Minimum Requirements Analysis – 11.28.2017
Bighorn Sheep and Mountain Goat disease study

Lone Peak, Twin Peaks, and Mount Timpanogos Wildernesses
Uinta-Wasatch-Cache National Forest, Utah

The purpose of this analysis is to determine if administrative action is necessary within designated Wilderness, and if so, determine the minimum necessary action. A minimum requirements analysis (MRA) is required by law whenever land managers are considering a use prohibited by Section 4(c) of the Wilderness Act of 1964.

Question 1: Is Action Necessary for administration of the area for the purposes of the Act?

Situation:
Bighorn sheep have been protected wildlife in Utah since 1896, and mountain goats have been protected wildlife in Utah since 1919. Utah Division of Wildlife Resources (UDWR) is charged by the Utah State Legislator to manage Utah's wildlife resources and assure the future of protected wildlife for its intrinsic, scientific, educational, and recreational values for the people in the State of Utah.

Based on aerial monitoring, UDWR has become concerned about the mountain goat and bighorn sheep populations found between Big Cottonwood Canyon and Provo Canyon, primarily in the Twin Peaks, Lone Peak and Mount Timpanogos Wildernesses. UDWR's findings indicate that mountain goat populations have declined by 40 percent since 1999 (UDWR Big Game Annual Report 1999 and 2015), and bighorn sheep populations have not shown growth since their re-introduction in 2000 despite the availability of suitable habitat (Shannon, 2014). Both populations have experienced poor herd performance for more than 15 years.

Bighorn sheep, and in some cases mountain goats, are susceptible to respiratory disease, notably pneumonia, which often results in subsequent die-off and poor juvenile recruitment. Pneumonia related pathogens have been documented in mountain goat populations located in other parts of Utah, but to date, no negative effects have been recorded (UDWR unpublished data). However, different strain types of pathogens express varying levels of virulence. The mountain goat population in the Wasatch Mountains has shown a steady decline for approximately 15 years, and the presence of disease is likely a contributing factor. Furthermore, there is increasing concern that bighorn sheep and mountain goats can spread disease across species, and infection of bighorn sheep populations almost always leads to a major mortality event. To date, no information is available on the presence and types of disease (including specific strain of pathogens) present within the bighorn sheep and mountain goat populations occupying the Wasatch Mountains.

UDWR has made disease surveillance on all bighorn sheep and mountain goat populations a priority, and they are particularly interested in identifying the specific pathogens in populations that occupy the Wasatch Mountains. In order to conserve and manage these state protected species as part of the wilderness environment, UDWR is proposing to conduct a study to achieve two key objectives:

1. Collect biological samples from 20 mountain goats and 10 bighorn sheep to determine the presence of disease pathogens and identify specific pathogen strain types. Assess the current health status of captured animals.
2. Monitor the survival and movement patterns of captured animals to determine the cause of mortality for any animal that dies during the study, and gather data on specific habitat use and

movement patterns within the Wildernesses including any migration to lower elevation areas outside Wilderness. Tracking spatial movement and areas of overlap between the two species will add insight regarding how disease is potentially being spread through and across populations.

Information from this study would provide essential data to help UDWR understand what is causing species-specific mortality and population decline. Most management options for infected bighorn sheep populations require identification of a strain type, and data regarding pathogen and strain type are crucial to finding a solution to the disease problem in general.

Options outside of Wilderness:

