ELKO COUNTY SAGEBRUSH ECOSYSTEM CONSERVATION STRATEGY

Prepared by:

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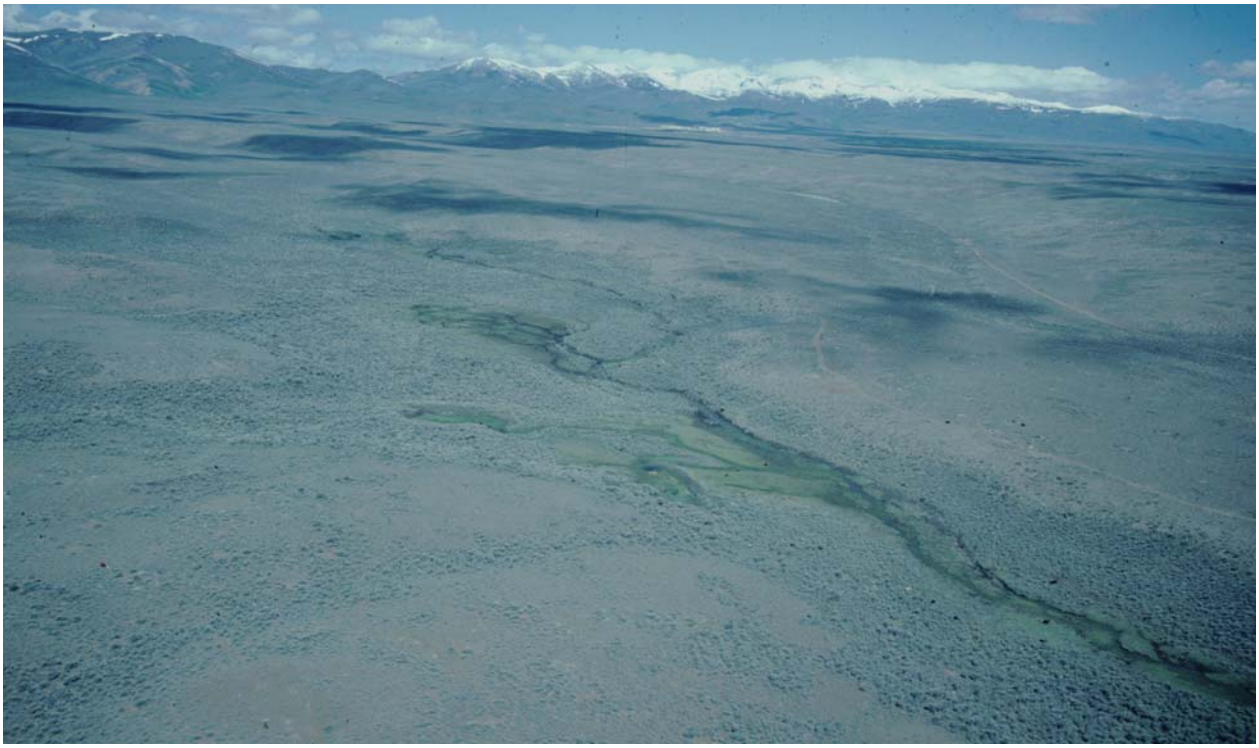

March 2004

NORTHEASTERN NEVADA STEWARDSHIP GROUP, INC.

Mission Statement

Whereas:
As the Northeastern Nevada Stewardship Group, Inc., we appreciate:
Opportunities which allow us to live and work in Northeast Nevada;
Natural resources which enable local prosperity;
Productive ecosystems which provide healthy environments and quality lifestyles;
Our western heritage, culture, and customs.

Therefore:
In order to ensure a better future for our families, community, and future generations,
To build trust amongst our diverse citizenry, and to
Ensure sustainable resource use,
We join together as full partners to
Provide a collaborative forum for all willing participants.
We are dedicated to dynamic, science-based resolution of
Important issues related to resource stewardship and
Informed management of our public lands with
Positive socioeconomic outcomes.

