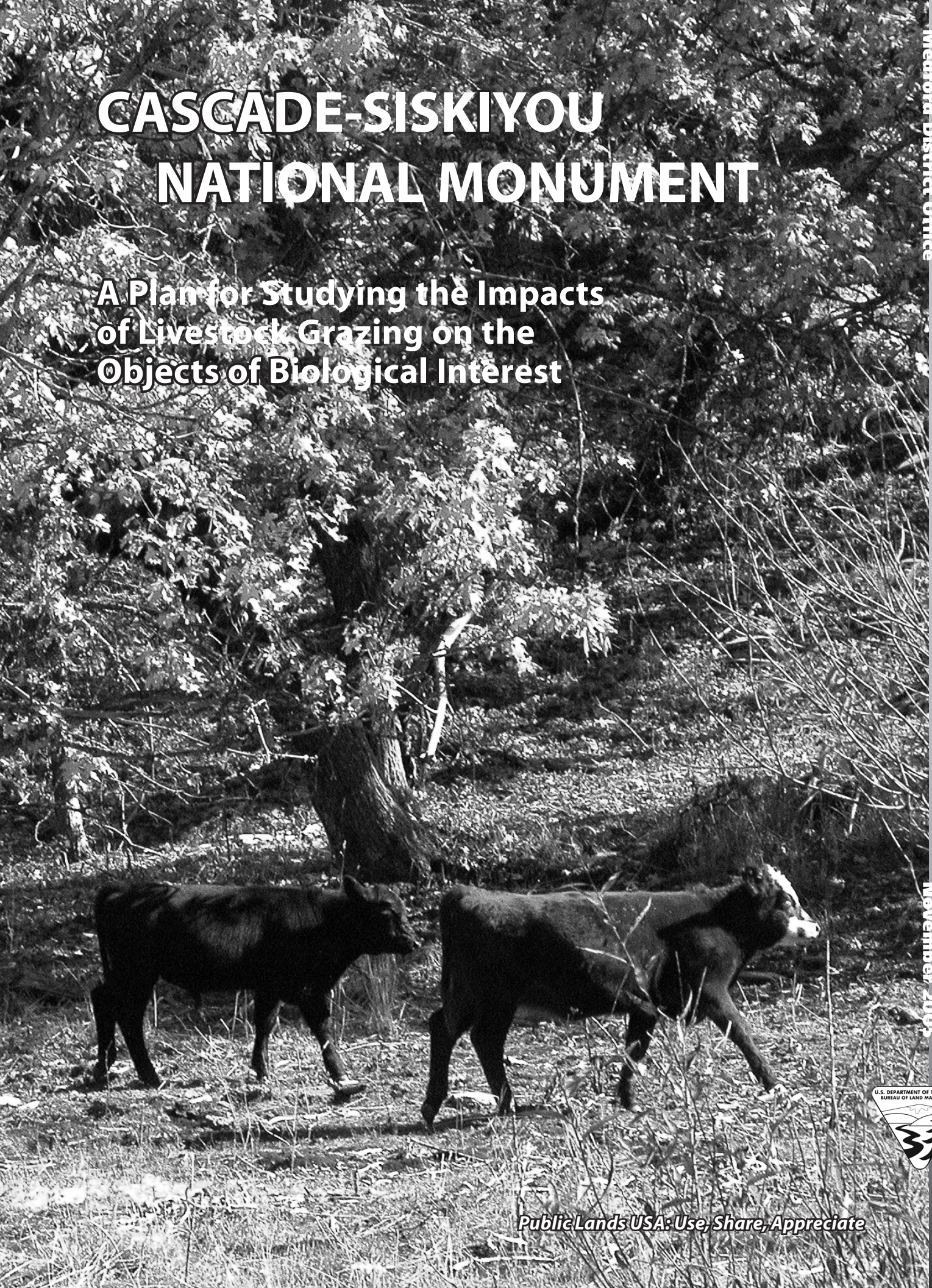

CASCADE-SISKIYOU NATIONAL MONUMENT

A Plan for Studying the Impacts of Livestock Grazing on the Objects of Biological Interest

BLM

Medford District Office

November 2005

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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United States Department of the Interior

BUREAU OF LAND MANAGEMENT
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email address: or110mb@or.blm.gov

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

6240(OR114)

Dear Reader:

The Cascade-Siskiyou National Monument (CSNM) was established on June 9, 2000 when President William J. Clinton issued a presidential proclamation (Proclamation 7318 of June 9, 2000) under the provisions of the Antiquities Act of 1906. The CSNM consists of 52,947 acres of federal land administered by the Medford District Office of the Bureau of Land Management (BLM) in southern Jackson County, Oregon.

Livestock grazing has continued as an authorized use since monument designation under existing laws and regulations and the terms and conditions for individual leases. The presidential proclamation mandated a study of "the impacts of livestock grazing on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics."

In keeping with this mandate, the BLM published the *Draft Study of Livestock Impacts on the Objects of Biological Interest* (draft study plan) in April 2001 for the CSNM. Comments on the draft study plan from the livestock operators, scientific peer reviewers, and the public were accepted until December 1, 2001. Based on comments received during this comment period, the BLM modified the studies. Further changes to the studies were made following a field tour in 2002. In March 2004, the BLM requested that the Southwest Oregon Provincial Advisory Committee (PAC) charter a working group to review how the BLM was studying the "impacts of livestock on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics." In April 2004, the BLM convened a panel of scientists from Oregon State University to review the draft study plan.

This study plan updates the draft study plan of 2001 to include comments from the scientific peer reviewers and the public provided during the comment period; recommendations from the OSU peer review; recommendations from the PAC; insights gained since data collection began in 2001; new information; and improved statistical analysis methods. It should be recognized that this study plan is dynamic, as the studies are ongoing. The studies may be expanded or modified as appropriate to consider additional information and/or changing conditions.

Thank you for your interest in the livestock impacts studies and the management of the Cascade-Siskiyou National Monument. If you have any questions, please contact Howard Hunter or Paul Hosten at (541) 618-2200.

Sincerely,

John Gerritsma
Field Manager/Monument Manager
Ashland Resource Area

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INTRODUCTION

The Cascade-Siskiyou National Monument (CSNM) was established on June 9, 2000 when President William J. Clinton issued a presidential proclamation (Appendix A) under the provisions of the Antiquities Act of 1906. Livestock grazing has continued as an authorized use since monument designation under existing laws and regulations and the terms and conditions for individual leases. The presidential proclamation mandated a study of "the impacts of livestock grazing on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics."

In keeping with this mandate, the BLM met with the livestock operators who hold grazing leases within the CSNM shortly after the presidential proclamation was signed and prior to developing a study plan in order to solicit their ideas on how to study the "impacts of livestock grazing on the objects of biological interest." Meetings were held on August 22, 2000; January 22, 2001; March 7, 2001; and April 5, 2001. Input from these meetings was considered in the development of the draft study plan.

In April 2001, the BLM published the *Draft Study of Livestock Impacts on the Objects of Biological Interest* (draft study plan) for the CSNM. The CSNM livestock operators, as well as a group of approximately 30 scientific peer reviewers, were mailed the draft study plan on May 3, 2001, while the general public did not receive a copy until May 30, 2001. The original closing date for receiving comments on the draft study plan was July 1, 2001. Due to numerous requests and the high level of interest, the comment period was re-opened and extended several times. The first extension concluded on October 1, 2001 and the last deadline extended the comment period until December 1, 2001. Based on comments distilled from the 69 letters and 263 postcards received and additional discussions with the potentially affected livestock operators, the BLM modified the studies.

On October 31 and November 1, 2002 a field tour with the livestock operators and several interested parties was held to look at the specific locations of proposed study exclosures. After receiving the input from the lessees during the field trip, the BLM dropped five of the proposed exclosures largely based on the lessees' concerns and the new information received.

In April 2004, in response to the continued interest and controversy surrounding the studies, the BLM convened a panel of scientists from Oregon State University (OSU) to review the draft study plan and comment on the multitude of studies, monitoring projects, and literature review currently being conducted by the BLM to evaluate "the impacts of livestock grazing on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics." Each panel member prepared a set of review comments that were compiled into a review document and presented to the BLM for consideration.

In March 2004, the BLM requested that a working group comprised of five to seven members of the Southwest Oregon Provincial Advisory Committee (PAC) and one or two members from the Klamath Provincial Advisory Committee be established to review how the BLM was studying the "impacts of livestock on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics" within the CSNM. The working group was assigned the task of reviewing the current livestock studies, reviewing and considering the OSU scientific peer review, and engaging in a joint fact-finding public participation process to acquire input from the public, interest groups, and elected officials.

In November 2004, the working group affirmed the "comprehensiveness and scientific integrity of the BLM study" and made several recommendations which were approved by the PAC. Recommendations included: 1) incorporate the OSU peer review recommendations into the studies; 2) incorporate peer-reviewed studies by World Wildlife Fund; 3) incorporate a thorough literature review; 4) maintain transparency with the public in this process; and 5) recognize that members of interest groups are available and willing to provide anecdotal and historic information as needed.

This study plan updates the draft study plan of 2001 to include comments from the scientific

peer reviewers and the public provided during the comment period; recommendations from the OSU peer review; recommendations from the PAC; insights gained since data collection began in 2001; new information; and improved statistical analysis methods. It should be recognized that this study plan is dynamic as the studies are ongoing. The studies may be expanded or modified as appropriate to consider additional information and/or changing conditions.

SUMMARY OF REVISIONS

REVISIONS TO STUDIES IN RESPONSE TO 2001 COMMENTS

Peer reviewers and the public provided comments during the 2001 extended comment period to improve the draft study plan for the CSNM. Several significant issues were identified in the comments received.

These included the following:

- the size of livestock exclosures;
- appropriate variables for measurement within livestock exclosures;
- the number of livestock exclosures;
- the design of the *Shrub- and Ground-Nesting Bird Density* project; and
- selection of thresholds of change for inferring livestock effect.

A review of the scientific literature indicates that 1/4-acre livestock exclosures (areas free of livestock) can be a powerful tool for assessing livestock effects to plant communities and soils. Several reviewers commented that livestock exclosures as defined within the draft study plan were too small. Some comments were in reference to particular variables such as bird nesting density, seed movement/plant recruitment, and interactions with wildlife—all variables that can only be measured at the landscape scale. The bird nesting project has been cancelled as a consequence of these comments. Monitoring within the exclosures and paired transects will be restricted to variables appropriate to the size of the constructed exclosures. Future livestock exclosure size will be dependent on the local site conditions including topography, and extent of plant community of interest. A total of 10 monitoring exclosures have been completed.

Livestock show a tendency to trail along fencelines, and this funneling effect of fences locally concentrates livestock impacts. Care will be taken to ensure that transect placement outside of livestock exclosures will not confound the measurement of livestock effects due to proximity to fencelines. Additional transects outside the exclosure and amended methods of analysis will allow the detection of fenceline effects where they occur. In addition to comparing paired plots to each other, plots will also be examined on an individual basis. Key plant species known to be increasers or decreasers in response to livestock utilization will be used to determine if plots external to exclosures are being influenced by the fenceline effect.

Some study projects proved to be impractical due to lack of Bureau of Land Management expertise or scientific rigor, including the monitoring of mollusks within springs and the assessment of butterfly assemblages. The need to protect rare mollusk habitat has led to fencing off of springs where these organisms occur. Neither fenceline contrast nor paired spring comparisons remain an option. Several reviewers were able to improve statistical methods employed to test hypotheses. Regression and randomization techniques have been included where relevant.

Several peer reviewers commented on the inappropriateness of using threshold values of monitored variables derived from research in other ecosystems. This study plan has dropped the concept of threshold values of livestock impact for use as indicators of proper management. Finally, many reviewers expressed concern that individual small scale studies may not be relevant at the larger landscape-scale of the monument. Actually, many of the surveys are designed to provide a landscape context for individual projects. Generalized maps of plant communities, soils, livestock utilization, weed invasion, individual plant habitat, etc., will be analyzed to provide a broader interpretation of results across the CSNM.

REVISIONS TO STUDIES IN RESPONSE TO OSU PEER REVIEW

In July 2004, the Oregon State University panel of scientists (David Pyke, Research Rangeland Ecologist, U.S. Geological Survey; Robert Beschta, Professor Emeritus, Hydrologist, OSU; Robert Anthony, Research Wildlife Ecologist, U.S. Geological Survey; and Patricia Muir, Plant Ecologist, OSU) provided scientific peer review of the draft study plan and the livestock studies. Their major findings and recommendations 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. They recommended additional consideration of livestock impacts on animals in the study plan.
- Additional studies may require collaboration with other organizations or funding agencies, but they 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 study plan.
- A list of the current threatened, endangered and sensitive species should be included in the study 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 studies will be used in making future decisions regarding livestock grazing, the study plan should include measurements of indicators relating to Standard 4 – Water Quality in the "Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the States of Oregon and Washington" (Appendix C).
- Since the study plan will rely heavily on exclosure data for identifying many livestock impacts, additional exclosures in areas of moderate to high use by livestock should be installed. Exclosures in drier areas of the monument would be useful in identifying upland impacts. Construction of some three-way exclosures to exclude large ungulates should also be considered.
- Consideration should be given to inclusions of one or more larger exclosures (500 to 1000 acres).
- Since remotely sensed data might reduce human costs of monitoring, they believe a feasibility study of the use of Hyperspectral/Light Detection and Ranging (LIDAR) data for addressing some of the indicators of livestock grazing should be considered.
- The study plan should include 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.

Although the draft study plan did not emphasize studies being conducted to evaluate the impacts of livestock on zoological components of the ecosystem, the BLM continues to monitor animals and their habitats within the CSNM as required under the 1995 Medford Resource Management Plan (RMP). The BLM currently surveys for the following species within the monument: bald eagle, northern spotted owl, great gray owl, fisher, western pond turtle, peregrine falcon, and several terrestrial mollusks. This study plan includes descriptions of the BLM studies or monitoring that will be used to evaluate livestock effects on animals within the CSNM.

The description of the objects of biological interest has been expanded in this study plan to include a list of the threatened and endangered, or sensitive plants and animals within the CSNM.

Water quality data continues to be collected throughout the monument as part of the Medford District's monitoring program. The BLM has collected stream temperature data at 18 locations within the monument. The BLM has conducted Properly Functioning Condition (PFC) stream surveys on approximately one-third of the streams within the monument. The water quality data being collected and the hydrologic surveys being conducted by the BLM are described in greater detail in this study plan.

No new fenced exclosures are planned at this time. Although the BLM recognizes the value of additional exclosures, larger exclosures, and three-way exclosures, timing and funding limitations prevent additional exclosures from being constructed. Exclosures are one method for achieving control, and since the BLM is limited in the number and size of exclosures that can be constructed, control will be inferred using other means such as distance from a water source, livestock use pattern, and the use of other established exclosures (built prior to monument designation). Additionally, the former Box-O Ranch is fenced and is functioning as a large-scale exclosure. The BLM is studying the vegetation response within the former Box-O Ranch; however, the management history of the former Box-O must also be taken into consideration.

The BLM has added a pilot study to examine the feasibility of using the Hyperspectral/LIDAR data to analyze the patterns of vegetation in relationship to other factors (elevation, proximity to water or roads, soils, livestock grazing intensity, etc.). This pilot study is described in detail in this study plan.

This study plan includes a new study that examines repeat counts (1991, 1992 versus 2003, 2004) of all fish species at set locations which may provide an understanding of the flux of fish abundance at select sites over the past 10 years.

Additionally, the BLM will review and consider studies conducted by other organizations and individuals, as well as all available information when evaluating the "impacts of livestock grazing on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics." The BLM will evaluate the information or studies in terms of objectivity and scientific credibility, giving more weight to studies that have been peer-reviewed and published in scientific journals. Studies and monitoring conducted by other organizations and individuals may be used to fill in some of the BLM data gaps as necessary and appropriate.

REVISIONS TO STUDIES IN RESPONSE TO PAC RECOMMENDATIONS

During the summer of 2004, the PAC working group reviewed the draft study plan, considered the OSU peer review, and received input from the public. They affirmed the comprehensiveness and scientific integrity of the BLM studies combined with the associated additional studies. They offered the following five recommendations to support the integrity of the process in studying the "impacts of livestock grazing on the objects of biological interest."

1. The OSU peer review recommendations should be incorporated into the livestock grazing studies, and the same panel with the same individual members should be asked to review additional formal studies.
2. As per the comments about data gaps offered in the OSU peer review, the BLM should incorporate the studies sponsored by the World Wildlife Fund, to the extent that peer review shows that these studies are valid and reliable, and that the studies follow established scientific methods and analyses. Other formal studies initiated to address data gaps should receive comparable peer review.
3. The BLM should incorporate a thorough review of relevant literature regarding the impact of livestock grazing on the objects of biological interest, to enhance the design and analysis of the studies.
4. The BLM should work to ensure that information regarding the studies associated with the proclamation is readily accessible to the public.
5. The BLM should recognize that members of interest groups are available and willing to provide anecdotal and historic information as needed.

The BLM is incorporating all of the PAC working group recommendations into its studies. The BLM maintains a web site to keep the public informed of the status of the livestock impact studies and other relevant information about the process. The BLM has incorporated the OSU peer review recommendations where appropriate. Modifications to the studies are described in detail in this updated version of the study plan. The BLM continues to review all relevant literature and will incorporate studies by other groups or

individuals, if appropriate, in the analysis of the "impacts of livestock grazing on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics."

MONUMENT BACKGROUND

The Cascade-Siskiyou National Monument consists of 52,947 acres of federal land administered by the Medford District Office of the BLM in southern Jackson County, Oregon (Map 1). The CSNM is located in the Klamath and Rogue River basins and four watersheds that have a combined total of approximately 780 miles of streams. The topography of the CSNM is variable, with the area around Agate Flat being nearly level to slopes in excess of seventy percent along the head walls of creeks in the Klamath River-Iron Gate Watershed. Elevation ranges from 2,400 feet along Emigrant Creek to 6,134 feet at the top of Chinquapin Mountain. Average annual precipitation for this area ranges from 24 to 46 inches, with most coming in the form of rain below 3,500 feet and snow above that level.

The CSNM is noted for its biological and ecological diversity because of its location at the confluence of the Klamath Mountains, Cascade Mountains and the Great Basin Geological Provinces. Each geologic province provides its own assemblage of organisms and ecological processes known as ecoregions which are based on geology, climate, soils, flora and fauna, elevation, and land use. There are four ecoregions identified in the CSNM having particular biological significance in terms of species richness, endemism, and unique evolutionary/ecological phenomenon.

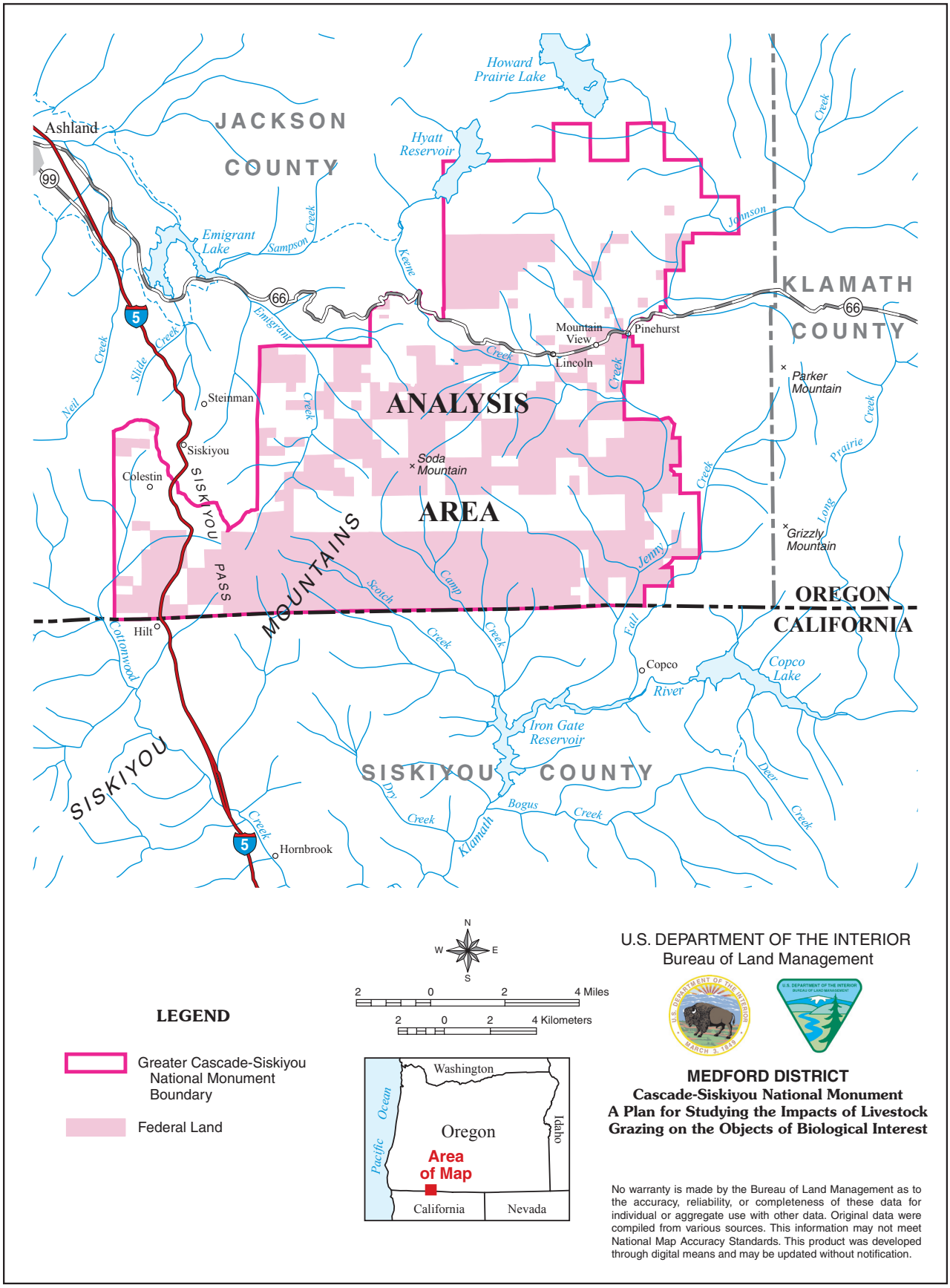
Archaeological evidence indicates that people have lived in the region for at least 10,000 years. Human populations were very low in numbers and highly mobile until about 7,000 years ago. Various native peoples inhabited or used the CSNM area including the Shasta, Klamath, and Modoc tribes. Euro-American settlement in the Rogue and Shasta valleys beginning around the 1850s spurred the development of a new way of life in the region. Farmers and ranchers began to transform the land. Cattle and sheep ranching became a significant use in the CSNM during the latter half of the nineteenth century. Livestock grazing of cattle on an allotment basis continues today across the monument with authorized active use of 2,714 animal unit months (AUMs). Logging became more important in the CSNM after the development of transportation routes, such as the railroad in the 1880s. Large scale salvage logging, partial harvests, and selective logging began in the 1940s and continued through the 1980s with clear-cutting being the preferred harvest method. In the 1990s, timber harvest levels decreased in the area now designated as the CSNM, although approximately 83 percent of the coniferous forest has a timber harvest history.

There are approximately 463 miles of road on approximately 85,126 acres of land across all ownerships within the greater CSNM boundary identified in the presidential proclamation. Of this total, the BLM controls approximately 246 miles of road that accesses the 52,947-acre monument. These roads provide access for recreation, private property, and management activities such as wildfire suppression.

The majority of the CSNM is in a moderate to high fire hazard as a result of past vegetation management and fire suppression activities. Fire has played an important role in influencing historical ecological processes and continues to be recognized as playing an important role in the development and maintenance of vegetative diversity in fire-prone ecosystems found throughout the CSNM.

Hobart overlook.

Map 1: Cascade-Siskiyou National Monument Vicinity Map



OBJECTS OF BIOLOGICAL INTEREST

The CSNM presidential proclamation states:

> With towering fir forests, sunlit oak groves, wildflower-strewn meadows, and steep canyons, the Cascade-Siskiyou National Monument is an ecological wonder, with biological diversity unmatched in the Cascade Range. This rich enclave of natural resources is a biological crossroads -- the interface of the Cascade, Klamath, and Siskiyou ecoregions, in an area of unique geology, biology, climate, and topography.
>
> The monument is home to a spectacular variety of rare and beautiful species of plants and animals, whose survival in this region depends upon its continued ecological integrity. Plant communities present a rich mosaic of grass and shrublands, Garry and California black oak woodlands, juniper scablands, mixed conifer and white fir forests, and wet meadows. Stream bottoms support broadleaf deciduous riparian trees and shrubs. Special plant communities include rosaceous chaparral and oak-juniper woodlands. The monument also contains many rare and endemic plants, such as Greene's Mariposa lily, Gentner's fritillary, and Bellinger's meadowfoam.
>
> The monument supports an exceptional range of fauna, including one of the highest diversities of butterfly species in the United States. The Jenny Creek portion of the monument is a significant center of fresh water snail diversity, and is home to three endemic fish species, including a long-isolated stock of redband trout. The monument contains important populations of small mammals, reptile and amphibian species, and ungulates, including important winter habitat for deer. It also contains old growth habitat crucial to the threatened Northern spotted owl and numerous other bird species such as the western bluebird, the western meadowlark, the pileated woodpecker, the flammulated owl, and the pygmy nuthatch.
>
> The monument's geology contributes substantially to its spectacular biological diversity. The majority of the monument is within the Cascade Mountain Range. The western edge of the monument lies within the older Klamath Mountain geologic province. The dynamic plate tectonics of the area, and the mixing of igneous, metamorphic, and sedimentary geological formations, have resulted in diverse lithologies and soils. Along with periods of geological isolation and a range of environmental conditions, the complex geologic history of the area has been instrumental in producing the diverse vegetative and biological richness seen today.
>
> One of the most striking features of the Western Cascades in this area is Pilot Rock, located near the southern boundary of the monument. The rock is a volcanic plug, a remnant of a feeder vent left after a volcano eroded away, leaving an outstanding example of the inside of a volcano. Pilot Rock has sheer, vertical basalt faces up to 400 feet above the talus slope at its base, with classic columnar jointing created by the cooling of its andesite composition.
>
> The Siskiyou Pass in the southwest corner of the monument contains portions of the Oregon/California Trail, the region's main north/south travel route first established by Native Americans in prehistoric times, and used by Peter Skene Ogden in his 1827 exploration for the Hudson's Bay Company.

The proclamation then goes on to say:

> "……..do proclaim that there are hereby set apart and reserved as the Cascade-Siskiyou National Monument, for the purpose of ***protecting the objects identified above*** (emphasis added)……"

Followed by the livestock grazing paragraph that states:

> "……..study the impacts of livestock grazing on the ***objects of biological interest***

(emphasis added) in the monument with specific attention to sustaining the natural ecosystem dynamics……..”

The BLM has interpreted this to mean that the biological objects of interest are as follows:

Tangible objects of interest:

- Towering fir forests, sunlit oak groves, wildflower-strewn meadows.
- Rare and beautiful species of plants and animals.
- Rich mosaic of grass and shrublands, Garry and California black oak woodlands, juniper scablands, mixed conifer and white fir forests, and wet meadows.
- Broad-leaf deciduous riparian trees and shrubs.
- Special plant communities include rosaceous chaparral and oak-juniper woodlands.
- Rare and endemic plants, such as Greene's mariposa lily, Gentner's fritillary, and Bellinger's meadowfoam.
- Range of fauna including; fresh water snail diversity, three endemic fish species including a long-isolated stock of redband trout, populations of small mammals, reptile and amphibian species, and ungulates, including important winter habitat for deer.
- Old growth habitat crucial to the threatened northern spotted owl and numerous other bird species such as the western bluebird, the western meadowlark, the pileated woodpecker, the flammulated owl, and the pygmy nuthatch.

The monument’s unique geology, climate, and topography contribute to the presence of many rare and endemic plants and animals. The monument contains known populations of 33 special status plant species, 45 special status terrestrial animal species, and eight special status aquatic animal species. Appendix B in this document contains a list of all special status species of plants and animals known to occur within the CSNM.

Intangible objects of concern:

- Ecological integrity.
- Natural processes.
- Diverse vegetative and biological richness.
- Natural ecosystem dynamics.

While most people understand tangible objects that can be seen and felt, many do not relate to intangible objects that are responsible for the persistence of plants, wildlife, parent communities, and their patterns of occurrence across the CSNM landscape. Richness, diversity, and integrity can change over time and are measures of ecosystem dynamics. Ecosystem dynamics reflect the effects of a range of forces (e.g., fire, succession, weed invasion, herbivory) that interact with the physical environment of the landscape to maintain objects of biological interest on the CSNM. The maintenance of forces or ecological processes that support the objects of biological interest is therefore central to management of the CSNM.

CURRENT LIVESTOCK GRAZING PROGRAM

CURRENT GRAZING ALLOTMENT ORGANIZATION

Livestock grazing in the monument is organized into nine grazing allotments (Map 2). Two of these allotments, Agate and Siskiyou, are currently vacant. Five of the active allotments, accounting for 97 percent of livestock grazing authorized use in the monument, are managed by the Medford District BLM. The Lakeview District BLM administers the Buck Mountain and Dixie Allotments in the CSNM (Table 1). Eleven lessees have active authorized use within the monument on seven allotments.

Table 1. Active Grazing Allotments

Allotment	Acres of Public Land (within the Greater Monument Boundary)
Soda Mountain	35,264
Keene Creek	10,600
Jenny Creek	1,417
Dixie	1,283
Buck Mountain	739
Box R	88
Deadwood	32

Existing grazing leases authorize a total of 2,714 active AUMs during the grazing season. An AUM is the amount of forage required to sustain a cow and calf for one month. Total AUMs represent the number of cows or cow/calf pairs multiplied by the number of months included in the season of use. For example, a lessee with one cow/calf pair that was turned out for five months would have used a total of five AUMs. Although the grazing seasons vary by allotment, grazing generally occurs from May through October within the monument.

Livestock lessees used a total of 1,889 AUMs on public lands in the monument during the 2004 grazing season (70 percent of the AUMs authorized under their grazing leases). The 10-year average of actual use shows that the livestock lessees in the monument used approximately 58 percent of the authorized AUMs (Table 2).

LAWS AND REGULATIONS RELATED TO LIVESTOCK GRAZING

The presidential proclamation stated that "Existing authorized permits or leases may continue with appropriate terms and conditions under existing laws and regulations." The primary laws that govern livestock grazing practices on BLM land are the Taylor Grazing Act (TGA) of 1934 and the Federal Land Policy and Management Act (FLPMA) of 1976 as amended by the Public Rangelands Improvement Act of 1978.

The TGA established a strategy for grazing management intended to "stop injury to the public grazing lands by preventing overgrazing and soil deterioration…." Subsequent to the TGA, 65 million acres of public land deemed "chiefly valuable for grazing and raising forage crops" were placed in grazing districts. Grazing districts in Oregon were created exclusively on the east side of the Cascades and did not include lands that are now part of the CSNM. Section 15 of the TGA allows the issuance of grazing leases on public lands outside the original grazing district boundaries. Grazing leases in the monument were issued under Section 15 of the TGA.

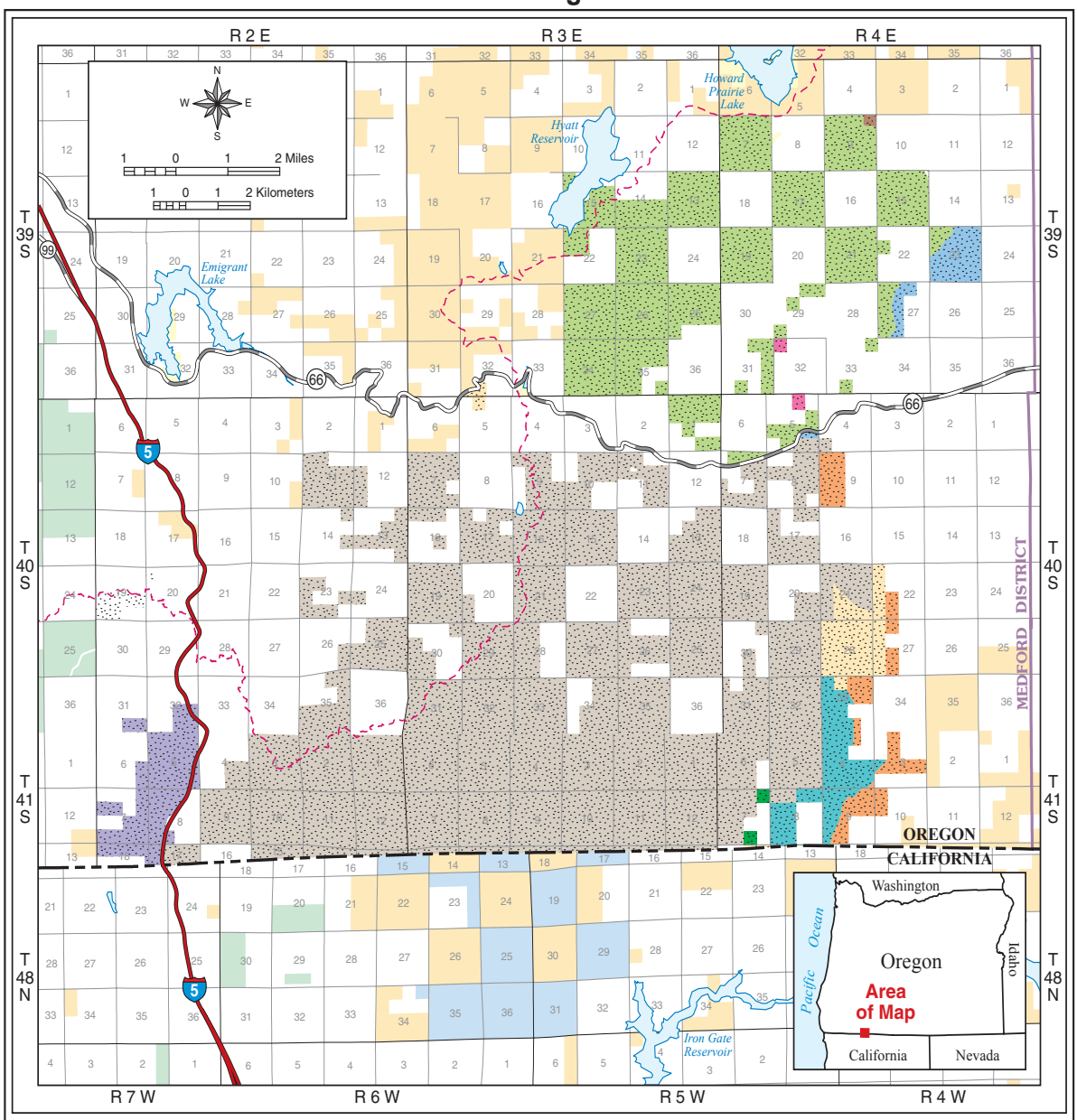
In 1976 Congress enacted FLPMA, making fundamental changes to the management of public lands overall, including grazing management. FLPMA did not distinguish between the administration of lands included in the original grazing districts and those leased under Section 15. Regulations regarding the administration of grazing on BLM lands are found in Volume 43 Code of Federal Regulations (CFR) Subpart 4100. Livestock grazing management in the monument would ensure that (1) the intent of the presidential proclamation is being met, and (2) that BLM regulations for managing livestock grazing are followed.