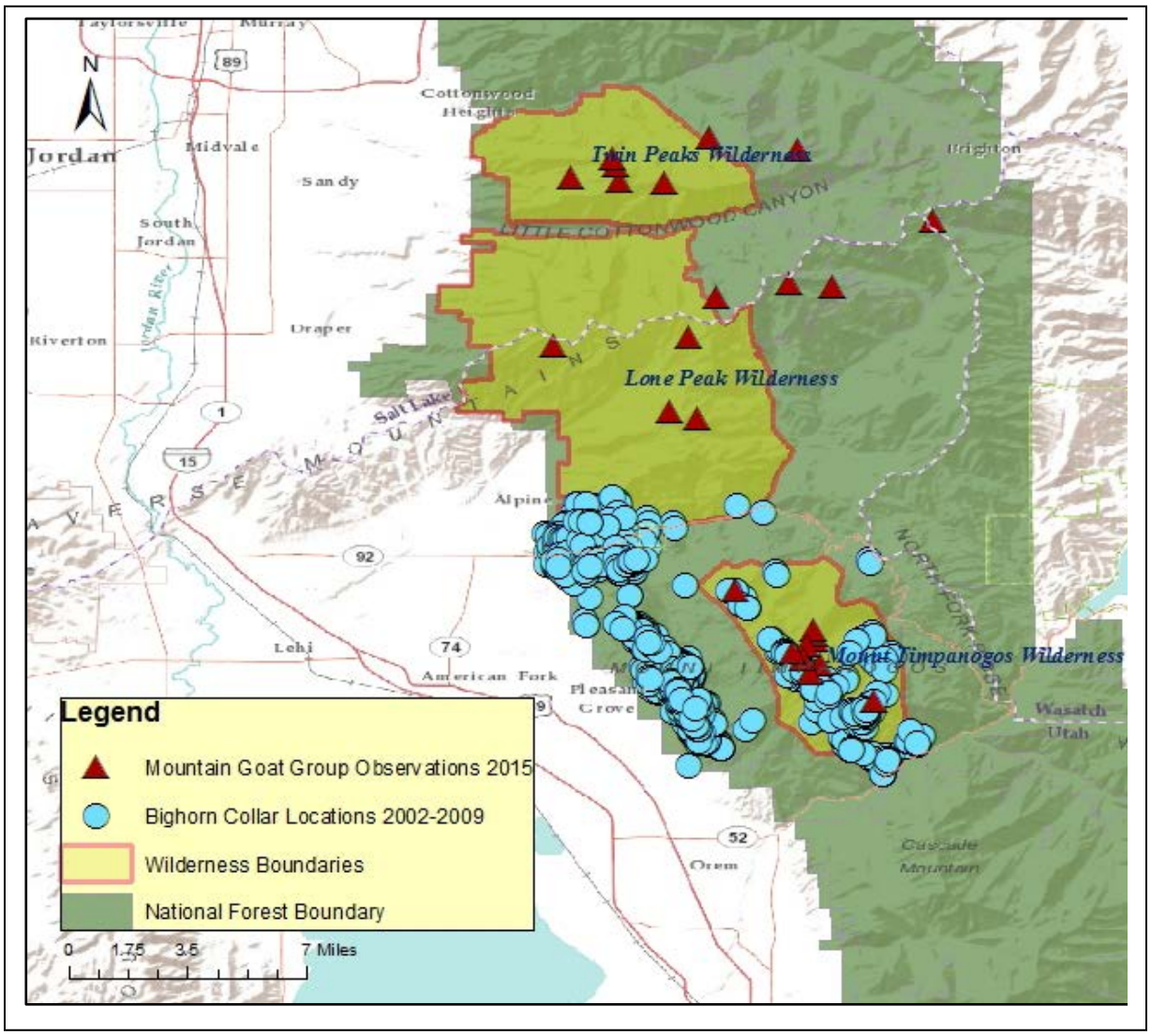

Figure 1. Location of mountain goat group observations (n=25) from 2015 aerial survey and historical bighorn sheep collar data from 2002 to 2009 (n=2805). [Note: When bighorn sheep were reintroduced in the 2000s outside of Wilderness, collars were placed on the animals, enabling collection of some locational data]

According to aerial spatial data, approximately 90 percent of the mountain goat population, and 40 percent of the bighorn sheep population reside within the three wilderness areas located in the project area (Personal Communication - Robinson 2017 and Figure 1). Capturing and collaring animals solely outside Wilderness would not be effective because the mountain goat population rarely leaves the Wilderness. Since a key objective is to study animals that co-mingle, it would not be effective to capture bighorn sheep that are geographically separated from mountain goats.

In January 2017 the UDWR attempted to capture bighorn sheep outside of wilderness in the Cedar Hills area near the mouth of American Fork Canyon. Two bighorn ewes were captured outside of wilderness before the helicopter pilot aborted the project due to difficulty navigating wilderness boundaries. These ewes tested positive for *Mycoplasma ovipneumoniae* in serology, meaning they had been exposed to the pathogen sometime in the past. However, they were not shedding the pathogen at the time, so a strain type could not be identified.

In January 2017 a mountain goat kid was observed near the highway in Provo Canyon. The UDWR captured the animal and tested it for pneumonia related pathogens. It tested positive for *Mycoplasma ovipneumoniae,* however a strain type was not identified. It is unclear whether this goat had come from Provo Peak or Mount Timpanogos.

These isolated samples are not representative of the populations as a whole and do not provide the UDWR with the necessary information to meet the study objectives.

Management Framework:

The 1964 Wilderness Act (PL 88-577) provides the key direction for stewardship of Wilderness including the affirmative responsibility to preserve the wilderness character of the area (sections 2a and 4b). The Wilderness Act also includes a prohibition on the use of motorized equipment, landing of aircraft, and mechanical transport, except as necessary to meet minimum requirements for the administration of the area for the purpose of the Act (section 4c).

