronghorn exhibit. The zoo continues to be interested in recovery and is willing to work with the CWG on captive breeding.

Potential Future Recovery Efforts

The greatest conservation measure allowing Sonoran pronghorn to persist is the existence of the large unsettled habitat afforded by the Cabeza Prieta NWR, Goldwater AFR, BLM lands near Ajo, and Organ Pipe Cactus NM. Maintaining the remote, seldom-visited nature of the federal lands will continue to allow for the nomadic movements which appear to be crucial strategy for survival in this area by moving great distances in search of ephemeral resources. Expanding present used range east of Highway 85 and north of Interstate 8 might prove to be the most effective recovery effort.

Research: Study proposals regarding food plots are being pursued. Food plots might assist recruitment efforts by aiding in dry periods and could also be used

to attract pronghorn away from the tactical ranges where potentially harmful activities occur.

The evaluation of core use areas and forage species has been done by AGFD with use of the Geographic Information System. In the summer of 1993, data was gathered on vegetation density and structure on Goldwater AFR, Cabeza Prieta NWR, and Organ Pipe Cactus NM. Locational vegetation information within Sonoran pronghorn habitat in the U.S. is documented on weekly aerial telemetry flights since 1994. As part of this investigation, a vegetation map of Sonoran pronghorn habitat is being pursued by the CWG.

Fecal pellet analysis, collected by AGFD ongoing since 1994, should provide some information on what plant species are more or less important in Sonoran pronghorn diet for bucks, does, and fawns at various times of the year. More than 200 food habit studies have been conducted during the past 50 years regarding pronghorn. However, these studies involved a variety of techniques and the findings often were not comparable (Sundstrom et al. 1973, Yoakum 1990). To provide consistency for comparison in future studies, Yoakum (1990) listed guidelines which might be of assistance for Sonoran pronghorn food habits studies.

Aerial Surveys: The evaluation of infrared aerial surveys by the CWG is planned for late 1998. These flights can be completed at 1,500 ft AGL, which would decrease disturbance compared to the previous flights by Cessna 182s, and 208s that were flown at 200 ft AGL according to the line transect method. In Mexico, a rangewide aerial survey is needed for Sonoran pronghorn.

Military Overflights: The CWG has a study proposal to investigate WTI regarding Sonoran pronghorn using computer modeling. Literature has suggested habituation takes place regarding over-flights (Workman et al. 1992). Further research is needed on cumulative effects of military low-level activities and recruitment over extended periods of time in conjunction with other factors such as drought.

Discussions with the military could start to address several topics: continuation of the military noise effects study on Sonoran pronghorn on Cabeza Prieta NWR to include WTI and MTRs as well as continuing the study on North and South Tactical Ranges to evaluate maintaining the ceiling at 1,500 ft AGL over the refuge at all times to minimize disturbance to all refuge wildlife; experimenting with food plots; and minimizing public access on Goldwater AFR and the refuge from March 1 to April 15 in pronghorn high use areas or known fawning areas.

The effects of military activities on airfields, plywood vehicles, and metal convoy targets in the tactical ranges on Luke AFB need to be evaluated regarding potential threats to Sonoran pronghorn. Hervert et al. (1997b) suggested an

attraction to airfield and High Explore Hill target by the availability of forbs, water, and unrestricted visibility.

Cabeza Prieta NWR and Goldwater AFR could jointly develop an educational Sonoran pronghorn brochure to inform public and agency people (targeting the users of pronghorn habitat) on the significance of an endangered species and to define harassment. Coordination efforts could include providing yearly public and agency education programs on Sonoran pronghorn.

Water: Artificial waters could be evaluated that could potentially be used by Sonoran pronghorn in their habitat relative to their accessibility, design, competition with other species, such as deer or mountain lion, and location (if located where pronghorn might need free-standing water in the driest part of the year or when does are lactating). Artificial waters, such as the Antelope parabolic collector, could be experimented with to make waters appear more natural to Sonoran pronghorn. Artificial waters should also be evaluated for possibly existing as predator traps.

In 1996, utilizing a predator control program during times of continued drought was discussed at CWG meetings. CWG members agreed to complete the necessary compliance paperwork and public scoping to have this program "on the shelf" and ready to use if and when needed.

Mexico: On June 10, 1993, the Pinacate National Park was given official designation as a National Biosphere Reserve. The reserve encompasses much of the Sonoran pronghorn habitat in Mexico and also borders Cabeza Prieta NWR and Organ Pipe Cactus NM in the U.S. These lands were discussed in a report by CES (Montijo and Sanchez 1993) as part of regional planning for sensitive species such as Sonoran pronghorn.

The 1997 Letter of Intent between the U.S. Department of the Interior and the Secretariat of Environment, Natural Resources, and Fisheries (SEMARNAP) of Mexico for Joint Work in Natural Areas on the border includes joint research and resource management projects for Sonoran pronghorn with Cabeza Prieta NWR, Organ Pipe Cactus NM, AGFD, and the Pinacate Biosphere Reserve. Meetings began in 1997 to prioritize and continue with ongoing projects.

Trail Closure: Cabeza Prieta NWR will begin to evaluate closure of some administrative trails in pronghorn high use areas, which will decrease harassment of Sonoran pronghorn.

Habitat Restoration: Restoration of suitable habitat along portions of the Gila River needs to be investigated. Providing corridors to the river corridor could provide habitat that was once available to the Sonoran pronghorn.

Crucial foraging areas such as the Pinta Sands need evaluation of non-native plant invasion, which may be replacing native Sonoran pronghorn forage plants.

Reintroduction: The CWG has begun investigating captive breeding to use in conjunction with reintroduction efforts when deemed feasible. The CWG has begun to evaluate some of the historic habitat for potentially introducing new populations of Sonoran pronghorn. Guidelines have been developed regarding other species of pronghorn other than Sonoran. In 1980, Terry Plummer, BLM Area Manager in Riverside, California, expressed interest in a reintroduction in California based on historic distribution. In the 1990s, the CGFD, Sacramento Office, began participating in CWG meetings to discuss future relocation possibilities. Historic habitat outside of historic range should be investigated if it is decided it might be significant to recovery efforts. But even though habitats may seem suitable, there may be physiological or biological reasons why these areas were not or are not presently used by Sonoran pronghorn. If there is historic habitat, evidence of past or present use by Sonoran pronghorn should be determined before considering the area for future use (J. Boggs, pers. commun.). Suitable habitat may be isolated from the historic range.

Historic range and habitat information is needed for evaluating and prioritizing reintroduction sites. Increasing the numbers of pronghorn in presently used habitats possibly in Cabeza Prieta NWR could be investigated relative to carrying capacity. Population monitoring has begun to reveal the level of use certain areas receive by pronghorn. The Colorado Division of Wildlife developed one of the first procedures for determining potential suitability of areas for translocations (Hoover et al. 1959). The International Union for Conservation of Nature and Natural Resources (1987) summarized the same criteria as a feasibility study, preparation phase, release or introduction phase, and follow-up phase. The latter often has been neglected; feasibility studies and preparation phases have been inadequate in many cases (O'Gara and Yoakum 1992).

Because reintroducing pronghorn involves large amounts of effort, time, and funding, it is recommended that detailed feasibility studies and management plans be developed before translocation is seriously considered. Reintroduction goals should address the question of establishing a viable herd. Relocated herds that increase 20 to 30 percent within 5 to 10 years after release are indicative of herds that are responding to suitable habitat conditions. Franklin (1980) considered 50 breeding adults as the minimum for a viable population. A reintroduction of Sonoran pronghorn could be attempted with no less than 20 animals to start a founder herd. Populations (presently estimated at 164; Hervert et al. 1997a) would have to increase to consider reintroduction efforts.

