ERRATA
August 2011

Sequoia and Kings Canyon National Parks
Sierra Nevada Bighorn Sheep: Research and Recovery Actions
Environmental Assessment
(June 2011)

The Sierra Nevada Bighorn Sheep Research and Recovery Actions Environmental Assessment (EA) was released for a 38-day public review from June 14 to July 21, 2011. The public review period for the EA was extended from its original 30-day period to meet USFS public scoping requirements. A total of 57 comments were received during the public review period. This included one letter from a state agency (Native American Heritage Commission), three letters from representatives/members of Wilderness Watch, one letter from the Backcountry Horsemen of California, and four letters from two bighorn sheep-related groups (Sierra Nevada Bighorn Sheep Foundation and Wild Sheep Foundation – California and National Chapters). There were also 13 form letters received.

These Errata (Part 1) documents minor edits to text in the EA. These changes correct, clarify or modify original text based on public comments. There are no edits or corrections which modify the determination of potential effects or which substantively amend proposed actions.

Part 2 documents substantive comments (stated by one or more respondents) received during public review, and park responses. Thirty-nine (39) comments (italicized) are grouped into 8 topic categories. No concerns surfaced during the review of the EA which had not already been considered during preparation of the EA. Several additional management or research actions were recommended by commenters during the review period; these are considered and addressed in Part 2. Finally, a number of clarifications were needed regarding information that was included in the EA (primarily about the potential effects to Sierra Nevada bighorn sheep, wilderness character, and visitor use and experience).

These Errata must be attached to the original EA to comprise the full and complete record of the environmental impact analysis completed for this initiative.

Part 1: Edits and Corrections to EA

The EA analyzed impacts from the 2-year research project on NPS lands and adjoining U.S. Forest Service (USFS) lands within Inyo National Forest (Inyo NF) as the USFS was considering issuing a permit for helicopter landings in wilderness. However, the selected action has been slightly modified, and wilderness lands within Inyo National Forest will no longer be utilized for the NPS research component of the project. Therefore, this project will not require a permit from the USFS, and Inyo NF will be preparing a separate environmental document to analyze the implementation of portions the Recovery Plan on USFS lands. This correction should be noted for USFS references within the description of alternatives within the EA. References to USFS projects are still applicable for the "Environmental Consequences" section, cumulative effects analysis.

1. *The term "GPS" is used quite a number of times. Within the introduction and within the text, it is referred to inconsistently. The correct reference is "Global Positioning System."*

This change has been made in the document on page 1, paragraph 3: Bighorn sheep movements would be remotely monitored using Very High Frequency (VHF) radio-transmitters and Global Positioning System (GPS) collars.

Part 2: EA Comments and Responses

This section summarizes the substantive comments that were received during the public review period of the EA. It does not include the entire correspondence text from any individual letter, but captures the primary concerns organized by topic. All correspondence received by the parks is contained in the Project administrative record.

Topic one: Potential Effects to Sierra Nevada Bighorn Sheep

1. *Netgunning operations have the potential to harm bighorn sheep in the short and long term. We are aware of a high mortality rate that approaches 15% when helicopters are used to capture bighorn sheep. Since fewer than 400 of these animals remain alive, capturing forty of them would result in the harassment, harm, and/or death of a significant proportion of the remaining population. Consider less harmful methods.*

We are unaware of studies that have reported a 15% mortality rate when helicopters are used to capture bighorn sheep. Nonetheless, as net-gunning and helicopter operations do have the possibility of disturbing, injuring or killing bighorn sheep, concern over these impacts is warranted, which is why ample research has been conducted on this topic.

For example, research comparing this technique to alternatives (e.g., drop-nets, drive-nets, chemical immobilization) has found that it is the safest method for bighorn sheep capture (Kock et al. 1987, Jessup et al 1988). Kock et al. (1987) found that only 2 of 137 (1.5%) of bighorn sheep captured with net-guns were accidentally killed and net-gunning had the lowest overall measure of risk (i.e., impacts of stress, capture myopathy, and accidental mortality) compared to other techniques. One year later, Jessup et al. (1988) further elaborated on the safety of the helicopter net-gun technique, stating that "…net-gunning was found to be the safest method for capturing bighorn sheep."

Specific to Sierra Nevada bighorn sheep, during 1999 to 2010, CDFG conducted 249 bighorn sheep captures, representing 180 individual animals range-wide. As a result of these captures (of which 240 were by helicopter net-gun), 8 mortalities occurred over the 10-year period, which represents a capture related mortality rate of 3.3% when using a net gun from a helicopter. This level of mortality is below the limits of the Recovery Permit issued from the USFWS.

Therefore, while implementation of this project might be expected to harm some of the bighorn sheep handled, the benefits of the data obtained to guide their recovery outweighs the possible negative impacts. This is fully evaluated in the Environmental Consequences section of the EA.

2. *The mere presence of helicopters (even without capture activities) can have significant adverse affects on bighorn sheep. One study (Stockwell et al. 1991) found that bighorn sheep were sensitive to disturbance by helicopters during winter and experienced a 43 percent reduction in foraging efficiency. Numerous other studies have also found that mountain sheep are dramatically affected by helicopter disturbance. See, for example, Bleich et al. (1990, 1994), and Frid (2003).*

Concerns regarding impacts to bighorn sheep foraging efficiency would be warranted if low-level helicopter flights (<100 m) were repeatedly occurring throughout the year (e.g., helicopter surveys, military flights, sight-seeing tours, etc.). The cumulative effects of such repeated flights can be problematic because, as the studies cited by the commenter indicate, bighorn sheep often do not become habituated to the disturbance; they are continuously disrupted throughout the year. However, the number of flights expected for this project is minimal (approximately 6 days/year, sometimes less; typically only 1-2 days

per year would be flown in any single herd unit) and only during certain times of the year. As a result, impacts to bighorn foraging are expected to be short-term (i.e., only during and shortly after helicopter flights). There would be no continual nor long-term disruption.

3. *Significant adverse sub-lethal and/or indirect effects would occur to Sierra Nevada bighorn, such as decreased long-term survival of captured animals, behavioral changes such as avoidance of key winter range, etc.*

We are unaware of any research indicating decreased long-term survival rates as a result of the proposed activities. Behavioral changes, such as winter range avoidance have been hypothesized to be caused by helicopter activities, but the available evidence suggests that winter range avoidance is actually caused by other factors. This is addressed on pages 17-18 of the Recovery Plan, which states:

> "Bighorn sheep herds in the Sierra Nevada ceased regular use of low elevation winter ranges during the 1980s. The timing of those changes in winter habitat use varied by herd from 1983 for the Sawmill Canyon herd to 1986 for the Mount Williamson herd and 1987 for the Mount Baxter herd (Figure 3). Similar changes in winter range use were observed for reintroduced herds. Wehausen (1996) considered three possible explanations for this behavioral change and concluded that widespread increases in mountain lion predation of bighorn sheep on winter ranges was the only one that plausibly explained this widespread phenomenon that was not synchronous, yet occurred over relatively few years."

Among the three possible hypotheses for winter range avoidance that Wehausen (1996) considered was that helicopter captures caused the shift in bighorn sheep behavior. Wehausen (1996) rejected this hypothesis for the following reasons: (1) previous helicopter activity did not cause winter range avoidance, (2) Mt. Baxter sheep wintered on low-elevation ranges immediately following helicopter activity, and (3) herds not subjected to helicopter captures also abandoned their winter ranges.

To further mitigate behavioral effects caused by helicopter capture, captures for monitoring purposes will primarily occur in October to avoid disturbing bighorn on low elevation winter range and during the rut. If animals remain at high elevation during winter because of mild snow or delayed onset of snow, monitoring captures may also occur in January to the first week of April, after the rut but before lambing season.

Literature cited:
Wehausen, J.D. 1996. Effects of mountain lion predation on bighorn sheep in the Sierra Nevada and Granite Mountaions of California. Wildlife Society Bulletin 24: 471-479.