The Presidential Proclamation

The presidential proclamation provides the following direction in regards to livestock grazing:

> The Secretary of the Interior shall study the impacts of livestock grazing on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics. Existing authorized

Map 2: Cascade-Siskiyou National Monument Livestock Grazing Allotments



LEGEND

Grazing Allotments (BLM Portion)

- 10103 Buck Mountain (738.78 Acres)
- 10106 Deadwood (32.18 Acres)
- 10107 Dixie (1,283.06 Acres)
- 10108 Jenny Creek (1,417.37 Acres)
- 10109 Agate (82.21 Acres)
- 10110 Soda Mountain (35,264.41 Acres)
- 10115 Keene Creek (10,600.33 Acres)
- 10118 Siskiyou (1,898.28 Acres)
- 10137 Box R (87.57 Acres)

- Pacific Crest Trail
- BLM District Boundary

BLM Administered Land

- Cascade-Siskiyou National Monument
- Other

Other Administered Land

- Forest Service
- Bureau of Reclamation
- State
- Private or Other

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management

MEDFORD DISTRICT
Cascade-Siskiyou National Monument
A Plan for Studying the Impacts of Livestock Grazing on the Objects of Biological Interest

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

> permits or leases may continue with appropriate terms and conditions under existing laws and regulations. Should grazing be found incompatible with protecting the objects of biological interest, the Secretary shall retire the grazing allotments pursuant to the processes of applicable law. Should grazing permits or leases be relinquished by existing holders, the Secretary shall not reallocate the forage available under such permits or for livestock grazing purposes unless the Secretary specifically finds, pending the outcome of the study, that such reallocation will advance the purposes of the proclamation.

The presidential proclamation directed the BLM to "study the impacts of livestock on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics." The BLM is currently implementing multiple projects designed to determine and quantify the effects of livestock grazing on these objects and ecosystem processes.

The mandate to study the impacts of livestock grazing is also a call to consider ecosystem dynamics (change over time) and ecosystem integrity (whether all the components of the ecosystem are present and functioning). This requires the BLM to consider the biological objects and ecosystem variables relative to the range of processes occurring within the CSNM landscape. The monitoring of indicator species and variables indicative of ecosystem functioning is critical to understanding the health of the ecosystems within the monument.

The proclamation also stated that "Should grazing be found incompatible with protecting the objects of biological interest, the Secretary shall retire the grazing allotments pursuant to the processes of applicable law." The results of the livestock studies will, therefore, be used to determine whether or not livestock grazing is compatible with "protecting the objects of biological interest."

Current Grazing Regulations

Current grazing regulations (43 CFR 4180) direct the BLM to manage livestock grazing in accordance with the *Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington* (Appendix C).

The Standards and Guidelines identify five specific standards that are used to determine the degree to which "ecological function and process exists within each ecosystem." Standards address the health, productivity, and sustainability of the BLM-administered public rangelands and represent the minimum acceptable conditions for the public rangelands. The guidelines are management practices that will either maintain existing desirable conditions or move rangelands toward statewide standards within reasonable timeframes. The five specific standards are defined as follows:

Standard 1 – Watershed Function, Uplands: Upland soils exhibit infiltration and permeability rates, moisture storage, and stability that are appropriate to soil, climate, and landform.

Standard 2 – Watershed Function, Riparian/Wetland Areas: Riparian/wetland areas are in properly functioning physical condition appropriate to soil, climate, and landform.

Standard 3 – Ecological Processes: Healthy, productive and diverse plant and animal populations and communities appropriate to soil, climate, and landform are supported by ecological processes of nutrient cycling, energy flow, and the hydrologic cycle.

Standard 4 – Water Quality: Surface water and groundwater quality, influenced by agency actions, complies with state water quality standards.

Standard 5 – Native, Threatened and Endangered, and Locally Important Species: Habitats support healthy, productive, and diverse populations and communities of native plants and animals (including special status species and species of local importance) appropriate to soil, climate, and landform.

The Standards and Guidelines (Appendix C) also specify a set of potential indicators for use when determining whether or not standards are being met. The livestock studies described in this study plan have been designed to provide

information regarding many of these potential indicators. In addition to the Standards and Guidelines, it may be necessary to use other site-specific or species-specific indicators to determine "the impacts of livestock grazing on the objects of biological interest in the monument." The results of the livestock impacts studies will be used in conjunction with other available data to determine whether or not the grazing standards are being met by current grazing practices.

PRIMARY MANAGEMENT CONCERNS RELATED TO LIVESTOCK GRAZING

A list of concerns and questions identified are presented below. They are based on quantitative and qualitative analyses, an extensive literature review, and site-specific knowledge regarding areas that are currently utilized by livestock. As described later in this study plan, the BLM has initiated multiple studies of potential livestock impacts on monument resources. These studies will continue to provide quantitative data regarding the impacts from livestock on the "objects of biological interest with specific attention to sustaining the natural ecosystem dynamics." Ongoing monitoring, data collection, and analysis will help to answer some of the outstanding questions regarding the role that livestock grazing plays in some of the existing conditions throughout the monument.

Noxious Weeds

The spread of noxious weeds is a problem throughout the monument. Livestock are one vector associated with the spread of noxious weeds: livestock disturbance may increase site receptiveness to noxious weed invasions; and livestock movement through areas may also contribute to weed spread. To what extent do livestock, as compared to other historic or current disturbance factors, contribute to the introduction and/or spread of noxious weeds and undesirable non-native species in the monument?

Riparian and Wetland Areas

Riparian and wetland areas are the most productive and highly prized resources found on public lands in the monument. These areas play a significant role in restoring and maintaining the chemical, physical, and biological integrity of water sources (USDA and USDI 1994). Monitoring of livestock use over the past few years has identified areas of use that exceed moderate levels (greater than 60 percent use of key forage species) within riparian areas. Livestock use patterns and associated trampling (hoof action) may be impacting the functionality of some riparian and wetland areas and impeding attainment of the Aquatic Conservation Strategy (ACS) in these areas. To what extent are livestock, as compared to other historic or current disturbance factors, impacting streams, springs, seeps, and wetlands or affecting aquatic organisms, including sensitive aquatic mollusk and fish species?

Springs, seeps, and wetlands have also been affected as a consequence of altered hydrology. Range facilities (the creation of stock ponds) and associated roads have altered the flow of water and may have deprived historic wetlands of water; they may have also inadvertently created and maintained new wet areas. How does the distribution of livestock facilities across the landscape, as compared to other historic or current disturbance factors, alter the monument's hydrologic systems?

Wildlife Habitat

Cattle use the landscape and forage resources differently than do the native ungulates. As a result, the effects of cattle herbivory on ecosystem processes are different from those of native ungulate herbivory. Cattle can reduce the forage available for native species, and can reduce ground cover that may serve as habitat for various species. What effects do livestock, as compared to other historic or current disturbance factors, have on important wildlife habitats, including black-tailed deer winter range, native ground-nesting birds, and rare or special status animal species?

Ecological Succession and Plant Community Composition

The literature indicates that direct and indirect livestock impacts can influence plant composition and, consequently, the relative abundance of weeds. Livestock preference for certain species and the plant's ability to withstand grazing can change the competitive balance between species, resulting in livestock-induced changes to the ecological state and successional processes. What role does livestock grazing play in changing the

vegetation community composition and structure, or in the maintenance of the existing annual/perennial grass ratios?

Special Status Species

Unique populations of native plant and animal species are an important part of the monument's ecology. Cattle grazing can influence populations of these rare objects, either directly from grazing or trampling, or indirectly from the successional changes described above. How are current livestock grazing practices affecting the recovery of rare, threatened, endangered, special status or native species populations?

Water Quality

There are nine streams in the CSNM currently listed as water quality limited for temperature (summer) by the Oregon Department of Environmental Quality's 2002 303(d) list. Grazing by ungulates can directly affect stream temperature through the alteration, reduction, or elimination of streamside vegetation that shades the stream. Indirectly, livestock grazing can widen stream channels through stream bank erosion from trampling, hoof-slide, and stream bank collapse. Stream widening reduces stream depth and increases the surface area of the water exposed to solar radiation leading to higher water temperatures. To what extent are current livestock grazing practices, as compared to other historic or current disturbance factors, contributing to high summer temperatures in these streams?

303(d) LIST

The Department of Environmental Quality (DEQ) is required by the Clean Water Act to maintain a list of stream segments that do not meet water quality standards. This list is called the 303(d) list in reference to the section of the Clean Water Act that makes the requirement.

The Oregon DEQ has the responsibility for developing water quality standards that protect beneficial uses of rivers, streams, lakes, and estuaries. Beneficial uses include drinking water, cold water fisheries, industrial water supply, recreation, and agricultural uses. Once standards are established, the state monitors water quality and reviews available data and information to determine if these standards are being met and water is protected.

Streams and rivers are not placed on the 303(d) list until sufficient data are available that indicate an exceedance of *water quality standards* has occurred. The 303(d) list includes data submitted by individuals, organizations and government agencies as well as DEQ's own monitoring data. The list is updated every two years.

Jenny Creek on the Box-O Ranch.

STUDY PLAN STRATEGY

This study plan describes studies and monitoring projects conducted by the BLM that will be used to analyze "the impacts of livestock grazing on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics." This study plan updates the draft study plan, *Draft Study of Livestock Impacts on the Objects of Biological Interest*, completed in 2001. There are 18 studies and monitoring projects described in this study plan. These studies and monitoring projects are a subset of all the monitoring projects described in Appendix J of the *Cascade-Siskiyou National Monument Proposed Resource Management Plan/Final Environmental Impact Statement* (USDI 2005).

Where appropriate, individual monitoring projects have clearly stated objectives with supportive predictors and/or standards. Methods of analysis will be transparent and repeatable, subject to peer review, and rely as little as possible on anecdotal information.

The effects of livestock grazing and associated activities on individual species, populations, communities, and the richness of plant and wildlife habitat in the context of ecosystem functioning across the landscape is complex and may not be easily understood over a period of a few years. Thus, a subset of monitoring projects will be continued beyond the 3-5 year initial study period. This study plan utilizes guidance from existing documents as well as the presidential proclamation of the CSNM to ensure an adequate monitoring program.

Several documents have been used to direct surveys, monitoring, and research:

- The Presidential Proclamation (Appendix A);
- Aquatic Conservation Strategy (ACS) in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (Northwest Forest Plan) (USDA and USDI 1994);
- Medford Grazing Management Program/ Environmental Impact Statement (USDI 1983a);
- Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the States of Oregon and Washington (Appendix C);
- Biological issues identified within Cascade Siskiyou Ecological Emphasis Area Draft Management Plan/Environmental Impact Statement completed prior to the Presidential Proclamation of the Cascade-Siskiyou National Monument (USDI 2000b).

The context for examining livestock impacts on objects of biological interest remains the allotment management plan(s) currently in place and the terms and conditions in the individual leases.

This study plan fulfills several general goals:

- the data provided by the individual monitoring projects will provide information for completing upcoming Rangeland Health Assessments;
- it examines whether current management is appropriate for the landscape in terms of the maintenance of important natural resources;
- it determines if the current livestock management strategies are effective in meeting the terms and conditions of the individual leases; and
- it monitors specific objects of biological and ecological context relative to livestock effects.

EXISTING DATA

Determining livestock effects on the objects of biological interest requires examining and critiquing existing data, as well as designing new projects to fill in any data gaps. Data and monitoring projects that existed prior to the designation of the CSNM include:

- rangeland trend data collected at 12 locations within the monument;
- utilization data collected within 29 plots/ transects within the monument;
- general maps of livestock utilization;
- transects examining browsing of trees/shrubs;
- riparian photos;
- riparian transects;

- analysis of fecal composition to determine diets of livestock, deer, and elk;
- wildlife surveys; and
- water quality monitoring data.

The existing data will be re-analyzed using a common set of statistical tools and interpreted in mutual context to each other and information from projects completed for the livestock impacts study. The individual study and project descriptions in this study plan provide more detail on existing data sets.

DATA GAPS

Several projects are underway to examine plant community changes that have occurred over the past few decades. This data will serve as an important temporal backdrop for current rangeland condition surveys. Together with historical information on management changes over the last 100 years, understanding patterns of plant community change will help prioritize management issues in the future.

Vegetation maps derived from imagery (acquired from satellite and low altitude plane platforms) and field surveys will provide an understanding of the patterning of plant communities across the landscape, while also identifying areas for restoration.

From existing information, it appears that there is little information about the distribution and condition of springs, seeps, and wetlands within the monument. Lack of historic compositional data within wetland plant communities constitutes a serious knowledge gap. Also missing is an understanding of livestock impacts on higher elevation semi-wet meadow and conifer understory plant communities.

Noxious weed surveys and preliminary plant community surveys indicate that the most serious threat to local plant communities is weed invasion. Patterns of weed invasion across the landscape, factors facilitating weed invasion, and methods of weed eradication need to be studied to prevent further deterioration of native plant communities.

Plant community trend monitoring needs to be extended to all plant communities across the landscape, particularly those used by livestock and located in parts of the landscape not currently monitored (north of Highway 66).

Perhaps the most serious problem with existing data is the lack of control areas (monitoring in livestock impact-free areas), to serve as a comparison to livestock impacted areas. Control areas in the form of livestock exclosures are needed to represent each general plant community within the CSNM. Additional livestock exclosures are needed to examine particular issues (for example, weed invasion or livestock impact to a rare plant or wildlife species).

Detailed site-specific studies centered on livestock exclosures must be supported by landscape surveys to achieve a landscape perspective of direct impacts of livestock on important elements of the CSNM. The remainder of the document describes the intensive monitoring projects associated with livestock exclosures, and the supporting monitoring/landscape surveys.

STUDIES AND MONITORING PROJECTS

The BLM is currently conducting studies, monitoring projects, and a literature review designed to determine "the impacts of livestock on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics" as directed by the presidential proclamation. These studies and monitoring projects are summarized in Table 3. For each study or project, Table 3 describes the protocols adhered to and the indicators being evaluated in accordance with the Standards and Guidelines (Appendix C).

The next section of the study plan describes in detail the studies and monitoring projects that are underway or are proposed for implementation. Results of these studies, monitoring projects, and literature review, as well as other available information will be used to evaluate the impacts of livestock grazing in the CSNM. Decisions will not be made on single critical indicators or studies (e.g. decline of listed species, increasing noxious weeds, etc.), but rather on the cumulative assessment of study results as highlighted by the data.

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument				
Project Identifier	**Project**	**Standards and Indicators Evaluated**	**Protocol**	**Reference**
1a	**Livestock Exclosure Project:** Plant Community Change Following Livestock Removal: Grasslands, Shrublands, Woodlands, Conifer Understory, Riparian, and Wetlands	**Standard 1—Watershed Function–Uplands** • amount and distribution of plant cover • amount and distribution of plant litter • amount and distribution of bare ground • plant community composition and community structure **Standard 2—Watershed Function–Riparian/ Wetland Areas** • plant composition • age class distribution and community structure • root mass • streambank/shoreline stability **Standard 3—Ecological Processses** • plant composition • accumulation, distribution, incorporation of plant litter into the soil • root occupancy in the soil profile • biological activity including plant growth, herbivory, and rodent, insect and microbial activity • soil compaction **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition • habitat elements • spatial distribution of habitat • population stability/resilience	Point Cover Transects TR 4400-4 p. 78	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1996

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument

Project Identifier	Project	Standards and Indicators Evaluated	Protocol	Reference
1b	**Livestock Exclosure Project:** Plant Community Change (Weeds) Following Livestock Removal: Grasslands, Shrublands, Woodlands, Conifer Understory, Riparian, and Wetlands	**Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition, age class distribution, and productivity • habitat elements • spatial distribution of habitat • population stability/resilience	Point Cover Transects TR 4400-4 p. 78	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1996
2	**Livestock Exclosure Project:** Greene's Mariposa Lily (*Calochortus greenei*) Monitoring	**Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition, age class distribution, and productivity • habitat elements • spatial distribution of habitat • population stability/resilience	Quadrat Frequency TR 4400-4 p. 37	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1996
4	**Livestock Exclosure Project:** Plant Community and Canada Thistle Recovery in Herbicide-Treated Pastures in the Presence and Absence of Livestock Impact	**Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition, age class distribution, and productivity • habitat elements • spatial distribution of habitat • population stability/resilience	Point Cover Transects TR 4400-4 p. 78	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1996

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument

Project Identifier	Project	Standards and Indicators Evaluated	Protocol	Reference
A	**General Landscape Condition Survey for Klamath River Ridges Area**	**Standard 1—Watershed Function–Uplands** • amount and distribution of plant cover • plant community composition and community structure **Standard 2—Watershed Function–Riparian/ Wetland Areas** • plant composition • age class distribution and community structure **Standard 3—Ecological Processses** • plant composition • root occupancy in the soil profile **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition • habitat elements • spatial distribution of habitat • population stability/resilience	Ocular Canopy Cover TR 4400-4 p. 25 TR 4400-5 p. 123-240	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1996 USDI Bureau of Land Management 1992

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument

Project Identifier	Project	Standards and Indicators Evaluated	Protocol	Reference
B	**Examination of Historical Vegetation Plots**	**Standard 1—Watershed Function–Uplands** • amount and distribution of plant cover • plant community composition and community structure **Standard 2—Watershed Function–Riparian/ Wetland Areas** • plant composition • age class distribution and community structure **Standard 3—Ecological Processses** • plant composition • root occupancy in the soil profile **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition • habitat elements • spatial distribution of habitat • population stability/resilience	Ocular Canopy Cover TR 4400-4 p. 25 TR 4400-5 p. 123-240	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1996 USDI Bureau of Land Management 1992
C	**Rare Individual Plant and Plant Community Analyses**	**Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition • habitat elements • spatial distribution of habitat • population stability/resilience	Intuitive Controlled Survey Geographic Information System (GIS)	USDA Forest Service and USDI Bureau of Land Management 1999 USDI Bureau of Land Management 2003

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument

Project Identifier	Project	Standards and Indicators Evaluated	Protocol	Reference
D	**Hyperspectral/Light Detection and Ranging (LIDAR) and Thematic Mapper Imagery to Characterize Vegetation**	**Standard 1—Watershed Function–Uplands** • amount and distribution of plant cover • amount and distribution of bare ground • plant community composition and community structure **Standard 2—Watershed Function–Riparian/ Wetland Areas** • frequency of floodplain/wetland inundation • plant composition • age class distribution and community structure **Standard 3—Ecological Processses** • plant composition **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition • habitat elements • spatial distribution of habitat • habitat connectivity	Hyperspectral/ Light Detec-tion and Ranging (LIDAR) and Thematic Mapper Imagery	Environmental System Research Institute (ESRI), Inc. 2004
E	**Weed Monitoring**	**Standard 1—Watershed Function–Uplands** • plant community composition and community structure **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition, age class distribution, and productivity • habitat elements • spatial distribution of habitat • population stability/resilience	Presence/Absence Survey Geographic Information System (GIS)	Environmental System Research Institute (ESRI), Inc. 2004

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument

Project Identifier	Project	Standards and Indicators Evaluated	Protocol	Reference
F	**Dietary Overlap between Livestock and Native Ungulates**	**Standard 5—Native Threatened and Endangered, and Locally Important Species** • animal community composition and productivity • habitat elements • spatial distribution of habitat	Fecal Analysis TR 4400-5 p. 233	USDI Bureau of Land Management 1992; Environmental System Research Institute (ESRI), Inc. 2004
G	**Shrub Utilization Studies**	**Standard 1—Watershed Function–Uplands** • plant community composition and community structure	Cole Browse TR 4400-3 p. 34	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1996
H	**Landscape Fish Distribution and Density Fluctuation at Select Study Sites**	**Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition, age class distribution, and productivity • habitat elements • spatial distribution of habitat • population stability/resilience	Properly Functioning Condition (PFC) TR 1737-15 p. 9	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1998

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument

Project Identifier	Project	Standards and Indicators Evaluated	Protocol	Reference
I	**Hydrologic/Proper Functioning Condition Surveys**	**Standard 1—Watershed Function–Uplands** • amount and distribution of plant cover • plant community composition and community structure • absence of accelerated erosion and overland flow **Standard 2—Watershed Function–Riparian/ Wetland Areas** • frequency of floodplain/wetland inundation • plant composition • age class distribution and community structure • root mass • point bars revegetating • streambank/shoreline stability • riparian area width • sediment deposition • active/stable beaver dams • coarse/large woody debris • upland watershed conditions • frequency/duration of soil saturation • water table fluctuation **Standard 3—Ecological Processses** • plant composition • root occupancy in the soil profile **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition • habitat elements	Properly Functioning Condition (PFC) TR 1737-15 p. 9	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1998

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument

Project Identifier	Project	Standards and Indicators Evaluated	Protocol	Reference
J	**Stubble Height Monitoring**	**Standard 1—Watershed Function–Uplands** • plant community composition and community structure • amount and distribution of plant cover • amount and distribution of plant litter • amount and distribution of bare ground **Standard 2—Watershed Function–Riparian/ Wetland Areas** • plant composition • streambank/shoreline stability **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition, age class distribution, and productivity • habitat elements	Stubble Height Method TR 4400-3 p. 51 Actual Weight Method TR 4400-3 p. 103	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1996
K	**Range Utilization**	**Standard 1—Watershed Function–Uplands** • plant community composition and community structure • amount and distribution of plant cover • amount and distribution of plant litter • amount and distribution of bare ground **Standard 2—Watershed Function–Riparian/ Wetland Areas** • plant composition • streambank/shoreline stability **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition, age class distribution, and productivity • habitat elements	Key Species Method TR 4400-3 p. 81 Mapping Use Zones TR 4400-3 p. 23	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1996

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument

Project Identifier	Project	Standards and Indicators Evaluated	Protocol	Reference
L	**Range Trend**	**Standard 1—Watershed Function–Uplands** • plant community composition and community structure • root occupancy in the soil profile **Standard 3—Ecological Processses** • plant composition • root occupancy in the soil profile **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition • habitat elements • spatial distribution of habitat • population stability/resilience	Nested Frequency TR 4400-4 p. 37	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1996

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument

Project Identifier	Project	Standards and Indicators Evaluated	Protocol	Reference
M	**Rangeland Condition**	**Standard 1—Watershed Function–Uplands** • plant community composition and community structure • amount and distribution of plant cover • amount and distribution of plant litter • amount and distribution of bare ground • absence of accelerated erosion and overland flow **Standard 3—Ecological Processses** • plant composition • accumulation, distribution, incorporation of plant litter into the soil • root occupancy in the soil profile • biological activity including plant growth, herbivory, and rodent, insect and microbial activity • soil compaction **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition • habitat elements • spatial distribution of habitat • population stability/resilience	Rangeland Condition H-4410-1 p. 305.1-305.9	USDI Bureau of Land Management, USDA Forest Service, USDA Soil Conservation Service 1976

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument				
Project Identifier	**Project**	**Standards and Indicators Evaluated**	**Protocol**	**Reference**
N	**Photo Monitoring**	**Standard 1—Watershed Function–Uplands** • amount and distribution of plant cover • amount and distribution of bare ground • amount and distribution of rock, stone, and gravel • plant community composition and community structure • absence of accelerated erosion and overland flow **Standard 2—Watershed Function–Riparian/ Wetland Areas** • plant composition • age class distribution and community structure • root mass • point bars revegetating • streambank/shoreline stability • sediment deposition • active/stable beaver dams • coarse/large woody debris • upland watershed conditions • frequency/duration of soil saturation **Standard 3—Ecological Processses** • plant composition • root occupancy in the soil profile • biological activity including plant growth, herbivory, and rodent, insect and microbial activity **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition • habitat elements • population stability/resilience	Photo Monitoring TR 4400-4 p. 31	USDI Bureau of Land Management, USDA Forest Service, USDA Natural Resource Conservation Service 1996

Table 3. Studies and Monitoring Projects within the Cascade-Siskiyou National Monument				
Project Identifier	**Project**	**Standards and Indicators Evaluated**	**Protocol**	**Reference**
P	**Macroinvertebrate Monitoring of Springs and Seeps in Grazed and Ungrazed Areas**	**Standard 3—Ecological Processses** • animal community structure and plant composition **Standard 4—Water Quality** • populations of aquatic organisms **Standard 5—Native Threatened and Endangered, and Locally Important Species** • animal community composition and productivity • habitat elements • spatial distribution of habitat • population stability/resilience	Presence/Absence	Wisseman 1996
Q	**Deer and Elk Distribution**	**Standard 5—Native Threatened and Endangered, and Locally Important Species** • animal community composition and productivity • habitat elements • spatial distribution of habitat • population stability/resilience	Oregon Department of Fish and Wildlife Telemetry	Environmental System Research Institute (ESRI), Inc. 2004; Bigman 1995
R	**Repeat Riparian Condition Survey**	**Standard 1—Watershed Function–Uplands** • amount and distribution of plant cover • amount and distribution of bare ground • plant community composition and community structure • absence of accelerated erosion and overland flow **Standard 2—Watershed Function–Riparian/ Wetland Areas** • plant composition • streambank/shoreline stability **Standard 3—Ecological Processses** • plant composition **Standard 5—Native Threatened and Endangered, and Locally Important Species** • plant community composition • habitat elements	Walk-through Surveys and Photos	USDI 1983b

LIVESTOCK EXCLOSURE PROJECT

Overview

Livestock impact on biological objects of the monument can best be assessed relative to areas of zero livestock impact. Since the entire landscape has been grazed in the past, monitoring within newly created control areas (livestock exclosures) will be a measure of response of plant communities/biological elements to the removal of current livestock impact. Control areas (livestock exclosures) without livestock are also necessary to determine if changes in the abundance of variables of interest are due to livestock impact, other extrinsic influences (climate change, fluctuation in amount and pattern of precipitation), or other unrecorded disturbance events. Ideally, livestock use areas and livestock exclosures should be located adjacent to each other on the same ecological site to ensure that transects are comparable.

Livestock exclosures have been constructed at 10 key locations (Map 3) to provide the necessary control to examine livestock impacts on a larger range of plant communities, as well as specific biological elements identified by the presidential proclamation for the CSNM.

The livestock exclosure study is limited by the number and size of the fenced areas.

Probably the most severe limitation of the livestock exclosure study relates to replication. In general, this is common to landscape-level projects. Some of the biological elements being examined only occur on two or three locations within the monument - an inherent restriction in replication. In the draft study plan (2001), the wide range of biological elements potentially impacted by livestock meant that few replicates were associated with each element being examined.

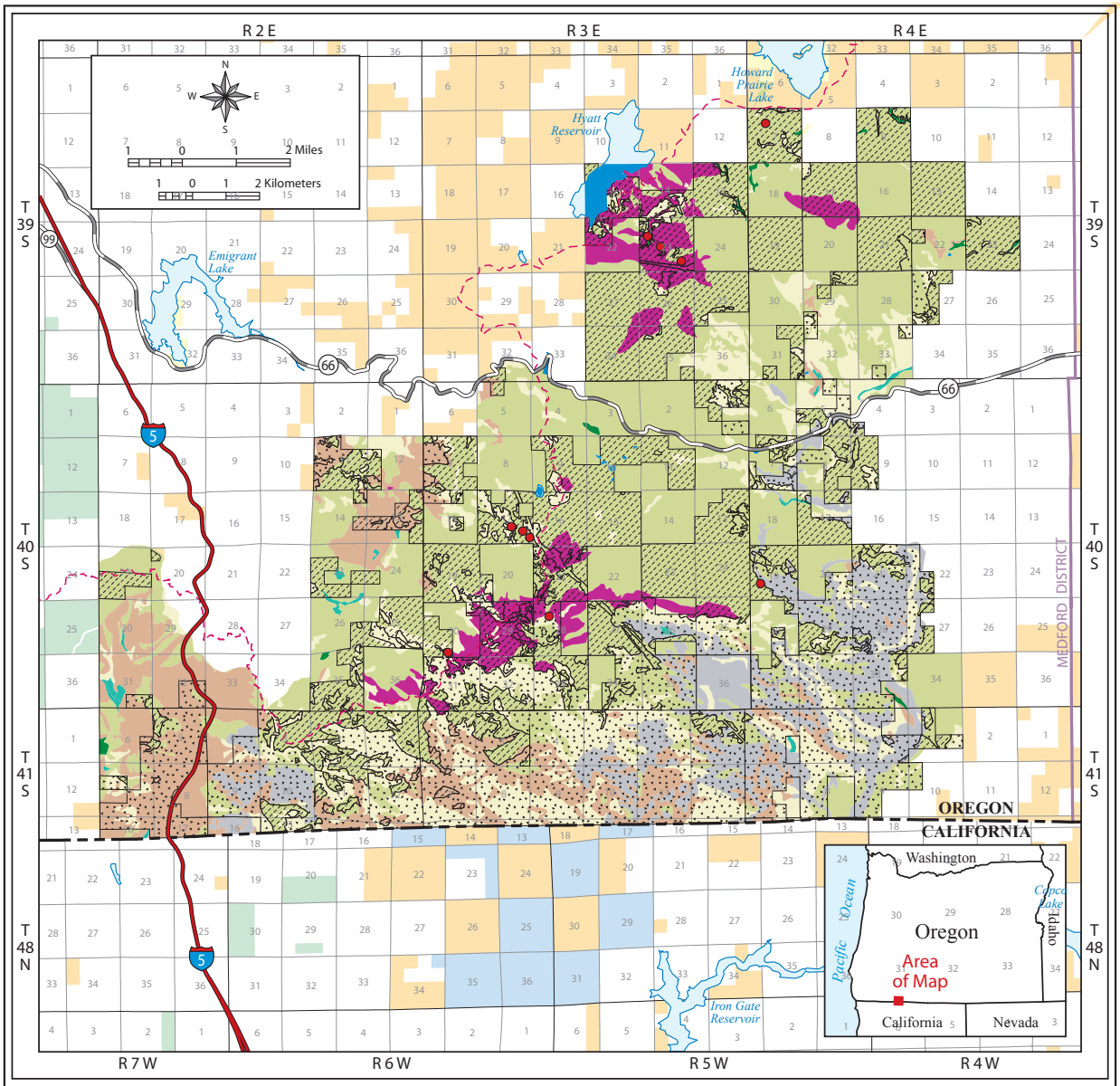
Additional monitoring plan design features to alleviate the problem of replication include:

- multiple external plots paired to individual plots within exclosures;
- landscape surveys of conditions represented by each livestock exclosure and paired area will be conducted to determine the extent of the situation represented by the livestock exclosure and paired transects;
- new monitoring endeavors will be integrated with historical data. The accumulation of historic sites together with the diversity of new monitoring projects will provide an improved understanding of livestock influence over space and time.

For most variables, statistical inference will be derived at the plot level as well as at the landscape level. Most data (vegetation, soil cover,

Livestock exclosure construction on Chinquapin Mountain, 2000/2001.

Map 3: Cascade-Siskiyou National Monument Exclosures



LEGEND

Plant Communities
- Grassland/Meadow
- Shrub/Woodland
- Hardwood
- Mixed Conifer
- White Fir
- Semi-Wetland
- Wetland
- Water
- Exclosure

- Pacific Crest Trail
- BLM District Boundary
- Cascade-Siskiyou National Monument Diversity Emphasis Area
- Cascade-Siskiyou National Monument Old-Growth Emphasis Area

Administered Land
- Bureau of Land Management
- Forest Service
- Bureau of Reclamation
- State
- Private or Other

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management

MEDFORD DISTRICT
Cascade-Siskiyou National Monument
A Plan for Studying the Impacts of Livestock Grazing on the Objects of Biological Interest

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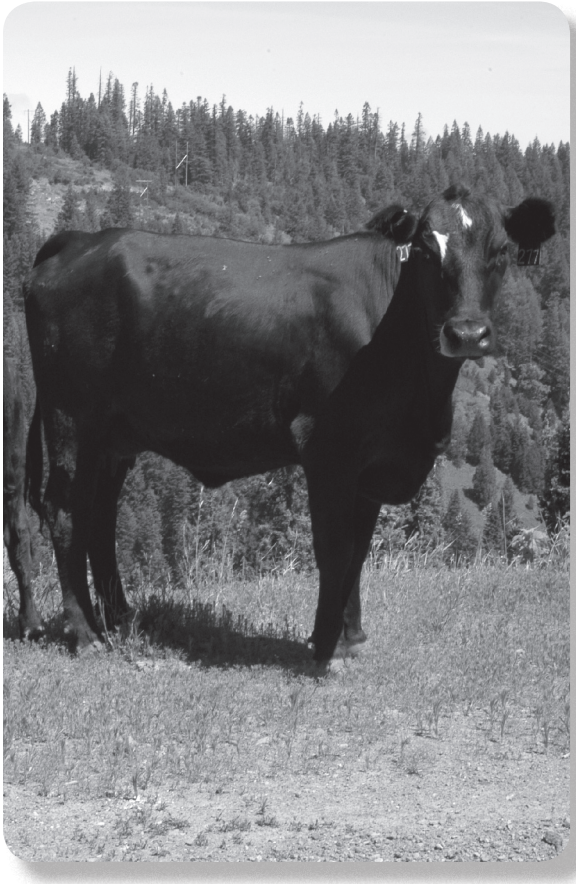
and disturbance) are collected as point cover, allowing their assessment as non-parametric or parametric data. At the plot level, chi-squared analysis will be used to examine change over time of individual transects or paired transects. This follows the standard BLM protocol also recommended for the rangeland frequency trend plots. T-tests will be used to determine if differences in stubble height exist inside and outside of livestock exclosures. At the landscape level, analysis of variance or correlation techniques will be used to assess statistical significance. Alternative statistical corollaries using randomization techniques (Manley 1991) will be used where the assumptions for statistics based on central tendency are not met. Regression analyses will be used to examine the relationship between measures of livestock utilization (residual stubble height and phytomass, hoof impact) and determinate variables of interest.



Four individual studies will use the data collected from the livestock exclosures to examine variables associated with individual plant, plant community composition/structure, and physical environment within livestock exclosures and paired sites (Table 4).

Table 4. Individual Studies Examining Important Biological Elements of the CSNM.

Study Number	Biological Object Examined Inside/Outside of Exclosures	Management Action/ Comment	Supporting Monitoring/ Survey Projects
1a	Plant communities (grasslands, shrublands, woodlands, conifer understory, riparian, wetlands).	Monitoring will focus on the balance between weeds and natives and key species utilized by livestock.	All livestock exclosures; existing range monitoring; landscape condition surveys; examination of historic vegetation plots.
1b	Weeds (classified as noxious, and others). The current emphasis on riparian areas means reduced focus on livestock impacts on upland weeds such as the annual grasses and yellow starthistle.	Weeds have the ability to directly impact most of the values described within the presidential proclamation.	Continuing surveys; pilot studies aimed at weed eradication; livestock exclosure study; permanent transects; trend data; landscape condition surveys; examination of historical data.
2	Greene's mariposa lily.	Mariposa Lily Botanical Area created to protect from grazing.	Continued landscape surveys; population monitoring.
4	Canada thistle is perceived to be invasive in disturbed areas at higher elevations.	Livestock may facilitate the reintroduction or persistence of Canada thistle in previously infested and treated areas.	Landscape-wide Canada thistle surveys, GIS analysis of interaction with livestock utilization, soils, etc.

INDIVIDUAL STUDIES 1a and 1b Plant Community Change Following Livestock Removal: Grasslands, Shrublands, Woodlands, Conifer Understory, Riparian, and Wetlands

Introduction

This project examines plant community change following livestock exclusion to determine if plant communities within livestock exclosures change towards a more desired condition relative to current vegetation composition and structure.