Some factors to consider for reintroduction sites are: What caused the animals to become extirpated? Do factors responsible for their elimination still exist? Has the habitat or other conditions been altered so much that pronghorn habitat

requirements are no longer met? Do current land uses and landowners favor reintroduction (O'Gara and Yoakum 1992)?

At times, sporting organizations, conservation groups, or local governments recommend translocating American pronghorn into areas not capable of sustaining herds. Such endeavors resulted in the loss of animals transported to Florida and Hawaii. Analysis of these two cases disclosed that the proposed sites did not meet American pronghorn habitat requirements. Ignoring basic biological requirements results in eventual death of translocated animals, high expenditure of public funds, and a negative reaction by the public (Yoakum 1978). Similar unsuccessful translocations have been made into areas of unsuitable habitat in other states and in Mexico. Likewise, mixing of significantly different populations or subspecies might precipitate the extinction of a subspecies.

A recent 1998 collaring of Sonoran pronghorn with low ambient air temperatures (60 to 70 °F) resulted in high body temperatures. Since 1994, questions have repeatedly arisen regarding the effect of handling and collaring Sonoran pronghorn. Some of the 1994 mortalities were thought to be attributed to exertional myopathy. A wide variety of species have been captured by net-gun with generally good results, though on occasion exertional myopathy has been a complicating factor; pursuit time is likely a major factor (Williams and Thorne 1996). Chalmers and Barrett (1974) believed sub-lethal effects of stress may be highly detrimental to the pronghorn's well-being. Chalmers and Barrett (1982) considered hyperthermia and metabolic acidosis to be of central importance. Metabolic acidosis is most severe in animals pursued rapidly over a short distance and is less severe in animals captured after a more prolonged but less intense chase (Harthoorn and Van Der Walt 1974). McNay (1980) reported that does with late fawns and does in late pregnancy were highly reactive to any form of harassment and that pregnant does moved out of a fawning area when cattle moved in.

G. Strategy for Recovery

CWG members completed a Charter in 1998 to more clearly address how meetings and recovery projects would progress. This charter addresses that CWG members will prioritize and critique all proposed projects to ensure that projects are directed towards recovery goals. The CWG coordinates with technical specialists to provide or obtain expertise on particular aspects of recovery projects. Since 1998, the Barry M. Goldwater Executive Committee oversees the CWG while the Service is the primary agency which regulates endangered species recovery activities through Section 7 of the Endangered Species Act.

This revision of the Sonoran Pronghorn Recovery Plan addresses the following:

1. Additional information regarding home range, movements, and diet has been obtained, but habitat and water use needs to be further studied.

2. Revised recovery goal objectives and updated population estimates; recent population decline.

3. Potential effects of drought coupled with predation.

4. Investigation of food plots to enhance present low population levels.

5. Military projects directed towards recovery goals.

6. Draft results of the 1996 Population Viability Assessment.

7. Investigation of suitable transplant sites within historic range/habitat.

8. Captive breeding.

II. Recovery

A. Objectives and Criteria

Objectives

The 1982 Recovery Plan stated as its objective to "maintain existing population numbers and distribution of Sonoran pronghorn while developing techniques which will result in a U.S. population of 300 animals (average for a 5-year period) or numbers determined feasible for the habitat." The recovery goal number has been revised to reflect significant new life history information learned about Sonoran pronghorn. The objective of this plan revision is to reach an estimate of 300 adult pronghorn to initially downlist the subspecies. This is further discussed below in the Criteria section.

Most participants of the 1996 Population Viability Assessment Workshop agreed that maintaining genetic diversity of at least 95 percent of the current population should be top priority, second only to species survival. The VORTEX analysis indicated that if carrying capacity was modeled at less than 500 individuals, most scenarios resulted in maintaining less than 90 percent genetic diversity. Although a carrying capacity of 300 individuals might be as likely to ensure simple survival as a carrying capacity of 500, only at carrying capacities at or above 500 would the long-term genetic diversity goal be likely to be achieved (Defenders of Wildlife 1996). In the summary of modeling results, the risk of ultimate extinction rose rapidly when the population dropped well below 100 animals. At the point where the population estimate reaches 300 adult pronghorn, downlisting the species would then be suggested. The status of the subspecies would then be reevaluated after the suggested 5-year monitoring period.

Criteria

The Sonoran pronghorn will be considered for reclassification from endangered to threatened when:

1. There are an estimated 300 adult Sonoran pronghorn in one U.S. population and a second separate population is established in the U.S. and remains stable over a 5-year period **or**

2. Numbers are determined to be adequate to sustain the population through time. If the following actions are completed successfully, downlisting to threatened is anticipated by the year 2005. If adverse conditions prevail through 2005, this recovery goal timetable should be evaluated and restated.

B. Narrative for Recovery Actions

1. **Enhance present population of Sonoran pronghorn to reach recovery goal of 300 adults. Decrease factors that are potentially limiting population growth.**

   1.1 Enhance Sonoran pronghorn numbers through fawn recruitment.

   1.2 Increase adult and fawn survival through habitat enhancement investigation of food plots, water developments, and establishment of jumping cholla.

   1.3 Investigate relationship between Sonoran pronghorn and water.

   1.4 Investigate effects of predation on Sonoran pronghorn, especially in times of drought.

   1.5 Protect present range.

      1.51 Protect present range from disturbance, habitat modification, and impediments to movements to allow continued seasonal migrations.

      1.52 Investigate preferred habitat. Determine areas preferred for pronghorn activities such as fawning, movement corridors, bachelor groups, etc., and seasonality of these uses so land managers can minimize disturbance to pronghorn. Once preferred habitats are identified, investigate preferred forage species within these areas to evaluate whether supplemental food plots might enhance the population numbers in times of drought or low forage production. Complete a vegetation map that includes all pronghorn habitat.

      1.53 Investigate expansion of present range through barriers such as east of Highway 85, south of Highway 2 in Mexico, north of Interstate 8, Wellton Canal, fences, agriculture (portions of the Wellton-Mohawk Irrigation and Drainage District) to Gila River historical habitat. Investigate providing corridors to and management of Lower Gila River to maintain sufficient instream flow to seasonally flood and regenerate vegetation growth.

   1.6 Investigate potential competition in areas where livestock occur in Sonoran pronghorn habitat. If competition occurs, evaluate

decreasing livestock numbers to eliminate negative effects on Sonoran pronghorn.

1.7 Investigate effects of military activities on Sonoran pronghorn.

1.71 Identify critical use areas and work with military to decrease negative effects on Sonoran pronghorn. Identify fawning, preferred habitat, movement corridors, forage areas, etc., and continue to work with military for maximum protection possible for these areas.

1.72 Investigate military activities that could be affecting pronghorn behavior. Work with military to obtain the highest flight ceilings possible for training routes over preferred Sonoran pronghorn habitat. Remove military ordnance in areas that presents a danger to Sonoran pronghorn.

1.73 Establish a long-term investigation (long-term to include periodic natural events such as drought) to evaluate effects of military activities on Sonoran pronghorn behavior. Obtain a noise profile map for military activities over Sonoran pronghorn habitat to help managers assess requested changes in military training exercises.

1.74 Maintain the updated Memorandum of Understanding between the U.S. Air Force and the U.S. Fish and Wildlife Service. Pursue shared funding and research efforts.

1.8 Minimize human disturbance.

1.81 Investigate seasonal closures of certain areas (e.g., Pinta Sands on Cabeza NWR and fawning areas in Organ Pipe Cactus NM backcountry) to decrease disturbance to foraging/fawning pronghorn.

1.9 Determine effects of disease and parasites.

1.10 Establish emergency protocols for sick or injured animals.

1.101 Maintain updated veterinarian contact. The Phoenix Zoo veterinarian is presently the contact for injured or deceased pronghorn. Provide backup as necessary.