To determine whether an action is necessary in Wilderness, it is important to consider other direction that explicitly allows consideration of a use otherwise prohibited by section 4(c) of the Wilderness Act as well as other direction such as agency policy, management plans, agreements with other agencies or other applicable direction.

There are no other laws that require action in this case. However, National Forest Policy and direction contained in the Association of Fish and Wildlife Agencies (AFWA) agreement provide relevant guidance.

Policy Direction (FSM 2323.3)

Objectives (FSM 2323.31)

1. Provide an environment where the forces of natural selection and survival rather than human actions determine which and what numbers of wildlife species will exist.
2. Consistent with objective 1, protect wildlife and fish indigenous to the area from human caused conditions that could lead to Federal listing as threatened or endangered.
3. Provide protection for known populations and aid recovery in areas of previous habitation, of federally listed threatened or endangered species and their habitats.

Wildlife and Fish Research (FSM 2323.37)
Wildlife and fish research is an appropriate activity in wilderness. In all cases, research shall be conducted in such a way as to minimize any adverse impacts on the wilderness resource or its users.

1. Research methods that temporarily infringe on the wilderness character may be used, provided the information sought is essential for wilderness management and alternative methods or locations are not available.
2. Scientific sampling of wildlife and fish populations is essential to the management of natural populations in wilderness.
3. Capturing and inconspicuous marking of animals, including radio telemetry, is permitted.

Agreement Direction

UDWR and the Intermountain region of the Forest Service signed an MOU (FS Agreement No, 2013-MU-11046000-024) June 6, 2013. While not specific to wilderness, the MOU recognizes that there is a mutual benefit for the agencies to work together for the common purpose of developing, maintaining, and managing the fish and wildlife resources, associated habitats, and other related resources on National Forest System lands.

The Association of Fish and Wildlife Agencies (AFWA) Agreement provides policy and guidelines for States to cooperate with the Forest Service and BLM on fish and wildlife management in Wilderness (amendment 2006). This agreement contains the following guidance on research projects.

Research and evaluation related to fish and wildlife, their habitats and the recreational users of these resources are legitimate activities in wilderness when conducted in a manner compatible with the area as wilderness. Coordination of all research and survey activities is essential between State and Federal agencies. Methods that temporarily infringe on the wilderness environment may be authorized by the Federal administering agency if alternative methods or other locations are not reasonably available.

Research or management survey activities that involve uses generally prohibited under Section 4 (c) of the Wilderness Act will be considered and may be authorized by the Federal administering agency through application of the Minimum Requirement Analysis.

Helicopters and fixed-wing aircraft over flights may be used to conduct fish and wildlife research and management activities. Use of aircraft for these activities will be coordinated among the State and Federal agencies to minimize conflicts with other wilderness uses. To the greatest extent possible**,** aircraft must be used in a manner that minimizes disturbance to wilderness character and to human and wildlife use of the wilderness.

Aerial counts and observations (i.e. surveys) of wildlife are allowed in the management of fish and wildlife resources in wilderness. Capturing and marking of animals, radio telemetry, and occasional installations (such as shelters for cameras and scientific apparatus and enclosures essential for wildlife research or management surveys) that would involve uses generally prohibited under Section 4 (c) of the Wilderness Act will be considered and may be authorized by the Federal administering agency through application of the Minimum Requirement Analysis.

d. Plan aircraft flights over wilderness to minimize disturbance. Consider time of day, season of the year, route and altitude of flight, and location of landing areas on the perimeter of the wilderness.

Determination:

For an action to be considered necessary in wilderness it must meet at least one of following conditions.

1. Action is necessary to satisfy valid existing rights or a special provision in the Wilderness Act of 1964, the enabling legislation for the specific wilderness area, or subsequent wilderness laws.
2. Action is required by other federal legislation.
3. Action is necessary to preserve one of the qualities of wilderness character defined by the Wilderness Act. (Untrammeled, Undeveloped, Natural, Solitude or Primitive and Unconfined Recreation, Other Features of Value).

This action (study of mountain goats and bighorn sheep to determine if disease is contributing to poor herd performance and if so, what specific pathogens are present) is not required to satisfy a valid existing right or a special provision of the Wilderness Act, though the Wilderness Act is clear that States retain jurisdiction with respect to wildlife. The Wilderness Act of 1964, Section 4(d)(8), states: "Nothing in this Act shall be construed as affecting the jurisdiction or responsibilities of the several States with respect to wildlife and fish in the national forests."