Objectives

Objective 1: Determine if the current range management regime results in differences in plant community composition between livestock exclosures and paired sites.

Objective 2: Determine if the current range management regime results in differences in key species (native bunchgrasses) abundance between livestock exclosures and paired sites.

Objective 3: Determine if the current range management regime impacts weed species abundance relative to livestock exclosure areas.

Objective 4: Determine if the current range management regime within springs, seeps, and wetlands increases or decreases soil surface and deeper soil disturbances relative to ungrazed controls.

Methods and Materials

Public comment and scientific opinion have differed regarding the effects of livestock on the range of structural, compositional, and environmental characteristics of plant communities within the CSNM. A literature survey of plant community changes associated with livestock exclosures in other ecosystems will identify the range of changes expected within the livestock exclosures constructed within the monument (Appendix D).

Results from the literature suggest that observable short-term (less than 3-4 years) differences between livestock exclosures and paired grazed sites may be restricted to fluctuations of annual plants, vegetation structure, and soil disturbance.

The following ecological issues and associated management objectives will be the focus for the determination of whether livestock impacts the objects of biological interest and the plant communities forming their context:

- plant community composition: increase relative cover by native species;
- key species age/maturity/condition class distribution: maintain a distribution of age/maturity/condition classes for key species;
- weed invasion/abundance: minimize new points of weed invasion; reduce existing noxious weed populations;
- establish and promote growth of riparian shrubs;
- vegetation structure: maintain/improve vegetation structure (sward height and the balance of life-forms (herbaceous, shrub, and tree strata)) as a basis for improving wildlife habitat;
- soil cover: minimize bare soil consequent to displacement of perennial vegetation by livestock;
- post-holing: minimize post-holing in riparian areas; and
- minimize thatch/litter buildup by medusahead.

Plant community, soil surface disturbance, and vegetation structural data will be collected in all livestock exclosures and paired sites. Individual plant species cover, soil surface cover, and soil surface disturbance will be assessed using a recognized BLM vegetation monitoring methodology (USDI 1996). A gimballed point technique (Winkworth and Goodall 1962) will be used to measure plant species point cover for the range of vegetation strata (tree, shrub, and herbaceous) within the livestock exclosures and paired plots. The technique is very similar to that employed by the Nature Conservancy (Sawyer and Keeler-Wolf 1995). The utility of a sighting device (gimballed point sighting tube) instead of a suspended rod improves accuracy of recordings (USDI 1996).

Livestock Exclosure Relative to Patterns of Vegetation

The easiest plant communities to monitor using livestock exclosures are relatively homogenous and occupy large portions of the monument (plant

community A: transects 1, 2, and 3 in Figure 1). In such situations it is usually feasible to locate paired transects beyond the fenceline effect surrounding exclosures (transects 1 and 3 versus transects 1 and 2 in Figure 1).

Plant communities within the monument are highly variable and usually occur as gradients in plant composition (plant community B: transects 4, 5, and 6 in Figure 1). At the time of exclosure construction, transects 4 and 5 would be more similar to each other than transects 4 and 6. In an effort to maintain high similarity between paired transects, transect 5 may inadvertantly be placed within the zone of fenceline effect. This situation can be identified through visual assessment (trailing, and gradient of stubble heights over short distances) and an examination of the data collected along the transects.

Some plant communities occupy very restricted ranges (plant community C: transects 7 and 8 in Figure 1), but still require study because of their rarity. Transects external to the livestock exclosure, but within the area of fenceline effect may be unavoidable.

Transect Placement

Since there is a tradeoff between transect similarity and confoundment due to the fenceline effect, at least two transects must be placed external to exclosures. Where the closest of the paired transects are shown to be compromised by a fenceline effect, the data may still be used to examine plant community successional changes and identify increaser and decreaser species relative to livestock disturbance and livestock exclusion. Such fenceline compromised paired plots will not be used to gauge the magnitude of plant community change due to removal of livestock disturbance from the area within the livestock exclosure. Instead, the less similar and further displaced paired transects will be used to gauge plant community change between livestock excluded and grazed transects. Transects located too close to exclosure fences are not representative of livestock impacts across the landscape.

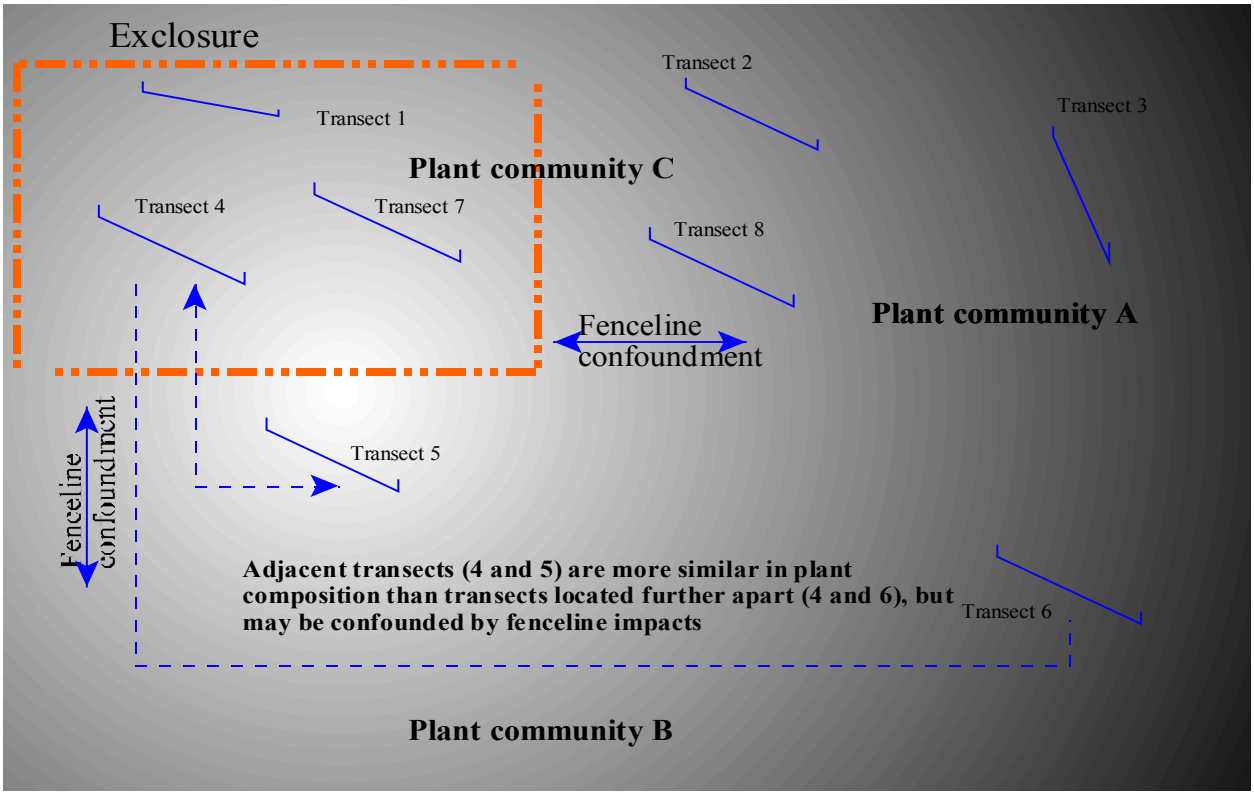


Figure 1. Location of vegetation transects relative to pattern of vegetation change.

Data Analysis Strategy

Individual species abundance and plant community change on individual transects

The change in abundance of individual species and changes in composition of the vegetation along transects can be compared to the initial data collection. Lack of change in abundance and composition would be indicated by fluctuation around the baseline data. Change would be indicated by continued divergence between readings subsequent to the baseline data. Examination for divergence over time is useful for identifying change in unpaired transects and transects compromised by the zone of increased livestock influence adjacent to the fenceline.

Individual species abundance and plant community change of paired transects

In addition to examining change over time relative to baseline data, change can also be examined as the difference between paired transects over time. Change would be identified as continued divergence between paired transects over time, while lack of change would be indicated by non-divergent differences. The advantage of using paired transects would be the removal of the confoundment of climatic influence on vegetation change (individual species abundance and composition) by use of a control.

All forms of vegetation and soil cover data need to be collected twice during a sampling season. During the first year of sampling, data needs to be collected prior to livestock turnout. This is necessary to measure the initial similarity of livestock exclosure and paired sites prior to livestock turnout. Measurement of the same variables at the end of the livestock season will quantify livestock impact on plant structural attributes and the physical environment defined by the percent bare soil and surface disturbance. Differences in individual species abundance and plant community composition can only be assessed during subsequent years, following at least one year of rest within livestock exclosures, and continued grazing within the paired site. These differences need to be based on data collected prior to livestock turnout, so as not to be biased by the current years grazing.

An important addition to the above-defined cover readings are the photos to be taken at the same time. Permanently installed fenceposts will identify the site of origin of the photos, as well as define the direction and angle of sighting. Photos will be taken at the same time of day to minimize confoundment by different patterns of shadow attributed to changes in the angle of insolation.

In addition to the transects described in this section, the Range Utilization study (Project K) is aimed at identifying the range in plant compositions and livestock impacts of riparian communities across the landscape, thus creating a landscape context for the exclosures.

Analysis

Following guidance by the Interagency Technical Reference (USDI 1996), analysis will consist of a Chi Square contingency table analysis to test for significant change in numbers of "hits" on key species, other plant species, or cover classes between years within individual transects, or between paired transects. Data will also be expressed and presented graphically as percentage cover. Repeated measures Analysis of Variance (ANOVA) will be used to examine the statistical difference between grazed and ungrazed pseudoreplicates at the individual livestock exclosure, and paired plots stratified by plant community.

Plant Community Analysis

Standard multi-variate statistical procedures will be used to identify plant communities and plant community dynamics from the original field data collected by field technicians. These statistical procedures are commonly referred to as "dimension reduction" techniques (Kent and Coker 1992). Several procedures will be employed to assure an unbiased examination of data. All multivariate techniques used are based on an examination of a plot by plot similarity matrix constructed using a similarity index. Indices bias the relative importance of rare or common species within the similarity matrix depending on the formulation of the index. For this reason, indices favoring either perspective (rare or common species) will be used to assure unbiased interpretation of results.

Classification is a multi-variate technique that seeks natural groupings of objects (in this case, stands or sampling locations) within multi-variate hyperspace. Stands (transects) within classes are

more similar to each other than stands representative of different classes. Hierarchical classification will be used to gain an understanding of the structure of the plant composition data. This will allow the choice of plant community classes at a suitable level of similarity as defined by similarity index chosen for the classification exercise. Groupings derived from the classification procedures should reflect patterns observed within ordination scatter diagrams. For pre-treatment data, paired transects should fall within the same classes prior to livestock impact. Paired transects separated into different classes in years following livestock exclosure construction and the completion of at least one year of livestock impact are indicative of divergent plant community development under rest and continued grazing.

Ordination summarizes data from n-dimensions (each plant species being a dimension) to just two or three dimensions. The proximity of objects (in this case, individual transects representing livestock exclosure and paired transects) within ordination space is a representation of similarity between transects. Patterns between sets of objects in ordination space represent patterns in the original field data. Such summarization of data may also result in loss of information, hence these techniques are termed exploratory. Adequacy of fit of objects within a scattergram in ordination space is measured by a "stress" indicator. Additional multi-variate techniques will be employed to validate observations where "stress" is above the acceptable level. Increased distance between paired sites after successive years of grazing would indicate that livestock are impacting plant communities for the sites examined.

Network analysis focuses on object-to-object relationships, a very different perspective than the "data-wide" patterns detected using ordination techniques. The algorithm produces minimum spanning trees, relating objects monotonically and using association values from the association matrix for the data set being examined. These diagrams can be used to check the relative positions of objects within ordination diagrams.

The collection of paired monitoring sites falling within similar plant communities may offer the opportunity of using Multi-variate Analysis of Variance (MANOVA) suitable for time series analysis based on difference in canopy cover for all species within the paired plots.

Transect within exclosure on Soda Mountain.

INDIVIDUAL STUDY 2
Greene's Mariposa Lily (Calochortus greenei) Monitoring

Introduction

Greene's mariposa lily *(Calochortus greenei*) is a local endemic plant, and is listed by the United States Fish and Wildlife Service as a federal species of concern (former candidate), and is proposed for listing as a threatened species in Oregon. Most of the known populations for this species occur within the monument in Jackson County, and south into Siskiyou County, California. Several past formal and informal monitoring studies have been completed, including Knight (1992) and Brock (1988). A Mariposa Lily Botanical Area was established within the monument in the Colestine Valley west of the Interstate 5. In 1996, the Medford Draft Conservation Strategy for *Calochortus greenei* identified the need for formal monitoring of this species to *a*) monitor trends, and *b*) more fully understand its biology and autecology, especially in response to herbivory and livestock grazing.

This species occurs in open sites in grasslands, chaparral and oak woodland/savannah communities, usually on gentle slopes (less than 30 percent), most often on south and west aspects in heavy clay soils. Many areas supporting the mariposa lily have been influenced by livestock grazing. Open areas with mariposa lily habitat that were once dominated by native bunch grasses are now dominated by annual grasses such as bulbous blue grass and medusa head. Herbivory from deer, rabbits, insects, and livestock, habitat conversion from noxious weeds, and tree and shrub encroachment (succession) have all been identified as threats to this species. This species, like other lilies, is relatively longed lived (50+ years). Individuals can go dormant and in any given year not appear above ground. Long-term studies of this species are necessary to understand population dynamics, and any effects from livestock grazing.

Objectives

Objective 1: Develop a better understanding of the life and reproduction cycle, and gain an insight into life history, physiology, and population biology.

Greene's mariposa lily.

Objective 2: Monitor populations to measure demographics, trends, and analyze any affects from herbivory, grazing, and successional changes.

Objective 3: Identify significant changes in the numbers of *Calochortus greenei* plants within livestock impacted areas versus paired livestock exclosures.

Methods and Materials

Formal Monitoring

Three areas within the monument are selected to establish long-term monitoring and grazing study plots for *Calochortus greenei* and the associated plant communities; Agate Flat, Oregon Gulch/ Keene Ridge, and the Colestine area. These study areas encompass the range of *C. greenei* in Oregon, contain some of the largest occurrences, and also span the range of cattle grazing utilization. The Agate Flat populations have the highest grazing utilization, Oregon Gulch/ Keene Ridge have moderate to low grazing, and Colestine is essentially ungrazed.

The monitoring at each site follows a modified protocol outlined in the Draft Conservation Strategy for *Calochortus greenei* (Brock 1996). Fifteen pairs of 2 meter x 2 meter plots are established, five pairs in each of the three areas (30 plots total). Plots are placed to contain as many

plants as possible and to maximize the similarity in microsite and plant community. Within the plot pairs, one is randomly selected to be fenced in a 3 meter x 3 meter hog wire enclosure, and the other is unfenced. All plots are monumented with rebar, mapped, documented with the UTM coordinates, and photographed.

Within each plot, individual *C. greenei* plants are mapped, using a 1 meter x 1 meter frame with 10 cm string and wire dividers, and the height and width of the leaves measured. With reproductive plants, plant height and flower number are measured. Any evidence of herbivory is recorded on leaves or flowering plants. Herbivory is classed as mammal (usually a bite from the top), or insect (usually small lateral holes).

Plant community information is also recorded, collecting data on the percent cover and frequency of associated species. Percent frequency is collected on life forms (perennial grass, annual grass, forbs, shrubs), bare soil, rock, and cow dung.

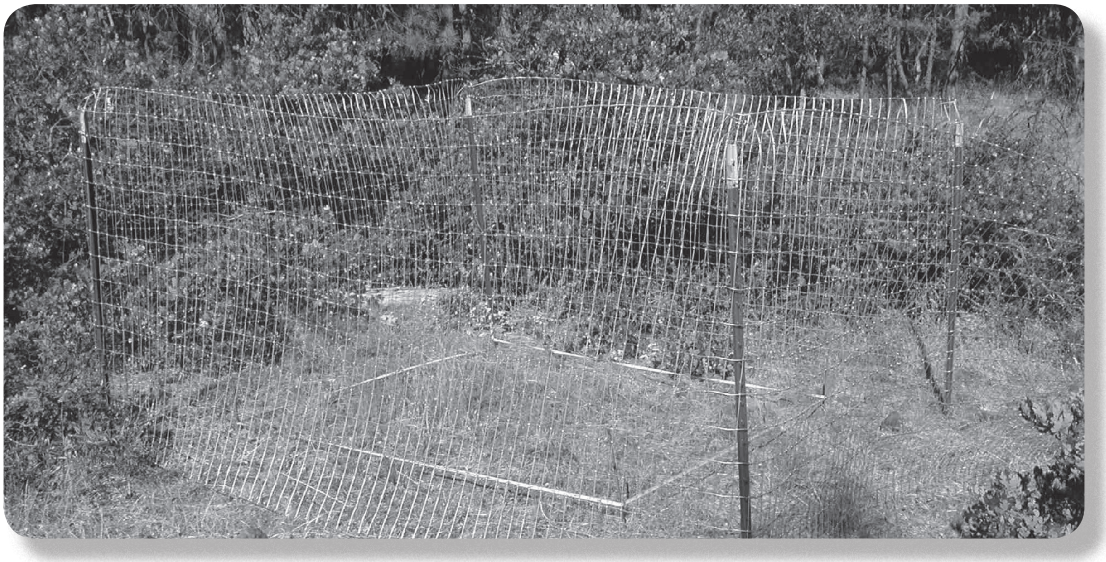
The plots are visited three times a year: 1) before cattle release; 2) during the flowering season; and 3) after seed set. These plots will be examined annually for five years during the grazing study, and then for five more years for the demographic study. At the end of this time frame, a determination will be made with regard to the continuation of monitoring.

Informal Monitoring

For each of the populations formally monitored, a 100 percent census will also be done every year using the standard BLM Rare Plant sighting form. At these sites, smaller satellite populations have been documented in close proximity, outside the formal monitoring areas. At a minimum, 10 percent of these sites will be revisited each year such that in ten years, all documented sites will have been revisited at least once. The sighting report information will be stored in the Medford Rare Plant database. Empirical comparisons with previous observations can be made to show general status and trends for *Calochortus greenei* throughout the monument.

Analysis

Differences in plant size, flowering, and herbivory collected from the paired plot areas will be analyzed by using paired t-tests or repeated measures ANOVA and post hoc Bonferroni tests. Differences in plant community data (frequency) are done by non-parametric Kruskal-Wallis tests with pair wise Mann-Whitney tests, as well as one-way ANOVA. Percent frequency of cover data will use chi-square from the non-parametric Kruskal-Wallis tests. Differences in plant community composition among the study areas are ordinated with non-parametric multidimensional scaling in PC-ORD. In the future, demographic data will be used to develop life cycle matrices and population estimates for different age classes. These estimates are necessary to understand Green's Mariposa viability and persistence on the landscape.



Greene's mariposa lily livestock exclosure.

INDIVIDUAL STUDY 4
Plant Community and Canada Thistle (Cirsium arvense) Recovery in Herbicide-Treated Pastures in the Presence and Absence of Livestock Impact

Introduction
Canada thistle (*Cirsium arvense*) invasion in meadows of the Cascade-Siskiyou National Monument is recognized as a serious problem. The pernicious nature and extent of Canada thistle monocultures as evidenced in Idaho and Montana has compelled the BLM to resort to spot herbicide treatment of infested areas within the monument. This project will help determine if continued livestock impact in meadows will promote the re-invasion of Canada thistle. Concurrent monitoring of adjacent transects will provide information on plant community recovery following herbicide treatment and removal of livestock impact. The exclosure containing Canada thistle is also subject to considerable gopher activity.

Canada thistle reproduces both vegetatively and sexually. Persistent perennial underground roots make hand-pulling and mechanical weed eradication impossible. Any disturbance resulting in root breakage produces new plants as pieces of the original rhizome sprout. Dispersal over longer distances occurs by seed. Establishment by seed likely requires disturbed soil and consequent reduced competition from the local plant community. Once established, the deep rooted nature of Canada thistle allows water and nutrient extraction in areas of the soil profile not utilized by more shallow rooted plants. This allows Canada thistle to prosper when other plants are entering summer dormancy.

Livestock impact may facilitate the return of Canada thistle by providing areas of bare soil for the reestablishment of plants by seed. Removal of competing vegetation during the non-dormant season (spring to early summer) may enhance the growth and thus reestablishment of Canada thistle. Alternatively, livestock trampling and browsing may slow down the reinfestation by Canada thistle. Examination of paired herbicide treated transects inside and outside of livestock exclosures may resolve this issue.

Objectives
Objective 1: Determine if livestock use favors the reestablishment of Canada thistle.

Objective 2: Determine if livestock use facilitates cover recruitment by Canada thistle.

Methods and Materials
The methods and materials will be the same as those described in Individual Study 1a.

Analysis
Analysis will be similar to that described in Individual Study 1a.

Corn lily exclosure on Soda Mountain, constructed fall 2004.

GENERAL LANDSCAPE CONDITION SURVEY FOR KLAMATH RIVER RIDGES ECOREGION (PROJECT A)

Introduction

Analyses of the plant community within individual plots at specific locations may provide little information concerning the condition of plant communities of the larger landscape. Plot-based field sampling intensive enough to achieve an understanding of plant community condition at the landscape-level is not economically feasible. Coarse walk-through surveys examining gross plant community composition can be used to attain a notion of the distribution of plant communities and associated range of conditions at the landscape scale. Plant community condition can be assessed relative to the dominant pathways of plant community change including weed invasion, the effects of fire suppression on shrub cover, and changes due to livestock impact using methods described under Rangeland Condition (Project M).

This project is aimed at classifying plant community data collected within the CSNM to identify the range of plant communities and associated conditions.

Objectives

Objective 1: Create a map of plant communities for the Klamath River Ridges portion of the monument.

Objective 2: Create a map denoting condition defined by the balance between native and non-native vegetation.

Objective 3: Create a map denoting condition defined by the cover abundance of shrubs reflecting past interaction with fire.

Objective 4: Create maps of plant community condition following methods described under Rangeland Condition (Project M).

Objective 5: Determine broad patterns of condition (e.g. relative abundance by non-natives with physical environment and management activities).

KLAMATH RIVER RIDGES

Much of the plant community richness in the CSNM is due to the monument's geographical location at the meeting of the Cascade, Klamath and Eastern Cascade Slopes Ecoregions.

Ecoregions are defined by a number of factors that include physiography (elevation and local relief); geology (surficial material and bedrock); soil (order, common soil series, temperature and moisture regimes); climate (mean annual precipitation, mean annual frost-free days, mean January and July min/max temperature); potential natural vegetation; land use (recreation, forestry, watershed); and land cover (present vegetation).

The Klamath River Ridges Ecoregion (3,800–7,000 feet) has a dry continental climate and receives an average of 25 to 35 inches of precipitation annually. Low elevation and south-facing slopes have more drought resistant vegetation than elsewhere in the Klamath Ecoregion, such as juniper, chaparral, and ponderosa pine. Mid-elevation forests are composed of sugar and ponderosa pine, as well as incense cedar and Douglas-fir. Higher and north-facing ridges are covered by Douglas-fir and white fir. This ecoregion has less precipitation, more sunny days, and a greater number of cold clear nights than the Inland Siskiyou Ecoregion to the west.

Methods and Materials

Estimates of plant composition within large polygons of homogenous vegetation have already been conducted across the Klamath River Ridges Ecoregion of the monument. Polygons were defined at a level of resolution similar to existing Natural Resources Conservation Service (NRCS) survey polygons. Canopy cover by trees and shrubs together with estimates of foliar cover by individual herbaceous species will provide the information for defining plant communities. A total of four surveys by different investigators will be combined to create seamless map coverage for the Klamath River Ridges Ecoregion overlapping with the CSNM. Additional surveys may be

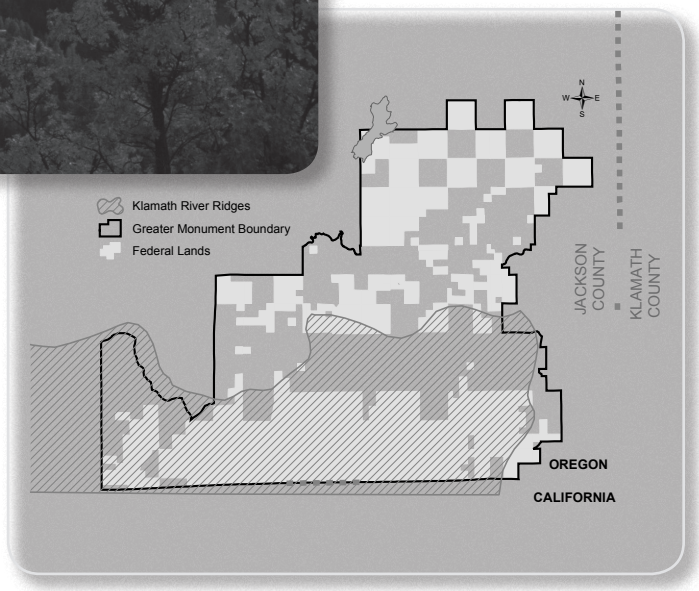
conducted in other areas of the monument identified as components of the diversity emphasis area (DEA) described in the CSNM Proposed Resource Management Plan/Final Environmental Impact Statement (USDI 2005).

The landscape surveys will be used to examine the richness of plant communities across the landscape. For all identified plant communities, the balance between native bunchgrasses and non-native annual grasses will be used as a measure of plant community condition from the weed invasion perspective. The data will also be used to assess landscape patterns of weed invasion (annual grasses and noxious weeds (see Weed Monitoring - Project E)), and contribute to an understanding of conventional rangeland condition (see Rangeland Condition - Project M). Data will also be used to validate the USDA SCS (1993) framework of plant communities for the Klamath River Ridges portion of the monument. The data will provide a basis for planning management by supplying *a*) a basic inventory of plant communities; *b*) fuels, as defined by woody vegetation cover; and *c*) plant community condition based on species composition.

Analysis

All of the standard multi-variate classification procedures described within the plant community portion of the livestock exclosure project will be used in this study. The resultant classifications will form the basis for creating maps. Standard Geographic Information System (GIS) procedures will be used to depict plant communities and their range of conditions as defined by the balance of weeds and desired herbaceous vegetation. Overlap analysis with livestock utilization, soil characteristics, and other environmental characteristics will identify factors correlating with the range of plant community conditions (as identified by the balance between native and non-native vegetation) stratified by plant community.

Klamath River Ridges Ecoregion.



EXAMINATION OF HISTORICAL VEGETATION PLOTS (PROJECT B)

Introduction

Plant community composition data collected by the Soil Conservation Service (now the Natural Resources Conservation Service (NRCS)) and BLM between 20 and 30 years ago will provide the basis for understanding some of the recent historical changes in plant communities across the CSNM landscape. A comparison of species composition between 20 to 30 year old vegetation study sites and current composition may provide an indication of whether plant communities are moving towards a desired condition under the current management regime. Desired conditions can be defined in different ways.

Desired conditions may be defined by a relative domination of native species, an equitable distribution of plant life-form groups composed of native plants. Condition will also be assessed using methods described under Rangeland Condition (Project M). Physical and management related factors involved in the inferred changes in composition will be examined using overlap analysis within the GIS environment, particularly regarding weeds (see Weed Monitoring (Project E)).

Objectives

Objective 1: Identify monument-wide and allotment-wide patterns of vegetation change stratified by major plant community.

Objective 2: Identify all site-specific changes in vegetation considered significant (based on literature-defined rates of sampling and observer error for the sampling methods employed).

Objective 3: Examine sites with significant compositional changes as case studies.

Objective 4: Interpret the plant composition data using the range of perspectives on condition (weed invasion, shrub abundance as a consequence of fire-suppression, conventional range condition).

Objective 5: Contribute data to other projects, specifically Weed Monitoring (Project E), Range Trend (Project L), and Rangeland Condition (Project M).

Methods and Materials

Ninety-seven vegetation plots and polygons from historical vegetation surveys have already been re-examined. The NRCS plots and Soil Vegetation Inventory Method (SVIM) vegetation polygons date back 20 to 30 years. Species level composition data will provide an understanding of plant community changes across the range of plant communities of the monument over the past three decades.

Analysis

The field data will be classified into plant community and conventional range condition. Site-specific indicators will provide inference about the range trend direction. More objective examination of the data will identify "significant" plant compositional changes based on observer and sampling error rates reported in the literature (West and Hatton 1990). Repeat estimates of species abundance with overlapping confidence limits from the literature-derived rates of observer and sampling error will be considered not significantly different from each other.

Sites showing significant changes in species abundance will be considered for local case studies. More detailed examination of site history (including past management), soil conditions, and local plant community composition may provide insight concerning local plant community dynamics. Within plant communities, CANONICAL CORRESPONDENCE ANALYSIS, MULTI-RESPONSE PERMUTATION procedures, and mantel tests (McCune and Grace 2002) may be used to elucidate plant community dynamics relative to the above factors.

Examining the same data within the GIS environment may identify spatial patterns particular to allotment boundaries, soil patterns, and other features. HYPERNICHE (MjM software 2004) will be used to relate community ordination scores and individual species abundances to the above defined multiple environmental variables. Precipitation data will be examined to ascertain that observed differences are not due to marked difference in precipitation pattern and abundance for those years during which data was collected.

RARE INDIVIDUAL PLANT AND PLANT COMMUNITY ANALYSIS (PROJECT C)

Introduction

Little is known about the range, distribution and condition of individual plants or communities of special interest. As these objects are inventoried they will be recorded in the GIS database for the monument. This will allow an analysis to determine proximity to areas of high livestock utilization, roads, areas of weed invasion, and other possible threats to their persistence on the monument landscape.

A number of rare plant species are documented within the monument, and recent surveys have focused mainly in areas where recent BLM activities have occurred. Some habitat-focused surveys in the southern and southwestern portions of the monument are proposed for Gentner's fritillary. These surveys are likely to document other populations of rare plants associated with similar habitat in this area of the monument. Many of the occurrences documented in the monument have not been revisited or informally monitored since they were initially located, some as early as 1979. To clearly assess the status of these rare elements, re-visits and documentation of some populations must occur. Formal monitoring of certain species is proposed.

Species are prioritized based on rarity and perceived threats. Specific information is given when indicated.

1. Gentner's fritillary *(Fritillaria gentneri).*
2. Greene's mariposa lily *(Calochortus greenei).*
3. California milk-vetch *(Astragalus californicus);* one population in the monument in the Scotch Creek Research Natural Area (RNA).
4. Tracy's peavine *(Lathyrus lanszwertii* var. *tracyi);* one population documented, also in the Scotch Creek RNA; monitor with *Astragalus californicus.*
5. Bellinger's meadowfoam *(Limnanthes floccosa* ssp. *bellingeriana);* populations near Lincoln and one small occurrence in the Oregon Gulch RNA.

Gentner's fritillary.

6. Clustered ladies slipper *(Cypripedium fasciculatum)*; one existing monitoring plot.
7. Coral seeded allocarya *(Plagiobothrys figuratus* ssp. *corallicarpus);* vernal pool species.

Objectives

Objective 1: Establish permanent monitoring plots for high priority plant species to gather needed demographic data, assess trends, and threats.

Objective 2: All high priority populations will be informally monitored at least once to assess the effects of grazing using qualitative methods (counts, photopoints, and site condition assessment) as part of the grazing study, and to gather the needed information to develop a long-term monitoring design and plan.

Objective 3: For all other Bureau Special Status Plant Species (Appendix B) documented in the monument, an informal monitoring schedule (revisits) will be developed with the goal that at least 70 percent of all known occurrences of Special Status Plant Species will be revisited at least once in a ten year period.

Objective 4: Complete GIS analyses to determine relationship of rare plant communities and individual species populations of interest relative to GIS-based information of environmental data including soils, livestock utilization, distance from watering points, etc.

Methods and Materials

Landscape Surveys for Fritillaria gentneri
Landscape-scale surveys will be used to validate presence and absence of Genter's fritillary within the southern and southwestern portion of the monument. Most of the unsurveyed habitat for this rare lily lies south of Tyler Creek, and west of the power line that intersects Tyler Creek and runs southeast to Agate Flat. Small unsurveyed areas also occur in the southeastern portion of the monument, however much of this area has had botanical surveys. The northern portion of the monument also has small areas of unsurveyed habitat.

Using aerial photographs, existing vegetation information, and professional knowledge, landscape-level surveys will be conducted during the blooming period for Gentner's fritillary. It is estimated that approximately 6,000 acres will be identified as suitable habitat and surveyed. Populations of other rare plants found in the communities surveyed will also be documented to further the understanding of the diversity in the CSNM.

Plot-based monitoring for Fritillaria gentneri
Permanent plant monitoring will occur in the one documented population and at least two new plots will be established if new occurrences are found in the landscape-level surveys.

The monitoring consists of two parts.

1. Annual revisits will census the entire population and count flowering *F. gentneri* and *F. recurva* individuals (a congener), and provide count estimates of vegetative *Fritillaria* spp. leaves. The standard BLM Rare Plant sighting form will be used to document this information. New occurrences found in landscape surveys will also be annually revisited. Every population of this listed plant in the monument will be visited annually during the blooming period. This monitoring will provide census trend data for the existing population in the monument.

2. Ten 1 meter x 1 meter permanent plots will randomly be selected within the existing population to annually monitor individual plants, herbivory, and physiology. Each plot needs to contain at least one flowering *Fritillaria gentneri* plant at establishment, which will be tagged with 1/16 inch diameter steel pins with aluminum tags, placed approximately three centimeters from the base of the plant on the north side. Vegetative plants within the plots will also be tagged to see what percentage of these plants are *F. gentneri* or *F. recurva*. Based on vegetative characteristics, these two species are indistinguishable. Each plot will be monumented (distance and bearing) from the one of the fence posts placed for the vegetation transect (below). The inside of each corner of the 1 meter x 1 meter plot will be permanently staked with steel pins so that a 1 meter x 1 meter frame can be accurately placed on it. Information on presence/absence, herbivory, number of buds, flowers, fruits, basal leaf width and length of vegetative leaves will be taken for each plant within the plot. Every plot will be photographed. Estimates of cover by species will be done for every micro-plot including population counts for invading species, e.g. yellow star-thistle. The plots are being monitored between May 1st and May 20th every year for three consecutive years.

Formal Monitoring for Calochortus greenei or Fritillaria gentneri
Plots will generally follow methods defined above for *Calochortus greenei* or *Fritillaria gentneri*. Site-specific monitoring objectives and methods will be developed and implemented within three years. The monitoring frequency will vary by species but will generally occur annually unless identified differently in specific monitoring plans.

At least three 5 meter x ½ meter permanent linear plots are placed within a population. Information is collected within 1 meter x ½ meter micro-plots. Qualitative, census, frequency, or density measures will be taken, depending on the species and the specific objectives developed.

For cases where the populations are very small (e.g. *Lathryus lanszwertii* var. *tracyi*), the entire population may be measured. For other larger populations, permanent plots will sample these occurrences. Sample adequacy will be dependent on the number of known existing populations consequent to the completion of landscape surveys.

