National Park Service
U.S. Department of the Interior

Grand Teton National Park
John D. Rockefeller, Jr. Memorial Parkway

Mountain Goat Management Plan
Environmental Assessment
December 2018

NPS Photo/M. Osipchuk

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CHAPTER 1: Purpose and Need for Action

The Proposal

The National Park Service (NPS) is proposing to implement a plan to remove exotic (nonnative) mountain goats from Grand Teton National Park and John D. Rockefeller, Jr. Memorial Parkway (Figure 1); collectively, the park. The purpose in taking action is to 1) aid in the conservation of a native population of Rocky Mountain bighorn sheep (*Ovis canadensis*) whose status is tenuous and 2) protect other park resources and values from the rapidly growing mountain goat population.

Per NPS policy (NPS 2006, sections 4.1.5 and 4.4.4), the park has a responsibility to prevent displacement of a native population by an exotic population, maintain the ecological role of native species, and reduce the potential for local extinction of a species, when feasible.

The removal of mountain goats from the park would be accomplished through the use of lethal and/or non-lethal means. The goal is to remove the mountain goat population as quickly as possible to minimize impacts to native species, ecological communities, and visitors. Based on current estimates of mountain goat numbers, significantly reducing or eliminating the population is achievable in one to five years.

The NPS Organic Act of 1916 and Management Policies 2006 (NPS 2006, sections 4.1.5 and 4.4.4) support the maintenance and restoration of natural systems and the control of exotic species. The Organic Act directs the National Park Service to conserve resources in their natural condition, leaving them unimpaired for the enjoyment of future generations. NPS Management Policies (section 4.4.4) also states that non-native species will not be allowed to displace native species if this displacement can be prevented. More detail is provided in section 4.4.4.2: "All exotic plant and animal species that are not maintained to meet an identified park purpose will be managed – up to and including eradication – if (1) control is prudent and feasible, and (2) the exotic species…interferes with natural processes and the perpetuation of natural features, native species or natural habitats..." (which is one of seven listed characteristics which indicate management is needed). It further states "High priority will be given to managing exotic species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controlled."

Need for the Proposal

Mountain goats are not native to the Greater Yellowstone Ecosystem (GYE; Skinner 1926, Hayden 1989, Laundré 1990, McWhirter and Roop 2007, Flesch et al. 2016), an area that includes the park. The native range of mountain goats extends from southeastern Alaska south to the Columbia River in Washington; east into Idaho and western Montana; and north to southern Yukon (http://explorer.natureserve.org/servlet/NatureServe?searchName=oreamnos+americanus; distribution section; Festa-Bianchet and Côté 2008, Rideout and Hoffman 1975).

Resident mountain goats within the park are likely dispersers from a population introduced southwest of the Teton Range in the late 1960s and early 1970s. First observed in the Teton Range in 1979, they have now established a breeding population that is growing rapidly.

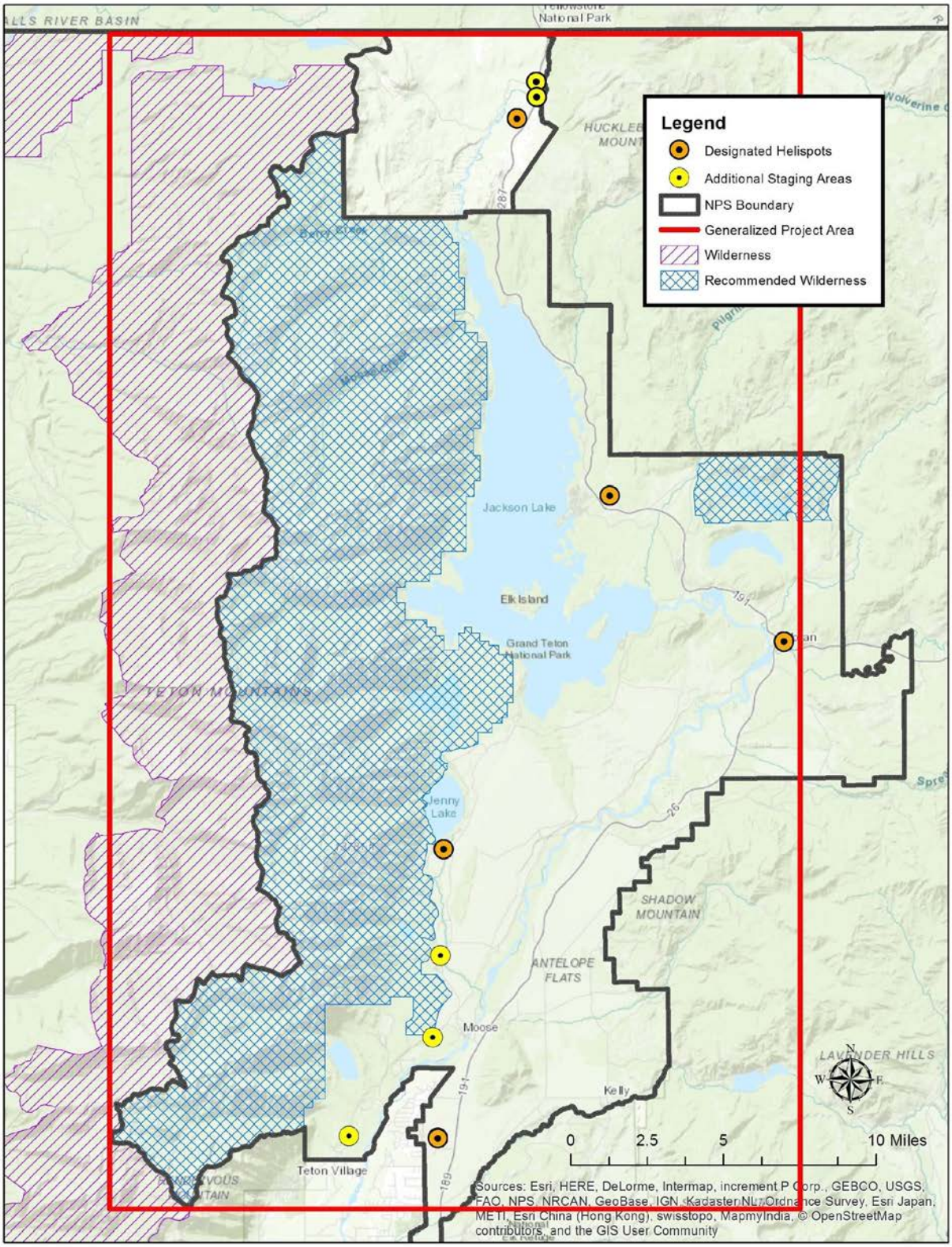

Figure 1. Wilderness areas (designated and recommended, managed as wilderness), staging areas/helispots, and generalized project area (outlined in red), Grand Teton National Park and John D. Rockefeller, Jr. Memorial Parkway, Wyoming, 2018.

Mountain goats present a potential threat to the Teton Range bighorn sheep population from transmission of pathogens that could result in disease and competition for forage or other resources, especially on limited winter ranges.

Given the observed high productivity of mountain goats and their growing numbers, the NPS has heightened concerns for the native bighorn sheep population, one of the smallest and most isolated in Wyoming, and is committed to ensuring the herd's long-term persistence. Recent monitoring suggests this bighorn herd has undergone a recent population decline (Wyoming Game and Fish Department (WGFD) 2009−2016) and is facing multiple environmental stressors that put its future in question. The bighorn sheep herd has never been extirpated and repopulated or augmented. Consequently, it is of high conservation value to the park, adjacent land and wildlife managers, and visitors whom enjoy knowing that a healthy population of this native species is present and persists within the park.

Without intervention, the mountain goat population is expected to grow rapidly and expand into habitats important to bighorn sheep. Biologists estimate that suitable habitat within the Teton Range could support roughly 250–400 mountain goats (DeVoe 2015), a number 2.5 to 4 times current population estimates. Given current mountain goat distribution and abundance, and expected population growth, the NPS is also concerned about current and potential increased impacts on other resources (e.g., vegetation and soils) and wilderness character.

Although mountain goats were first seen in the Teton Range nearly four decades ago, it is only recently that a breeding population has been documented. Prompt action is needed to remove or significantly reduce the non-native goats from the park to prevent the rapidly growing and expanding mountain goat population from displacing the small and declining population of native bighorn sheep.

History and Status of Exotic Mountain Goats

As noted above, the current population of mountain goats that resides in the Teton Range is likely derived from individuals that dispersed from a population introduced into the Snake River Range in Idaho more than 45 years ago. Based on consistent observations of adult female mountain goats with young of the year starting in 2008 and a growing number of mountain goat reports since then (Figure 2), it is likely that a breeding population of mountain goats established in the Teton Range in the mid to late 2000s. Mountain goats are adapted to live in steep and rugged mountains year-round and select these areas as their habitat (DeVoe et al. 2015, Lowrey et al. 2017). The species is characterized by long bodies with stocky limbs and specialized hooves that provide the ability to move adeptly in this extreme habitat (Chadwick 1983). Mountain goats are generalist herbivores that consume a wide variety of grass, forb, shrub, moss, and tree species (Chadwick 1983, Houston et al. 1994). Home ranges are typically fixed throughout an adult's life and are larger for females than for males (Chadwick 1983, Festa-Bianchet and Côté 2008).

In 2014, NPS personnel began intensive monitoring of mountain goats to better understand their distribution, movements, and reproduction in the park. Survival of radio-collared mountain goats has been 100%, which is very high for adult ungulates. Although there is currently insufficient data to quantify the population growth rate of the Teton Range mountain goat population, all available information suggests that the population is growing. Approximately 100 mountain goats currently reside in the Teton Range. The apparently high twinning rate suggests that the population is not resource limited (Houston et al. 1994) and will continue to grow. Currently, the majority of mountain goats are found in the central portion of the Teton Range, which is an area of relatively low bighorn sheep occupancy (Figure 2), but they have begun to expand to the north and south. As of winter 2017−18, several mountain goats were observed wintering in the Mt. Hunt/Prospectors area – an important area for wintering bighorn sheep.

As the number of mountain goats in the Teton Range increases, their range will likely expand further into habitat currently occupied by bighorn sheep. Recent research on bighorn sheep and mountain goat habitat use in the GYE indicated high levels of niche and geographic overlap between the two species at the population scale (Lowrey et al. *in review*). A review of 34 bighorn sheep and mountain goat diet studies found evidence for high levels of diet overlap between the two species in both summer and winter (Laundré 1994). However, these findings were primarily obtained from single-species studies rather than comparative studies of both species on shared range. It has been hypothesized that where the distribution of bighorn sheep and mountain goats overlap, the species have narrower niches than where they do not occur together, a result of resource competition (Adams et al. 1982). This hypothesis has some support from the two studies of sympatric bighorn sheep and mountain goat diets that found lower levels of diet overlap than the other studies synthesized by Laundré (1994).

Mountain goats can host a variety of pathogens that can negatively affect bighorn sheep. Given the apparently similar habitat requirements of the two species, transmission of pathogens between species is viewed as a legitimate risk where the two species overlap. Indeed, this was recently documented in Nevada (Wolff et al. 2016). The transmission of bacterial respiratory pathogens from mountain goats to bighorn sheep is of particular concern for the viability of the Teton Range bighorn sheep herd. Respiratory pathogen sampling of mountain goats in the Teton Range has detected bacteria associated with bighorn sheep pneumonia (leukotoxigenic *Bibersteinia trehalosi* and leukotoxigenic *Mannheimia spp.*), in five of 14 animals sampled since 2014. In the absence of other respiratory pathogens, these bacteria are thought to pose only a minor risk to bighorn sheep. However, the likely source population of the goats in the park (Snake River Range population; Figure 2) is known to host several additional respiratory pathogens (*Mycoplasma ovipneumoniae*, and leukotoxigenic *Mannheimia haemolytica;* Lowrey et al. 2018) that collectively pose a high risk of disease to bighorn sheep in the Teton Range. Thus, the lack of detection of these pathogens in the modest sample (n = 14) of Teton Range mountain goats should be interpreted with caution. An effective vaccine against the pneumonia pathogens in bighorn sheep has not been developed. If an effective vaccine existed, delivering it to a sufficient number of the park's bighorn sheep would not be feasible because the animals spend the entire year in remote areas with difficult access.

In northwest Wyoming and adjacent Idaho, mountain goats can be hunted outside of the park in three hunt areas (Figure 3). Wyoming Hunt Area 2 was expanded in 2014 to include the west slope of the Teton Range adjacent to the park. Current Wyoming statute only allows hunters to harvest one mountain goat over their lifetime. Although hunters can harvest a mountain goat on the west side of the Teton Range, due to the accessibility and once-in-a-lifetime restriction, none have been harvested in that portion of the hunt area to date.

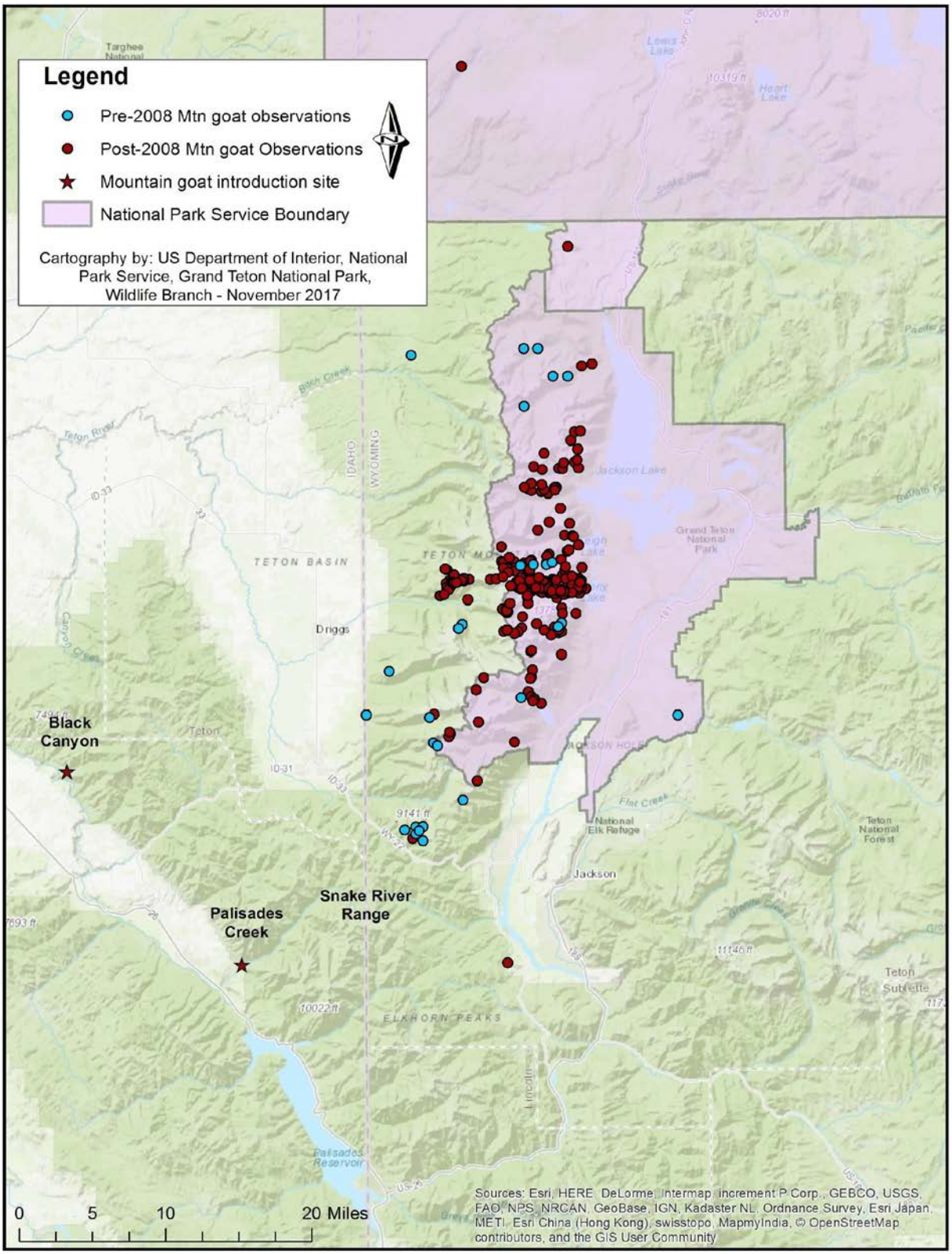

Figure 2. Observations of mountain goats in the Teton Range, 1977−2016.