SIGNATURE PAGE

The Strategy presented herein is a process for assessing the 19 watersheds within the planning area. As such, there is no commitment by any agency or individual signatory below to any expenditure of funds or personnel resources to the process. By their signatures, these individuals and/or the agency represented by the signatory, are agreeing to proceed with the process and are indicating a general approval of the Strategy. Their signature should not be interpreted to mean that each signatory is in total agreement with all of the wording or all of the components of this Strategy. Each agency can only participate to the extent allowable by law, regulation, or policy.

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PREFACE

The Northeastern Nevada Stewardship Group, Inc. (NNSG) was established in the fall of 1998 as a result of frustration with the confrontational manner in which natural resource and land use issues were being addressed in the region. Seeking an alternative means of conflict resolution, a collaborative training session was conducted. Following the training, the group met again and decided that sufficient interest and support existed to form a community-based organization operating under the concept of collaboration. The NNSG was thus formed, and the first task undertaken was to develop a mission statement that met the needs and expressed the values of the diverse membership (see preceding page).

The NNSG is open to all individuals, organizations, interest groups, businesses, corporations, and governmental agencies. The NNSG has no jurisdictional authority, yet is empowered by the process of collaboration and by its membership. It is noteworthy that the NNSG did not form as a result of the potential petition to list the sage grouse as threatened or endangered under the Endangered Species Act (ESA) of 1973, as amended. Rather, the NNSG formed as a group and developed their mission prior to seeking an issue to pursue (i.e., the mission statement was not born of any specific issue, but recognized the need to develop a format to address all issues). As such, the NNSG has incorporated community values into the development of this strategy, a strategy developed to provide for the natural resources within the county, as well as to provide for the well being of the people, continuance of the land uses, and maintenance of the cultures of Elko County.

By 1999, the potential for a petition to list sage grouse as threatened or endangered under the ESA was the issue “du jour.” Because this issue had the potential to affect land users of every persuasion; and therefore, the potential to bring diverse viewpoints to the table to resolve the issue, sage grouse conservation was selected as the issue for NNSG to implement the collaborative process. This was a new issue and hard-line positions had not yet developed. The potential for a successful collaborative effort existed and the citizens worked to resolve differences for the common good.

Developing and accepting the strategy are only the first steps in a long journey. The strategy is the road map, but there will be unexpected detours in the road ahead. Only time will tell if the trust that has been built among the members will be sufficient to weather the obstacles ahead. It is important that we remain true to our mission, and so the mission statement is included as the very first page, convenient for continual reference.

The NNSG makes no pretense to having ownership or jurisdiction over any lands or resources. However, as indicated by the development of this document, the NNSG does have a stake in how these lands are managed, and has taken the active role in providing a road map for the management of the lands within Elko County. The NNSG also recognizes the importance of private lands within the regional landscape. Management strategies on private and public lands need to complement each other if either strategy is to be successful. Therefore, in terms of land management actions, the strategy will not distinguish between private land and public land. The distinction will lie in how those strategies can be implemented, funding for the implementation, and the adaptive management process for modifying the strategies based on monitoring.

The strategy that follows is the result of a collaborative effort. The NNSG as a group decided to explore the sage grouse conservation issue and assigned the task to a committee or “pod.” The pod then went through a series of steps, including weekly meetings over a six-month period, and monthly meetings (more or less) over a four-year period, to develop the framework and content of the strategy. During this time, Governor Guinn convened a statewide Sage Grouse Conservation Team. NNSG was invited to participate in this statewide effort. The completion of the NNSG Sagebrush Ecosystem Conservation Strategy was delayed to allow the statewide Sage Grouse Conservation Strategy to develop. The NNSG agreed to be one of the six local planning groups involved in the statewide effort, but also decided to maintain the original course of the NNSG Sagebrush Ecosystem Conservation Strategy. The primary difference is the focus of the two strategies. The

NNSG strategy is a watershed-based, ecosystem conservation strategy and the State strategy is primarily focused on sage grouse conservation. While the two strategies share common goals and considerable overlap in process, they remain separate approaches. The end result is that the NNSG has incorporated some of the statewide strategy for sage grouse conservation, but will implement sage grouse conservation through watershed/ecosystem management. The actual writing of the strategy was contracted out to a third party to facilitate the writing process, but the process has been at the direction and supervision of the pod. The pod members and contributors to this strategy are listed in **Appendix A**.

