

**Review of the
Cascade-Siskiyou National Monument
Study of Livestock Impacts on Objects of Biological Interest**

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Executive Summary

The Presidential Proclamation for the Cascade-Siskiyou National Monument identified that the impacts of livestock grazing on the objects of biological interest with attention given to sustaining the natural ecosystem dynamics of the land. To fulfill this aspect of the Proclamation, the Monument staff prepared a study plan that was revised after public comment and then was sent to a panel of scientists (David Pyke (Research Rangeland Ecologist, USGS), Robert Anthony (Research Wildlife Ecologist, USGS), Robert Beschta (Professor Emeritus, Hydrologist, Oregon State University), and Patricia Muir (Professor, Plant Ecologist, Oregon State University)) for their scientific peer review. The major findings and recommendations provided in this report are outlined below:

- The major strength of the study plan is its use of multiple lines of investigation to identify the degree of impact cattle grazing is having on objects of biological interest. The Plan provides an excellent representation of potential livestock impacts on vegetation.
- However, the study plan lacked a similar emphasis for determining the impacts of livestock on animals in the Monument. We recommend additional consideration of livestock impacts on animals be given in the Plan.
- We recognize that additional studies may require collaboration with other organizations or funding agencies, but we believe the BLM should insist that study plans and reports be scientifically peer-reviewed if they will be included as meeting an objective of the Plan.
- We recommend a list of the current threatened, endangered and sensitive species be included in the Plan with identification of those species that livestock might impact. These species should be prioritized for study and a rationale provided for the prioritization.
- Since the Plan will be used as part of the Framework for Making Future Decisions Regarding Livestock Grazing, we recommend the Plan include measurements of indicators relating to Standard 4 – Water Quality.
- Since the Plan will rely heavily on enclosure data for identifying many livestock impacts, we recommend additional enclosures in areas of moderate to high use by livestock. Enclosures in drier areas of the Monument would be useful in identifying upland impacts. Construction of some 3-way enclosures to exclude large ungulates should also be considered.
- Consideration should be given to inclusions of one or more larger enclosures (500 to 1000 ac)
- Since remotely sensed data might reduce human costs of monitoring, we believe a feasibility study of the use of Hyperspectral/LIDAR data for addressing some of the indicators of livestock grazing should be considered.
- We recommend the implementation of electro-shocking and snorkeling surveys for determining fish and amphibian abundances in streams, especially when these surveys are associated with measured impacts on riparian and stream habitat.

Process & Objective of the Review

The Bureau of Land Management (BLM) convened a panel of scientists to review and comment on a series of studies that compose the Study of Livestock Grazing Impacts on the Objects of Biological Interest for the Cascade-Siskiyou National Monument (CSNM). A core set of studies on plant community impacts were funded and conducted by the BLM. In addition, several studies on wildlife and plant species of interest were partially or totally funded by the World Wildlife Fund and are being conducted by contractors. The panel concentrated its efforts on the core BLM studies, but also reviewed and added comments, where appropriate for these additional studies.

The process used to conduct this review involved the BLM sending the following documents to the review team for their consideration:

1. Draft Study Plan of Livestock Impacts on the Objects of Biological Interest that was released for public comment. Hereafter referred to as the Study Plan.
2. The individual comments from the 69 letters received regarding the plan and the contact information for those individuals.
3. Cascade-Siskiyou National Monument, Study of Livestock Impacts on the Objects of Biological Interest. April 2001. USDI, BLM/OR/WA/PL-01/013+1792, Medford District Office, Medford OR – This includes the BLM’s response to these comments.
4. Contracted Studies:
 - a. Study design for using methods to measure livestock utilization in the Cascade-Siskiyou National Monument – JD Alexander, S. Kies (Klamath Bird Observatory) and P. Hosten, S. Slavic (BLM)
 - b. Study design for investigating the effects of livestock grazing on Greene’s mariposa lily (*Calochortus greenei*) in the Cascade-Siskiyou National Monument April 2003 and June 2003 – EJ Frost (Wildwood Environmental Consulting)
 - c. Study Design – Relative abundance and habitat associations of small mammals and herpetofauna in two forest types of southern Oregon – R Anthony, A Blaustein, & A Johnston
 - d. Population monitoring and grazing research for *Calochortus greenei* on the Cascade-Siskiyou National Monument – CA Menke and TN Kaye
 - e. Assessment of CSEEA rangelands data and monitoring protocols – JW Menke

On April 13, 2004, the BLM gave a presentation to the panel that covered the Study Plan and some of their preliminary results. The panel was able to question the BLM personnel during and after the presentation to gain further clarification regarding the studies.

Each panel member then prepared a set of review comments that were compiled into this review document and presented to the BLM for their consideration on July 22, 2004.

General Comments

This study is an important undertaking for the Bureau of Land Management and is a direct result of the proclamation issued by President William J. Clinton on June 9, 2000 that established the Cascade-Siskiyou National Monument (CSNM). That proclamation directed the Secretary of the Interior, through the BLM, to “study the impacts of livestock grazing on the objects of biological interest in the Monument with specific attention to sustaining the natural ecosystem dynamics.” The major strength of the Study Plan and associated studies (listed above) is the multiple lines of investigation that are being pursued to meet this directive. Botanical studies are an area of emphasis and are an important component of the overall effort. These include assessments of plant community change following livestock removal; willow and aspen establishment and growth following livestock removal; rare individual plants and plant communities; livestock enclosure studies; range condition and utilization; and proper functioning of riparian areas as well as monitoring of Green’s mariposa lily populations and exotic weed species, and historical photo-monitoring of plant communities. The results from the multiple studies should, collectively, provide evidence to determine whether livestock are impacting the dynamics of vegetation communities.

In contrast, the Study Plan lacks a similar emphasis on zoological components of the ecosystem. Studies of livestock impacts on fish habitat and on dietary overlap with native ungulates are included, but it lacks studies of impacts of livestock on threatened and endangered animals that occur in the monument. There is no list of the T & E species that occur on the Monument, nor is there any plan to assess the potential effects of livestock grazing on these species. Most of the studies on animal species and communities will be conducted by studies that are being funded by the World Wildlife Fund. Without those studies, there would be a significant neglect of the effect of livestock grazing on the zoological objects of interest. There are several threatened and endangered, sensitive, or species of special concern that are not adequately addressed including northern spotted owls, bald eagles, northern goshawks, pileated woodpeckers, willow flycatchers, American marten, red tree voles, beaver, Pacific giant salamanders, and tailed frogs. Most of these species are important components of ecosystems and could be considered as indicators of potential effects of livestock grazing on components of the ecosystem. The lack of attention to the zoological components of the ecosystem is something the panel feels the BLM should consider addressing in future studies.

