Catalina Bighorn Sheep Reintroduction Project
January 6, 2014 – January 19, 2014

BACKGROUND

On November 18, 2013, the Arizona Game and Fish Department (Department) released 31 desert bighorn sheep into the Santa Catalina Mountains just north of Tucson. Bighorn sheep that once inhabited the Santa Catalinas disappeared in the early 1990s. This restoration project represents a historical new approach that involves a collaborative effort bringing together a local group of diverse stakeholders. These stakeholders formed an Advisory Committee and have been advising the Department on how best to accomplish the goal of restoring ecosystem health that would support a wide variety of species, including bighorn sheep. This methodology represents a significant change in the planning process and has been built on recognizing differences, finding commonalities, and working towards a common goal. The restoration project has generated a great deal of interest, and consequently, many inquiries regarding project status. The Advisory Committee and Department have decided to use a briefing format to deliver the most accurate and up-to-date information in a consistent and equitable manner to all.

ADVISORY COMMITTEE

The Advisory Committee is comprised of the following members and their respective affiliations:

Brian Dolan – Arizona Desert Bighorn Sheep Society
Mike Quigley – The Wilderness Society
Randy Serraglio – Center for Biological Diversity
Trica Oshant Hawkins – Arizona Wilderness Coalition
Joe Sheehey – Arizona Desert Bighorn Sheep Society
Acasia Berry – Sky Island Alliance
Sergio Avila – Sky Island Alliance
Brian Ham - Sportsman
Les Corey – Arizona Wilderness Coalition

BRIEFING

The following is a summary of Catalina Bighorn Sheep Reintroduction activities on the Coronado National Forest. Additional project information can be obtained by visiting the Arizona Game and Fish Department Facebook page at https://www.facebook.com/azgafd#!/CatalinaBighorns , the Arizona Game and Fish Department webpage at http://www.azgfd.gov/w_c/bighornSheep.shtml , or by visiting the Catalina Bighorn Advisory Committee webpage at http://www.catalinabighornrestoration.org/. Past updates may be viewed on these websites. This update is a public document and information in it can be used for any purpose.

OVERVIEW AND DISTRIBUTION

No Change.

CURRENT POPULATION STATUS

The original release of 31 sheep consisted of 21 adult females or ewes, three yearling/juvenile ewes, five adult males or rams, and two yearling/juvenile rams. Thirty of the released sheep were outfitted with satellite GPS collars to provide managers with up-to-date information to help make adaptive**,** data-driven decisions. As of January 19, 2014, 22 of the 30 collared sheep were known to be alive on the mountains.

To date there have been eight bighorn sheep mortalities. Seven of the sheep were killed by mountain lions while the eighth most likely died of capture myopathy. To follow are the details of each mortality, the result of the investigation and management actions. Additionally, the habitat evaluation map showing corresponding block numbers for the project area is included below (see Figure 1), as is a map illustrating the location of the sheep mortalities for the project as of this reporting period (see Figure 2).

On January 15, 2014, an adult ewe (ID #64) was found on the border of Habitat Blocks 31 (fair) and 32 (poor). This is just south and west of Ski Valley and the location was within the Aspen fire burn area. The area is characterized by substantial rock outcroppings and borders thicker vegetation. This sheep had been in this area since shortly after the release. Investigators concluded that the cause of the mortality was due to predation. Pursuit of the offending mountain lion was initiated but the lion was not located.

On January 11, 2014, an adult ewe (ID #45) was found in Habitat Block 40 (fair). In general, the area was characterized by steep cliffs and rock outcroppings. Dense oak and grass sporadically covered the ravine where the sheep was discovered. Investigation of the scene determined that the cause of death was predation by a mountain lion. There was a significant delay in locating the carcass due to collar satellite uplink issues. A preliminary investigation was done on foot on January 5, 2014. Although investigators were close to the last known location and subsequent mortality location, they were unable to get a signal or find the sheep, suggesting that the sheep had left the area which was later determined to not be the case. The sheep carcass was likely moved, perhaps while it was fed upon by a lion, and the collar was eventually positioned in a way that allowed for a successful uplink of locational data. Once a satellite transmission was received it was apparent that the sheep was dead and had been in the same location for several days. Due to the time lapse, pursuit of the lion was not initiated.

