

**ARIZONA GAME AND FISH DEPARTMENT
HABITAT PARTNERSHIP COMMITTEE
HABITAT ENHANCEMENT AND WILDLIFE MANAGEMENT PROPOSAL**

Game Branch / HPC Project Number:	11-507
Possible Funding Partners:	

PROJECT INFORMATION

Project Title: Restoration of Bighorn Sheep in the Santa Catalina Mountains

Region and Game Management Unit: 5, 33

Local Habitat Partnership Committee (LHPC):

- Tucson

Was the project presented to the LHPC?

YES[X] NO[]

Has this project been submitted in previous years? YES[] NO[X]

If Yes, was it funded? YES[] NO[] → HPC Project #:

Project Type: Bighorn Sheep Restoration

Brief Project Summary:

To restore a viable population of bighorn sheep (*Ovis Canadensis*) in the Santa Catalina Mountains of GMU 33. Recent habitat assessments have confirmed suitable, but unoccupied habitat in the Catalinas. Krausman et al. (2004) reevaluated bighorn sheep habitat in the Catalinas following the Bullock and Aspen fires in 2002 and 2003 respectively. Using their GIS model, they calculated 39,201 ha of potential habitat in the entire Santa Catalina Mountains and 9,017 ha of historic habitat in the western portion of the range. Approximately 21% of the potential bighorn sheep habitat and approximately 24% of the historic bighorn sheep habitat was burned during the Bullock and Aspen fires. This year, AGFD Regional personnel and the Forest Service used the Cunningham/Hansen method (Cunningham 1989) to evaluate bighorn sheep habitat in the Catalinas and concluded that the range is suitable for bighorn sheep.

Approximately 30 bighorn sheep will be captured from Region's 4, 5, and 6 pending availability, and fitted with real time mortality sensing satellite GPS collars. The collars will provide cause-specific mortality data, as well as other important information for sheep, which will be used to drive the Adaptive Cougar Management Plan. This plan has been developed to address cougar predation on bighorn sheep for the restoration effort. As suggested by the Bighorn Species Management Guidelines, preferred ratios will be 65% ewes, 20% yearlings, and 15% medium aged rams [Classes II and III]). Approximately 22 females and 8 males (or a ratio of about 3 females to 1 male if fewer than 30 sheep are captured) will be captured.

Secondary and tertiary releases of 30 sheep may be considered and deemed necessary depending on the success of the initial release, funding and availability of source sheep. If funding is available to facilitate post-release monitoring, future releases of sheep may be outfitted with GPS collars. Aerial monitoring of the transplanted animals will be conducted for a minimum of 5 years post release to monitor population trends.

Big Game Wildlife Species to Benefit: Bighorn sheep

<p>Implementation Schedule (Month/Day/Year):</p> <p>Project Start Date: September 1, 2011</p> <p>Project End Date: June 30, 2016</p>	<p>Environmental Compliance:</p> <p>NEPA Completed: YES[] No[] N/A[X] Projected Completion Date: _____</p> <p>State Historic Preservation Office - Archaeological Clearance: YES[] No[] N/A[X] Projected Completion Date: _____</p> <p>Arizona Game and Fish Department EA Checklist: N/A[] To be Completed by: <u>Region 5 Wildlife Managers</u> Projected Completion Date: <u>November 1, 2012</u></p>
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PROJECT FUNDING

<p>Special Big Game License Tag Funds Requested:</p> <p>Cost Share or Matching Funds: Note: We intend to use a variety of approaches to solicit donations from the general public, local business, organizations and homeowners, the ADBSS and FNAWS memberships, and others to offset the costs of the project. We anticipate tremendous support for the project.</p>	<p>\$169,728</p> <p>\$ See Note to the left</p>
<p>Total Project Costs:</p>	<p>\$169,728</p>

PARTICIPANT INFORMATION

<p>Applicant (please print): Martin Guerena, John McGehee and Ben Brochu Wildlife Managers, Region 5</p>	<p>Address: Arizona Game and Fish Department 555 N Greasewood Rd. Tucson, AZ. 85745</p>	<p>E-mail: @azgfd. @azgfd. @azgfd.</p>
<p>Telephone: 520-628-5376</p>	<p>Date: September 1, 2011</p>	

AGFD Contact and Phone No. (If applicant is not AGFD personnel):

Project has been coordinated with:
 Game Branch, Research Branch, Region IV, Region VI, ADBSS, U.S. Forest Service, Catalina State Park.