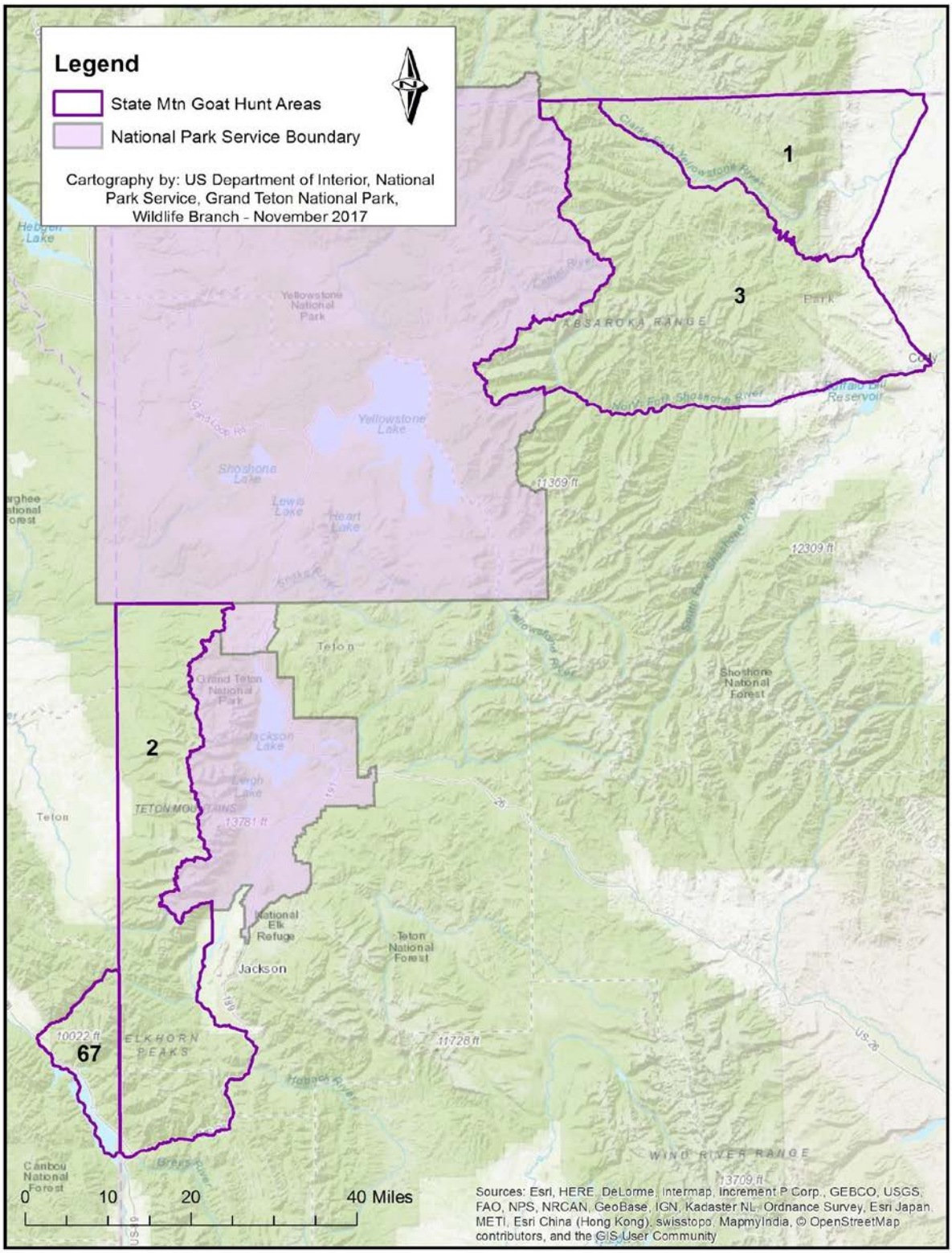

Figure 3. Wyoming and Idaho Mountain Goat Hunt Areas

Issues and Impact Topics Considered

The following topics are carried forward for further analysis in this EA:

- Bighorn Sheep
- Vegetation and Soils
- Whitebark Pine
- Wilderness Character

When determining whether to retain an impact topic for more detailed analysis in this EA, the NPS considered whether or not: the potential environmental impacts to the resource are central to the proposal or of critical importance; a detailed analysis of these impacts is necessary to make a reasoned choice between alternatives; and there could be significant impacts to resources. Because the following impact topics met one or more of these considerations, they were retained for further analysis in this EA.

Issues and Impact Topics Dismissed

Using the same considerations noted previously, the following topics were determined not to warrant more detailed analysis and were dismissed from further analysis in this EA. These topics are not retained for consideration because they are not (1) central to the proposal or of critical importance, (2) necessary to make a reasoned choice between alternatives, (3) a big point of contention among the public or other agencies, or (4) potentially significant impacts associated with the issue. A brief rationale for dismissal is provided for each topic.

Acoustic Environment

Natural soundscapes exist in the absence of human-caused sound. An intact natural soundscape enhances visitor experience and allows for natural functioning of wildlife communication. NPS policies require park managers to protect and restore the natural conditions and soundscapes of parks.

The relative loudness of sounds as perceived by the human ear is expressed using sound levels in units of A-weighted decibels, abbreviated dBA (OSHA 2013). A table of common sound sources and their sound levels is provided below:

Common Sound Sources	Similar Sounds Sources from other NPS Units	Sound Level (dBA)
Train horn at 1 meter	Military jet at 100 meters AGL (Yukon-Charley Rivers National Preserve)	120
Jackhammer at 2 meters	Thunder (Arches National Park)	100
Curbside of busy street	Cruiser motorcycle at 15 meters (Blue Ridge Parkway)	80
Busy restaurant	Conversation at 5 meters (Whitman Mission National Historic Site)	60
Residential area at night	Crickets at 5 meters (Zion National Park)	40
Whispering	Leaves rustling (Canyonlands National Park)	20
Human breathing at 3 meters	Volcano crater (Haleakalā National Park)	10

Table 1. Common sound sources and levels

The following values illustrate some key sound level thresholds and the effects that they have on humans:

- Natural Ambient Sound Level (dBA) – Baseline for current conditions
- Existing Ambient Sound Level (dBA) – Baseline for assessment of impacts
- 52 dBA – Raised voice speech interference at 10 meters (EPA 1974)
- 60 dBA – Normal voice speech interference at 2 meters (EPA 1974)

The use of helicopters, fixed-wing aircraft, and firearms would result in noise that would be temporary and limited in duration but could in turn impact visitors, wildlife, and wilderness character within the park. Potential impacts on the acoustic environment were analyzed using median natural and existing ambient sound levels (26 and 29 dBA, NPS 2010), along with thresholds for disturbance to humans and wildlife from human-caused noise. Between 2007 and 2015, aircraft noise in the summer (July 15−August 15) and winter months (January) were audible a small portion (approximately 6 and 18%, respectively) of the 25-day sampling periods in the northern area of the park (NPS 2015a). The vast majority of aircraft operations that occur within and over the park/parkway originate at the Jackson Hole Airport, and are audible ≤35% of the day. There are also high, transient aircraft flying over the park/parkway daily (audible approximately 7% of a 15-hour day (0700−2200 hours; NPS 2010). Other aircraft operations are not consistently reported to nor tracked by the NPS.

Since helicopter noise impacts (intensity, distance, and duration) are substantially greater than the intensity of noise generated from fixed-winged aircraft overflights, the following acoustic assessment focuses on helicopter sound level intensities. Based on reported data (FAA 1982), the maximum sound level (L_{max}) from a hovering, light helicopter would be approximately 75-78 dBA at a slant distance of 500 feet and 68-71 dBA at 1,000 feet. At a slant distance of 500 feet, up to 18 acres could be impacted with L_{max} at or above 75-78 dBA. At 1,000 feet, up to 72 acres could be impacted with L_{max} or above 68-71 dBA. Helicopter noise would affect the acoustic environment over distances of up to approximately 3.5 miles before maximum sound levels attenuate to existing ambient levels. Helicopter noise would likely not be noticeable to humans and wildlife beyond a distance of 3.5 miles. At 2,000 feet (up to 290 acres), L_{max} could reach or exceed 60 dBA, the threshold for normal voice speech interference, e.g. for hikers. At distances less than 4,000 feet (up to 1,150 acres), L_{max} could reach or exceed 52 dBA, the threshold for interpretive speech interference.

Other sources of noise include gunshots and ground vehicles. Noise from ground vehicles would be restricted to existing roads and not substantially increase noise. The minimum number of gunshots sufficient to remove animals would be limited to the area where a control event is occurring. The majority of gunshots would coincide with the use of helicopters. For a fraction of a second, peak levels from an individual gunshot can reach 140 decibels at very close range. Using impulsive time weighting, gunshot sound pressure levels typically vary from 120-127 dBA at 10m from the muzzle (downrange) and will decay at a minimum rate of 6 dBA per doubling of distance (RCMP 1999). Generally, gunshots would not be heard by most visitors because 1) control events would mostly occur during period of low visitor use (i.e., winter) and 2) visitors would not be allowed into areas where active shooting was occurring. If necessary, sound suppression techniques would be used to reduce gunshot noise.

Aerial mountain goat management operations would take place primarily during the late fall and winter months (mid-December to early March) where ≤1 percent of the total annual backcountry visitation occurs (NPS 2017). In most areas of the park, noise from helicopters would not be audible. For areas near where helicopters are operating, noise would only be audible a fraction of its operation, a period of up to 8 hours per day over a maximum of 35 days (Alternative B) and 50 days (Alternative C) annually. The number of aerial operations would substantially decrease after one to five years as the mountain goat population is reduced. Under typical conditions, sounds of helicopters and gunfire would not be heard ≥3.5 miles away.

To ensure visitor safety, these areas of operation would likely be under temporary closures, thus greatly reducing the likelihood of visitors being affected by intensive short-term aerial flight operations and gunshot noise. To mitigate these affects, park staff would provide advance notifications of scheduled aerial and ground field activities and temporary closures. These notifications would provide an opportunity for visitors to seek alternative arrangements.

Visitors recreating outside of but close to a closure area should be able to verbally communicate to one another, but could hear a distant helicopter, fixed-winged aircraft, and/or gunshot in the distance (see Visitor Use and Experience dismissal). Since few other wildlife species are likely to be present during fall and winter operations, the potential to disturb wildlife at breeding or rearing sites (e.g. dens or nests) or other sensitive habitats would be greatly reduced. Infrequent mountain goat management operations occurring outside of the fall and winter seasons would follow migratory bird and other wildlife protection measures. Therefore, the acoustic environment is dismissed from further analysis. Aircraft operations and gunshot noise impacts on bighorn sheep and wilderness character are discussed in Chapter 3.

Air Quality

The park is designated as a Class I air quality area under the Clean Air Act of 1963 (42 U.S.C. 7401 et seq.) and receives the highest level of protection with only a small amount of additional air pollution allowed. The proposed actions include short-term, periodic use of aircraft and ground vehicles, which would result in temporary increases of vehicle exhaust, emissions, and fugitive dust localized in parts of the general project area. Aircraft and ground vehicles would be intensively used during the first one to five years (as few days as necessary during up to three 14-day periods/year), and then only occasionally (once per year, with the possibility of a small number of additional flights to continue to remove mountain goats into the future). Ground vehicles would be used to transport staff to trailheads and/or frontcountry staging/helispot areas, and may be used under one proposed alternative to move some mountain goats out of the park after being carried by helicopter out of the backcountry. The slight temporary increases in exhaust, emissions, and dust would not affect air quality in the long term or the park's Class I air quality designation.

Archeological Resources

The park is known to contain a variety of archeological resources. To protect these resources, all of the action alternatives would avoid known archeological sites. Appropriate steps, such as halting work, employing archeological monitors, and notifying the park's Cultural Resources Branch staff immediately upon discovery, would be taken to protect any archeological resources that are inadvertently discovered during activities related to implementation. Helicopter landings in the backcountry, if needed, would occur on top of existing snow pack, which would avoid disturbing archaeological resources through downdraft and low frequency vibration absorption within the snow layer. Any helicopter landings in areas without proper snowpack may require archeological monitors to be present. All backcountry landing site coordinates would be reported to the park's Cultural Resource Branch for record keeping purposes. Staging areas/helispots in the frontcountry are located in previously disturbed areas.

Environmental Justice

Executive Order 12898, *General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. Given the analysis in this EA, it was determined that none of the alternatives would have disproportionate health or environmental effects on minorities or low-income populations or

communities, as defined in Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses (EPA 1998).

Ethnographic Resources

NPS Director's Order 28: *Cultural Resource Management* defines ethnographic resources as "any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it." Any known sacred sites, as defined in Department of the Interior Environmental Compliance Memorandum 97-2, would be avoided (DOI 1997).

It is known that American Indian people utilized the area over thousands of years for hunting and gathering subsistence and occupation. The park holds many resources important to these tribes including minerals, wildlife, plants, and water. These resources do not always have a defined boundary and may occur in and adjacent to the project area.

Twenty-four tribes traditionally, and currently, value Jackson Hole for hunting, gathering, ceremonial, and other practices (see Chapter 4: Consultation and Coordination for a list of traditionally associated tribes and consultation information). During the planning process for this EA, the park contacted these tribes and consulted with them about potential concerns associated with ethnographic resources. They did not have any particular concerns with removing exotic mountain goats from the park or with the management activities needed to remove these animals. If tribes subsequently identify the presence of ethnographic resources, appropriate mitigation measures would be undertaken in consultation with the tribes. Any known sacred sites would be avoided during management activities. The locations of ethnographic sites would not be made public. In the unlikely event that human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered, provisions outlined in the Native American Graves Protection and Repatriation Act of 1990 (25 USCUSC 3001) will be followed.

Federally Listed Wildlife Species

Four federally listed or proposed wildlife species and one critical habitat occur or have potential to occur within the project area (Table 2). The yellow-billed cuckoo, western glacier stonefly, and designated critical habitat for Canada lynx would not be impacted as a result of implementing any of the alternatives. Yellow-billed cuckoos are migratory and generally are only present in northwest Wyoming during the summer months. They nest in low elevation riparian woodland forests which do not occur in the action area. The glacier stonefly occurs in several melt water streams within the action area. However, during the winter (when most activities would take place) these locations are covered in snow and would not be impacted. Monitoring or other activities that take place in the summer are not expected to occur near sites where glacier stoneflies reside. Although a small amount of designated critical habitat for lynx occurs within the action area, no activities that would change the amount or condition of lynx habitat are proposed.

Table 2. Endangered, threatened, and proposed wildlife species of Grand Teton National Park and John D. Rockefeller, Jr. Memorial Parkway, 2018.

Common Name (Scientific Name)	Status
Canada lynx *(Lynx canadensis)*	Threatened
Canada lynx critical habitat	Designated
Grizzly bear (*Ursus arctos*)	Threatened
North American wolverine (*Gulo gulo*)	Proposed Threatened
Yellow-billed cuckoo (*Coccyzus americanus*)	Threatened
Western glacier stonefly (*Zapada glacier*)	Proposed Threatened

Two species, Canada lynx and wolverine, could be present within or near the proposed project area during the late fall and winter months (mid-December – early March) when intensive activities may take place. Grizzly bears could also be present and active in the project area in spring, summer, and fall. Although some grizzly bears may also be present in the project area in winter, they are typically inactive for about 5 months while in winter dens. A detailed Biological Assessment (BA) of Canada lynx, grizzly bears, and wolverine will be completed and submitted to USFWS prior to determining the selected action. The BA will contain more detailed information on potential impacts to these species and a final impact determination for each. In brief, monitoring and management activities proposed under the alternatives are not expected to have lasting or substantial effects on Canada lynx, grizzly bears, or wolverine, and some beneficial effects would occur.

Lynx are strongly tied to subalpine forests with abundant snowshoe hare, whereas mountain goats are generally associated with non-forested alpine or subalpine habitats near steep terrain. In addition, lynx are typically active at dawn and dusk, when monitoring and management activities would not occur. Given these differences in habitat preferences and use, the likelihood of temporal and spatial overlap between lynx and mountain goats is low; therefore, impacts on lynx are not anticipated. This in combination with a lack of recent confirmed lynx observations in the park and the surrounding area, despite intensive surveys, indicates lynx may currently be absent from the project area and therefore are unlikely to be impacted. Notwithstanding, aircraft could overfly habitat suitable for lynx, thus possibly disturbing any individuals or prey species that are present. Any disturbance is likely to be limited to the time the aircraft is passing overhead (<10 minutes), which could cause individual lynx or prey species to change their behavior or seek cover if the aircraft is perceived as a threat. It is likely that individuals will resume their prior or undisturbed behavior (if it was altered) once the aircraft is no longer in the vicinity.

All of GRTE, including the Teton Range, is considered occupied grizzly bear habitat, although most reported activity in the Teton Range occurs north of Moran Canyon. Suitable denning habitat for grizzly bears occurs throughout the Tetons (Podruzny et al. 2002). Overlap between high quality mountain goat habitat and grizzly bear denning habitat is limited, but these habitats are adjacent to each other in some locations. Grizzly bears are considered opportunistic omnivores whose diet varies widely and is influenced by annual and seasonal variation in available foods. The highest quality food available to grizzly bears in the GYE includes army cutworm moths, whitebark pine nuts, ungulates, and cutthroat trout. Under all alternatives (but more so under B and C), mountain goat carcasses would occur on the landscape and represent a potential food source and attractant to grizzly bears. However, because grizzly bears hibernate for 4-6 months each year and are likely to be in their dens when management activities occur, the risk of conflicts due to the presence of carcasses on the landscape can be adequately managed. The potential also exists to disturb grizzly bears either in or outside of their dens during flight operations. Denning grizzly bears appear to be most sensitive to disturbance early in the denning season (Linnell et al. 2000). In the GYE, 90% of female and male grizzly bears were denned by the fourth week of November and the second week of December, respectively (Haroldson et al. 2002). Given the proposed timing of intensive aircraft based management activities (when most bears have been denned for several weeks to a month), disturbance to grizzly bears is expected to be minimal. In addition, conservation measures to limit highly disturbing activities near known, occupied dens would further reduce the potential for impacts. Similarly, management actions that would result in mountain goat carcasses on the landscape would occur while bears are denned and there would be several month when bears are inactive for carcasses to be consumed by other scavengers or predators. However, carcasses could become buried in snow and become available again in the spring once bears emerge. NPS personnel would monitor the status of carcasses and either remove those in potential conflict areas or implement an area closure until the carcass if fully consumed or decomposed and no longer is an attractant.

As a species tied to high elevation remote areas, wolverine may occupy the same areas as mountain goats. Monitoring and management flight operations in areas where wolverine are present could cause

disturbance. In areas where project-related activities are relatively high and continuous over the course of several days, wolverine may alter their normal behaviors (e.g., feeding, traveling, etc.) or be displaced from those habitats. However, such disturbance would be temporary (i.e., limited to the time aircraft and associated human activities are occurring – several minutes to several hours) and wolverines would be expected to return to these areas once those activities have ended. Wolverine may be especially sensitive to disturbance during the denning period in later winter, consequently conservation measures would be implemented to prevent activities near den sites that could result in females relocating their litters or abandoning dens due to project-related disturbances. In addition, the expected timing of intense aircraft-based activities (mid-December–early March) would not overlap with the majority of the denning period. All alternatives could have beneficial impacts on wolverines due to the presence of carcasses (from a pneumonia die-off, should one occur, or from lethal removal actions) to feed on in the project area. These benefits would be short-term and limited to the time that carcasses are available on the landscape (1−2 weeks or longer if cached).

With conservation measures in place, disturbance under the alternatives could temporarily affect individuals, but would not negatively impact the grizzly bear, wolverine, or lynx populations as a whole.

Historic Structures and Cultural Landscapes

The park currently contain 732 resources that are listed, or eligible for listing, in the National Register of Historic Places. Individual resources may be historic sites, buildings, structures, or objects. These resources are found in 44 locations, where there may be one or multiple resources with the same context and historical significance in what is commonly called a historic district. Some of these historic districts, such as Colter Bay Village, Kimmel Cabins/Lupine Meadows, and Snake River Land Company Office and Residence, are located near the frontcountry staging areas/helispots that would be used for processing captured mountain goats, and for transferring mountain goats to recipients for translocation via live removal from the park. In backcountry areas, there are six historic patrol cabins (Cascade Canyon, Death Canyon, Granite Canyon, Leigh Lake, Lower Berry Creek Patrol Cabins, and White Grass Ranger Station) and the Valley Trail System, which includes the Teton Crest Trail, and nearly all the trails accessing the canyons of the Teton Range. Moose-Wilson Road is located at the base of the Teton Range west of the Snake River and south of Moose. The majority of this road is closed in winter as the road section from Granite Canyon Trailhead to Death Canyon Trailhead is gated, closed to motor vehicles, and unplowed. Other historic properties occur near the foothills of the Teton Range, including the White Grass Dude Ranch, which is operated by the Western Center for Historic Preservation during the summer months.