Informal Monitoring

For all other rare plant species in the monument, 70 percent of all existing occurrences will be revisited at least once over the next ten years (dependent on funding), starting in 2001. During this project (contingent on funding), an effort will be made to revisit at least one population for each of the 24 Bureau Special Status Plants (Appendix B) documented for the monument that occur in areas that are grazed. Information will be recorded using the Standard BLM Rare Plant sighting form, any threats will be assessed and populations will be accurately mapped using Global Positioning System (GPS) and GIS technology. Data will be stored on the Medford Rare Plant Database, within GIS, and at the Oregon Natural Heritage Program. Comparisons of past visits will be used to assess general population trends. Depending on the status, condition, and threats, populations may be revisited more than once in the ten-year period, and if necessary, permanent plots could be established. Activities or conditions potentially affecting populations would likely trigger the establishment of formal monitoring plots to assess effects and trends.

Tracy's peavine.

Bellinger's meadowfoam.

Analysis

Specific analytical processes will be developed in the monitoring plans developed for the plant species that are formally monitored. Normally, paired t-tests and repeated measure ANOVA will be used to analyze significant changes in permanent plots. Informal monitoring data (counts) from different time periods can be analyzed using chi-square analysis to assess trends.

New sites documented will be included in the monitoring portion of this document. Repeated site visits will monitor the trend in these populations.

The total census information (counts) will be analyzed with non-parametric statistics for annual information to detect significant changes in total population numbers, assuming the surveys find more populations. Information collected within the 10 plots will be analyzed using paired t-tests (two-year comparisons), or for data three years and older, a repeated measure ANOVA will be used. Vegetative point and cover information will be analyzed following methods outlined in the plant community section of this document.

Standard GIS-based analyses will be used to examine the relationship between objects of biological interest (rare plant communities, individual plants of interest) and environmental data (soils, slope, aspect, livestock utilization, distance from watering point, etc). Analytical methods include overlap analyses, weighted averages, logit modeling, and log linear modeling.

HYPERSPECTRAL/LIGHT DETECTION AND RANGING (LIDAR) AND THEMATIC MAPPER IMAGERY TO CHARACTERIZE VEGETATION (PROJECT D)

Introduction

The hyperspectral data provide a high resolution spectral (60 bands between 300 to 1,050 nanometers (nm) of the electro-magnetic spectrum) and spatial ($1m^2$) data. The associated LIDAR data, acquired by the BLM in 2002, provide digital elevation data at a resolution of one meter. However, preliminary analysis (Nelson et. al 2004) has revealed problems with the data that would be very expensive to overcome. Only four bands (blue, green, red and infrared) have been geo-referenced, and variable illumination amongst individual mosaics preclude many of the standard methods of data transformation to achieve desired end-products such as seamless classification to achieve maps of plant communities. The quality of the LIDAR data is not compromised, and remains available for use. Use of the hyperspectral/LIDAR data will be restricted to create products that are not impacted by the shortcomings of the data. Optimal use of the LIDAR data will include the creation of masks identifying vegetation height. The combination of height and spectral data will aide the identification of vegetation life-form and plant community. Plant community mapping will be completed using other existing imagery.

Objectives

Objective 1: Use spectral data to identify vegetated versus non-vegetated surfaces of the CSNM.

Objective 2: Use LIDAR data to create layers to identify vegetation of different heights (1, 3, and 6 meters). These layers will be used to differentiate between herbaceous, shrub, and tree vegetation.

Objective 3: Use LIDAR data to identify areas of homogenous vegetation.

Objective 4: Use spectral data to identify areas of high photosynthetic activity as an aide for delineating riparian vegetation associated with seeps, springs, and streams.

Objective 5: Examine the feasibility of differentiating between hardwood and conifer vegetation using spectral data.

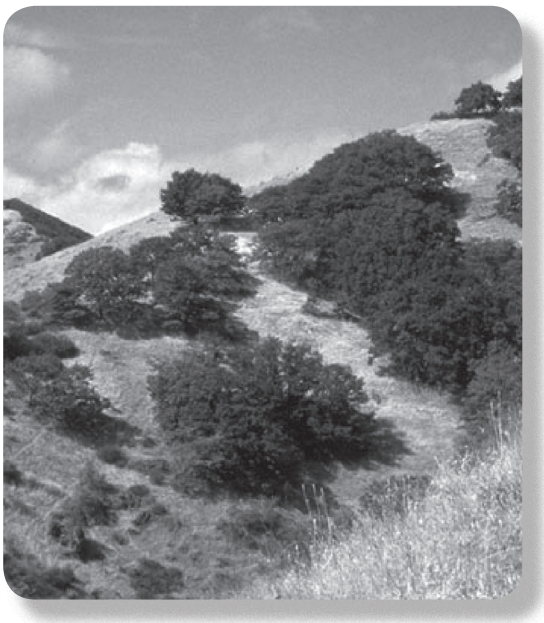
Objective 6: Examine the feasibility of detecting gullies using the LIDAR data.

Objective 7: Use other imagery in conjunction with the hyperspectral data to create seamless maps of vegetation cover by life-form.

The hyperspectral data covers the portion of the CSNM south of the Greensprings highway. As such it represents an incomplete dataset relative to the CSNM as a whole. While the data may be useful for projects centered south of the highway (many of the rare plant surveys and associated spatial analyses), other projects have a requirement for vegetation data across the entire CSNM. For this reason, results from already completed (albeit coarser resolution) Thematic Mapper imagery will be used to create seamless maps of vegetation characteristics of interest across the CSNM.

Methods and Materials

Standard methods for processing images will be used to create desired end-products from the hyperspectral data. Ratio-ing and principal components analysis will be used for creating indices representing information groups of interest (conifer versus deciduous, vegetated



Ridgetop oak woodland.

versus unvegetated, etc) to overcome the variable illumination found throughout the mosaic of images. Masks identifying areas of different vegetation height will be used interactively with the above indices to further refine desired information classes.

Analysis

Since products from this project are for use as contextual data in other projects, analyses will be restricted to validation of products defined in the above methods and materials. Validation of coarse vegetation data (vegetated, unvegetated, life-form) will be achieved by examining aerial photos at 100 randomly selected sites within the CSNM. Validation of finer vegetation information groups (tree, shrub, deciduous, hardwood) will be achieved through the collation of vegetation data collected along transects and photo-monitoring sites. Over 200 sites with associated species identification have been located throughout the CSNM. The correlation of spectral and LIDAR data with GPS located (on-the-ground) data will be constructed within the GIS environment using standard analytical procedures provided by ARC-GIS9 (ESRI 2004).

Scotch Creek Research Natural Area.

WEED MONITORING (PROJECT E)

Introduction

The establishment of new populations of weeds or the increase in abundance of noxious and other weeds are indicators of the degradation of native plant communities. Many authors have implicated livestock in the introduction and spread of weeds on western rangelands (Belsky and Gelbard 2000). DeClerck-Floate (1997) concluded that livestock have the potential to be very effective spreaders of certain weed seeds by transporting burrs in their fur. Allen and Bartolome (1989) noted higher numbers of weeds in grazed versus ungrazed clear-cuts in northern California.

Existing maps of weed locations can be used to determine which plant communities are at greatest risk to weed invasion. Many factors contribute to the rate and extent of weed invasion. This GIS-based project uses overlap analysis to examine relationships between weed abundance and a range of environmental factors thought to play a role in the process of weed invasion. Factors considered include soils (type, texture, and mineralogy), plant community, topography (slope and aspect), livestock utilization (including hotspots of utilization), range management strategy, and road proximity.

Based on the above information, permanent transects will be located across the CSNM landscape to more accurately measure the rate of weed invasion within susceptible plant communities.

Objectives

Objective 1: Identify monument-wide and allotment-wide patterns of weed presence/absence or increase (where temporal data exists) stratified by soils (type, texture, mineralogy), USDA SCS defined plant communities (1993), topography, rangeland management strategy, livestock utilization, proximity to roads, etc.

Objective 2: Establish transects to more accurately monitor future rates of weed invasion within susceptible plant communities of the CSNM.

Methods and Materials

Several sources of point locations for noxious weeds exist within the CSNM. Past and ongoing BLM-sponsored weed surveys form the basis of the noxious weed location maps. Other field observations and senior student projects from Southern Oregon University have also contributed to the weed location map. Plant community surveys and analyses derived from other projects (Projects A, B, H, I, K and R) will be used to analyze the patterns of weed abundance concomitant with environmental factors (soil characteristics, slope, topography, existing plant community, range management strategy, and livestock utilization) across the landscape.

Analysis

The maps of weed abundance resulting from weed surveys, general landscape condition surveys, and the re-examination of historical vegetation plots will be intersected by GIS coverages of the range of factors thought to play a role in the process of weed invasion. Each factor is divided into a number of classes (for example, the range of soil types or mineralogy classes). Overlap analysis of soil types with weed presence/abundance will identify soil types most commonly associated with a particular weed species. The strength of the relationship between soils (and a particular class of soils) will be indicated by the percentage overlap between weed presence/absence and the range of classes for the factor of interest. A ranking of the maximum percentage overlap with any class associated with the range of factors is a measure of the relative importance of that factor.

CANONICAL CORRESPONDENCE ANALYSIS (McCune and Grace 2002) and Non-Parametric Multiplicative Regression (HYPERNICHE, MjM Software 2004) will be used to verify relationships between plant community/weed abundance and attributes relating to the physical environment. Results from this and other projects will contribute to a monument-wide understanding of weed invasion.

Yellow starthistle.

DIETARY OVERLAP BETWEEN LIVESTOCK AND NATIVE UNGULATES (PROJECT F)

Introduction

The Medford Grazing Management Program/ EIS (1983a) states: "The amount of forage removed by cattle during the summer months on elk winter range could play a significant role in winter elk survival due to dietary overlap." Similar interactions may occur between deer and livestock.

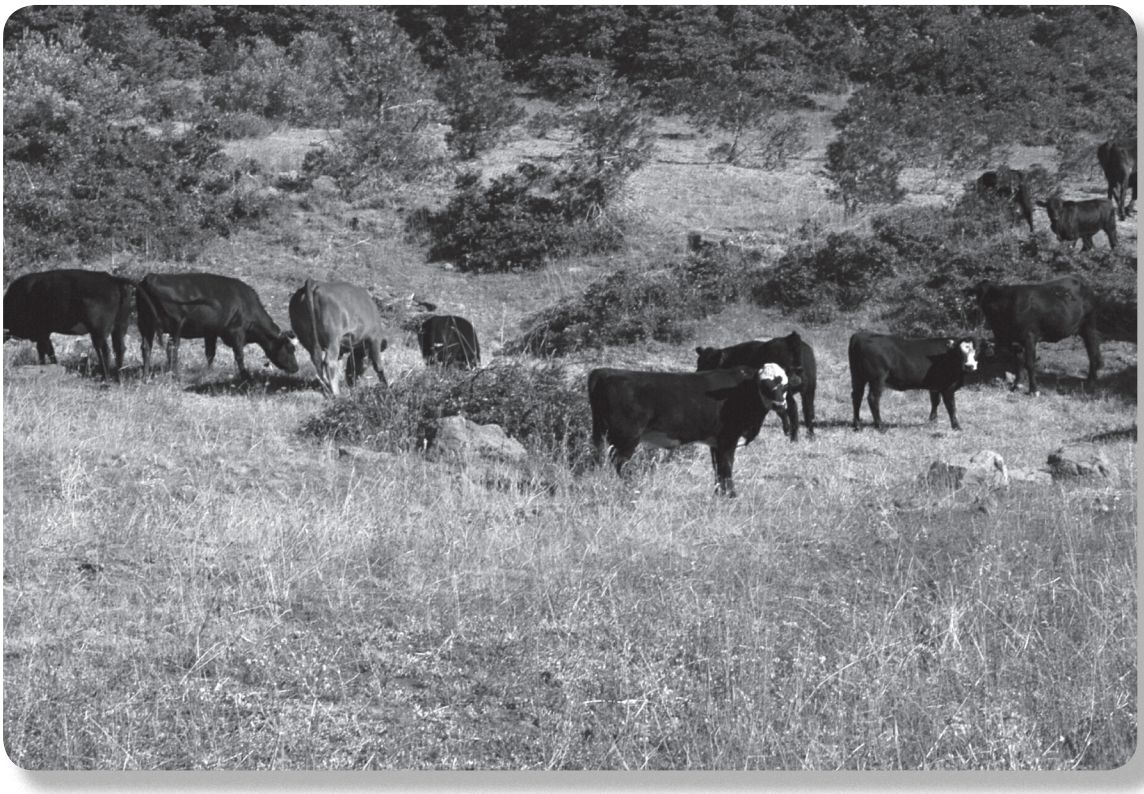
Research literature indicates that livestock grazing has the potential to impact forage quality, forage amount, and foraging site selection by deer and elk. The competitive relationships are not clear, and it appears that the effect of livestock grazing on the forage resource available to deer and elk are highly variable and are highly situation dependant. Variables that appear to be important in determining effects of grazing include: timing, duration, and intensity of livestock use, forage species being utilized, variation in seasonal and annual weather patterns, and type of livestock on the range (steers vs. cow/calf) (Bernardo et. al. 1994, Loomis et. al. 1991, Ragotzkie and Bailey 1991).

Some studies from the western United States indicate that livestock grazing under some conditions is generally neutral or even beneficial with regard to forage resources available to wild ungulates (Austin and Urness 1986, Stevens 1966, Thilenius and Hungerford 1967, Roberts and Tiller 1985, Dragt and Havstad 1987).

Other studies cite reduced forage quality and or quantity and deer/ elk avoidance of areas recently grazed by livestock (Austin and Urness 1986). Some studies indicate that deer and elk actively avoid livestock on shared range (Stevens 1966, Prasad and Guthery 1986, Ragotzkie and Bailey 1991).

Factors other than livestock presence, and current and historic livestock grazing are very important in forage site selection by deer and elk. These factors include: availability of hiding cover, slope, aspect, distance to open roads, and availability of thermal cover (Wambolt and McNeal 1987, Lyon 1979, Black et. al. 1976, Edge et. al. 1988).

Fecal content data collected during the late 1970s and early 1980s will be re-examined to identify



Livestock in steep mountain grasslands.

plants commonly used by native and non-native ungulates to assess the potential for competition for individual species. Total percentage dietary overlap will be a further indication of potential competition for forage. Where dietary overlap does occur and the potential for competition for resources exists, further study may be warranted to determine if forage/browse is limited, threatened through overuse, and if no alternative source of forage/browse exists.

Together with patterns of livestock utilization (Range Utilization - Project K) and results from past browse studies (Cole Browse Utilization Transects - Project G), the existing fecal analysis data will be used to examine the possibility of interaction between livestock and native ungulates (deer and elk) on the basis of diet.

Objectives

Objective 1: From samples collected in the early 1980s, determine if diets for cattle, deer, and elk within the monument overlap based on fecal plant species composition.

Objective 2: From samples collected in the early 1980s, determine if seasonal shifts in fecal plant species composition occur for livestock, deer, and elk.

Objective 3: Where dietary overlap occurs, determine if use is concurrent by using graphic overlay of species-time utilization histograms for livestock, deer, and elk.

Objective 4: Determine if plant species utilized by livestock and native ungulates are in short supply or threatened through lack of reproduction and/or over-use.

Methods and Materials

Fresh fecal samples from livestock and native ungulates (deer and elk) were collected intermittently throughout all seasons from 1979 through 1981. The Composition Analysis Laboratory at Colorado State University identified relative utilization of individual plant species expressed as a percentage of recognizable plant fragments.

In addition to the fecal analysis data, this project makes use of other existing information (shrub browse data, livestock utilization maps, and plant community maps) and information derived from other projects. All data layers and related projects will contribute to the final interpretation of livestock interaction with native ungulates.

Analysis

Fecal analysis yields plant species compositional data expressed as a percentage. Standard ordination and classification tools can be used to examine for dietary overlap between livestock and native ungulates. Direct ordination [gradient analysis (Kent and Coker 1992)] will be used to examine seasonal trends in fecal composition. Together with browse utilization data, seasonal trends may determine if use of any forage/browse base occurs simultaneously by different animals, or if use is separated by time.

Fecal analysis data was collected within three regions of the CSNM including Agate Flat, Keene Creek Ridge, and Skookum Creek. If dietary overlap between livestock and native ungulates is observed in any of these areas, livestock utilization, vegetation maps, and data from Cole Browse transects will be examined to determine if the plant species in question are in short supply within the pastures of concern.

Standard GIS procedures will be used to examine relationships between diet overlap, livestock distribution (current and historic), forage/browse utilization patterns (see Projects G and K), plant community (see Project A, B, I, J and R), and maturity and age classes as discerned by the Cole Browse transects (see Project G).

Livestock at water trough.

SHRUB UTILIZATION (PROJECT G)

Introduction

Site-specific surveys of shrub form and maturity class provide information about the past history of shrub browse use by livestock and native ungulates. Cole Browse transects determine shrub form class indicating the availability and degree of hedging by browsing on a particular shrub species. High rates of browsing are indicated by form classes restricted to browse height (the entire shrub can be reached by the browsing animal) and a high degree of hedging. Maturity classes indicate whether shrubs at the site examined are reproducing and likely to persist on the landscape. A literature review will be used to characterize the range of shrubs utilized by livestock and native ungulates. An understanding of life-history, longevity, and response to browsing as well as other common ecological processes on the monument will provide a suitable background for the interpretation of the shrub form and maturity data. A re-examination of transects may provide information about changes in shrub form and maturity class over the last 20 years.

Objectives

Objective 1: Determine the nature of browsing pressure on shrubs considered to be a critical winter browse source for deer.

Objective 2: Examine the health of the shrub population as defined by the distribution of shrub maturity classes.

Objective 3: Determine if shrub form and maturity class distribution has changed in the last 20 years (compare class distribution patterns using histograms).

Methods and Materials

Histograms showing the distribution of form and maturity classes will be assessed to examine shrubland condition at the sites examined. The sites examined will be mapped to determine if the data can be generalized for the entire landscape. Additional study sites will be examined if the distribution of transects is inadequate, or if other commonly utilized shrub species (as identified by Project F) are not considered. Final results will be stratified by plant community. Transects will be repeated during the ensuing two years if conditions have changed considerably.

Analysis

In this study, data from historical transects located across the monument landscape in the early 1980s will be re-analyzed to determine the distribution of age and form classes. Data will be interpreted relative to the biology of the shrub species in question. For example, the dynamics of re-sprouting versus obligate seed reproducers are likely to differ in accordance with their life-histories. The fecal analysis data (previously discussed in Project F) will indicate whether additional surveys need to be implemented within other shrub-dominated communities not represented by the current suite of Cole Browse transects.

Livestock near elderberry.

LANDSCAPE FISH DISTRIBUTION AND DENSITY FLUCTUATION AT SELECT SITES (PROJECT H)

Introduction

This study is comprised of two components. First, the distribution of fish within the monument will be examined in the context of the environment defined by the following factors: known barriers to dispersal, continuity of aquatic habitat, slope, aspect, water quality, and management impacts to the landscape (road density, livestock utilization, timber harvest, factors detracting from Proper Functioning Condition (PFC) and other management activities summarized by subwatershed). Second, repeat counts (1991, 1992 versus 2003, 2004) of all fish species at set locations may provide an understanding of the flux of fish abundance at select sites over the past 10 years.

Objectives

Objective 1: To assess fish distribution relative to environmental factors and livestock use in the CSNM.

Objective 2: To examine changes in fish abundance relative to site specific and larger landscape changes in the CSNM.

Methods and Materials

Many factors affect the distribution of fish across the CSNM landscape. Natural (discontinuous habitat) and artificial (road culverts) impediments to fish movement are documented but have not yet undergone spatial analysis to determine the potential impact to optimal distribution. In addition to restrictions on the movement of fish, various natural and human-influenced environmental factors are also known to affect fish habitat. Optimal fish distribution will be assessed by modeling existing continuous aquatic habitat where fish distribution has been truncated by artificial impediments. GIS spatial analysis will allow the calculation of habitat removed by artificial barriers.

While direct impacts to fish are not likely to be encountered, a general habitat assessment of landscape condition in relation to important variables potentially impacting fish habitat, and a collation of site specific reports may provide insight about locality and factors impacting fish distribution.

The literature provides insight about variables known to influence fish habitat: bank vegetation species composition and condition, emergent vegetation species composition and condition, extent of overhanging banks, shade, bank angle, and feces deposition (Platts and Nelson 1985, USDI 1997, Moore et al. 1998). Woody species (e.g. willow) protect stream banks from erosion, create cover for fish (critical in meadow areas), provide habitat for aquatic macroinvertebrates, and are an important allocthonous food source. Grasses and forbs are important for bank stabilization and trapping fine sediments during floods. Overhanging vegetation provides critical cover for fish, resting areas for the adult forms of aquatic insects, and important food sources for streams (with leaf fall). Shade is critical to keep stream temperatures low and aquatic systems healthy.

In addition, stream channel width:depth ratio and overall riparian condition are analyzed in the context of other riparian and watershed activities. An inappropriately large width:depth ratio can increase stream temperature, increase fouling by algae, and decrease quality of good aquatic habitat. Bankfull stage shear stress decreases, which changes velocity and consequently induces sediment deposition (Rosgen 1996). Channel widening can be caused by degrading streambanks. In some stream channel types, downcutting and narrowing of the stream channel has the opposite but equally deleterious effect.

Analysis

Standard spatial analysis will be used to achieve the above-defined objectives. Difference between optimal versus current fish distribution will assess the potential impact of artificial impediments on fish distribution. Overlap analysis with all environmental factors at several spatial scales will allow a ranking of factors thought to impact fish habitat across the CSNM landscape.

HYDROLOGIC/PROPER FUNCTIONING CONDITION (PFC) SURVEYS (PROJECT I)

Introduction

Riparian zones are one of the most limited, (Elmore 1987) and most sensitive (Kaufman and Krueger 1984) habitats in the western landscape. Riparian zones are the most productive and diverse habitats in much of the west (Thomas et al. 1979) and frequently produce 10 times the forage of adjacent upland forested sites (Elmore1987).

The link between riparian vegetation diversity, especially in the shrub and overstory layers, and riparian wildlife diversity is well documented (Kauffman and Krueger 1984, Taylor 1986, Szaro et al. 1985). Wildlife populations adjacent to riparian zones are affected by habitat conditions and resultant wildlife populations in the riparian zones (Kauffman and Krueger 1984). Healthy riparian habitat usually supports species not found in the uplands and thus contributes to species diversity at larger landscape scales.

Riparian areas also play a critical role in channel process and aquatic habitat. Riparian trees and shrubs slow flood water and trap flood debris (Platts 1991). Trees fall into the stream during flood events, creating pools and trapping gravels for spawning habitat. Trees and shrubs also provide shade and in some cases, cover for fish. Grasses and forbs in floodplains trap fine sediments during floods (Platts 1991). In meadows, grasses and shrubs stabilize stream banks with their roots. The stream scours against these banks at curves, creating pools and deep overhanging banks. Riparian vegetation also provides an important food source for instream insects (Allan 1995).

Several years ago, the BLM directed the Field Offices to complete Proper Functioning Condition (PFC) surveys on all its streams. The Medford District BLM has been working towards this goal as funding has allowed. Some of the streams within the CSNM have already been surveyed for PFC, but coverage is not complete. Having all the streams, wetlands, and other hydrologic features surveyed would provide more contextual information about the condition of streams and riparian areas throughout the CSNM, and as such is a vital component of the overall monitoring program as well as the livestock monitoring program.

Objectives

Objective 1: To comprehensively assess all streams, wetlands, and other hydrologic features on BLM-managed land with consistent methodology that is compatible and interchangeable with existing methodologies. This will provide the information needed to direct restoration or other land management activities.

Early spring along Jenny Creek at the Box-O Ranch.

Objective 2: Provide general hydrologic/riparian spatial information, morphologic description, flow regime, and ecological condition as context for other studies; input to transportation planning; and protection of aquatic/riparian objects. Will serve as baseline for long-term monitoring.

Objective 3: Provide data to assist in assessment of all Aquatic Conservation Strategy (ACS) objectives.

Methods and Materials

The PFC method was developed by the BLM, the Fish and Wildlife Service, and the Natural Resources Conservation Service. The PFC method for assessing the condition of flowing water (lotic) systems is found in Technical Report (TR) 1737-15 (USDI et al. 1998), and the PFC method for assessing standing water (lentic) systems is found in TR 1737-16 (USDI et al. 1999). The Medford District lotic PFC assessments follow the method described in TR 1737-15 with a Riparian-Wetland Functional Checklist that has been modified for western Oregon.

PFC surveys are a minimum tool for assessing the physical functioning of a riparian-wetland area. PFC does not take the place of more intensive inventory and monitoring protocols; it is a minimum tool that can and should be used in conjunction with more detailed methodologies (USDA and USDI 1997).

The Medford BLM has expanded upon the PFC methodology in order to collect additional information necessary for a variety of land management activities. Variables collected for surveys (by reach, or section of stream generally between major tributaries) on all perennial and intermittent reaches include:

- location information;
- feature type (e.g. pool, riffle);
- classification as perennial or intermittent as defined by the Northwest Forest Plan's Aquatic Conservation Strategy (ACS) (USDA and USDI 1994);
- streamflow classification that classifies flow in relation to the expression of flow at the ground surface (continuous or interrupted) and in terms of seasonal duration (perennial, intermittent, or ephemeral);
- presence of biotic indicators of perennial flow (e.g. presence of Pacific giant salamanders, *Dicamptodon tenebrosus*, or *Lara* spp.);
- percent streambed material;
- bank condition (percent eroding, stable, etc.);
- valley form;
- slump presence and potential;
- amount of large woody material and debris jam in specified length and diameter categories;
- percent stream canopy cover;
- amount of past timber harvest, each bank; and
- vegetation species within Riparian Reserve widths.

AQUATIC CONSERVATION STRATEGY

The Aquatic Conservation Strategy (ACS) was developed as part of the Northwest Forest Plan (USDA/USDI 1994) to restore and maintain the ecological health of watersheds and the aquatic ecosystems contained within them on public lands. The ACS contains four components: Riparian Reserves; Key Watersheds; Watershed Analysis; and Watershed Restoration.

Riparian Reserves: Lands along streams and unstable and potentially unstable areas where special standards and guidelines direct land use.

Key Watersheds: A system of large refugia comprising watersheds that are crucial to at-risk fish species and stocks and provide high quality water. The Jenny Creek Level 5 Watershed is the only Key Watershed identified within the CSNM.

Watershed Analysis: Procedures for conducting analysis that evaluates geomorphic and ecologic processes operating in specific watersheds. This analysis should enable watershed planning that achieves ACS objectives (B-11, USDA and USDI 1994). Watershed Analysis provides the basis for monitoring and restoration programs and the foundation from which Riparian Reserves can be delineated. The Jenny Creek Watershed Analysis was completed in 1995.

Watershed Restoration: A comprehensive, long-term program of watershed restoration to restore watershed health and aquatic ecosystems, including the habitats supporting fish and other aquatic and riparian-dependent organisms.

In addition, each reach is tagged (locations of tags recorded), photos taken, and three cross-sections provide estimates of the bankfull channel dimensions, floodprone area width, stream gradient, and width:depth ratio. Surveyors also record notes and observations.

On features that are not a perennial or intermittent stream channel (dry draw, wetland, spring, seep, pond, lake, reservoir, ditch, etc.), the following variables are recorded:

- location information;
- feature type (e.g. pool, riffle);
- valley form;
- slump presence and potential;
- reach tag location information;
- photo point location;
- notes, including the size of a wetland area, the depth of water or amount of flow present, and the associated riparian vegetation, when applicable.

Analysis

All data are organized, collated, and entered into a computer database. In the near future, the database will be integrated into GIS. Once this is achieved, a variety of spatial analyses will be possible. The types of analysis will include the following:

- The PFC Surveys will be used to see if problem areas identified in 1979/1980 surveys are in "Proper Functioning Condition."
- Determine if there is an association of reaches in the "at risk" or "non-functioning" conditions with the major disturbance types of the CSNM (roads, timber harvest, livestock impacts).
- Compare conditions in paired watersheds with different management histories (grazing and timber harvest).

The PFC Surveys will also provide contextual data for site specific studies (e.g. exclosures) in riparian areas. The provision of context will allow a landscape perspective of site specific observations.

STUBBLE HEIGHT MONITORING (PROJECT J)

Introduction

This project is designed to support Project I (Hydrologic/Proper Functioning Condition Surveys) to quantify plant community composition and utilization by livestock in riparian and wetland plant communities of the CSNM. Statements from the 1983 Grazing EIS (USDI 1983a) supporting the need for riparian surveys include:

- "Due to its relative scarcity (less than five percent of the total land base), water-associated and riparian vegetation are very important to wildlife as habitat for feeding and reproducing."
- "Habitat for semi-wet meadow is far below potential for most semi-wet meadow primarily because of past heavy livestock use, and the subsequent invasion of annual weed species such as medusahead."
- "Important summer deer areas also include the numerous riparian areas and wet meadow habitats."
- "The riparian and upland wet meadows provide a large supply of insects and succulent forbs for young birds, making them crucial habitat for both quail and brood rearing."
- "Hyatt and Howard Prairie lakes are the two main areas of significant waterfowl production on public lands within the EIS area."

Little is known about the variability of plant composition, structure, and livestock impact to these communities within the CSNM. More detailed study of springs, seeps, isolated wetlands and riparian areas is critical since these communities occupy a small part of the landscape, but are disproportionately important to wildlife (Thomas et al. 1979, Elmore 1987). Springs, seeps, and isolated wetlands are likely to be the most highly livestock-impacted plant communities within rangelands (Lytjen et al. 2000, USDI 1983a).

Cattle are adapted to live in cool, moist environments where water is readily available. In the arid and semi-arid portions of western United States, the riparian zones provide the habitat most preferred by cattle. The availability of water, high quality forage in relative abundance, shade, and relatively flat ground make riparian zones highly attractive to cattle (Kauffman and Krueger 1984, Bryant 1982). Generally, the hotter and drier the uplands, the more attractive riparian areas become. Thus cattle tend to concentrate their use and associated impacts in riparian zones (Roath and Krueger 1982, Bryant 1982, Kauffman and Krueger 1984).

In a 1982 study of cattle use patterns in an allotment in northeastern Oregon, Roath and Krueger found that riparian areas (as described and defined in 1982) constituted 1.9 percent of the allotment, produced 21 percent of the available forage on the allotment, and provided 81 percent of the forage actually consumed by the cattle on the allotment. Large portions of the allotment's uplands were not used at all. An improved understanding of riparian/wetland utilization by livestock is needed to ensure adequate management of these rare landscape elements.

Stubble Height as a Guideline for Range Management

Stubble height has become a commonly used variable for measuring herbage left ungrazed within riparian areas and uplands. Stubble height is easier to measure than the traditional "percent utilization" and provides a better gauge of grazing impacts to wildlife habitat within riparian areas (Clary and Leininger 2000). Assessment of the vegetation that remains following a period of grazing is a good indicator of cover for ground-nesting birds, sediment traps, and streambank protection during times of high flow. While no residual stubble guides have been developed for the monument, the literature suggests a minimum of seven centimeters for high elevation systems with naturally low-statured vegetation to 15-20 cm of stubble on vulnerable streambanks, or where willows exist (Clary and Leininger 2000). These stubble heights are for sediment capture, and do not reflect the needs of wildlife for cover. Permanent transects located at sites identified by this project will provide information on riparian use by livestock in Class I and II streams (fish-bearing).

Smith et. al (1992) suggest that ephemeral channels may be greater contributors to non-point source sediment loads. Though ephemeral streams are far less studied, it is known

that riparian plants in these situations offer important structural diversity. Transects will be permanently marked along the ephemeral streams of Agate Flat to better understand this phenomenon.

Stubble height is also a useful tool in upland areas. This will be explored within the Oregon Gulch Research Natural Area, part of the landscape that has been set aside to study natural ecosystem processes (see CSNM PRMP/FEIS 2005, Appendix M).

Plant Community Composition

Plant community data will be collected concomitant with the above stubble height study. The Medford District Grazing Program EIS (USDI 1983a) also identifies several potential impacts of livestock (grazing and trampling) on plant community composition and structure.

Impacts may vary with grazing strategy (Bock et al. 1992, Taylor 1986, USDI 1983a). Suitably designed research objectives will answer the need for implementation monitoring, as well as determine landscape pattern and levels of utilization by livestock. Abbreviated descriptions of potential livestock impacts by grazing strategy include:

Spring/Summer Grazing System: "Grazing occurs every year during the critical part of the growing season under this system. A decrease in composition of key native, upland herbaceous and woody species is expected on those areas of the allotment that receive heavy utilization - primarily areas adjacent to water developments, riparian areas, and flat valley bottoms."

Summer Grazing: "The majority of summer grazing takes place in the forested zone on logged areas. Forage is temporary in nature and is generally shaded out due to increased canopy of conifers within 20-25 years." "... as herbaceous upland species become dry in the late summer, livestock begin grazing green herbaceous and shrubby species in riparian areas, and heavy utilization may occur."

Deferred Rotation Grazing System: "Under this system, grazing takes place during the growing season until seed ripe of grass key species. Pastures are allowed to rest every other year. At moderate grazing levels, shrub species composition is not expected to change. Concentration of livestock in riparian zones is expected to decrease because of the timing and brevity of the grazing season."

Rest Rotation Grazing System: "Rest rotation grazing alternates one or more years of complete rest with other grazing strategies. The length of the rotation cycle and number of grazing strategies depend on the number of pastures in the grazing system." Where employed in the monument, "the rest rotation system alternates 1-1/2 to 2 months of spring or summer grazing with one complete year of rest. This system would increase the composition of all upland and riparian key species because early spring grazing allows plants to complete regrowth and replenish carbohydrate reserves. The year of rest further ensures reproductive success and seedling survival of key species."

Exclusion: "An initial improvement in the vigor of key species occurs because the absence of grazing during the growing season allows plants to complete vegetative growth and reproduction. Where the potential exists, a rapid increase in riparian woody species is expected."

Plant species compositional data will contribute to an existing classification framework (USDI 1983b). Where possible, transects placed to address the objectives of this project will be located at sites examined in the past to integrate current information with past studies and to provide a historical context.

Objectives

Objective 1: Determine the range of plant composition within springs, seeps, wetlands, and riparian areas.

Objective 2: Determine current rates of utilization (referenced to livestock exclosures and temporary exclusion cages) by livestock and residual stubble height stratified by plant life-form.

Objective 3: Evaluate stability, current condition and long-term trend of the physical aspects of riparian areas, woody, and herbaceous riparian plant communities as an indication of the

effectiveness of management towards meeting ecological objectives.

Objective 4: Determine if the spring/summer and other grazing management strategies fit the generalized landscape of the diverse allotments and pastures of the monument.

Objective 5: Determine if any livestock handling features (e.g. corrals, loading ramps, etc.) fall within riparian systems.

Methods and Materials

Transects for measuring plant community composition using the same protocol as described in the livestock exclosure project will be applied to a minimum of 30 percent of spring, seeps, wetlands and riparian areas identified on USGS topographical maps. These transects will be conducted immediately prior to the advent of grazing to identify the range of plant community compositions within riparian communities.

The same transect lines will be repeated at the closure of the grazing season. Following the grazing season, stubble height measurements will be collected using guidelines from the Interagency Technical Reference 4400-3 (USDI et al. 1996). The permanent and temporary livestock exclosures will be used to calculate livestock utilization on a sward height basis. Utilization cages are located at sites dispersed throughout the CSNM to use as a reference for percent utilization.