This action is not necessary to comply with other federal laws.

This action is not necessary to preserve the wilderness qualities of Untrammeled, Undeveloped, Solitude or Primitive and Unconfined Recreation, or Other Features of Value, but is necessary to preserve the Natural quality of wilderness character. It is important to the future preservation of native bighorn sheep in the Lone Peak, Twin Peaks, and Mount Timpanogos Wildernesses to understand why bighorn sheep populations are not meeting UDWR's population objective. Bighorn sheep are particularly susceptible to respiratory disease which can result in rapid population decline. By doing the research now to understand the prevalence of disease and the specific strains of pathogens present in the population, informed decisions can be made about whether or not further management action is necessary and, if so, more proactive, wilderness-compatible management actions can be developed to preserve this species as a natural component of these wilderness areas.

Bighorn sheep are native to Utah. Archeological evidence indicates they were well known to the prehistoric inhabitants of Utah, since bighorns are depicted in pictographs and petroglyphs more than any other form of wildlife. Historical records of the first Europeans in the state also confirm the presence of bighorns. Father Escalante noted in his journal as he crossed the Colorado River in Utah, "through here wild sheep live in such abundance that their tracks are like those of great herds of domestic sheep" (Rawley 1985). Native populations of Rocky Mountain bighorn sheep were nearly extirpated following pioneer settlement. A few scattered sightings of bighorns persisted in northern Utah as late as the 1960's. Factors contributing to their demise included competition with domestic livestock for forage and space, vulnerability to domestic livestock-borne diseases, habitat conversions away from native grasslands towards shrub lands due to excessive grazing and fire suppression, and unregulated hunting (Shields 1999). Bighorn sheep were reintroduced outside of the three wilderness areas beginning in 2000 and concluding in 2007.

One of the primary concerns and need for this study is understanding the significant decline in the mountain goat population. The native status of mountain goats in Utah is debatable and has long been the subject of professional disagreement. Mountain goats are native to the North American continent and the Northern Rocky Mountains. The first documented report of a mountain goat found in Utah was

in a census report created by the U.S. Forestry Department, which displayed game conditions for Utah National Forests. This report was referred to in the twelfth biennial report of the Fish and Game Commissioner of the State of Utah, for the years 1917-1918. No confirmed sightings of mountain goats were reported in Utah after 1918. In 1967 mountain goats were transplanted into the Wasatch Mountains east of Salt Lake City (Lone Peak and Twin Peaks area). In 1981 mountain goats were transplanted into the Mount Timpanogos area. Monitoring in 1995 found that the goat population was stable in the Lone Peak and Twin Peaks area and increasing in the Mount Timpanogos area. UDWR maintains that mountain goats are a valuable addition to the diversity of wildlife and are a legitimate part of the modern Utah faunal landscape. For the purposes of this minimum requirements analysis, mountain goats will be considered part of the natural conditions present at the time of wilderness designation, but it must be made clear that this does not imply that we believe mountain goats are native.

Bighorn sheep and mountain goats in the area of concern have exhibited poor herd performance and the cause is unclear. It is reasonable to believe that disease could be a major factor and that significant reduction to these herds is possible. Interest in understanding the potential for disease transmission between bighorn sheep and mountain goats has been voiced for these populations since 1996 (Wolfe and Belovsky 1996). This study of disease and interaction between bighorn sheep and mountain goats cannot effectively be conducted outside of Wilderness because 90 percent of the mountain goat population resides exclusively within Wilderness and past efforts to capture animals outside Wilderness have not yielded an adequate number of animals to meet project objectives. Understanding the potential for disease spread between bighorn sheep and mountain goat populations, monitoring and maintaining meaningful data regarding current health status, survival, causes of mortality, year-round habitat use, and migration/movements within and to/from the three wilderness areas is important for retaining these species as part of the wilderness environment. For these reasons, conducting the proposed study of bighorn sheep and mountain goat populations within the Lone Peak, Twin Peaks, and Mount Timpanogos Wildernesses is considered necessary for the administration of the area for the purposes of the Wilderness Act.

Question 2: What is the Minimum Activity?

To determine the minimum activity, multiple alternatives including a no action alternative have been developed to meet the project objectives and answer key questions regarding whether or not disease is contributing to population decline of bighorn sheep and mountain goats. These alternatives are compared to determine which alternative has the least effect, considering both intensity and duration, to wilderness character. Each component of an alternative that could affect wilderness character is considered for each of the four key qualities of wilderness character (Untrammeled, Undeveloped, Natural, and Solitude or Opportunities for Primitive and Unconfined Recreation). The “Other Features of Value” quality is one that may be present in wilderness but is not required. Typically this quality is used to identify a cultural, geological, paleontological or other feature that is not captured by the other listed qualities and is considered integral to wilderness character. For these three wilderness areas, other features of value that help distinguish these areas and give them meaning have not been identified in the enabling legislation or through other guidance.