Field activities associated with management of mountain goats would not change the character or use of any cultural resources within or adjacent to the project area. Vehicular use of historic roadways and parking areas, and ground crews on hiking trails are activities commensurate with the intended and designed purpose of these structures. The footprint of helicopter landing zones (including disturbance from downdraft and low frequency vibration) and ground crew activity would occur outside of developed areas and not within close proximity to historic buildings and would thus avoid disturbing historic structures.

According to the NPS Director's Order-28: *Cultural Resource Management Guideline*, a cultural landscape is a reflection of human adaptation and use of natural resources, and is often expressed in the way the land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. Although noise from helicopters, and gunshots would occur during monitoring and management operations, the sounds would be distant and audible for a period of up to 8 hours per day over a maximum of 35 days (Alternative B) and 50 days (Alternative C) annually. The number of aerial operations would substantially decrease after one to five years as the mountain goat

population is reduced. No impacts to historic structures would occur, and no permanent or long-term impacts to cultural landscapes would occur.

Indian Trust Resources

The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. The park's lands and resources related to this project are not held in trust by the Secretary of the Interior for the benefit of Native Americans.

State Listed Species of Greatest Conservation Need

The State of Wyoming has identified five Species of Greatest Conservation Need (SGCN) with a native species status of 1 or 2 (highest need for conservation) that may be present within the proposed project area including: Common loon (*Gavia immer*), trumpeter swan (*Cygnus buccinator*), Canada lynx (*Lynx canadensis*), American pika (*Ochotona princeps*), and western toad (*Anaxyrus boreas*). The Canada lynx is also a federally listed species and is addressed in the Federally Listed Wildlife Species section above. The loon, trumpeter swan, and western toad are dismissed from further analysis as the project area is outside the elevational range of these species or the species is not expected to occur during the season of impact.

American pikas are small mammals that reside in the alpine zone of the Teton Range where mountain goats also occur. During the snow-free months, pikas actively forage in meadows adjacent to talus slopes. Although they do not hibernate and are active in the winter, they remain in their dens that are covered by snow. Consequently, pika would not be disturbed by actions proposed during the winter months. During the snow-free months, pika may occur near camera monitoring sites or at other locations where mountain goat management activities occur. Recent research (Stafl and O'Connor 2015) suggests that pikas respond to hiker disturbance by exhibiting anti-predator behaviors (e.g., alert response and reduced foraging time). Although individuals near trails showed tolerance for human activity, they still exhibited an anti-predator response. This study also found that temperature was the most important predictor of pika foraging behavior. In the summer, pika are highly sensitive to temperatures >25°C (77°F) and may restrict their activities to the cooler talus environment and limit their foraging activities. Any negative disturbance effects from deploying and checking cameras for monitoring purposes or from management actions in habitats also used by pikas may be minimized by the timing of those activities. Camera deployments and checks frequently occur around midday as these are typically day trips. Consequently, disturbance to pikas may be reduced if they are already restricting their foraging activities due to higher temperatures. However, activities occurring during cooler periods when pika may be active, could temporarily disturb individual pikas for the time those activities occur (~15 minutes to 1 hour), but they are not anticipated to affect the population as a whole. Summer activities, including those related to monitoring and mountain goat management, are expected to be intermittent and of short duration (i.e., few minutes to a few hours).

Visitor and Employee Health and Safety

The potential for impacts to the health and safety of the public and park employees during proposed management actions (e.g., helicopter use and landings in mountainous terrain, and firearms use to lethally remove mountain goats) would be mitigated through strict adherence to established NPS safety protocols. Temporary area closures would occur to ensure that visitors would not risk injury by inadvertently walking into areas where planned management actions are occurring. In addition, if individual mountain goats behave aggressively toward humans, the context of the encounter would be analyzed immediately, and the animal promptly and humanely dispatched, if appropriate.

Visitor Use and Experience

The wilderness and backcountry areas of the Teton Range where mountain goats are present offer a wide range of visitor uses and experiences throughout the year. Visitor activities that frequently occur during the summer and spring/fall shoulder seasons include day hiking, backpacking, mountain climbing, and backcountry camping. Popular activities during the winter and spring months include backcountry skiing and snowshoeing. Throughout the year, visitors enjoy the park's spectacular scenery and diverse native wildlife.

Primary access points into the wilderness and backcountry areas of the park's Teton Range are the Death Canyon, Taggart Lake, Lupine Meadows, Jenny Lake, and String Lake trailheads. Based on counter data obtained at these trailheads, about 281,000 recreational visits occurred in the park's Teton Range in 2016 (Newton 2017a).

Backcountry camping is a popular recreational activity, especially in the high elevation canyons and lakes of the Teton Range. In 2016, there was a total of 36,206 backcountry user nights (NPS 2017). This number represents all backcountry areas in the park, including areas within the Teton Range where the majority of backcountry camping occurs.

Guided climbing in the Teton Range comprises the vast majority of guided visitation in the Grand Teton wilderness. Guided climbing in the Teton Range occurs as day trips, overnight trips, and climbing schools. In 2016, 6,644 visitors participated in guided climbs in the Teton Range. The most popular peaks that are ascended in the Teton Range are Grand Teton, Middle Teton, Disappointment Peak, and Storm Point. The most popular month for climbing the peaks in the Teton Range is August (Newton 2017b). Other guided activities include backcountry skiing where a total of 1,093 visitors were guided during the winter of 2016-2017 (Canetta, 2017).

Fixed-winged and helicopter operations would temporarily affect visitors due to the visual presence and acoustic intensity of aircraft operating in the Teton Range where mountain goats are present (see Acoustic Environment dismissal above). Under all alternatives there would likely be temporary area closures during management activities. The total number of closures would vary annually and by alternative and largely depend on environmental conditions that affect duration of the operations, level of visitor use, and locations of mountain goats.

The majority of aircraft operations and temporary closures would occur in the fall and winter months (October through April) when backcountry visitation is ≤1 percent of total annual backcountry visitation (NPS 2017).The temporary effects of aircraft operations and temporary closures would likely diminish individual visitor use and experience within the backcountry and wilderness areas of the Teton Range. These effects are anticipated to lessen as mountain goats are removed from the park over the first one to five years. To mitigate these affects, park staff would provide advance notifications of scheduled aerial and ground field activities and temporary closures. These notifications would provide an opportunity for visitors to seek alternative arrangements. Therefore, visitor use and experience is dismissed from further analysis. Visitor experience as it specifically relates to wilderness solitude or primitive and unconfined recreation is retained as an impact topic under wilderness character (see chapter 3).

Wildlife including Migratory Birds (Excluding Bighorn Sheep)

There are 60 species of mammals, over 300 species of birds, and several species of reptiles, amphibians, and other vertebrates that reside within the park, some of which may occur in the action area (in the alpine

and subalpine environments where mountain goats live as well as near frontcountry staging areas). Those that could potentially occur in the project area during the winter months when intensive monitoring or removal actions would occur include several species that may scavenge on mountain goat carcasses including mountain lion (*Puma concolor*), coyote (*Canis latrans*), red fox (*Vuples vulpes*), Pacific marten (*Martes caurina*), gray wolf (*Canis lupus*), and common raven (*Corvus corax*). Given that mountain goats occur at high elevation where snow is deep, conditions are harsh, and food resources are limited during the winter, it is likely that if any of these species are present, they would occur at very low density. Grizzly and black bears typical hibernate from late fall through early spring and are unlikely to occur in habitats used by mountain goats in mid-winter. Similarly, most bird species, including those sensitive to disturbance such as golden (*Aquila chrysaetos*) and bald eagles (*Haliaeetus leucocephalus*) and peregrine falcons (*Falco peregrinus*) migrate out of northwest Wyoming or to lower elevations and are unlikely to be present at higher elevation in mid-winter. Amphibians and reptiles are also typically inactive during the winter months at high elevation.

Helicopter activities may cause short-term disturbances (for the time the helicopter is in the vicinity – generally several minutes to an hour) to any wildlife present. Because few species are likely to be present during winter operations and given implementation of conservation measures, the potential to disturb wildlife at breeding or rearing sites (e.g. dens or nests) or other sensitive habitats would be reduced significantly. No substantial impacts to wildlife, including migratory birds or their behavior is anticipated. Any disturbance impacts are likely to be temporary and short-term (described above) and are not expected to affect these species at the population level. Potential impacts are not expected to measurably increase impacts to migratory birds or other wildlife, consequently this topic is dismissed from detailed analysis.

CHAPTER 2: Alternatives

Alternative A – No Action

Under the no-action alternative, current actions to manage nuisance mountain goats and monitor the population would continue, but no active population management of exotic mountain goats would occur within the park, except if needed to address a human safety concern. Such management of nuisance mountain goats would include hazing or removal of individual goats, public education, and/or area closures. Ongoing monitoring efforts to document the distribution and abundance of mountain goats would continue, as funding allows. Aircraft based operations would occur ≤20 days; including ≤12 days of fixed-wing monitoring (approx. 1 flight/month), ≤3 helicopter survey days, and ≤5 helicopter-based capture days (Table 2).

Refer to Elements Common to All Alternatives and Table 2 for additional information on humane management actions, helicopter/firearms use requirements, monitoring, live capture, lethal removal of nuisance animals, and other actions.

Alternative B – Lethal Removal Only

Alternative B would manage exotic mountain goats using lethal actions to remove goats from the park. The alternative would also include the range of actions common to all alternatives and common to the action alternatives. It is likely that few mountain goats would be captured, sampled, and radio-collared for monitoring purposes since emphasis would be on population reduction. However, there still may be a need to capture, collar, and release a limited number of animals to facilitate monitoring and aid in finding goats for management activities.

Aerial-based lethal removal would be performed by federal personnel or contractors with the appropriate training, certifications, skills, and proficiencies in aviation operations and safe use of firearms for dispatching wildlife. Mountain goats would be killed using firearms with non-lead ammunition from fixed-wing aircraft, helicopter, or the ground. If direct removal efforts fail or goats occur in a location that does not lend itself to direct lethal removal, mountain goats would be captured and euthanized. Aerial capture techniques would include darting or net-gunning from a helicopter. Ground capture techniques would include ground darting or baiting goats to a drop net, clover trap, or snare. Aerially-captured mountain goats would be hobbled and blindfolded, placed in a transport bag, and attached to a helicopter by a sling for transport to a processing site where they would be humanely dispatched. Those captured using ground techniques would be dispatched on site. Animals would be dispatched (i.e., using euthanasia drugs or by gunshot) by trained personnel following established and approved guidelines from the American Veterinary Medical Association (AVMA 2013). The actions described above would take place in the Teton Range backcountry, most of which is recommended wilderness.

Mountain goat carcasses would generally be left on the landscape for the benefit and use of scavengers and/or to decompose naturally. When possible, carcasses would be kept away from popular visitor-use areas such as trails and campsites. However, in situations where carcass relocation is not possible, temporary trail or area closures may be implemented to reduce the potential for conflicts with wildlife feeding on carcasses, such as grizzly or black bears. Assuming that 90% of the estimated 2018 population of 100 mountain goats could be removed over the course of the population reduction, approximately 90 mountain goat carcasses could be left on the landscape.

Initial lethal removal activities are expected to take 3−5 years, with most activity occurring within the first 1−2 years. Although weather-dependent, the initial management activities would occur in ≤3 removal periods/year between mid-December and early March. If late fall/winter missions are unsuccessful, removals could occur at any time of year. Each management period would last ≤2 weeks. Aircraft-based operations would occur ≤25 days, which would include ≤12 days of fixed-wing monitoring, ≤3 helicopter survey days, ≤5 helicopter-based capture days, and ≤5 days of lethal removal per management period (Table 2). If funding allows, up to 10 additional days (2 removal periods) of lethal removal could occur.

Lethal removals would take place where mountain goats occur within the park, but would generally be concentrated in the central portion of the range between Cascade and Snowshoe Canyons (Fig. 1), where the majority of mountain goats currently occur. Following the initial population reduction, approximately 10% of the mountain goat population or 10−12 goats would likely remain. Over time, as the remaining mountain goats become less numerous and more wary, removal efficiency is likely to decrease, thus slowing removal efforts.

Helicopters would also be used to ferry equipment or drop off/pick up ground-based crews performing lethal removal activities: ≤10 helicopter landings/year would occur for this purpose. To increase capture efficiency and enhance safety, a fixed-wing aircraft may be used to spot remaining mountain goats and direct crews to their location. These helicopter landings and fixed-wing aircraft use are part of the ≤25 days of aircraft-based operations previously described.

It took roughly 40 years from their introduction in Idaho for mountain goats to establish a breeding population in the park. If lethal management is effective, it could be 5−30 years before goats disperse to the Teton Range again. The actual time frame would depend on where goats are dispersing from, the current management framework in place, and population trends at those locations outside the park. NPS management activities to remove individual goats that enter the park during this period would likely be infrequent and of short duration (1−2 days) and involve removal of mountain goats by park staff, other federal personnel, and/or contractors as needed.

Refer to Elements Common to All Alternatives, Elements Common to the Action Alternatives (B and C), and Table 2 for additional information on humane management actions, helicopter/firearms use requirements, monitoring, live capture, lethal removal, management framework, and other actions.

Alternative C – Combination of Lethal and Non-Lethal Removal (Preferred)

Under Alternative C, mountain goats could be captured within the park and translocated to suitable locations where they are native, or be transferred to accredited zoos. The NPS would work closely with appropriate state wildlife and federal land management agencies or other approved recipients (including zoo personnel) to plan and execute the translocations. Recipients would generally be responsible for transport and associated costs to move mountain goats from frontcountry staging areas within the Grand Teton to release sites outside of the park. Mountain goats could be captured over the course of up to 3 to 5 years, with most activity in years 1 and 2. Capture operations would occur between December and March. Captured mountain goats would be transported by helicopter to frontcountry staging areas, where they would be transferred to approved recipients. Capture and translocation under Alternative C is projected to involve approximately 25% of the 100 mountain goats. However, the number of mountain goats captured and translocated could be more or less, depending on capture success and the interest from outside entities to receive mountain goats and their ability to cover transport, disease testing, and associated expenses.

When translocation and lethal removal activities occur in the same management period, live capture and translocation activities would generally occur prior to lethal removal. This order of actions is desirable because capture efficiency is likely to be greatest at the onset of operations, when mountain goats are naïve and a significant portion of the population is in terrain where capture can be achieved safely. As the removal activities continue, the remaining mountain goats would be more likely to seek areas where operations are more difficult (steep, rocky terrain), and flee from the helicopter in order to elude capture. Once capture efficiency and opportunities for safe capture decline, the operation would transition to lethal removal techniques. However, if/when appropriate the park may conduct lethal removal actions before translocations as dictated by conditions.

Mountain goats would be captured and then transferred to the interested recipient. Capture operations would occur wherever goats are located within the park, but would likely take place between Cascade and Snowshoe canyons (Fig. 1), which are within recommended wilderness. Goats would be captured via net gunning or darting from a helicopter, or from the ground using traps, nets, or snares, and/or chemical immobilization. A fixed-wing aircraft may also be used to spot goats from the air for capture. Captured mountain goats would be ferried beneath the helicopter in a transport bag to a staging area. NPS personnel would coordinate with WGFD personnel and others to facilitate the transfer of mountain goats to recipients. Recipients would be responsible for acquiring transport or other permits as necessary. No more than four goats would be transported via helicopter during a single trip. The maximum ferry time would be approximately 45 minutes. If a mountain goat were to sustain a life-threatening injury during capture and relocation activities, it would be dispatched as quickly as possible using approved techniques (AVMA 2013). Translocation activities would initially require ≤10 helicopter flight operation days annually to transport goats to frontcountry staging areas (Table 2). The number of flights would decrease as the mountain goat population is reduced. After reaching the staging areas, mountain goats would be transported by recipients using road-based vehicles to translocation sites outside of the park. Ground transport would likely take ≤2 days to reach the translocation sites. Translocations would occur primarily from mid-Decmber through early March, but could occur at other times of the year as necessary. The number of park staff and other individuals taking part in translocation activities would vary between approximately 5−10 people.

Helicopter capture efficiency would be greatest at the start of live capture operations, when mountain goats are naïve and occur in areas with safe access. As capture operations progress, the goats are likely to shift their distribution to areas of rougher terrain where safe capture is difficult. If capture efficiency exceeds typical effort for capturing goats (2014−2016 = 2.5 hours/goat), helicopter-supported translocation operations would cease, and shift to lethal removal techniques as described under Alternative B (Table 2).

Refer to Elements Common to All Alternatives, Elements Common to the Action Alternatives (B and C), and Table 2 for additional information on humane management actions, helicopter/firearms use requirements, monitoring, live capture, lethal removal, management framework, and other actions.

Elements Common to All Alternatives

1. **Humane Management Actions**: In accordance with standard operating procedures, NPS *Management Policies 2006* (4.2.3; NPS 2006), the Animal Welfare Act, and guidance from the American Society of Mammologists (Sikes and Gannon 2016), all actions involving direct handling or management of goats would be conducted humanely and in accordance with NPS-approved capture and handling protocols to ensure animal welfare and human safety are maintained.

2. **Designated Frontcountry Helispots and Staging areas:** Frontcountry helispots and staging areas would be required for mobilization of staff and equipment during management activities. When accessible, helicopter landing and/or refueling sites would be used (Figure 1). All helispots and staging areas are located within frontcountry developed areas and are intermittently used for search and rescue and other park administrative aerial- and ground-based operations.

3. **Helicopter/Firearms Use Requirements:** Helicopter and firearms use would comply with the NPS firearms use policies, Interagency Helicopter Operations Guide (IAMC 2006), and the NPS Aerial Capture Eradication and Tagging of Animals (ACETA) Operations Plan (2017). Per NPS aviation policy, only qualified government or contract personnel would participate in aerially-based operations. If available and approved by the helicopter base manager and aviation officer, helicopter operations would be based out of the Teton Interagency Helibase adjacent to the Jackson Hole Airport. Otherwise, operations would base out of the Jackson Hole Airport. Firearms would be used to humanely dispatch seriously injured mountain goats, to remove goats that may become aggressive to humans, and, under the action alternatives, to lethally remove mountain goats in the park.