4. *The proposed project would focus on capturing bighorn sheep within their east-side winter range. The bighorn sheep-after being substantially harassed, frightened, and stressed by numerous helicopter net-gun assaults within their winter range-may avoid portions of crucial winter habitats in the future. The Recovery Plan for the Sierra Nevada Bighorn Sheep (USFWS 2007) acknowledges that such capturing of Sierra bighorn is certain to cause "major disturbance" and may cause "winter range avoidance."*

There is no doubt that captures are a major disturbance, however the available evidence supports the conclusion that the disturbance is temporary. Helicopter captures have been hypothesized to cause winter range avoidance, which is why the *Recovery Plan* states on page 144 (where it appears that the text from this comment is derived from) that, "*If* (emphasis added) efforts to capture members of such small groups cause winter range avoidance, those efforts may trade off population recovery for easier and better

information." While helicopter capture-caused winter range avoidance has been hypothesized, the available evidence suggests that winter range avoidance is actually caused by other factors.

This is addressed on pages 17-18 of the *Recovery Plan*, which states:

> "Bighorn sheep herds in the Sierra Nevada ceased regular use of low elevation winter ranges during the 1980s. The timing of those changes in winter habitat use varied by herd from 1983 for the Sawmill Canyon herd to 1986 for the Mount Williamson herd and 1987 for the Mount Baxter herd (Figure 3). Similar changes in winter range use were observed for reintroduced herds. Wehausen (1996) considered three possible explanations for this behavioral change and concluded that widespread increases in mountain lion predation of bighorn sheep on winter ranges was the only one that plausibly explained this widespread phenomenon that was not synchronous, yet occurred over relatively few years."

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To further mitigate behavioral effects caused by helicopter capture, captures for monitoring purposes will primarily occur in October to avoid disturbing bighorn on low elevation winter range and during the rut. If animals remain at high elevation during winter because of mild snow or delayed onset of snow, monitoring captures may also occur in January to the first week of April, after the rut but before lambing season.

Literature cited:
Wehausen, J.D. 1996. Effects of mountain lion predation on bighorn sheep in the Sierra Nevada and Granite Mountaions of California. Wildlife Society Bulletin 24: 471-479.

5. *The proposed project conflicts with the Recovery Plan (USFWS 2007) in at least two significant respects. First, the Recovery Plan "calls for the monitoring of habitat use patterns only relative to winter ranges." Thus, the Recovery Plan clearly anticipated that Sierra Nevada bighorn sheep would not be subjected to the dangers of capture/collaring to facilitate the monitoring of summer habitats (as is proposed here by SEKI); the Recovery Plan clearly acknowledges the potential harm of doing so. And second, the Recovery Plan explicitly favors the incremental addition of telemetry collars to the Sierra Nevada bighorn sheep population during translocation projects (i.e., when sheep are already being captured for another purpose, as opposed to conducting stand-alone collaring projects, as SEKI proposes here). The Recovery Plan cautions that stand-alone collaring projects would be harmful, due to direct "major disturbance," and may cause sub-lethal effects such as winter range avoidance, and it notes that such unnecessary collaring projects "may trade off population recovery for easier and better information." SEKI should heed this warning and refrain from any action(s) that could risk, delay, or otherwise impede population recovery due to its desire for easier and better information.*

We disagree. As stated in the EA (pages 7-8; 18), the proposed project does not conflict with the *Recovery Plan* in any way.

Regarding the first point, the commenter has taken the quote from the *Recovery Plan* out of context. The full statement of the *Recovery Plan* regarding the use of collars (page144) is as follows:

> "While the recovery plan calls for the monitoring of habitat use patterns only relative to winter ranges, *telemetry collars placed on sheep to aid in population monitoring also can provide considerable other important information on home range patterns and changes in the distribution of bighorn sheep* [Emphasis added]. That information will be important for proper definition of populations and development of sampling strategies. Detailed data on movements of bighorn sheep also are important relative to understanding potential for disease transmission from contact with domestic sheep and among herd units (Gross *et al*. 2000, Zeigenfuss *et al*. 2000, Singer *et al*. 2001) and metapopulation questions regarding potential for gene flow and natural colonization (Schwartz *et al*. 1986, Bleich *et al*. 1990, 1996, Mills and Allendorf 1996). Monitoring of bighorn movements relative to diseases is particularly pertinent to the Northern and Central Recovery Units, which continue to have domestic sheep grazing in the vicinity. Data from GPS collars placed on rams in those areas will allow a more quantitative assessment of risk of contact with domestic sheep.
>
> Detailed information from GPS collars also can be used to research questions of habitat use by sex and season (White and Garrott 1990) at varying levels of detail relative to resource selection: home range delineation, habitat selection within home ranges, and use of foraging patches (Johnson 1980). Habitat suitability modeling using resource selection probability functions (Manly *et al*. 2002, Johnson *et al*. 2005) should help refine understanding of bighorn habitat in the Sierra Nevada. Those models should be useful in identifying important movement corridors, areas where natural range expansions are most likely to occur, and more quantitative assessment of areas for translocation, while better understanding factors determining carrying capacities (DeYoung *et al* 2000).
>
> Capture of animals for placement of telemetry collars can yield additional data not directly associated with the collars themselves, such as ultrasonography and serum assays to assess pregnancy status (Stephenson *et al*. 1995, Drew *et al*. 2001), ultrasonography to measure fat deposits (Stephenson *et al*. 1998, 2002), and serum assays of disease exposure. Radio-collared females can be monitored to determine birthing dates, lamb production, and lamb survival and recruitment to provide additional data on reproduction."

Further, the *Recovery Plan* also states on page 143:

> "Capture opportunities will be limited largely to low-elevation winter ranges because of logistical constraints."

Therefore, the *Recovery Plan* clearly supports both the use of collars and the capture of bighorn sheep on their winter ranges. When the recovery plan was originally drafted, helicopter capture aircraft and methods constrained their use to lower elevations. However, by employing different aircraft and methods, logistical constraints no longer limit captures to low-elevation winter range. Thus, captures for monitoring purposes will largely occur during October prior to the rut to avoid disturbing bighorn on low-elevation winter range. Capture methods are employed that minimize activity in sensitive habitats.

Regarding the second point, the full statement in the *Recovery Plan* pertinent to this discussion is as follows:

> "Consequently, the option of translocating sheep to add radio collars will have the advantage of not putting members of small herds through the major disturbance of capturing them during brief visits to winter ranges that these sheep may be hesitant to utilize. If efforts to capture members of

such small groups cause winter range avoidance, those efforts may trade off population recovery for easier and better information."

Nowhere is it stated in the *Recovery Plan* that captures not involving translocation are "harmful" or "unnecessary." It simply states that captures involving translocations are more advantageous (i.e., they can accomplish more objectives). Therefore, the *Recovery Plan* clearly supports captures that do not involve translocation.

6. *Bighorn sheep are easily stressed, and have been documented to be susceptible to a condition called "capture myopathy" when handled (see, for example, Bunch et al. 1999). Capture myopathy is a non-infectious disease characterized by serious damage to muscle tissues due to physiological changes following extreme exertion, struggle, and/or stress.*

   In one study, Kock et al. (1987b) documented capture myopathy (CM) in bighorn sheep captured via the net-gun method, and concluded that net-gunning "appears to have the potential to cause some post-capture CM mortality."

Because the commenter did not provide a full citation of the Kock et al. (1987b) study that is referred to, we are assuming that could be one of the two following studies:

Kock, M.D., D.A. Jessup, R. K. Clark, and C.E. Franti. 1987. Effects of capture on biological parameters in free-ranging bighorn sheep (*Ovis Canadensis*): evaluation of drop-net, drive-net, chemical immobilization and the net-gun. Journal of Wildlife Diseases 23: 641-651.

Kock, M.D., D.A. Jessup, R. K. Clark, C.E. Franti, and R. A. Weaver. 1987. Capture methods in five subspecies of free-ranging bighorn sheep: an evaluation of drop-net, drive-net, chemical immobilization and the net-gun. Journal of Wildlife Diseases 23: 634-640.

We have reviewed both papers and we cannot find the text that the commenter has quoted. Regardless, every capture method has the potential to cause some post-capture CM mortality, as stated in the Environmental Consequences section of the EA (pages 59-63). However, in animals involved in the two studies cited above, net-gunning produced the least amount of CM mortality relative to alternative techniques: zero mortality out of 137 captures. One year after these studies were published, Jessup et al. (1988) further elaborated on the safety of the helicopter net-gun technique, stating that "…net-gunning was found to be the safest method for capturing bighorn sheep."