Specific Comments

Many of the suggestions below reflect apparent gaps in the Study Plan. Although the Plan has been finalized as a written document, many of the following suggestions may be helpful in refining the plan and developing future documents associated with this study. It is our hope that some of these suggestions might be implemented as the study is continued.

Introduction

In the first paragraph, the Study Plan refers to a list of objects of biological interest. This list is limited for the faunal components of the monument and should be expanded in this area to include many of those animals that are currently being funded for research or might be funded in

the future. It is true that BLM may not have the funding currently to pursue studies of all of these organisms, but this document and future documents that list BLM's research needs for the CSNM should include these other organisms as they relate to livestock.

Monitoring Plan Strategy

The plan states that "individual monitoring projects will have clearly stated objectives and hypotheses with supportive predictors/standards defined." In general, we found that projects met these guidelines with two exceptions: (1) several project descriptions include specific objectives but no hypotheses are formally stated, and (2) acceptable thresholds of change have not yet been defined for several projects. The lack of hypotheses isn't an issue, since the objectives are clearly stated as are approaches to data analyses, but the statement that all monitoring projects will be associated with specific hypotheses and that thresholds will be defined should be revised to fit reality.

Description of the Cascade-Siskiyou National Monument (Fragmentation and Study Impacts)

The Monument includes about 60% non-federal lands. The private lands are scattered throughout the Monument leading to considerable fragmentation of federal land by private lands, and vice versa. Many study locations are located less than one mile from private lands with several adjacent to private lands (see maps 46 & 47). If the potential exists for management or land use to change across these ownership boundaries, then this situation should be noted and considered in several of the studies. The potential effects of fragmentation and landscape corridors should be considered under the Plan. Differences in livestock management on two sides of an ownership boundary will be relatively important for wildlife studies. Roads have been shown in several recent studies to be corridors for weed spread. This could be an important component to consider in the LIDAR project and the general landscape/plant community condition survey for Klamath River Ridges project and weed monitoring surveys.

Oregon Standards for Rangeland Health and Guidelines for Grazing Management Framework for Making Future Decisions Regarding Livestock Grazing

These sections created some confusion for the panel and we believe that some reordering of this information in the document might resolve this confusion. The Study Plan states that livestock studies will contribute information that may be used to determine if the Standards of Rangeland Health are being met. However, it is not clear whether the studies described in the Study Plan will be the only information obtained to address these Standards. This should be clarified.

Many of the indicators that are listed with asterisks, indicating that the livestock studies will contribute information about them, are not clearly identified in the study objectives. For example, the amount and distribution of litter and bare ground as well as erosion and overland flow are indicators for Standard 1 – Watershed Function. Yet, the study has no objectives, hypotheses or methods that explicitly state how to collect data for these indicators. The same is true for Standard 2 – Watershed Function – Riparian/Wetland Areas. Indicators such as channel sinuosity, pool/riffle ratios, pool size and frequency are listed as indicators that the study will

contribute information, but no objectives, hypotheses, or methods are presented indicating how to collect data for these indicators.

We suggest that this section be modified to reflect accurately and identify the studies by objective number or by additional studies (e.g., the World Wildlife Studies) that will contribute information to each Standard. If this Study Plan is intended to document the connection between individual studies and Rangeland Health Standards, then the methods for each measured indicator should be provided in enough detail so that reader can understand the connection between the study and the Standard. For example, collecting plant community data using point intercept techniques will allow the collection of soil surface parameters, but the objectives and methods do not provide this explanation.

The Framework for Making Future Decisions Regarding Livestock Grazing section seems to be well organized and thought out, but it would be helpful if an explanation would be given regarding how the objects of biological interest will be considered in the decisions regarding the future of livestock grazing. The Study Plan is vague regarding how the results from studies might be included in decisions regarding future livestock grazing on the monument.

The absence of animal components as they relate to Rangeland Health is readily apparent. We encourage the BLM to conduct some studies, especially if the BLM or the Oregon Department of Fish and Wildlife are already monitoring wildlife populations on the study areas. An attempt to relate existing BLM or ODFW data on wildlife populations to the standards should be made. Below are some examples:

Standards 1 & 2: Potential Indicators of Watershed Function. In Standard 1, the biological activity indicator lists plant, animal and insect, but this succinct description of the indicator implies that there are specific animals or animal guilds whose presences or abundance will indicate water infiltration, permeability, and storage or soil stability. In upland communities, the relationship between animal species or guilds and water capture, storage and release are poorly understood. The typical animal indicators for this standard are micro and macro invertebrates as they relate to the presence and amount of soil organic material. Burrowing mammals may contribute in certain soil types and in patches across the landscape, but they are not a common indicator across a range of soil types. We recommend that the Plan be more specific as to what is meant by biological activity and by animals and plants as it relates to this indicator.

We also wondered why biotic crusts were not included as an indicator for Standard 1. Their importance in soil stabilization relates directly to this Standard and their cover should be assessed along with assessments of plant communities that are being conducted as part of the enclosure studies and several of the Projects. The point intercept technique being used to measure ground cover could provide this information. Data need not be species-level, as that requires considerable expertise, but could at least include biotic crusts in the generic as a type of cover.

For Standard 2-the riparian wetland watershed function, beaver dams and activity are listed as a potential indicator. This is an example where inclusion of methods to measure

this animal indicator could be included, especially along streams with varying degrees of livestock use. In addition, some potential indicators listed here are described so succinctly that they are unclear. For example, the third potential indicator under Standard 2 reads, “age class distribution, and community structure*,” raising the question “Of distribution and structure of what?” Trees? Fish? This needs to be clarified.