Analysis

Sample Adequacy

Several methods are used to assess sample adequacy. For cover data collected using a point cover intercept technique, the Interagency Technical Reference 4400-3 (USDI et al. 1996) recommends plotting running average and standard deviation for a range of sample sizes bracketing the likely desired sampling rate.

Individual Variable (species, growth form, or soil cover attribute)

For stubble height measurements, the Interagency Technical Reference 4400-3 (USDI et al. 1996) suggests the use of confidence intervals calculated around the median value. This analysis will be stratified by plant community and life-form. Change in composition or soil cover attributes will be measured using Chi Square contingency table analysis to test for significant change in numbers of "hits" on key species, and life-forms. This is described in greater detail within the livestock exclosure projects section. Data will also be expressed and presented graphically as percentage cover.

Community Level

In addition to multi-variate statistical methods described previously, TWINSPAN will be used to classify plant communities, while DECORANA (Kent and Coker 1992) will be used to identify gradients of plant community composition. CANONICAL CORRESPONDENCE ANALYSIS (McCune and Grace 2002) will be used to elucidate relations between plant community composition and variables of interest such as percent utilization by livestock, stubble height, percent bare soil, and percent soil subjected to deep disturbance. Overlap analysis within GIS will be used to examine and quantify spatial patterns of change in plant community associated with management strategy, soils, slope, and aspect. In addition to the objectives outlined above, the data will contribute to the completion of livestock utilization mapping.

Transect for measuring stubble height and plant community composition.

RANGE UTILIZATION (PROJECT K)

Introduction

The proportion or degree of the current year's forage production that is consumed or destroyed by animals (including insects) is called rangeland utilization. The term may refer either to a single plant, a group of species, or to the vegetation community as a whole. Utilization is synonymous with use.

Monitoring utilization ensures in part that the management guidelines are achieved, or identifies management problems subject to possible alleviation by altering the number of animal unit months (AUMs), the strategy of grazing, or by moving salt and watering points.

Current and past utilization maps will be used to describe current and historical utilization patterns within the monument. These maps will provide spatial utilization data used in other projects described in this study plan while also allowing assessment of rangeland conditions.

Objectives

Objective 1: Determine if current utilization within utilization plots placed to represent the larger landscape meets utilization standards (less than 60 percent utilization of herbaceous vegetation in upland plant communities; less than 40 percent utilization of woody species on upland plant communities; less than 40 percent utilization of herbaceous vegetation in riparian plant communities; less than 25 percent utilization of woody species in riparian plant communities).

Objective 2: Create maps of forage utilization to determine if utilization meets allotment-wide standards and to identify possible 'hotspots' of use.

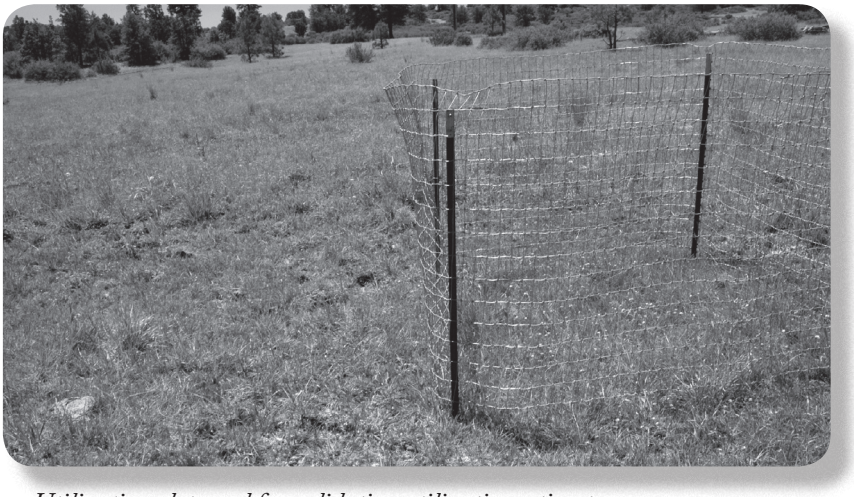
Objective 3: Field validate above-defined utilization maps.

Methods and Materials

Utilization transects are completed annually on key areas using the *Key Species Method* described in TR 4400-3 (USDI et al. 1996). Key species are generally an important component of the plant community. Key species serve as indicators of change and may or may not be forage species. Key areas are indicator areas that are able to reflect utilization across the larger landscape. A key area should be a representative sample of a large stratum, such as a pasture, allotment, wildlife habitat area, herd management area, watershed area, etc. Additionally, an ocular estimation method is employed annually throughout the allotments and this information used to develop maps of utilization patterns.

Analysis

Standard analysis identified by the Interagency Technical Reference 4400-3 (USDI et al. 1996) will allow statistical validation of utilization data to determine if current grazing standards are being achieved. Digitizing will be used to transcribe hand-drawn utilization maps into the GIS environment. These maps will be used to determine if general allotment-wide utilization standards are achieved.



Utilization plot, used for validating utilization estimates.

RANGE TREND (PROJECT L)

Introduction

Together with the assessment of rangeland condition (Project M) and utilization (Project K), determining rangeland trend is considered critical to ensure adequate management of rangeland allotments. Trend generally refers to changes in plant community composition based on cover, frequency, or phytomass data. True trend can only be interpreted from a time series of data collected at fixed points. Apparent trend is a professional estimate of trend direction derived by examining community compositional changes along a chronosequence or seral ensemble. Such data are considered to be much less reliable than temporal data collected from fixed points. Where clear management objectives are identified (for example a 'potential natural community composition' - see project M), trend (change across time) can be assessed to be moving towards or away from the desired condition.

Intense plot-based methods for assessing rangeland trend are considered to be relevant to the site of data collection only. Since trend monitoring sites are selected to be representative of rangelands across the larger landscape, results are often extrapolated to similar plant communities on similar soils experiencing similar environmental/management conditions (i.e., within allotments). Together with plant community maps, actual use (number of animal unit months (AUMs) reported by lessees), range condition and utilization surveys help validate such extrapolations.

Several assumptions underlying the rangeland condition framework need to be described to ensure an adequate interpretation of trend:

- Trends can only be assumed to be similar in the same plant community proximal (within the allotment or pasture) to the trend site - it cannot be assumed that trend in one plant community is the same as trend in different plant community close-by.
- Livestock are uniformly distributed across the plant communities represented by trend sites.
- The successional framework on which condition is based accurately represents plant community dynamics relevant to the plant communities of interest.

Range trend plot on Agate Flat.

While these assumptions may not be met in the strict sense of the word, they need to be carefully considered before statistically validated trends are extrapolated from data collection sites to the larger landscape. This requires the professional judgment of the rangeland management specialist and reliable additional information regarding the location of study plots relative to salt and watering sites, maps of rangeland utilization and condition, as well as the dispersion and patterning of the full range of plant communities across the landscape.

Objectives

Objective 1: Determine if there are significant changes (trends) in individual key plant frequency.

Objective 2: Describe significant changes in key species relative to range condition.

Methods and Materials

Nested frequency is a BLM-approved method for monitoring rangeland trend. Frequency is usually measured in plots, and can be defined as the percentage of possible plots within a sampled area occupied by the target or key species. It describes the abundance and distribution of species and is

used to detect changes in plant community over time. The change over time is expressed as trend.

Frequency is appropriate for any growth form. It is especially sensitive to changes in spatial arrangement. It may be appropriate for monitoring some annuals, whose density may vary dramatically from year to year, but whose spatial arrangement of germination remains fairly stable. Rhizomatous species, especially grass species growing within similar vegetation, are often measured by frequency because there is no need to define a counting unit as would be the case with measurements of density. Frequency is also a good measure for monitoring invasions of undesirable species.

If the primary reason for collecting frequency data is to demonstrate that a change in vegetation has occurred, then on most sites the frequency method is capable of accomplishing the task with statistical evidence more rapidly and at less cost than any other method that is currently available (Hironaka 1985).

Another advantage of measuring frequency over the measuring of cover is the longer time frame for sampling. Once germination has occurred, frequency measurements are fairly stable throughout the growing season. Comparatively, cover measurements may change dramatically from week to week as plants grow. Cover measurements are thus taken once communities are stabilized consequent to advanced phenology over the course of the summer.

However, frequency is a measure affected by both spatial distribution and the density of the population. Numbers obtained are dependent upon quadrat size. Therefore, care must be taken to select quadrat sizes which will include an accurate representation of the plant community sampled. A further disadvantage is that frequency provides no information about structural characteristics defining habitat for plants and wildlife. Since frequency only measures presence or absence within plots, increases or decreases in size and number of individual plant species are not recorded. This shortcoming of frequency may be alleviated by measuring point cover at the tip of the nested frequency quadrat frames.

Fourteen plots are established for the seven allotments overlapping with the boundary of the CSNM. Seven of these plots fall within the actual boundary of the CSNM.

Temporal data derived from other projects (Projects B, I, and J) will be examined in a similar manner to deduce trend and whether change is towards a desired condition.

Analysis

Trend analysis will follow the BLM-approved protocol set forth in *Rangeland Monitoring* TR 4400-2 (USDI 1984). To determine if the change for key species between sampling periods is significant, a Chi-Square contingency table analysis will be used.

Photo trend plot.

RANGELAND CONDITION (PROJECT M)

Introduction

Several government agencies have developed frameworks for assessing rangeland condition, where condition is assumed to indicate ecological integrity. Most condition frameworks within the Bureau of Land Management and Natural Resource Conservation Service are based on the comparison of similar current plant community composition to the 'climax' or 'potential natural community' plant composition. Current condition may be expressed as the percent similarity to the climax composition, or categorized using terms such as early-seral, mid-seral, late-seral, and climax. Older terminology uses terms such as poor, fair, good, and excellent condition. Under older range management terminology, plant community compositions closely representing the climax composition are deemed to be in excellent condition. Condition is considered to decrease as the percent similarity to the assumed benchmark decreases. These terminologies fail to capture the difference in plant community development due to the varied forces of fire, grazing, succession, and weed invasion. Fire and grazing also vary in effect with intensity and timing of occurrence. Another reason for not using stand-level condition ratings (such as poor, fair, good, and excellent condition) is the desirability to retain a range of 'conditions' or 'seral states' representing a range of plant and wildlife habitat at the landscape-level. The monitoring plan as a whole considers different stand-level and landscape-level metrics for a balanced perspective.

The Jackson County Soil Survey (USDA 1993) identifies Potential Natural Community (PNC) composition by soil type. For this project, this soil and vegetation data will be used as guidance for the determination of current stand-level plant community condition/state. Current plant community data for assessing state relative to the climax condition will be derived from other projects described within this monitoring plan (Projects A, B, I, and J). The major objective of this study will be the production of rangeland condition/state maps to be used in other projects and provide input to the final interpretation of livestock impact on the biological resources of the CSNM.

Objectives

Objective 1: Within non-transitory rangeland, create maps of rangeland condition/state based on current plant community composition (stratified by plant community) relative to the composition of the climax/PNC and soil condition utilizing the interagency protocol from *Interpreting Indicators of Rangeland Health* (USDI 2000c).

Objective 2: Within transitory range, consider the percentage composition by native species compared to noxious weeds and "non-desirable" introduced species as an alternative metric. The term "non-desirable" introduced species is used to distinguish between introduced species that were used to reseed disturbed areas with the intention of stabilizing soils and providing forage for wildlife and livestock from those that are not considered noxious, but are undesirable from all other perspectives (limited use to wildlife and ability to stabilize soil, etc).

Objective 3: An assessment of percent composition of native versus non-native species within transitory range communities will also be completed.

Methods and Materials

Condition of rangeland is determined by comparing existing vegetation on the site to the PNC and measurements of soil conditions. Potential Natural Community is dependent on soil, climate, aspect, slope, and other environmental factors. Monitored sites are periodically compared to the assumed PNC and rated on a percentage accordingly for that vegetation type.

Early-seral (poor condition) is 0 to 24 percent of climax/PNC; mid-seral (fair condition) is 25 to 49 percent of climax/PNC; and late-seral (good condition) is 50 to 74 percent of climax/PNC. A site is considered at climax (excellent condition) when the current plant composition is above 74 percent similarity to the climax/PNC. In the past, range evaluations rated conifer forests along with standard rangelands. Since even standard rangelands in excellent condition would not approach PNC for a forested community type, they would be rated lower than their actual seral state. According to the 1997 Little Butte Creek Watershed Analysis (USDA and USDI) future

range evaluations will be based only on monitoring non-transitory range sites. Oak woodlands, shrublands, and grasslands are all considered non-transitory range sites. In the 1993 Soil Survey of Jackson County, Oregon, each range type has a description of full climax (100 percent PNC).

Several projects will contribute data for the assessment of rangeland condition. Plant species cover data was sampled at 97 sites in the 2000 field season to examine changes against field data collected in the past 20 years. Further compilation and analysis of these data sets is described elsewhere in this document (see Examination of Historical Vegetation Plots - Project B). Coarse plant community composition data derived from Project A will be analyzed using the same standards. Though older and of questionable quality, Soil and Vegetation Inventory Methods (SVIM) data collected in the early 1980s may also provide information about rangeland condition. This project examines condition relative to climax or potential natural vegetation. The final interpretation of results from all projects will consider range condition, but not be limited to:

- amount and distribution of canopy cover;
- amount and distribution of plant litter;
- accumulation/incorporation of organic matter;
- amount and distribution of bare ground;
- plant composition and community structure; and
- absence of accelerated erosion and overland flow.

Currently the two-phase method of determining rangeland condition (Appendix D) is used within the monument landscape. This system of condition survey will be replaced with the more recent and comprehensive interagency protocol entitled *Interpreting Indicators of Rangeland Health* (USDI 2000c).

Analysis

Several projects and data sets will supply plant compositional data to classify study sites into the range of condition classes as described in the Methods and Materials section for this project. A spreadsheet or statistical program will be used to create a similarity matrix based on the Bray Curtis Index. The resultant similarity matrix will contain comparisons of field data to the hypothetical 'climax' or 'potential natural vegetation' expressed as a percentage similarity. These percentages will be used to classify the represented sites into the condition classes identified above.

Yampah meadow on Agate Flat.

PHOTO-MONITORING (PROJECT N)

Introduction

Numerous photos documenting surveys, fence building projects, restoration efforts, wildfire, prescribed fire, historic photos along roadways back to the early 1900s and other management endeavors from the mid-1950s through the 1990s are archived at the BLM. The photos are part of the routine monitoring performed by hydrologists, rangeland management specialists, fisheries biologists, wildlife biologists, and ecologists, and do not exist in a centralized collection. This project aims at duplicating images in hard-copy and digital image formats. The establishment of exact photo-location using a Global Position System (GPS) will allow easier repetition of photo-monitoring as well as the documentation of local

REPEAT PHOTO COMPARISONS

Looking northwards towards Ashland (southwest Oregon), Photo 1, taken in July of 1915, shows short-statured Oregon white oak in the foreground, oak dominated slopes in the left middle ground, and patchy oak woodlands interspersed with grassy meadows in the mid-right background (photo by John Gribble). Photo 2, the photo-retake (July 2004), shows larger statured oaks in the foreground, conversion to conifer in the left middle ground, with the woodland in the background remaining relatively unchanged (photo by Paul Hosten). The photo-retake illustrates patterns of change common to oak woodlands throughout the Pacific northwest, as well as the retention of the open oak woodland habitat through edaphic control.

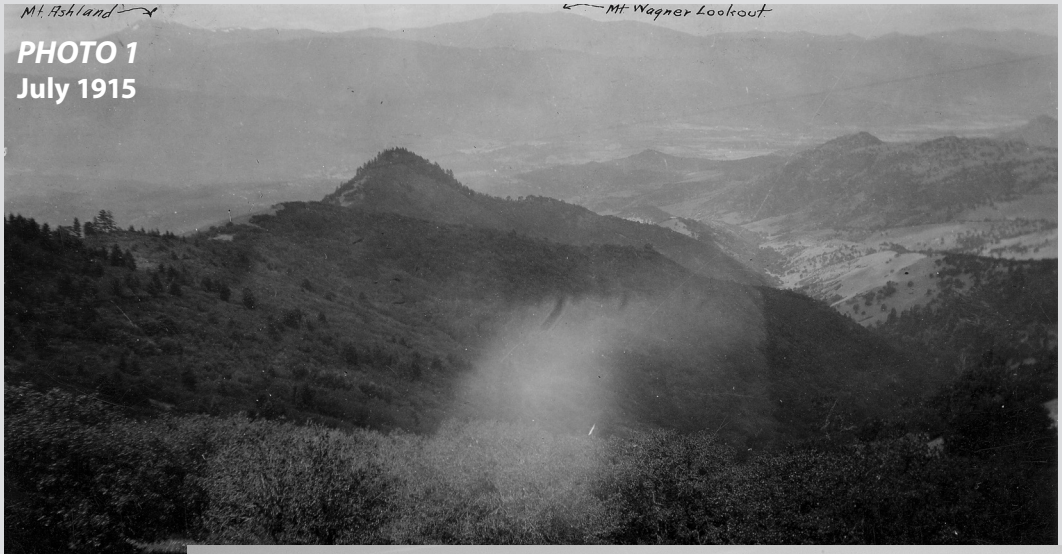


PHOTO 1
July 1915

PHOTO 2
July 2004

management history within the GIS database. The construction of a GIS-based chronology of disturbance events (fire, flood, road construction, timber harvest) and livestock management in terms of grazing system (spring, summer, etc.), grazing intensity, timing of grazing, proximity to watering/salting points, and grazing exclusion (as in the case of the former Box-O Ranch) will provide the necessary information for the accurate interpretation of monitoring photos.

Objectives

Objective 1: Identify photos suitable for longer-term photo-monitoring.

Objective 2: Create GIS-based photo-location database.

Objective 3: Repeat photos suitable for long-term monitoring.

Objective 4: Identify coarse plant community change in terms of increase or decrease of plant life forms (annual grass/forb, perennial grass/forb, shrub, and tree) between photo-monitoring events.

Objective 5: Interpret results relative to disturbance events, by plant community, and by livestock management practices.

Methods and Materials

Existing photos will be relocated in the field using features from the photos. Time of year, time of day, weather, and photo azimuth will be replicated as close as possible to facilitate comparison of photos. Positions will be accurately located using GPS technology. Once positions are imported within the GIS database for the CSNM, photos will be stratified by plant community, geographic, and management criteria as part of the photo-interpretation process. Relative abundance of the top 10 species will be recorded at each photo site. Since the photo database exceeds 300 photos, this will allow the association of species composition with management activities. Plant community change will be assessed as increase, decrease, or no change in life-form abundance between photo-monitoring events. Where possible, these observations will be extended to individual species on a photo-by-photo basis.

Analysis

Association analyses, LOGIT modeling, or Log Linear Modeling of photo observations, vegetation data collected at each photo site and landscape data (utilization, soils, etc.) will provide information about vegetation change, over time and consequent to environmental variables. In general, photos will be interpreted on a case-by-case basis, or be used to substantiate results from other projects in close proximity to photo-points. More general conclusions stratified by plant community will be made where sufficient numbers of photos exist across management or geographic boundaries. In such cases, the strength of the observations will be expressed by the percentage of photos showing similar plant community dynamics.

MACROINVERTEBRATE MONITORING OF SPRINGS AND SEEPS IN GRAZED AND UNGRAZED AREAS (PROJECT P)

Introduction

Aquatic macroinvertebrates are commonly used as indicators of aquatic health. Life history traits or feeding methods limit certain species to environments with specific suites of geomorphic, water quality, and food availability characteristics. Some species are very sensitive to even small changes in their environment. Hence, one can ascertain current water quality condition along an environmental gradient such as livestock utilization. One assumes that similar environments (e.g. springs of similar water quality) historically contained very similar aquatic insect communities, because of the mobility of the adult stage.

Objective

Objective 1: Determine if macro-invertebrate presence/absence, richness, and abundance are different along a perceived gradient of grazing utilization and between livestock-grazed and ungrazed areas. A difference could indicate a difference in water quality and the biological health of certain seeps or springs.

Methods and Materials

Seeps and springs with differential livestock use will be identified using prior inventories. Ancillary vegetation utilization and soil surface disturbance data coupled with livestock utilization maps enable BLM to sample seeps and springs ranging from highly utilized by livestock to unused. Untenanted allotments and pastures provide seeps and springs ungrazed by livestock.

Approximately 40 samples from springs across a gradient of livestock use areas will be collected by students from Southern Oregon University. As yet, the number of samples (at individual springs) through the spring-summer-fall sampling season has not yet been determined. Samples will be sent to a recognized laboratory for processing (identification and counting of macro-invertebrate individuals).

Analysis

Three analytical approaches will be used to examine the pattern between livestock use and the macro-invertebrate community. One approach will be to examine change in macro-invertebrate richness and abundance along a gradient of livestock use using regression. A second approach will be to examine patterns of richness and abundance for seeps and springs falling within different classes of use by livestock. Classes will include used versus unused, and a range of classes including high, moderate, light and no use by livestock.

The two approaches above are necessary because of the difficulty of separating current years use by livestock from recent and longer term use. Chi-squared analysis and Multi-Response Permutation Procedures will be the principal statistical algorithms used in these approaches. The joint depiction of ordinations of macroinvertebrate community data and environmental data (in the form of vectors) will provide further analysis and visual depiction of macro-invertebrate community relationships with the environment.

The third approach for data interpretation is by examining the biological significance of the macro-invertebrate species presence/absence and functional group abundance within the above-defined classes of livestock use. A literature review will determine if observed patterns are validated by other studies.

DEER AND ELK DISTRIBUTION (PROJECT Q)

Introduction

This project will examine existing data (collected primarily by ODFW personnel) on deer and elk distribution, herd composition, migration, calving/fawning areas, and seasonal ranges. Timing and distribution analysis of native and non-native ungulate presence will determine potential conflicts between native ungulates and livestock (see Project F (Dietary Overlap)). The literature identifies both positive and negative influences of livestock on native ungulates. Livestock may improve forage quality and abundance for native ungulates by removing decadent herbaceous vegetation. The subsequent re-growth is more palatable and contains higher nutrients thereby favoring native ungulate health and vigor. Negative interactions include the modification of habitat as well as behavioral changes for native ungulates in the form of range alteration (for example, the reduction in habitat complexity and hiding cover in riparian areas). GIS analysis enables the assessment of distribution patterns of native ungulate species relative to patterns of livestock utilization. Patterns of deer and elk distribution will also become contextual layers for general use within the larger livestock impacts study. For example, livestock, deer and elk distribution will be examined for association with patterns of weed distribution across the landscape.

Skovlin et al. (1983) investigated elk use of winter range following treatments (fire, cattle grazing and fertilizing) commonly used to improve forage/browse quality. Fertilization was found to have the most marked effect on winter elk use. Spring grazing by livestock reduced winter use by elk, while burning did not appear to impact use.

Patterns of native and non-native ungulate use will be examined in GIS against the backdrop of environmental data collected from other monitoring projects.

Objectives

Objective 1: To examine data and reports for interaction of deer and elk populations with the public (including human activity such as road construction and road closures).

Objective 2: Identify patterns of deer and elk movement through the CSNM and adjacent lands.

Objective 3: Identify calving/fawning areas and other areas of high use by native ungulates.

Objective 4: Determine if the pattern of native ungulate distribution shows positive or negative association with patterns of livestock use across the CSNM landscape.

Methods and Materials

Much of the deer and elk location data used in this study were derived from telemetry studies by Oregon Department of Fish and Wildlife (ODFW) (Bigman 1995). The original data were collected between 1992 and 2000 as part of longer-term monitoring of the deer and elk herds. The database includes information on location (latitude, longitude), day and month of observation, and deer/elk gender. Standard methods will be used for collating deer and elk location data within the GIS environment to ensure compatibility with existing data layers. Existing datapoints will be reclassified by month of observation to allow for graphic depiction of deer and

elk movement across the CSNM landscape on a seasonal basis. Elk and deer point locations will also be converted to polygons depicting density of observations. Other observations on deer and elk presence, gender, activity, etc., and reports of interaction with livestock and humans will be collated in GIS to be included in the interpretation of telemetry data. This information will be used as contextual data in other livestock impact studies including the examination of patterns of weeds across the landscape.

Note: A limitation of the data relates to the number of animals collared and how the collared animals represent the larger herd. Both native ungulate type and gender play a role in herd representability. Elk are considered to have a stronger herding instinct than deer. Males will behave differently depending on status within the herd, while females may segregate or be in isolation depending on the reproductive season.

Analysis

Both point and polygon data relating to deer/elk location will be used to determine association with patterns of livestock utilization and other landscape contextual data. Other important contextual data include: soil, slope, aspect, plant community, proximity to roads (open and closed to the public), and proximity to watersource (stockponds as well as riparian features). Statistical analysis will include the use of Moran's I to detect spatial autocorrelation, interpolative methods of calculating ungulate location density, scatter plots and regression analysis, and contingency analysis. Analyses will be restricted within the home range defined by animal observations (as defined by density mapping) to overcome problems of herd representability.

Non-parametric Multiplicative Regression (HYPERNICHE, MjM Software 2004) will be used to examine for patterns of native and non-native ungulate distribution relative to environmental data collated from other landscape-wide projects.

REPEAT RIPARIAN CONDITION SURVEY (PROJECT R)

Introduction

Assessments of riparian zones were completed between 1980 and 1982 in preparation for the Medford District Grazing EIS (USDI 1983a). Fifty-four of the assessed sites cover the current CSNM. The twenty year old data includes handwritten site observations, site maps showing coarse vegetation composition, cut bank location, and other localized impacts. Indices rate livestock, road construction, and logging impacts, as well as the structural and compositional diversity of vegetation (USDI 1983b). While step point data was collected at key locations, these were not permanently marked or located on maps, and may not be repeatable. This project aims at replicating observations on vegetation structure, composition and impacts due to grazing, road construction, and logging.

In addition to riparian surveys, BLM fisheries teams completed fish habitat surveys throughout the Jenny Creek drainage in 1981 and 1982 (USDI 1983b). Teams surveyed fish-bearing streams on federal land. For every quarter mile, they estimated or assessed riparian condition, shade (percent channel shaded at noon), bank damage (bank breakage and trail erosion), stream channel width, pool size, pool:riffle ratio, and channel substrate. They also used a form to rate bank stability, habitat quality, substrate, and habitat structure. They estimated sinuosity and gradient, and noted presence and abundance of different kinds of aquatic vegetation. For every four to five quarter-mile segments, the survey teams made additional field notes on grazing (livestock, deer, and elk), timber harvest, and recreation.

Objectives

Objective 1: Use original study design to define the current extent of observable logging, road building, and grazing impacts within the CSNM.

Objective 2: Determine if current spatial extent of observable impacts differ from the early 1980s.

Jenny Creek on the Box O Ranch.

Objective 3: Determine if current livestock impacts differ from impacts as measured using the early 1980s indices.

Objective 4: Determine if localized impacts mapped during the 1980s surveys remain under the current management regime.

The following replicate the 1980 riparian condition survey objectives:

Objective 5: Classify the riparian zones as to habitat diversity, condition, and trend.

Objective 6: Identify the causative factors which are detrimentally influencing site specific riparian communities.

Methods and Materials

The monument contains 54 of the total monitoring sites originally falling within the Klamath Resource Area at the time of the survey (1981-1982). The methods and materials are reproduced verbatim from the report by Montgomery and Culbertson (USDI 1983b):

> This riparian zone survey was conducted during the 1981 and 1982 field seasons in the Butte Falls and Klamath Resource Areas, Medford District, Bureau of Land Management (BLM). An attempt was made to survey 100% of the Class I streams in both resource areas. Class II streams were randomly sampled; 6.3% in the Butte Falls Resource Area and 5.3% in the Klamath Resource Area.
>
> Transportation maps of the resource areas were utilized to determine the sections of Class I and II streams on BLM administered lands. Each stream segment was numbered; Class I's in one mile segments and Class II's in quarter-mile segments. A random numbers table was used to select the Class II streams to be sampled. A sufficient number was selected to cover the time allotted. These segments of "miles" as they will be referred to hereafter were numbered separately for each resource area.
>
> Each section or mile of stream was surveyed separately. For each mile, a map was drawn showing significant features within the riparian zone, stream, and upland. A species list of the flora and fauna was maintained. For each plant species, an ocular estimate of percent foliar cover was made. Other measurements included aspect, slope, canopy cover, bank slopes, stream width and depth, and riparian zone width. A mean and range was noted for each measurement. Streambed composition and character were noted. Terrestrial vertebrate and avian species were recorded when observed or identified by sign (scat, track) or vocalization (song).
>
> Three numerical ratings were made for each vegetative community of each mile surveys: the *Habitat Diversity Index* (HDI), condition, and trend [see Appendix E]. The HDI is an evaluation of the complexity of the vegetation, physical features, and unique features of a site. In general, riparian wildlife communities are influenced more by structural form of the vegetation than by species composition. The type, size, and arrangement of canopy, shrubs, and herbaceous vegetation are major contributors to the suitability as a site for wildlife.
>
> The riparian zone condition is a numerical rating of the overall condition of the community. It is based on the vegetation age and composition, bank conditions, and the impacts of logging, grazing, and/or roads. The total rating is classified as excellent, good, fair, or poor condition.
>
> The observed apparent trend is a numerical rating of the progress of succession of the community. It is rated as downward, static, or upward, based on plant vigor, seedling establishment; age class representation, vegetation composition; amount and distribution of litter, and the amount and severity of pedestalling (see Appendix E, Riparian Zone Survey Forms).
>
> Influences upon the trend were observed and ranked according to their relative impact upon the riparian zone. Logging, grazing, and roads were the principle factors influencing the successional state of the communities and the amount of influence was a subjective interpretation of the examiner based on observable influences.
>
> All Class I streams and Class II streams with a riparian zone were classified. Those Class II streams without a riparian zone did not have a condition, trend, or HDI rating completed. Each riparian community of the Class I streams had a step-point transect performed. The step-point provides relative percent of each plant species and plant forms found in each canopy level of the sample. Each transect had a 50 meter transect parallel to the stream on each side and a minimum 5 m[meter] perpendicular transect from the stream edge on each bank. Step-points were conducted at the most "typical" site in each community.
>
> Horizontal-vertical vegetation structure drawings were made at the saw location as the step-point. One was drawn in a 10M[meter] x 2M[meter] strip on the left bank, a second was perpendicular from the stream edge, which included the topography of the stream channel and banks. Step-points and horizontal-vertical drawings were not done on Class II streams.

Some of the sample sites from the riparian crew overlap with the survey sites from the fish crew. In an effort to save time and money, only these sites, where both historical riparian survey and

historical fish habitat survey data were collected, will be re-surveyed.

Of the historical data collected, the following categories lend themselves to repeat collection: shade, bank condition, pool:riffle ratio, channel substrate, aquatic vegetation, and field notes on upland condition.

Analysis

The subjective nature of the data complicates data analysis. LOGIT modeling, Log Linear Modeling and suitable forms of categorical data analysis may be used to affect a statistical analysis of indices measuring bank condition, and impacts due to grazing, logging, and roads. Changes in index value between the early 1980s and early 2000s will be summarized in a table to allow an assessment of current condition relative to the time of the original survey. Current and historical condition as indicated by the range of indices will be included in GIS for spatial analysis. Summaries of change in index value will be stratified by plant community, geographic and management boundaries (watershed, range allotments/pastures), and range management criteria (grazing strategy).

FINAL PROJECT INTERPRETATION

Individual projects generally provide information on a portion of the CSNM landscape, or on biological objects of interest (rare plants, coarse plant community composition, weeds, deer, elk, fish distribution, etc.). Since the scope, intensity, and method of data collection varies between projects, it is critical to evaluate results within the context of the individual projects and to integrate project results relative to the entire CSNM landscape.

All study results will be examined in GIS relative to contextual layers depicting the environment of the CSNM. Contextual layers include soil designation (and relevant associated properties of texture, depth, temperature, water regime, etc.), plant community, plant community composition, individual plant species abundance, individual species flux over time, proper functioning condition, canopy cover, weed abundance, slope, aspect, distance from water, distance from roads, past timber harvest, patterns of livestock utilization, season of livestock use, and past management activities (including scarification, prescribed fire, seeding, etc.). Analysis at the landscape scale will identify the association (positive or negative) of objects of interest with patterns of livestock use and other forms of disturbance. Several strategies of analysis will be used to separate the influence of livestock from other disturbance types.

Examining the association of biological objects of interest relative to distance from livestock water-sources (stockponds, perennial streams, long duration intermittent streams, seeps and springs), and the summarized patterns of livestock-use provide a landscape-wide foundation for discerning livestock impact from other site specific disturbance types (roads, timber harvest, past management projects). The examination of objects of interest relative to the multiple disturbance types prevalent on the CSNM will prevent attributing undesired impacts on natural resources to only livestock. A few individual projects examine livestock impacts in grazing excluded areas more closely. Recently constructed livestock exclosures provide a glimpse of short-term plant community dynamics following the removal of livestock. Photos within older livestock exclosures (including the Box O Ranch) provide a longer-term examination of vegetation change in livestock excluded areas.

Finally, the repetition of historic photos, examination of General Land Office Surveys (from the 1870s), aerial photograph comparison, collation of past management activities and old grazing records provide a historic context to enable the separation of recent vegetation change from longer-term changes consequent to fire suppression efforts of the past century, and the intense livestock use from the time of settlement to the second world war.

The final discussion will focus on using this knowledge to determine how livestock affect the important biological elements defined within the Presidential Proclamation of the monument, as well as the ecosystem functioning and integrity of the larger landscape forming the context for the collection of study sites. The final data analysis will be accompanied by a more thorough literature review than that presented within the current monitoring plan manuscript.

FRAMEWORK FOR MAKING FUTURE DECISIONS REGARDING LIVESTOCK GRAZING AND COMPLYING WITH THE PRESIDENTIAL PROCLAMATION

The results of the studies, monitoring, and literature review will be used to help determine whether or not livestock grazing is compatible with "protecting the objects of biological interest."

Additionally, monument grazing leases administered by the Medford District expire in 2006. Under Public Law 108-108, Section 325, leases that expire prior to fiscal year 2009 are renewed automatically with the same terms and conditions of the expiring lease until completion of the appropriate level of environmental analysis required under NEPA. The environmental analysis is preceded by a Rangeland Health Assessment of grazing allotments and an evaluation to determine whether or not they are meeting the *Oregon Standards and Guidelines for Rangeland Health* (Appendix C) and other applicable guidelines.

The process for determining if livestock grazing is compatible with "protecting the objects of biological interest" and evaluating the allotments for lease renewal to ensure that livestock grazing is consistent with current laws and regulations is

described in the following steps (Figure 2). Each grazing allotment would be assessed and monitored, and management specific to allotments would be developed, consistent with the BLM-wide grazing lease renewal process and meeting the intent of the monument proclamation.

Step 1: Livestock Impacts Study

The *Livestock Impacts Study* and associated data collection will continue through 2006. Data analysis will take place concurrently and extend through 2006. Some monitoring projects and data collection would continue over the long-term.

Step 2: Conduct Rangeland Health Assessments, Evaluate Current Livestock Grazing Practices and Determine Rangeland Health and Impacts to Objects

Rangeland Health Assessments are required on each allotment prior to consideration of grazing lease renewal. These assessments are conducted by an interdisciplinary team of resource specialists who assess ecological processes, watershed functioning condition, water quality conditions, special status species, and wildlife habitat conditions on an allotment. Assessments include field visits to the allotments and evaluation of all available data. All available data, including the results of the Livestock Impact Study, would be used to make an overall assessment of rangeland health as described in the *Oregon Standards for Rangeland Health*, in light of the Fundamentals of Rangeland Health at 43 CFR § 4180.1.