7. *Capture can cause significant sub-lethal and/or indirect effects to bighorn sheep. For example, capture may alter individual (and/or herd) behavior, and may affect reproduction, social status (dominance), and other life history traits.*

We are unaware of any research indicating alterations in individual/herd behavior, reproduction, social status, or other life history traits as a result of the proposed activities. Behavioral changes, such as winter range avoidance have been hypothesized to be caused by helicopter activities, but the available evidence suggests that winter range avoidance is actually caused by other factors.

This is addressed on pages 17-18 of the *Recovery Plan*, which states:

"Bighorn sheep herds in the Sierra Nevada ceased regular use of low elevation winter ranges during the 1980s. The timing of those changes in winter habitat use varied by herd from 1983 for the Sawmill Canyon herd to 1986 for the Mount Williamson herd and 1987 for the Mount Baxter

herd (Figure 3). Similar changes in winter range use were observed for reintroduced herds. Wehausen (1996) considered three possible explanations for this behavioral change and concluded that widespread increases in mountain lion predation of bighorn sheep on winter ranges was the only one that plausibly explained this widespread phenomenon that was not synchronous, yet occurred over relatively few years."

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To further mitigate behavioral effects caused by helicopter capture, captures for monitoring purposes will primarily occur in October to avoid disturbing bighorn on low elevation winter range and during the rut. If animals remain at high elevation during winter because of mild snow or delayed onset of snow, monitoring captures may also occur in January to the first week of April, after the rut but before lambing season.

Literature cited:
Wehausen, J.D. 1996. Effects of mountain lion predation on bighorn sheep in the Sierra Nevada and Granite Mountaions of California. Wildlife Society Bulletin 24: 471-479.

8. *There exists the possibility that helicopter capture and/or collaring may affect the welfare of sheep populations in ways not currently understood and not considered in the present environmental assessment. An eight-year study of lamb survival and yearling recruitment in the Wheeler Ridge herd (Lamb survival and recruitment of Sierra Nevada bighorn sheep, Jensen, D., 2011) shows good correlation with number of adult ewes (R2= 0.724), indicating classic density dependence. Surprisingly, lamb survival and yearling recruitment shows an even stronger correlation to helicopter capture activity (R2=0.837). In years of high helicopter capture activity (such as that proposed for translocations to Big Arroyo and Laurel Creek) the herd experienced extremely low lamb survival and yearling recruitment. The number of winter range captures required to meet the needs of the Big Arroyo and Laurel Creek translocation goals could cause irreversible collapse of existing stock herds (Wheeler Ridge, Baxter, Sawmill, Langley).*

There is always the possibility that there are impacts to wildlife as a result of research activities that are unanticipated or not well understood. This is an issue that is inherent in all wildlife studies. However, the methods proposed in this EA are based on the best available science and have been proven to be effective for bighorn sheep management throughout the U.S., including Sierra Nevada bighorn sheep.

To achieve recovery goals set forth in the *Recovery Plan*, reintroductions are required, which necessarily means that bighorn sheep must be captured for transportation to release sites. While there are several different techniques that could be used to capture bighorn sheep, research comparing helicopter net-gunning to alternatives (e.g., drop-nets, drive-nets, chemical immobilization) has found that it is the safest method for bighorn sheep capture (Kock et al. 1987, Jessup et al 1988). Kock et al. (1987) found that only 2 of 137 (1.5%) of bighorn sheep captured with net-guns were accidentally killed and net-gunning had the lowest overall measure of risk (i.e., impacts of stress, capture myopathy, and accidental mortality) compared to other techniques (EA pages 17; 59-63). One year later, Jessup et al. (1988) further elaborated on the safety of the helicopter net-gun technique, stating that "…net-gunning was found to be the safest method for capturing bighorn sheep."

Specific to Sierra Nevada bighorn sheep, during 1999 to 2010, CDFG conducted 249 bighorn sheep captures, representing 180 individual animals rangewide. As a result of these captures (of which 240 were by helicopter net-gun), 8 mortalities occurred over the 10-year period, which represents a capture related mortality rate of 3.3% when using a net gun from a helicopter. This level of mortality is below the limits of the Recovery Permit issued from the USFWS.

Therefore, while implementation of this project might be expected to harm some of the bighorn sheep handled, the benefits of the data obtained to guide their management outweighs the expected negative impacts. This is fully evaluated in the Environmental Consequences section of the EA.

Regarding the correlations described in the comment that suggest helicopter capture and/or collaring are responsible for decreased lamb survival and recruitment at Wheeler Ridge, to our knowledge similar correlations have not been observed herd units outside of Wheeler Ridge, either in Sierra Nevada bighorn sheep or other bighorn subspecies. This suggests that while there is a correlation between helicopter activity and lamb survival and recruitment at Wheeler Ridge, it is unlikely that there is a cause and effect relationship. Other factors influencing productivity are more likely responsible, or this could be a spurious result.

Finally, since the recovery program began in 2001, hundreds of bighorn sheep have been captured and handled, while the population has increased from approximately 100 to 400 animals. It is difficult to envision how this population growth could have occurred if capture activity significantly influenced bighorn sheep vital rates and population dynamics; the creation of new herd units through translocation has constituted most of the increase in populations size.

9. *There is evidence that helicopter net-gun captures and collaring can have negative consequences for sheep that have not been considered in the current environmental assessment. A four-year study of rams on Wheeler Ridge (2006-2009) showed that collared rams had twice the mortality rate of uncollared rams (P=0.010). The relationship holds when the data is age-corrected (P=0.021). I have proposed that capture and collaring of older rams leads to loss of social status and contributes to increased mortality risk (Effect of capture and collaring on ram mortality risk, Jensen, D., 2010).*

To our knowledge similar data have not been observed herd units outside of Wheeler Ridge, either in Sierra Nevada bighorn sheep or other bighorn subspecies. This suggests that while there is a correlation between helicopter activity and ram survival at Wheeler Ridge, it is unlikely that there is a cause and effect relationship. Other factors influencing mortality are more likely responsible, or this could be a spurious result. How was the mortality of uncollared rams determined? One would expect that it would be far more difficult to detect mortalities of uncollared sheep in a rugged environment compared to collared ones.

In addition, the observed survival rates of rams at Wheeler Ridge are well within what would be expected based on studies in other areas of the country. This provides further evidence that there is likely nothing unusual about ram survival at Wheeler Ridge, especially with respect to collaring activities.

Finally, since the recovery program began in 2001, hundreds of bighorn sheep have been captured and handled, while the population has increased from approximately 100 to 400 animals. It is difficult to envision how this population growth could have occurred if capture activity significantly influenced bighorn sheep vital rates and population dynamics.

10. *It may be incorrect to assume that data from collared animals accurately represents the behavior of uncaptured sheep. The possibility of behavior modification on the part of collared sheep is completely ignored in the proposed research project. It has been my*

experience that collared sheep can exhibit hyper-vigilant behavior (exaggerated responses), particularly in regard to human activities, for extended periods of time following collaring (Response of bighorn sheep to helicopter capture activity, Jensen D., 2009). Before the proposed research project is initiated, research personnel should demonstrate that there are no significant differences between the reactions of collared and uncollared sheep to pack animals and human recreational activities (studies of this type are difficult, but not impossible). In the absence of such control studies data from recently captured animals is meaningless and may lead researchers to completely erroneous conclusions. The problem may be severely compounded if the test animals have recently been translocated into an unfamiliar environment.

The question regarding whether collared, or otherwise marked, animals behave similarly to uncollared animals is an important one, and it is inherent in all wildlife investigations in which animals are marked, not just this one. Investigators take every effort to ensure that marking techniques do not influence wildlife behavior, but in most instances, assumptions are made because of the difficulty (or impossibility) of designing a controlled experiment to test hypotheses regarding the impacts of marking techniques.