Standard 3: Ecological Processes. Animal community structure and composition is included as part of the indicators for this standard, but the BLM does not plan to provide data on this component. This is a component where the inclusion of animal species in the Plan could contribute to this Standard. The lack of animal species, such as beaver, American marten, red tree voles, riparian associated mammals, northern spotted owls, Northern goshawks, bald eagles, willow flycatcher, and endemic amphibians, just to name a few could contribute to the Plan. Many animal species are sensitive to alterations of their environment and are good indicators of ecological change. At least some species should be monitored with respect to livestock grazing and we suggest that BLM consider additional studies like those proposed by the WWF studies.

Standard 4: Water Quality. We were surprised that none of these listed indicators were being considered in the Plan. Many of these have standard protocols and could be applied on surface water locations with different levels of livestock use. We suggest using USGS or EPA protocols that include many of these indicators, including aquatic invertebrate protocols. If wetlands, springs or seeps will be excluded from grazing, or if large areas of grazing exclusion are implemented, then these might be good candidates for such studies.

Standard 5: Native, Threatened, and Endangered, and Locally Important Species. This is an area where the plan is particularly deficient. There is no list of the threatened, endangered, or species of special concern for the Monument for the reader to peruse. We suspect such a list exists for the Monument and thus should be included for the reader. A few plant species are included in the list of species of concern; is this list comprehensive for T & E plants that occur on the monument? If not, it seems that making the list comprehensive is important, as is justifying the choice of particular species to focus on.. Why has the list not been extended to species of mammals, birds, amphibians, reptiles, butterflies, and mollusks? The Plan includes animal community structure and composition under this standard, but there is no indication that the BLM plans to provide data on this component. This could be a problem in their final assessment of the effect of livestock on the objects of biological interest. Two alternatives might be considered to address this problem. One might be to fund studies to gather these data or collaborate with other agencies that might be gathering such data if they exist (e.g., USFWS or ODFW).

Implementation, Effectiveness, and Validation Monitoring:

The definition of “implementation monitoring” offered here differs from that offered earlier, under “Monitoring Plan Strategy.” Earlier, implementation monitoring is described as, “examines whether current management strategies fit the landscape in terms of the maintenance of important natural resources,” while at the beginning of Section II, it is described as,

“monitored to ensure that management actions follow prescribed management direction.” The assumption must be that the prescribed management direction will be that which seeks to maintain important natural resources, but use of two definitions for the same term has potential to be confusing, and the first definition is difficult to distinguish from that provided for “effectiveness monitoring.”

Most of the objectives associated with implementation monitoring and effectiveness monitoring listed in this section will be attained by the combination of studies described in the draft Study Plan. However, it isn't clear in subsequent sections how it will be determined whether the use of “Potential Natural Vegetation” is or is not an adequate benchmark for assessing rangeland condition. Similarly, the Plan is not clear on how the BLM will determine whether current management maintains water quality associated with riparian communities. None of the potential indicators listed under Standard 4 (Water Quality) are marked with an asterisk, indicating they will be accomplished as part of the study. We believe the BLM should consider the inclusion of some of these indicators.

The Study Plan also indicates that the BLM will determine if surveys for listed species (RMP) have been completed. Does this apply to all listed species, and if so, how will they be considered? These evaluation objectives focus primarily on the botanical components of the ecosystem and there is little mention of the zoological components. Again, this is a deficiency in the Plan.

The description of the two primary research goals for validation monitoring (do livestock directly affect any of the objects of biological interest listed in Table 1... and are livestock enclosures representative of the rest of the monument) contribute to the impression that much of the emphasis in the livestock study is enclosure-centered. This impression, however, is incorrect, as subsequent portions of the document, and the meeting of the Scientific Review Panel made clear.

Existing Data

The list of existing data omits LIDAR, historical photographs (other than those associated with riparian areas), reexamination of historical vegetation plots, previously conducted surveys for rare plants and for weed occurrences, and possibly other existing data. It would be useful if the list was expanded to include these other sources of existing information. A more complete list is particularly important since much of the assessment will actually rely on these data sources.

Summary of Perceived Data Gaps

It would be useful if this section was explicit about which of the data gaps identified in the Study Plan will be filled over the course of the livestock impacts study. A list of gaps that will be filled is particularly important since some of the gaps relate to “Research Objectives Fulfilling the Role of Implementation Monitoring” (and to Effectiveness Monitoring) described previously.

From the two sections, Existing Data and Perceived Data Gaps, it is obvious that there is little information available on the structure and composition of animal communities in the Monument.

If this is an oversight, then animal (fish and wildlife) composition information for the Monument should be included as existing data. If it is truly a gap, then it is an important data gap that needs to be filled. Also, the BLM is to be credited for recognizing that few controls or livestock free areas are available for comparison to areas that are used by livestock.

Livestock Exclosure Studies

The BLM is to be commended for planning and implementing livestock exclosure studies to help provide “controls” for evaluating the effects of livestock grazing. The Plan indicates that 18 exclosures were planned for installation with 13 of those now in operation. Many of these are specifically constructed to protect rare plant species. While the need to protect rare biological elements can be an important need, the primary purpose of this study is to assess livestock impacts. Thus, there appears to be a great need for more exclosures, particularly in areas of moderate-high levels of livestock use, to ultimately allow for the assessment of potential livestock impacts. Since the topic of “livestock exclosures” represents a significant component of the overall Study Plan, it is important that all proposed exclosures be constructed as soon as possible.

Exclosures are an important component of the Study Plan and these efforts should be expanded regardless of concerns that might come from the public. For example, this portion of the study could benefit from more and larger exclosures with sufficient replication so that statistical comparisons could be made among the different vegetation types and grazing intensities. The present size of the exclosures may be appropriate for some botanical studies (although their small size may create problems from rodents that could impact the vegetation in the exclosure), but they are relatively small for studies on animal communities. The livestock exclosure portion of the study should be retained and expanded as it is critical to the success of the project.

In lieu of additional exclosures (e.g., because of unavailable funding), the BLM should attempt to find locations within grazing allotments where the distance from water or access minimizes livestock impacts. These can often be locations in excess of 1 mile from water or mineral licks. In these areas, monitoring plots similar to those in exclosures could be implemented without removing land from grazers. Such efforts might reduce or eliminate the need for additional exclosures.