1.102 Keep necessary materials available for medical situations and/or salvage of specimen parts. The Phoenix Zoo supplies necessary materials for salvage from carcasses.

1.103 Notify Cabeza Prieta NWR immediately of fatality/crisis situations.

1.11 Determine a minimal viable population estimate that will sustain acceptable levels of genetic diversity.

2. Establish and monitor new, separate herd(s).

2.1 Investigate captive breeding programs. Captive breeding could be used to create breeders to produce animals for gene interaction and/or to produce animals to augment transplanted or reintroduced populations.

2.11 Determine number and sex of selected animals. Select minimum number. If mortality occurs, determine if replacement from the wild population could occur. Offspring of captive-bred animals could be released to the wild.

2.111 Consider captive population demographics and genetic requirements.

2.112 Consider captive population size requirements.

2.113 Consider husbandry requirements and guidelines.

2.114 Consider captive space availability.

2.12 Decide type of physiologic monitoring to conduct. Decide what unknown factors of life history can be evaluated while animals are in captivity.

2.13 Consider hand-raising for separate captive groups. Hand-raising might provide for intensive monitoring of physiological factors, maintaining a genetic stock, evaluating implications of captive habituations such as dependence on water, and for purposes of a permanently captive group.

2.2 Evaluate and prioritize reintroduction sites in historic habitat.

2.21 Determine evaluation techniques. Use recent literature to evaluate techniques applicable to the Sonoran pronghorn.

2.22 Determine habitat criteria for reintroduction based on habitat use preferences learned from collared Sonoran pronghorn.

2.23 Provide for public input into reintroduction program.

2.24 Determine habitat status at reintroduction sites.

2.241 Review predator status relative to pronghorn. Determine desired results and manage for these.

2.242 Determine necessity for fencing.

2.243 Determine status and availability of preferred forage.

2.244 Determine if water available at release sites is sufficient.

2.25 Determine legal aspects of reintroduction. Work with local agencies and comply with legal responsibilities to provide for successful herd management.

2.3 Transplant

2.31 Criteria for age, sex, and herd size selection will need to consider least impact on host population and optimum chances for success of transplanted herd.

2.32 Review capture techniques for Sonoran pronghorn, updating and using information from past collaring efforts to minimize harmful effects to individual Sonoran pronghorn.

2.33 Information on holding requirements can be investigated from other subspecies and should be clearly decided upon before implementation.

2.34 Research successful methods of transportation and establish protocol before program begins.

2.4 Ensure consistent, periodic monitoring after release.

2.41 Identify expectations of mortality and natality rates before release with appropriate management steps.

2.411 Identify acceptable levels of losses and relevant management steps for unacceptable levels.

2.412 Identify management steps for expected and unexpected threats.

2.413 Document and evaluate behavior and habitat use.

3. **Continue monitoring the Sonoran pronghorn population. Maintain a protocol for a repeatable, comparable and justifiable survey technique.**

3.1 Continue range wide line transect aerial surveys.

3.2 Investigate use of infrared aerial surveys.

3.3 Investigate other repeatable, comparable types of survey techniques.

3.4 Continue telemetry tracking a sample of the population.

2.5 Continue obtaining and updating recruitment estimates.

4. **Verify taxonomic status of subspecies.**

4.1 Evaluate all available specimen evidence and data regarding taxonomic status.

4.2 Document subspecies differentiation.

4.3 Determine if additional information is necessary.

III. Implementation Process

Many individual implementation plans are needed for the various recovery steps listed above, as each will be an involved project within itself. These implementation plans will contain specific measurable objectives and actions that can be tracked by the CWG.

Implementation plans will be completed for major projects such as captive breeding or aerial surveys. Technical experts will be utilized on subject matter related to projects when the CWG sees this as necessary.

Discussion and a listing for management plans specifically for pronghorn, their habitat, and enhancement of recovery will soon be available (Yoakum and OGara, in prep.) and might be valuable in Sonoran pronghorn recovery.

See Implementation Schedule on following pages.

Implementation Schedule

Priority	Task	Task Description	Duration	Party Responsible	Cost Estimate (in thousands)		
					1999	2000	2001
1	1.1	Fawn recruitment	ongoing	CWG	30.0	30.0	30.0
1	1.2	Habitat enhancement	ongoing	CWG	50.0	50.0	50.0
1	1.3	Water investigation	ongoing	CWG	150.0	150.0	150.0
1	1.4	Predator investigation	2 years	CWG	40.0	40.0	
1	1.5	Protect present range	ongoing	CWG	20.0	50.0	50.0
1	1.6	Livestock	ongoing	CWG	50.0	50.0	50.0
1	1.7	Military activities	ongoing	WMIDD, CWG	200.0	200.0	200.0
1	1.8	Human disturbance	ongoing	CWG	50.0	50.0	50.0
1	1.9	Disease	5 years	CWG	20.0	20.0	20.0
1	1.10	Emergency protocols	ongoing	CWG	10.0	10.0	10.0
1	1.11	Viable population estimates	ongoing	CWG	10.0	10.0	10.0
2	2.1	Captive breeding	ongoing	Phoenix Zoo, CWG	50.0	200.0	200.0
2	2.2	Reintroduction sites	ongoing	CWG	100.0	100.0	100.0
2	2.3	Transplant	ongoing	CWG	100.0	100.0	100.0
2	2.4	Monitoring	ongoing	CWG	50.0	50.0	50.0
3	3.1	Aerial surveys	ongoing	CFGD, BEC, CWG	10.0	10.0	10.0
3	3.2	Infrared aerial surveys	ongoing	CWG	100.0	100.0	100.0
3	3.3	Other surveys	ongoing	CWG	30.0	30.0	30.0
3	3.4	Telemetry	ongoing	CWG	50.0	50.0	50.0

Priority	Task	Task Description	Duration	Party Responsible	Cost Estimate (in thousands)		
					1999	2000	2001
3	3.5	Recruitment	ongoing	CWG	10.0	10.0	10.0
4	4.1	Evaluate taxonomic specimens	3 years	CWG	50.0	50.0	50.0
4	4.2	Documentation	1 year	CWG	10.0	10.0	10.0
4	4.3	Additional information	1 year	CWG			

IV. Literature Cited

Arizona Game and Fish Department. 1981. The Sonoran Pronghorn. Special Report Number 10. Ariz. Game and Fish Dept. Phoenix, Ariz. 55 pp.

_____. 1985 Interim Report on the Sonoran Pronghorn Antelope. (*Antilocapra americana sonoriensis*) Oct. 1983 - March 1985. Phoenix, Ariz. 57 pp.

Arizona Game and Fish Department Endangered Species Investigation Sonoran Pronghorn Project W-53-20 Work Plan 8, Job 1. Progress Report May 1, 1969 to June 30, 1970. p. 205.

Ballou, J.D., T.J. Foose, R.C. Lacy, and U.S. Seal. 1989. Florida Panther Population Viability Analysis and Recommendations. Service Co-op Contract # 14-16-0004-89-911. 51 pp.

Beale, D.M., and A.D. Smith. 1970. Forage use, water consumption, and productivity of pronghorn antelope in Western Utah. J. Wildl. Manage. 34(3):570-582.

Brown, D.E. 1982. Biotic communities of the American southwest United States and Mexico. Desert Plants. 4 pp.

Cabeza Prieta National Wildlife Refuge. 1980. Cabeza Prieta National Wildlife Refuge Management Plan. 1980. School of Renewable Nat. Res., Univ. of Ariz., Tucson.

_____. 1986. Cabeza Prieta National Wildlife Refuge Updated Planning Needs Assessment. Ajo, Ariz.

Carr, J.N. 1970. Endangered species investigation. Sonoran pronghorn. Ariz. Game and Fish Dept. Phoenix, Ariz. 13 pp.