4. **Monitoring**: Monitoring activities would include temporary capture (helicopter based), radio-collaring and/or marking with paint of mountain goats; collecting samples for disease and genetic testing; fixed-wing and helicopter-based population monitoring; ground-based population surveys; and/or deployment of remote cameras at natural and artificial mineral licks. Collaring mountain goats would provide a more complete assessment of mountain goat survival, productivity, distribution, as well as possible competitive interactions with, and influences on, bighorn sheep.

   Ground-based surveys involve using spotting scopes and binoculars from a distant observation point to scan suitable habitats for goats. These surveys would occur from May–October. Camera deployment entails attaching a camera using nylon straps to a nearby tree or rock and orienting the camera towards the natural or artificial mineral lick. Remote cameras would be checked every few weeks to change out memory cards and batteries. Helicopter-based population trend monitoring flights for mountain goats, conducted by the NPS or WGFD, could occur every 1−5 years in combination with surveys for bighorn sheep in winter. These surveys would be completed over 1−3 days per year, with 6−8 hours of flight time each day (Table 2). During the aerial survey, a low-level helicopter would systematically search all mountain goat habitat in the park.

   For monitoring purposes mountain goats would be captured via net gunning or remote drug delivery (i.e., darting) from a helicopter following established and approved capture and handling protocols. Upon capture, the helicopter would land close by and the mountain goat(s) would be restrained, blindfolded, and processed on site or placed in a transport bag for ferry to a frontcountry processing site. During processing mountain goats would be placed in a sternal or left lateral recumbent position to prevent bloat. A physical exam would be conducted to check for signs of respiratory distress or capture-related injuries and baseline heart rate, respiratory rate, and rectal temperature would be established and subsequently monitored every 5−10 minutes. Goats processed at backcountry sites would be radio-collared and released on site. Blood and fecal samples, and nasal and tonsil swabs would be collected from goats transported to frontcountry sites to assess disease, micronutrient, or genetic status. These goats would then be radio-collared and returned to the capture location for release.

   The number of days needed for captures would depend on the number of goats targeted, with flight time estimated as 2.5 hours/animal captured, but weather delays could extend that

timeframe. Given favorable weather conditions, approximately 10 goats could be captured in a five-day period flying approximately 5 hours/day. Based on these time estimates, it is anticipated that helicopter-supported capture of mountain goats for monitoring purposes would likely take place in a 5−7 day window during the late fall and winter months (mid-December – early March) when needed and as funding allows. However, if necessary, captures for monitoring purposes could occur outside this window. The NPS would continue to coordinate closely with WGFD personnel on capture and monitoring of goats. Refueling and processing of mountain goats (if not taking place in the field) would occur at established frontcountry staging/refueling sites. No vegetation clearing is proposed at landing sites. A contract helicopter would base operations out of the Teton Interagency Helibase at the Jackson Hole Airport, if it is available. Alternatively, operations would base out of the fixed-wing base operations at the south end of the Jackson Hole Airport. Other staging/refueling areas have been identified in the park (BTNF and GRTE 2017; Figure 1) and could be used for processing/sampling captured mountain goats and refueling the helicopter. Capture with transport would involve two backcountry landings per animal–one to pick the animal up and one to return it to its capture location.

5. **Carcass disposal:** Carcasses resulting from aerial- and ground-based removal activities would generally be left in place to provide biological and ecological benefits. They would be relocated away from high-use system trails, campsites, or where visible from visitor use areas, if accessible. If necessary, carcasses would be moved by ground personnel, who would drag or carry carcasses ≥100 yards away from these areas, or, if conditions allow, carcasses would be relocated or removed by the eradication crew using a helicopter. Transportation of carcasses would be done within the helicopter, or via a short-haul line and transport bag or cargo net. In situations where carcasses cannot be moved, but may pose a risk to park visitors, temporary area closures would be implemented (see Temporary Closures below).

6. **Temporary Closures:** It is possible that specific areas of the park would need to be temporarily closed during mountain goat management activities if park staff would determine this is necessary to ensure public safety. Closures of specific areas could last for several hours, days, or for the duration of the management activities. It is anticipated that the majority of these closures would occur in the late fall and winter months during periods of lower visitor use. Larger areas defined by canyons or drainages may be closed during management activities for ≤7 days to ensure human safety during helicopter-based removal activities. In situations where mountain goat carcasses cannot be moved, but may pose a risk to park visitors, temporary area closures would be implemented. These closures (≤ 5 acres) would remain in place until carcasses are consumed, which could be up to 2 weeks or longer in the winter if carcasses become buried in snow and become accessible at a later date. The public would be appropriately notified in advance of these temporary closures.

7. **Artificial Baits**: Temporary salt baits could be placed to attract mountain goats to suitable areas for more efficient monitoring, capture, collaring, and/or removal. Locations would be chosen to minimize effects to the environment.

8. **Education/Interpretation**: The NPS would continue to provide educational and interpretive information to the public about mountain goat and bighorn sheep population status and ecology, and the potential impacts of mountain goats on bighorn sheep and other park resources. The NPS would continue to solicit observation reports of bighorn sheep and mountain goats from park visitors and employees.

9. **Work Cooperatively with Non-NPS Land and Wildlife Managers**: The NPS would work cooperatively with WGFD, Idaho Department of Fish and Game (IDFG), the United States Forest

Service (USFS) (Bridger–Teton and Caribou–Targhee national forests, BTNF and CTNF respectively) and other adjacent stakeholders to identify possible management strategies that could be implemented outside the park to reduce the mountain goat population in the Teton Range. The aim of interagency cooperation is to limit future colonization by mountain goats and the need for additional intensive management events within the park, and to support interagency partners in taking actions outside the park.

10. **Wilderness Character Monitoring:** NPS wildlife biologists would report wilderness character monitoring measures to the park's wilderness coordinator in accordance with the *Grand Teton Recommended and Potential Wilderness Building Blocks for Wilderness Stewardship* (NPS 2015a). Measures reported would include authorized actions that manipulate wildlife, status of nonnative animal species, non-recreational physical developments, administrative flight operations, and the number and extent of visitor behavior restrictions (area closures).

Elements Common to the Action Alternatives (B and C)

1. Management of mountain goats would be guided by the following framework:

   Population Reduction (Years 1-5). The goal would be to reduce the number of mountain goats in the population as quickly as possible. Repeated systematic surveys may be used to determine population trajectory and the rate of removal necessary for further population reduction. Systematic surveys may become less effective as abundance decreases. The timing and duration of population reduction efforts would ultimately depend on weather, density and distribution of goats, and technique, but intensive reduction efforts via helicopter-based efforts would generally occur mid-December to early March. With favorable weather and goat distribution, approximately 90% of the population could be removed in the first 1−5 years.

   Post-reduction (Years 6-7). This would occur when the total number of mountain goats has been substantially reduced (≥90%), but small groups or individuals remain. These remaining animals often become more difficult to detect, monitor, and manage; some may learn to avoid locations repeatedly visited by staff. With approximately 10% of the population expected to remain after population reduction, efforts would transition from intensive to tactical monitoring and removal. Tactical monitoring and removal efforts would occur year round.

   Maintenance (Year 7 and beyond, as long as mountain goats are present). The goal would be to prevent immigration of mountain goats into the park, and to remove any that do so. It is uncertain how often dispersing goats would enter the park after initial removal efforts are completed. Some strategic monitoring would continue and it may be necessary to employ several monitoring methods simultaneously in combination. Removal efforts would likely be ground-based and tactical.

2. **Education/Interpretation:** In addition to the educational and interpretive information provided to the public under all alternatives the NPS would provide additional information on the progress towards achieving the desired conditions. The NPS would also continue to request visitors to report observations of mountain goats and bighorn sheep.

3. **Lethal Removal:** Both alternatives would involve the use of firearms to lethally remove mountain goats from the park. The type of firearms used would typically be shotguns for helicopter-based removals and rifles for ground-based actions.

Given the steep, inaccessible terrain where mountain goats reside it is likely that a significant portion of the removal work would involve aviation operations, although some work may occur from the ground. Ground-based removals may be necessary to complete removal of mountain goats, and these efforts could include federal staff (i.e., NPS staff, Wildlife Services staff, or other approved and qualified government employees).

Conservation Measures to Reduce or Avoid Potential Impacts

The following conservation measures are applicable to all alternatives:

Acoustic Environment

- When possible, select/contract aircraft with quieter technology, for example, fixed-wing aircraft having propellers with slower tip speed, e.g. propellers with 3 or more blades, and quiet technology helicopters.
- Use direct routes, avoiding sensitive sites to and from launch and staging areas.
- Minimize low level flight when practicable. When flying to and from the work area, aircraft will maintain a minimum 2,000 foot altitude where possible, per Federal Aviation Administration (FAA) Advisory Circular 91-36D Visual Flight Rules (VFR) Flight Near Noise-Sensitive Areas (FAA 2004).
- Brief pilots on the value of natural soundscapes and ask for their compliance and suggestions about noise mitigation. Helicopter pilots will be encouraged to take the FAA Fly Neighborly training at https://go.usa.gov/xQPCW
- Use firearm silencers, as possible, during lethal removal efforts to mitigate soundscape impacts.
- Avoid prolonged aircraft and road vehicle idling at staging areas.
- Minimize conducting activities during temperature inversion periods when noise propagation can affect ground points at greater distances, and noise can be louder.

Cultural Resources

All staff and other persons involved in mountain goat management would be informed of the procedures to follow in the event of archaeological and ethnographic resource discovery, as well as the penalties for illegally collecting artifacts, or intentionally damaging archeological resources and/or historic properties.

If previously unknown archeological (human-modified) resources and/or human remains are discovered during monitoring or management activities, all work in the immediate vicinity (≤600 feet) of the discovery shall be halted until the resources are identified and documented and an appropriate mitigation strategy developed. The park archaeologist (307-739-3671) will be contact for any questions or discoveries. The same measures would be followed for paleontological (fossils) and other non-cultural related resources.

In the unlikely event that human remains are discovered during project activities, park law enforcement rangers, the park superintendent, and the park and regional archaeologists would be contacted immediately. All provisions outlined in the Native American Graves Protection and Repatriation Act (1990) would be followed.

Coordinates for backcountry helicopter landing sites occurring in snow-free locations will be provided to the Cultural Resources Program Manager (307-739-3671) for record keeping purposes and to pursue archaeological surveys of the areas, as warranted, post-project.

- Backcountry/wilderness helicopter landing sites will occur on snow covered areas away from the edges of snow patches or snow fields to avoid any unevaluated, sensitive cultural sites that may exist at the receding snowline.
  Coordinates for any known backcountry cultural sites within areas where goat management activities will occur will be supplied to helicopter pilots to ensure landings do not occur at sensitive sites.

Soils

- Field activities would minimize disturbances on steep slopes and bare mineral soil.

Vegetation

- Location information on backcountry work areas (e.g. bait and capture sites) would be recorded and maintained as part of the record of actions taken; this would ensure that proper revegetation, if necessary, is completed.
- Backcountry work areas would be minimal in size and short-term in nature to reduce vegetation impacts of staging.
- Equipment and boots would be cleaned and free of soil, plant material, and seeds prior to all operations to prevent the accidental spread of nonnative species.

Visitor Use and Experience

- As much as possible, field activities in backcountry and wilderness areas would occur during periods of minimal visitation, and would avoid trails, overlooks, backcountry camping zones, and climbing routes.
- Signs, alerts, bulletins, press releases, and notifications would be issued to inform visitors of temporary area closures and other management activities.

Wilderness Character

- **Undeveloped:** Bait lures, traps, cameras and other installations would be removed at the end of each field season. Located animal collars that no longer serve as tracking devices would be retrieved when practicable.
- **Solitude or primitive and unconfined recreation:** Aerial and ground-based field activities in wilderness areas would occur during periods of minimal visitation and would avoid trails, overlooks, backcountry camping zones, and climbing routes when visitors are likely present. Park staff would examine the proposed location, timing, and duration of each temporary area closure and consider ways to modify the closure to minimize effects on visitors (see Visitor Use and Experience above).
- **Other features of value:** Field activities would avoid subsurface ground disturbance and known archeological (human-modified) and paleontological (fossils) resources. If previously unknown archeological and/or paleontological resources and/or human remains are discovered during field activities, all work in the immediate vicinity of the discovery shall be halted until the resources are identified and documented, and an appropriate mitigation strategy is developed by park cultural resources staff (see Cultural Resources above).

Wildlife

- To prevent environmental contamination, only lead-free ammunition would be used.
- Helicopter pursuits for the purpose of live capture would occur only in terrain where mountain goats may be safely netted/darted and recovered.
- The location of mountain goat carcasses would be recorded and passed on to park staff at the end of each day. Based on this information, appropriate trail or area closures would be identified and implemented, as necessary, or carcasses would be moved/removed to minimize the potential for conflicts.

- The decomposition status of mountain goat carcasses would be monitored throughout the season and appropriate measures (e.g. removal, demolition, area closure, etc.) would be taken to reduce the potential for conflicts with any scavengers or carnivores feeding on carcasses.
- Helicopter based management activities would avoid sensitive bighorn sheep lambing areas during the lambing season (late May−June).
- Helicopter based removal of mountain goats would be permitted within important bighorn sheep winter habitat only under the following conditions:
  - Only one sub-segment (north or south) of bighorn sheep population is exposed to extended helicopter activity in any given year;
  - No more than ⅓ of important bighorn sheep wintering areas used by a sub-segment is exposed to helicopter activities in any given year; and
  - When feasible, removal actions in important bighorn sheep wintering areas would occur during the early morning or late afternoon, when bighorn sheep are less likely to be bedded and ruminating.
- When active golden eagle territories occur within the area of operation from January 15–July 31, a ½-mile flight buffer would be established around the active nest.
- When active peregrine falcon territories occur within the area of operation from March 1–August 15, a ½-mile flight buffer would be established around the active nest.
- Personnel involved in helicopter-based monitoring, capture, lethal removal, or translocation activities would be briefed on identification of wolverines, their tracks or other sign, and instructed to report any observations to the project manager as soon as practical.
- If a wolverine is observed, pilots would be instructed to remain ≥500 feet above ground level from the animal with no circling or direct approach.
- If helicopter activities take place in potential wolverine denning habitat during the sensitive denning period (after mid-February), a denning survey would be performed from fixed-wing aircraft prior to beginning operations. If a potential den location is found, an appropriate disturbance-free buffer would be established around the den.
- A disturbance free buffer of 1 km around known, occupied grizzly bear dens would be implemented to minimize disturbance to denning grizzly bears.
- All activities would comply with the parks' Superintendent's Compendium (2018 and as updated) regulations related to food storage and recommended best management practices for living and working in bear country. For the purpose of the food storage regulation, the word "food" includes the following: all food (regardless of packaging), all beverages (including alcoholic beverages), lawfully taken fish or wildlife, garbage, stock feed (processed feed and grains, etc.), and pet food. Additionally, equipment used to cook or store food includes the following: cooking utensils, pots/pans/plates, stoves, grills, empty or full coolers, storage containers with food or that had previously contained food (except approved bear resistant containers), beverage containers, and pet food bowls. Water stored in its original packaging is excluded from the following restrictions.
  - At all times in all locations, including the backcountry, all staff (NPS, Volunteers-in-Parks, contractors, etc.) would ensure that all bear attractants are attended at all times. All unattended attractants must be stored securely inside a building, a bear-resistant food storage locker (if available), in a hard-sided vehicle with doors locked and windows closed, or in an Interagency Grizzly Bear Committee (IGBC)-approved portable bear-resistant food storage canister; or disposed of properly in a bear-resistant garbage receptacle. Backpacks and/or daypacks containing unsecured attractants (i.e., not in a canister) must not be left unattended.
  - All project personnel must attend a briefing on proper food/attractant storage and bear safety presented by a qualified member of the park's bear management team or their designee. The park's Bear Management Office (307-739-3673) will be contacted ≥2 weeks prior to the desired start date to schedule a briefing.

- All human-bear conflicts must be reported to Teton Interagency Dispatch Center immediately (307-739-3301). All bear sightings must be reported to the park's Bear Management Office (307-739-3673) in ≤24 hours.

Table 3. Summary of Actions in the Alternatives

Action	Element	Purpose	Operational Window	Target[1]	Duration (days)	Frequency	Alt. A	Alt. B	Alt. C
Monitoring	Telemetry/observation fixed-wing flights	Monitor distribution, movement, demographics, and abundance, and support live-capture operations	Year-round	None	Monitoring/capture support: ≤12 flight days total; support for translocations (Alt C only): ≤5	As needed to support capture or monitoring efforts	X	X	X
	Camera traps	Population estimate	Year-round	None	Year-round in some locations; May−Oct. in others	Annually	X	X	X
	Helicopter survey	Population estimate	Dec−Mar	None	1−3 flight days	Annually with bighorn sheep survey	X	X	X
	Ground surveys	Population estimate	May−Oct	None	≤2 weeks	Annually	X	X	X
Live capture	Capture, radio collar, and release	Aid monitoring/disease testing	Dec−Mar	5−10 goats	2−5 days	As needed to facilitate management and monitoring and as funding allows	X	X	X
	Translocation	Population reduction	Dec−Mar or at other times of year as necessary	≤25% of existing population (≤25 goats)	5−10 days	Consider annually during population reduction when interest warrants and funding allows			X
Lethal Removal	Nuisance individuals	Reduce safety threat	Year-round	Targeted individual(s)	≤1 flight day/individual	As needed	X	X	X
	Aerial removal	Population reduction	Dec−Mar or other times of year as necessary	Alt A = 0; Alt. B ≈ 90% Alt. C ≈ 75%	Alt B and C: ≤5 flight days per management period, but weather dependent	Annually during population reduction		X	X
	Live capture and euthanize/ dispatch	Population reduction	Year-round	TBD	TBD	As needed		X	X

Action	Element	Purpose	Operational Window	Target[1]	Duration (days)	Frequency	Alt. A	Alt. B	Alt. C
Lethal Removal	Ground removal	Population reduction	Year-round	Alt A. = 0; Alt. B ≤ 20% over duration of plan; Alt. C ≤ 10% over duration of plan	Up to several days per goat	Consider annually during population reduction; as needed in perpetuity at low levels		X	X
Other Actions	Hazing	Reduce safety threat	Year-round	Targeted individual(s)	Several hours to several days	As needed in perpetuity	X	X	X
	Information/ Education/ Outreach	Reduce safety threat from rogue goat; inform public about mountain goat plan/management actions	Year-round	Affected publics	Duration of project	As needed but likely limited	X	X	X
	Area closures	Carcass management; reduce safety threat from rogue goats; human safety near active staging and management areas	Year-round	None	During lethal and non-lethal removal activities	As needed	X	X	X

[1]Target is defined as desired outcome.