When considering the potential of obtaining biased data because of marking affects, one important question to ask is: "Would the information obtained from the investigation justify marking of animals, even if the data obtained is biased?" In this case, the answer is an unqualified "Yes." Radio-collars are the only way to obtain significant spatial information on species such as bighorn sheep, because the rugged terrain they inhabit precludes the utility of visual observations. As mentioned in the EA, alternatives for documenting space use of bighorn sheep were ruled out of consideration because the data obtained would be known to be biased (page 17). With collar data, there is potential bias, but this is by no means certain and we would rather generate large amounts of data they *may* be biased rather than small amounts of data that are *known* to be biased. In addition, secondary data obtained from collared animals, outside of spatial data (i.e., nutritional status, health/disease status, and pregnancy status by handling bighorn sheep during captures) has been used and would continue to be used to direct management and species recovery. The known benefits of using collars clearly outweigh potential impacts.

To allay some of the concern about whether collars influence long-term bighorn sheep behavior, the best available science on which we have to base decisions indicates that while there are certainly short-term impacts to bighorn sheep behavior from helicopter activities (and presumably fixation of collars as well), long-term changes in behavior are not expected unless that activity is repeatedly occurring throughout the year (e.g., helicopter surveys, military flights, sight-seeing tours, etc.). The cumulative effects of such repeated flights can be problematic because, bighorn sheep often do not become habituated to the disturbance - they are continuously disrupted throughout the year. However, the number of flights being proposed for this project is minimal (up to 6 days/year; but often less typically limited to 1-2 days/year for a given herd unit) and only during certain times of the year. As a result, impacts to bighorn foraging are expected to be short-term (i.e., only during and shortly after helicopter flights). There would be no continual disruption.

Therefore, although we agree that investigating impacts of collars on long-term sheep behavior is a worthy endeavor, we are satisfied that conducting such an investigation prior to beginning this project is unnecessary.

Topic two: Alternatives Considered but Dismissed

11. Consider the use of tranquilizing animals to reduce risk to bighorn sheep.

Chemical immobilization actually has a higher risk of injury to bighorn sheep than any alternative method (page 17 of the EA). In a comparison of the four most common techniques for capturing bighorn sheep (i.e., drop-nets, drive-nets, chemical immobilization, and helicopter net-guns), Kock et al. (1987) found that chemical immobilization had the highest combined measure of risk, while helicopter net-guns had the lowest. One year later, Jessup et al. (1988) further elaborated on the safety of the helicopter net-gun technique, stating that "…net-gunning was found to be the safest method for capturing bighorn sheep."

12. *Consider using paintballs to tag and count the animals instead of collars. Wait for injured animals to be brought in and fit them with collars upon release.*

Addressing the first point: We disagree; we cannot accomplish the same objectives without the capture and collaring of bighorn sheep. Aerial tagging with paint balls may be effective in producing an abundance estimate of bighorn sheep populations in a given area, but it would not meet the project objectives (pages 7-8 of the EA) to:

1a. Monitor indicators of population status such as recruitment and mortality, movements, body condition, disease, etc.
1b.Develop a predictive model of future bighorn sheep distribution to aid in identifying future habitat needs and movement corridors and selecting sites for reintroductions.

Also it would not provide information needed for developing the Wilderness Stewardship Plan, including:

2a. The degree of spatial overlap between bighorn sheep and areas grazed by packstock.
2b. The impacts of packstock on bighorn sheep forage resources.

Addressing the second point: We are unaware of a source of injured bighorn sheep.

13. *Consider closing all high country access to all pack stock to decrease the transmission of diseases. Separate domestic sheep from bighorn sheep.*

There is no evidence that pack stock such as horses and mules transmit disease to Sierra Nevada bighorn sheep. Domestic sheep are already prohibited within Sequoia and Kings Canyon National Parks because they do pose a disease risk to bighorn sheep. Outside the parks on USFS administered lands, the Inyo and the Humboldt-Toiyabe National Forests have removed domestic sheep grazing from several allotments that posed a threat of contact between domestic sheep and bighorn sheep.

14. *Culling/relocation of the mountain lion population would seem like a more effective approach towards the continued existence of this magnificent species.*

Selective mountain lion control is an important component of the recovery program outside the boundaries of Sequoia and Kings Canyon National Parks to reduce predation effects on bighorn sheep. The Recovery Plan states the following (page 49):

> "2.1 Prepare and implement a management plan to temporarily protect Sierra Nevada bighorn sheep herds from predation losses, where needed, until viable herd sizes are reached. The management plan must address the immediate needs for selective predator management while allowing for a long-range approach that restores and maintains the health of the larger predator-prey system. Known predation losses have been primarily attributed to mountain lions. Thus, efforts to prevent further losses should focus on this predator, but not ignore other potential predators.

Individual mountain lions can vary in behavior, including whether they prey on bighorn sheep and whether immigrating lions become potential threats for each herd when resident lions are removed. Therefore, this management plan should attempt to set up criteria to remove only lions that are a threat. Radio-collaring and careful monitoring of mountain lions near bighorn sheep winter ranges will help with selective removal. Additionally, the need to protect bighorn sheep should be carefully balanced with concerns for the viability of the mountain lion population. Potential effects of mountain lions on winter habitat selection by bighorn sheep should be included in this predator management plan. Predator management should be viewed as a temporary measure. It should be terminated when herd units reach a reproductive base of 25 females, with the possible exception of herd units serving as sources of translocation stock. It should be reinstated if a herd unit subsequently declines below 20 females and predators are preventing recovery of that herd unit. Biologists familiar with bighorn sheep have independently arrived at a threshold of 25 females as the minimum number for herd viability (Sierra Nevada Bighorn Sheep Interagency Advisory Group 1997, Fisher et al. 1999, U.S. Fish and Wildlife Service 2000)."

However, no mountain lion control is considered in this EA. If mountain lion population control is pursued in the future as a course of action within Sequoia and Kings Canyon National Parks, it would require additional information that is not available at this time (e.g. status of deer and mountain lion populations particularly within the reintroduction areas), and also the development of a separate management plan and environmental review under the National Environmental Policy Act, and therefore, is outside the scope of this analysis.

15. *Direct observation of habitat utilization by bighorn sheep, backpackers, and packstock could preclude the need to capture/collar bighorn sheep for such a study.*

Radio-collars are the only way to obtain significant spatial information on species such as bighorn sheep, because the rugged terrain they inhabit precludes the utility of visual observations. As mentioned in the EA, alternatives for documenting space use of bighorn sheep were ruled out of consideration because the data obtained would be known to be biased (page 17).

This project is relying on multiple sources of information (i.e., vegetation sampling of four different meadow conditions, direct observations of visitor use/packstock interactions with bighorn sheep, diet analyses, etc.) that will complement data collected on bighorn sheep movements and habitat use (see page 25). The cumulative information gained from these studies will provide a more complete picture of how recreation impacts bighorn sheep than either an observation study or a GPS collar study alone could.

Further, capturing bighorn sheep is essential to meet the other objectives of this project (see pages 7-8 of the EA), and to achieve the objectives of the *Recovery Plan*. In particular, reintroduction into Big Arroyo and Laurel Creek is impossible without first capturing sheep in the source herds (the reintroduction is referenced throughout the EA). Captures are also required for maintaining collars that are used for population monitoring (see pages 1-2 of the EA).

16. *Consider on-ground methods and research to determine the effects to bighorn sheep. Add additional research such as water quality monitoring and archeological surveys to your studies.*

Per the EA (page 25), on-the-ground studies are a component of the proposed project, including vegetation monitoring, a bighorn sheep diet study, and a visitor/bighorn sheep interaction study. As scientists are

conducting these studies, it is standard practice to note any archeological sites found and coordinate with the parks' archeologist.

Water quality monitoring has been ongoing in the park for years. There have been numerous studies within Sequoia and Kings Canyon National Parks since the 1980s conducted by the NPS and other agencies and scientists, including measuring lake chemistry, conducting water quality monitoring to determine impacts from visitor and administrative use, and an intensive study to look for contaminants in our ecosystem. Current the NPS is in year 2 of a 3-year-study looking at water quality and the effects that may be occurring from backpacker and stock use. While additional water quality data would be useful, it is not a component of the selected alternative.