_____. 1971. Progress report - Endangered species investigation. Sonoran pronghorn. pp. 247-262. Arizona Game and Fish Dept. Phoenix, Ariz.

_____. 1972. Endangered species investigation. Sonoran pronghorn. Ariz. Game and Fish Dept. Phoenix, Ariz. 8 pp.

_____. 1973. Endangered species investigation. Sonoran pronghorn. Ariz. Game and Fish Dept. Phoenix, Ariz.

_____. 1974. Complete report - Endangered species investigation. Sonoran pronghorn. pp. 1-5. Arizona Game and Fish Dept. Phoenix, Ariz.

Centro Ecológico de Sonora. 1990. Strategy for the Revoery of the Sonoran Pronghorn. Final Report of the Firts Phase. Hermosillo, Sonora.

Chalmers, G.A., and M.W. Barrett. 1974. Some problems associated with chasing pronghorns. Pronghorn Antelope Workshop Proc. 6:13-14.

_____. 1982. Capture myopathy. Pp. 84-94 *in* G.L. Hoff and J.W. Davis, eds., Noninfectious diseases of wildlife. Iowa State Univ. Press. Ames.

Cherkovich, G.M., and S.K. Tatoyan. 1973. Heart rate (radiotelemetric registration) in macaques and baboons according to dominant-submissive rank in a group. Folia Primatol. 20:265-273.

Corneli, P.S., B. Von Gunten Moran, and B.W. O'Gara. 1984. Pronghorn fawn mortality on the National Bison Range. Pronghorn Antelope Workshop Proc. 11:41-48.

Cutler, T.L., M.L. Morrison, and D.J. Griffin. 1996. Final report: wildlife use of Jose Juan and Red Tail Tank, Cabeza Prieta National Wildlife Refuge, southwestern Arizona. U.S. Dept. of Defense Contract N68711-93-LT-3026. 108 pp.

Defenders of Wildlife. 1998. Population Viability Analysis Workshop for the Endangered Sonoran Pronghorn (*Antilocapra americana sonoriensis*) in the United States. Proceedings from a Population Viability Analysis Workshop held at the Phoenix Zoo, 4-6 September, 1996. Washington, D.C.

Ellis, J.E. 1970. A computer analysis of fawn survival in the pronghorn antelope. Ph.D. Thesis, Univ. of Calif. Davis. 70 pp.

Fox, L.M., P.R. Krausman, M.L. Morrison, and R.M. Kattnig. 1997. Nutritional content of forage in Sonoran pronghorn habitat, Arizona. M.S. Thesis, Univ. of Ariz. Tucson. 228 pp.

Franklin, I.R. 1980. Evolutionary change in small populations. Pp. 35-149. *in* M. Soule and B. Wilcox, ed., Conservation biology: An evolutionary-ecological perspective. Sinauer Assoc., Sunderland, Mass.

Frick, C. 1937. Horned Ruminants of North America. Bull. Am. Mus. Nat. Hist. 69: 1-699.

Goldman, E.A. 1945. A new pronghorn from Sonora. Proc. Biol. Soc. Wash. 58: 3-4.

Halloran, A.F. 1957. A note on Sonoran pronghorn. J. Mamm. 38(3):423.

Harthoorn, A.M., and K. Van Der Walt. 1974. Physiological aspects of forced exercise in wild ungulates with special reference to (so-called) overstraining disease. 1. Acid-base balance and pO2 levels in blesbok *Damaliscus dorcas phillipsi*. J. So. African Wildl. Manage. Assoc. 4:25-28.

Hastings, J.R., and R.M.Turner. 1980. The Changing Mile. Sec. Ed. Univ. Ariz. Press, Tucson, Ariz. 317 pp.

Hervert, J.J., R.S. Henry, M.T. Brown, D.W. Belitsky, and M.E. Kreighbaum. 1995. Sonoran pronghorn population monitoring: progress report. Nongame and Endangered Wildlife Program Technical Report 98. Arizona Game and Fish Dept. Phoenix, Ariz.

Hervert, J.J., B. Henry, M. Brown, and L. Piest. 1996. Sonoran pronghorn population monitoring: progress report. Nongame and Endangered Wildlife Program Technical Report 110. Arizona Game and Fish Dept. Phoenix, Ariz.

Hervert, J.J., L.A. Piest, R.S. Henry, and M.T. Brown. 1997a. Sonoran pronghorn 1996 aerial survey summary. Nongame and Endangered Wildlife Program Technical Report. Arizona Game and Fish Dept., Phoenix, Ariz.

Hervert, J.J., L.A. Piest, W. Ballard, R.S. Henry, M.T. Brown, and S. Boe. 1997b. Sonoran pronghorn population monitoring: progress report. Nongame and endangered Wildlife Program Technical Report. Arizona Game and Fish Dept., Phoenix, Ariz.

Hoffmeister, D.F. 1986. Mammals of Arizona. Univ. of Ariz. Press, Tucson, Ariz. 602 pp.

Hoover, R.L., C.E. Till, and S. Ogilvie. 1959. The antelope in Colorado. Tech. Bull. 4. Colo. Dept. Game and Fish, Denver. 110 pp.

Hornocker, M.G. 1970. An analysis of mountain lion predation upon mule deer and elk in the Idaho Primitive Area. Wildl. Mongr. 21. 39 pp.

Howard, V.W., J.L. Holechek, R.D. Pieper, K. Green-Hammond, M. Cardenas, and S.L. Beasom. 1990. Habitat requirements for pronghorns on rangelands

impacted by livestock and net wire in east central New Mexico. Agric. Exp. Sta. Bull. 750, N. M. State Univ., Las Cruces. 48 pp.

Hughes, K.S., and N.S. Smith. 1990. Sonoran pronghorn use of habitat in southwest Arizona. Final Report 14-16-009-1564 RWO #6. AZ Coop Fish & Wildl. Research Unit, Tucson, Ariz. 58 pp.

International Union of the Conservation of Nature and Natural Resources. 1987. Introductions, reintroductions, and restocking. IUCN Council, Gland, Switzerland. 20 pp.

Johnson, B.K., F.G. Lindzey, and R.J. Guenzel. 1991. Use of aerial line transect surveys to estimate pronghorn populations in Wyoming. Wildl. Soc. Bull. 19:315-321.

Kindschy, R.R., C. Sundstrom, and J.D. Yoakum. 1982. Range/wildlife habitats in managed rangelands - The Great Basin of southeastern Oregon: Pronghorns. U.S. Dept. Agric., Pac. NW Forest Range Exp. Sta., Portland, Ore. Gen. Tech. Rep. PNW 145. 18 pp.

Kitchen, D.W. 1982. Pronghorn (*Antilocapra americana*). Wild Mammals of North America. John Hopkins Univ. Press.

Kitchen, D.W., and B.W. O'Gara. 1974. Social behavior and ecology of the pronghorn. Wildl. Monogr. 38. 96 pp.

Laake, J.L., S.T. Buckland, D.R. Anderson, and K.P. Burnham. 1992. Draft pub. Distance Sampling: Abundance Estimation of Biological Populations. Colorado Coop. Wildl. Research Unit., Colo. State Univ. Fort Collins, Colo. 54 pp.

Luke Air Force Base. 1986. Natural Resource Management Plan. Phoenix, Ariz.

McAuliffe, J. 1998. Rangeland water developments: Conservation solution or illusion? pp. 310-359 *in* J. Feller and D. Strouse, eds., Environmental, Economic, and Legal Issues Related to Rangeland Water Developments. Center for the Study of Law, Science, and Technology, Ariz. State Univ., Tempe, Ariz.