On January 8, 2014, an adult ewe (ID #61) was found on the south face of the Catalina Mountains in Esperero Canyon, on the border between habitat blocks 59 and 60. These blocks both ranked as fair because of the housing component in each although the terrain is steep and rugged. On the hike to the site, a Department investigator discovered lion scat with what is believed to be sheep hair in it, estimated to be approximately 2-3 days old and lion tracks heading towards Tucson. Mountain lion sightings are common in the foothills and other parts of Tucson close to wildlife corridors such as the Pantano wash. Assessment of the mortality location confirmed that the sheep had been killed by a mountain lion. In considering the totality of the kill location and the age of the kill, the Department determined that pursuit of the offending lion would likely be futile so it was not initiated.

On January 3, 2014, an adult ewe (ID #46) was found south of the Biosphere, in an area characterized by low elevation hills and mesquite scrub. This area is rated as "fair" (block 8) according to the Cunningham/Hansen habitat suitability model. When this ewe was released on November 18th, 2013, she moved north and approached Highway 77 before turning southeast and settling in near the Biosphere. Based on GPS locations, this ewe appeared to be alone and did not demonstrate extensive movement. Managers checked on this sheep 3 weeks ago and observed that it was in good condition. After receiving a mortality signal from the collar, the ensuing investigation concluded that the ewe had been killed by a mountain lion. Subsequent pursuit of the lion by the Department's houndsman was unsuccessful and discontinued due to lack of certainty that the offending lion could be identified.

On December 9, 2013, an adult ewe (ID #38) was found in low quality habitat (block 40) characterized by thick vegetation that likely limited her ability to detect predators. Investigators determined that the sheep had been killed by a mountain lion. Pursuit of the lion was unsuccessful.

On December 1, 2013, an adult ewe (ID #36) was discovered dead in habitat characterized by low elevation hills and mesquite scrub, and rated as "fair" (block 38). The ewe was in the later stages of pregnancy. On-scene investigators concluded that the ewe had been killed by a mountain lion. The male lion was removed by Department personnel in accordance with the Mountain Lion Management Plan developed explicitly for this project, which allows for the removal of specific lions that have preyed on sheep, with the exception of females with kittens or solitary kittens. The mountain lion's stomach contents confirmed conclusively that the lion had fed on the ewe.

On November 30, 2013, a yearling ewe (ID #50) was discovered in thick vegetation, rated as "fair" (block 41). The ewe was found cached in a small ravine. During the investigation of the scene, the investigating Wildlife Manager was stalked by a mountain lion that remained in close proximity. Fearing for his and the public's safety, the Wildlife Manager was forced to kill the male lion in self defense. An investigation of the sheep carcass and the mountain lion's stomach contents confirmed conclusively that the lion had fed on the ewe.

On November 27, 2013, an adult ram (ID #52) was found in the higher elevations in an area characterized by dense Manzanita bushes and rated as "fair" (block 39). The ram had been scavenged by a bear and all indicators pointed towards capture myopathy as the cause of death. Every effort is made during the capture process to minimize capture related complications, including monitoring and controlling body temperature, minimizing handling and providing oxygen to the animal, all of which helps to avoid lactic acid build-up. Capture myopathy is associated with a build-up of lactic acid in the muscle tissue that can lead to heart failure. Myopathy generally occurs during the first two weeks after animals are transplanted and released, but lasting effects of capture myopathy can be observed up to four weeks post release.