During this process, NNSG sponsored a series of workshops and symposia on topics directly related to this effort. Producing a strategy that is science-based requires that the membership be exposed to the existing science and to understand the underlying scientific principles sufficiently to evaluate the various fact and fiction that arises during the process. For many people, reading this document may be their first, or their only, or their major exposure, to sage grouse or sagebrush ecology; therefore, the information from the literature and the science symposia has been included extensively into this document. Although this has added to the length of the document, Section 2 provides the reader with an opportunity to have this information in one location for easy reference. This information has also been the basis for understanding the relationship between sage grouse and its habitat, and therefore, the basis for developing the several of the management strategies.

Of utmost importance is the recognition that this is not an ending point, but a starting point. The concern about sage grouse has led to additional research to explore relationships between habitat and nutrition, habitat and predation, seasonal movements, population genetics, and many other topics. The strategy presented herein includes the concept of adaptive management. This allows for new information and new hypotheses, which develop from controlled research studies or from on-the-ground experience, to be included into the decision-making process. Therefore, this strategy is based on our current understanding of the sagebrush ecosystem, which is admittedly only superficial. However, this basic understanding is sufficient to move forward and to allow us to learn from our mistakes, as well as our successes. With approximately 11 million acres in the planning area, it is impossible with current, or even with wishful funding levels, to affect a large amount of acreage in a short period of time. Therefore, by taking small steps and implementing the monitoring of the key resources and systems, and by implementing the adaptive management process, the on-the-ground work can proceed without fear of making a mistake that will wreak irrevocable damage to the ecosystem. That is not to imply that we won't make mistakes, but that they will be made at a scale and magnitude that they can be corrected with time

ACKNOWLEDGEMENTS

The major contributors to this strategy are listed in **Appendix A**; these are the pod members that attended meetings, discussed the issues, and contributed to the solutions. Their perseverance is appreciated. This document is first and foremost, their collective vision.

Mr. J. Kent McAdoo, University of Nevada Cooperative Extension, accepted the task of editing the document before it was presented to the pod for their review. His suggestions greatly improved the document and his contributions to the process are greatly appreciated. Kent was also a "sounding board" for many of the theoretical concepts that are included in this Strategy, and the discussions about these topics were improved by his thoughts.

Mr. Ray Lister, Elko Field Office, Bureau of Land Management (BLM), led the effort to coordinate the GIS mapping and the determination of "restoration" ratings (habitat R values) of the habitat within the planning area. He was assisted in this effort by Mr. Bruce Piper, also of the Elko Field Office, BLM. Ray also provided the summary of BLM activities that currently provide consideration and/or benefits to sage grouse within the Elko Field Office.

Mr. Larry Gilbertson and Mr. Sid Eaton of the Nevada Department of Wildlife (NDOW), provided access to the local NDOW data base regarding sage grouse. This included lek count data, lek locations, and wing data. In addition, they revised the original sage grouse Population Management Unit (PMU) boundaries based on their local knowledge and developed the population estimates for each PMU. They also made the first assignment of risks within the risk matrix. Mr. Steve Foree, NDOW Habitat Biologist contributed in a variety of ways, not the least of which was his questioning of the basis for each part of the strategy. Steve also provided a summary of NDOW's efforts to enhance sage grouse populations and the monitoring conducted by NDOW.

Mr. Paul Blackburn and Mr. Chuck Petersen, Natural Resource Conservation Service (NRCS) provided guidance on the use of the NRCS soil survey data that was used in the identification of the restoration ratings. Mr. Leland (Lee) Campsey, also of the NRCS, took minutes of the pod meetings and provided important information regarding range issues and grazing. Lee also served as an important link between the NNSG Sage Grouse Pod and the ranching community through the local Conservation Districts.

Mr. Will Amy and Ms. Portia Jelineck, U.S. Forest Service (USFS) also contributed with their local knowledge of habitat condition and sage grouse seasonal use areas on National Forest lands. They also kept the group advised of actions that had potential to be in conflict with the Forest Plan. Will provided a summary of the USFS actions that benefit sage grouse or sage grouse habitat.