NEED STATEMENT – PROBLEM ANALYSIS:

Bighorn sheep historically were a natural component of the Santa Catalina Mountain ecosystem. While they were once widespread, today they have been extirpated from this range. Recent habitat assessments by AGFD personnel have confirmed suitable, but presently unoccupied bighorn sheep habitat in the Catalinas. This is also confirmed by Krausman et al. (2004) who reported that the Bullock and Aspen fires of 2002 and 2003 respectively burned 21% of all potential bighorn habitat (39,201 ha) and 24% of all historic bighorn habitat (9,017 ha) in the Catalina Mountains. These burns have undoubtedly improved habitat conditions.

The historical presence of bighorn sheep in the Catalinas has been well documented (Allen 1895, Mearns 1907, Hornaday 1914, Seton 1929, Dice and Blossom 1937, Buechner 1960). This was the last

population of wild sheep found in close proximity to a major metropolitan area in Arizona (Purdy 1981). In the year 1885, Mearns (1907) ascertained that mountain sheep occurred in the Santa Rita and Catalina mountains, and that several were killed in those mountains during the winter of 1884-1885 and the meat sold in the markets of Tucson, Arizona. Allen (1895) reports mountain sheep were not uncommon on the bare rocky spurs of the Catalina Mountains, where they were seen during 1894. Several were killed in the fall of 1893 by an Indian hunter, and the meat sold to settlers at the foot of the mountains (Allen, 1895). In 1928, United States Forest Service records show 220 bighorn sheep for the Catalinas, when that population was presumed to be the largest in the state (Buechner 1960). In 1930, D.T. MacDougal stated that a few still occurred on the lower rocky slopes of the Catalinas, near the mouth of Pima Canyon and elsewhere (Dice and Blossom 1937). In September, 1936, a visual count of 23 rams, 48 ewes, and 12 lambs was made by personnel of the Coronado National Forest during an organized effort to ascertain numbers (Buechner 1960). In the autumn of 1937, Vorhies claimed that 71 bighorn sheep were known to exist in the Catalinas (Cowan 1940). Despite the establishment of a game preserve in 1934, numbers seem to have declined rapidly shortly thereafter (Buechner 1960). An extirpation was thought to have taken place in the Catalina Mountains, until John F. Reed, a student in Wildlife Management at the University of Arizona, saw 3 bighorn sheep, 2 ewes of which were photographed on January 18, 1955 in Finger Rock Canyon (Buechner 1960).

Formal annual bighorn sheep surveys began in the Catalinas in 1962 following John Russo's 5-year study, which concluded in 1955 and paved the way for legalized hunting and the eventual implementation of a trapping and transplant program for bighorn sheep. The public's ability to hunt this species intensified interest in bighorn sheep management among the state's sportsmen and brought public attention to the species' needs (Lee 1986). Surveys in the Catalinas were discontinued after 1999 due to a lack of sheep being observed. The peak of the Catalina bighorn sheep herd is believed to have occurred in the late 1970's and early-mid 1980's. Bighorn sheep in the Catalinas began to decline in the 1980's until eventually disappearing in the late 1990's (Wakeling et al. 2009).