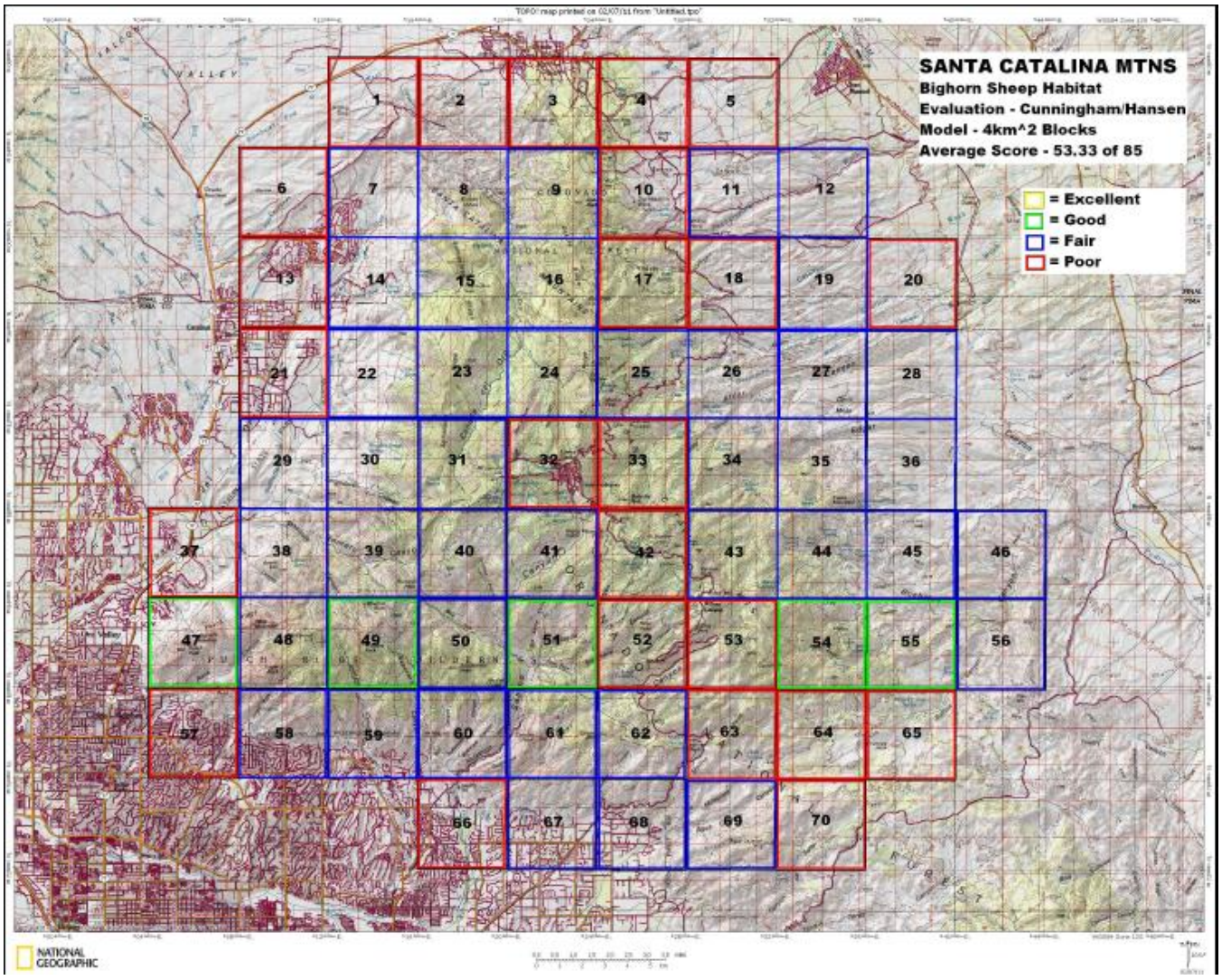

Figure 1. Cunningham Hansen Habitat Evaluation Map.