Table 1 (or supporting text) – this might be a place to provide rationale for including (or excluding) certain of the objects of biological interest in the study (as mentioned relative to the Introduction, above).

Table 1 No. 1b – Is the focus on weeds in upland systems actually being deemphasized as described here in the first column? It appears that several supporting projects (e.g., those listed in Table 3 – Projects A, B, C, D, E, L, M, & N – all have the potential to contribute to an assessment of upland weed dynamics), and some exclosures, do (or could easily) include weed assessments in upland systems. Therefore, is the statement in Table 1, No. 1b about deemphasizing upland weeds really necessary?

Limitations of the Livestock Exclosure Project

The Study Plan states that most future livestock exclosures will be built in riparian areas, however Table 2 suggests that drier areas, rather than riparian, may already be underrepresented in the current exclosure system. Text under “Landscape Location” in this section indicates that new exclosures will preferentially be places in springs, seeps, wetlands, and riparian systems to improve assessment of these areas, but the list of current exclosures in Table 2 shows that, of 13 exclosures described as “already completed,” 7 already include one or more of these moist site features. We encourage the expansion of exclosures in upland and riparian systems. Oak woodland communities are particularly under-represented.

The map showing locations of current exclosures shows that the existing structures tend to be aggregated in a few areas within the monument (in the Keene Allotment and in the Emigrant-Keene Creek area), with large areas apparently including no exclosures at all. For example, we could not find any marked in shrub/woodlands or hardwoodlands. It seems that the current vegetation map, while incomplete in detail, may be sufficient for estimating the proportion of monument lands in various vegetation types, and that these proportions could be used to guide installation of additional exclosures in areas proportional to their representation on the landscape. In addition, sites for new exclosures could be selected in part based on the availability of previous data from the sites.

The lack of sufficient control areas (areas free of livestock) is a serious gap in the current monitoring especially for effectiveness monitoring, and as indicated above efforts should be made to expand the network of exclosures (and, potentially, sizes of new exclosures compared to those that currently exist). For example, can the Box O ranch be included as a large-scale exclosure? Were data taken on parameters of interest for this ranch before livestock were excluded? If so, these would allow an important contrast with current measures of range condition. Are any of the RNA’s or ACEC’s fenced, and, if so, can they be included in exclosure studies? Can pastures or allotments that are fenced also be assessed not as full exclosures, but as areas with defined grazing regimes that contrast with each other and with other areas in the monument? Finally, several of the projects associated with the overall study include exclosures (however small), and it would be useful to add ALL exclosures to those listed in Table 2, along with a map showing locations of all exclosures.

Dr. Carl Bock (U CO, Boulder) wrote a review of an earlier draft of this study plan, in which he suggested installing a few very large exclosures, and his arguments in favor of this were well made. A few large exclosures (he suggested as large as 500 – 1000 acres) could each include more than one vegetation type, and could enable monitoring of recovery for bird and animal populations as well.

The Study Plan indicates that the location of multiple plots external to exclosures will help to alleviate the lack of replication problem that the limited exclosure number creates. This, however, as presented here, immediately raises the specter of pseudo-replication.

Statistical tools that might be used to assess data from exclosures (and paired external transects) are described, however the small sample size of exclosures and likely nonnormality of data will make some of these problematic. The description omits some methods that could be

illuminating, including multiresponse permutation procedure (MRPP), which is a nonparametric test for multivariate differences between groups (internal and external transects). This could be used, for example, to assess differences between groups in species cover data, stubble height measurements, or other variables recorded in the plots. Indicator Species Analysis could also be informative (this is an iterative technique that assesses species indicator status for predefined groups based on species' frequency and abundance), as could pattern-exploration tools, such as nonmetric multidimensional scaling (NMS) ordination, again a technique that is free of assumptions about data distributions.

A limitation of the exclosure studies that is not discussed in this section, but that is important, is that while exclosures can effectively exclude livestock they often encourage use by native ungulates that can jump a fence, and thus effects of the two kinds of animals become confounded. Three-way exclosure systems would help circumvent this potentially important limitation. We encourage the construction of wildlife exclosures to provide for comparing the effects of wildlife separately from those of livestock.

Finally, one of the people who commented on the previous draft of the study plan indicated that they had heard that lessees may tend to keep their cattle away from areas with exclosures, so as to minimize apparent livestock impacts. If this is true, is there a plan for assuring that this doesn't occur? Is livestock utilization outside exclosures being measured too? Lastly, will exclosure maintenance receive high priority and will cattle intrusion be tracked and documented? This may aid the interpretation of results from these exclosures.

Time-line:

We are glad to see that the study proposes assessment of exclosures for longer than the initial 3–5 year period, as 3–5 years is not sufficient for a full assessment of responses to grazing removal (as emphasized in Dr. Sarr's [OSU] letter of comment on the previous draft of this study plan).

Monitoring Within Livestock Exclosures:

Introduction

Note the several references to the long time spans required for adequate understanding of vegetation changes that result from livestock exclosures; these support strongly the argument that monitoring should continue for longer than 3–5 years. Overall, the literature review in this section seems commendable. However, the emphasis is on uplands. There has been an increasing amount of literature on riparian systems in recent years that assess the effects of livestock on a wide range of plant communities and riparian functions. Will this "newer" literature be considered in the final analyses of riparian data collected by this study?

Issues: Management Objectives (and the following "Objectives" section):

A relatively comprehensive list of specific objectives is given under "Management Objectives" (except that the list excludes animal response variables), however, the subsequent section, "Objectives" does not include all of the management objectives listed previously. For example,

none of the objectives listed in that subsequent section address measures related to riparian shrubs, vegetation structure, or thatch litter build-up associated with medusahead, all of which are listed under “Management Objectives.”

The statement of minimum differences that will be considered significant at a given p-level is important (e.g., detect at least a 5% difference at $p = 0.10$), and a similar degree of specificity should be applied to Objective 4.

A related comment that applies more widely is that some aspects of the study are to be assessed at an alpha level of 0.05 and others at 0.10. This might be fine, but justification for use of various p-values should be provided wherever they are mentioned (unless all are standardized at the same cut off, in which case one general statement could be made). Given the limitations in study design, treatments, and controls, it might be appropriate to use an alpha level of 0.10 throughout.