Multiple factors have been hypothesized as being associated with the decline of desert bighorn sheep in the Catalinas including urban development (i.e., housing development, road construction), human recreation (i.e., hikers, hikers with dogs, trail development), changes in habitat conditions associated with the suppression of wildfires (Etchberger et al. 1989, Czech and Krausman 1997, Krausman et al. 1996, 2000, Papouchis et al. 2001, Krausman et al. 2004), predation (Wakeling et al. 2009), and disease (Brown 1989, deVos 1989, Wakeling et al. 2009). Reduced fitness associated with genetic bottlenecks as described in Ramey et al. (2000) and Whittaker et al. (2004) also warrants merit, however no studies have ever been done testing this theory in the Catalinas. Today, no conclusive determination has ever been made as to the cause for the decline and eventual extirpation of desert bighorn sheep in the Catalinas (Wakeling et al. 2009).

The public has been supportive of bighorn sheep restoration and has placed significant value on the presence of bighorn sheep in the Catalinas as a natural component of this ecosystem. This is supported by Purdy (1981), Burgarsky (1986), Harris et al. (1995), and Devers (1999).

Burgarsky (1986) conducted a study of the economic value of bighorn sheep in the Catalina's in the mid 1980's and found that people placed a value of \$1.3 to 2.4 million on the continued existence of those animals, even if they would never see the bighorn sheep. With approximately 100 bighorn sheep on Pusch Ridge in the mid 1980's, each sheep would be worth \$13,000 to \$24,000. If the bighorn sheep could be seen, their value was estimated to be \$2.2 million to 3.9 million, or \$22,000 to \$39,000 per animal. Today, assuming average annual inflation from 1985-2010 to be 2.91%, these respective values would be \$2.7 million to \$4.9 million or \$26,000 to \$49,000 per animal. If they could be seen, their value would be approximately \$45,000 to \$79,000 per animal or \$4.6 million to \$8 million for a population of 100 animals.

The translocation of bighorn sheep into the Catalinas has been discussed since 1985 when it was identified as the single research need in the AGFD Region V Big Game Strategic Plan. A recommendation was made to analyze the possibility of improving survival within the heard by introducing bighorn sheep from other mountain ranges to improve the genetic diversity of the population (Shaw and DeVos, 1989). No additional sheep were introduced into the Catalinas and the population soon disappeared from the mountain.

Below is a photo taken by Joe Sheehey in 1977 of 27 bighorn sheep of various cohorts in the Catalinas.



PROJECT OBJECTIVES:

The main objective is to restore a viable population of bighorn sheep in the Santa Catalina Mountains of Game Management Unit (GMU) 33, a historical natural component of this ecosystem (Figure 1).

We also hope to accomplish/learn the following as it relates to the project:

- Habitat use, population distributions, travel corridors, lambing areas, and cause-specific mortality rates will be studied through the monitoring of GPS collared sheep.
- Generate public support and appreciation for bighorn sheep in the Tucson area.
- Increase watchable wildlife opportunities.

- Increase the opportunity to hunt bighorn sheep, if the population expands to harvestable levels.
- Evaluate the survival rates of mountain lion educated vs. uneducated sheep depending on the source of the sheep.

PROJECT DESCRIPTION AND STRATEGIES:

Thirty sheep will be captured from Regions 4, 5 and 6 (specific locations unknown at this time) (as suggested by the Bighorn Species Management Guidelines, preferably these will be 65% ewes, 20% yearlings, and 15% medium aged rams [Classes II and III]), and outfitted and monitored with state-of-the-art North Star Globalstar satellite collars. These collars provide GPS locations in real time to the World Wide Web and can be accessed electronically with the necessary login and password credentials. Secondary and tertiary releases of 30 sheep may be considered and deemed necessary depending on the success of the initial release, funding and availability of source sheep. If funding is available, we hope to collar as many of the secondary and tertiary released sheep as possible.