Time Constraints and Components of Alternatives

Any proposed handling of bighorn sheep and mountain goats would occur between September 1st and November 30th to avoid disruption of lamb / kid birth and development and decrease the possibility of heat stress and mortality to captured animals. Additionally, this time frame reduces potential conflict with wilderness visitors in the busy summer season. UDWR has determined that to effectively understand what is causing these herds to underperform, collecting blood samples as well as GPS radio collaring are needed. The minimum number of animals studied for an effective sample has been determined to be 20 mountain goats and 10 bighorn sheep.

The components of all alternatives include:

- Transporting personnel to and from capture site
- Staging and/or camping sites for personnel
- Capturing animals
- Processing animal
- Retrieving collars

Alternative 1: No Action

The No Action Alternative serves as a baseline to compare the effects of the action alternatives to wilderness character. UDWR would continue aerial monitoring of mountain goats and bighorn sheep in the UDWR Wasatch Mountain Unit once every other year to obtain population estimates and juvenile recruitment. Some data would also collected from hunter participation surveys.

- *Untrammeled:* In the context of the Wilderness Act, an untrammeled area is where human influence does not impede the free play of natural forces or interfere with natural processes in the ecosystem (FSM 2320.5). No action would have no effect to untrammeled quality.
- *Undeveloped:* Undeveloped is defined by the Wilderness Act as "…retaining its primeval character and influence, without permanent improvements or human habitation…" Preserving this quality keeps areas free from "expanding settlement and growing mechanization" and "with the imprint of man's work substantially unnoticeable" as required by the Wilderness Act. There would be no effect to undeveloped quality from the no action alternative.
- *Natural:* The Wilderness Act describes wilderness as an area "… which is protected and managed so as to preserve its natural conditions..." If no action is taken, there is legitimate concern that populations of these species would continue to decline and this important aspect of the natural quality of wilderness could be impacted. The population of the bighorn sheep within the three wilderness areas may continue to be stable but below UDWR's population objective or the population could decline rapidly due to disease spread. While no domestic sheep are permitted on the Forest in Salt Lake, Utah, or Summit Counties within the project area, some potential for disease transmission from domestic sheep to bighorn sheep still exists due to the presence of domestic sheep on private land or outside the project area. Transmission of disease to bighorn sheep and mountain goats inside the wilderness areas from individuals that have interacted with domestic animals is a primary concern and likely cause of the underperformance of bighorn sheep and mountain goats in the Wasatch. Whether or not the underperformance of these herds is a natural process or if it is being caused by disease from domestic livestock or something else would not be understood if no action is taken. If no action is taken, the effect to

the natural quality could range from minor to catastrophic (loss of one or both of the herds) with potential significant and long-duration effects.

- *Solitude or Primitive and Unconfined Recreation*: If no action is taken there would not be any effect on the ability of wilderness visitors to find solitude or recreate in these wilderness areas.

Alternative 2: Helicopter Net Gunning / One Time Capture

This alternative would include a onetime capture in the fall. Captures may occur in September, October and/or November to minimize conflicts with hunting and other recreational activities. It is estimated that the proposed method would take 30 capture hours (2-4 capture days, which may not occur consecutively). Helicopter net-gunning would be used to capture, take biological samples for disease testing, and GPS radio collar 20 mountain goats and 10 bighorn sheep in the Twin Peaks, Lone Peak and Mt. Timpanogos wilderness areas within the months of September through November.

Once an animal is net-gunned from the helicopter, the helicopter touches down to off-load one to two people to process the animal. Processing the animal includes taking a blood sample, placing a collar on the animal and then releasing it. While one crew is processing the first captured animal, the helicopter proceeds to find another animal to capture and off-load the second crew to process the second animal. The pilot then returns to retrieve the first capture crew.

In order to capture 30 animals, UDWR anticipates an estimated 60 landings with approximately 30 hours of flight time. Additional landings may occur to pick up nets if a net is shot and misses a target animal (less ten percent of shots), but landings would be kept to a minimum. Multiple captures would occur each day with the objective to capture a representative sample based on group size and distribution of animals. Once the sample quota is reached, helicopter operations would cease within the three wilderness areas.