Alternatives Considered but Dismissed

Removal of Mountain Goats by Public Hunting. Title 36 Section 2.2 (b) (1) of the Code of Federal Regulations (36 CFR 2.2 (b) (1)) states hunting shall be allowed in park areas where such activity is specifically mandated by Federal statutory law. While the 1950 enabling legislation for Grand Teton National Park allows for the controlled reduction of elk when necessary for proper management of the herd, with the assistance of qualified and experienced hunters deputized by the National Park Service, public hunting is not authorized in Grand Teton National Park's enabling laws. This alternative was dismissed because it would require a major change to Grand Teton National Park's enabling legislation.

Use of Skilled Volunteers to Assist with Ground-Based Lethal Removal of Mountain Goats. The rapid reduction of the park's mountain goat population is vital for the continued existence of the Teton Range bighorn sheep population. The mountain goat population is currently at a size where complete removal or a substantial reduction (as described in this plan) is achievable in a short time frame. However, if no action is taken, the apparent growth rate of this population suggests that mountain goat removal may become more challenging or possibly unattainable after three years. Additionally, the threats of competition and/or pathogen transmission from mountain goats could contribute to the rapid extirpation of the declining population of bighorn sheep.

Compared to the immediate need for the actions described in this plan, most animal removal programs in national parks involve managing native population numbers (e.g. elk and bison) or reducing large populations of nonnative animals over a longer period of time. The expected initial removal of approximately 90% of the mountain goats in the Teton Range within 1−5 years and the subsequent removal of a small number of goats that may remain or repopulate the area would be better achieved using skilled park staff and contractors. Because mountain goats are dispersed in backcountry areas, distant from road access, and seldom seen from park trails, there is little likelihood of successful expeditious control by volunteers on the ground. Thus, there would be little benefit in developing and managing a short-term ground-based skilled volunteer program to remove mountain goats. This alternative was dismissed because it is duplicative when compared to using skilled park staff and contractors to more effectively and efficiently remove the remaining mountain goats from the Teton Range.

Mountain Goat Removal Using Only Non-Lethal Methods. The capture and relocation of mountain goats may not be practical if there is not enough interest from agencies and organizations to accept the number of goats that need to be removed from the park. In addition, given the inaccessible and remote areas where mountain goats reside and low capture efficiency for mountain goats in the Tetons (i.e. large time investment to live capture a single individual) it would be very difficult and costly to safely achieve complete removal using only non-lethal means. An alternative has been retained (Alternative C) that proposes to use a combination of lethal and non-lethal methods to remove mountain goats. This alternative provides greater flexibility for the park to use non-lethal methods whenever possible. This alternative was dismissed because of its inability to resolve the purpose and need for taking action.

Fertility Control. Fertility control has been used in NPS units for population control of several ungulate species (Powers and Moresco 2015). The utility and appropriateness of this tool depends on the objectives for management. With the goal of eliminating exotic mountain goats and limiting adverse effects due to increasing numbers, fertility control could be a useful tool in helping achieve these objectives. Fertility control per se would not eliminate mountain goats from the park nor address possible pathogen transmission, competition, or vegetation concerns, but it could slow the growth rate and reduce the number of mountain goats that need to be removed. However, there is no fertility control agent currently approved for use in mountain goats and no effective delivery technique. Until the aforementioned

technical challenges are addressed, fertility control as a non-lethal technique in the toolbox (e.g., Alternative C) is not feasible. This alternative was dismissed because of its technical infeasibility and its inability to resolve the purpose and need for taking action.

Use of Only Non-Mechanized Transport to Manage Mountain Goats (Wilderness Minimum Requirement). Three options that do not use mechanized transport and temporary installations have been analyzed in the mountain goat management plan wilderness minimum requirement analysis (MRA; NPS 2017) for all alternatives carried forward in this EA. Luring and capturing mountain goats using non-mechanized transport and without the aid of temporary installations (e.g., lures and traps) would not be practicable for the following reasons: 1) Locating and capturing mountain goats on foot within the wilderness would require special expertise in high-elevation technical climbing over extreme terrain and in rapidly changing weather conditions. This would result in an unacceptable safety and health risk to individuals conducting field activities. 2) Ground-based monitoring and lethal removals would not be enough to meet the purpose and need of the EA, as the likelihood of successfully monitoring and removing mountain goats expeditiously would be difficult and improbable to achieve. This alternative was dismissed because of its technical infeasibility and its inability to resolve the purpose and need for taking action.

CHAPTER 3: Affected Environment and Environmental Consequences

This chapter describes the affected environment (existing setting or baseline conditions) and analyzes the potential environmental consequences (direct, indirect, and cumulative impacts) that would occur as a result of implementing the proposed alternatives.

Bighorn Sheep

Affected Environment

Rocky Mountain bighorn sheep are native to parts of Wyoming including the Teton Range in the northwest corner of the state. Historical records from fur trappers and explorers confirm the presence of bighorn sheep in this area. However, no reliable estimates exist for the size of the population historically, but it is thought that the bighorn sheep were more widely distributed and more numerous throughout the Teton Range prior to settlement of the surrounding area (Whitfield 1983). Bighorn sheep numbers declined as pioneers settled the area and by the 1950s the Teton Range bighorn sheep no longer accessed low elevation winter habitats in canyons and valleys on the east and west slopes of the range. Although the specific cause of the decline is not known, it was likely due to a combination of factors including development of low elevation habitats on the flanks of the Teton Range and in the valley bottoms, fire suppression and loss of open habitats, and possibly disease due to large flocks of domestic sheep grazing the west slope of the Teton Range and portions of the park (Whitfield 1983).

Currently, the Teton Range bighorn sheep herd is comprised of two subpopulations that occur in the north and south-central portions of the range (Figure 5; Whitfield 1983, Whitfield and Keller 1984, NPS unpublished data, Courtemanch 2014). The sheep herd occupies much of the higher elevations of the Teton Range, using constricted high-elevation windblown areas during the winter and broader areas of varying elevation during the summer and fall (Whitfield 1984, Courtemanch 2014). In general, bighorn sheep select open areas with good visibility in close proximity to steep and rugged terrain and forage on a

variety of grasses, forbs, and shrubs (Laundré 1994, Shackleton 2013, Courtemanch 2014). Bighorn sheep have high fidelity to seasonal home ranges and are slow to colonize new or currently unoccupied but suitable habitat (Risenhoover et al. 1988). The herd's range lies primarily within the park and on the west slope of CTNF, but it also occupies a small portion of the BTNF on the east slope of the Teton Range. Management of the herd and its habitat is coordinated between NPS, WGFD, and the USFS. The bighorn sheep are considered a core native herd by the State of Wyoming (Wyoming State-wide Bighorn/Domestic Sheep Interaction Working Group 2004), which means they have never been extirpated and repopulated with transplanted bighorn sheep. The USFS and WGFD have special designations for bighorn sheep which the NPS respects. WGFD considers bighorn sheep as a Species of Greatest Conservation Need (WGFD 2017b), which means they warrant increased management attention and funding, as well as consideration in conservation, land use, and development planning. Bighorn sheep are considered a sensitive species on the BTNF and on the Targhee portion of the CTNF. Sensitive species are those for which population viability is a concern.

Winter helicopter surveys have been conducted periodically to assess population numbers and trends. During the three most recent winter surveys (2015−2017) a total of just 57, 46, and 48 bighorns were counted in the Teton Range (WGFD 2015, 2016, and 2017a). Comparatively, the previous helicopter surveys conducted in 2008 and 2010 yielded counts of 96 and 81 bighorns, respectively. Currently the herd is estimated at about 80 individuals (WGFD 2017a). Prior to 2015, population was thought to be approximately 100−125 individuals. The cause of this apparent population decline is unknown. Due in part to its small size, the Teton Range bighorn sheep herd exhibits low genetic diversity and is genetically isolated from neighboring herds (Kardos et al. 2010). The two population segments two segments at the north and south ends of the range do not appear to interbreed with one another (Kardos et al. 2010).

Winter range for the Teton Range herd is currently limited to small areas of windswept alpine tundra, rock, and snow-free krummholz (high-elevation treeline areas of stunted, wind-blown trees) on ridges and slopes generally ≥8,500 feet (Whitfield 1983, Reid and Cain 1996, NPS unpublished data, Courtemanch 2014). Wintering conditions in these areas are extreme due to high winds, low temperatures, deep snow, and little available forage. These high-elevation winter ranges also predispose these bighorn sheep to sources of mortality not usually associated with more typical, low-elevation winter areas. Mortality due to avalanches and falls from cliffs is high, and starvation may also be important during some years (Reid and Cain 1996, Courtemanch 2014, NPS and WGFD unpublished data 2017).

Biologists have long recognized the potential for human disturbance of crucial bighorn sheep wintering areas in the Teton Range. Recent research by Courtemanch (2014) has demonstrated that the Teton Range bighorn herd is adversely affected by winter backcountry recreation. GPS-collared animals avoided areas of suitable winter habitat that experienced backcountry recreation, and animals exposed to high levels of winter recreation exhibited increased daily movement rates compared to animals exposed to low or no winter recreation (Courtemanch 2014). For bighorns that live at high elevation where winter conditions are harsh and deep snow buries forage and adds energetic costs to movements, energy conservation is critical to survival. Consequently, increased movements in response to backcountry activity can cause bighorn sheep to burn calories that are needed simply to survive the winter, resulting in reduced survival or reproductive potential.

To protect some of the most important areas for wintering bighorn sheep, Static Peak and the Prospectors/Mt Hunt complex have been closed to human entry during winter to provide secure wintering habitat. Both areas were known bighorn sheep wintering areas and once popular ski mountaineering destinations. Based on location data from radio-collared bighorn sheep (NPS unpublished data), other important bighorn sheep wintering areas within the park were identified in the early 2000s. However, closures were not implemented then because winter recreation use levels were relatively low at the time and the closures were deemed unnecessary. Since then, winter backcountry use has increased and

recreationists regularly access bighorn sheep wintering areas in the south, and frequently in some areas at the north end of the range.

Bighorn sheep are highly susceptible to pathogens that have been introduced by domestic livestock (particularly domestic sheep) and, consequently, disease (particularly polymicrobial bacterial pneumonia) plays an important role in hindering conservation and restoration of the species in much of its range (Buechner 1960, Wehausen et al. 2012, Manlove et al. 2016, Cassirer et al. 2017). Although all domestic sheep allotments in the Teton Range are now closed (except for an area where sheep are trailed and loaded along Highway 22 west of Teton Pass), domestic sheep still graze in the Snake River Range in Idaho and Wyoming approximately seven miles south of the southern boundary of the park. The existing domestic sheep allotments overlap with mountain goat range and disease testing indicated that mountain goats from the Wyoming and Idaho populations in the Snake River Range are positive for all the pathogens associated with polymicrobial pneumonia. Limited testing of the Teton Range bighorn sheep herd has detected two pathogenic agents indicating the herd may be immunologically naïve (i.e., not previously exposed) to most pneumonia-causing pathogens. However, only 18 animals have been tested since modern disease tests have been available and the missing pathogens could have simply not been detected (Butler et al. 2017).

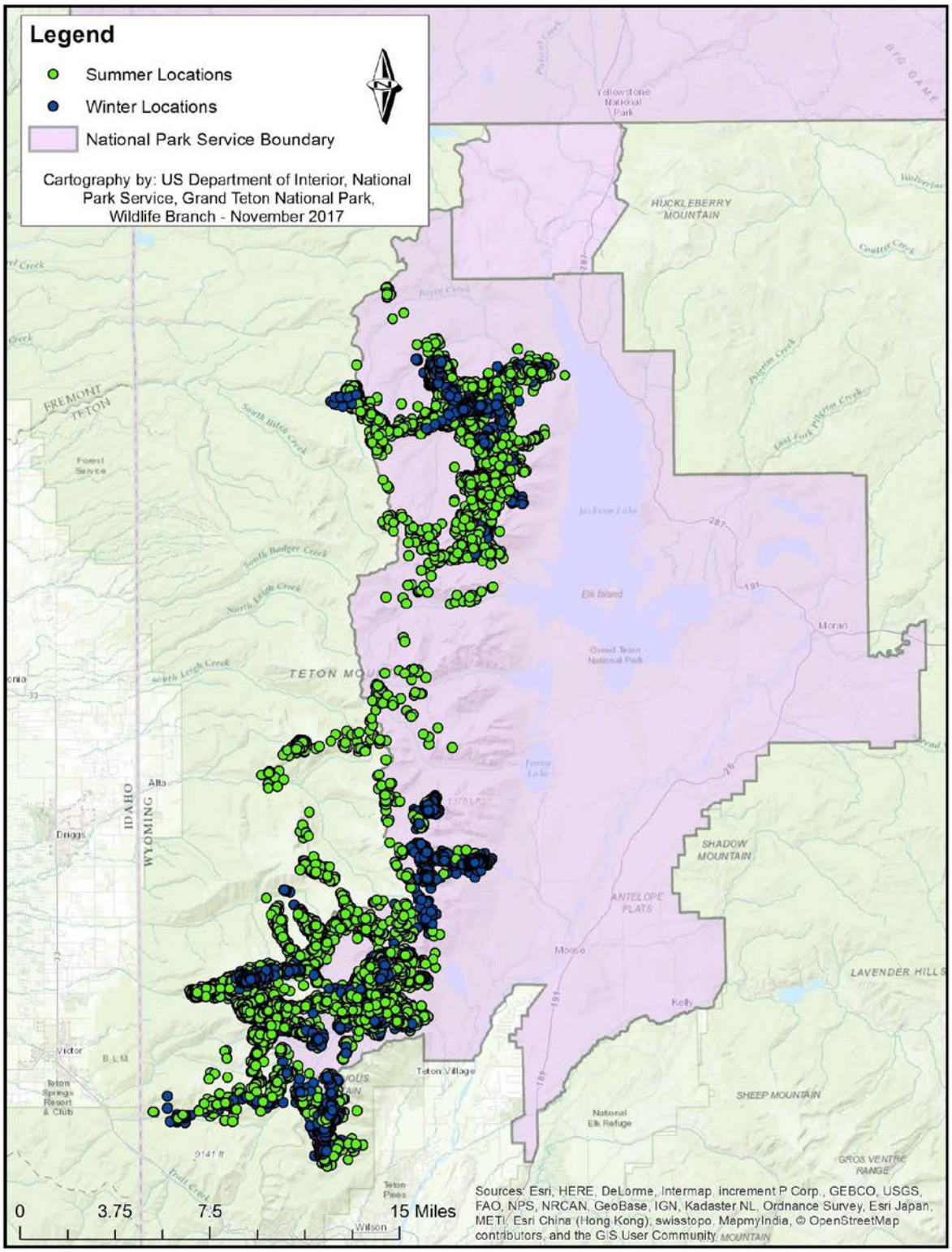

Figure 5. Global-positioning system locations of 28 adult female bighorn sheep that were captured and collared, Teton Mountain Range, Wyoming, 2008−2010. Green dots represent summer locations for all 28 individuals, while blue dots represent winter locations.

Environmental Consequences

Alternative A – No Action

Direct and Indirect Impacts

Under Alternative A, there would be no actions taken to actively reduce the number of mountain goats in the park. With no active management of mountain goats, it is expected that the population would continue to grow rapidly, with occasional population reductions resulting from disease outbreaks, weather conditions, density dependence, or other factors. Continued growth of the mountain goat population increases the likelihood that they will expand out of the current core use area in the central portion of the Teton Range and into areas at the north and south ends of the range that are currently used by and critical to the persistence of bighorn sheep. Given the severely limited extent of available winter range in the Teton Range, expansion of mountain goats onto these ranges would increase overlap between bighorns and mountain goats, and could result in displacement and/or competition adding to the stresses (e.g., energetic stresses, low genetic diversity, etc.) the bighorn sheep herd currently faces. In addition, as greater overlap with bighorn sheep occurs, the potential for transmission of pathogens between the two species is also expected to increase. Because the bighorn sheep population appears to be naïve to common pathogens found in neighboring bighorn sheep populations, an outbreak of pneumonia could be catastrophic for this herd. When a naïve herd of bighorn sheep is exposed to the pneumonia-causing pathogens, a pneumonia outbreak and subsequent die-off involving a significant portion of the herd often occurs. Often bighorn sheep herds see lingering effects (for several years) of a pneumonia outbreak on lamb survival that can prevent the herd from recovering (Cassier et al. 2013, Wood et al. 2017). Depending on the severity of an outbreak, the population could be severely reduced to a point where it is no longer viable or extirpated.

Indirect effects to bighorn sheep from the continued presence of mountain goats include degradation of habitat and impacts to the availability of forage. A recent habitat-modeling study in the GYE found that 75% of historic bighorn sheep observations in the ecosystem fell within areas predicted to be suitable mountain goat habitat (Devoe et al. 2015), supporting general notions that the two species occupy similar environments. Degradation of habitat and forage impacts could increase over time if the mountain goat population continues to grow and expand. DeVoe et al. (2015) estimated that the Teton Range could support a population of approximately 250−400 mountain goats, which is at least 2.5−4 times the current population size. The limited scope of actions proposed under Alternative A would not affect the projected population trajectory of mountain goats in the Teton Range. Thus, the negative impacts to bighorn sheep from the continued growth and expansion of the mountain goat population into new areas are expected to increase under Alternative A as the mountain goat population approaches carrying capacity. Where habitat use and diet between bighorn sheep and mountain goats overlap to a large degree, impacts from competition for habitat and food resources could be severe (Laundre 1990) as research suggests mountain goats may be socially dominant over bighorn sheep (Festa-Bianchet and Cote 2008). This could potentially further limit the habitat availability and quality for bighorn sheep in the Teton Range, which has already experienced dramatic limitations in habitat, especially in winter. Currently, there is limited overlap between mountain goats and bighorn sheep and competition is not likely occurring. However, as the mountain goat population continues to grow and expand into areas important to bighorn sheep in winter or summer, displacement or competition for resources may occur. In the long-term (5−10 years), if bighorn sheep are displaced from traditional seasonal ranges or shift away from areas used by mountain goats to areas of lower quality habitat, survival and reproduction could be negatively affected.

If individual mountain goats exhibited nuisance behavior that presented a threat to human safety, actions could be taken (e.g., hazing, removal, public education, or area closures) to address the issue. Individual

bighorn sheep in proximity to hazing or lethal removal actions could be temporarily (hours to <1 day) disturbed while these activities occur. The need for management actions to address nuisance mountain goat behavior is expected to be infrequent (to date there have been no human-mountain goat interactions that have warranted action) and actions associated with hazing or lethal removal are anticipated to be of short duration (hours to <1 day). Given the current separation between bighorn sheep and mountain goats and implementation of specific conservation measures for bighorn sheep, impacts to individual bighorn sheep are expected to be minimal and population-level impacts are not anticipated.