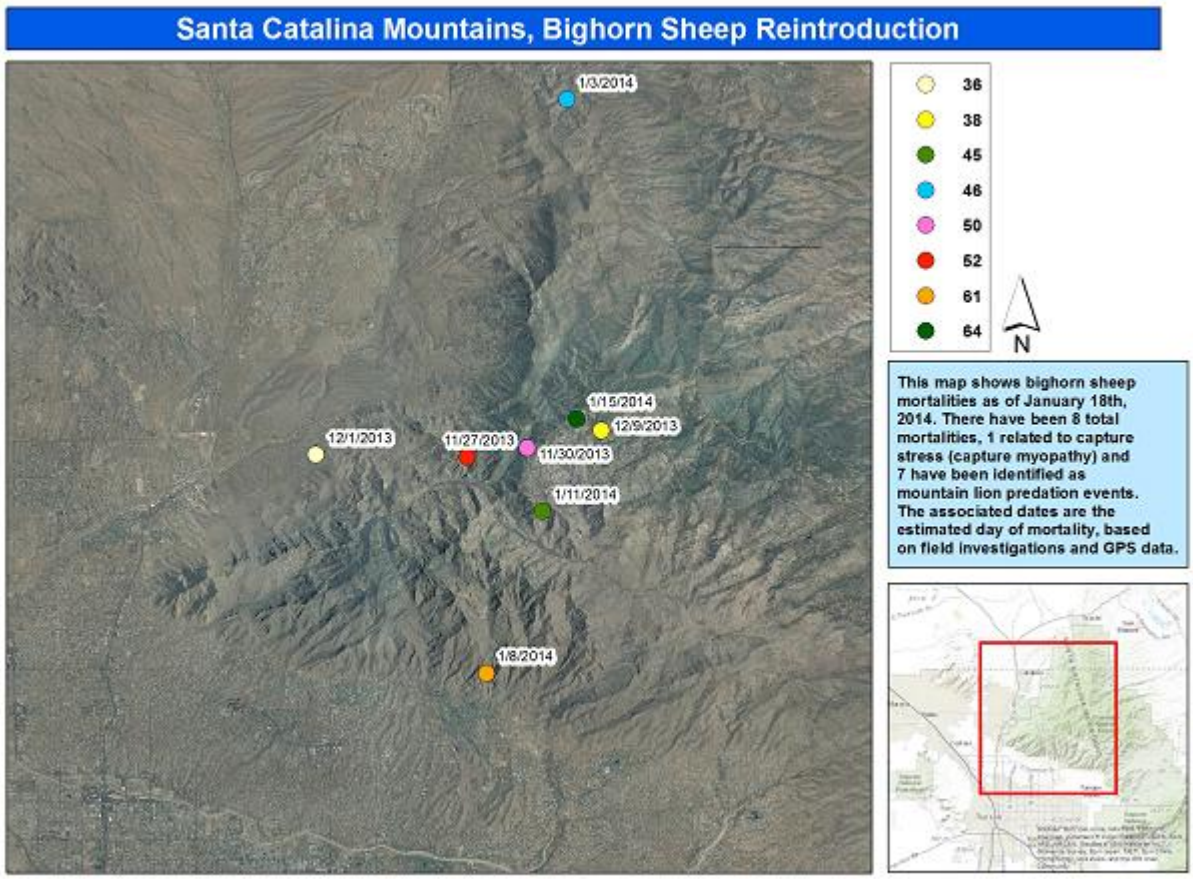

Figure 2. Sheep Mortalities during 11/18/2013 (Release Date) - 01/19/2014.

COMMUNICATION AND COORDINATION

The next written briefing will be provided on February 7, 2014.

PROJECT PERSONNEL

Diane Tilton is the Acting Public Information Officer for this project and can be reached at (520) 628-5376.

RESEARCH PROJECT FIELD NOTES

The Arizona Game and Fish Department's Research Branch is conducting a research project in the Catalina Mountains, in collaboration with the recent translocation of bighorn sheep, and as part of a larger project that also includes a study site in northwestern Arizona. We are working closely with Department staff in Tucson, with the goal of learning as much as we can from this translocation project.

Although we know that bighorn sheep occurred in the Catalina Mountains in the past, we know little about why the population ceased to persist in these mountains. Several ideas have been proposed, but little information exists to evaluate causes of the bighorn sheep's past decline. The translocation project initiated this year, together with advanced technology such as Global Positioning System collars, gives us an unprecedented and incredibly valuable opportunity to learn about the establishment of a relocated population in historic habitat potentially improved by recent large fires. Our research will look at the influence of habitat attributes, human activities, and the risk of predation on habitat use and establishment of this population.