Animals that are injured, in poor health or compromised during the capture and processing phase may be slung to a staging area. The GPS radio collars would transmit a mortality signal when an animal dies and transmit a signal when the collar falls off. Collars would be retrieved on foot or horseback. Capture and study of animals may occur outside of wilderness areas, as the opportunity exists, but these opportunities are limited, especially with mountain goats.

- *Untrammeled:* In this alternative, one aspect of the action would have a negative effect to untrammeled quality.
    - Capturing animals: Animals would be captured by shooting a net from helicopter and then personnel would secure the net. This is a very clear trammeling action as human intervention occurs to capture and manipulate the animals. The intensity and duration of the effect is not known as pertains to each specific animal, but 20 mountain goats and 10 bighorn sheep would be captured. The actual trammeling action is high intensity, of short duration and has no lasting effects beyond the one-time initial action to capture animals.
- *Undeveloped:* In this alternative, three components of the action have a negative effect to undeveloped quality.
    - Transporting personnel to and from capture site: Personnel will be transported using a helicopter. There is an estimated 60 landings over 2-4 days which may not be consecutive days. The presence of a helicopter is a relatively intense effect to undeveloped quality, though the duration is short and not permanent.

- Capturing animals: Discharging a net from a helicopter also effects the undeveloped quality since Forest Service regulations prohibit dropping of materials or supplies from aircraft in Wilderness (36 CFR 293). Based on the project objectives to capture 30 animals, there could be up to 33 drops (considering a 10 percent miss rate). However, since the net and personnel are dropped off simultaneously, there would no additional effect beyond what is described for transporting personnel to the capture sites.
- Processing animals: Affixing GPS radio collars affect the undeveloped quality because they are scientific installations that represent visible evidence of human activity. Because the collars fall off after a few years, they are considered temporary installations. A small percent of the population would have radio collars, thus the effect would be low intensity and of moderate duration.

- *Natural:* In this alternative, one component of the action may have potentially negative effects to Natural quality, while two components would have positive effects to Natural quality.
  - Capturing animals: Nets are shot from helicopter and animals are secured for health check, blood draw and collaring. This could have negative effects to natural quality if animals are injured or killed. In similar activities approximately three percent of captured animals are injured and some injuries lead to mortality. Although specific animals could be injured or killed, the effect to natural quality is high intensity, but short duration with no lasting effects to the population.
  - Processing animals: Drawing blood samples will provide UDWR the opportunity to understand what is causing poor herd performance. This is potentially very important information for preservation of both species in the wilderness areas. Understanding the potential for disease spread between bighorn sheep and mountain goat populations, monitoring and maintaining meaningful data regarding current health status, survival, and causes of mortality will inform future management actions and potentially have long term positive effects to the natural quality of wilderness character.
  - Retrieving collars: Similarly, data obtained from radio collars will allow UDWR to track movements and interactions of these species which will help inform the understanding of the potential for spread of disease within and between species as well as provide information about year-round habitat use and movement/migration patterns. Data from animals that die (transmit a mortality signal) will provide important information on specific cause of death. Positive effects to natural quality could range from minimal to substantial and long lasting.
- *Solitude or Primitive and Unconfined Recreation*: Two components of this action have negative effects to this quality of wilderness character.
  - Transporting personnel to and from capture site: The sights and sounds of up to 60 helicopter landings would have a negative effect on solitude and the sense of isolation from the sounds and sights of modern civilization. Wilderness visitors will likely notice the helicopters and this can intrude on their wilderness experience. Because activity is planned for the fall when there is less recreation and the helicopter operation is expected to last 2-4 days, this effect is reduced but still exists. The negative effect will likely be moderate to intense, of short duration, with no lasting effect.
  - Capturing animals: In addition to the presence and landing of helicopters, the net gunning and capture of animals has a potential negative effect if observed by wilderness visitors. The sights and sounds of the actual operation of netting, capturing and

processing the animals could be very intense, though the effect would be of short duration.

Alternative 3: Trap Netting with Helicopter support

This alternative consists of using a helicopter to support trap-net activities. (Approximate total number of flights 44 for two sites per wilderness area, personnel 15)

Helicopter will do reconnaissance to locate areas where mountain goat and bighorn sheep occupy the same geographic area to identify highest potential trap locations in each wilderness. Highest potential sites are prioritized and trap site spike camp(s) location is determined.

Trap crew transported by a helicopter to trap location which includes: trap crew (3 people), bait, and spike camp equipment and supplies to highest potential pre-net test area and to a spike camp location.

Pre-test area suitability – Trap crew sets out bait (300lbs of apple mash) to attract animals. If pre-net test area draws in desired number of animals in up to 3 days then a spike camp is set up in a location that will not affect net test operations.