The ranching community was well represented at the meetings and contributed much in the way of local knowledge of sage grouse distribution, as well as providing a historical perspective of sage grouse abundance, landscape changes, and grazing practices. Mr. Fred Zaga and Mr. Harvey Barnes also assisted the pod through their support of the NNSG effort through their membership in other organizations, such as the Nevada Cattlemen's Association, the Elko County Public Land Use Advisory Council, and the N-1 Grazing Board. Of all the stakeholders in this process, the ranching community has the potential to be most affected. The strategy would be hollow without their input and support.

The mining industry was also well represented on the pod and contributed ideas for the Strategy, funds for symposia, and funds to support the administrative needs of NNSG. There has been willingness by this industry to be part of the solution and it is greatly appreciated.

The Nevada Subcommittee for Public Lands provided the initial grant for writing the Strategy and for acquiring information on the other sagebrush obligate species. We hope they view this as money well spent.

At the beginning of this process, the N-1 Grazing Board provided a grant of $20,000 to allow the NNSG to implement demonstration projects. These projects were a test of some of the ideas included in this Strategy and were important in letting individuals see the opportunity that exists for improving wildlife habitat, livestock forage, and fuels management.

The Elko Field Office, BLM and Mountain City and Ruby Mountain Districts, USFS have also contributed funding for various operational, symposia, and activity costs. The completion of this strategy would not have occurred without their assistance.

Many other individuals have contributed to the thinking that went into this document through questions, suggestions, and comments about sage grouse, range management, predation, and a variety of other topics. Too numerous to mention, or even remember, but they will recognize their contribution as they read the strategy.

There are two men who guided the preparation of this document, yet never attended a meeting. Dr. William H. Marshall, a pioneer in the field of wildlife ecology, stressed the value of habitat in the management of game animals, and the interrelationships of plants and animals as the basis for developing management plans. Mr. Gordon W. Gullion, a former resident of Elko and game biologist with NDOW, and one of the foremost experts of ruffed grouse ecology, stressed the need to learn the conditions under which healthy populations existed prior to settlement. This includes the factors that created suitable habitat conditions, as well as the factors (such as predators), that influenced how a species used or selected habitats. While these conditions cannot often be recreated exactly, they do provide the basis for designing habitat management actions. These two themes were the paradigm for this strategy.

PREAMBLE

The NNSG recognizes that the federal land management agencies have laws, regulations, and policies that direct how they administer the public lands. The Federal Land Policy Management Act (FLPMA) directs the agencies to develop land use plans (LUPs) to guide their on the ground management. In addition, the federal agencies are required by the National Environmental Policy Act (NEPA) to conduct environmental analysis of federal actions or federally funded actions. The federal agencies have also entered into agreements (Memoranda of Understanding, Cooperative Agreements, etc.) that further define roles and responsibilities. One such agreement is the Memorandum of Understanding (MOU) between the federal land management agencies and the Western Association of Fish and Wildlife Agencies (WAFWA). This MOU states that the federal agencies will consider the guidelines for the management and conservation of sage grouse developed by WAFWA in federal land actions.

In addition, the Bureau of Land Management (BLM) Nevada has included sage grouse as a Sensitive Species and has developed guidelines for considering the potential impacts to sage grouse or sage grouse habitat from various program-specific actions (i.e., rights-of-way for utility lines, mining, fences, land exchanges, etc.). These guidelines were risk-based and are incorporated into the decision-making process. The U.S. Forest Service (USFS) has also identified sage grouse as a Sensitive Species, but has not yet developed specific management guidelines; however, sage grouse was previously considered a USFS Management Indicator Species, which provides special consideration of the species in their decision-making process.

The Northeastern Great Basin Resource Advisory Council (RAC) has also developed Standards and Guidelines for Rangeland Health. These standards apply to livestock and wild horse and burro actions as they relate to vegetative conditions, or rangeland health. The USFS also has desired conditions that are developed for each plant community. These conditions address the soil, vegetation, hydrology, and disturbance associated with functioning, not functioning, and threshold conditions. These plant community conditions are the basis for evaluating land uses and planning new actions.