These topics relate to additional underlying questions about bighorn sheep habitat selection and predator avoidance behavior, which have relevance to management of both these species and their habitat. There are a number of theories about how bighorn sheep behaviorally evade predators, and these may include living in large groups, using steep rugged terrain, and avoiding potentially risky habitats such as areas with dense brush that creates high visual obstruction. Increased knowledge about the factors that put a bighorn sheep at risk, and how bighorn sheep select habitat to reduce this risk, may have important relevance to management decisions (such as those related to fire, recreation, and predators, as well as translocation strategies) and our understanding about the ability for the Catalina Mountains to support a bighorn sheep population.

During the coming years, Research Branch biologists will monitor the movements and survival of the collared bighorn sheep and collect visual information, such as group size and recruitment. We will also be collecting a variety of habitat measures such as vegetation type, vegetation structural characteristics, and visual obstruction. These data, which will all be collected via noninvasive methods to avoid disturbance to the animals, will be evaluated together with spatial data on topography (e.g., slope, ruggedness, aspect), fire history, and areas of human activity to address several objectives.

Specifically, we will address the following three objectives:

> *Objective 1*: Examine which factors put bighorn sheep at increased risk of various forms of mortality. Factors evaluated will include habitat use in relation to topography (slope, ruggedness, aspect), vegetation type and cover (horizontal visibility), burn history (habitat conversion), distance to water, and other factors such as group size, season, time since release (time since transplant), age/sex, and distance to human activity centers. This objective is designed to inform future decisions on habitat restoration (e.g., fire management), transplant site selection, group size for transplants and augmentations, management of water developments, and management of recreational activities. Our research will consist of a risk assessment analysis, using established methods such as those often used in human epidemiological studies.
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> *Objective 2*: Describe bighorn sheep habitat selection and if/how this changes with time after translocation, in relation to topography (slope, ruggedness, aspect), vegetation type and cover (horizontal visibility), burn history, distance to water, and distance to human activities. This objective is designed to test whether bighorn sheep select habitat consistent with presumed predator avoidance strategies, and to ask if they are selecting habitat in relation to characteristics influenced by previous fires or human activity. This information may be used to guide future decisions related to fire management, recreation, and predation management.

Objective 3: Determine the proportion of bighorn sheep mortality due to specific mortality agents, and examine the relative influence of these mortality agents on the long-term sustainability of the sheep population. This analysis will also consider other important population parameters such as lamb production and recruitment. This objective is designed to examine the relative importance of multiple factors influencing sustainability of a bighorn sheep population, and to provide an evaluation of the key parameters we can target with management.

We anticipate that this research project will last multiple years, and will include additional bighorn sheep translocated to the Catalina Mountains as part of future management actions. As we move ahead, we will coordinate closely with Department personnel in our Tucson office as well as the Catalina Bighorn Advisory Committee, to ensure that our research helps produce the most useful information from this unprecedented translocation project.

OTHER REMARKS

Collar Performance and Mortality Signals: False readings from the tracking collars continue to be an issue. For background, the collars take location measurements using a GPS receiver. Once per day, the readings are batch-uploaded via satellite and downloaded by Department staff. If a sheep is under dense cover or otherwise out of sight of the satellite at the upload time, there will be no data from that sheep until the upload window opens on the following day. The collars also self-calculate mortality of a sheep by using three axes of movement: up-down, forward-backward, and side-to-side motions made by a collared animal. If the sheep remains fairly stationary for a set number of hours, the collar interprets the lack of movement as a "mortality" and sends an emergency alert via satellite to the Department. Initially, mortality alerts were set to go off after 8 hours of sheep inactivity, and we received a very large number of false positive mortality signals—that is, the collar interprets movement data and thinks the sheep is dead when it is not. When a mortality signal is received, staff are dispatched to verify the mortality using a backup VHF radio signal or visual confirmation. This has been a very time- and resource-consuming process (a single investigation may take all day and may go into the night). We have since increased the period of inactivity to 10 hours to avoid false alarms after investigating several alerts only to find that sheep were bedded down or otherwise stationary for long periods (e.g., in times of inclement weather) as they were adjusting to their new environment, and the Department is considering additional options to both decrease the rate of false positives and to lessen the staff workload and time for verification.