Methods and Materials:

While we understand the utility of the point technique that is being used to assess species cover (minimizes bias and standardizes across different observers), the technique is best for assessing cover of common species and can miss entirely the occurrence of less common species. Some less common species may be of interest (important indicators of change or special status species), and the technique is likely to miss them entirely in sampling. A complete listing of species encountered on transects (even if simply their presence is recorded) would be a useful addition to the protocol.

Transect Placement:

Concerns over fence line effects are legitimate, but we do not find a treatment of how the study will determine whether or not a transect is “compromised” by virtue of proximity to a fence line and how that be determined objectively (nor how it will be determined whether or not a transect is “too close” to a fence line). Perhaps the implication is that the external transect closest to the fence line will not be used for assessing grazing recovery, but language in the Study Plan is a bit ambiguous in that regard. Perhaps uncertainties about interpreting cause and effect could be decreased by simply stating that the external transects closest to the fence will not be used for assessing grazing recovery, but used only for identifying increaser and decreaser species.

Data Analysis Strategy:

The data analysis strategy for this section appears to be well thought out and has plenty of detail on how data will be analyzed. Paired transects (inside of and external to exclosures) are powerful tools for assessing livestock impacts, and, ideally more will be established as additional exclosures are set up. Sampling each pair twice a year (before livestock turnout and at the end of the season) will also enhance the power of the exclosure studies to assess responses and infer cause and effect. Similarly, the photo records can contribute substantially to response assessment, particularly as the years go by.

Analyses:

Were procedures recommended by the Interagency Technical Reference for determining required sampling intensity used as part of decision-making about transect length or number? If not, why not and what were these decisions based on *in lieu* of that Reference? It is important to be able to justify these decisions.

The individual variable and plant community analyses described are appropriate. To the community analyses, we would add MRPP (multivariate test for differences in communities between predefined groups) and Indicator Species Analysis, both described above. While the multivariate analyses may be more challenging to explain to lay reviewers, it is essential that they be used in this study, given the nature of the data.

Green's Mariposa Lily Monitoring:

The study design for assessing livestock impacts on this lily is strong, and should yield important insights. However, we are not clear about whether the entire "Mariposa preserve" is fenced, but if not it seems that doing so should be a priority as an enclosure there would enhance assessment of this species and add to the enclosure network. In addition, the 3-X-3 m "cages" established in three areas within the Monument by researchers studying this plant can serve as supplemental mini-enclosures and can, perhaps, be included in the wider-scale assessment of livestock impacts on plant communities. (Plant community data have been taken in caged plots and their paired, uncaged plots). These cages should be maintained and monitored over several years, along with their paired, uncaged plots, as is proposed (a 10 yr duration is described in the study plan), particularly since data from them can be used not only for assessing livestock impacts to the lily but also for assessing impacts on other community attributes.

We have the impression that more than one group is studying this lily (Institute for Applied Ecology and Wildwood Environmental Consulting), although perhaps in different years? Given the large number of objects of biological interest found in the Monument, we hope that one object is not receiving undue attention (the mariposa lily, in this case) at the expense of others.

Equal consideration should be given to other threatened, endangered, or sensitive species of plants and animals. We suggest a prioritized list of these species with an indication if livestock have been listed as a potential threat to the species and then a rationale for the prioritization. This might guide future studies of threatened, endangered and sensitive species relative to livestock impacts.

Progress reports furnished by outside contractors, such as the Institute for Applied Ecology, should be subjected to review by scientists with appropriate expertise before acceptance of the final report. Such reviews will increase the credibility of these reports, and enhance their contribution to the overall livestock study.

Willow and Aspen Establishment and Growth Following Livestock Enclosure:

The inclusion of this component of the study is important because livestock use of willow or aspen during late summer or fall may have an influence on the availability of these browse species for deer and elk during the winter months. Also, willow and aspen provide important nesting structures for many species of song birds. As such, it is not only important to measure the number of individuals of willow and aspen inside and outside of exclosures, but also the amount of the current year's growth that is consumed by livestock and what impact livestock grazing has on the overall growth form of the individual plants. Much of this will require direct measurements of the amount of annual growth that is consumed, and visual observation alone will not suffice. This portion of the project should be expanded to include some of these additional measurements.

While the description of methods and analyses seem to be appropriate, we were unable to answer several questions.. For example, how many replicates of these exclosures will be established and how will their locations be determined? (Table 2 implies only one exclosure, but plural terms are used in the description of this portion of the study.) Will the study of regeneration include counts (or estimates) of seedling numbers as well as of saplings? How about reproductive plants? How long will the study last? One caveat is that the study of willow cover, stem density and height, as described, will not necessarily elucidate causes of cover changes inside and outside exclosures. For example, if cover or stem density or height increases inside exclosures, is that due to livestock *browsing*, or livestock *trampling* of plants (or other soil disturbances) outside exclosures, or both, or other causes, such as wildlife impacts? If data on browsing and soil disturbance were collected in addition to cover data, more inferences about cause-and-effect might be possible.

Can the exclosures used for this study also be used as part of the larger-scale livestock impact assessment? For example, could plant community and soils data be collected within and without these exclosures, following protocols described previously for the livestock impact exclosures?

It should also be noted that photographs of exclosures, which can effectively illustrate the effects of livestock browsing on aspen and willows, are often very persuasive with regard to illustrating whether significant impacts to woody browse species are occurring.

Plant Community and Canada Thistle Recovery....

How many exclosures will this study involve (Table 2 suggests one, but plural terms are used in the description of this thistle study) and how is their location determined?

Can this exclosure (exclosures?) be used as part of the larger livestock exclosure study, by recording data on plant communities and soils as described earlier?

Projects Providing Context for the Livestock Exclosure Study

After reading the Study Plan and hearing its description at our day-long meeting, we believe that these projects should not be described as they are in this section header. The projects described here do much more than provide context for the exclosure study; each has importance for livestock impact assessment in its own right, and the exclosure portion of the study may well

turn out to be a minor component of the overall study plan, particularly if few to no new enclosures are built.. Nevertheless, these projects add greatly to the strength of the livestock impact assessment, and are commendable for their diversity, attention to historical information, and for the enhancement of basic understanding of plant communities found on the Monument.