Translocated sheep will be divided into two or three groups of 10-15 individuals each and released in separate sites. The “mini release” concept, as suggested by Dodd (1983) has been successful in maximizing bighorn sheep dispersal and lambing site utilization, selection and annual use. This approach is based upon the behavioral studies by Geist (1971), who demonstrated that ewes imprint on areas where they bear their lambs and returned to the same areas annually. Thus, distribution of groups of lambing ewes throughout an area disperses transplanted populations (Shaw and deVos 1989). The release sites, identified in Figure 3, will be near historical lambing areas as identified by deVos (1983) and newly identified potential lambing areas identified by regional Department personnel through aerial and ground surveys on the east side of the Catalinas near Sabino and Finger Rock Canyons.

Once bighorn sheep have been released into the Catalinas, they will be monitored daily via internet. If and when a mortality is detected on a collared sheep, managers will investigate kill sites within 1-2 days, if logistically feasible, and determine cause-specific mortality. A Bighorn Sheep Mortality Report Form will be completed at each site to assist in determining cause-specific mortality. The totality of the circumstances at the kill site will determine the appropriate cause of death. If a cougar is detected at the kill site, the cougar management criteria in the Adaptive Cougar Management Plan will be used to determine the appropriate response.

An Adaptive Cougar Management Plan has been developed to minimize cougars as a limiting factor in restoring the population to viable levels. Consistent with this plan, the following is being planned:

- MBL – adopt a multiple bag limit for cougars to increase sport harvest rates and hunter opportunity among our constituents.
- Active cougar control on offending animals detected at sheep kill sites using snares, leg-hold traps, aerial gunning, shooting, and hunting with the aid of hounds or other approved methods. USDA APHIS – Wildlife Services may be contracted to perform the removal.
- Research opportunities – The overall purpose of a proposed study should be to collect data that will inform and support cougar management decisions in the Santa Catalina Mountains and potentially statewide. In light of potential reintroduction of bighorn sheep, this information could also guide predator management decisions to support bighorn sheep persistence.

PROJECT LOCATION:

Figure 1: Map of Santa Catalina Mountains & Pusch Ridge Wilderness Area near Tucson, AZ in GMU33.