Lambing: Lambing season for Desert Bighorn sheep is January through April. We have entered lambing season and are hopeful that the ewes will successfully birth lambs over the coming months. Lambing season is also a sensitive time for bighorn sheep and off-trail hiking restrictions are in place to minimize the disturbance to the sheep during this period. Volunteers and trailhead notices will be reminding hikers of this season and we hope hikers will understand the potential impacts and respect the sheep by staying on-trail during lambing season."

MAPS

Maps are being provided to help illustrate some of the interesting aspects of the project gathered through the GPS collars.

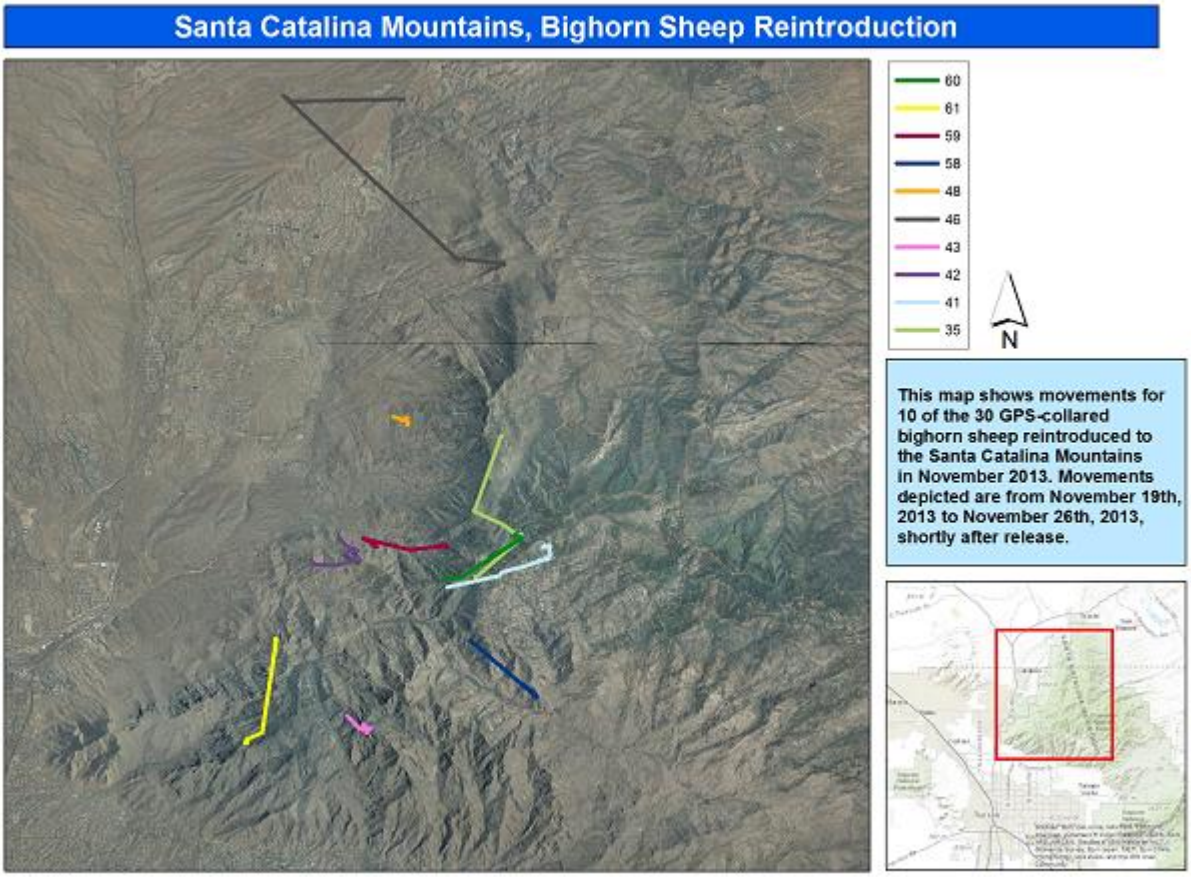

Figure 3. The distribution of several selected bighorn sheep the first week after release. Note that sheep scattered in various directions.