Trap area determined – Trap crew will call in a helicopter to transport addition trap crew (2 people), spike camp supplies, additional bait and a trap-net that includes: 6 steel poles, stakes, 60'X60' net, 2-12volt batteries, associated cables and pulleys (600lbs).

Trap setup - Expanded crew will set up the trap with bait and monitor.

Trap release – It generally takes 7 days or more for animals to get accustomed to trap and for human scent to dissipate. (Note: another helicopter fight may be required to provide more bait if trap bait is needed) When needed survey quota of animals stay under trap an additional crew (2 people to one animal ratio) up to 10 (number is based on 5 animals) people will be called in to assist the night before trap release day. 3 flights will be required to bring in processing crew and equipment. On trap release day morning, spotter signals for trap release when number of animals are within net area. Support crew and trap crew converge on netted animals and subdue.

Processing – Crew will do blood work and collar animals. (If animal is overstressed crew members will call in a helicopter and sling animal to helicopter staging area for care.) Once processing is complete animals will be released.

Trap removal – Crew will remove trap and associated materials and ready for transport by a helicopter to a new location. Assuming that 4 people and equipment can be transported at a time with an additional flight to haul out trap, the number of flights could be 7 or more. Optimal time would be 9 days of trap operations per suitable site with a minimum of 2 sites per wilderness area.

These steps are repeated for each capture site. An estimated two sites per wilderness area (6 total) will be needed to capture and process the required number of animals.

- *Untrammeled:* In this alternative, one component of the action would have negative effects to untrammeled quality.
    - Capturing animals: A trap with bait (apple mash) is set up to attract and trap animals. This is a clear manipulation and negative effect to untrammeled. The effect is likely similar to alternative 2. Intensity and duration of the effect is not known as pertains to

each specific animal, but the actual trammeling action is high intensity, of moderate duration and likely has no lasting effects.

- *Undeveloped:* Similar to alternative 2, two components of the action affect undeveloped quality.
    - Transportation to and from capture site: There will be an estimated 44 landings over the period of time required to capture a sufficient number of animals. Compared to alternative 2 the intensity is slightly less with a longer duration.
    - Processing animals: Affixing GPS radio collars affects the undeveloped quality because they are scientific installations that represent visible evidence of human activity. Because the collars fall off after a few years, they are considered temporary installations. A small percent of the population would have radio collars, thus the effect would be low intensity and of moderate duration.
- *Natural:* Positive effects to natural quality would be nearly identical to Alternative two. However this is a less effective capture technique so the requisite number of animals may take multiple seasons to study. Because multiple animals are captured together there could be more injury and a higher chance for mortality. Additionally, the introduction of a large quantity of apple mash could potentially attract bears with subsequent negative effects from habituated bears.
- *Solitude or Primitive and Unconfined Recreation*: Effects are similar to Alternative two, however because of the longer term presence of base camps and trap structure, the effect will be of moderate duration. Wilderness visitors are more likely to encounter and notice the activities since the camp and trap structures will be in place for at least 7 days for each site.

Alternative 4: Net Trapping - ground crew only

This alternative consists of using porters and/or stock to support activities. (Stock is not allowed in the Salt Lake City watershed, which includes the Salt Lake County portion of Lone Peak, Twin Peaks and part of Mount Timpanogos wilderness areas.) The maximum number of crew per site is 15. 18 porters or 7 stock per wilderness would be required and estimated stay is 16 days per wilderness.

Helicopter will do reconnaissance to locate areas where mountain goat and bighorn sheep occupy the same geographic area to identify highest potential trap locations in each wilderness. Highest potential sites are prioritized and trap site spike camp(s) location is determined.

Trap crew (3 people) hike into location. Material are transported by stock or porters to trap location which includes: bait (300lbs of apple mash), and spike camp equipment and supplies to highest potential pre-net test area and to a spike camp location. Stock and porters may stay overnight, but will leave wilderness area after delivery of equipment and materials.

Pre-test area suitability – Trap crew sets out bait (300lbs of apple mash) to attract animals. If pre-net test area draws in desired number of animals in up to 3 days Spike camp set up in a location that will not affect net test operations.

Trap area determined – Trap crew will call in additional trap crew (2 people). Stock or porters will haul in spike camp supplies, additional bait (300lbs of apple mash) and a trap-net that includes: 6 steel poles, stakes, 60'X60' net, 2-12volt batteries, associated cables and pulleys (600lbs). Trap setup - Expanded crew will set up the trap with bait and monitor.