The list of projects in Table 3 appears to exemplify the focus on the botanical versus zoological components of the ecosystem. What is the justification for this discrimination between these two components? We believe that the zoological components are just as important as the botanical components and there should be a balance of plant and animal studies. At present, we see only two projects on animals, fish habitat and dietary overlap among livestock and native ungulates. Both of these projects are indeed important, but there is no sense that wildlife communities are to be measured and characterized relative to different grazing intensities, nor is there any sense that threatened, endangered, or sensitive species of animals will be studied. The lack of such studies will likely leave the BLM open to criticism when they make their final decisions on the continuation or modification on the current grazing allotments. This gap may be covered to some extent by projects funded by the World Wildlife Fund, but we doubt that those studies have sufficiently addressed concerns for threatened, endangered, or sensitive species. It may well be that conditions within the study area preclude definitive assessments of cause-and-effect regarding livestock grazing and wildlife, but either justification as to why animal studies do not have greater representation is needed or additional animal studies need to be included in future endeavors.

A. Landscape/Plant Community Condition Survey for the Klamath River Ridges Area

Walk-through surveys are a reasonable approach for assessing vegetation at a large scale, however some concerns are raised by the protocol outlined in the Study Plan. Foremost of these is the fact that data from four surveys made by different investigators will be used. What kinds of calibration exercises did the various investigators complete (or will they complete) to ensure reasonable compatibility between observers? Quality control over semi-qualitative data like these can be difficult to achieve, but is important, particularly if the data are to be used, in part, to make inferences about livestock impacts.

The second concern involves the size of the polygons that form the basis for assessment and the fact that cover by individual species will be assessed at the polygon scale. How large are the polygons, and what kinds of training do observers undergo to enable them to make cover assessments over large scales? We do not question the feasibility of these assessments being made with reasonable accuracy, assuming reasonable training and calibration of observers has occurred.

Finally, are estimates of cover made in terms of actual percentages or using cover classes, and, if the latter (which is most reasonable), how coarse are the cover classes? There is no sense in taking data at a finer level of precision than can actually be estimated reasonably, and cover classes should be scaled accordingly.

B. Re-examination of Historical Vegetation Plots

The NRCS and BLM plot data are apparently available from 20-30 years ago and these data are proposed to be used as a basis for understanding “recent historical changes” in plant communities. This is certainly a good idea, but the major caveat here is the available understanding about how much change had or had not already occurred before the 1970s and 1980s. How these areas were originally selected may become important in interpreting the results. Thus, setting the historical context for the data collected 20-30 years ago (i.e., how much had the sites already changed because of heavy grazing that occurred before the passage of the Taylor Grazing Act was enacted and stocking rates were determined for this region is probably just as important as evaluating changes in the last 30 years. Furthermore, it needs to be determined if the locations of plots (or polygons, as the case may be) were monumented carefully enough in the previous surveys that they can be re-sampled with confidence that the same areas are actually being included.

Re-examination of these plots, and analysis of patterns of change in vegetation over the past 20 –30 years in relation to possible causal factors (climatic, management history, etc.) should result in useful, if suggestive, information about possible livestock impacts. Analysis of patterns of change in relation to several criteria for desired condition is a strength of this portion of the study, as is the fact that data from this study can be used in other projects as well. The data seem well-suited to analysis with GIS and layers relating to past and present livestock allotments and other site factors.

It should be noted that vegetation dominance measures must remain the same between historical and current methods. Generally, NRCS plant composition data are based on current year’s production. Using cover data as the current measurement will not allow comparisons to be made because cover and production are not correlated for all species. You must use the original measures for comparisons.

In addition to the quality assurance questions raised above (part A), we wonder here what kinds of quality assurance data are available from the initial sampling of these areas 20 – 30 years ago? It will be important to be able to answer questions about how much any apparent vegetation changes may be influenced by differences in observer skill and methods between the two time periods.

What portions of the CSNM are included in this data set and how many plots (or polygons) are available for re-sampling?

CCA, proposed for some of the data analysis here, can be problematic if used for general explorations of patterns in communities in relation to patterns in potential predictor variables. It is best suited for a situation in which the analyst knows which single predictor variable is important, and is not well-suited for cases in which that information is uncertain or for cases where several predictor variables are important (see McCune and Grace 2002). It would be preferable to use an alternative ordination technique for this situation, since community changes are unlikely to have only one causal factor and since there may be uncertainty associated with the suite of potential predictors.

One difficult issue in this type of historical analysis is determining the grazing intensities at the time of the previous study and how that level of intensity relates to present day intensities. Does the BLM have any records of the grazing intensity for the earlier time periods?

C. Rare Individual Plant and Community Analyses:

The inclusion and focus on rare plant species is an important aspect of the study plan. A major omission in the study plan is a comparable effort on rare animal species, and such an effort should be designed for the Monument as well.

The co-location of a community transect with these monitoring efforts is an important strength of this portion of the study, as information from those transects can, presumably, feed into the larger scale landscape vegetation surveys and assessments. Similarly, synergy between projects can be advanced if people taking data for project B (re-examination of historical plots) are trained to identify the species of particular concern that are the focus of project C, so that their work can contribute to locating populations of these species.

Since several of these plant species, and probably several of the additional sensitive species that occur on the monument, are found in only one to a few sites, it will be challenging to make robust inferences about livestock impacts on these populations. Can a design similar to that being used in the *Calachortus* study, incorporating “cages” around some plots for each species be used for at least the six additional species listed in this section? Without that, and without data on these species from sites that differ in grazing intensity, but are similar in other ways, power to infer anything about livestock impacts is likely to be quite limited.

D. Hyperspectral Imagery/LIDAR:

Only an introduction to the data available from this technology is provided in the Study Plan and it provides precious little information about the potential utility of the data. Nothing is said regarding analysis, except that it depends on funding. This imagery has the potential to provide an important basis for understanding the spatial distribution of vegetation types across the CSNM as well as providing spatial/biological context for all of the exclosure studies, vegetation plot studies, photo monitoring studies, etc. This imagery is inherently, perhaps, the most important spatial monitoring methodology available to the CSNM for this study. The sample that we saw of its product was impressive in its detail, and we believe that a good deal of understanding could be gained by a detailed analysis of the patterns in vegetation that it reveals in relationship to other factors (elevation, proximity to water or roads, soils, livestock grazing intensity, and so forth). In fact, if a thorough analysis of these images could be accomplished, it might make unnecessary some of the other work proposed in the study plan, such as projects “A” (general landscape condition survey) and “E” (patterns of weed abundance), or at least reduce considerably the field work that they would otherwise require. However, this area of science is still new and may require considerable fine-tuning before it can become practical, and some ground-truthing would probably be required. Funding to ascertain the feasibility of this technology to provide useful and less expensive monitoring for various aspects of the Plan is encouraged.