Actions to monitor mountain goats, including helicopter capture or surveying, could disturb individual bighorns present in the vicinity. In this context disturbance is defined as an activity that changes the regular behavior or routine on an animal (Government of Yukon 2006). The effects of aircraft operations on bighorn sheep can vary with intensity, duration, timing, predictability, proximity of operations to the animal, or location of the animal relative to escape terrain or secure habitat. Alternative A, would have the fewest number of days on which aircraft are used to perform monitoring or support management activities. Helicopter overflight or landing could interrupt normal activity patterns of bighorn sheep (i.e. resting, feeding, traveling, ruminating, etc.). When disturbed a bighorn sheep could increase its vigilance, flee, or stop eating or ruminating. Such impacts, if they occur, are expected to be short-term and limited to the time that helicopters are in the vicinity of bighorn sheep (hours to a few days). Currently, bighorn sheep and mountain goats occur in separate portions of the Teton Range, thus impacts from helicopter captures or surveys of mountain goats to individual bighorn sheep are expected to be minimal and population-level impacts are not anticipated. However, as the mountain goat population grows, distribution expands, and overlap between the goats and sheep increases, disturbance impacts from helicopter-based capture and monitoring activities could also increase, although any impacts are still expected to be temporary and limited to the time that aircraft are in the immediate vicinity of bighorn sheep.

Deploying and maintaining remote cameras at mineral licks would likely displace any individual bighorn sheep present in the vicinity at the time the site is visited. Initial camera deployment can take <1 hour, but subsequent visits usually require <15 minutes on site. Again, any bighorn sheep present would likely leave the area as they detect people approaching. Once humans are no longer present, bighorn sheep would likely resume their prior activities.

Cumulative Impacts

The geographic scope of cumulative impacts for bighorn sheep includes the areas of the Teton Range and adjacent Jackson Hole where the bighorn sheep herd historically occurred. The temporal scope is approximately 20 years, which is the estimated time it may take for mountain goats to fully occupy the Teton Range and reach carrying capacity. Past, present, and reasonably foreseeable future actions under Alternative A that have or could impact Teton Range bighorn sheep both within and outside the park include: trail maintenance, search and rescue operations, fire management activities (including long-term fire suppression), vegetation and exotic plan management, scientific or social science research and monitoring activities, year-round backcountry recreation, human development, ski area management, permitted helicopter skiing, public hunting (including bighorn sheep outside the park), current permitted domestic livestock grazing, past retirement of domestic sheep allotments, and overflights and airport activity.

As a result of past management actions and human activities, the size and geographic distribution of the Teton Range bighorn sheep herd has been reduced and the herd is now genetically isolated from neighboring herds. The amount of habitat available to Teton Range bighorn sheep has been reduced due to human disturbance and fire suppression. The bighorn sheep have lost access to their traditional low elevation winter ranges because of residential, agricultural, or commercial development in the valleys and

as a result of conifer encroachment and loss of seral foraging habitats due to fire suppression throughout the Teton Range. Additionally, ski area development has resulted in the direct loss of suitable bighorn sheep habitat; indirect loss of habitat through avoidance behavior and increased movements of bighorn sheep due to winter recreation that overlaps with important bighorn sheep wintering areas (Courtemanch 2014).

Fire can influence bighorn sheep distribution through changes in habitat conditions (e.g. vegetation type, seral stage, amount and quality of various habitats). Decades of fire suppression has altered natural fire regimes and changed vegetation and wildlife habitat. Continued fire suppression could result in further negative impacts to vegetation and wildlife habitat. Alternatively, decisions to manage wildfires could have long-term beneficial effects to bighorn sheep habitats if sight lines are opened and seral grass/forb habitats are restored. Fire can reduce dense forest growth improving sight lines which allow bighorn sheep to detect and evade predators. Improved forage conditions and increased forage availability also often result from fire and, when realized, may translate to higher survival and reproduction in bighorn sheep. The timing and specific locations of fire events would influence the magnitude and type of impacts and benefits. For example, fire management activities during the lambing season or near important habitat features (e.g., mineral licks, and water features) could displace bighorn sheep from these locations, whereas those occurring under other circumstances could have long-term beneficial effects as noted above.

Retirement of domestic sheep allotments on the west side of the Teton Range have had a beneficial effect on bighorn sheep by reducing the risk of contact and resulting pathogen transmission between domestic and bighorn sheep. However, domestic sheep grazing occurs on USFS lands in the Snake River Range directly south of the Teton Range and mountain goats there test positive for pneumonia-causing pathogens. The potential exists for mountain goats to disperse from the Snake River Range to the Teton Range. Although the likelihood of dispersal is unknown, it is likely related to population size: higher likelihood at higher population size. Although the risk of contact for new goats that disperse is unknown, the impacts of any contacts between mountain goats and bighorn sheep could be significant.

In the Teton Range outside of the park, many wildlife species, such as elk, mule deer, bighorn sheep, mountain goats, and predators, can be hunted. These seasons are managed by WGFD. Hunting in areas close to the park boundary could reduce the numbers of bighorn sheep within the park as these species generally range across political boundaries. However, hunting quotas are typically tied to herd unit objectives, and current harvest objectives for Teton Range bighorn sheep are conservative: 2 licenses for rams have been offered in recent years.

The park performs and authorizes various scientific surveys and research efforts within the action area (Figure 1). These studies have minimal impacts on wildlife and bighorn sheep in particular. These activities provide indirect benefits to wildlife and sheep by increasing the understanding of the status of wildlife populations and other resources of interest in the park. Wildlife monitoring from fixed-wing aircraft and helicopters occur within the action area several times throughout the year. Fixed-wing telemetry and observation flights have low potential to disturb bighorn sheep as these flights occur infrequently, at a time of year when habitat is not limiting, and generally are not over high use bighorn sheep habitats. On the other hand, winter helicopter surveys, helicopter supported search and rescue operations, and non-permitted scenic flight tours have some potential to disturb wildlife if they are encountered along flight paths. Such interactions could result in short-term (approx. $\leq$1 hour) increases in movement and physiological stress that would subside once the aircraft has passed. Aircraft landing and departing the Jackson Hole Airport typically follow designated flight paths away from the Teton Range, thus are unlikely to directly disturb bighorn sheep. However, incoming and outgoing aircraft and airport operations add to the background noise audible to bighorn sheep in the Teton Range.

Alternative A is expected to increase the likelihood for competition between bighorn sheep and mountain goats, particularly on limited winter ranges, as well as increase the potential for pathogen transmission between the two species. Although, wildland fire use or habitat treatments could have beneficial effects to bighorn sheep, the direct and indirect losses of habitat due to past, present, and reasonably foreseeable activities would continue to add to adverse cumulative impacts. Although some disturbance and behavioral changes associated with cumulative actions (e.g., visitation, some park operations, wildlife monitoring, etc.) would be temporary and small, others have had large-scale lasting impacts that continue to influence the tenuous status of the Teton Range bighorn sheep population. The incremental impacts of Alternative A would contribute substantial adverse impacts to those that are already occurring. If left unmanaged, the mountain goat population could impact the vital rates (i.e., survival/mortality, productivity, population change, etc.) of the bighorn sheep population and, thus, reduce the likelihood of population persistence.

Alternative B – Lethal Removal

Direct and Indirect Impacts

Impacts from monitoring mountain goats including deploying and maintaining remote cameras, helicopter captures, and helicopter based surveys would be the same as described for Alternative A.

Actions to monitor mountain goats, including helicopter capture or surveying, could disturb individual bighorns present in the vicinity. Helicopter overflights or landings could interrupt normal activity patterns of bighorn sheep (i.e., resting, feeding, traveling, ruminating, etc.). When disturbed a bighorn sheep could increase its vigilance, flee, and/or stop eating or ruminating. Overflights of bighorn sheep habitat could cause individual sheep below or in close proximity to become alert. Given the limited current spatial overlap between wintering bighorn sheep and mountain goats, bighorn sheep are not expected to be exposed to much direct overflight. Nevertheless, helicopter noise may still be audible from a distance, and sheep could be more alert while those sounds are audible (~5 minutes to 30 minutes). However, in locations where the two species co-occur in winter, it is likely that bighorn sheep would flee if a helicopter makes a direct or close approach (Frid 2003). Because relatively few mountain goats currently winter in areas used by bighorn sheep, such disturbance impacts are expected to be limited to the time it takes to remove those individuals (several minutes to several hours). Conservation measures aimed at minimizing disturbance impacts to bighorn sheep at the population scale would be implemented (see Conservation Measures to Reduce or Avoid Potential Impacts section). Minimizing disturbance impacts to bighorn sheep from aircraft based management activities through Conservation Measures would reduce the potential for negative behavioral responses (e.g. increased movements and energy expenditure, reduced energy intake, habitat shifts/abandonment, etc.) that could negatively affect reproduction and survival. While overflights of bighorn sheep habitat or removal actions (including landings) within bighorn sheep habitat could impact individual bighorn sheep as described above, these actions are not expected to have effects at the population level.

No impacts to bighorn sheep are anticipated from the use of low elevation frontcountry staging areas, as these locations are not within habitats used by bighorn sheep. However, short-term (several minutes to several hours), direct adverse impacts to individual bighorn sheep could result from mountain goat lethal removal activities due to noise and disturbance associated with the use of firearms and aircraft. The extent to which these impacts could affect the bighorn population would depend on the degree of overlap between the bighorn sheep and mountain goat populations.

Alternative B is expected to result in an approximately 90% reduction in the mountain goat population of roughly 100 animals (2018 estimate) within 1−5 years. Reduction and ultimate elimination of the

mountain goat population is expected to be beneficial to the bighorn sheep population in the long-term due to reduced risk of competition and pathogen transmission between bighorn sheep and mountain goats. Reductions in these risks could be achieved over a shorter seasonal time frame as well as overall time frame because of the greater efficiencies in lethal removal (minutes) compared to live capture and translocation (hours). Over the course of the population reduction phase (years 1-5), approximately 90-100 mountain goats would be killed and the majority of these carcasses would be left of the landscape. The number of individuals that would be lethally removed each year would depend on available funding and culling efficiency. At a minimum this could be 15-25 individuals annually or up to 75 individuals in the first few years.

In the short-term (several months annually over approx. 5 years), Alternative B would result in numerous carcasses on the landscape, which could result in temporary increases in the number of predators and scavengers for the time carcasses are present. Removal operations are expected to occur in the winter when bears (both black and grizzly) are hibernating. During the winter months, mountain goats generally occur at higher elevations than at other times of year (NPS unpublished data). Given the severe winter conditions and deep snow at these elevations, numbers of potential mammalian scavengers (e.g., wolverine, wolves, mountain lions, coyotes, foxes, etc.) would be low because travel is difficult and other food resources in the mountains are generally lacking. Similarly, numbers of avian scavengers (e.g., bald and golden eagles and corvids) are also expected to be limited that time of year. Carcasses would be relatively aggregated in space and time (e.g. primarily in the central portion of the Tetons where mountain goats occur for several weeks to several months in the winter/spring) and exploited by scavengers opportunistically. Although numerous carcasses on the landscape could affect the risk of predation on bighorn sheep such a response if not anticipated for several reasons. Scavenger and predator populations typically increase via immigration (individuals moving into an area) or demographically (food surplus leading to improved condition of adults, larger litters, and higher survival of offspring). In mid-winter, the wolverine is the species most likely to be present in the high elevations of the project area where mountain goats occur. Wolverines are territorial, occur at low densities, and have relatively large home ranges. If wolverines find and cache carcasses for later use, individuals may benefit through improved condition and higher survival or higher reproductive success. This is unlikely to translate into higher predation risk for bighorn sheep because mountain goats and bighorn sheep currently occur in spatially distinct areas and the availability of carrion may divert predation away from live prey.

Given implementation of specific conservation measures for bighorn sheep, adverse impacts to individual bighorn sheep from management actions are expected to be minimal and population-level impacts are not anticipated. Reducing the mountain goat population is also expected to benefit the Teton Range bighorn sheep herd by eliminating a major population-level threat. Overall, the effects of Alternative B are expected to be substantial and beneficial, effectively removing the risk of pathogen transmission (and subsequent risk of a disease outbreak) and competition for habitat and forage between bighorn sheep and mountain goats.

Cumulative Impacts

The cumulative impact scenario (geographic and temporal scope, past, present, reasonably foreseeable future actions) for the impacts on bighorn sheep would be the same as those discussed under Alternative A. Although the temporal scope of impacts from Alternative B would be ≤20 years, the mountain goat population reduction activities would mainly be limited to the first 5 years, with the most concentrated efforts to remove 90% of the animals in years 1−3. In later years, occasional actions would remove the few remaining goats, and any new ones that enter the park.

As described for Alternative A, other past, present, and reasonably foreseeable actions in the park and adjacent landscape have had and would continue to have overall adverse effects on bighorn sheep

primarily through the direct and indirect loss of habitat. These impacts influence the current distribution and tenuous status of the Teton Range bighorn sheep population. The potential direct and indirect impacts from Alternative B include short-term disruption of normal behaviors and increased stress in bighorn sheep during monitoring, removal, and/or other management activities. Reducing the mountain goat population is also expected to benefit the Teton Range bighorn sheep herd by eliminating a major population-level threat. Overall, the effects of Alternative B are expected to be beneficial, effectively removing the risk of pathogen transmission (and subsequent risk of a disease outbreak) and competition for habitat and forage between bighorn sheep and mountain goats. When the beneficial effects of Alternative B are combined with the effects of past, present, and reasonably foreseeable future actions, the total cumulative impact on bighorn sheep remains adverse. Because there are other stressors facing the Teton Range bighorn sheep herd not addressed by this plan the positive increment expected from Alternative B does not substantially change the overall cumulative impact.

Alternative C – Combination of Lethal and Nonlethal Removal

Direct and Indirect Impacts

Impacts related to management of nuisance mountain goats, lethal removal, and monitoring activities would be similar to those described under Alternative B. The impacts related to non-lethal removal of mountain goats via live capture and translocation would be similar to those described above under Alternative B for helicopter-based captures for monitoring purposes. During the first few years of active management, Alternative C would include live capture and translocation of mountain goats as well as lethal removal. Live capture and translocation requires more time per individual and is more costly than lethal removal. Consequently, the time to achieve a 90-100% reduction in the mountain goat population is likely to require the full time identified for the reduction phase (5 years). This would mean that risks to bighorn sheep from the presence of mountain goats would continue to exist until all mountain goats are removed. Because some mountain goats would be live captured and translocated, fewer individuals would be lethally removed over the course of the population reduction phase (years 1-5) and fewer carcasses would remain on the landscape. Potential impacts from carcasses remaining on the landscape would be similar to those described for Alternative B.

Indirect, adverse and beneficial impacts on bighorn sheep from the presence (or lack thereof) of mountain goats would also be similar to those described under Alternative B, although beneficial impacts may take longer to be realized due to the longer anticipated timeline for live removals. Any adverse impacts are expected to be short-term for duration that the mountain goat population persists, while beneficial impacts are expected to be long-term (10−20 years).

Cumulative Impacts

The cumulative impact scenario (geographic and temporal scope, past, present, reasonably foreseeable future actions) for the impacts on bighorn sheep is the same as described for Alternative B. Impacts on bighorn sheep from these past, present and reasonably foreseeable actions would be the same under Alternative C as those described for Alternative A.

As described for Alternative A, other past, present, and reasonably foreseeable actions in the park and adjacent landscape have had, and would continue to have, overall adverse effects on bighorn sheep primarily through the direct and indirect loss of habitat. These impacts influence the current distribution and tenuous status of the Teton Range bighorn sheep population. The potential direct and indirect impacts from Alternative C include short-term disruption (several minutes to hours) of normal behaviors and increased stress in bighorn sheep during monitoring, capture and translocations, removal, or other

management activities. Reducing the mountain goat population is also expected to benefit the Teton Range bighorn sheep herd by eliminating a major population-level threat. Overall, the effects of Alternative C are expected to be beneficial, effectively removing the risk of pathogen transmission (and subsequent risk of a disease outbreak) and competition for forage and other resources between bighorn sheep and mountain goats. When the beneficial effects of Alternative C are combined with the effects of past, present, and reasonably foreseeable future actions, the total cumulative impact on bighorn sheep remains adverse. Because there are other stressors facing the Teton Range bighorn sheep herd not addressed by this plan, the positive increment expected from Alternative C does not substantially change the overall cumulative impact.

Vegetation and Soils

Affected Environment

The Teton Range rises from the Jackson Hole valley floor (approx. 6,500 feet) to the top the Grand Teton (13,770 feet). Vegetation communities vary across this elevational gradient (Knight et al. 2014). Over 80% of the plant taxa in the park occurs within an elevation range of 7,500 to 11,000 feet. The affected vegetation environment can best be described in terms of vegetation communities – recurring assemblages of vegetation that include, and are characterized, by a suite of species. The Grand Teton National Park 2002−2005 Vegetation Mapping Project Final Report (Cogan, et al. 2005) and its appendices describe a total of 167 plant associations, while the accompanying map is divided more coarsely into 35 vegetation types, 24 of which occur in the project area. These vegetation zones and types are described in more detail below.

High-elevation plants experience harsh climatic conditions and a short growing season. They generally flower and reproduce in a short period of time in mid-summer. If plants are consumed or damaged at this time they will not only be destroyed but will not be self-replacing on the landscape. Winter feeding on senescent plant material removes biomass and alters plant conditions, but has less effect on reproduction than summer use of rapidly growing and reproducing plants.

Nonnative invasive plant species occur in the park, including areas where mountain goats occur. Invasive plants are more common in the lower elevation habitats than the high elevation vegetation types where mountain goats occur.

Soils in the park are described in the Soil Survey Teton County, WY Grand Teton National Park Area (USDA Soil Conservation Service 1982). Soils can be categorized in several ways: parent material, texture, or stability, and vary over the area of interest. The soils classified in the project area (USDA Soil Conservation Service 1982) are a mixture of Rubble land (talus and boulder fields), rock outcrops, and soils which are generally very shallow. Mid-slopes may have deeper soils. Slopes range from gently sloping to steep, thus soils can be highly erosive. More than 90% of the project area is classified as one of two units: the “Rock-outcrop-Rubble land Leighcan,” which makes up about two-thirds of the project area, and the “Starman-Rubble land-Midfork” unit makes up about one-third of the area. The project area is 40−45% rock outcrops, 20−25% rubble lands, and 30−40% soil. The soils vary with topographic position with generally thin cobbly soils on ridges, stony sandy loam soils on mid to upper slopes and deeper soils comprised of stony loam or stony clay loam on lower slopes and toe slopes. Poor soil development and frequent soil movement is common throughout the project area.