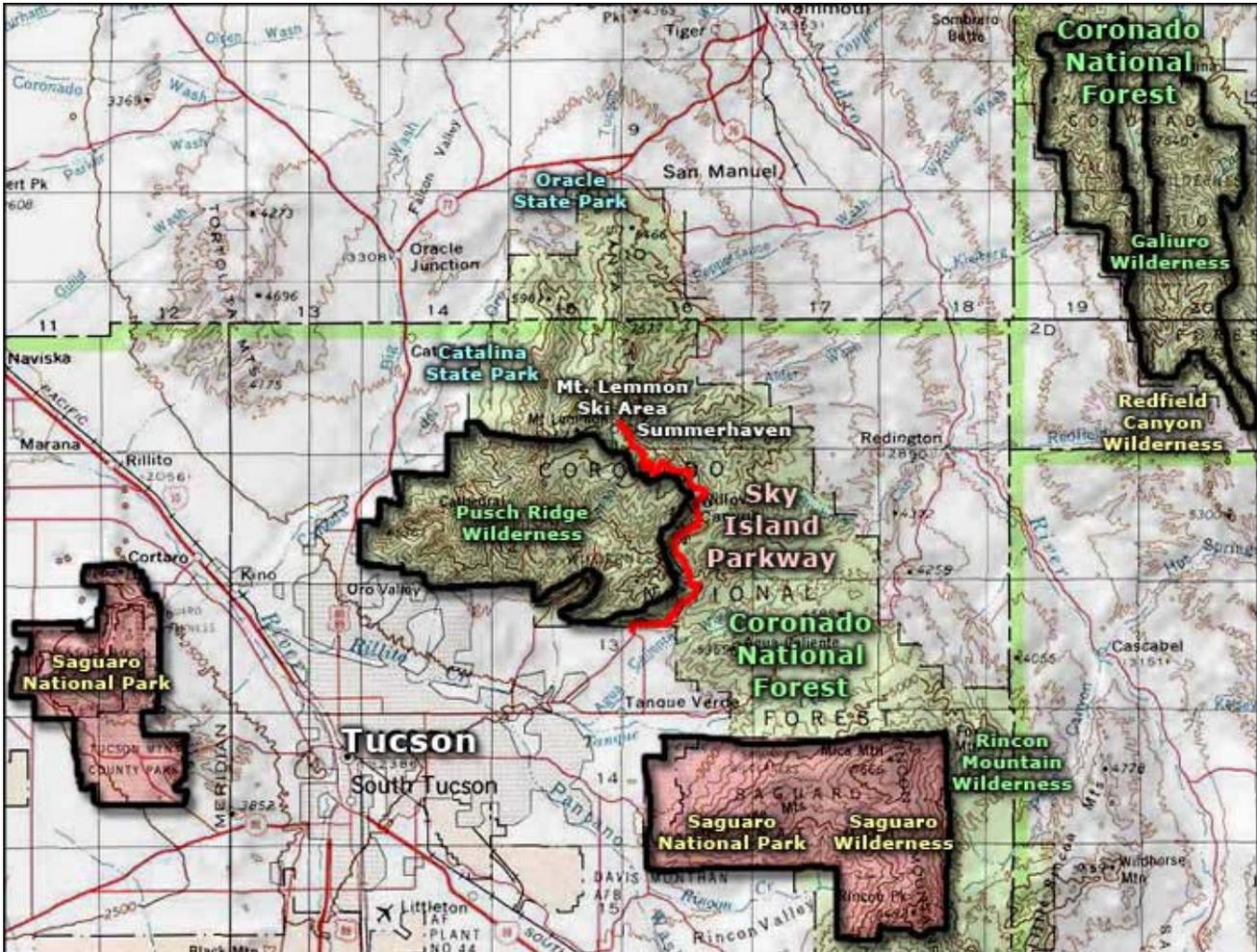


Figure 2: Map of the Pusch Ridge Wilderness Area in the Santa Catalina Mountains.