McNay, M.E. 1980. Causes of low pronghorn fawn:doe ratios on the Sheldon National Wildlife Refuge, Nevada. M.S. Thesis., Univ. Mont. Missoula. 128 pp.

Mearns, E.A. 1907. Mammals of the Mexican boundary of the United States. Pt. I, families Didelphidae to Muridae. Bull. U.S. Nat. Museum, 56:XVT530, 13 April.

Moen, A.N., M.A. DellaFera, A.L. Hiller, and B.A. Buxton. 1978. Heart rates of white-tailed deer fawns in response to recorded wolf howls. Can. J. Zool. 56:1207-1210.

Monson, G. 1968. The Desert Pronghorn. Desert Bighorn Council Transactions. April 10-12 Las Vegas, Nev. 63-69.

Montijo, A.B., and C.C. Sanchez. 1993. Propuesta Para Decretar La Reserva De La Biosfera El Pinacate y Gran Desierto de Altar, Municipios de Puerto Peñasco, General Plutarco Elias Calles y San Luis Rio Colorado, Sonora, Mexico. Centro Ecológico de Sonora, Hermosillo, Sonora. 169 pp.

Nelson, F.W. 1925. Status of the pronghorn antelope, 1922-1924. U. S. Dept. Agric. Bull. 1346. 64 pp.

Nichol, A.A. 1941. Game Reconnaissance of Southwest Arizona, South of the Gila River. Unpublished. Arizona Game and Fish Dept. Phoenix, Ariz.

Nowak, R.M., and J.L. Paradiso. 1983. Walker's Mammals of the World. 4th. Ed. Vol. II. John Hopkins Univ. Press. Baltimore, Maryland. pp. 1230-1232.

O'Connor, J. 1939. Game in the Desert. The Derrydale Press, New York.

O'Gara, B.W. 1978. *Antilocapra americana.* Am. Soc. Mamm., Mamm. Species No. 90. 7 pp.

O'Gara, B.W., and J.D. Yoakum. 1990. Additional capture methods and habitat suitability criteria for pronghorn translocations. Pronghorn Antelope Workshop Proc. 14:51-62.

_____. 1992. Pronghorn Management Guides. 15th Bien. Pronghorn Antelope Work., Rock Springs, Wyo.

Ockenfels, R.A. 1994. Mountain lion predation on pronghorn in Central Arizona. Southwest. Nat. 39(3)305-306.

Paradiso, J.L. and R.W. Nowak. 1971. Taxonomic status of the Sonoran Pronghorn. J. Mamm. 52(4):855-858.

Phelps. J.S. 1974. Endangered species investigation. Sonoran pronghorn habitat in Arizona. Proc. Bien. Pronghorn Workshop 8:70-77.

Reynolds, T.D. 1984. Daily summer movements, activity patterns, and home range of pronghorn. Northwest Sci. 58:300-311.

Rutman, S. 1998. Dirt is not cheap: livestock grazing and accelerated erosion on Organ Pipe Cactus National Monument. Presented at symposium on environmental, economic and legal issues related to rangeland water developments. Arizona State Univ., Tempe, Ariz.

Sellers, W.D., and R.H. Hill. 1974. Arizona Climate 1931-1972. Second ed. Univ. of Ariz. Press. Tucson, Ariz.

Seton, E.T. 1937. Lives of game animals. The Literary Guild of America, Inc., New York. 3:411-467.

Simmons, N.M. 1969. The social organization, behavior and environment of the desert bighorn sheep on the Cabeza Prieta Game Range, Arizona. Ph.D. Dissertation, Univ. of Ariz.

Snow, T. 1994. Sonoran pronghorn aerial survey summary 1992-94. Nongame and Endangered Wildlife Program Technical Report. Arizona Game and Fish Dept., Phoenix, Ariz.

Sundstrom, C., W.G. Hepworth, and K.L. Diem. 1973. Abundance, distribution, and food habits of the pronghorn. Wyo. Game and Fish Comm., Cheyenne. Bull. 12. 61 pp.

Thompson, R.D., C.V. Grant, E.W. Pearson, and G.W. Corner. 1968. Cardiac response of starlings to sound: effects of lighting and grouping. Am. J. Physiol. 214:41-44.

Trainer, C.E., M.J. Willis, G.P. Keister Jr., and D.P. Sheely. 1983. Fawn mortality and habitat use among pronghorn during spring and summer in southeastern Oregon, 1981-82. Ore. Dept. Fish and Wildl., Portland. Wildl. Res. Rep. 12. 117 pp.

Udy, J.R. 1953. Effects of predator control on antelope populations. Ut. Dept. Fish and Game. Salt Lake City. Pub. 5. 48 pp.

U.S. Fish and Wildlife Service. 1982. Sonoran Pronghorn Recovery Plan. U.S. Fish and Wildlife Service. Denver, Colorado. 26 pp.

_____. 1994. Desert Tortoise (Mohave population) Recovery Plan. Portland, Or. 73 pp.

_____. 1997a. Biological Opinion For "Use of Ground-Surface and Airspace For Military Training on the Barry M. Goldwater Range Which May Affect the Endangered Sonoran Pronghorn." U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office. Phoenix, Ariz. 25 pp.

_____. 1997b. Interim Biological Opinion For "Use of Ground-Surface and Airspace for Military Training on the Barry M. Goldwater Range Which May Affect the Endangered Sonoran Pronghorn." U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office. Phoenix, Ariz. 26 pp.

Villa, R.B. 1958. Partial account of Prof. Bernardo Villa R. Concerning the study of bighorn sheep and antelope in northern Mexico. Inst. Biol., Mexico, D.F. Unpublished.

Wagner, F.H. 1978. Livestock grazing and the livestock industry. Pp. 121-145 *in* H.P. Brokaw, ed. Wildlife and America. U.S. GPO, Wash. D. C. 532 pp.

Wald, J., and D. Alberswerth. 1989. Our ailing public rangelands. Natl. Wildl. Fed., Wash. D.C. 15 pp.

Williams, E.S., and E.T. Thorne. 1996. Exertional myopathy (capture myopathy). Pp. 181-193 *in* A. Fairbrother, L.N. Locke, and G.L. Hoff, eds. Noninfectious diseases of wildlife. Iowa State Univ. Press, Ames.

Workman, G.W., T.D.Bunch, J.W. Call, R.C. Evans, L.D.S. Neilson, E.M. Rawlings. 1992. Sonic boom and other disturbance impacts on pronghorn antelope (*Antilocapra americana*). Air Force Contract: F42650-87-C-0349, Utah State Univ. Logan, Ut. 67 pp.

Wright, R.L., and J.C. deVos Jr. 1986. Final Report on Sonoran Pronghorn Status in Arizona. Ariz. Game and Fish Dept. Phoenix, Ariz. 132 pp.

Yoakum, J.D. 1978. Pronghorn. Pp. 103-121 *in* J.L. Schmidt and D.L. Gilbert, eds. Big game of North America: Ecology and management. Stackpole Books, Harrisburg, Pa.

_____. 1990. Food habits of the pronghorn. Pronghorn Antelope Workshop Proc. 14:102-110.

Yoakum, J.D., and B.W. O'Gara. In prep. Wildlife Management Plans. *In* Ecology and management of the pronghorn. Wildl. Manage. Inst., Wash. D.C.