Alpine vegetation–True alpine vegetation communities occur in the park in locations ≥9,000 feet that are sparsely vegetated. These areas are intermixed with numerous non-vegetated cliffs and rock faces,

boulder fields, and snowfields. Mapped alpine vegetation occupies approximately 32,000 acres, including about 10,000 acres of alpine meadows and limestone pavement vegetation, and approximately 22,000 acres of cliff and talus sparse vegetation. These communities grow in sites with little soil development, subject to harsh weather conditions, and a brief growing season with shifts from water-saturated to drought conditions in a matter of days. These communities are dominated by perennial tufted or mat-forming herbs and by prostrate or ground-hugging shrubs. Dwarf shrublands occur just above treeline, occupy approximately 675 acres, and are dominated by two arctic willow (*Salix arctica)* associations – Arctic Willow-Alpine-Willow/White Marsh-marigold Dwarf-shrubland and Arctic Willow/American Bistort Dwarf-shrubland. These shrub communities occur in mosaics of meadows, tundra, talus communities, barren areas, and bare rock. Mat-forming cushion-plant alpine tundra communities include flowering plants (Rocky Mountain phlox (*Phlox multiflora*), twinflower sandwort (*Minuartia obtusiloba*), creeping sibbaldia *(Sibbaldia procumbens),* Gordon's ivesia (*Ivesia gordonii*), and matted buckwheat (*Eriogonum caespitosum*)), and grasses such as rough bentgrass (*Agrostis scabra*), Parry's rush (*Juncus parryii*), Payson's sedge (*Carex paysonis*), alpine bluegrass (*Poa alpine*), and tufted hairgrass (*Deschampsia cespitosa*). In talus, cliffs and rock crevices plant species including yellow dot saxifrage (*Saxifraga bronchialis),* alpine smelowskia (*Smelowskia calycina),* American rockbrake *(Cryptogramma acrostichoides),* and alumroot brookfoam *(Telesonix heucheriformis)* are more common.

Treeline vegetation–Treeline vegetation occurs commonly between 9,500−10,000 feet and is characterized by a mosaic of alpine vegetation and/or sub-alpine vegetation, and stunted or krummholz conifer trees which grow prostrate due to the harsh conditions. High wind, low temperatures, low moisture, and poor soil development characterizes the treeline and alpine areas. These "trees" generally reach only 3−4 feet in height with the occasional emergent trunk reaching higher. Dominant tree species include Englemann spruce (*Picea engelmanii*), subalpine fir (*Abies lasiocarpa*), and whitebark pine (*Pinus albicaulus*).

Sub-alpine mixed conifer forest–Sub-alpine forests dominate the landscape from about 7,000−9,500 feet. These forests can be dominated by one or several tree species: lodgepole pine (*Pinus contorta*), Engelman spruce, subalpine fir, and whitebark pine. The most common of these types is referred to as spruce-fir forest, and Engelmann spruce and subalpine fir are often co-dominant. Common understory shrubs include Rocky mountain maple (*Acer glabrum var glabrum*), gooseberry currant *(Ribes montigenum),* and grouse whortleberry (*Vaccinium scoparium*), and occasionally low-growing common juniper (*Juniperus communialis*). Common forbs include heartleaf arnica (*Arnica cordifolia*), broadleaf arnica (*arnica latifolia),* Hitchcock's smoot woodrush (*Luzula glabrata var hitchcockii),* spike trisetum (*Trisetum spicatum),* western sweetvetch (*Hedysarum occidental),* and goosefoot violet (*Viola purpuea* ssp. *venosa*). In many areas the spruce-fir forest is dense, blocking light, resulting in a relatively unproductive understory. Where whitebark pine is dominant, common understory species also include Ross' sedge (*Carex rossii*) and smooth woodrush (*Luzula piperi*).

Whitebark pine–Whitebark pine occurs primarily within the park's treeline vegetation and sub-alpine conifer forests as described above. At treeline habitats, whitebark pine occurs in scattered copses of stands and is typically stunted and growing prostate as krummholz stands. At lower elevations, whitebark pine occurs within mixed conifer stands and is less prominent at lower elevations due to increase conifer competition. Whitebark pine regeneration will occur throughout the elevational gradient within these zones.

The USFWS has designated whitebark pine as a "Candidate Species" under the Endangered Species Act (ESA) where a proposed rule of the ESA listing has been warranted but precluded from protection due to other priorities (USFWS 2011). As such, whitebark pine does not have ESA protection at this time. However, it is considered a species of concern for the NPS, thus requiring special attention and management consideration where warranted (NPS 2006).

Whitebark pine, throughout its range within the northern U.S. Rocky Mountains, has decreased significantly and it distribution, abundance and survival has been under threat due to a combination of nonnative white pine blister rust (*Cronartium ribicola*), native mountain pine beetle (*Dendroctonus ponderosae*), changes in fire regimes, and potential climate change scenarios (Tomback et al. 2001). In the park, as well as throughout its range in the Greater Yellowstone Area, whitebark pine is monitored to determine trends in the health, reproduction and survivorship of whitebark pine in the ecosystem (Shanahan et al. 2017).

Sub-alpine and montane shrubland–Occurring at elevations from 7,000−9,000 feet, montane and sub-alpine shrublands are generally located on slopes and in drainages. Species co-occur in both the montane and subalpine zones. Avalanche paths and small drainages are frequently dominated by species including Rocky mountain maple, mountain ash (*Sorbus scopulina),* serviceberry (*Amelanchier alnifolia*), huckleberry (*Vaccinium spp*), and in the montane zone small aspen (*Populus tremuloides*). Scrublands dominated by multiple willow species occur along streams and in areas of high moisture.

Sub-alpine herbaceous–Herbaceous meadow communities ranging from 8,000−9,500 feet include a wide range of flowering species. These can grow on slopes, in talus, at the bases of steep rock faces, and on ledges. Common species in these communities include tall forbs such as western aster (*Symphyotrichum ascendens*), subalpine fleabane *(Erigeron peregrinus*), sulphur Indian paintbrush (*Castilleja sulphurea*), and fireweed (*Epilobium sp*). Rocky outcrops and cliffs are home to species including spike fescue (*Leucopoa kingie*), wallflower (*Erysimum capitatum*), and Whipple's penstemon (*Penstemon whippleanus*). More mesic sites frequently include: alpine laurel (*Kalmia microphylla),* tall fringed bluebells (*Mertensia ciliate*), and shootingstar (*Dodecatheon pulchellum*). Drier and sparsely vegetated montane and sub-alpine slopes are more commonly dominated by forbs including Wyeth biscuitroot (*Lomatium ambguum*), hawksbeard (*Crepis spp.*), silverleaf phacelia (*Phacelia hastate*), and blue penstemon (*Penstemon cyaneus*).

Montane herbaceous meadows–These communities (6,500−8,500 feet) transition smoothly and overlap in composition with sub-alpine herbaceous communities. Mesic montane meadow dominants include tall fringed bluebells, common cow parsnip (*Heracleum maximum*), western coneflower (*Rudbeckia occidentalis*), sticky geranium (*Geranium viscossisimum*), fernleaf licorice-root (*Ligusticum filicinum*), and subalpine larkspur (*Delphinium occidentale*). Drier sites less commonly intergrade with the sub-alpine meadows and include a suite of more pre-dominantly lower elevation species such as arrowleaf balsamroot (*Balsamhoriza sagittata*), blue flax (*Linum lewisii*), yarrow (*Achillea millefolium*), and the suite of grasses, purple onion grass (*Melica spectabilis*), Sandberg's bluegrass (*Poa secunda*), Hood's sedge (*Carex hoodia*), and mountain brome (*Bromus marginatus*).

Montane mixed-conifer forest–Mixed conifer forests of the montane zone are commonly characterized by a shrubby or unproductive understory. Common tree species include lodgepole pine, Douglas fir, and subalpine fir. Understory species frequently include huckleberry (*Vaccinium* species), Geyer's sedge (*Carex geyeri*), Engelmann's aster (*Aster engelmanii*), and heartleaf arnica (*Arnica cordifolia*).

Environmental Consequences

Alternative A – No Action

Direct and Indirect Impacts

Mountain goats currently use different physical and vegetative habitats at varying levels (Schreiner 1994). Mountain goat-habitat analysis in the park and elsewhere indicate that mountain goats primarily use rock outcrops and cliffs, alpine vegetation and treeline vegetation, including whitebark pine stands. To a lesser extent, mountain goats use subalpine conifer, shrubland and herbaceous vegetation, and have shown the least use of montane forest and nonforest communities. Current effects to soils and vegetation from mountain goat presence observed by park wildlife staff on mountain surveys include seasonal herbivory, trailing, and trampling, and wallowing with localized direct impacts on high elevation vegetation and soils.

The mountain goat population would increase in size for the foreseeable future under Alternative A. Current impacts of mountain goats, include direct herbivory on individual plants (e.g., alpine and subalpine grass, forb, shrub and conifer tree species), and bedding and wallowing, which would negatively impact both vegetation and soils. With increasing population size these effects would increase (Houston et al. 1994).

Mountain goats are generalist herbivores and require plant nutrition to survive. They are known to spend most of their lives at high elevation areas, frequenting cliffs and ledges. They return to the same areas for the winter in most years, frequently to the exact locations for multiple years. These foraging behaviors have direct impacts on localized high elevation trees and plants by removing or disturbing them. High-elevation plants experience harsh climatic conditions and a short growing season. They generally flower and reproduce in a brief time in the mid-summer. If plants are consumed or damaged by mountain goats at this time, they will not only be destroyed but would not be self-replacing. Winter feeding on senescent plant material removes biomass and alters plant conditions, but has less effect on reproduction than summer use of rapidly growing and reproducing plants (Houston et al. 1994).

Mountain goat herbivory would affect some plant species more than others and may affect plant community composition. Some species would decrease and others would increase due to a combination of goat preference for certain species and species-specific characteristics, which include varied tolerances to herbivory, and effects of herbivory on regeneration (Houston et al. 1994). Mountain goats would cause greater vegetation impacts in the alpine and subalpine zones than in the montane areas due to the shorter growing season, shallower soils, and substantially more intensive use of these. In the subalpine zone, impacts of wallowing could include damage to and removal of grasses, forbs, and tree seedlings. Whitebark pine and subalpine fir are slow-growing high elevation trees whose seedlings could readily be uprooted by wallowing resulting in mortality and a lack of regeneration success.

Grazing pressure would likely intensify in the more commonly used habitats and in habitats that remain snow-free (e.g., rock outcrops, cliffs, and south-facing canyon walls). Tree and species that grow in these harsh conditions are likely to be most impacted and may not be able to maintain the population sizes in which they presently occur. As mountain goats are known to return to the same wintering sites year after year (Smith 2014), it is likely that localized areas would experience greater impacts.

An assessment of mountain goat locations by time and vegetation type (NPS unpublished data 2017) indicates that mountain goats spend over 45% of their time in areas of rock outcrops and cliffs, 23% in

Krummholz whitebark pine woodlands, and the remaining time in alpine herbaceous and other vegetation types. In particular, high elevation vegetation receives disproportionately higher use by mountain goats, due to animals seeking shelter in the harsh upper subalpine to alpine environments.

Soil effects would include erosion and compaction, which reduces available soil for plant growth. This decreases the potential for recolonization by native tree and other plant species, and likely decreases plant populations in the areas of high mountain goat use.

In addition to herbivory, trailing, and trampling, wallowing is mountain goat behavior with direct impacts on native vegetation and soils. Wallowing removes soil surface layers and that decreases water-holding capacity and the nutrients available for vegetation, and increases soil aeration and surface temperature. The soil disturbance from mountain goat wallowing provides less stability for plant regeneration. These changes to the soil can cause major shifts in plant community composition around wallow edges (NPS 1995).

Each mountain goat wallow results in approximately 20 square feet of vegetation removed, which results in exposed ground surface and disturbances to bare mineral soil (Festa-Bianchet and Côté 2008). This condition removes vascular and non-vascular plant material resulting in no growth, no photosynthesis, and an open area available for colonization by other plant species, native or nonnative. Seeds carried on the hooves or fur of animals, or by the wind are readily introduced to these areas. Increased erosion would result from exposure of the soil surface. The current number of goat-created wallows is unknown. However, it is anticipated that the estimated number of wallows would increase as the population expands proportionately under Alternative A.

Monitoring/management activities under Alternative A would include some use of artificial baits and helicopter-assisted capture of mountain goats for radio-collaring for future monitoring or to remove nuisance animals for human safety. These sites occur within the high-elevation vegetation types and can range from 400−3,600 square feet. The use of artificial baits (mineral licks) to attract mountain goats for monitoring, common to all alternatives, would likely result in increased bedding, trampling, and trailing effects on soils, and increased localized herbivory in one to two areas in the alpine zone which are likely to require decades to recover native plant community functions. Helicopter landings would target snowfields in the backcountry and existing staging areas/helispots to avoid affecting undisturbed vegetation. Backcountry landing locations would be recorded to facilitate any revegetation that might be needed, and would not be used repeatedly so any ground or vegetation disturbance is expected to be minimal.

Whitebark pine would continue to be impacted as mountain goats trample, wallow, and rub trees within the high elevation treeline and krummholz habitats. Impacts, as described above, from herbivory, trampling, and soil erosion and disturbance has occurred in and around whitebark pine stands. Under Alternative A, impacts from trampling and wallowing would become more prevalent as mountain goat populations increase, which would result in diminished vigor, abundance and survivability in whitebark pine at the localized level.

Overall, Alternative A would result in continued and increased adverse impacts on high elevation vegetation and soils due to higher mountain goat numbers and resultant increases in herbivory, as well as trampling, soil erosion, and disturbance associated with bedding, wallowing, and rubbing. The results of these localized impacts would increase the area of bare ground, decrease the abundance of native plant communities, and potentially lead to increase of invasive vegetation in the alpine and treeline habitats of the park. These negative impacts would increase over the long term as the mountain goat population grows. Vegetation removal and damage would be more severe in the high elevation areas goats currently prefer, and more areas would be affected as their range expands. The impacts would be geographically

localized and variable on the high elevation vegetation habitats where mountain goats occupy, specifically, rock outcrops, and alpine vegetation. Whitebark pine would be impacted as mountain goats trample, wallow tree-rub within the high elevation treeline and krummholz habitats.

Cumulative Impacts

Under Alternative A, the geographic scope of the impacts on vegetation and soils is the Teton Range alpine and subalpine environments where goats live, as well as areas near frontcountry staging areas/helispots. The temporal scope is the approximately 20-year life of the plan. Past, present, and reasonably foreseeable future human actions in the park that would have cumulative impacts on plants and soils include the impacts of park visitors and staff traveling primarily off-trail, vegetation monitoring and research activities, trail maintenance activities, and herbivory and trampling of vegetation by pack stock and other wildlife species. Introduction and proliferation of nonnative invasive plant species would occur within the park and the surrounding areas that impact soils and native vegetation. Collectively, all of these actions have had and would continue to have adverse cumulative impacts on vegetation and soils.

As previously described, the direct and indirect impacts of Alternative A on vegetation and soils, including krummholz and whitebark pine stands, would result in continued and increased adverse impacts on high elevation vegetation due to higher mountain goat numbers and resultant increases in herbivory, as well as trampling, soil erosion, and disturbance associated with bedding, wallowing, and rubbing. When the effects of the alternative are combined with other past, present, and foreseeable future impacts, the total cumulative impact on vegetation and soils would continue to be adverse. The incremental impacts of the alternative would contribute substantially to the impacts on high elevation vegetation and soils (7,500 to 11,000 feet in elevation) that are already occurring. The incremental impacts of the alternative would contribute slightly to, but not substantially to the impacts on lower elevation vegetation and soils (frontcountry staging areas/helispots) that are already occurring.

Alternative B – Lethal Removal

Direct and Indirect Impacts

Under Alternative B the impacts of nonnative mountain goat herbivory, trampling, bedding, and wallowing would be expected to decrease incrementally as the population of mountain goats in the project area decreases. This would improve overall and long-term ecosystem function as native plant growth and regeneration proceed naturally, unhindered by mountain goat herbivory, and soil disturbance. The diminishing of goat-caused disturbance and bare ground would also lessen the potential of nonnative plant species introduction. Similarly, as mountain goats and their impacts are diminished with incremental removal, high elevation whitebark pine and krummholz habitats would benefit with fewer and eventually no mountain goats trampling, wallowing and foraging within these habitats, thus supporting the perpetuation of native plant communities and processes. Baiting and capturing, as described in Alternative A, would be intensified briefly during goat removal operations. However, this short-term localized activity would cause minimal impact to native high elevation vegetation and soils.

Cumulative Impacts

Under Alternative B, the geographic scope and the past, present, and reasonably foreseeable future actions that adversely impact vegetation and soils would be similar to those described under Alternative A.

As previously described, the direct and indirect impacts of Alternative B on vegetation and soils, including krummholz and whitebark pine stands, would gradually result in a beneficial effect on high elevation vegetation. As the mountain goat population is reduced under this alternative, goat use of herbivory, trampling, soil erosion, and disturbance associated with foraging, bedding, wallowing and tree running would decrease incrementally. When the effects of the alternative are combined with other past, present, and foreseeable future impacts, the total cumulative impact on vegetation and soils would be adverse, then gradually beneficial as goats are removed. The incremental beneficial impacts of the alternative would contribute substantially to the impacts on high elevation vegetation and soils (7,500 to 11,000 feet in elevation) that are already occurring. The incremental impacts of the alternative would contribute slightly to, but not substantially to the impacts on lower elevation vegetation and soils (frontcountry staging areas/helispots) that are already occurring.

Alternative C – Combination Lethal and Nonlethal Removal

Direct and Indirect Impacts

Under Alternative C, there would be additional activity associated with increase handling of mountain goats in this alternative that would lead to more sites where localized vegetation would be affected. The removal of mountain goats would reduce adverse impacts on soils and native plant communities in the alpine and sub-alpine zones. Herbivory, wallowing, and soil compaction would be decreased, though not as rapidly when utilizing only lethal removal techniques. Backcountry work areas may lead to some impact on soils and vegetation as non-lethal removal may require more activity on the ground to process goats, however this impact would be short-term (1 to 3 years to allow for impacted vegetation to recover).