These are just some of the sideboards within which the federal agencies must operate. Therefore, the NNSG Elko County Sagebrush Ecosystem Conservation Strategy can only be adopted by the federal land management agencies to the extent that the actions proposed in the strategy are in conformance with the applicable LUPs, laws, policies, and agreements. However, there are also lands in Elko County that are not administered by the federal agencies; and therefore, it is appropriate to include in this strategy actions that may be conducted on private lands that are beyond the actions appropriate for federally-administered lands. Consequently, the signing of this strategy by authorized officers of the federal agencies does not imply that all actions proposed within this strategy, or subsequent watershed plans, are appropriate for federally-administered lands, but is an acceptance of the strategy in concept.

Actions that are developed and proposed for specific locations on public lands, or actions that are federally funded, will be reviewed for conformance with LUPs, laws, regulations, policies, and agreements. If a specific action is not in conformance with the LUPs, laws, regulations, policies, and agreements, then either the action will be modified to the extent possible to provide conformance, or an amendment to the LUP will be proposed. In addition, all actions that are proposed for public lands or that are federally funded, will be subject to NEPA analysis. Under this process, the special consideration afforded to sage grouse as a BLM Sensitive Species or a USFS Sensitive and/or Management Indicator Species, and any other risk-based guidelines would be incorporated into the analysis.

Furthermore, the NNSG Elko County Sagebrush Ecosystem Conservation Strategy (Strategy) does not supercede any LUPs or seek to interfere or replace existing federal agency management. However, the NNSG is hopeful that some of the solutions to resource issues provided within this strategy, and to be developed in subsequent watershed management plans, can be viewed as consistent with the goals, objectives, and management decisions outlined in the LUPs and

will be incorporated into existing LUP implementation strategies or actions. The process outlined in this Strategy may be useful to identify and prioritize needed changes in management to address specific issues.

As part of this effort, the Strategy presented focuses on those aspects of ecosystem management that have not been a priority for the federal agencies and does not address those issues that the federal agencies are currently addressing. In addition, there is overlap in dealing with some issues where the synergy of two or more independent actions can be combined to achieve results not possible by either action alone. For example, the federal land management agencies regulate grazing on public lands in terms of kind of livestock, number of livestock, season of use, and allowable utilization levels. The NNSG does not propose to conduct independent allotment evaluations to determine if the existing grazing systems are achieving the desired results; this is the purview of the federal agencies. However, the NNSG strategy focuses on the functionality of systems (energy, nutrient, and water) within watersheds. The stressors on the systems, including but not limited to livestock grazing, will be evaluated through the watershed assessment process. As a result of the assessment process, the NNSG may determine that some adjustments in grazing may be required to allow a system to function. In such cases, the information will be provided to the appropriate federal land management agencies to be incorporated as part of the allotment monitoring data and as input from an interested party in the allotment evaluation process. Thus, the NNSG will attempt to influence the decision-making process based on the results of the watershed assessment, but it remains up to the federal land management agencies to make the final decision.

The major focus of the NNSG strategy is that of landscape health. This is a synergistic effort in that the Bureau of Land Management's Great Basin Restoration Initiative and the Forest Service's Healthy Forest Initiative provide the direction for restoring rangeland and forests to healthy, productive condition. The watershed assessment/planning process is compatible with the goals and objectives of these agency initiatives.

The NNSG has identified several factors that affect sage grouse populations; however the three general conditions that need to be addressed through the watershed assessment/planning process that allow for synergism and include: 1) annual grasslands (primarily cheatgrass); 2) encroachment of pinyon-juniper woodlands from woodland sites to range sites; and 3) the interference of natural disturbance regimes that have allowed for sagebrush-grassland plant communities to become dominated by older sagebrush and to reach extreme fuel loading conditions. Each of these conditions represents a stressor on the sagebrush ecosystem and to the fauna and flora that inhabit this ecosystem. The watershed assessment/planning process will allow for an objective evaluation of the causes of these conditions, as well as other stressors to the watershed, and the appropriate site-specific actions needed to rectify the conditions or to remove the stressors. The end result should be increased health of the range and forest lands.