E. Examining Patterns of Weed Abundance

This portion of the study is important, and will require little field work on its own, given that other studies (on-going and planned) can contribute data to it. Permanent transects established as part of this study will provide useful information to CSNM managers over time, regardless of whether livestock are implicated in fostering spread of weeds. Site selection will be important in the transect work, and this is not described in detail in the current study plan.

F. Dietary Overlap Between Deer, Elk, and Livestock within CSNM Winter Deer Habitat:

The BLM should be commended for taking on this facet of the study and resurrecting fecal content data collected during the late 1970s and early 1980s. This historical data set will be valuable in comparison to similar data from the present time. Is there a way to get some estimate of livestock grazing intensity during the previous study for comparison to the present time? This may be important in terms of any potential impacts of livestock grazing. The primary objective with this aspect of the study should be to determine the amount of overlap in diets of livestock and that of native ungulates, then to assess forage availability from the shrub utilization surveys. These data will then allow some estimate of the amount of forage removed by cattle during the spring and summer months and whether there is potential for competition between livestock and native ungulates. This portion of the project is important and the BLM has done a good job of designing it. Some additional relevant references for consideration are offered below:

Holechek, J.L., M. Vavra, and R.D. Pieper. 1982. Methods for determining the nutritive quality of range ungulate diets: a review: *Journal of Animal Science*. 54:363-376.

Leslie, D.M., E.E. Starkey, and B.G. Smith. 1987. Forage acquisition by sympatric cervids along and old-growth sere. *Journal of Mammalogy* 68:430-434.

Schwartz, C.C. and J.E. Ellis. 1981. Feeding ecology and niche separation in some native and domestic ungulates on the shortgrass prairie. *Journal of Applied Ecology*.18:343-353.

Wehausen, J.D. 1995. Fecal measures of diet quality in wild and domestic ruminants. *Journal of Wildlife Management* 59:816-823.

G. Shrub Utilization Studies:

Shrub utilization studies will be important to determine the browsing pressure on these species and how browsing may or may not influence the availability of browse for deer and elk during the critical winter months. After livestock are removed from the Monument in the fall, it is important to estimate the amount of annual leader growth of shrub species that was utilized by livestock, and, correspondingly, how much is left for consumption by native ungulates going into the critical winter months. Consequently, this portion of the study should include an estimation of the amount annual growth consumed by livestock, or the results will not be entirely adequate to make these assessments. This is another example where some 3-way exclosures would be helpful.

In addition, it is also of fundamental importance to know if shrubs continue to establish seedlings/sprouts and whether such seedlings/sprouts can grow into taller growth forms (and eventually produce seed). Thus, the ecological issues regarding plant population dynamics in the presence/absence of livestock may well be a more fundamental issue of concern than the current level of browsing. While there may well be a high degree of correlation between utilization and population dynamics (i.e., high browsing levels on existing shrubs may also preclude the ability of seedlings/sprouts to become established and grow above the browse level of ungulates), it is important that the “utilization” study also attempt to specifically address the establishment/recruitment issue for wildland shrub communities that are found on the CSNM.

H. Fish Habitat and Riparian Condition Monitoring in Grazed and Ungrazed Streams:

Because livestock tend to concentrate use along riparian systems, it is a good idea to assess the condition of fish habitat and riparian areas within the Monument. While none of us are fisheries ecologists, the approach presented seems relatively superficial in terms of determining if fish habitat is in good condition. As an initial step, we would recommend the implementation of electro-shocking and snorkeling surveys of CSNM streams to estimate the distribution and abundance of the variety of fish species that occur in the Monument. While habitat assessments have an important role in understanding potential grazing effects, we are not convinced that an assessment of the habitat alone will be indicative of fish populations. Can the BLM provide references that provide high correlations between habitat condition and abundance of certain fish species that will provide for a high degree of predictability? Cross-section channel surveys may be related to some fish populations, but the cross-section technique should be cited, and some expectations on how fish populations should respond to varying width-to-depth ratios should be provided. If CSNM streams have been included in surveys for threatened and endangered fish, then we suggest that those data be incorporated in the Study Plan.

I. Proper Functioning Condition Riparian Surveys:

Proper Functioning Condition (PFC) has become a widely used tool for range managers and protocols have been developed for this method. However, it is important that the specific reference streams/riparian systems that are used to represent a “proper functioning condition” be specifically identified early in this procedure since they become a reference condition for comparison with reaches that are in varying degrees of functioning.

In addition to all of the variables that are surveyed using this method (as listed on page 53), it is important to take a photograph of representative conditions for each of the various stream reaches where the PFC assessment is being performed. These photographs provide a quick and convenient way of illustrating conditions represented by the detailed information collected during a PFC assessment. Such photographs also become a key monitoring item for illustrating changes in riparian systems if livestock management practices are altered.

In addition, the surveys of riparian areas should include a more diverse set of variables including presence of beaver, riparian associated mammals, and sensitive bird species like the willow flycatcher. For example, adding the number of beaver dams or beaver bank dens per mile of stream might contribute to these evaluations. Some data on riparian-associated animals will be

collected by studies funded by the World Wildlife Fund, so the BLM will have access to other data sets that will help broaden the scope of this project. We encourage BLM to incorporate some of these data sets into their assessments.

J. Stubble Height Studies:

Ample detail on the objectives, methods, data analyses and pertinent literature references are provided for this project. Since some of the studies funded by the World Wildlife Fund will be conducted in riparian areas and around wetlands, seeps, and springs, the BLM should coordinate efforts with the WWF to see if some of those data will aid in their assessment of plant and animal community structure and composition in the Monument. The studies on mammals, birds, and mollusks that are being funded by WWF or other sources may be particularly useful with this project.