Appendix A

Taxonomy of the Sonoran Pronghorn

Taxonomy of the Sonoran Pronghorn

Over the last quarter century, I have examined 13 specimens (skulls) from the generally accepted range of the Sonoran pronghorn antelope (Antilocapra americana sonoriensis), and that were sent to the U.S. National Museum of Natural History. These include: the type adult female from northwestern Sonora and a second female, taken at Crittenden, Arizona, also assigned to sonoriensis by the describer (Goldman, Proc. Biol. Soc. Washington. 58:3-4, 1945); three juvenile males and one adult male taken in 1969 in northwestern Sonora and assigned by John Paradiso and I (J. Mammal. 52:855-858. 1971) to sonoriensis: an adult male from Organ Pipe Cactus National Monument and two adult females from Cabeza Prieta Refuge that were taken in the 1970s or 1980s, that I examined in 1988, and that I thought appeared likely to represent the subspecies mexicana and not sonoriensis; a juvenile male taken near Yuma on 6 July 1989 that I examined in 1995 and thought looked nothing like sonoriensis; and three males taken in 1989-1990 on Organ Pipe Cactus National Monument, and that I examined in 1995, finding one (apparently immature) too fragmentary to assess and the other two (apparently young adults) to generally be more like mexicana than like sonoriensis.

In general these examinations suggest that the only available specimens that can definitively be assigned to the subspecies sonoriensis are from Sonora. Even the female from Crittenden was found by Paradiso and I to be intermediate to sonoriensis and mexicana. The other Arizona specimens also are either intermediate in appearance or decidedly unlike sonoriensis. It thus may be that the part of Arizona within the accepted range of sonoriensis is actually a zone of intergradation between that subspecies and others. However, it would be premature to come to that or any other systematic conclusion. If I were going to begin a serious study of the taxonomic status of sonoriensis, I would want to look at the entire species Antilocapra americana, to see how much variation there is within and between different geographically separated samples, and to determine whether the specimens of southwestern Arizona and northwestern Sonora fall beyond the range of variation shown by other populations.

It also would be completely unjustified at this point to state that the subspecies sonoriensis is invalid. It was properly described and named by a knowledgeable authority who determined that it differed substantially from other recognized subspecies. Indeed, the investigations of Paradiso and I confirmed that the type specimen is remarkably distinctive in its small size and other characters, and that the males from Sonora also stand out from other populations. There is absolutely nothing wrong or unusual about designating a subspecies or other taxon based on just one or a few specimens; it is done all the time with fossils. Just to pull out one recent example, Dr. Philip Hershkovitz, probably the world's foremost living mammalogist, described a new species of South American possum, using just one specimen (Fieldiana Zool. 70:1-56, 1992). Until someone publishes a thorough reassessment of appropriate series of specimens, and comes to a different conclusion that can be accepted by the mammalogical community, sonoriensis would have to stand.

Ron Nowak
28 August 1995

Appendix B

Sonoran Pronghorn Genetics

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Law Enforcement
National Fish and Wildlife Forensics Laboratory
1490 East Main Street
Ashland, Oregon 97520

IN REPLY REFER TO:

MEMORANDUM

TO: Laura Thompson-Olais, Cabeza-Prieta National Wildlife Refuge

FAX NO: (520) 387-5359

FROM: Dr. Steven R. Fain, NFWS Forensics Laboratory

FAX NO: (541) 482-4989

DATE: April 25, 1996

SUBJECT: Sonoran Pronghorn Genetics

We have completed a sequence comparison of a portion of the mitochondrial DNA control region of the Sonoran and Mexican subspecies of pronghorn antelope. The comparison was comprised of ten individuals of each subspecies. We did not observe any variation among the individuals selected to represent each subspecies (i.e., all of the individuals of the same subspecies were identical). The subspecies we compared were distinguished by less than 1% mtDNA sequence divergence (i.e., 1 substitution per 185 bases compared).

This study should be expanded to include a sample of the American pronghorn subspecies in order to more fully appreciate mtDNA variation within the pronghorn species throughout it's range.

In a second study, a portion of the nuclear SRY gene sequence was compared between a single Sonoran pronghorn individual and a single American pronghorn individual. The gene sequences were identical.

I had hoped to be further along in this work Laura, but our caseload has prevented this. We plan to continue as time allows. I hope that these data represent a meaningful contribution to your paper and to pronghorn conservation.

Regards,

S.R. Fain

Appendix C

Policy Regarding the Recognition of Distinct Vertebrate Populations Under the Endangered Species Act

federal register

Wednesday
February 7, 1996

Part IV

Department of the Interior

Fish and Wildlife Service

Department of Commerce

National Oceanic and Atmospheric Administration

Policy Regarding the Recognition of District Vertebrate Population; Notice

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act

AGENCIES: Fish and Wildlife Service, Interior; National Marine Fisheries Service, NOAA, Commerce.

ACTION: Notice of policy.

SUMMARY: The Fish and Wildlife Service and the National Marine Fisheries Service (Services) have adopted a policy to clarify their interpretation of the phrase "distinct population segment of any species of vertebrate fish or wildlife" for the purposes of listing, delisting, and reclassifying species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act).

ADDRESSES: The complete record pertaining to this action is available for inspection, by appointment, during normal business hours at the Division of Endangered Species, U.S. Fish and Wildlife Service, in Room 452, Arlington Square Building, 4401 North Fairfax Drive, Arlington, Virginia.

FOR FURTHER INFORMATION CONTACT: E. LaVerne Smith, Chief, Division of Endangered Species, U.S. Fish and Wildlife Service at the above address (703/358-2171), or Russell Bellmer, Chief, Endangered Species Division, National Marine Fisheries Service, 1335 East-West Highway, Silver Spring, Maryland 20910 (301/713-1401).

SUPPLEMENTARY INFORMATION:

Background

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et. seq.*). (Act) requires the Secretary of the Interior or the Secretary of Commerce (depending on jurisdiction) to determine whether species are endangered or threatened. In defining "species," the Act as originally passed included, "* * * any subspecies of fish or wildlife or plants and any other group of fish or wildlife of the same species or smaller taxa in common spatial arrangement that interbreed when mature." In 1978, the Act was amended so that the definition read "* * * any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." This change restricted application of this portion of the definition to vertebrates. The authority to list a "species" as endangered or threatened is thus not restricted to species as recognized in formal taxonomic terms, but extends to subspecies, and for vertebrate taxa, to distinct population segments (DPS's).

Because the Secretary must "* * * determine whether any species is an endangered species or a threatened species" (section 4(a)(1)), it is important that the term "distinct population segment" be interpreted in a clear and consistent fashion. Furthermore, Congress has instructed the Secretary to exercise this authority with regard to DPS's "* * * sparingly and only when the biological evidence indicates that such action is warranted." (Senate Report 151, 96th Congress, 1st Session). The Services have used this authority relatively rarely; of over 300 native vertebrate species listed under the Act, only about 30 are given separate status as DPS's.

It is important in light of the Act's requirement to use the best available scientific information in determining the status of species that this interpretation follows sound biological principles. Any interpretation adopted should also be aimed at carrying out the purposes of the Act (i.e., "* * * to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in subsection (a) of this section" (section 2(b)).

Available scientific information provides little specific enlightenment in interpreting the phrase "distinct population segment." This term is not commonly used in scientific discourse, although "population" is an important term in a variety of contexts. For instance, a population may be circumscribed by a set of experimental conditions, or it may approximate an ideal natural group of organisms with approximately equal breeding opportunities among its members, or it may refer to a loosely bounded, regionally distributed collection of organisms. In all cases, the organisms in a population are members of a single species or lesser taxon.

The National Marine Fisheries Service (NMFS) has developed a Policy on the Definition of Species under the Endangered Species Act (56 FR 58612-58618; November 20, 1991). The policy applies only to species of salmonids native to the Pacific. Under this policy, a stock of Pacific salmon is considered a DPS if it represents an evolutionarily significant unit (ESU) of a biological species. A stock must satisfy two criteria to be considered an ESU:

(1) It must be substantially reproductively isolated from other conspecific population units; and

(2) It must represent an important component in the evolutionary legacy of the species.