17. *In addition to the no action alternative, you should consider alternatives for gathering any needed information about the critically endangered Sierra Nevada bighorn sheep without the need for invasive, harmful capture methods or intrusive helicopter operations. It should also craft and consider only alternatives that are consistent with the requirements of the Wilderness Act. For example, existing habitat models could be overlaid with SEKI meadows to predict/determine the suitability of SEKI's meadows as habitat for the Sierra Nevada bighorn sheep. This could provide a scientifically valid means of meeting management objectives without any need for capture/collaring or helicopter overflights of wilderness.*

Capturing bighorn sheep is essential to meet the objectives of this project, and to achieve the objectives of the *Recovery Plan*. In particular, reintroduction into Big Arroyo and Laurel Creek is impossible without first capturing sheep in the source herds (the reintroduction is referenced throughout the EA). Captures are also required for maintaining collars that are used for population monitoring (see pages 1-2 of the EA).

With respect to developing habitat models, while a large database of bighorn sheep observations has been collected by CDFG during the last several decades, inferences are constrained by sampling biases (based on sexes and ages of animals collared and locations where collars have been deployed) or incomplete sampling throughout the year (see page 2 of the EA). The additional captures proposed in this project will result in a more representative sample, which will improve our ability to make scientifically based, credible management decisions.

Per the comment about consistency with the Wilderness Act, the landing of helicopters is a *generally* prohibited activity as described in Section 4(c) of the Wilderness Act. This activity is allowed for wilderness managing agencies so long as it is the "minimum requirement" for the administration of the area for the purpose of the Act. This project will further the public purposes of recreational, scientific, educational, and conservation as defined in the Wilderness Act.

Therefore, while capturing bighorn sheep necessarily involves activities that will impact wilderness, these captures are essential to meet project objectives, which include stewarding bighorn sheep as a component of wilderness, and our analysis of the preferred alternative demonstrates that the benefits outweigh the impacts (see chapter 4 of the EA). Also, we determined that our method is consistent with the Wilderness Act and will provide for the long term preservation and restoration of wilderness character in that it will optimize the probability of the continued existence of bighorn sheep in these wildernesses, and restore them to wilderness areas where they once lived. As related to wilderness character and as stated in the EA, this action will have short term adverse effects on the elements of solitude, via helicopter noise, and untrammeled, via the manipulation of sheep in the ecosystem. Conversely it will have long-term benefits on the element of natural by ensuring that all is being done to ensure the survival of this critical species.

18. *Under the project description on page 26, the document stated that bighorn sheep staging areas would be located on the Inyo National Forest outside of wilderness. While the Inyo is a preferred logical location for staging areas, without being unable to predict either future knowledge or constraints, I recommend that the option be left open for doing the workups (staging areas) within the park wilderness or elsewhere. Because this species is easily stressed, minimizing impact to the species should take priority over temporary impact to the wilderness character.*

Bighorn sheep will need to be transported outside of SEKI wilderness for workups for 2 reasons: (1) because of logistical constraints (i.e., transporting work up equipment into the park is not feasible) and (2) to minimize impacts to wilderness. Work ups will not occur within the Inyo National Forest wilderness because they have not authorized the landings of helicopters in their wilderness areas.

Topic three: Clarification of the Project Components

19. *The objectives of the proposed study are very broad and vague, and the news release provides no details whatsoever about the specific monitoring questions or a research design capable of answering those questions. This is a serious concern because the stated objectives include such things as determining whether packstock or backpackers affect the selection and use of meadow habitats in SEKI, yet the only proposed action is to capture and collar endangered sheep. Simply collaring and tracking the movements of bighorn sheep cannot, by itself, provide information that would help answer such questions.*

Capturing and collaring bighorn is not the only proposed action. This project is relying on multiple sources of information (i.e., vegetation sampling of four different meadow conditions, direct observations of visitor use/packstock interactions with bighorn sheep, diet analyses, etc.) that will complement data collected on bighorn sheep movements and habitat use (see page 25 of the EA). The cumulative information gained from these studies will provide a more complete picture of how recreation impacts bighorn sheep than either an observation study or a GPS collar study alone could.

Further, capturing bighorn sheep is essential to meet the other objectives of this project (see pages 7-8 of the EA), and to achieve the objectives of the *Recovery Plan*. In particular, reintroduction into Big Arroyo and Laurel Creek is impossible without first capturing sheep in the source herds (the reintroduction is referenced throughout the EA). Captures are also required for maintaining collars that are used for population monitoring (see pages 1-2 of the EA).

The full text of the study plan has been posted on the NPS website at:
http://parkplanning.nps.gov/document.cfm?parkID=342&projectID=29693&documentID=41503

20. *Studies show that there is an increase in growth with the Bighorn Sheep, and history shows that the bighorn sheep naturally reproduce at slow rate. Apparently they instinctually maintain balance between population growth and survival. So it appears to me that we should leave well enough alone.*

Bighorn sheep have increased in abundance over the past 2 decades and the herd is estimated at close to 400 animals (pages 18-19 of EA). This is an increase from a low of 100 animals in 1995. However, there is little doubt that this comeback has been heavily facilitated by management actions. For example, since bighorn sheep were federally listed, CDFG has translocated bighorn sheep for three augmentations: 1) two rams from Wheeler Ridge to Mt. Warren in 2005; 2) five ewes from Wheeler Ridge to Baxter/Sawmill in 2007; and, 3) three ewes from Wheeler Ridge to Lundy Canyon and 3 ewes from Mt. Langley to Lundy

Canyon in 2009. Prior to listing, bighorn sheep were translocated from Baxter/Sawmill during 1979 to 1988 and resulted in the reestablishment of the Mt. Warren, Mt. Gibbs, Wheeler Ridge, and Mt. Langley herds (see page 5 of the EA). It is extremely unlikely that this level of recovery of bighorn sheep would have been reached if there had not been management intervention.

21. *The EA fails to consider other actions that could benefit bighorns other than the proposal to capture, collar, and translocate animals.*

The EA did consider other actions that could benefit bighorn sheep that do not include animal capture. For example, the selected alternative incorporates research and non-invasive data collection that is common to all alternatives, including the no-action alternative (i.e., vegetation monitoring, bighorn sheep diet analysis, analysis of visitor/bighorn sheep interactions). The data from these studies also would later be used in developing management alternatives in the parks Wilderness Stewardship Plan (EA page 25) that both benefit bighorn sheep and ensure recreational activities do not lead to unacceptable impacts.

22. *There is no reason given why the existing population won't expand into unoccupied habitat if given the chance. The EA states that recolonization may not happen in a "reasonable time," but "reasonable" is not defined, nor is it determined in the context of wilderness.*

There is a reason given why the existing population would not be expected to expand into unoccupied habitat. On page 3 of the EA, in the Purpose and Need section, we state:

> "Because bighorn sheep are naturally slow to disperse and colonize new habitat, occupation of Big Arroyo and Laurel Creek within a reasonable time period will ultimately depend on translocations of bighorn sheep from other areas."

Similar language may also be found in the *Recovery Plan* on page 47.

However, to expand upon this, while males have been occasionally documented to explore new ranges in search of females with which to breed, even down to the floor of the Owens Valley for example, females of all mountain sheep species (not just the Sierra Nevada subspecies) are known to have especially low dispersal rates. The consequences of limited female dispersal are summarized by Avis (1995) on pg 688:

> "For any species exhibiting strong matrilineal population structure as a result of limited female-mediated dispersal and gene flow, this genetic differentiation implies a considerable demographic independence among populations, at least over ecological timescales germane to immediate management interests. In other words, because recruitment is contingent upon female reproductive success, any population that is compromised or extirpated by human or natural causes will unlikely recover or re-establish in the short term via recruitment of nonindigenous females when female dispersal is low."

Historically, bighorn sheep naturally occurred throughout the Sierra Nevada in a "metapopulation," with numerous relatively distinct subpopulations that each occupied a patch of suitable habitat within a matrix of otherwise less suitable or unsuitable habitat. The complex topography and the vegetation structure of the southern and central Sierra landscape, coupled with the intrinsic biology and behavior of bighorn sheep resulted in a naturally fragmented distribution of animals that interacted intermittently to varying degrees, depending on site-specific geography, movement characteristics of males (occasional) and females (rare), and chance.