Actions under Alternative C would lead to diminishing adverse impacts and would also have localized beneficial long-term effect on high elevation vegetation and soils: it would reduce or eliminate mountain goat presence and diminish the impacts of nonnative mountain goat herbivory, trampling, and wallowing, thus supporting the perpetuation of native plant communities and processes. Similarly, as mountain goats and their impacts are diminished with incremental removal, whitebark pine and krummholz habitats would receive less adverse impacts with fewer and eventually no mountain goats trampling and wallowing within these habitats.

Cumulative Impacts

Under Alternative C, the geographic scope and the past, present, and reasonably foreseeable future actions that adversely impact vegetation and soils would be similar to those described under Alternative A.

As previously described, the direct and indirect impacts of Alternative C on vegetation and soils, including krummholz and whitebark pine stands, would gradually result in a beneficial effect on high elevation vegetation. As the mountain goat population is reduced under this alternative, goat use of herbivory, trampling, soil erosion, and disturbance associated with foraging, bedding, wallowing and tree running would decrease incrementally. When the effects of the alternative are combined with other past, present, and foreseeable future impacts, the total cumulative impact on vegetation and soils would be adverse, then gradually beneficial as goats are removed. The incremental beneficial impacts of the alternative would contribute substantially to the impacts on high elevation vegetation and soils (7,500 to 11,000 feet in elevation) that are already occurring. The incremental impacts of the alternative would contribute slightly to, but not substantially to the impacts on lower elevation vegetation and soils (frontcountry staging areas/helispots) that are already occurring.

Wilderness Character

Affected Environment

The mountain goat management area is located within areas identified as recommended, potential, or eligible for wilderness designation (Figure 1). The areas include approximately 143,000 acres in the park recommended in 1978 to Congress, and approximately 21,500 acres in the parkway, determined eligible by the National Park Service Director in 2013.

The impacts of each of the alternatives are based on the proposed mountain goat management plan wilderness MRA (NPS 2017) which focuses on the five qualities of wilderness character. Together, the five qualities are used to monitor how stewardship actions, impacts from modernization, and other changes occurring outside of a given wilderness area affect the wilderness area over time (NPS 2015a).

1. **Untrammeled:** *Wilderness is essentially unhindered and free from modern human actions that control or manipulate the community of life.*
2. **Natural:** *Wilderness maintains ecological systems that are substantially free from the effects of modern civilization.*
3. **Undeveloped:** *Wilderness retains its primeval character and influence, and is essentially without permanent improvements or modern human occupation.*
4. **Solitude or Primitive and Unconfined Recreation:** *Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation.*
5. **Other Features of Value:** *Wilderness may also contain other features of scientific, educational, scenic, or historical value.*

The **solitude or primitive and unconfined recreation** wilderness character analysis takes into consideration impacts on natural soundscape and visitor use and experience within wilderness. These two impact topics are included in the analysis below.

The **other features of value** within the wilderness consists of the Teton Range and surrounding lakes, Native American sacred areas and archeological sites, and historic trails and patrol cabins constructed by the Civilian Conservation Corps (NPS 2015a). Mitigation measures would be in place to ensure these other features of value are not adversely affected by the actions described in the alternatives. Therefore, the **other features of value** in wilderness character quality is not carried forward in the following impact analysis.

The following impact analysis pertains to the park wilderness areas for ≥20 years.

Environmental Consequences

The impacts described for each of the alternatives take into account the use of helicopters and fixed-winged aircraft (collectively called aircraft flight operations) and small temporary installations for the luring, capturing, and handling mountain goats and bighorn sheep. An alternative that does not utilize mechanized transport and installations was analyzed in the wilderness MRA and dismissed in the "Alternatives Considered but Dismissed" section of this EA.

Alternative A – No Action

Direct and Indirect Impacts

Under this alternative, it is anticipated that field activities would occur for ≥20 years. This alternative would have a negative effect on the **untrammeled** quality of wilderness due to the continuation of luring and live-capturing mountain goats for monitoring purposes and the disposal of carcasses if animals are seriously injured during implementation of non-lethal monitoring activities. This alternative would have a negative effect on the **undeveloped** quality of wilderness due to an estimated ≤20 administrative flight operations per year, the use of small installations (baits) to lure and capture mountain goats, and the placement of collars and/or other tracking devices to monitor mountain goat locations. Direct and indirect impacts from field activities would be ≥20 years due to the existence of lures and tracking devices in wilderness. This alternative would have a negative effect on the **natural** quality of wilderness because mountain goats would continue to inhabit and reproduce in wilderness. This alternative would have a negative effect on the **solitude or primitive and unconfined recreation** quality of wilderness because the occurrence of aircraft flight operations and other field activities would affect a visitor's solitude and/or primitive recreational use and experience.

Under Alternative A, wilderness character (collectively the wilderness qualities described above) would continue to be adversely affected over the long-term by the ever-increasing nonnative mountain goat population. This effect would persist as long as mountain goats are present in park wilderness. The short-term effects resulting from monitoring activities would exacerbate these effects, because these monitoring actions do nothing to remove the mountain goat population.

Cumulative Impacts

The NPS monitors wilderness character in the park wilderness areas to better understand and respond to cumulative impacts. Past, present, and reasonably foreseeable future actions that adversely impacts the five wilderness character qualities include a variety of actions undertaken by the NPS or by individuals or groups authorized under a special use permit or other approval. Administrative actions undertaken by the NPS within wilderness include activities that intentionally manipulate native and nonnative (exotic) vegetation and wildlife (native plant restoration, capturing and collaring wildlife, and using herbicides), and wildland fire management; utilize mechanized transport, motorized equipment, and structures and installations; and inventory, monitor, and research of the wilderness resource. Authorized activities routinely conducted by individuals and groups within wilderness that require a permit or other approval include backcountry camping, guided services, and commercial filming. Unauthorized visitor activities that occasionally occur within wilderness include backcountry camping in areas outside of designated camping zones or sites, guided services, commercial filming, and the intentional or unintentional collection or destruction of natural and cultural resources. These administrative and authorized activities would continue to have negative effects on the untrammeled, natural, undeveloped, and solitude or primitive and unconfined recreation wilderness character qualities. The duration of these effects would vary by season and year, but are expected to remain in the distant future (multiple decades) as long as these activities are permitted to continue to occur in wilderness.

The 2015 wilderness character monitoring baseline data value for authorized administrative flight operations in the wilderness is 47 operations per year. These operations would occur annually within the project area for wildlife research and monitoring; search and rescue operations; flight training; supply and infrastructure transport; trail, bridge, and cabin maintenance projects; and fire surveillance and suppression (NPS 2015a). In addition to these recurring administrative flights, ≤20 mountain goat-related aircraft operations would occur annually to monitor distribution, movement, demographics, and population numbers; conduct disease testing; and when needed, remove animals due to threats to visitor

and employee safety. An increase of 15% or more in the number of authorized administrative flight operations above the baseline number (seven additional operations per year) would be considered an adverse cumulative effect on the undeveloped quality of wilderness because the number of aircraft activities, especially during the winter months, would be noticeable by visitors. Any increase to the number and extent of visitor behavior restrictions, such as temporary area closures, would have an adverse cumulative effect on solitude or primitive and unconfined recreation quality of wilderness because the additional closures would likely affect more visitors. Conversely, the removal of all mountain goats from wilderness would have a beneficial cumulative effect on the natural quality of wilderness (NPS 2015a) because the nonnative species would be removed from wilderness.

Under Alternative A, the increment contributed by the direct and indirect impacts would result in no change in the cumulative impacts for the **untrammeled** quality in wilderness because the NPS is currently baiting, capturing, and collaring mountain goats for monitoring purposes (NPS 2015a). The increment contributed by the direct and indirect impacts of leaving goats in place would have an adverse cumulative effect on the **natural** quality of wilderness. The increment contributed by the direct and indirect impacts of ongoing authorized administrative flight operations up to 20 per year over the 2015 baseline of 47 operations would have a cumulative adverse effect on the **undeveloped** quality of wilderness. The increment contributed by the direct and indirect impacts of anthropogenic noise on the natural soundscape from the additional authorized administrative flight operations per year would have a cumulative adverse effect on the **solitude or primitive and unconfined recreation** quality of wilderness. Taken together, when the adverse effects of Alternative A are combined with the collective effects of past, present, and reasonably foreseeable future actions, the total cumulative impact on wilderness character (collectively the wilderness qualities described above), would remain adverse. The incremental impact of Alternative A would substantially change the overall cumulative impact because of the ever-increasing nonnative mountain goat population.

Alternative B – Lethal Removal

Direct and Indirect Impacts

Under this alternative, field activities that involve the lethal removal of mountain goats would likely begin at a higher intensity level and then steadily decrease as the goat population within wilderness is substantially reduced. Nevertheless, field activities to lethally remove goats would continue for ≥20 years. The lethal removal alternative would have a negative effect on the **untrammeled** quality of wilderness due to the continuation of luring and live capturing mountain goats for monitoring purposes and carcass disposal. This alternative would have a negative effect on the **undeveloped** quality of wilderness due to ≤35 administrative flight operations per year for lethal removal and monitoring activities, the use of small installations to lure and capture mountain goats, and the placement of collars and/or other tracking devices. This alternative would have a positive effect on the **natural** quality of wilderness because exotic mountain goats would be removed from wilderness. This alternative would have a negative effect on the natural quality of wilderness because carcasses would be disposed in wilderness. This alternative would have a negative effect on the **solitude or primitive and unconfined recreation** quality of wilderness because the occurrence of helicopter flight operations, other field activities, and potential short-term area closures would affect a visitor's solitude and/or primitive recreational use and experience.

Under Alternative B, wilderness character (collectively the wilderness qualities described above) would be mostly adversely impacted during the fall and winter months when lethal removal and monitoring activities occur. However, this short-term impact would diminish as the mountain goat population is removed or greatly reduced after the first one to five years resulting in a long-term benefit on wilderness character.

Cumulative Impacts

The NPS administrative actions, authorized and unauthorized visitor activities, and wilderness character monitoring 2015 baseline data explanation are the same as described above in Alternative A.

The increment contributed by the direct and indirect impacts would be slightly greater in the cumulative impacts for the **untrammeled** quality of wilderness because of the short-term (during scavenging and decomposition) presence of mountain goat carcasses. The increment contributed by the direct and indirect impacts would have a substantial cumulative beneficial effect on the **natural** quality of wilderness because mountain goats would be lethally removed from wilderness. However, due to lethal removal activities, there would be a short-term (during scavenging and decomposition) negative effect on the natural quality due to the presence of mountain goat carcasses. These carcasses may likely be utilized as a food source by native animals. The increment contributed by the direct and indirect impacts of increasing authorized administrative flight operations (days of flights) up to 35 per year over the 2015 baseline of 47 operations would have a noticeable cumulative adverse effect on the **undeveloped** quality of wilderness during the first one to five years. The increment contributed by the direct and indirect impacts of the additional administrative flight operations and related field activities that involve human created noise would have similar short-term and long-term adverse cumulative effects on the **solitude or primitive and unconfined recreation** as those described for the undeveloped quality of wilderness. Potential temporary area closures would have a noticeable cumulative effect on solitude or primitive and unconfined recreation. However, due to the long-term benefits to wilderness character as a whole (collectively the wilderness qualities described above), Alternative B would substantially change cumulative effects for the better.

Alternative C – Combination Lethal and Nonlethal Removal

Direct and Indirect Impacts

Under this alternative, field activities that involve the lethal removal of mountain goats would likely begin at a higher intensity level and then steadily decrease as the goat population within wilderness is substantially reduced. Nevertheless, field activities to lethally remove goats would continue for a period of ≥20 years. The lethal removal alternative would have a negative effect on the **untrammeled** quality of wilderness due to the continuation of luring and live capturing mountain goats and carcass disposal. This alternative would have a negative effect on the undeveloped quality of wilderness due to ≤50 administrative flight operations per year for lethal removal and translocation activities, monitoring, the use of small installations to lure and capture mountain goats, and the placement of collars and/or other tracking devices. These direct and indirect impacts for ≤20 years due to the existence of lures and tracking devices in wilderness. This alternative would have a positive effect on the **natural** quality of wilderness because exotic mountain goats would be removed from wilderness. However, due to lethal removal activities, there would be a short-term (during scavenging and decomposition) negative effect on the natural quality due to the presence of mountain goat carcasses. These carcasses may likely be utilized as a food source by native animals. It is anticipated that the number of carcasses would be reduced if translocation operations are successful This alternative would have a negative effect on the **solitude or primitive and unconfined recreation** quality of wilderness because the occurrence of helicopter flight operations, other field activities, and potential short-term area closures would affect a visitor's solitude and/or primitive recreational use and experience.

Under Alternative C, wilderness character (collectively the wilderness qualities described above) would be mostly impacted during the fall and winter months when lethal removal and monitoring activities

occur. However, this short-term impact would diminish as the mountain goat population is removed or greatly reduced after the first one to five years resulting in a long-term benefit on wilderness character.

Cumulative Impacts

The NPS administrative actions, authorized and unauthorized visitor activities, and wilderness character monitoring 2015 baseline data explanation are the same as described above in Alternative A.

The increment contributed by the direct and indirect impacts would result in no change in the cumulative impacts for the **untrammeled** quality of wilderness because the NPS is currently baiting, capturing, and collaring mountain goats for monitoring purposes (NPS 2015a). The increment contributed by the direct and indirect impacts would have a substantial cumulative beneficial effect on the **natural** quality of wilderness because mountain goats would be removed from wilderness. The increment contributed by the direct and indirect impacts of increasing authorized administrative flight operations up to 50 per year over the 2015 baseline of 47 operations would have a noticeable cumulative adverse effect on the **undeveloped** quality of wilderness during the first one to five years. The increment contributed by the direct and indirect impacts of the additional administrative flight operations and related field activities that involve human created noise would have similar short-term and long-term adverse cumulative effects on the **solitude or primitive and unconfined recreation** as those described for the undeveloped quality of wilderness. Potential temporary area closures would have a noticeable cumulative effect on solitude or primitive and unconfined recreation. However, due to the long-term benefits to wilderness character as a whole (collectively the wilderness qualities described above), Alternative C would substantially change cumulative effects for the better.

CHAPTER 4: Consultation and Coordination

In May 2013, the NPS sent letters to Wyoming Game and Fish Department (WGFD), Idaho Fish and Game Department, the US Forest Service (BTNF and CTNF), and the US Fish and Wildlife Service (USFWS). The letters announced the park intention to develop a mountain goat management plan and environmental assessment, and requested feedback on the proposal. Responses included support of the concept of controlling mountain goats in the park, the wish to be involved in further discussions if relocation outside the park is analyzed, interest in learning about NPS strategies to deal long-term with mountain goats that move into the park in the future, concern about potential disturbance to Teton Range bighorn sheep if an action alternative is selected, interest in better understanding the disease implications for bighorn sheep if the no action alternative is selected, and desire to work with the park analysis team on potential effects of the alternatives on adjoining National Forest System lands. During development of this plan, park staff have continued to coordinate with WGFD biologists regarding the status and management of mountain goats outside the park.

The park obtained an official list of endangered species from the USFWS Information, Planning, and Conservation System (IPAC) website (https://ecos.fws.gov/ipac/location/2FZ7E4JCV5FXXPR353WXKJ4USQ/resources) on 1/31/2017. Consultation will be initiated upon public release of the EA.

Public scoping to assist with the development of this document began on November 12, 2013 with a press release to media outlets and a letter (sent to approximately 450 interested parties, including individual members of the public, state and federal agencies, local town government, and non-government organizations). The public was directed to the NPS Planning, Environment, and Public Comment (PEPC) website for information, and asked to comment, identify key concerns, and provide ideas about how best to manage mountain goats in the park. The park received 22 correspondences during the public scoping comment period. Substantive comments included recommendations for the NPS to work closely with other agencies, to provide public education and outreach, and to focus on ecological integrity versus invasive species management; and concerns about the Teton Range bighorn sheep population, and about mountain goats continuing to come into the park after eradication efforts.

The park sent letters to 24 affiliated tribes (Coeur d'Alene Tribe of the Coeur d'Alene Indian Reservation; Assiniboine and Sioux Tribe of the Fort Peck Reservation; Comanche Nation, Oklahoma; Confederated Salish and Kootenai Tribes of the Flathead Reservation, Montana; Confederated Tribes of the Colville Reservation; Fort Belknap Indian Community of the Fort Belknap Reservation of Montana; Shoshone Tribe of the Wind River Reservation; Confederated Tribes of the Umatilla Indian Reservation; Crow Tribe; Arapaho Tribe of the Wind River Reservation, Wyoming; Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation; Blackfeet Tribe of the Blackfeet Indian Reservation; Shoshone-Bannock Tribes of the Fort Hall Reservation; Yakama Nation; Burns Paiute Tribe; Kiowa Indian Tribe of Oklahoma; Apache Tribe of Oklahoma; Nez Perce Tribe of Idaho; Rosebud Sioux Tribe; Kootenai Tribe of Idaho; Oglala Sioux Tribe; Standing Rock Sioux Tribe; and Yankton Sioux) in late 2013 and early 2014. The letter, as well as emails and telephone calls, informed them about the developing plan/EA, summarized how exotic mountain goats came to be in the park, and asked to hear concerns and ideas. Five tribes indicated they would like to be listed as interested parties and continue to hear from the park about the management plan. Subsequent letters were sent to the Tribes on August 2, 2018 requesting specific feedback on the alternatives and potential resource impacts. Tribal consultation is continuing.

The park's National Historic Preservation Act (NHPA) Section 106 Coordinator contacted the Wyoming State Historic Preservation Officer (SHPO) on April 6, 2018. The park's Coordinator and SHPO agreed

that the proposed actions described in this plan/EA would have "no potential to cause effect" on cultural resources. This informal determination and concurrence has been documented in writing for the administrative record. Archeological resources, historic structures, and cultural landscapes have been dismissed as impact topics.

NPS Preparers and Contributors

Rich Baerwald, Jenny Lake Ranger
Kate Birmingham, Branch Chief of Cultural Resources (acting)
Shan Burson, Soundscape Ecologist (retired)
Carson Butler, Biological Science Technician
Steve Cain, Senior Wildlife Biologist (retired)
Sue Consolo-Murphy, Chief of Science and Resource Management
Carol Cunningham, Technical Writer/Editor (retired)
Jim Dahlstrom, Snake River Ranger (former)
Sarah Dewey, Wildlife Biologist
Dave Gustine, Supervisory Wildlife Biologist
Kelly McCloskey, Ecologist
Daniel Noon, Chief of Planning
Dan Reinhart, Supervisory Vegetation Ecologist
Andrew White, Public Affairs Specialist
Margaret Wilson, Planner

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