This document adopts an interpretation of the term "distinct population segment" for the purposes of listing, delisting, and reclassifying vertebrates by the U.S. Fish and Wildlife Service (FWS) and NMFS. The Services believe that the NMFS policy, as described above, on Pacific salmon is consistent with the policy outlined in this notice. The NMFS policy is a detailed extension of this joint policy. Consequently, NMFS will continue to exercise its policy with respect to Pacific salmonids

The Services' draft policy on this subject was published on December 21, 1994 (59 FR 65885) and public comment was invited. After review of comments and further consideration, the Services adopt the policy as issued in draft form.

Summary of Comments and Recommendations

The Services received 31 letters from individuals and organizations commenting on the draft policy. In addition, since publication of the draft policy, the National Academy of Sciences, National Research Council (NRC), has published a report titled "Science and the Endangered Species Act," prepared by a committee appointed by the Academy at the request of several members of Congress. This report in part examines the definition of "species" under the Act, and endorses the recognition of scientifically identified evolutionary units for conservation purposes. It discusses the recognition of DPS's in terms of "distinctiveness," which is consistent with the concept of "discreteness" as presented in the draft policy except that it would not recognize an international political boundary to delimit a DPS. The committee noted that: "Although there can be good policy reasons for such delineations, there are not sound scientific reasons to delineate species only in accordance with political boundaries." The Services agree that the inclusion of international boundaries in determining whether a population segment is discrete is sometimes undertaken as a matter of policy rather than science. Although the committee

expressed the belief that application of a distinctiveness test (analogous to the standard of discreteness in the policy) would adequately carry out the congressional instruction that the authority to address DPS's be exercised sparingly, the Services continue to believe that a judgement regarding the significance of any unit found to be discrete is necessary to comply with congressional intent.

Respondents presented a wide range of opinion regarding the recognition of DPS's. Some argued that the draft policy would be too restrictive and make it difficult or impossible to protect important elements of biodiversity; others maintained that the draft was not restrictive enough and would allow the Services to extend protection to entities never intended to be eligible for protection under the Act. A few respondents questioned the need for any policy framework and advocated case-by-case determinations of the eligibility of entities for listing under the DPS provision. The Services continue to believe that the Act will be best administered if there is a general policy framework governing the recognition of DPS's that can be disseminated and understood by the affected public.

Several respondents questioned the relationship of the draft policy to the NMFS policy regarding salmonids. The Services believe that the NMFS policy for salmonids is consistent with the general policy outlined in this notice, although the salmonid policy is formulated specifically to address the biology of this group. Several respondents also questioned the use of qualifying words such as "significant" or "markedly" in the policy. The Services intended these words to have their commonly understood senses. At the time any distinct population is recognized or not recognized the reasons for which it is believed to satisfy or not satisfy the conditions of the policy will be fully explained.

Several respondents maintained that a policy of this nature required adoption under rulemaking procedures of the Administrative Procedure Act. The Services disagree, and continue to regard the policy as non-regulatory in nature. Specific recommendations advanced by respondents are paraphrased and responded to below.

Only Full Species are Genetically Distinct From one Another, and Listing Should Only be Extended to These Genetically Distinct Entities.

Restricting listings to full taxonomic species would render the Act's definition of species, which explicitly includes subspecies and DPS's of vertebrates, superfluous. Clearly, the Act is intended to authorize listing of some entities that are not accorded the taxonomic rank of species, and the Services are obliged to interpret this authority in a clear and reasonable manner.

The Services Should Focus on Genetic Distinctness in Recognizing a Distinct Population Segment. Conversely, Some Respondents Believed There Should be No Requirement That a DPS be Genetically Differentiated or Recognizable for it to be Protected Under the Act

There appears to be a diversity of understanding regarding the purposes of the Act, with some individuals viewing it as directed almost exclusively toward the conservation of unique genetic resources while other individuals emphasize its stated intention of conserving ecosystems. This diversity of viewpoints is reflected in comments addressing the role to be played by genetic information in the draft policy. The Services understand the Act to support interrelated goals of conserving genetic resources and maintaining natural systems and biodiversity over a representative portion of their historic occurrence. The draft policy was intended to recognize both these intentions, but without focusing on either to the exclusion of the other. Thus, evidence of genetic distinctness or of the presence of genetically determined traits may be important in recognizing some DPS's, but the draft policy was not intended to always specifically require this kind of evidence in order for a DPS to be recognized. The ESU policy of NMFS also does not require genetic data before an ESU can be identified. Thus in determining whether the test for discreteness has been met under the policy, the Services allow but do not require genetic evidence to be used. At least one respondent evidently understood the draft policy to require that genetic distinctness be demonstrated before a DPS could be recognized, and criticized the draft on that basis. As explained above, this was never intended.

The Elements Describing Reasons for Considering a Population Segment Significant Should be Laid Out Comprehensively, Rather Than Presented as an Open-Ended Set of Examples as in the Draft Policy

The Services appreciate the need to make a policy on this subject as complete and comprehensive as possible, but continue to believe that it is not possible to describe in advance all the potential attributes that could be considered to support a conclusion that a particular population segment is "significant" in terms of the policy. When a distinct population is accepted or rejected for review pursuant to a petition or proposed for listing or delisting, the Services intend to explain in detail why it is considered to satisfy both the discreteness and significance tests of the policy.

In Assessing the Significance of a Potential Distinct Population Segment, the Services Should Focus on its Importance to the Status of the Species to Which it Belongs. Alternatively, the Services Should Emphasize the Importance of a Potential DPS to the Environment in Which it Occurs

Despite its orientation toward conservation of ecosystems, the Services do not believe the Act provides authority to recognize a potential DPS as significant on the basis of the importance of its role in the ecosystem in which it occurs. In addition, it may be assumed that most, if not all, populations play roles of some significance in the environments to which they are native, so that this importance might not afford a meaningful way to differentiate among populations. On the other hand, populations commonly differ in their importance to the overall welfare of the species they represent, and it is this importance that the policy attempts to reflect in the consideration of significance.

International Boundaries are not Appropriate in Determining That a Population is Discrete in the Draft Policy; Political Boundaries Other Than Those Between Nations may be Appropriate in Some Cases to Delimit DPS's

The Services recognize that the use of international boundaries as a measure of discreteness may introduce an artificial and non-biological element to the recognition of DPS's. Nevertheless, it appears to be reasonable for national legislation, which has its principal effects on a national scale, to recognize units delimited by international boundaries when these coincide with differences in the management, status, or exploitation of a species. Recognition of international boundaries in this way is also consistent with practice under the Convention on International Trade in Endangered Species of Wild Fauna and Flora, which is implemented in the United States by the Act. Recognition of other political boundaries, such as State lines within the United States, would appear to lead to the recognition of

entities that are primarily of conservation interest at the State and local level, and inappropriate as a focus for a national program. The Services recognize, as suggested in some comments, that infra-national political boundaries offer opportunities to provide incentives for the favorable management of species if they were used as a basis for recognizing discrete entities for delisting or for exclusion from a listing. Particularly when applied to the delisting or reclassification of a relatively widespread species for which a recovery program is being successfully carried out in some States, recognition of State boundaries would offer attractive possibilities. Nevertheless, the Act provides no basis for applying different standards for delisting than those adopted for listing. If the Services do not consider entities for listing that are not primarily of conservation interest at a national level, they must also refrain from delisting or reclassifying units at this level.

Complete Reproductive Isolation Should be Required as a Prerequisite to the Recognition of a Distinct Population Segment

The Services do not consider it appropriate to require absolute reproductive isolation as a prerequisite to recognizing a distinct population segment. This would be an impracticably stringent standard, and one that would not be satisfied even by some recognized species that are known to sustain a low frequency of interbreeding with related species.