Assessments are appropriate at the watershed and subwatershed levels, at the allotment and pasture levels, and on individual ecological sites or groups of sites. Monitoring, which is the well-documented and orderly collection, analysis, and interpretation of resource data, serves as the basis for making determinations of rangeland conditions and trends and for making management decisions. In cases where monitoring data do not exist, professional judgment, supported by interdisciplinary team recommendations, may be relied upon by the authorized officer in order to take necessary action.

The monument manager (authorized officer) will use the assessment described above to determine whether or not current livestock grazing practices within the monument allotments are meeting the standards and following the guidelines described in the *Oregon Standards for Rangeland Health* and whether or not current livestock grazing practices are impacting "the objects of biological interest."

To the extent the evaluation results determine that the standards are not being achieved or are not making progress toward being achieved, the monument manager will determine whether or not existing livestock grazing management practices or levels of use are significant factors in failing to achieve the standards and conforming to the guidelines. The monument manager shall take appropriate action such that significant progress toward fulfillment of the standards and conformance with the guidelines is reached. This action shall be taken as soon as practicable, consistent with the regulations, and may include actions such as reducing livestock stocking rates; adjusting the season or duration of livestock use; modifying or relocating range improvements; and/or restricting or eliminating livestock use in portions of the allotments.

To the extent the evaluation results determine that existing livestock grazing practices are "incompatible with protecting the objects of biological interest" as defined in the presidential proclamation, the monument manager will determine whether or not practices can be modified in a manner that is economically and logistically feasible to achieve compatibility.

Step 3: Follow the NEPA Process for Lease Renewals or Allotment Retirements

Following the evaluation and determination of rangeland health and compatibility "with protecting the objects of biological interest", lease renewals would be subject to the appropriate level of environmental analysis as prescribed under the National Environmental Policy Act (NEPA). The NEPA analysis would develop a full range of management alternatives for livestock grazing consistent with all applicable legal authorities, including the presidential proclamation. Alternatives would include current grazing management, a no-grazing alternative, and other alternatives developed to respond to the findings in Step 2. Evaluation of the consequences of implementing each alternative would include consideration of

the social impacts, as well as the economic and logistical feasibility.

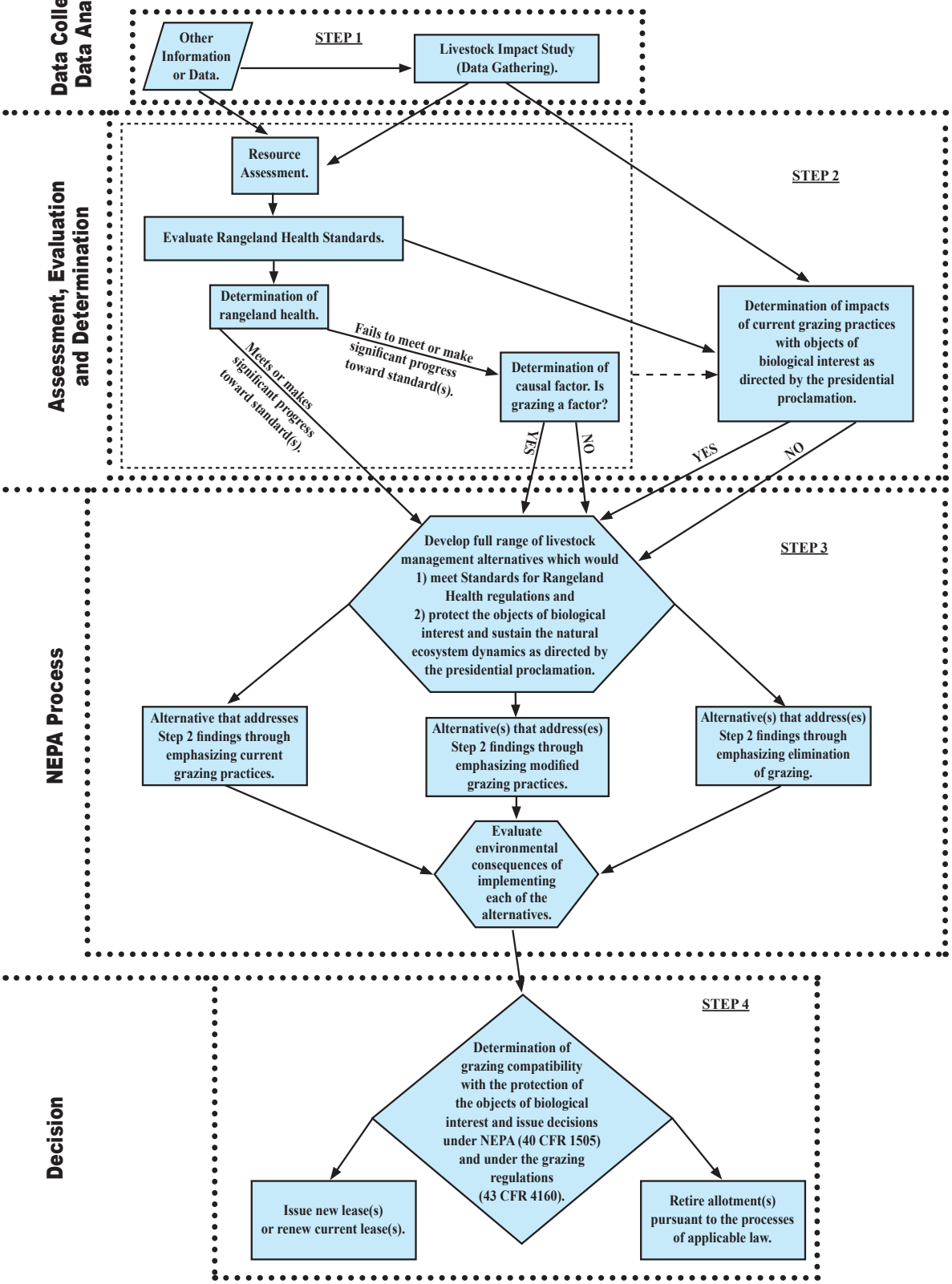
Step 4: Determine Grazing Compatibility, Issue Decision and Implement Grazing Lease Issuance/Renewal or Retire Allotments

Following the appropriate level of NEPA analysis, a determination on the compatibility of grazing with "protecting the objects of biological interest" would be made and a decision would be issued under the provisions of 40 CFR 1505 and 43 CFR 4160 to implement the issuance/renewal of a grazing lease or retire the grazing allotments. Decisions regarding livestock grazing will utilize a landscape approach relying on all available data including information gained from the study mandated by the proclamation. If modification of current grazing systems is required, leases would include an adaptive management strategy that allows for modifications to the leases in response to ongoing monitoring, future rangeland health evaluations, and the needs of the lessees where consistent with the monument plan and the mandates of the proclamation.

A term grazing lease would be issued if current or proposed grazing practices are compatible "with protecting the objects of biological interest" and meet the Oregon Standards for Rangeland Health. This process would designate lands that are available for livestock grazing based on compatibility with monument resources and the objects of biological interest. Grazing leases would specify the types and levels of use authorized and would define quantifiable, time-specific objectives for meeting standards.

If livestock grazing on specific allotments should be found "incompatible with protecting the objects of biological interest," and grazing systems cannot be modified to achieve compatibility, or if the BLM determines that the lands are best allocated to other purposes, those allotments would be retired as specified in the presidential proclamation and applicable laws, regulations, and procedures.

Figure 2. Process for assessing rangeland health and determining livestock compatibility with the objects of biological interest.



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GLOSSARY OF TERMS

A

Actual Use: a report of the actual livestock grazing use certified to be accurate by the permittee or lessee. Actual use may be expressed in terms of animal unit months or animal months.

Allotment: an area of land designated and managed for grazing of livestock. Such an area may include intermingled private, State, or Federal lands used for grazing in conjunction with the public lands.

Allotment Management Plan (AMP): a documented program which applies to livestock grazing on the public lands, prepared by consulting, cooperating, and coordinating with the permittee(s), lessee(s), or other involved affected interests.

Analysis: (1) a detailed examination of anything complex in order to understand its nature or determine its essential features; or (2) a separating or breaking up of any whole into its component parts for the purpose of examining their nature, function, relationship, etc. (A rangeland analysis includes an examination of both biotic (plants, and animals) and abiotic (soils, topography, etc.) attributes of the rangeland.)

Analysis of Variance (ANOVA): a statistical algorithm intended to test whether differences between sample means of a single variable (for example, cover) are large enough to imply significant differences between population means. This is achieved by comparing within-sample-variation to between-sample-variation. The algorithm makes assumptions about random sampling, sample independence, homogeneity of variance, normality, and additivity, all of which are required to be verified to ensure test results are valid.

Animal Month: a month's tenure upon the rangeland by one animal. Animal month is not synonymous with animal unit month.

Animal Unit: one mature (1000 lb. or 455 kg.) cow, either dry or with a calf up to six months of age, or their equivalent, based on a standardized amount of forage consumed.

Animal Unit Month (AUM): the amount of feed or forage (600 lb. or 273 kg.) required by one animal unit for one month.

Annual Plant: a plant that completes its life cycle and dies in one year or less.

Autecology: the branch of ecology that deals with the biological relationship between an individual organism or an individual species and its environment.

Available Forage: that portion of the forage production that is accessible for use by a specified kind or class of grazing animal.

B

Biomass: the total amount of living plants and animals above and below the ground in an area at a given time.

Browse: (1) the part of shrubs, half-shrubs, woody vines and trees available for animal consumption; or (2) to search for or consume browse.

C

Canopy Cover: the percentage of ground covered by a vertical projection of the outermost perimeter of the natural spread of foliage of plants. Small openings within the canopy are included. Canopy cover is synonymous with crown cover.

Carrying Capacity: the maximum stocking rate possible year after year without causing damage to vegetation or related resources.

Class 1 Stream: a system of stream classification established in the Oregon Forest Practices Act. Class 1 streams are those which are significant for: a) domestic use; b) angling; c) water dependent recreation; and d) spawning, rearing, or migration of anadromous or game fish.

Class 2 Stream: all other streams that don't meet the definition of a Class 1 stream.

Community: an assemblage of populations of plants and/or animals in a common spatial arrangement.

Congener: an organism belonging to the same taxonomic genus as another organism.

Crucial Habitat: habitat that is basic to maintaining viable populations of fish or wildlife during certain seasons of the year or specific reproduction periods.

D

Deferred Rotation: deferment involves delay of grazing in a pasture until the seed maturity of the key forage species. This permits the better forage species to gain vigor and reproduce. Under a deferred rotation system one pasture may be used early one year and late the next.

E

Edaphic: influence of soil on living things.

Endemism: a species that is unique to a specific locality.

Ephemeral Stream: stream that flows briefly and only in direct response to local precipitation, and whose channel is always above the water table.

F

Forage: (1) browse and herbage which is available and can provide food for animals or be harvested for feeding; or (2) to search for or consume forage.

Forb: (1) any herbaceous plant other than those in the Poaceae (true grasses), Cyperaceae (sedges), and Juncaceae (rushes) families - i.e., any nongrass-like plant having little or no woody material on it; or (2) a broadleaved flowering plant whose above-ground stem does not become woody and persistent.

Frequency: a quantitative expression of the presence or absence of individuals of a species in a population. It is defined as the percentage of occurrence of a species in a series of samples of uniform size.

G

Grassland: land on which the vegetation is dominated by grasses, grasslike plants, and/or forbs. Non-forested lands are classified as grassland if herbaceous vegetation provides at least eighty percent of the canopy cover, excluding trees. Lands not presently grassland that were originally or could become grassland through natural succession may be classified as potential natural grassland.

Grasslike Plant: a plant of the *Cyperaceae* or *Juncaceae* families which vegetatively resembles a true grass of the Gramineae family.

Grazing Capacity: the maximum stocking rate possible year after year without causing damage to vegetation or related resources.

Greenup: the period of time during which plants break dormancy and put on vegetative growth.

Ground Cover: the percentage of material, other than bare ground, covering the land surface. It may include live and standing dead vegetation, litter, cobble, gravel, stones, and bedrock. Ground cover plus bare ground would total 100 percent.

H

Habitat Diversity: the relative degree or abundance of plant species, communities, habitats, or habitat features (e.g. topography, canopy layers) per unit area.

Half-shrub: a perennial plant with a woody base whose annual stems die each year.

Hedging: (1) the appearance of browse plants that have been browsed so as to appear artificially clipped; or (2) consistent browsing of terminal buds of browse species that results in excessive lateral branching and a reduction in upward and outward growth.

Herbaceous : vegetation growth with little or no woody component; non-woody vegetation such as graminoids and forbs.

I

Intermittent Stream: a seasonal stream that flows only at certain times of the year when it receives water from springs or from some surface source, such as melting snow in mountainous areas.

Inventory: the systematic acquisition and analysis of information needed to describe, characterize, or quantify resources for land-use planning and management of the public lands.

K

Key Species: a forage species whose use serves as an indicator to the degree of use of associated species, and because of its importance, must be considered in any management program.

L

Litter: non-decomposed dead organic matter.

Livestock Exclosure: an area of approximately ¼ to 3 acres that is completely enclosed by a fence to prevent animal disturbance such as grazing. This term is synonymous with livestock enclosure.

M

Monitoring: the orderly collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives.

Multivariate Analysis of Variance (MANOVA): the same as 'Analysis of Variance', but intended for more than one variable.

O

Obligate: restricted to one particularly characteristic mode of life.

P

Pasture: an area designated to be grazed for a specified time period, usually enclosed and separated from other areas by a fence or natural barrier.

Perennial Stream: a stream that flows continuously. Perennial streams are usually associated with a water table in the localities through which they flow.

Post-hole: deep (greater than five centimeters), narrow, vertical hole formed by ungulates stepping in water-soaked soil that often surrounds riparian areas.

Potential Natural Community (PNC): the stable vegetation community which could occupy a site under current climatic conditions without further influence by man.

Properly Functioning Condition (PFC): riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality; filter sediment, capture bedload, and aid floodplain development; improve flood-water retention and ground-water recharge; develop root masses that stabilize streambanks against cutting action; develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity. The functioning condition of riparian-wetland areas is a result of interaction among geology, soil, water, and vegetation.

Public Lands: any land and interest in land outside of Alaska owned by the United Stated and administered by the Secretary of the Interior through the Bureau of Land Management (Sec. 43 CFR 4100.0-5).

R

Range Condition: departures from some conceived potential for a particular site, usually based on soil parameters and differences in vegetative species composition.

Range Improvement: An authorized physical modification or treatment which is designed to improve production of forage; change vegetation composition; control patterns of use; provide water; stabilize soil and water conditions; restore, protect, and improve the condition of rangeland ecosystems to benefit livestock, wild horses and burros, and fish and wildlife. The term includes but is not limited to structures, treatment projects, and use of mechanical devices or modifications achieved through mechanical means.

Rangeland: a kind of land on which the native vegetation is predominantly grasses, grass-like plants, forbs, or shrubs; includes lands revegetated naturally or artificially when routine management of that vegetation is through manipulation of grazing. Rangelands include natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, and wet meadows. Rangelands also include lands revegetated naturally or artificially to provide a plant cover that is managed like native vegetation.

Range Trend: the direction of change over time, either towards or away from desired management objectives.

Rest: indicates the range receives non-use for a full year rather than just during the growth period.

Rest Rotation: a grazing system in which animals are moved on a scheduled basis from one pasture to another, with one pasture receiving a full year's rest.

Riparian Zone: the banks and adjacent areas of water bodies, water courses, seeps, and springs whose waters provide soil moisture sufficiently in excess of that otherwise available locally so as to provide a more moist habitat than that of contiguous flood plains and uplands.

S

Seral Community: one of a series of biotic communities that follow one another in time on any given area. Seral community is synonymous with successional.

Seral Stages: the developmental stages of an ecological succession. Seral stage is synonymous with successional stage.

Shrub: a plant that has persistent woody stems and a relatively low growth habit, and that generally produces several basal shoots instead of a single bole. It differs from a tree by its low stature - less than five meters (16 feet) - and nonarborescent form.

Shrubland: land on which the vegetation is dominated by shrubs. Nonforested lands are classified as shrubland if shrubs provide more than twenty percent of the canopy cover, excluding trees. Lands not presently shrubland that were originally or could become shrubland through natural succession may be classified as potential natural shrubland.

Spring/Summer Grazing: grazing that occurs during the spring/summer seasons of the year.

Stubble: the basal portion of herbaceous plants remaining after the top portion has been harvested either artificially or by grazing animals.

Sward Height: the leaf height of grasses and sedges (excluding flowering shoots).

Succession: the orderly process of community change; it is the sequence of communities which replace one another in a given area.

T

Transitory Range: forested lands that are suitable for grazing for a limited time following complete or partial forest removal.

Tree: a woody perennial, usually single-stemmed plant that has a definite crown shape and characteristically reaches a mature height of at least five meters (16 feet). Some plants, such as oaks (*Quercus* spp.), may grow as either trees or shrubs.

Trend: the direction of change in ecological status or in resource value ratings observed over time. Trend in ecological status is described as "toward" or "away from" the potential natural community, or as "not apparent". Appropriate terms are used to describe trends in resource value ratings. Trends in resource value ratings for several uses on the same site at a given time may be in different directions, and there is no necessary correlation between trends in resource value ratings and the trend in ecological status.

U

Understory: plants growing beneath the canopy of other plants. Usually refers to grasses, forbs, and low shrubs under a tree or shrub canopy.

Upland: any area that is not considered a riparian area.

Utilization: the proportion or degree of the current year's forage production that is consumed or destroyed by animals (including insects). The term may refer either to a single plant species, a group of species, or to the vegetation community as a whole. Utilization is synonymous with use.

V

Vegetation: plants in general, or the sum total of the plant life above and below ground in an area.

Vegetation Type: a kind of existing plant community with distinguishable characteristics described in terms of the present vegetation that dominates the aspect or physiognomy of the area.

Vigor: relates to the relative robustness of a plant in comparison to other individuals of the same species. It is reflected primarily by the size of a plant and its parts in relation to its age and the environment in which it is growing.

W

Wet meadow: a meadow where the surface remains wet or moist throughout the summer, usually characterized by sedges and rushes.

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APPENDIX A

PRESIDENTIAL PROCLAMATION

June 9, 2000

ESTABLISHMENT OF THE CASCADE-SISKIYOU NATIONAL MONUMENT
BY THE PRESIDENT OF THE UNITED STATES OF AMERICA
A PROCLAMATION

With towering fir forests, sunlit oak groves, wildflower-strewn meadows, and steep canyons, the Cascade-Siskiyou National Monument is an ecological wonder, with biological diversity unmatched in the Cascade Range. This rich enclave of natural resources is a biological crossroads -- the interface of the Cascade, Klamath, and Siskiyou ecoregions, in an area of unique geology, biology, climate, and topography.

The monument is home to a spectacular variety of rare and beautiful species of plants and animals, whose survival in this region depends upon its continued ecological integrity. Plant communities present a rich mosaic of grass and shrublands, Garry and California black oak woodlands, juniper scablands, mixed conifer and white fir forests, and wet meadows. Stream bottoms support broad-leaf deciduous riparian trees and shrubs. Special plant communities include rosaceous chaparral and oak-juniper woodlands. The monument also contains many rare and endemic plants, such as Greene's Mariposa lily, Gentner's fritillary, and Bellinger's meadowfoam.

The monument supports an exceptional range of fauna, including one of the highest diversities of butterfly species in the United States. The Jenny Creek portion of the monument is a significant center of fresh water snail diversity, and is home to three endemic fish species, including a long-isolated stock of redband trout. The monument contains important populations of small mammals, reptile and amphibian species, and ungulates, including important winter habitat for deer. It also contains old growth habitat crucial to the threatened Northern spotted owl and numerous other bird species such as the western bluebird, the western meadowlark, the pileated woodpecker, the flammulated owl, and the pygmy nuthatch.

The monument's geology contributes substantially to its spectacular biological diversity. The majority of the monument is within the Cascade Mountain Range. The western edge of the monument lies within the older Klamath Mountain geologic province. The dynamic plate tectonics of the area, and the mixing of igneous, metamorphic, and sedimentary geological formations, have resulted in diverse lithologies and soils. Along with periods of geological isolation and a range of environmental conditions, the complex geologic history of the area has been instrumental in producing the diverse vegetative and biological richness seen today.

One of the most striking features of the Western Cascades in this area is Pilot Rock, located near the southern boundary of the monument. The rock is a volcanic plug, a remnant of a feeder vent left after a volcano eroded away, leaving an out-standing example of the inside of a volcano. Pilot Rock has sheer, vertical basalt faces up to 400 feet above the talus slope at its base, with classic columnar jointing created by the cooling of its andesite composition.

The Siskiyou Pass in the southwest corner of the monument contains portions of the Oregon/California Trail, the region's main north/south travel route first established by Native Americans in prehistoric times, and used by Peter Skene Ogden in his 1827 exploration for the Hudson's Bay Company.

Section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 43 1), authorizes the President, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and to reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected.

WHEREAS it appears that it would be in the public interest to reserve such lands as a national monument to be known as the Cascade-Siskiyou National Monument:

NOW, THEREFORE, I, WILLIAM J. CLINTON, President of the United States of America, by the authority vested in me by section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 43 1), do proclaim that there are hereby set apart and reserved as the Cascade-Siskiyou National Monument, for the purpose of protecting the objects identified above, all lands and interests in lands owned or controlled by the United States within the boundaries of the area described on the map entitled "Cascade-Siskiyou National Monument" attached to and forming a part of this proclamation. The Federal land and interests in land reserved consist of approximately 52,000 acres, which is the smallest area compatible with the proper care and management of the objects to be protected.

All Federal lands and interests in lands within the boundaries of this monument are hereby appropriated and withdrawn from all forms of entry, location, selection, sale, or leasing or other disposition under the public land laws, including but not limited to withdrawal from location, entry, and patent under the mining laws, and from disposition under all laws relating to mineral and geothermal leasing, other than by exchange that furthers the protective purposes of the monument.

There is hereby reserved, as of the date of this proclamation and subject to valid existing rights, a quantity of water sufficient to fulfill the purposes for which this monument is established. Nothing in this reservation shall be construed as a relinquishment or reduction of any water use or rights reserved or appropriated by the United States on or before the date of this proclamation.

The commercial harvest of timber or other vegetative material is prohibited, except when part of an authorized science-based ecological restoration project aimed at meeting protection and old growth enhancement objectives. Any such project must be consistent with the purposes of this proclamation. No portion of the monument shall be considered to be suited for timber production, and no part of the monument shall be used in a calculation or provision of a sustained yield of timber. Removal of trees from within the monument area may take place only if clearly needed for ecological restoration and maintenance or public safety.

For the purpose of protecting the objects identified above, the Secretary of the Interior shall prohibit all motorized and mechanized vehicle use off road and shall close the Schoheim Road, except for emergency or authorized administrative purposes.

Lands and interests in lands within the monument not owned by the United States shall be reserved as a part of the monument upon acquisition of title thereto by the United States.

The Secretary of the Interior shall manage the monument through the Bureau of Land Management, pursuant to applicable legal authorities (including, where applicable, the Act of August 28, 1937, as amended (43 U.S.C. 11 8 la-I 18 lj)), to implement the purposes of this proclamation.

The Secretary of the Interior shall prepare, within 3 years of this date, a management plan for this monument, and shall promulgate such regulations for its management as he deems appropriate. The manage-

ment plan shall include appropriate transportation planning that addresses the actions, including road closures or travel restrictions, necessary to protect the objects identified in this proclamation.

The Secretary of the Interior shall study the impacts of livestock grazing on the objects of biological interest in the monument with specific attention to sustaining the natural ecosystem dynamics. Existing authorized permits or leases may continue with appropriate terms and conditions under existing laws and regulations. Should grazing be found incompatible with protecting the objects of biological interest, the Secretary shall retire the grazing allotments pursuant to the processes of applicable law. Should grazing permits or leases be relinquished by existing holders, the Secretary shall not reallocate the forage available under such permits or for livestock grazing purposes unless the Secretary specifically finds, pending the outcome of the study, that such reallocation will advance the purposes of the proclamation.

The establishment of this monument is subject to valid existing rights.

Nothing in this proclamation shall be deemed to enlarge or diminish the jurisdiction of the State of Oregon with respect to fish and wildlife management.

Nothing in this proclamation shall be deemed to revoke any existing withdrawal, reservation, or appropriation; however, the national monument shall be the dominant reservation.

Warning is hereby given to all unauthorized persons not to appropriate, injure, destroy, or remove any feature of this monument and not to locate or settle upon any of the lands thereof.

IN WITNESS WHEREOF, I have hereunto set my hand this ninth day of June, in the year of our Lord two thousand, and of the Independence of the United States of America the two hundred and twenty-fourth.

WILLIAM J. CLINTON

APPENDIX B

SPECIAL STATUS SPECIES

SPECIAL STATUS PLANT SPECIES

The monument's unique geology, climate, and topography contribute to the presence of many rare and endemic plants. The region including and surrounding the monument has one of the highest rates of plant endemism in the United States (The Nature Conservancy 2000). The monument contains known populations of 33 plant species that are on the current Special Status Species list (Table B-1), including Gentner's fritillary, which is listed as threatened under the Endangered Species Act.

Occurrences of special species plants are documented in grasslands, chaparral, oak woodlands, conifer communities, rocky openings, vernal pools, seeps, and riparian areas within the Diversity Emphasis Area (DEA) and in the Old-Growth Emphasis Area (OGEA) as defined in the CSNM PRMP/FEIS. Open grasslands, chaparral and oak woodlands, and conifer communities blend into a mosaic on the landscape, providing a diversity of habitats for groups of special species plants. As a result, many of these communities are spread out across the landscape.

Some special status species are known for fairly specific habitats: California milkvetch (*Astragalus californicus*) occurs only in open grasslands; the rare fungi *Plectani milleri,* and *Bondarzewia mesenterica* occur only in white fir communities; Coralseed popcorn flower (*Plagiobothrys figuratus* spp. *corallicarpus*) is found only in vernal pools and meadows; and a terrestrial orchid, clustered lady's slipper (*Cypripedium fasciculatum*), is found in old growth Douglas-fir in the monument, often under older madrone and canyon live oak. Other special status plant species can be found in several different types of communities, or are found in transitional zones between different community types. Species like Gentner's fritillary is known from mixed evergreen, oak woodlands, and chaparral and grassland edges. Green's mariposa lily (*Calochortus greenei*) can be found in Oregon white oak-western juniper/wedgeleaf ceanothus-Klamath plum communities, Ponderosa pine-white oak/savanna , and on the margin of open grasslands in heavy clay soils (now often dominated by annual grasses). Some species occur in microsites within larger, more discrete communities. Special status plant species like *Nemacladus capillaris, Monardella glauca* and *Hieracium greenei* are documented in "rocky openings" within many different community types. Thus, management activities within grasslands, riparian areas, oak woodlands, mixed conifer and old growth conifer communities have the potential to influence special status plant species.

In 2004, the Oregon Natural Heritage Program re-evaluated all rare Oregon plants and fungi. A few species documented for the monument were dropped, and no longer have ONHP or Bureau status. These species were left on the following table for reference as they are still found in the Cascade-Siskiyou National Monument.

Table B-1. Overview of Current Special Status Plant Species within the CSNM.
BS=Bureau Sensitive **BA**=Bureau Assessment **BT**=Bureau Tracking **FE**=Federally Endangered

Species	Status	Habitat	Emphasis Area	Number Sites[1]	Documented Individuals
Astragalus californicus (California milk-vetch)	BA	Grassland	DEA	15	972
Asarum wagneri (green-flowered ginger)	BT	Moist conifer	OGEA	1	Unknown
Boletus pulcherrimus	BS	White fir	OGEA	1	Unknown
Bondarzewia mesenterica (Bondarzew's polypore)	Dropped	White fir	OGEA	1	Unknown
Calochortus greenei (Greene's mariposa lily)	BS	Oak woodlands–chaparral	DEA	110[2]	13,355
Carex livida (livid sedge)	BA	Riparian–meadow	DEA	1	20
Carex praticola (meadow sedge)	BT	Riparian–wet meadow	DEA	1	45
Carex serratodens (two-tooth sedge)	BA	Riparian–wet meadow	DEA	1	30
Cirsium ciliolatum (Ashland thistle)	BS	Grassland–oak woodlands	DEA	18	10,327
Cypripedium fasciculatum (clustered lady's slipper)	BA	Mixed conifer	OGEA	2	48
Cypripedium montanum (mountain lady's slipper)	BT	Mixed conifer–evergreen–oak woodland	OGEA DEA	10	246
Delphinium nudicale (red larkspur)	BA	Rock outcrop	OGEA	1	10,000
Fritillaria gentneri (Gentner's fritillary)	FE	Mixed conifer–oak woodland–mountain mahogany chaparral	DEA	22	368
Fritillaria glauca (Siskiyou fritillary)	BA	Dry, open, rocky ridgeline with mountain mahogany	DEA	7	315
Hackelia bella (greater showy stickseed)	BA	Riparian–grassy meadows–openings in white fir	OGEA	23	896
Hieracium greenei (Greene's hawkweed)	BT	Dry, open, ponderosa pine ridgelines	DEA	1	7
Iliamna bakeri (Baker's wild hollyhock)	BS	White fir openings	OGEA	4	9
Enemion stipitatum [Isopyrum stipitatum] (Siskiyou false rue-anemone)	BT	Grasslands–oak woodlands with ceanothus	DEA	28	177,530
Lathyrus lanzwertii tracyi (Tracy's peavine)	BT	Oak woodland–mountain mahogany chaparral	DEA	3	64
Limnanthes floccosa bellingeriana (Bellinger's meadowfoam)	BS	Wet meadows–vernal pools	DEA (moist meadows in OGEA)	11	16,151

Table B-1. Overview of Current Special Status Plant Species within the CSNM.
BS=Bureau Sensitive **BA**=Bureau Assessment **BT**=Bureau Tracking **FE**=Federally Endangered

Species	Status	Habitat	Emphasis Area	Number Sites[1]	Documented Individuals
Mimulus kelloggii (Kellogg's monkeyflower)	BT	Moist microsites in oak woodland	DEA	1	100
Microseris laciniata detlingii (Detling's silverpuffs)	BS	Grasslands–oak woodlands	DEA	21	2,212,193
Monardella glauca (pale monardella)	BT	Open mixed conifer–rocky openings	OGEA	1	Unknown
Nemacladus capillaris (common threadplant)	BA	Rocky openings in mixed conifer	OGEA	4	4,705
Perideridia howellii (Howell's false-caraway)	Dropped	Wet meadows, moist slopes, riparian	DEA OGEA	11	101,034
Plagiobothrys austinae (Austin's popcorn flower)	BA	Grassy meadows–vernal pools	DEA	1	10
Plagiobothrys figuratus corallicarpus (coral seeded popcorn flower)	BS	Grassy meadows– vernal pools	DEA	4	14,500
Plectania milleri (Miller's cup fungus)	BT	White fir	OGEA	4	Unknown
Poa rhizomata (rhizome bluegrass)	BA	Grasslands – oak woodlands	DEA	10	3,340
Ranunculus austro-oreganus (southern Oregon buttercup)	BS	Grasslands–oak woodlands–chaparral	DEA	1	2,000
Ribes inerme klamathense (Klamath gooseberry)	BT	Riparian–moist meadow edge	DEA	3	25
Solanum parishii (Parish's nightshade)	BA	Oak–pine woodlands–chaparral	DEA	3	20
Tremiscus helvelliodes	Dropped	White fir	OGEA	1	Unknown

[1]Based on 2004 data from the BLM Medford Rare Plant Database.
[2]Does not include 20 new sites documented in 2003 by non-government surveys that report to have over 3,000 plants.

SPECIAL STATUS ANIMAL SPECIES - TERRESTRIAL WILDLIFE

The diverse plant communities, varied topography, and broad range of climatic zones come together to foster a diverse assemblage of terrestrial wildlife species. The monument is home to 45 animal species that are on the current special status species list (Table B-2).

Some special status animal species occupy well-defined habitat areas (e.g. Oregon spotted frog (*Rana pretiosa*) occurs only in association with ponds or lakes). Other species range widely across the landscape, utilizing a variety of habitats. For example, great gray owls (*Strix nebulosa*) choose nest sites in late-successional and old-growth conifer stands while foraging in meadows and other open areas, as well as traveling 10 miles or more and utilizing a variety of habitat including oak savannah, and mixed conifer.

Management activities across all habitat types have the potential to affect terrestrial wildlife species.

Table B-2. Terrestrial Wildlife Species Documented or Likely to Occur in the CSNM.

BS=Bureau Sensitive BA=Bureau Assessment BT=Bureau Tracking
FE/FT/FC=Federally Endangered/Federally Threatened/Federal Candidate Species

Species	Status
Acorn Woodpecker *Melanerpes formicivorus*	BT
American Peregrine Falcon *Falco peregrinus anatum*	BS
American Marten *Martes Americana*	BT
Bald Eagle *Haliaeetus leucocephalus*	FT
Band-tailed Pigeon *Columba fasciata*	BT
Black Salamander *Aneides flavipunctatus*	BA
California Mountain Kingsnake *Lampropeltis zonata*	BT
California Myotis *Myotis californicus*	BT
Cascade Frog *Rana cascadae*	BT
Common Kingsnake *Lampropeltis getula*	BT
Common Nighthawk *Chordeiles minor*	BT
Coronis Fritallary Butterfly *Speyeria coronis coronis*	BT
Fisher *Martes pennanti pacifica*	FC
Flammulated Owl *Otus flammeolus*	BS
Foothill Yellow-legged Frog *Rana boylii*	BA
Fringed Myotis *Myotis thysanodes*	BA
Great Gray Owl *Strix nebulosa*	BT
Greater Sandhill Crane *Grus Canadensis*	BT
Hoary Bat *Laiurus cinereus*	BT
Klamath Mardon Skipper *Polites mardon klamathensis*	FC

Table B-2. Terrestrial Wildlife Species Documented or Likely to Occur in the CSNM.

BS=Bureau Sensitive BA=Bureau Assessment BT=Bureau Tracking
FE/FT/FC=Federally Endangered/Federally Threatened/Federal Candidate Species

Species	Status
Lewis' Woodpecker *Melanerpes lewis*	BS
Long-eared Myotis *Myotis evotis*	BT
Long-legged Myotis *Myotis volans*	BT
Mountain Quail *Oreortyx pictus*	BT
Northern Goshawk *Accipiter gentilis*	BS
Northern Pygmy Owl *Glaucidium gnoma*	BT
Northern Sagebrush Lizard *Sceloporus graciosus graciosus*	BT
Northern Spotted Owl *Strix occidentalis caurina*	FT
Northwestern Pond Turtle *Clemmys marmorata marmorata*	BS
Olive-sided Flycatcher *Contopus cooperi*	BT
Oregon Shoulderband *Helminthoglypta hertleini*	BS
Pacific Pallid Bat *Antrozous pallidus pacificus*	BA
Pileated Woodpecker *Dryocopus pileatus*	BT
Pygmy Nuthatch *Sitta pygmaea*	BT
Ringtail *Bassariscus astutus*	BT
Silver-haired Bat *Lasionycteris noctivagans*	BT
Spotted Frog *Rana pretiosa*	FC
Townsend's Big-eared Bat *Corinorhynus townsendii*	BS
Western Bluebird *Siala mexicana*	BT
Western Gray Squirrel *Sciurus griseus*	BT

Table B-2. Terrestrial Wildlife Species Documented or Likely to Occur in the CSNM.