Sage grouse have been the impetus for this conservation effort, but should be viewed as the "means" not the "ends"; by understanding the ecology of this species and the ecology of the sagebrush plant community on which it depends, some of the general concepts for ecosystem management can be developed. The "ends" is to achieve properly functioning ecosystems that allow for sustainability of the resources and the sustainability of the land uses that depend on those resources.

ELKO COUNTY SAGEBRUSH ECOSYSTEM CONSERVATION STRATEGY

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EXECUTIVE SUMMARY

Introduction

The Elko County Sagebrush Ecosystem Conservation Strategy (Strategy) is the result of collaboration among various interest groups, individuals, and agency personnel in response to the potential for listing sage grouse as threatened or endangered under the Endangered Species Act. However, the Northeastern Nevada Stewardship Group (NNSG) quickly realized that the sage grouse was an indicator species of ecosystem health. Because of the variety of plant community types (i.e., habitats) needed by sage grouse for breeding, nesting, brood-rearing, and wintering, "the goal of managing sage grouse habitats for an optimal balance of shrubs, forbs, and grasses at community and landscape scales should be analogous with restoring and /or maintaining form, function, and process in sagebrush-dominated habitats" (Crawford et al. 2004). Consequently, the focus of the effort changed from a single-species conservation plan to an ecosystem conservation strategy. However, the emphasis on sage grouse has not been lost in the process. Throughout the process, sagebrush obligate species, special status species (both plants and animals), and other unique land features (e.g., aspen stands, sub-alpine forests, etc.) will be considered in the management actions developed with the intent on maintaining the diversity of communities on the landscape.

Habitat Conservation Assessment

The Strategy includes an assessment of the planning area that consists of a summary of sage grouse biology and ecology, a description of sagebrush ecology, a list of factors that affect sage grouse and sage grouse habitats, and a historical perspective of the landscape changes and sage grouse populations.

As part of this assessment, the NNSG followed portions of the Nevada Sage Grouse Conservation Strategy developed by the Governor's Sage Grouse Conservation Team. Sage grouse population management units (PMUs) were identified within the planning area, and each PMU was evaluated for risks to sage grouse using the following factors: Habitat Quantity, Habitat Quality/Nutrition, Habitat Fragmentation, Changing Land Uses, Livestock Grazing, Fire Ecology, Disturbance, Predation, Hunting, Disease, Cycles, and Climate/Weather. Those PMUs with higher total risk values were identified as priority areas for management. The level of risk assessment was general; not specific enough to identify individual project level actions, but detailed enough to identify the general types of issues that need to be addressed.

The condition of the vegetation with respect to sage grouse habitat requirements was also evaluated using soil mapping provided by the Natural Resource Conservation Service (NRCS), various vegetation mapping efforts provided by the Elko Field Office, Bureau of Land Management (BLM), allotment evaluation data from BLM and U.S. Forest Service, Humboldt-Toiyabe National Forest (USFS), and field experience of the members of the team. The evaluation generally followed the protocols developed in Idaho and included five habitat categories:

- R-0: Habitat areas with desired species composition that have sufficient, but not excessive, sagebrush canopy and sufficient grasses and forbs in the understory to provide adequate cover and forage to meet the seasonal needs of sage grouse (4,805,000 acres);
- R-1: Habitat areas which currently lack sufficient sagebrush and are currently dominated by perennial grasses and forbs, yet have the potential to produce sagebrush plant communities with good understory composition of desired grasses and forbs (1,170,000 acres);
- R-2: Existing sagebrush habitat areas with insufficient desired grasses and forbs in the understory to meet seasonal needs of sage grouse (2,018,000 acres);
- R-3: Sagebrush habitat areas where pinyon-juniper encroachment has affected the potential to produce sagebrush plant communities that provide adequate cover and forage to

meet the seasonal needs of sage grouse (354,000 acres); and

- R-4: Habitat areas which have the potential to produce sagebrush plant communities but are currently dominated by annual grasses, annual forbs, or bare ground (251,573 acres).

The remaining 1,626,000 acres of the planning area were identified as non-sage grouse habitats (forests, urban areas, salt-desert shrub, etc.).