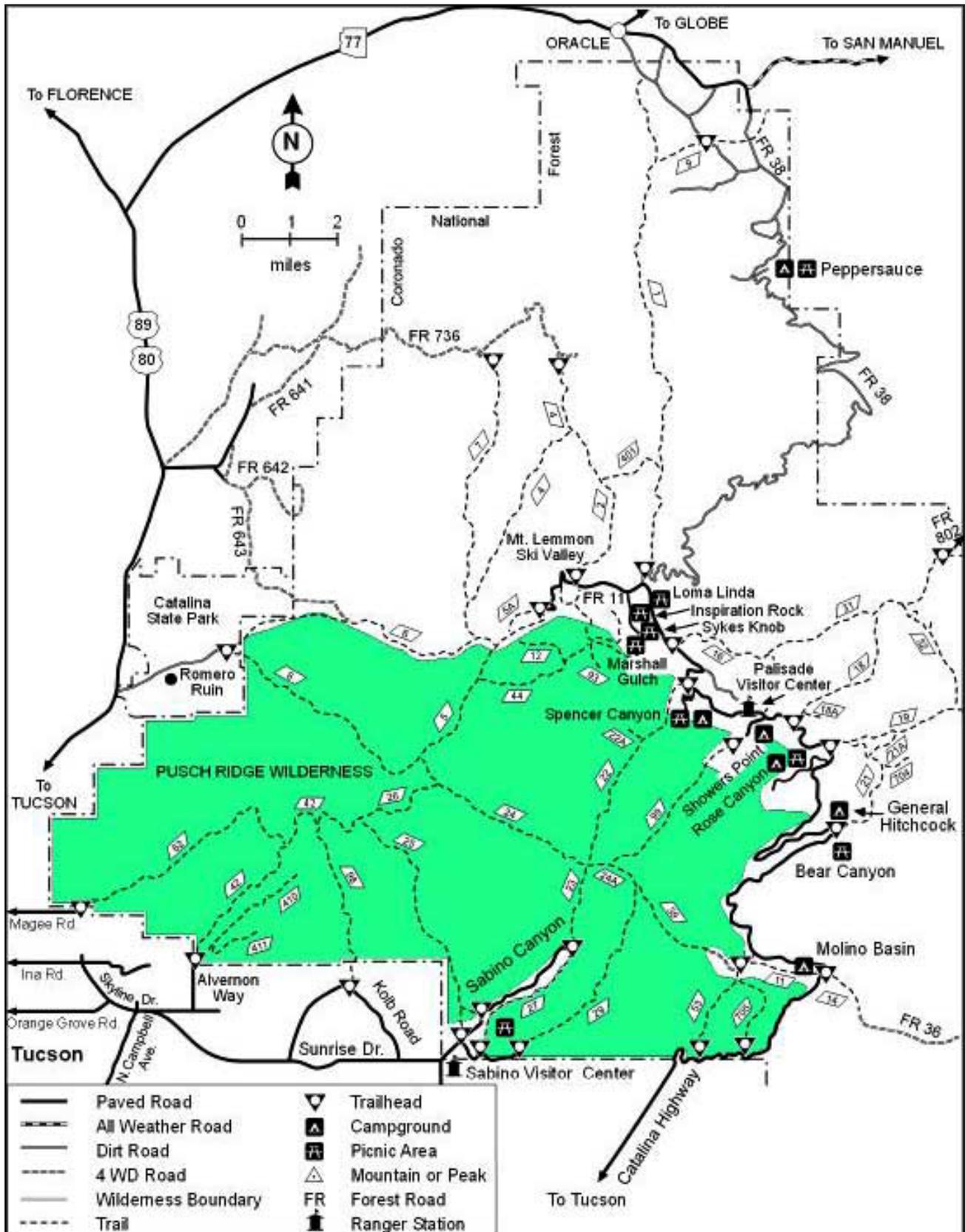
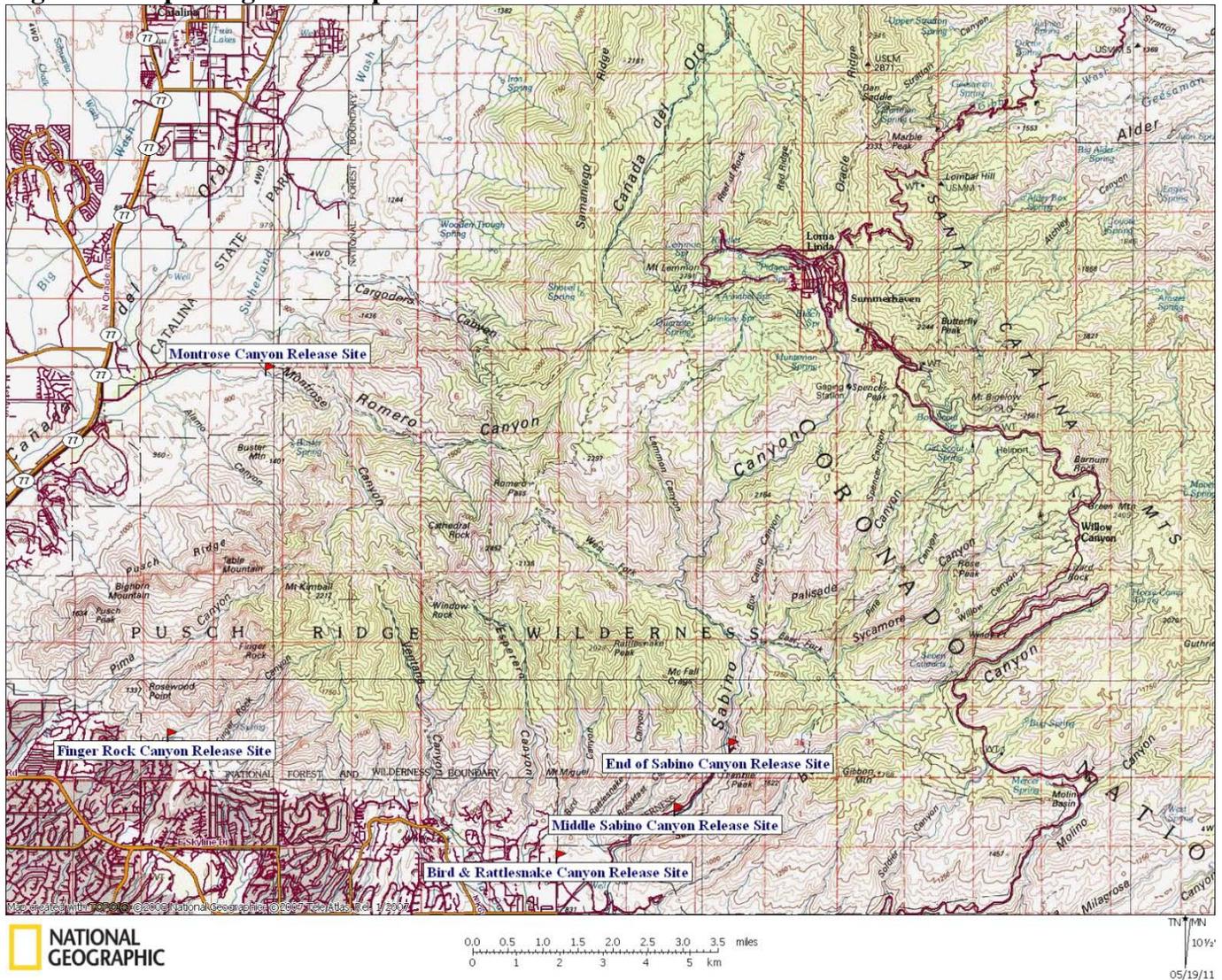