BS=Bureau Sensitive BA=Bureau Assessment BT=Bureau Tracking
FE/FT/FC=Federally Endangered/Federally Threatened/Federal Candidate Species

Species	Status
Western Meadowlark *Stunella neglecta*	BT
Western Toad *Bufo boreas*	BT
White-headed Woodpecker *Dendrocopos albolarvatus*	BS
Willow Flycatcher *Empidonax traillii adastus*	BT
Yuma Myotis *Myotis yumanensis*	BT

SPECIAL STATUS ANIMAL SPECIES – AQUATIC WILDLIFE

The monument is home to a variety of aquatic organisms including several special status species: Jenny Creek redband trout (*Oncorhynchus mykiss spp.*) a BLM special status species, Jenny Creek sucker (*Catostomus rimiculus*) a BLM special status species, and Fredenberg pebblesnail (*Fluminicola n. sp. 17*), Nerite pebblesnail (*Fluminicola n. sp. 10*), Toothed pebblesnail (*Fluminicola n. sp. 11*), Diminutive Pebblesnail (*Fluminicola n. sp. 12*), Fall Creek pebblesnail (*Fluminicola n. sp. 14*), Keene Creek pebblesnail (*Fluminicola n. sp. 16*), all Bureau Sensitive Species in Oregon.

APPENDIX C

STANDARDS FOR RANGELAND HEALTH AND GUIDELINES FOR LIVESTOCK GRAZING MANAGEMENT

STANDARDS FOR RANGELAND HEALTH
AND
GUIDELINES FOR LIVESTOCK
GRAZING MANAGEMENT
FOR
PUBLIC LANDS ADMINISTERED BY THE
BUREAU OF LAND MANAGEMENT
IN THE STATES OF OREGON AND WASHINGTON
AUGUST 12, 1997

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STANDARDS FOR RANGELAND HEALTH AND GUIDELINES FOR LIVESTOCK GRAZING MANAGEMENT FOR PUBLIC LANDS IN OREGON AND WASHINGTON

INTRODUCTION

These Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington were developed in consultation with Resource Advisory Councils and Provincial Advisory Committees, tribes and others. These standards and guidelines meet the requirements and intent of 43 Code of Federal Regulations, Subpart 4180 (Rangeland Health) and are to be used as presented, in their entirety. These standards and guidelines are intended to provide a clear statement of agency policy and direction for those who use public lands for livestock grazing, and for those who are responsible for their management and accountable for their condition. Nothing in this document should be interpreted as an abrogation of Federal trust responsibilities in protection of treaty rights of Indian tribes or any other statutory responsibilities including, but not limited to, the Taylor Grazing Act, the Clean Water Act, and the Endangered Species Act.

FUNDAMENTALS OF RANGELAND HEALTH

The objectives of the rangeland health regulations referred to above are: "to promote healthy sustainable rangeland ecosystems; to accelerate restoration and improvement of public rangelands to properly functioning conditions; . . . and to provide for the sustainability of the western livestock industry and communities that are dependent upon productive, healthy public rangelands."

To help meet these objectives, the regulations on rangeland health identify fundamental principles providing direction to the States, districts, and on-the-ground public land managers and users in the management and use of rangeland ecosystems.

A hierarchy, or order, of ecological function and process exists within each ecosystem. The rangeland ecosystem consists of four primary, interactive components: a physical component, a biological component, a social component, and an economic component. This perspective implies that the physical function of an ecosystem supports the biological health, diversity and productivity of that system. In turn, the interaction of the physical and biological components of the ecosystem provides the basic needs of society and supports economic use and potential.

The Fundamentals of Rangeland Health stated in 43 CFR 4180 are:

1. Watersheds are in, or are making significant progress toward, properly functioning physical condition, including their upland, riparian-wetland, and aquatic components; soil and plant conditions support infiltration, soil moisture storage and the release of water that are in balance with climate and landform and maintain or improve water quality, water quantity and the timing and duration of flow.
2. Ecological processes, including the hydrologic cycle, nutrient cycle and energy flow, are maintained, or there is significant progress toward their attainment, in order to support healthy biotic populations and communities.
3. Water quality complies with State water quality standards and achieves, or is making significant progress toward achieving, established Bureau of Land Management objectives such as meeting wildlife needs.
4. Habitats are, or are making significant progress toward being, restored or maintained for Federal threatened and endangered species, Federal Proposed, Category 1 and 2 Federal candidate and other special status species.

The fundamentals of rangeland health combine the basic precepts of physical function and biological health with elements of law relating to water quality, and plant and animal populations and communities. They provide direction in the development and implementation of the standards for rangeland health.

STANDARDS FOR RANGELAND HEALTH

The standards for rangeland health (standards), based on the above fundamentals, are expressions of the physical and biological condition or degree of function necessary to sustain healthy rangeland ecosystems. Although the focus of these standards is on domestic livestock grazing on Bureau of Land Management lands, on-the-ground decisions must consider the effects and impacts of all uses.

Standards that address the physical components of rangeland ecosystems focus on the roles and interactions of geology and landform, soil, climate and water as they govern watershed function and soil stability. The biological components addressed in the standards focus on the roles and interactions of plants, animals and microbes (producers, consumers and decomposers), and their habitats in the ecosystem. The biological component of rangeland ecosystems is supported by physical function of the system, and it is recognized that biological activity also influences and supports many of the ecosystem's physical functions.

Guidance contained in 43 CFR 4180 of the regulations directs management toward the maintenance or restoration of the physical function and biological health of rangeland ecosystems. Focusing on the basic ecological health and function of rangelands is expected to provide for the maintenance, enhancement, or creation of future social and economic options.

The standards are based upon the ecological potential and capability of each site. In assessing a site's condition or degree of function, it must be understood that the evaluation compares each site to its own potential or capability. Potential and capability are defined as follows:

> **Potential –** The highest level of condition or degree of function a site can attain given no political, social or economic constraints.
>
> **Capability –** The highest level of condition or degree of function a site can attain given certain political, social or economic constraints. For example, these constraints might include riparian areas permanently occupied by a highway or railroad bed that prevent the stream's full access to its original flood plain. If such constraints are removed, the site may be able to move toward its potential.

In designing and implementing management strategies to meet the standards of rangeland health, the potential of the site must be identified, and any constraints recognized, in order that plan goals and objectives are realistic and physically and economically achievable.

STANDARDS AND GUIDELINES IN RELATION TO THE PLANNING PROCESS

The standards apply to the goals of land use plans, activity plans, and project plans (Allotment Management Plans, Annual Operating Plans, Habitat Management Plans, etc.). They establish the physical and biological conditions or degree of function toward which management of publicly-owned rangeland is to be directed. In the development of a plan, direction provided by the standards and the social and economic needs expressed by local communities and individuals are brought together in formulating the goal(s) of that plan.

When the standards and the social and economic goals of the planning participants are woven together in the plan goal(s), the quantifiable, time specific objective(s) of the plan are then developed. Objectives describe and quantify the desired future conditions to be achieved within a specified timeframe. Each plan objective should address the physical, biological, social and economic elements identified in the plan goal. Standards apply to all ecological sites and land forms on public rangelands throughout Oregon and Washington. The standards require site-specific information for full on-ground usability. For each standard, a set of indicators is identified for use in tailoring the standards to site-specific situations. These indicators are used for rangeland ecosystem assessments and monitoring and for developing terms and conditions for permits and leases that achieve the plan goal.

Guidelines for livestock grazing management offer guidance in achieving the plan goal and objectives. The guidelines outline practices, methods, techniques and considerations used to ensure that progress is achieved in a way, and at a rate, that meets the plan goal and objectives.

INDICATORS OF RANGELAND HEALTH

The condition or degree of function of a site in relation to the standards and its trend toward or away from any standard is determined through the use of reliable and scientifically sound indicators. The consistent application of such indicators can provide an objective view of the condition and trend of a site when used by trained observers.

For example, the amount and distribution of ground cover can be used to indicate that infiltration at the soil surface can take place as described in the standard relating to upland watershed function. In applying this indicator, the specific levels of plant cover necessary to support infiltration in a particular soil should be identified using currently available information from reference areas, if they exist; from technical sources like soil survey reports, Ecological Site Inventories, and Ecological Site Descriptions, or from other existing reference materials. Reference areas are lands that best represent the potential of a specific ecological site in both physical function and biological health. In many instances potential reference areas are identified in Ecological Site Descriptions and are referred to as "type locations." In the absence of suitable reference areas, the selection of indicators to be used in measuring or judging condition or function should be made by an interdisciplinary team of experienced professionals and other trained individuals.

Not all indicators identified for each standard are expected to be employed in every situation. Criteria for selecting appropriate indicators and methods of measurement and observation include, but are not limited to: 1. the relationship between the attribute(s) being measured or observed and the desired outcome; 2. the relationship between the activity (e.g., livestock grazing) and the attribute(s) being measured or observed; and 3. funds and workforce available to conduct the measurements or observations.

ASSESSMENTS AND MONITORING

The standards are the basis for assessing and monitoring rangeland condition and trend. Carrying out well-designed assessment and monitoring is critical to restoring or maintaining healthy rangelands and determining trends and conditions.

Assessments are a cursory form of evaluation based on the standards that can be used at different landscape scales. Assessments, conducted by qualified interdisciplinary teams (which may include but are not limited to physical, biological and social specialists, and interagency personnel) with participation from lessees and other interested parties, are appropriate at the watershed and sub-watershed levels, at the allotment and pasture levels and on individual ecological sites or groups of sites. Assessments identify the condition or degree of function within the rangeland ecosystem and indicate resource problems and issues that should be monitored or studied in more detail. The results of assessments are a valuable tool for managers in assigning priorities within an administrative area and the subsequent allocation of personnel, money and time in resource monitoring and treatment. The results of assessments may also be used in making management decisions where an obvious problem exists.

Monitoring, which is the well documented and orderly collection, analysis and interpretation of resource data, serves as the basis for determining trends in the condition or degree of function of rangeland resources and for making management decisions. Monitoring should be designed and carried out to identify trends in resource conditions, to point out resource problems, to help indicate the cause of such problems, to point out solutions, and/or to contribute to adaptive management decisions. In cases where monitoring data do not exist, professional judgement, supported by interdisciplinary team

recommendation, may be relied upon by the authorized officer in order to take necessary action. Review and evaluation of new information must be an ongoing activity.

To be effective, monitoring must be consistent over time, throughout administrative areas, and in the methods of measurement and observation of selected indicators. Those doing the monitoring must have the knowledge and skill required by the level or intensity of the monitoring being done, as well as the experience to properly interpret the results. Technical support for training must be made available.

MEASURABILITY

It is recognized that not every area will immediately meet the standards and that it will sometimes be a long-term process to restore some rangelands to properly functioning condition. It is intended that in cases where standards are not being met, measurable progress should be made toward achieving those standards, and significant progress should be made toward fulfilling the fundamentals of rangeland health. Measurability is defined on a case-specific basis based upon the stated planning objectives (i.e., quantifiable, time specific), taking into account economic and social goals along with the biological and ecological capability of the area. To the extent that a rate of recovery conforms with the planning objectives, the area is allowed the time to meet the standard under the selected management regime.

IMPLEMENTATION

The material contained in this document will be incorporated into existing Land Use Plans and used in the development of new Land Use Plans. According to 43 CFR 4130.3-1, permits and leases shall incorporate terms and conditions that ensure conformance with 43 CFR 4180. Terms and conditions of existing permits and leases will be modified to reflect standards and guidelines at the earliest possible date with priority for modification being at the discretion of the authorized officer. Terms and conditions of new permits and leases will reflect standards and guidelines in their development.

Indicators identified in this document will serve as a focus of interpretation of existing monitoring data and will provide the basis of design for monitoring and assessment techniques, and in the development of monitoring and assessment plans.

The authorized officer shall take appropriate action as soon as practicable but not later than the start of the next grazing year upon determining, through assessment or monitoring by experienced professionals and interdisciplinary teams, that a standard is not being achieved and that livestock are a significant contributing factor to the failure to achieve the standards and conform with the guidelines.

STANDARDS FOR RANGELAND HEALTH

STANDARD 1 WATERSHED FUNCTION – UPLANDS

UPLAND SOILS EXHIBIT INFILTRATION AND PERMEABILITY RATES, MOISTURE STORAGE AND STABILITY THAT ARE APPROPRIATE TO SOIL, CLIMATE AND LANDFORM.

Rationale and Intent

This standard focuses on the basic physical functions of upland soils that support plant growth, the maintenance or development of plant populations and communities, and promote dependable flows of quality water from the watershed.

To achieve and sustain rangeland health, watersheds must function properly. Watersheds consist of three principle components: the uplands, riparian/wetland areas and the aquatic zone. This standard addresses the upland component of the watershed. When functioning properly, within its potential, a watershed captures, stores and safely releases the moisture associated with normal precipitation events (equal to or less than the 25 year, 5 hour event) that falls within its boundaries. Uplands make up the largest part of

the watershed and are where most of the moisture received during precipitation events is captured and stored.

While all watersheds consist of similar components and processes, each is unique in its individual make-up. Each watershed displays its own pattern of landform and soil, its unique climate and weather patterns, and its own history of use and current condition. In directing management toward achieving this standard, it is essential to treat each unit of the landscape (soil, ecological site, and watershed) according to its own capability and how it fits with both smaller and larger units of the landscape.

A set of potential indicators has been identified for which site-specific criteria will be used to determine if this standard is being met. The appropriate indicators to be used in determining attainment of the standard should be drawn from the following list.

Potential Indicators

Protection of the soil surface from raindrop impact; detention of overland flow; maintenance of infiltration and permeability, and protection of the soil surface from erosion, consistent with the potential/capability of the site, as evidenced by the:

- amount and distribution of plant cover (including forest canopy cover);
- amount and distribution of plant litter;
- accumulation/incorporation of organic matter;
- amount and distribution of bare ground;
- amount and distribution of rock, stone, and gravel;
- plant composition and community structure;
- thickness and continuity of A horizon;
- character of micro-relief;
- presence and integrity of biotic crusts;
- root occupancy of the soil profile;
- biological activity (plant, animal, and insect); and
- absence of accelerated erosion and overland flow.

Soil and plant conditions promote moisture storage as evidenced by:

- amount and distribution of plant cover (including forest canopy cover);
- amount and distribution of plant litter;
- plant composition and community structure; and
- accumulation/incorporation of organic matter.

STANDARD 2 WATERSHED FUNCTION - RIPARIAN/WETLAND AREAS

RIPARIAN-WETLAND AREAS ARE IN PROPERLY FUNCTIONING PHYSICAL CONDITION APPROPRIATE TO SOIL, CLIMATE, AND LANDFORM.

Rationale and Intent

Riparian-wetland areas are grouped into two major categories: 1. lentic, or standing water systems such as lakes, ponds, seeps, bogs, and meadows; and 2. lotic, or moving water systems such as rivers, streams, and springs. Wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration to support, and which under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Riparian areas commonly occupy the transition zone between the uplands and surface water bodies (the aquatic zone) or permanently saturated wetlands. Properly functioning condition of riparian and wetland areas describes the degree of physical function of these components of the watershed. Their functionality is important to water quality in the capture and

retention of sediment and debris, the detention and detoxification of pollutants, and in moderating seasonal extremes of water temperature. Properly functioning riparian areas and wetlands enhance the timing and duration of streamflow through dissipation of flood energy, improved bank storage, and ground water recharge. Properly functioning condition should not be confused with the Desired Plant Community (DPC) or the Desired Future Condition (DFC) since, in most cases, it is the precursor to these levels of resource condition and is required for their attainment.

A set of indicators has been identified for which site-specific criteria will be used to determine if this standard is being met. The criteria are based upon the potential (or upon the capability where potential cannot be achieved) of individual sites or land forms.

Potential Indicators

Hydrologic, vegetative, and erosional/depositional processes interact in supporting physical function, consistent with the potential or capability of the site, as evidenced by:

- frequency of floodplain/wetland inundation;
- plant composition, age class distribution, and community structure;
- root mass;
- point bars revegetating;
- streambank/shoreline stability;
- riparian area width;
- sediment deposition;
- active/stable beaver dams;
- coarse/large woody debris;
- upland watershed conditions;
- frequency/duration of soil saturation; and
- water table fluctuation.

Stream channel characteristics are appropriate for landscape position as evidenced by:

- channel width/depth ratio;
- channel sinuosity;
- gradient;
- rocks and coarse and/or large woody debris;
- overhanging banks;
- pool/riffle ratio;
- pool size and frequency; and
- stream embeddedness.

STANDARD 3 ECOLOGICAL PROCESSES

HEALTHY, PRODUCTIVE AND DIVERSE PLANT AND ANIMAL POPULATIONS AND COMMUNITIES APPROPRIATE TO SOIL, CLIMATE AND LANDFORM ARE SUPPORTED BY ECOLOGICAL PROCESSES OF NUTRIENT CYCLING, ENERGY FLOW AND THE HYDROLOGIC CYCLE.

Rationale and Intent

This standard addresses the ecological processes of energy flow and nutrient cycling as influenced by existing and desired plant and animal communities without establishing the kinds, amounts or proportions of plant and animal community compositions. While emphasis may be on native species, an ecological site may be capable of supporting a number of different native and introduced plant and animal populations and communities while meeting this standard. This standard also addresses the hydrologic cycle which is essential for plant growth and appropriate levels of energy flow and nutrient cycling. Standards 1 and 2 address the watershed aspects of the hydrologic cycle.

With few exceptions, all life on earth is supported by the energy supplied by the sun and captured by plants in the process of photosynthesis. This energy enters the food chain when plants are consumed by insects and herbivores and passes upward through the food chain to the carnivores. Eventually, the energy reaches the decomposers and is released as the thermal output of decomposition or through oxidation.

The ability of plants to capture sunlight energy, to grow and develop, to play a role in soil development and watershed function, to provide habitat for wildlife and to support economic uses depends on the availability of nutrients and moisture. Nutrients necessary for plant growth are made available to plants through the decomposition and metabolization of organic matter by insects, bacteria and fungi, the weathering of rocks and extraction from the atmosphere. Nutrients are transported through the soil by plant uptake, leaching and by rodent, insect and microbial activity. They follow cyclical patterns as they are used and reused by living organisms.

The ability of rangelands to supply resources and satisfy social and economic needs depends on the build-up and cycling of nutrients over time. Interrupting or slowing nutrient cycling can lead to site degradation, as these lands become increasingly deficient in the nutrients plants require.

Some plant communities, because of past use, frequent fire or other histories of extreme or continued disturbance, are incapable of meeting this standard. For example, shallow-rooted winter-annual grasses that completely dominate some sites do not fully occupy the potential rooting depth of some soils, thereby reducing nutrient cycling well below optimum levels. In addition, these plants have a relatively short growth period and thus capture less sunlight than more diverse plant communities. Plant communities like those cited in this example are considered to have crossed the threshold of recovery and often require great expense to be recovered. The cost of recovery must be weighed against the site's potential ecological/economic value in establishing treatment priorities.

The role of fire in natural ecosystems should be considered, whether it acts as a primary driver or only as one of many factors. It may play a significant role in both nutrient cycling and energy flows.

A set of indicators has been identified for which site-specific criteria will be used to determine if this standard is being met.

Potential Indicators

Photosynthesis is effectively occurring throughout the potential growing season, consistent with the potential/capability of the site, as evidenced by plant composition and community structure.
Nutrient cycling is occurring effectively, consistent with the potential/capability of the site, as evidenced by:

- plant composition and community structure;
- accumulation, distribution, incorporation of plant litter and organic matter into the soil;
- animal community structure and composition;
- root occupancy in the soil profile; and
- biological activity including plant growth, herbivory, and rodent, insect and microbial activity.

STANDARD 4 WATER QUALITY

SURFACE WATER AND GROUNDWATER QUALITY, INFLUENCED BY AGENCY ACTIONS, COMPLIES WITH STATE WATER QUALITY STANDARDS.

Rationale and Intent

The quality of the water yielded by a watershed is determined by the physical and chemical properties of the geology and soils unique to the watershed, the prevailing climate and weather patterns, current resource conditions, the uses to which the land is put and the quality of the management of those uses. Standards 1, 2 and 3 contribute to attaining this standard.

States are legally required to establish water quality standards and Federal land management agencies are to comply with those standards. In mixed ownership watersheds, agencies, like any other land owners, have limited influence on the quality of the water yielded by the watershed. The actions taken by the agency will contribute to meeting State water quality standards during the period that water crosses agency administered holdings.

Potential Indicators

Water quality meets applicable water quality standards as evidenced by:

- water temperature;
- dissolved oxygen;
- fecal coliform;
- turbidity;
- pH;
- populations of aquatic organisms; and
- effects on beneficial uses (i.e., effects of management activities on beneficial uses as defined under the Clean Water Act and State implementing regulations).

STANDARD 5 NATIVE, T&E, AND LOCALLY IMPORTANT SPECIES

HABITATS SUPPORT HEALTHY, PRODUCTIVE AND DIVERSE POPULATIONS AND COMMUNITIES OF NATIVE PLANTS AND ANIMALS (INCLUDING SPECIAL STATUS SPECIES AND SPECIES OF LOCAL IMPORTANCE) APPROPRIATE TO SOIL, CLIMATE AND LANDFORM.

Rationale and Intent

Federal agencies are mandated to protect threatened and endangered species and will take appropriate action to avoid the listing of any species. This standard focuses on retaining and restoring native plant and animal (including fish) species, populations and communities (including threatened, endangered and other special status species and species of local importance). In meeting the standard, native plant communities and animal habitats would be spatially distributed across the landscape with a density and frequency of species suitable to ensure reproductive capability and sustainability. Plant populations and communities would exhibit a range of age classes necessary to sustain recruitment and mortality fluctuations.

Potential Indicators

Essential habitat elements for species, populations and communities are present and available, consistent with the potential/capability of the landscape, as evidenced by:

- plant community composition, age class distribution, productivity;
- animal community composition, productivity;
- habitat elements;
- spatial distribution of habitat;
- habitat connectivity; and
- population stability/resilience.

GUIDELINES FOR LIVESTOCK GRAZING MANAGEMENT

Guidelines for livestock grazing management offer guidance in achieving plan goals, meeting standards for rangeland health and fulfilling the fundamentals of rangeland health. Guidelines are applied in accordance with the capabilities of the resource in consultation, cooperation, and coordination with lessees and the interested public. Guidelines enable managers to adjust grazing management on public lands to meet current and anticipated climatic and biological conditions.

GENERAL GUIDELINES

1. Involve diverse interests in rangeland assessment, planning and monitoring.
2. Assessment and monitoring are essential to the management of rangelands, especially in areas where resource problems exist or issues arise. Monitoring should proceed using a qualitative method of assessment to identify critical, site-specific problems or issues using interdisciplinary teams of specialists, managers, and knowledgeable land users.

Once identified, critical, site-specific problems or issues should be targeted for more intensive, quantitative monitoring or investigation. Priority for monitoring and treatment should be given to those areas that are ecologically at-risk where benefits can be maximized given existing budgets and other resources.

Livestock Grazing Management

1. The season, timing, frequency, duration and intensity of livestock grazing use should be based on the physical and biological characteristics of the site and the management unit in order to:
   a. provide adequate cover (live plants, plant litter and residue) to promote infiltration, conserve soil moisture and to maintain soil stability in upland areas;

   b. provide adequate cover and plant community structure to promote streambank stability, debris and sediment capture, and floodwater energy dissipation in riparian areas.

   c. promote soil surface conditions that support infiltration;

   d. avoid sub-surface soil compaction that retards the movement of water in the soil profile;

   e. help prevent the increase and spread of noxious weeds;

   f. maintain or restore diverse plant populations and communities that fully occupy the potential rooting volume of the soil;

   g. maintain or restore plant communities to promote photosynthesis throughout the potential growing season;

h. promote soil and site conditions that provide the opportunity for the establishment of desirable plants;

i. protect or restore water quality; and

j. provide for the life cycle requirements, and maintain or restore the habitat elements of native (including T&E, special status, and locally important species) and desired plants and animals.

2. Grazing management plans should be tailored to site-specific conditions and plan objectives. Livestock grazing should be coordinated with the timing of precipitation, plant growth and plant form. Soil moisture, plant growth stage and the timing of peak stream flows are key factors in determining when to graze. Response to different grazing strategies varies with differing ecological sites.

3. Grazing management systems should consider nutritional and herd health requirements of the livestock.

4. Integrate grazing management systems into the year-round management strategy and resources of the permittee(s) or lessee(s). Consider the use of collaborative approaches (e.g., Coordinated Resource Management, Working Groups) in this integration.

5. Consider competition for forage and browse among livestock, big game animals, and wild horses in designing and implementing a grazing plan.

6. Provide periodic rest from grazing for rangeland vegetation during critical growth periods to promote plant vigor, reproduction and productivity.

7. Range improvement practices should be prioritized to promote rehabilitation and resolve grazing concerns on transitory grazing land.

8. Consider the potential for conflict between grazing use on public land and adjoining land uses in the design and implementation of a grazing management plan.

Facilitating the Management of Livestock Grazing

1. The use of practices to facilitate the implementation of grazing systems should consider the kind and class of animals managed, indigenous wildlife, wild horses, the terrain and the availability of water. Practices such as fencing, herding, water development, and the placement of salt and supplements (where authorized) are used where appropriate to:

   a. promote livestock distribution;

   b. encourage a uniform level of proper grazing use throughout the grazing unit;

   c. avoid unwanted or damaging concentrations of livestock on streambanks, in riparian areas and other sensitive areas such as highly erodible soils, unique wildlife habitats and plant communities; and

   d. protect water quality.

2. Roads and trails used to facilitate livestock grazing are constructed and maintained in a manner that minimizes the effects on landscape hydrology; concentration of overland flow, erosion and sediment transport are prevented; and subsurface flows are retained.

Accelerating Rangeland Recovery

1. Upland treatments that alter the vegetative composition of a site, like prescribed burning, juniper management and seedings or plantings must be based on the potential of the site and should:

   a. retain or promote infiltration, permeability, and soil moisture storage;

   b. contribute to nutrient cycling and energy flow;

   c. protect water quality;

   d. help prevent the increase and spread of noxious weeds;

   e. contribute to the diversity of plant communities, and plant community composition and structure;

   f. support the conservation of T&E, other special status species and species of local importance; and
   g. be followed up with grazing management and other treatments that extend the life of the treatment and address the cause of the original treatment need.

2. Seedings and plantings of non-native vegetation should only be used in those cases where native species are not available in sufficient quantities; where native species are incapable of maintaining or achieving the standards; or where non-native species are essential to the functional integrity of the site.

3. Structural and vegetative treatments and animal introductions in riparian and wetland areas must be compatible with the capability of the site, including the system's hydrologic regime, and contribute to the maintenance or restoration of properly functioning condition.

GLOSSARY

Appropriate action--implementing actions pursuant to subparts 4110, 4120, 4130 and 4160 of the regulations that will result in significant progress toward fulfillment of the standards and significant progress toward conformance with the guidelines (see significant progress below).

Assessment--a form of evaluation based on the standards of rangeland health, conducted by an interdisciplinary team at the appropriate landscape scale (pasture, allotment, sub-watershed, watershed, etc.) to determine conditions relative to standards.

Compaction layer--a layer within the soil profile in which the soil particles have been rearranged to decrease void space, thereby increasing soil bulk density and often reducing permeability.

Crust, Abioti--(physical crust) a surface layer on soils, ranging in thickness from a few millimeters to a few centimeters, that is much more compact, hard and brittle, when dry, than the material immediately beneath it.

Crust, Bioti--(microbiotic or cryptogamic crust) a layer of living organisms (mosses, lichens, liverworts, algae, fungi, bacteria, and/or cyanobacteria) occurring on, or near the soil surface.

Degree of function--a level of physical function relative to properly functioning condition commonly expressed as: properly functioning, functioning-at-risk, or non-functional.

Diversity--the aggregate of species assemblages (communities), individual species, and the genetic variation within species and the processes by which these components interact within and among themselves. The elements of diversity are: 1. community diversity (habitat, ecosystem), 2. species diversity; and 3. genetic diversity within a species; all three of which change over time.

Energy flow--the processes in which solar energy is converted to chemical energy through photosynthesis and passed through the food chain until it is eventually dispersed through respiration and decomposition.

Groundwater--water in the ground that is in the zone of saturation; water in the ground that exists at, or below the water table.

Guideline--practices, methods, techniques and considerations used to ensure that progress is made in a way and at a rate that achieves the standard(s).

Gully--a channel resulting from erosion and caused by the concentrated but intermittent flow of water usually during and immediately following heavy rains.

Hydrologic cycle--the process in which water enters the atmosphere through evaporation, transpiration, or sublimation from the oceans, other surface water bodies, or from the land and vegetation, and through condensation and precipitation returns to the earth's surface. The precipitation then occurring as overland flow, stream flow, or percolating underground flow to the oceans or other surface water bodies or to other sites of evapo-transpiration and recirculation to the atmosphere.

Indicators--parameters of ecosystem function that are observed, assessed, measured, or monitored to directly or indirectly determine attainment of a standard(s).

Infiltration--the downward entry of water into the soil.

Infiltration rate--the rate at which water enters the soil.

Nutrient cycling--the movement of essential elements and inorganic compounds between the reservoir pool (soil, for example) and the cycling pool (organisms) in the rapid exchange (i.e., moving back and forth) between organisms and their immediate environment.

Organic matter--plant and animal residues accumulated or deposited at the soil surface; the organic fraction of the soil that includes plant and animal residues at various stages of decomposition; cells and tissues of soil organisms, and the substances synthesized by the soil population.

Permeability--the ease with which gases, liquids or plant roots penetrate or pass through a bulk mass of soil or a layer of soil.

Properly functioning condition--Riparian-wetland: adequate vegetation, landform, or large (coarse) woody debris is present to dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality; filter sediment, capture bedload, and aid in flood plain development; improve flood-water retention and ground water recharge; develop root masses that stabilize streambanks against cutting action; develop diverse channel and ponding characteristics to provide the habitat and water depth, duration and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity. The result of interaction among geology, soil, water, and vegetation.

Uplands-- soil and plant conditions support the physical processes of infiltration and moisture storage and promote soil stability (as appropriate to site potential); includes the production of plant cover and the accumulation of plant residue that protect the soil surface from raindrop impact, moderate soil temperature in minimizing frozen soil conditions (frequency, depth, and duration), and the loss of soil moisture to evaporation; root growth and development in the support of permeability and soil aeration. The result of interaction among geology, climate, landform, soil, and organisms.

Proper grazing use--grazing that, through the control of timing, frequency, intensity and duration of use, meets the physiological needs of the desirable vegetation, provides for the establishment of desirable plants and is in accord with the physical function and stability of soil and landform (properly functioning condition).

Reference area--sites that, because of their condition and degree of function, represent the ecological potential or capability of similar sites in an area or region (ecological province); serve as a benchmark in determining the ecological potential of sites with similar soil, climatic, and landscape characteristics.

Rill--a small, intermittent water course with steep sides; usually only a few inches deep.

Riparian area--a form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and stream, glacial potholes, and shores of lakes and reservoirs with stable water levels area typical

riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil. Includes, but is not limited to, jurisdictional wetlands.

Significant progress--when used in reference to achieving a standard: (actions), the necessary land treatments, practices and/or changes to management have been applied or are in effect; (rate), a rate of progress that is consistent with the anticipated recovery rate described in plan objectives, with due recognition of the effects of climatic extremes (drought, flooding, etc.), fire, and other unforeseen naturally occurring events or disturbances. Monitoring reference areas that are ungrazed and properly grazed may provide evidence of appropriate recovery rates. (See Proper Grazing Use)

Soil density--(bulk density)--the mass of dry soil per unit bulk volume.

Soil moisture--water contained in the soil; commonly used to describe water in the soil above the water table.

Special status species--species proposed for listing, officially listed (T/E), or candidates for listing as threatened or endangered by the Secretary of the Interior under the provisions of the Endangered Species Act; those listed or proposed for listing by the State in a category implying potential endangerment or extinction; those designated by each Bureau of Land Management State Director as sensitive.

Species of local importance--species of significant importance to Native American populations (e.g., medicinal and food plants).

Standard--an expression of the physical and biological condition or degree of function necessary to sustain healthy rangeland ecosystems.

Uplands--lands that exist above the riparian/wetland area, or active flood plains of rivers and streams; those lands not influenced by the water table or by free or unbound water; commonly represented by toe slopes, alluvial fans, and side slopes, shoulders and ridges of mountains and hills.

Watershed--an area of land that contributes to the surface flow of water past a given point. The watershed dimensions are determined by the point past, or through which, runoff flows.

Watershed function--the principal functions of a watershed include the capture of moisture contributed by precipitation; the storage of moisture within the soil profile, and the release of moisture through subsurface flow, deep percolation to groundwater, evaporation from the soil, and transpiration by live vegetation.

Wetland--areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and which under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

APPENDIX D

LITERATURE SURVEY OF PLANT COMMUNITY CHANGES ASSOCIATED WITH LIVESTOCK EXCLOSURES IN OTHER ECOSYSTEMS

CASE STUDIES OF LONG-TERM VEGETATION DYNAMICS - UPLAND COMMUNITIES

Anderson and Holte (1981) reported a doubling in the cover of shrubs and perennial grasses after 25 years of rest from livestock grazing at Idaho National Engineering Laboratory (INEL). The 20-fold increase in grasses is thought not to be at the expense of shrubs, but related to increased seed reserves with the development of the perennial grass plants. The authors described a stage of slow recovery (the initial 10 years) followed by more rapid recovery related to seed reserves. No obvious seral stages could be defined. The study showed high variance between plots. Anderson and Inouye (1988) discussed the establishment of dense stands of non-native cheatgrass (*Bromus tectorum*) since monitoring the initial presence of non-native cheatgrass (*Bromus tectorum*) at the INEL sites in 1975. The authors noted that establishment occurred in the absence of fire and grazing and during a period of higher than average rainfall (1966-1975). A subsequent decrease during drier years implied a dependence on rainfall.

Burning of good condition plots, including perennial grasses, resulted in an increase in palatable grasses, in spite of an initial large increase in cheatgrass (Hosten 1995). The exclusion of cattle during the recovery period after burning is thought to be crucial (West and Hassan 1985, Hassan and West 1986).

Yorks et al. (1992) reported on the repetition of a 63-year-old transect covering several vegetation types, including sagebrush-dominated communities in Pine Valley, Utah. Many factors, including a moderation in livestock grazing, could be responsible for the substantial increases in canopy cover observed for several perennial grasses. This trend was less noticeable with sagebrush and attributed to a filling out of individual plants rather than increased numbers. The proportion of understory cover relative to total plant cover also showed an increase.

West et al. (1984) found that shrub-dominated communities (sagebrush semidesert) in 5 large paddocks in west central Utah did not show significant increases in perennial grasses following 13 years of rest under favorable precipitation conditions. The presence of annual grasses increased the possibility of community deflection towards cheatgrass domination.

Eckert and Spencer (1986) examined changes in shrub canopy cover, basal cover of herbaceous species, and frequency of occurrence of all species at 2 sites in northern Nevada. Both sites were managed under a 3-pasture rest rotation grazing system. One site showed no long-term change in frequency of species. The other site showed increased shrub cover and decreased palatable grass (*Stipa thurberiana* and *Agropyron spicatum*) cover over the 10 years examined. At one of the above sites, Eckert and Spencer (1987) found heavy periodic grazing to be the major cause for restriction of basal area growth and reproduction of palatable grass species over a 9-year study period.