The Services Should Emphasize Congress' Instruction to use Their Authority to Dddress DPS's "Sparingly"

The Services believe that application of the policy framework announced in this document will lead to consistent and sparing exercise of the authority to address DPS's, in accord with congressional instruction.

The Occurrence of a Population Segment in an Unusual Setting Should not be Used as Evidence for its Significance

The Services continue to believe that occurrence in an unusual ecological setting is potentially an indication that a population segment represents a significant resource of the kind sought to be conserved by the Act. In any actual case of a DPS recognized in part on this basis, the Services will describe in detail the nature of this significance when accepting a petition or proposing a rule.

The Authority to Address DPS's Should be Extended to Plant and Invertebrate Species

The Services recognize the inconsistency of allowing only vertebrate species to be addressed at the level of DPS's, and the findings of the NRC committee also noted that such recognition would be appropriate for other species. Nevertheless, the Act is perfectly clear and unambiguous in limiting this authority. This policy acknowledges the specific limitations imposed by the Act on the definition of "species."

The Services Should Stress Uniqueness and Irreplaceability of Ecological Functions in Recognizing DPS's

The Services consider the Act to be directed at maintenance of species and populations as elements of natural diversity. Consequently, the principal significance to be considered in a potential DPS will be the significance to the taxon to which it belongs. The respondent appears to be recommending that the Services consider the significance of a potential DPS to the community or ecosystem in which it occurs and the likelihood of another species filling its niche if it should be extirpated from a particular portion of its range. These are important considerations in general for the maintenance of healthy ecosystems, and they often coincide with conservation programs supported by the Act. Nevertheless, the Act is not intended to establish a comprehensive biodiversity conservation program, and it would be improper for the Services to recognize a potential DPS as significant and afford it the Act's substantive protections solely or primarily on these grounds.

Congress did not Intend to Require That DPS's be Discrete. In a Similar Vein, Congress did not Require That a Potential DPS be Significant to be Considered Under the Act

With regard to the discreteness standard, the Services believe that logic demands a distinct population recognized under the Act be circumscribed in some way that distinguishes it from other representatives of its species. The standard established for discreteness is simply an attempt to allow an entity given DPS status under the Act to be adequately defined and described. If some level of discreteness were not required, it is difficult to imagine how the Act could be effectively administered or enforced. At the same time, the standard adopted does not require absolute separation of a DPS from other members of its species, because this can rarely be demonstrated in nature for any population of organisms. The standard adopted is believed to allow entities recognized under the Act to be identified without requiring an unreasonably rigid test for distinctness. The requirement that a DPS be significant is intended to carry out the expressed congressional intent that this authority be exercised sparingly as well as to concentrate conservation efforts undertaken under the Act on avoiding important losses of genetic diversity.

A Population Should Only be Required to be Discrete or Significant, but not Both, to be Recognized as a Distinct Population Segment

The measures of discreteness and significance serve decidedly different purposes in the policy, as explained above. The Services believe that both are necessary for a policy that is workable and that carries out congressional intent. The interests of conserving genetic diversity would not be well served by efforts directed at either well-defined but insignificant units or entities believed to be significant but around which boundaries cannot be recognized.

Requiring That a DPS be Discrete Effectively Prevents the Loss of Such a Segment From Resulting in a Gap in the Distribution of a Species. Essentially, if Distinct Populations are Entirely Separate, the Loss of One Has Little Significance to the Others

If the standard for discreteness were very rigid or absolute, this could very well be true. However, the standard adopted allows for some limited interchange among population segments considered to be discrete, so that loss of an interstitial population could well have consequences for gene flow and demographic stability of a species as a whole. On the other hand, not only population segments whose loss would produce a gap in the range of a species can be recognized as significant, so that a nearly or completely isolated population segment could well be judged significant on other grounds and recognized as a distinct population segment.

The Services Lack Authority to Address DPS's of Subspecies

The Services maintain that the authority to address DPS's extends to species in which subspecies are recognized, since anything included in the taxon of lower rank is also included in the higher ranking taxon.

The following principles will guide the Services' listing, delisting and reclassification of DPS's of vertebrate species. Any proposed or final rule affecting status determination for a DPS would clearly analyze the action in light of these guiding principles.

Policy

Three elements are considered in a decision regarding the status of a possible DPS as endangered or threatened under the Act. These are applied similarly for addition to the lists of endangered and threatened wildlife and plants, reclassification, and removal from the lists:

1. Discreteness of the population segment in relation to the remainder of the species to which it belongs;
2. The significance of the population segment to the species to which it belongs; and
3. The population segment's conservation status in relation to the Act's standards for listing (i.e., is the population segment, when treated as if it were a species, endangered or threatened?).

Discreteness: A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions:

1. It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation.
2. It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

Significance: If a population segment is considered discrete under one or more of the above conditions, its biological and ecological significance will then be considered in light of Congressional guidance (see Senate Report 151, 96th Congress, 1st Session) that the authority to list DPS's be used "* * * sparingly" while encouraging the conservation of genetic diversity. In carrying out this examination, the Services will consider available scientific evidence of the discrete population segment's importance to the taxon to which it belongs. This consideration may include, but is not limited to, the following:

1. Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon.
2. Evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon.
3. Evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range, or
4. Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.

Because precise circumstances are likely to vary considerably from case to case, it is not possible to describe prospectively all the classes of information that might bear on the biological and ecological importance of a discrete population segment.

Status: If a population segment is discrete and significant (i.e., it is a distinct population segment) its evaluation for endangered or threatened status will be based on the Act's definitions of those terms and a review of the factors enumerated in section 4(a). It may be appropriate to assign different classifications to different DPS's of the same vertebrate taxon.

Relationship to Other Activities

The Fish and Wildlife Service's Listing and Recovery Priority Guidelines (48 FR 43098; September 21, 1983) generally afford DPS's the same consideration as subspecies, but when a subspecies and a DPS have the same numerical priority, the subspecies receives higher priority for listing. The Services will continue to generally accord subspecies higher priority than DPS's.

Any DPS of a vertebrate taxon that was listed prior to implementation of this policy will be reevaluated on a case-by-case basis as recommendations are made to change the listing status for that distinct population segment. The appropriate application of the policy will also be considered in the 5-year reviews of the status of listed species required by section 4(c)(2) of the Act.

Effects of Policy

This guides the evaluation of distinct vertebrate population segments for the purposes of listing, delisting, and reclassifying under the Act. The only direct effect of the policy is to accept or reject population segments for these purposes. More uniform treatment of DPS's will allow the Services, various other government agencies, private individuals and organizations, and other interested or concerned parties to better judge and concentrate their efforts toward the conservation of biological resources at risk of extinction.

Listing, delisting, or reclassifying distinct vertebrate population segments may allow the Services to protect and conserve species and the ecosystems upon which they depend before large-scale decline occurs that would necessitate listing a species or subspecies throughout its entire range. This may allow protection and recovery of declining organisms in a more timely and less costly manner, and on a smaller scale than the more costly and extensive efforts that might be needed to recover an entire species or subspecies. The Services' ability to address local issues (without the need to list, recover, and consult rangewide) will result in a more effective program.

Author/Editor: The editors of this policy are Dr. John J. Fay of the Fish and Wildlife Service's Division of Endangered Species, 452 ARLSQ, Washington, DC 20240 (703/358-2105) and Marta Nammack of the National Marine Fisheries Service's Endangered Species Division, 1335 East-West Highway, Silver Spring, Maryland 20910 (301/713-2322).

Authority: The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Dated: February 1, 1996.

John G. Rogers,

Acting Director, Fish and Wildlife Service.

Dated: February 1, 1996.

Nancy Foster,

Deputy Assistant Administrator for Fisheries, National Marine Fisheries Service.

[FR Doc. 96-2639 Filed 2-6-96; 8:45 am]

BILLING CODE 3510-22-P