Persistence of such natural metapopulations can be high if (1) abundance within subpopulations is high and (2) the subpopulations are numerous. Occasional movements between subpopulations, primarily by males, will ensure genetic integrity. However, neither of these conditions occurs with Sierra Nevada bighorn sheep. The challenge of managing this species is that because the population is so small, stochastic events (e.g., disease, predation) could cause extinctions of subpopulations before colonization of new suitable habitat occurs, even if natural barriers are the only landscape factors limiting dispersal. In other words, if we rely on natural colonization of suitable vacant habitat by bighorn sheep (a process that would take decades or centuries), rather than assisting the process through carefully planned reintroductions, the risk of extinction is significantly elevated.

Literature cited:
Avis, J.C. 1995. Mitochondrial DNA polymorphism and a connection between genetics and demography of relevance to conservation. Conservation Biology 9: 6856-690.

23. *Are there human caused impediments that are inhibiting the expansion of the current bighorn sheep range? If so, actions to address those impediments should precede any consideration of the activities proposed in the EA.*

It is possible that there are human-caused impediments that limit bighorn use of habitat within the areas that they currently occupy (e.g., packstock use of meadows may cause sheep to avoid these areas, or hiker use of pass areas may disperse sheep away from human transportation corridors). At this point, the answers to such questions are unclear, which is why a variety of research activities to address this issue are being proposed (pages 8 and 25 of the EA). Such research necessarily involves activities that result in impacts to wilderness values however, and these impacts are analyzed in the EA.

On the other hand, it is very unlikely that human-caused impediments are involved in preventing bighorn sheep from expanding into suitable habitat that was formerly occupied, such as Big Arroyo and Laurel Creek. Historically, we believe that bighorn sheep naturally occurred throughout the Sierra Nevada in a "metapopulation," with numerous relatively distinct subpopulations that each occupied a patch of suitable habitat within a matrix of otherwise less suitable or unsuitable habitat. The complex topography and the vegetation structure of the southern and central Sierra landscape, coupled with the intrinsic biology and behavior of bighorn sheep resulted in a naturally fragmented distribution of animals that interacted intermittently to varying degrees, depending on site-specific geography, movement characteristics of males (occasional) and females (rare), and chance.

Persistence of such natural metapopulations can be high if (1) abundance within subpopulations is high and (2) the subpopulations are numerous. Occasional movements between subpopulations, primarily by males, will ensure genetic integrity. However, neither of these conditions occurs with Sierra Nevada bighorn sheep. The challenge of managing this species is that because the population is so small, stochastic events (e.g., disease, predation) could cause extinctions of subpopulations before colonization of new suitable habitat occurs, even if natural barriers are the only landscape factors limiting dispersal. In other words, if we rely on natural colonization of suitable vacant habitat by bighorn sheep (a process that would take time on the order of decades or centuries), rather than assisting the process through carefully planned reintroductions, the risk of extinction is significantly elevated.

24. *While I am in favor of continuing ongoing population monitoring of all existing herds, I do not see the need to continue the capture and collaring of animals to facilitate this effort.*

Radio-collars are the only way to obtain adequate spatial information on species such as bighorn sheep, because the rugged terrain they inhabit precludes the utility of visual observations. As mentioned in the

EA, alternatives for documenting space use of bighorn sheep were ruled out of consideration because the data obtained would be known to be biased (page 17).

Further, capturing bighorn sheep is essential to meet the other objectives of this project (see pages 7-8 of the EA), and to achieve the objectives of the *Recovery Plan*. In particular, reintroduction into Big Arroyo and Laurel Creek is impossible without first capturing sheep in the source herds (the reintroduction is referenced throughout the EA). Captures are also required for maintaining collars that are used for population monitoring (see pages 1-2 of the EA).

> *25. In light of all the past studies conducted on these animals by the Fish and Wildlife Services, the Sierra Nevada Bighorn Sheep Foundation, the California Department of Fish and Game, Sequoia and Kings Canyon National Parks, the U.S. Geological Survey, and the Inyo National Forest, why would you consider yet another study that could harm or kill bighorn sheep?*

The primary reason for conducting another study is to facilitate the recovery of this federally endangered species. In addition, information on nutritional status, health/disease status, and pregnancy status by handling bighorn sheep during captures would continue to be used to direct management and species recovery. There have been numerous studies and management actions conducted on Sierra Nevada bighorn sheep. Prior to listing, bighorn sheep were translocated from Baxter/Sawmill during 1979 to 1988 and resulted in the successful reestablishment of the Mt. Warren, Mt. Gibbs, Wheeler Ridge, and Mt. Langley herds (EA page 5). Since bighorn sheep were federally listed in 1999, CDFG has translocated bighorn sheep for three augmentations: 1) two rams from Wheeler Ridge to Mt. Warren in 2005; 2) five ewes from Wheeler Ridge to Baxter/Sawmill in 2007; and, 3) three ewes from Wheeler Ridge to Lundy Canyon and 3 ewes from Mt. Langley to Lundy Canyon in 2009.).The population has since increased from a low of 100 animals in 1999 to approximately 400 today. There is little doubt that this comeback has been heavily facilitated by management actions, and future work is needed to reach recovery goals.

In addition, mitigation measures required of CDFG by the USFWS recovery permit ensure that any incidental take of bighorn during captures will not significantly impact the growth or long-term viability of this population.

> *26. If bighorn sheep avoid or make limited use of certain meadows, it would not be possible without extensive direct observations (and/or GPS beacons on all stock/hiker groups who visit certain areas) to determine why the sheep are avoiding or limiting use of an area. SEKI cannot infer or conclude that a meadow (or other habitat) is unsuitable or non-preferred simply because bighorn sheep don't (or rarely) go there. The bighorn sheep may avoid many places because of direct encounters-or even the experience of past encounters-with packstock or backpackers.*

If an analysis of bighorn movements were the only study being proposed, the commenter would be correct. Inferences regarding the reasons why bighorn sheep select certain habitats would be speculative, and based on knowledge of bighorn ecology in combination with observed habitat use. However, this project is relying on multiple sources of information (i.e., vegetation sampling of four different meadow conditions, direct observations of visitor use/packstock interactions with bighorn sheep, diet analyses, etc.) that will complement data collected on bighorn sheep movements and habitat use (page 25 of the EA). Therefore, we will not be making conclusions about the reasons why bighorn select certain habitats simply because of their observed habitat use patterns. Other sources of data will be considered as well, allowing for a much stronger inference than a habitat use study alone.

27. *In order to determine the effects of packstock and backpackers on bighorn sheep, SEKI should at minimum: 1) articulate the specific research questions to be addressed; 2) design a study(ies) based on the principles of scientific experimentation that is/are capable of answering the research questions; and 3) obtain scientific peer review of the research design from multiple (at least three or four) external and unaffiliated scientists.*

The specific study components were not included in the EA. However, the NPS has posted the study "Determining the Relationship between Packstock and Sierra Nevada Bighorn Sheep in Sequoia and Kings Canyon National Parks: Are there Negative Effects?" on the NPS Planning, Environment, and Public Comment (PEPC) website at: http://parkplanning.nps.gov/SEKISHEEP. The study includes the methodology and research questions to be addressed. The study was developed by CDFG and USGS biologists who have more than 20 years experience in their fields. The study was peer reviewed by NPS biologists from Sequoia and Kings Canyon National Park, from the NPS Pacific West Regional Office, and biologists from the USGS and the USFS. Also the methods used are those recommended by the USFWS in the 2007 Recovery Plan, which was a multi-agency effort.

28. *A previously unknown herd (Bubbs Creek) has since been discovered in Kings Canyon National Park. This is the only herd of Sierra bighorn currently known to winter on western slopes of the range. This herd is well isolated from other herd units and could serve as a reservoir of healthy sheep in the event of a disease outbreak. I believe more effort should be devoted to determine how many other small isolated herds currently exist (sheep have been reported in the Window Peak region of Woods Creek).*

Nothing in the preferred alternative precludes efforts at surveying for such herds.