Figure 3: Map of bighorn sheep release sites in the Catalina Mountains.



- 1) Finger Rock Canyon Release Site: N3220.754 W11055.127
- 2) Montrose Canyon Release Site: N3225.352 W11053.683
- 3) Middle Sabino Canyon Release Site: N3219.806 W11047.619
- 4) Bird and Rattlesnake Canyon Release Site: N3219.216 W11049.356
- 5) End of Sabino Canyon Release Site: N3220.645 W11046.765

*All Proposed Release Sites are on Coronado National Forest Land.

LAND OWNERSHIP AT PROJECT SITE (Please state specifically if PRIVATE PROPERTY and provide landowner's name):

All Release Sites in the Santa Catalina Mountains are located on public land managed by the Coronado National Forest, Santa Catalina Ranger District. Other portions of desert bighorn sheep habitat are located on State and Forest Lands in Catalina State Park and the 56,933 acres, which make up the Pusch Ridge Wilderness area.

IF PRIVATE PROPERTY, IS THERE A STEWARDSHIP or LANDOWNER AGREEMENT BETWEEN THE LANDOWNER AND THE DEPARTMENT?
YES[] NO[]

HABITAT DESCRIPTION:

The Catalina Mountains are located in south-central Arizona on the Coronado National Forest. Located to the south and west of the Catalinas is Tucson, a metropolitan area with a population in excess of 520,000 people.

The Catalinas are roughly triangular in shape with an east-west base of about 20 miles and the apex approximately 20 miles north of that base. Elevations range from 2800 feet at the southwest base of Pusch Ridge to over 9000 feet at Mt. Lemmon. Within the area where most bighorn sheep were historically found, elevations seldom exceed 6000 feet (deVos 1983). Topography varies from the broad bajadas that surround the Catalina Mountains to sharply bisected canyons (Whittaker and Niering 1965).