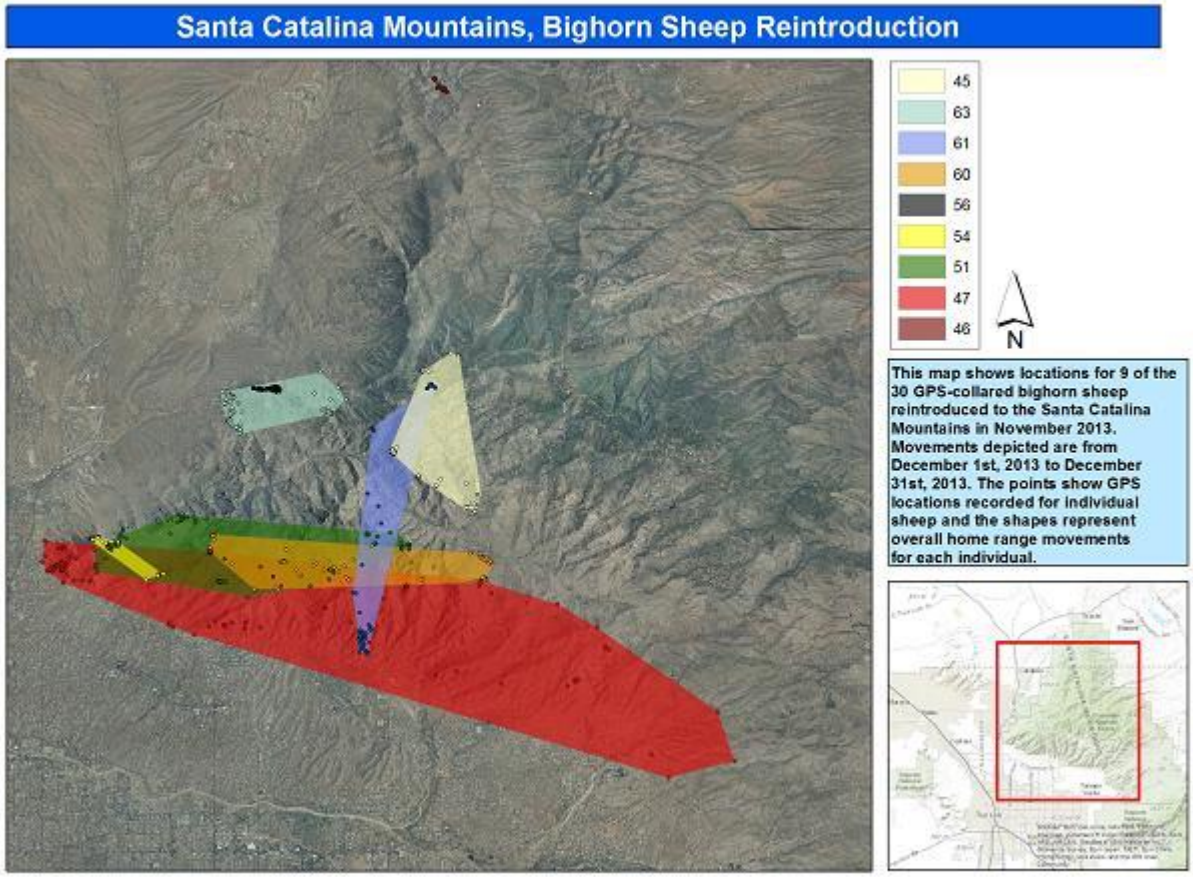

Figure 4. The movement of several selected bighorn sheep during the month of December. Note that animal 47 is a ram and covered the most ground. The other animals showed various use patterns; some moved great distances (61) while others utilized a much smaller area (46 & 56).