29. *If sheep are to be translocated to the Big Arroyo and Laurel Creek regions, it seems prudent to undertake a more diligent effort to determine suitability of habitat. Preferred habitat models of Sierra Nevada bighorn sheep indicate that the Big Arroyo and Laurel Creek areas of Sequoia National Park represent extremely poor sheep habitat. Of particular note is the almost complete absence of low-elevation winter range (even the Red Spur receives substantial snowfall in years like the winter of 2010/2011). All healthy herds of Sierra Nevada bighorn sheep (Langley, Baxter, Sawmill, Wheeler Ridge) share the common characteristic of having and utilizing substantial snow-free winter range.*

We are relying on the recommendations by the U.S. Fish and Wildlife Service (USFWS) that have been put forth in the *Recovery Plan* for implementation of the reintroduction portion of this project. Given that the inter-agency Science Team that reviewed the *Recovery Plan* was composed of bighorn sheep experts from the USFWS, U.S. Forest Service, National Park Service, California Department of Fish and Game, University of California, Hornocker Wildlife Institute, and the Sierra Nevada Research Center, we believe the best available science has been used to make site selections for reintroductions. Specifically, the suitability of habitat in the Big Arroyo and Laurel Creek regions is described in the *Recovery Plan* on pages 133-134 as follows:

> "There is good historical evidence of bighorn sheep on the Great Western Divide. They occurred in the Mineral King and Kaweah Peaks area, with notable concentrations on Red Spur and in Big Arroyo (Jones 1950). A die-off was reported in the Kaweah Peaks in the 1870s that was attributed to scabies (Jones 1950).
>
> Big Arroyo and Laurel Creek Herd Units: Bighorn sheep would have moved readily along the east-facing cliff areas of the Kern River Canyon in winter, but Big Arroyo, Rattlesnake Creek, and

Laurel Creek would have been particularly attractive due to south-facing exposures on which snow melts faster and forage grows earlier. These sites are probably the best ones for reintroductions. Since there are no high elevation windswept areas west of the Kern River, the issues in comparing these three winter range sites are: (1) elevation; (2) visual openness; (3) amount of south-facing range; and (4) access to alpine ranges. Minimum elevations differ little among the sites. Big Arroyo may have the largest amount of low open habitat, but there appears to be ample habitat at each site, and all three are substantially open with some scattered trees. The Chagoopa Plateau largely blocks access to alpine habitat from Big Arroyo, but bighorn sheep can be expected to find access to the Kaweah Peaks at the upper end of the drainage. Alternatively, Red Spur can be immediately accessed from the Kern River canyon. In contrast, Rattlesnake and Laurel Creeks provide immediate access to summer ranges. One alternative would be to release bighorn sheep along the Kern River near Red Spur and let them ultimately find Big Arroyo as a preferred winter range. Laurel Creek has the potential advantage of having no trails and, thus, probably the least human use."

Given both the documented presence of bighorn sheep in Big Arroyo and Laurel Creek historically and the analysis of habitat suitability in the Recovery Plan, we are confident that suitable winter range exists within the Big Arroyo and Laurel Creek herd units. However, as described in the EA on page 31, habitat suitability in the reintroduction areas will be further informed by the creation of a resource selection function (RSF) that would be developed after analysis of GPS data from bighorn sheep collared in 2011-2012. This analysis will assist in determining exact release sites and in predicting future habitat use.

30. *Sierra Nevada bighorn sheep have been driven to near extinction in the Sierra Nevada and it is only through aggressive recovery actions and scientific study that these populations have a chance of recovering to even a shadow of their former numbers. This has been well demonstrated in other areas of the Sierras where recovery has been seeded and monitored using helicopters and radio telemetry, respectively.*

We agree, and the actions included in the preferred alternative are designed primarily to facilitate recovery of bighorn sheep.

31. *Human recreational activity does not negatively affect sheep and it is extremely unlikely that pack animals will overgraze to the point that sheep will be affected. It is well documented that bighorn sheep habituate to most non-threatening stimuli. In Pine Creek Canyon, the Wheeler Ridge bighorn tolerate cars, trucks, heavy equipment and rock climbers by the hundreds. The Pine Creek pack station has operated in sheep habitat for years with no detrimental effects to the bighorn sheep in the region. Recognizing the fact that bighorn are not adversely affected by non-threatening human activity, the U.S. Forest Service, with encouragement from the California Department of Fish and Game, has recently opened the Sierra Nevada Bighorn Zoological Area to unrestricted recreational use.*

Anecdotal information does suggest that habituation of Sierra Nevada bighorn sheep to humans occurs in Sierra Nevada bighorn sheep. However, site-specific scientifically credible data (i.e., not anecdotes) is required because bighorn sheep populations have been documented to respond differently to recreational activity in different locations. The preferred alternative does not address management decisions regarding wilderness recreation.

Topic 4: National Environmental Policy Act/California Environmental Quality Act

32. *We request that a joint environmental impact statement and environmental impact report (joint EIS/EIR) be prepared. The regulations for both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) call for the preparation of joint environmental documents for joint federal/state projects.*

The EA was prepared by the NPS pursuant to the National Environmental Policy Act (NEPA, 1969, as amended), in accordance with NPS Director's Order 12, in cooperation with the CDFG, USGS, and the USFS. As cooperators, the USFS, CDFG, and USGS provided input on the EA to make sure it contains the best available and most complete information regarding alternatives, environmental consequences, and mitigation measures. Generally, because Sequoia and Kings Canyon National Parks are exclusive federal reservations, CEQA is not normally evoked. However, because the CDFG is a cooperator in this project, the EA was prepared in accordance with both NEPA and CEQA.

The USFS is currently preparing a separate environmental document to authorize the CDFG to land a helicopter when capturing Sierra Nevada bighorn sheep within wilderness areas in Inyo National Forest. Because wildlife management activities on Inyo National Forest lands are administered by the State of California, and the USFS proposed action is the issuance of a permit, not the implementation of the Recovery Plan, preparing a joint environmental document would not be appropriate since there would be no consistency in the proposed action between agencies. Therefore it was determined that the USFS and the CDFG would be cooperators on this effort, and that cross boundary effects would be analyzed in the Cumulative Effects section of the EA.

Topic 5: Effects to Visitor Experience and Recreational Opportunities

33. *The EA does not fully analyze the effects to visitor experience and recreational opportunities from the exclusion of recreational use, including humans and stock from various areas, including the Big Arroyo and Laurel Creek areas.*

As noted above, and discussed in the EA, there will be no changes to recreational use as part of the selected alternative. However, the research will be used to inform the development of alternatives in the Sequoia and Kings Canyon National Parks Wilderness Stewardship Plan / Environmental Impact Statement (WSP/EIS) (page 8 of the EA). Any future proposed changes in recreational use would be fully evaluated in the WSP/EIS, with opportunity for public review.

Topic 6: Wilderness Minimum Requirement Analysis and Minimum Tool Determination

34. *The use of a helicopter to assist in the preservation of an endangered species is contradictory of the stated goals of wilderness. There is no evidence that the proposed actions are the "minimum tool" for achieving the project's objectives. We believe the NPS has done a disservice to both the Wilderness and the bighorn by not considering a full range of non-invasive management actions that could improve conditions for bighorns without degrading the area's wilderness character or values.*

Proactive management actions, such as capturing bighorn sheep, are essential for meeting objectives of this project, and to achieve the objectives of the *Recovery Plan*. In particular, reintroduction into Big Arroyo and Laurel Creek is impossible without first capturing sheep in the source herds (reintroduction is addressed throughout the EA). Captures are also required for maintaining collars that are used for population monitoring (see pages 1-2 of the EA).