VARIOUS LIVESTOCK EXCLOSURE STUDIES - UPLAND COMMUNITIES

Peters et al. (1993) commented on vegetation changes in 2 livestock exclosures near Burley and Castleford (Idaho) over 50+ years following crop-land abandonment. Using frequency of occurrence data, the authors showed that 1 site showed change toward late-seral perennial grass species (*Agropyron riparium* and *Poa secunda*) while the other site remained dominated by annuals and biennials.

Rose and Miller (1993) reported on inside versus outside differences of 13 livestock exclosures 66 years after establishment using cover and density data. No statistically significant differences in cover between grazed pastures and livestock exclosures were found for shrubs, although *Artemisia tridentata* showed increased density outside the livestock exclosure. Total grass cover and density of all perennial bunchgrasses, except *Poa sandbergii*, were higher inside the livestock exclosure. Forbs appeared to have a slightly higher cover and density within the livestock exclosures, although these changes appeared to be species-specific.

Robertson (1971) examined an eroded and grazed 20-acre tract 30 years after the initiation of rest. The plant community showed increased cover by all its life-forms and re-establishment by *Agropyron spicatum*. The highest recovery was exhibited by thurber needlegrass (a 7-fold increase). The only decreases were shown by annual forbs and locoweed.

Tueller and Tower (1979) emphasized the negative aspects of livestock exclosures – the stagnation effect arising from non-use of plants. As an example, they presented data showing an average 70% decline in the production of bitterbrush 10 years after fencing.

Pearson (1965) showed that above-ground production for sagebrush and several major bunchgrasses increased after 11 years of rest, in comparison to a site that had been grazed continuously for 70 years. An exception was *Phlox caespitosa*. This trend did not extend to below-ground production. The area being rested showed only 68% of the below-ground root mass of the grazed area.

Sanders and Voth (1983) found greater ground cover on grazed plots versus protected plots in the Boise National Forest after 46 years of periodic data collection. No clear trends could be found on a species basis.

Holecheck and Stephenson (1983) found that 22 years of rest from grazing in northwestern New Mexico had little influence on plant composition at either of 2 sagebrush semi-desert sites studied. Forbs had been eliminated from the study site prior to construction of the livestock exclosures by heavy sheep grazing.

Potter and Krenetsky (1967) showed a decrease in ground cover by both grass and forbs in protected and grazed plots occupied by sagebrush semi-desert in northwestern New Mexico.

Daddy et al. (1988) examined 3 sites with different grazing histories in northwestern New Mexico. Major phytomass contributors at the heavily grazed site were *Aristida sp.* and *Bromus tectorum*. *Brotclova gracilis* and *Hilaria jamesii* were more productive on grazed sites. The moderately grazed site had twice the herbaceous above-ground phytomass of the protected site.

Sneva et al. (1984) examined 10 livestock exclosures established in eastern Oregon during the drought years of the 1930s in big and low sagebrush-dominated vegetation. Frequency estimates were evaluated in 1937, 1960, and 1974. Frequency of all native grasses (*Agropyron spicatum, Festuca idahoensis, Sitanion hystrix, Stipa thurberiana, Poa sandbergii*) was shown to increase or remain stable both within and outside the livestock exclosures with one exception. *Poa sandbergii* decreased in 1 livestock exclosure located in low sagebrush-dominated vegetation. Several factors confounded the results: the switch from spring sheep to spring-through-fall cattle-grazing, higher precipitation following 1937, a decline in overall livestock grazing intensity, and the effects of the sagebrush defoliator moth during the early 1960s.

McLean and Tisdale (1972) noted dramatic changes in the range of plant communities within a set of livestock exclosures located in southern British Columbia.

Fescue Grassland Zone (McLean and Tisdale 1972): "Twenty nine years after fencing, there was five times the foliage cover of bluebunch wheatgrass, (*Agropyron spicatum*), Rough fescue, and Kentucky bluegrass (*Poa pratensis*) inside the livestock exclosure as compared with that outside. There was also a marked decrease in the amount of Sandberg bluegrass, low pussy toes, and dwarf fleabane." "The average herbage production during the period 1959 to 1966 showed a 98% greater yield inside the livestock exclosure compared with outside."

Fescue Grassland Zone (McLean and Tisdale 1972): "Twenty-nine years after fencing, there was a much greater cover of rough fescue, bluebunch wheatgrass, and junegrass inside the livestock exclosure, compared to an abundance of dwarf fleabane and Sandberg bluegrass outside. A review of earlier observations suggests that vegetation on the grazed area had not changed appreciably." "The 4-year average herbage yield shows 73% greater production inside the fence [no grazing] as compared with outside [grazed area] following 32 years of protection".
Text in brackets [ ] added for clarity.

Fescue Grassland Zone (McLean and Tisdale 1972): "Observations made in 1940 and 1950 suggest that considerable improvement took place in the first 10 years after fencing. There was a marked increase in bluebunch wheatgrass and decrease in sandberg bluegrass. Between 1950 and 1959, there was a striking increase in the proportion of rough fescue present. The data support these observations, for 21 years after fencing the foliage cover of rough fescue was 10 times greater inside the livestock exclosure than in the grazed area."

Ponderosa Pine Zone (McLean and Tisdale 1972): "Ten years after fencing, there was a considerably more bluebunch wheatgrass and rough fescue inside the livestock exclosure as compared with the grazed area and much less low pussy toes and Sandberg bluegrass. By the end of the next 9 years, there was still greater increase in the amount of bluebunch wheatgrass and rough fescue inside the livestock exclosure and a marked decrease in Sandberg bluegrass, needleandthread, and low pussy toes." "Average herbage production indicated a 60% greater yield inside the livestock exclosure as compared with that outside 15 years after fencing".

Ponderosa Pine Zone (McLean and Tisdale 1972): "Data recorded in 1959, 23 years after fencing, show that bluebunch wheatgrass plants inside the exclosure had over four times the foliage cover of those plants outside. Sandberg bluegrass on the other hand had much greater coverage on the outside as compared with inside. The poorer range condition outside was also reflected in the greater frequency of low pussy toes. In the 9 years following 1959 there was a marked increase in bluebunch wheatgrass both inside and outside the exclosure, and increase in pasture sage inside and a decrease in low pussy toes." "The average herbage yield indicated a 160% increase in production inside the exclosure over that outside after 23 years of protection."

Ponderosa Pine Zone (McLean and Tisdale 1972): "General observations and limited quadrat data obtained in 1949 and 1959 suggest that the greatest improvement took place in the 13 years following 1936, and continued to a lesser extent over the next ten years. During the initial period there was a marked increase in bluebunch wheatgrass. There was also a decrease in needleandthread, low pussy toes, and rabbitbrush." "The average herbage yield indicates a 124% increase in production inside the exclosure as compared with outside."

Ponderosa Pine Zone (McLean and Tisdale 1972): "Records taken in 1960 (23 years after fencing) indicate more bluebunch wheatgrass and silky lupine inside the exclosure as compared with the grazed area. There was also less western needlegrass (Stipa occidentalis), low pussy toes, shaggy fleabane, sixweeks fescue, and cheatgrass inside the exclosure. Ten years later the bluebunch wheatgrass had decreased and cheatgrass increased inside the exclosure because of gopher activity. Ground disturbance by gophers was

greater inside the exclosure presumably as a result of protective cover for the rodents provided by old plant growth."

In studies under Ponderosa pine forests of northern Arizona, Arnold (1950) noted grazing related shifts away from native bunchgrasses and towards weeds and undesirable annual grasses. The authors noted the following:

"Under protection from grazing the taller bunchgrass species dominated the herbaceous composition within the five exclosures. The species that escaped or withstood a high degree of repeated grazing [outside the exclosures] were less abundant [inside the exclosures]."

"...the bunchgrass were highly sensitive to grazing, particularly under the lighter [tree] canopy [closure] classes where grazing was intense."

"By repeated removal of the tall stems and leaves [by livestock] the bunchgrasses on the grazed areas were reduced to a small part of the total herbaceous cover. This result contrasts sharply with those obtained from the ungrazed exclosures, where bunchgrass species dominated the herbaceous composition."
Text in brackets [ ] added for clarity.

CHRONOSEQUENCE APPROACHES - UPLAND COMMUNITIES

Tueller and Platou (1991) determined a successional gradient in northern Nevada by examining plant community changes moving away from a watering point. The observed pattern was determined to be different from theoretical pathways. *Agropyron spicatum* was found to vary greatly between plots but was greatly reduced in the 2 plots closest to the watering points. *Bromus tectorum* cover was found to be highest closest to the watering points, while *Lupinus caudatus* and *Phlox longifolia* showed the opposite trend. *Poa secunda* generally showed a lack of trend. Cover values seem to correspond well with density data. *Sitanion hystrix* showed relatively high densities in low and high seral stage plots. Sagebrush density appears to vary considerably, being highest in the third and last plots, thus not yielding a clear pattern. In general, vegetation cover increased with decreasing condition, while litter cover and microphytic cover was highest in the plots furthest away from the water.

An examination of ten piospheres on the Snake River plains of Idaho yielded different results (Hosten 1995). While species level trends were apparent within individual piospheres, species trends were not replicated at the landscape level. This may be due to the diversity of environmental factors at larger spatial scales. Across the landscape, the least impacted transects (furthest from the watering points) were most similar to nearby relict (ungrazed) areas. The data stress the importance of basing management on site-specific plant community monitoring.

Studies of bitterbrush habitat types in north central Washington also suggest that moderately livestock impacted communities were more similar to reference communities than heavily impacted sites (Youtie et al. 1988). As with sagebrush steppe communities, areas of intense livestock impact showed higher shrub cover and lower bunchgrass cover (Youtie 1988, Hosten 1995). General landscape-level patterns of community change may be obscured by the interaction of other ecological processes such as fire.

Many of the above upland studies were conducted in the Great Basin, however, a generalized model of plant community dynamics within an oak woodland environment supports some of the common plant community changes identified in the above literature, especially regarding annual and perennial grass dynamics. George et al. (1992) associates annualization of grasslands in an oak woodland environment with poor livestock management and identifies the difficulty of restoring "Mediterranean" grasslands back to native perennial domination [see the weed management plan and literature review in Appendix GG of the CSNM DRMP (USDI 2001)].

RIPARIAN COMMUNITIES

The importance of riparian zone habitat to the maintenance of biological diversity at the landscape and local scales cannot be over emphasized. Riparian zones are one of the most limited, (Elmore 1987) and most sensitive (Kaufman and Krueger 1984) habitats in the western landscape. Riparian zones are the most productive and diverse habitats in much of the west (Thomas et al. 1979) and frequently produce 10 times the forage of adjacent upland forested sites (Elmore1987).

The link between riparian vegetation diversity, especially in the shrub and overstory layers, and riparian wildlife diversity is well documented (Kauffman and Krueger 1984, Taylor 1986, Szaro et al. 1985). Wildlife populations adjacent to riparian zones are affected by habitat conditions and resultant wildlife populations in the riparian zones (Kauffman and Krueger 1984). Healthy riparian habitat also usually supports species not found in the uplands and thus contributes to species diversity at larger landscape scales.

Plant compositional and structural changes in riparian communities are better understood. Poor livestock management can result in the loss of woody and herbaceous species critical for stabilizing streambanks.

In a study comparing riparian vegetation between grazed areas and ungrazed livestock exclosures northwest of Fort Collins (Colorado), Schultz and Leininger (1990) found significant differences in vegetation structure and composition. Total vascular vegetation and the abundance of shrubs and grasses were greater in livestock excluded areas, while forbs showed similar abundance to grazed areas. Livestock excluded areas showed higher litter and lower bare ground.

The recovery of woody riparian vegetation appears to occur rapidly following livestock exclusion. In south central Washington, Rickard and Cushing (1982) show the re-establishment of willow (*Salix amygdaloides*) in streamside riparian areas within 10 years of livestock exclusion.

APPENDIX E

RIPARIAN SURVEY FORMS AND PROCEDURES

RIPARIAN VEGETATION COMMUNITIES
HABITAT DIVERSITY INDEX SYSTEM
REMARKS BY QUARTER MILE
RIPARIAN ZONE CONDITION
OBSERVED APPARENT TREND
SPECIES LIST
HORIZONTAL – VERTICAL DISTRIBUTION
STEP-POINT TRANSECT
SKETCH OF STREAM SECTION
EXAMPLES OF FORMS

EXCERPT FROM:
RIPARIAN ZONES: CLASS I & II STREAMS
IN BUTTE FALLS AND KLAMATH RESOURCE AREAS
1980 – 1982

MONTGOMERY AND CULBERTSON, 1983
BUREAU OF LAND MANAGEMENT

To gather similar data from all sites and facilitate summarizing data, standard forms are utilized. The following contains samples of each form and a brief explanation of its use and, for some, a more detailed explanation of meaning and values.

1. Riparian Vegetative Community

   This is the basic form for obtaining stream vegetation data. It contains spaces for species and foliar cover, location, and various parameters pertinent to this community which set it apart from others. The spaces are self-explanatory.

2. Habitat Diversity Index System

   The Habitat Diversity Index (HDI) is one that incorporates most of the basic premises of wildlife habitat management. It can be used to measure the ability of a habitat site to provide food, cover, and reproductive requirements for a species or a group of species. It deals with the number of potential niches available for expected species richness and can be used graphically to predict the presence of a "feature" species or group of species on the site. The data used in calculating the Habitat Diversity Indices (HDI's) can be used in determining limiting factors for a species or group of species for a selected habitat site. The system employs data in such a manner that the loss or gain in species richness or relative abundance of a select species due to a management action (i.e. timber harvest) can be predicted.

   Most of the data required to calculate the HDI's can be obtained from the range management portion of the Soil-Vegetation Inventory Method (SVIM) effort. There need not be <u>any</u> duplication of effort. If SVIM data is not available, an HDI for a standard habitat site can be calculated with minimum field time (approximately 30-45 minutes). Additional sampling may require more time due to the complexity of the site or the severity of proposed action, but for the majority of cases it is not necessary. In certain western Oregon districts where no SVIM data is yet available, timber management systems such as the Operation Inventory (O.I.) or Timber Production Class Capability can be used in part.

   The HDI system is basically used to record the physical attributes of a standard habitat site and then calculate the potential use by wildlife species of that site. The greater the HDI, the more probable that a greater number of species (species richness) use that site for their life needs because of the greater "opportunities" available.

   The habitat diversity indices were calculated for each habitat site based on information on the following parameters: plant species present (plant forms i.e. grass, shrub, trees), vertical and horizontal spatial distribution of plant species present, presence of rocks greater than ten inches diameter and the presence of persistent litter.

   Sites were evaluated on the following criteria:

   a. Plant Forms

      A numerical value for plant forms is assigned based on the presence or absense of the various plant forms. A value of two points was assigned

for growth forms having greater than 2% foliar cover. An optional one point value could be assigned if the plant form was present along the site but comprised less than 2% folier cover.

The plant form categories are: Submergents/emergents, sedges/rushes, grasses, forbs, upright shrubs, hardwood trees, and conifers.

Example:	POPR		PEFR5		BENE2	(Species)
	Grass		Forb		Upright Shrub	(Veg. Type)
	2	+	2	+	2	= 6 Points

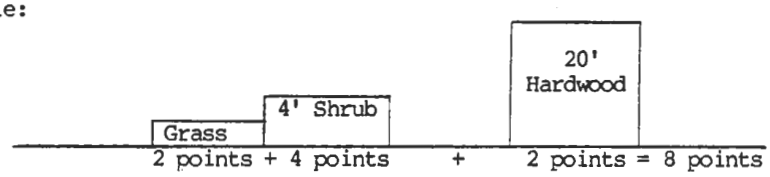
If all plant forms are present, a value of 14 points is assigned.

b. Edges

Edges are present spatially both vertically and horizontally, each is considered separately. Vertical edges are assigned a point value if the growth form (grass and/or forbs) or height group is present.

The vertical edge categories are: Grass/forb, four feet, four to fifteen feet, fifteen to forty-five feet, forty-five to ninety feet, and ninety feet and above. Each category is valued at two points except the four feet high which is four points. These are based on ocular observations.

Example:

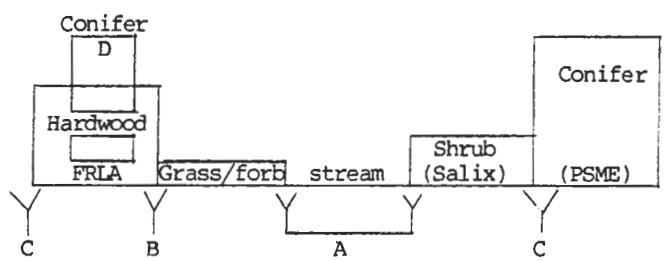


Fourteen points possible if all vertical layers represented.

Horizontal edges are present when different growth forms grow side by side. Each growth form abutting another growth form has a value of two points. The horizontal edge categories are:

streamside	shrub: hardwood
grass/forb: shrub	shrub: conifer
grass/forb: hardwood	hardwood: conifer
grass/forb: conifer	riparian: upland

Example:



Streamside = 2 points (A)
Riparian: upland = 2 points (C) = 8 points
Grass/forb: hardwood = 2 points (B)
Hardwood: conifer = 2 points (D)

Sixteen points possible if all potentials are present.

c. Water Availability

The water availability categories are based on seasonal or perennial surface flows. Point values are the perennial streams six points, intermittent streams four points, and seasonal streams two points. Since a stream is generally only one of the above, a maximum of six points is assigned.

d. Unique Habitats

Unique habitats are generally small in comparison to the overall habitat, but unique in nature. Each unique habitat was assigned a value of one point. Examples of unique habitats are:

cliffs	Gravelbar greater than 50' long
talus slope	beaver pond(s)
cave	thick streamside grass cover
spring	stable cutbank greater than 8' high
cattails	

e. Riparian Zone Condition

The value of the condition of the riparian zone is reflected in the points for each condition class. The condition classes and point values are:

Excellent	6 points
Good	4 points
Fair	2 points
Poor	0 points

Points from one category only will be assigned.

f. Width of Riparian Zone

The width of the combined sides of the riparian zone are assigned point values by width classes. The width classes and their point values are:

0-20 feet	2 points
20-40 feet	4 points
40 feet or wider	6 points

Only one category may be utilized, that which fits the average riparian zone width.

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g. Snags

Snags are grouped by height and DBH into two groups: less than six feet tall and less than eleven inches DBH and greater than six feet tall and eleven inches DBH. Point values are assigned by the number of snags per acre in each size class. If both size classes are present, only the larger value is assigned. One additional point is assigned if both conifer and hardwood snags are present.

Point values for group of snags are:

Number of Snags Per Acre	Less than 6' tall & less than 11" DBH	Greater than 6' tall & greater than 11" DBH
1 - 3	1 point	2 points
3 or more	2 points	3 points

Estimates are by ocular calculation. A maximum of four points is allowed.

The Habitat Diversity Index equals the sum of the component sections, A through G, above. Low HDI values represent habitats with little diversity. High HDI's represent habitats with high diversity and complexities.

3. Remarks by Quarter Mile

This page explains itself well. It is for any notes not covered in the field forms. It may be utilized as a place for a narrative of the site. The items recorded may include any from the list above or any other pertinent information such as a special habitat feature.

Include: management of adjacent habitat, type of adjacent habitat; character of stream channel; continuity of habitat, bank conditions, layers, etc.; tributaries and springs, seepages and size; snags, number and size, location of clumped; cliffs, rock outcroppings, or any other special feature; any type of irregularity of difference in the type of habitat or expansion of points in main section.

4. Riparian Zone Condition

The evaluation of the condition includes five aspects (see Rating Form and Criteria Sheet). The two primary are vegetation age and composition, and bank condition. These two are rated for all streams. The secondary three; logging, grazing, and roads are rated only as they apply. The rating system is a sliding scale of 0-20 (15) points for each aspect considered. The closer to excellent condition, the higher the score or rating.

If an area has been logged and had a detrimental effect on the stream, then 20 points are added to the total possible points and the appropriate deductions made from that total possible. Depending on the activities affecting a stream, the points may or may not be added. For example, if a riparian zone had been previously logged and had recovered from that logging, yet was rated in fair condition due to other influences, then logging points would not be added. This is because the design of the rating system would ultimately increase the condition of the stream rather than decrease it.

Therefore, the rating may have 40, 60, 80, or 100 points possible depending on the riparian zone use. The assigned points are taken as a percentage of the total possible which equates to condition.

5. Observed Apparent Trend

The evaluation of the trend involves four primary observations and one secondary. The first four are plant, vigor, seedling establishment, vegetation composition, and surface litter (see rating and criteria forms). These are rated on all streams riparian zones. The secondary value of pedestalling is rated only if pedestalling is present. If present, the value of damage from fifteen possible points is subtracted from the total of the primary factors. This value gives a rating relative to the changing complexity of the area.

The vegetation composition is also examined under the condition rating. They are, however looking for different factors relating to composition and rated at different values.

6. The wildlife observed section is a space for recording the sighting of animals, tracks, scat or calls that indicate presence.

7. The Horizontal-Vertical Distribution (H/V Dist)

The horizontal-vertical distribution (H/V Dist) drawings graphically show a two-dimensional outline of existing woody vegetation. It is useful for defining layers and serves as a record for the future. Photographs were taken at many of the sites and in some cases served as the H/V distribution record.

8. The Step-Point Transect

The Step-Point Transect is a method of gathering data about species composition at the various canopy levels. Estimates of foliar cover may frequently exceed 100% due to overlapping forage layers. The step-point demonstrates that layering and provides raw data for percentages of each canopy, species or ground cover types. The step-point is a selection method with an imaginary line from your toe through all canopy layers. Any plant touching that line is registered on the step point form in its proper canopy layer. Generally, 50 one-meter steps were registered for each bank of the stream, and a perpendicular transect was run from the stream to the outer edge of the riparian zone, for each side.

9. Sketch of Stream

A sketch of the stream section surveyed was drawn during the 1981 and 1982 surveys. These are useful for recording features of the stream or riparian zone such as cutbanks, waterfalls, groups of snags, etc.

FORM # 1

RIPARIAN VEGETATIVE COMMUNITY

GRASSES & GRASSLIKE	% PRESENT	
MOSS		
FORBS		
SHRUBS		
TREES		

STREAM ____________ CLASS ______

T ____ R ____ S ____ MILE ______

Resource area ______ tenths ______

DATE ____________ PHOTO ______

EXAMINERS ________/__________

PLANT COMMUNITY ______________

CANOPY COVER $\bar{X}$ _____ % (_____TO_____)

CLUMPED ______ EVEN ______

STREAM GRADIENT $\bar{X}$ _____% (_____TO_____)

STREAM WIDTH $\bar{X}$ _____ (_____TO_____)

STREAM DEPTH $\bar{X}$ _____ (_____TO_____)

BANK SLOPE: RIGHT $\bar{X}$_____% (_____TO_____)

LEFT $\bar{X}$ _____% (_____TO_____)

RIPARIAN ZONE WIDTH

RIGHT $\bar{X}$ _____ (_____TO_____)

LEFT $\bar{X}$ _____ (_____TO_____)

STREAMBED COMPOSITION silt sand gravel cobblestone boulder bedrock

ELEVATION ________

ACRES ________

SWA # ________

CHANNEL WIDTH $\bar{X}$ _____ (_____ TO _____)

Temperature: TIME _____ H_2O _____ AMB _____

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FORM # 2

HABITAT DIVERSITY INDEX

PLANT FORMS

emergents/submergents	2	___
sedges/rushes	2	___
grasses	2	___
forbs	2	___
upright shrubs	2	___
hardwood trees	2	___
conifers	2	___
Total Points		_____

UNIQUE HABITATS 1 point ea.

cliff	___
talus slope	___
cave	___
stable cut bank 8 ft high +	___
gravel bar 50 ft long +	___
beaver pond	___
thick grass cover at streamside	___
spring	___
cattails	___
other....	___
Total points	_____

EDGES

Vertical layers		
grasses/forbs	2	___
4 ft.	4	___
4 - 15 ft.	2	___
15 - 45 ft.	2	___
45 - 90 ft.	2	___
90 ft. and above	2	___
Total points		_____
Horizontal layers		
streamsiede	2	___
grass/forb:shrub	2	___
grass/forb:hardwood	2	___
grass/forb:conifer	2	___
shrubs:hardwood	2	___
shrubs:conifer	2	___
hardwood:conifer	2	___
riparian:upland	2	___
Total points		_____

WATER AVAILABILITY

perrennial	6	___
intermittent	4	___
seasonal	2	___
Total points		_____

RIPARIAN ZONE CONDITION

excellent	6	___
good	4	___
fair	2	___
poor	0	
Total points		_____

WIDTH OF RIPARIAN ZONE

0 - 20 ft.	2	___
20- 40 ft.	4	___
40 ft. or wider	6	___
Total points		_____

SNAGS

#/acre	6' tall 11" DBH	6' tall 11" DE
1-3	1 point	2 points
3+	2 points	3 points
both hardwood and conifer snags		1 point
Total points		_____

HDI total _____

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FORM #

4. RIPARIAN ZONE CONDITION

PARAMETER	POINTS POSSIBLE	POINTS ASSIGNED	
Vegetation age and composition	0-20	_____	80 - 100 excellent
Bank condition	0-20	_____	55 - 79 good
Grazing impacts	0-20 n/a	_____	30 - 54 fair
Logging impacts	0-20 n/a	_____	0 - 29 poor
Roads and/or crossings	0-20 n/a	_____	

TOTALS

points assigned _____ X 100 = _____ % of possible
points possible _____

5. OBSERVED APPARENT TREND

	Points	
Plant vigor	_____	51 - 75 upward
Seedling establishment	_____	
Vegetative composition	_____	26 - 50 static
Surface litter	_____	
Pedestalling	_____	0 - 25 downward
TOTAL	_____	

6. WILDLIFE OBSERVED

AVIAN SPECIES	MAMMALIAN SPECIES	HERPTILES AND FISH

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CRITERIA FOR FORM # 4

CRITERIA FORM

STREAM RIPARIAN ZONE CONDITION EVALUATION

80 - 100% excellent
55 - 79 good
30 - 54 fair
0 - 29 poor

VEGETATION AGE AND COMPOSITION

16 - 20 Desirable trees and shrubs numerous, mature and immature stages present. Grasses and forbs vigorous and common.

11 - 15 All age classes of trees and shrubs, fewer mature trees, seedlings common. Grasses and forbs present, minor disturbances revegetating well.

6 - 10 Moderate numbers of trees and shrubs, mostly single age class. Grasses and forbs present, including invader species.

0 - 5 Trees and shrubs few and/or decadent, single age class, few seedlings present. Many invader species present.

BANK CONDITIONS

16 - 20 Bank stable, failures rare; gullies, if present, in stable condition.

11 - 15 Bank failure and slumps uncommon and small, adequately revegetated; gullies, if present, with some active erosion.

6 - 10 Occasional bank failure, some severe; root mats disturbed; gullies well developed with moderate erosion.

0 - 5 Bank sloughing common, erosion and siltation evident; gullies deep, V-shaped, and activity eroding.

GRAZING IMPACTS (at date of evaluation)

16 - 20 Trails few, not eroding; minimal grazing, less than 10% new growth (current grazing season).

11 - 15 Trails not eroding; moderate grazing/browsing, less than 30% new growth.

6 - 10 Frequent cattle trails, compaction, trampling and erosion light to moderate; 30 to 50% browsing/grazing of new gorwth; moderate pedastaling.

0 - 5 Trails increasing runoff and erosion; heavy browsing/grazing, greater than 50% of new growth; moderate to heavy pedastaling.

LOGGING IMPACTS

16 - 20 None, logging greater than 100m from stream.

11 - 15 Logging to stream, hardwoods and shrubs remain, occasional siltation.

6 - 10 Some vegetation remains after logging, debris in stream, siltation present

0 - 5 Debris in stream, silt jams, no buffer eroding banks common.

PARALLEL ROADS AND/OR CROSSINGS

16 - 20 Minimal effect or limited to parallel roads some distance from stream, or a single crossing that is fully revegetated.

11 - 15 Occasional minor slough from road bank; areas previously impacted have recovered; crossings infrequent, mostly revegetated.

6 - 10 Light to moderate erosion of road cuts and crossings; some revegetation, limits riparian zone width, not directly adjacent to stream.

0 - 5 Moderate to severe erosion of road cuts; limits width of zone; little vegetative cover.

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CRITERIA FOR FORM # 5

51 - 75 upward
26 - 50 static
0 - 25 downward

CRITERIA SHEET

OBSERVED APPARENT TREND

	POINTS	PLANT VIGOR
	16-20	Desirable grasses forbs and shrubs vigorous, showing good size and color and producing abundant herbage.
	11-15	Desirable grasses, forbs, and shrubs have moderate vigor. Medium size, fair color, and producing moderate amounts of herbage. Some seedstalks present.
A	6-10	Some increaser and invader species present. Desirable vegetation has low vigor, with small size and poor color. Some plants dead or partially dead. Few seedstalks or seedheads present.
	0- 5	Increaser and invader species abundant. Few desirables remain and many are dead or dying.
		SEEDLINGS
	16-20	Abundant seedling establishment of desirable vegetation. Most age classes represented by vegetation. Few seedlings or invaders or increasers.
	11-15	Moderate seedling establishment of desirable plants. Some age classes
B		represented. Some invader and increaser seedlings present.
	6-10	Few seedlings or desirable vegetation and few age classes represented. Many increaser and invader species present.
	0- 5	Mostly seedlings of invaders or increasers present. Mostly a single age class.
		VEGETATION COMPOSITION
	16-20	Riparian vegetation highly diverse with many vertical layers represented. Good woody plant development. 80-100% canopy cover.
	11-15	Vegetation moderately diverse with at least 3-4 vertical layers represented.
C		Woody vegetation common. 65-79% canopy cover.
	6-10	Fair diversity with at lease 2-3 vertical layers. Some woody vegetation 40-64% canopy cover.
	0- 5	Little diversity with only one or two levels. Woody vegetation scarce or absent. Less than 40% canopy cover.
		SURFACE LITTER
	11-15	Surface litter is plentiful and continuing to accumulate.
D	6-10	Moderate movement of surface litter is apparent and deposited against obstacles.
	0- 5	Very little surface litter remaining.
	Total A+B+C+D	Subtract points taken from E if E applicable
		PEDESTALS
	11-15	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounded and accumulating litter; desirable forage grasses may be found along edges of pedestals.
E	6-10	Moderate plant pedestalling. No visual evidence of healing or deterioration. All rock and plant pedestals may be occuring in flow patterns.
	0- 5	Most rocks and plants are pedestalled. Pedestals are sharp, wide, and eroding often exposing grass roots.

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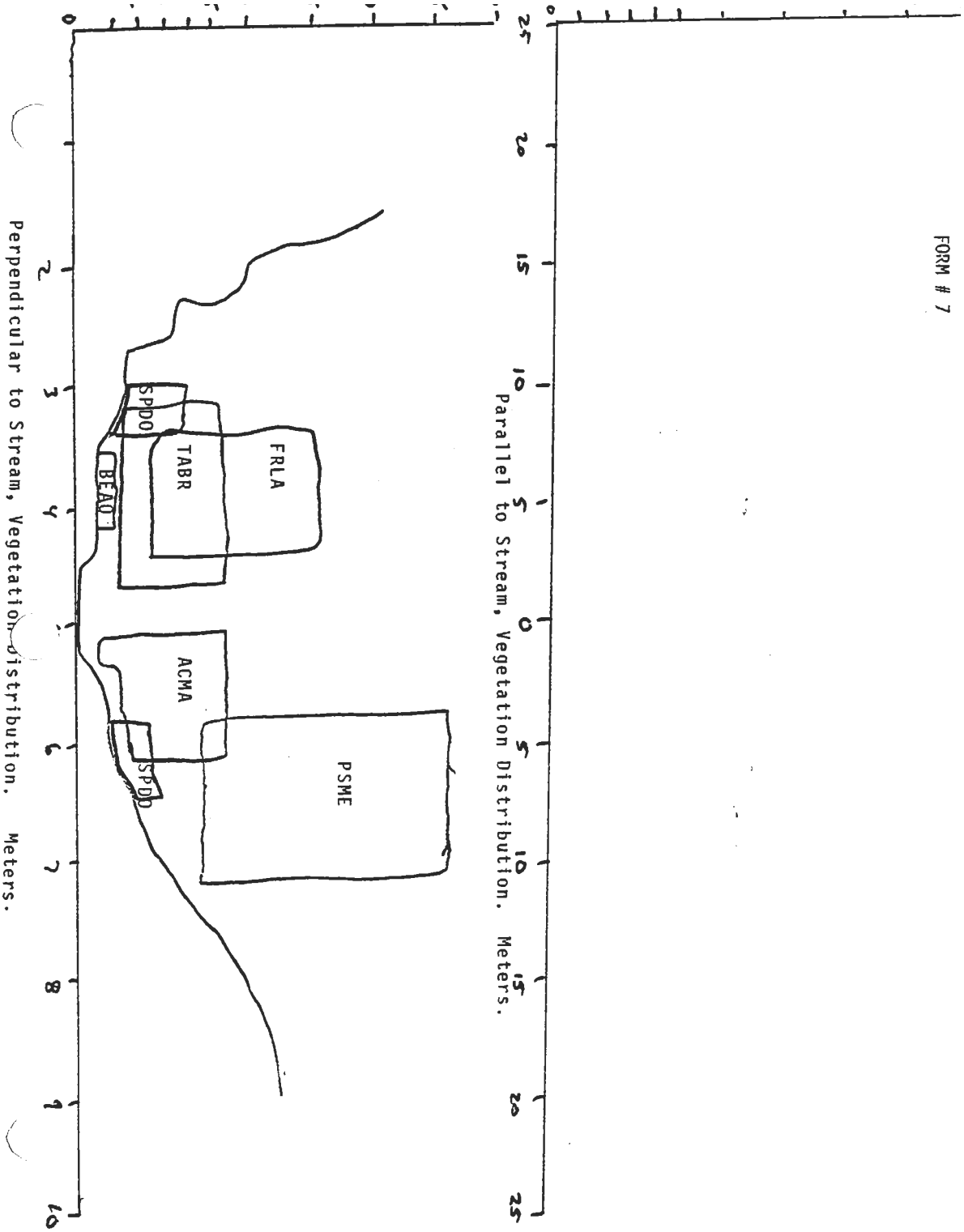
FORM # 7
Parallel to Stream, Vegetation Distribution. Meters.
Perpendicular to Stream, Vegetation distribution. Meters.
FRLA
TABR
SPDO
BEAQ
ACMA
SPDO
PSME

FORM # 8

STEP POINT DATA

Stream:
Mile:
T.____R.____Sec.____Date

Left Bank Aspect:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
							FRLA													
							SPDO													
C1							POPR													
GRD							B													

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
C3																				
C2																				
C1																				
GRD																				

	41	42	43	44	45	46	47	48	49	50
C3										
C2										
C1										
GRD										

ıt Bank Aspect:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
C3																				
C2																				
C1																				
GRD																				

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
C3																				
C2																				
C1																				
GRD																				

	41	42	43	44	45	46	47	48	49	50
C3										
C2										
C1										
GRD										

Examiners_____

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