Trap release – It generally takes 7 days or more for animals to get accustomed to trap and for human scent to dissipate. (Note: Porters may be required to haul in more bait, if bait is needed) When survey

quota of animals stay under trap an additional crew of 10 (number is based on 5 animals with a ratio of 2 people per animal) people will be called in to assist the night before trap release day. Stock or porters will be required to bring in processing supplies and equipment. On trap release day morning, spotter signals for trap release when number of animals are within net area. Support crew and trap crew converge on netted animals and subdue.

Processing – Crew will do blood work and collar animals. (If animal is overstressed crew members will call in a helicopter and sling animal to helicopter staging area for care.) Once processing is complete animals will be released.

Trap removal – Crew will remove trap and associated materials and ready for transport by stock or porters to a new location.

These steps are repeated for each capture site. An estimated two sites will be needed for each wilderness area (6 total sites) to capture and process the required number of animals.

- *Untrammeled:* In this alternative, one component of the action would have negative effects to untrammeled quality.
    - Capturing animals: Same effects as Alternative 3.
- *Undeveloped:* Because traditional methods (Stock or Foot Travel) will be used to access the Wilderness, only one component of the action would affect the undeveloped quality. Helicopters would only be used in an urgent situation if an animal is injured. However, processing animals would still include affixing GPS radio collars which would have the same effect as described under alternative 3.
- *Natural:* Effects to natural quality will be nearly identical to Alternative 3.
- *Solitude or Primitive and Unconfined Recreation:* Effects are similar to Alternative 3, however because of the longer term presence of base camps and trap structure, as well as significant numbers or porters or pack stock required to support this alternative, the effect will be of moderate duration. Wilderness visitors are more likely to encounter and notice the activities since the camp and trap structures will be in place for at least 7 days for each site. A camp such as this could leave compacted soil, damaged vegetation and other evidence of human occupation in an areas that was previously undisturbed even if leave no trace techniques are used. There will be no use of a helicopter (except in an urgent situation), so the effect to this quality will be less intense.

Other Alternatives Considered but Not analyzed.

- Chemical immobilization using dart gun: This Alternative was not analyzed further due to the high risk of increased injury or mortality to animals
- Net gunning from helicopter with reduced landings: This alternative was not analyzed further because the number of estimated landings needed to capture the necessary 20 mountain goats and 10 bighorn sheep to produce sufficient data for the study has already been minimized in alternative 2. Net gunning in and of itself is considered a landing since materials are being dropped and the nature of aerial net capture requires personnel to be on site as soon as the animal is captured to avoid potential injury and over-stress.
- *Obtain data via animals harvested within the wilderness areas:* This alternative would obtain blood samples from animals that have been harvested in the project area. If the UDWR used harvested animals there would be a limited distribution and no guarantee that co-mingling

between both of the species had occurred. Sampling would not be distributed across the unit and would be biased towards males. For this past year only 1 bighorn and 5 mountain goats are recommended to be harvested for the project area. This number is insufficient to acquire the necessary biological samples and would not meet the purpose and need.

Determination

In determining the minimum activity, the potential long term negative effects of the no action alternative on the natural quality are weighed against the short term effects of the action alternatives on the Untrammeled, Undeveloped, and Solitude or Primitive and Unconfined Recreation qualities. Even though numerous short term effects were identified in the action alternatives, the potential long term effect of either bighorn sheep or mountain goats being lost in these Wildernesses is considered a greater impact to Wilderness character.

In comparing the action alternatives, it is necessary to weigh the intensity and duration of effects to Wilderness Character. Alternatives 2 and 3 have a more intense effect to both the undeveloped and solitude qualities due to the use of helicopters. Alternative 3 and 4 have a longer term effect to the natural and solitude qualities due to the need for a long term base camp and trap structures as well as the need to repeat the process until the necessary number of animals are captured and processed. Alternative 3 produces a combination of intense and longer term effects to wilderness character so is not recommended.

When comparing Alternative 2 and 4, the intensity of motorized equipment (an estimated 60 helicopter landings over 2-4 days) is weighed against the longer term effects of base camps and trap structures in place over a week at a time for each capture site (likely 6 sites). Additionally because the baiting and capture method used in alternative 4 is less effective and may lead to more injury or mortality to animals as well as creating a potential food attractant for bears, there could be negative effects to the natural quality.

Considering all aspects of each alternative and positive / negative effects to wilderness character, Alternative 2 appears to be the minimum necessary action to preserve wilderness character while minimizing negative effects. This alternative has the best chance to provide the necessary information to preserve the natural quality of wilderness character. Though there are short term intense effects from the use of helicopters and actions to capture and process animals, these are not long lasting.

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