Therefore, while the expressed purpose and need for management actions necessarily involve activities that will impact wilderness in the short term, they are essential to meet project objectives and our analysis of the preferred alternative demonstrates that the long-term benefits outweigh the impacts (see chapter 4 of the EA). It was determined through the minimum requirement analysis process that the project activities were required in wilderness, as that is where bighorn sheep and critical bighorn sheep habitat occur, and that the purpose of the proposed activities includes restoring a component of wilderness character in the long-term by improving the natural condition of wilderness. The minimum tool was determined after consultation with subject matter experts and review of past and current research on bighorn sheep. Research comparing alternative techniques (e.g., helicopter/capture, drop-nets, drive-nets, chemical immobilization) has found that helicopter capture using net-guns is the safest method for bighorn sheep capture (Kock et al. 1987, Jessup et al 1988). This analysis is included in the EA as Appendix A

35. *Reestablishing extirpated species or increasing the numbers of rare species is not required to administer the Wilderness.*

The NPS has a legal requirement to adhere to the *Endangered Species Act*, per section 2(c)(1), which requires that all federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of the *Endangered Species Act* (page 9 of the EA). The *Endangered Species Act* also directs all federal agencies to cooperate in the conservation and management of federally-listed threatened and endangered species and their habitats (Sec. 7. [16 U.S.C. 1536] (a)). A key purpose of the proposed activities includes restoring bighorn sheep - a distinctive component of wilderness character - in the long-term, which is needed to improve the natural condition of wilderness in the parks. It is the policy of the National Park Service to restore native ecosystem elements and functions where feasible, including in Wilderness.

36. *There is a lack of evidence the project is necessary to meet minimum requirements to preserve the area as wilderness. The Wilderness Act prohibits the use or landing of aircraft (i.e., helicopters) in wilderness except in emergencies, rescue operations, and as necessary to meet the minimum requirements for the administration of the area to protect its wilderness character. SEKI has not shown, and must make a credible showing before allowing the use of aircraft within the SEKI Wilderness, that this project is necessary for this purpose or that the minimum requirements for the administration of the area cannot be met in any other way.*

The reference to the Wilderness Act is partially correct. §4(c) of the Wilderness Act specifically prohibits the "landing" of aircraft. The "use" of aircraft is not addressed. Regardless, prior to any prohibited action, including the landing of aircraft in wilderness, the NPS conducts a minimum requirement/minimum tool analysis and evaluates the impacts versus the benefits of the proposal. This is included in Appendix A of the EA and in the Environmental Consequences Section where the NPS evaluated the short and long-term, direct and indirect, and cumulative effects from the alternatives on wilderness character.

According to the Wilderness Act, science and conservation are two of the purposes of wilderness (§4(b)). Each proposed project element has been evaluated through the EA to determine the potential adverse and beneficial effects, and any element that is a prohibited use (as stipulated in §4(c)) was evaluated through a Minimum Requirements Analysis (Appendix A of the EA) to determine 1) if the action is indeed necessary in wilderness, and 2) what specific activities are the minimum necessary to complete the action, in order to help preserve wilderness character. Section 6.3.5 of NPS Management Policies 2006 states that the Minimum Requirement concept will be a two step process to determine (1) if the management action is necessary for administration of the area as wilderness and does not cause a significant impact to wilderness

resources and character, and (2) the techniques and types of equipment needed to ensure that impacts on wilderness resources and character are minimized.

In order to produce the data necessary to meet the goals of the Recovery Plan, and to meet the requirements of the *Endangered Species Act*, and to protect and restore the natural element to wilderness character by better protecting and restoring populations of bighorn sheep , the use and landing of a helicopter for capture, collaring, and translocation activities has been determined to meet the minimum requirement of the Wilderness Act, and is the minimum tool necessary to meet the project purpose, need, and objectives (Appendix A of the EA).

Topic 7: Effects on Wilderness Character

37. *The EA failed to consider the cumulative effects of this plan and other wilderness-degrading projects in SEKI. In particular, the use of helicopters in SEKI has become so routine that it is unlikely a visitor to the wilderness can escape the noise and intrusions from these motor vehicles. While the EA makes note that other helicopter use occurs, nowhere is the impact on visitors described or analyzed. Simply noting that an activity might occur is not the same as analyzing the impacts from that activity.*

The NPS fully analyzed the cumulative effects of the project on all applicable impact topics in the Environmental Consequences section of the EA (chapter 4). Specifically, the cumulative effects of the selected alternative on visitors, when compared with other past, ongoing, and future actions in wilderness, would be low as most other project activities occur during summer months, and this project would occur outside the primary operational season. In addition, the number of flights expected for this project is minimal (approximately 6 days/year, sometimes less). There would be a very low likelihood of overlapping project work in the same areas within the wilderness, and a low likelihood that visitors would be near or in the project areas.

Helicopter use within Sequoia and Kings Canyon National Parks is not a routine event. The parks use helicopters for emergencies, including fire, search and rescue, and law enforcement actions only when necessary. Any use of helicopters for administrative purposes (e.g. in support of trail maintenance, resources management, research, etc.) within wilderness is evaluated through a wilderness minimum requirements analysis (EA page 53). Helicopters are only used if the proposed management action is determined to be essential for the administration of wilderness, and if a helicopter is determined to be the minimum tool necessary to accomplish the work proposed. Between 2005 and 2009, helicopter use for administrative purposes decreased by nearly 65% within Sequoia and Kings Canyon National Parks as the parks have more frequently used stock, when possible, to transport supplies for project work.

38. *The impacts from helicopter use in alternatives 2-4 is treated very cavalierly. The impacts are dismissed as transitory and temporary even though there will be hundreds of flights and landings for the next decade or so. But the transitory nature doesn't diminish the impact of motor vehicles on an area set aside to be free from motor vehicles, nor does the fact that there will be times when helicopters associated with this project aren't in the area. The law abides no diminishment of wilderness character, no matter how much is left. There would be significant adverse effects to wilderness character (e.g., mechanized intrusion, noise, loss of solitude) due to using helicopters within designated wilderness.*

The NPS fully analyzed the effects to the wilderness character in the Environmental Consequences section of the EA (chapter 4). We acknowledge that manipulation of sheep in this project could result in short-term moderate adverse effects on the untrammeled wilderness character element of during sheep handling

operations. There would also be short-term minor adverse effects on the wilderness character element of providing opportunities for solitude or primitive and unconfined recreation due to the presence and use of helicopters. This project also introduces short-term visual and audio disturbance to visitors in the specific areas where the helicopter would be operating. Users who visit these areas during helicopter operations include cross country or wilderness skiers, however, due to the time of year, visitation in these areas is lower than other months of the year. Visitors may see and/or hear the helicopter when it is in flight.

However, these are transitory effects, limited to one day (or less) in each helicopter flight area. The helicopter may not be seen or heard continuously during the day from the same location, as flight paths may change depending on bighorn sheep locations or while the helicopter is parked at the base station. This would reduce the potential for recreationists in these areas to see or hear the helicopter. Potential helicopter landings are generally located above 9,000 feet and adjacent to steep topography, generally on wind-swept slopes. These locations are not ideal for winter recreation users as access is difficult and dangerous due to potential avalanches.

Based on this information, the effects on wilderness from the project activities would not be significant, and do not warrant the preparation of an Environmental Impact Statement.

Topic 8: Miscellaneous comments

39. *There is high probability that mountain lions are performing the same predator / prey function that wolves preformed on caribou in Alaska, only killing off the weak and diseased "hoofed species", while, the predator primarily lives on smaller species such as wolves on mice, or mountain lions on rabbits.*

The available evidence suggests that on the contrary, mountain lions do not prey on only weak and diseased Sierra Nevada bighorn sheep. Rather they often prey on prime-aged, healthy animals. There is substantial evidence that mountain lion predation causes significant direct mortality as well as indirect effects, such as causing bighorn sheep to avoid winter ranges, where predation most often occurs. For a review of the relationship between mountain lions and bighorn sheep, see USFWS (1999).

However, no mountain lion control is contemplated under the proposed action. If mountain lion population control were pursued in the future as a course of action within Sequoia and Kings Canyon National Parks, it would require additional information that is not available at this time (e.g., status of deer and mountain lion populations, particularly within the reintroduction areas), and also the development of a separate management plan and environmental review under the National Environmental Policy Act, and therefore, is outside the scope of this analysis.

Literature cited:

U. S. Fish and Wildlife Service. 1999. Emergency Rule To List the Sierra Nevada Distinct Population Segment of California Bighorn Sheep as Endangered. Federal Register 64 (75): 19300-19309.