The vegetative composition of the Catalinas has been well documented by Whittaker and Niering (1964, 1965, and 1975). Vegetative composition of this mountain range is unique in that it possesses a full sequence of plant communities from limited subalpine fir (*Abies lasiocarpa*) forests to large expanses of paloverde-mixed cacti desert. Vegetation of the Catalinas includes mountain coniferous forests, Mexican oak (*Quercus oblongifolia*) and pine (*Pinus spp.*)-oak communities of southern affinities, desert grasslands with affinities to the east and Sonoran Desert with affinities to the west and south. Flora of the Catalinas is rich and community species diversities are high. Species diversities increase toward lower elevations; desert-grasslands and deserts of lower mountain slopes are among the richest communities in the United States. Floristic diversity is higher in continental than maritime climates, as indicated by comparison of species diversities and community differentiation along topographic moisture gradients in the Catalinas. Based upon the classification system described by Brown et al. (1979), eight vegetative communities and 18 plant associations were identified within the Catalinas.

Precipitation in the Catalinas is quite variable from year to year. Mean annual precipitations at Tucson on the southwest, Oracle on the northeast side of the Catalinas, and the Mt. Lemmon summit are 11.42, 19.40, and 29.56 inches respectively (Western Regional Climate Center, 2011).

Within the southwest portion of the Catalinas lies the Pusch Ridge Wilderness Area (PRWA – Figure 2), which historically has held most of the bighorn sheep that occupied this mountain range. The PRWA was established February 24, 1978 by the Endangered American Wilderness Act. As established, this area consists of 22,837 ha. One of the major goals of the PRWA was to protect habitat for desert bighorn sheep (Anonymous 1978). The PRWA consists of steep, highly erosive areas with large, deep canyons that support riparian vegetation. Hogbacks rise from the desert floor to higher elevations forming vertical rock faces and spectacular geologic formations (Krausman et al. 1979).

ITEMIZED USE OF FUNDS:

Special Big Game License Tag Funds

Helicopter Services:

DBHS Capture - 2 ships, 2 days, 5 hours per day
20 hours @ \$564/hr = \$11280

Ferry - 7 hours @ \$464/hr = \$ 3248

Annual helicopter surveys in October:

year survey (5 hrs @ \$1000/hr) = \$5000

Global Positioning System Collars:		
30 GPS Collars @ \$5000	=	\$150000
Miscellaneous Supplies (ear phones, Ivermectin, syringes, hardware, ear tags, etc.):	=	\$200
		<hr/>
Total	=	\$169,728

Cost Share or Matching Funds

We intend to use a variety of approaches to solicit donations from the general public, local business, organizations and homeowners, the ADBSS and FNAWS memberships, and others to offset the costs of the project. We anticipate tremendous support for the project. We anticipate beginning this effort in early 2012.

LIST COOPERATORS AND DESCRIBE POTENTIAL PARTICIPATION:

- USFS assist with processing, release and post release monitoring of sheep as well as implementing habitat improvements through FireScape.
- ADBSS assist with funding, processing, release, and post release monitoring.
- NPS assist with release and post release monitoring.
- Donations from various groups and organizations.

PROJECT MONITORING PLAN:

An operational release plan for a November 2012 Santa Catalina Mountains bighorn sheep translocation will be developed.

Bighorn sheep will be monitored several times per day using the GPS satellite collars, which upload real time coordinates and activity (mortality/non-mortality) signals to AGFD personnel via computer. When a sheep mortality occurs, regional personnel will investigate the site ASAP to determine cause of death. If a cougar is determined to have killed the sheep, criteria in our Adaptive Cougar Management Plan will be used to determine the appropriate response.

PROJECT MAINTENANCE:

N/A

PROJECT COMPLETION REPORT TO BE FILED BY:

Jim Heffelfinger, Game Specialist Region V

WATER DEVELOPMENT PROJECTS (see attached worksheet):

N/A

TREE SHEARING (AGRA-AXE, PUSH) PROJECTS (see attached worksheet):

N/A