We assume that, in addition to placing transects for this project in sites from which data were previously collected (cited as USDI 1983b in the proposal), consideration will be given to maximizing overlap between this project and other riparian-related projects (e.g., livestock enclosure sites, projects H and I, and others). Careful coordination across projects can help to maximize information returns per unit time and money.

Although the Plan uses 7 cm for the standard stubble height, it is recommended that a standard be developed in ecosystems where none is available. We would encourage the development of a standard for the Monument.

It is not entirely clear how some of these objectives relate to “stubble height measurements”. For those not familiar with stubble height techniques, some direct connection to stubble height should be incorporated into the objectives.

In terms of data analysis, see our previous comments (Project B, above) about appropriateness of CCA (or DECORANA) for community analysis in this type of study. Another ordination technique (such as NMS – nonmetric multidimensional scaling) would be more appropriate, since patterns in communities are unlikely to be related to a single primary environmental predictor. In addition, TWINSPAN, while a commonly used clustering technique, is problematic for data like these. According to McCune and Grace (2002, pg. 97), “Ecologists should not use TWINSPAN, except in the very special case of when a two-way ordered table is needed for a data set *with a simple, one-dimensional underlying structure.*” (italics ours). Given that these data are not likely to have such a structure, use of an alternative clustering technique should be considered.

Finally, how large are the “cages” that will be used in this study, must they be “temporary,” and can they be included as part of the enclosure network?

K. Rangeland Utilization

The assessment of rangeland utilization, condition and trend are certainly important components of the Study Plan and have historical ties to rangeland management data throughout the BLM

and other agencies. However, we are concerned that the ocular estimation methods used for utilization in these studies (Key Species technique) will not provide a level of detail to actually accomplish the objectives. In addition, this technique does not provide any quantitative correction factor as a quality control for the estimate. We suggest the use of utilization cages to provide some quantitative checks of utilization estimates.

The identification of what constitutes a “key area” needs to be explicitly stated and should be reevaluated to verify the selections. These decisions should be based on clearly articulated (and defensible) criteria. How many key areas per allotment are used in this determination?

L. Rangeland Trend

For Objective 1, the hypotheses should be changed from abundance to frequency of the key species. Also, the desired frequencies of plant species that are needed to achieve Objective 2 should be identified. The NRCS plant composition data cannot be used for determining similarity to the potential natural community because NRCS used composition based on production, a different measure than composition based on frequency. Thus clearly stating the expected frequencies of the dominant plants in the desired community is important to achieve this objective.

Why is the standard of disproof for trend studies set at $p = 0.05$, rather than the 0.10 that is used elsewhere in the livestock studies? Problems with frequency data are described and it is important to acknowledge these limitations, particularly the complete dependence of the data on the size of the sampling unit (quadrat) and on the spatial distribution of plants, and the fact that the data are not sensitive to changes in abundance that don't translate into changes in presence/absence. We gather, however, that recording frequency is a standard method for these kinds of analyses, so we suspect that the data will be more acceptable to various interest groups if they are based on this metric rather than on another metric, such as cover.

M. Range Condition

This project will use data from many other projects (past and present), and is a logical extension of use of those data. Critically important are decisions about the “potential natural community” (PNC) composition against which condition will be evaluated. Are there well-accepted standard definitions that apply to the types of nontransitory rangelands found in the monument, and are these definitions defensible? The combination of various techniques for collecting species composition information may confound the analysis. The NRCS (SCS) ecological site descriptions use production data, but the Study Plan calls for collecting data on species cover and frequency. These cannot be directly compared for similarity. One method of comparison should be selected for comparing current to historical data or for comparing current rangeland condition to some standard such as the potential natural community.

N. Photo-monitoring

The proposed use of historical photos previously archived by the BLM is an important objective for helping meet the overall goals of this study. All historical databases (GLO surveys, historical

societies, etc.) should be utilized for obtaining early photographs (as well as descriptive information) regarding historical conditions of the CSNM. The use of GPS referencing for all photos is also important. Understanding historical conditions, as well as possible with the help of historical photos and other historical information, will help to frame issues associated with the effects of livestock practices. Information that provides a historical context for existing conditions is a fundamental need of this study. Is there any way to assess the intensity of livestock grazing from such photographs? If so, methods should be described here, with appropriate references. Additional pieces of information such as this would enhance the use of historical photographs for interpreting livestock impacts. Important will be training of individuals who will interpret the historical and newly-taken photos, including calibration of their estimates of cover by life form (and other parameters), and adherence to a clearly defined quality assurance procedure.

O. Actual Use

This section on actual use seems straightforward and important.

Potential Thresholds of Change

This section identifies the potential biological and environmental thresholds of change prompting management action, and the implication is that these are the only thresholds that will prompt modifications in the grazing allotments for various pastures. If this is the case, this set of thresholds is severely deficient in that it focuses on plants and only plants. There should be comparable thresholds with respect to the animal components of the ecosystem for this to be a thorough assessment of the impacts of livestock on the objects of biological interest. There are a number of wildlife indicators that could be developed as thresholds, including presence of sensitive species of mollusks, fish, riparian-associated birds and mammals, beaver, and abundance and condition of native ungulates. The BLM needs to round out this section to include attention to zoological as well as botanical components. This is a common thread of concern seen throughout the Study Plan.

As presented in Table 4, thresholds are not defined quantitatively. Section VII indicates that many of the thresholds will be established pursuant to completion of several of the previously described projects, however it seems that this means of defining thresholds may be overly subjective. We recognize that science to provide these thresholds is lacking, but providing a range of values that might imply an early warning vs. a range of values suggesting that a threshold has been crossed might provide a more objective approach. The Monument could organize a group of managers, biologists, ranchers, wildlife and fisheries experts to aid Monument staff in developing some rough estimates of these thresholds. Decisions about thresholds are, obviously, critical to the entire project, and must be made in a way that can be defended not only scientifically but in court.

II. Final Project Interpretation

How many thresholds must be exceeded before it is determined that livestock grazing should be restricted, altered as to season of use, or even eliminated on the Monument?

Reference cited

McCune, B. and J.B. Grace. 2002. *Analysis of Ecological Communities*. MjM Software Design, Gleneden Beach, OR.