This breakdown indicated that although Elko County has considerable acreage of intact sage grouse habitat (R-0 acreage), the potential habitat in which sagebrush can be readily established and sagebrush habitat in poor condition (R-1 and R-2 acreage, respectively), and the areas formerly occupied by sagebrush but now occupied by pinyon-juniper and cheatgrass (R-3 and R-4 acreage, respectively) account for 44 percent of the acreage (3,793,000 acres) that have potential to support sage grouse within the planning area. These habitat condition categories that represent risks to sage grouse also represent acreage that is not functioning in terms of watershed values. Consequently, the issues of habitat quantity and habitat quality were identified as major issues to be addressed.

Conservation Strategy

The NNSG Strategy and the Nevada Sage Grouse Conservation Strategy (State Strategy) identify some common goals. The first goal of the State Strategy is to:

> Create healthy, self-sustaining Sage Grouse populations well distributed throughout the species' historic range by maintaining and restoring ecologically diverse, sustainable, and contiguous sagebrush ecosystems and by implementing scientifically-sound management practices.

The goal of the NNSG Strategy is to:

> Manage watersheds, basins, and sub basins in a manner that restores or enhances (as appropriate) the ecological processes necessary to maintain proper functioning ecosystems, inclusive of sage grouse.

The NNSG Strategy also includes goals specific to various resources (e.g., sage grouse, vegetation, special status species, livestock, recreation, mining, and fuels management). However, these goals are general goals that can be refined at the watershed management unit level.

The objectives of the NNSG Strategy are to:

> Implement a watershed analysis process on the watersheds within the planning area by initiating the assessment of three watersheds each year; and
>
> Develop a watershed plan for each watershed within one and one-half years following the initiation of the process.

The watershed assessment will follow range, watershed, riparian, and sage grouse habitat evaluation processes developed by the BLM, U.S. Geological Survey, NRCS, Agricultural Research Service, USFS, Environmental Protection Agency, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, National Park Service, the Bureau of Indian Affairs, and the Western Association of Fish and Wildlife Agencies.

The watershed management plans will include actions and management strategies that address the specific land health and sage grouse habitat issues identified in the watershed assessment. Once completed, the individual projects, groups of inter-related projects, or the entire watershed plan will be subject to National Environmental Policy Act (NEPA) analysis to determine the impacts of such actions on the critical elements of the human environment, as well as the cumulative impacts of such actions.

The NNSG Strategy identifies several management strategies that are likely to be incorporated into the watershed management plans on a site-specific basis. The management strategies identified to date address some of the major issues that have been identified in the initial PMU risk assessment and watershed review. As other issues are identified in the watershed assessment process, additional management strategies will be developed.

Monitoring at the watershed plan-level, at the individual watershed project-level, and at the on-the-ground resources-level will be part of the

watershed management process. For each monitoring level, the responsibility for conducting the monitoring, the variable(s) to be monitoried, the frequency at which monitoring is to occur, and the manner in which the monitoring will be reported will be specified. The variables to be monitored will be directly related to the goals and objectives of the watershed plan, the project, and the resources to be affected by the project.

The feedback provided by the monitoring with respect to the objectives will provide the basis for implementing adaptive management strategies. If objectives are being achieved, then the type of action implemented will continue. If objectives are not being achieved, then the hypothesis on which the objective is based, the practice that was implemented, the conditions under which it was implemented, the variables being monitored, and monitoring methodology will all be re-evaluated to determine where changes need to be instituted.

This Strategy is the process for identifying the site-specific issues, developing watershed-specific management/conservation plans, proposing and implementing site-specific actions, determining the appropriate monitoring of these actions, and implementing adaptive management concepts to the entire process.

1 INTRODUCTION

1.1 Background

The potential of a petition to list sage grouse under the Endangered Species Act (ESA) of 1973, as amended, had broad implications for land uses; and therefore, was an appropriate issue with which NNSG to become involved. The initial approach was to develop a sage grouse conservation plan (i.e., a plan to manage appropriate habitats and lands for the benefit of sage grouse). It soon became apparent that such an undertaking was myopic because improving conditions for the benefit of one species often results in worsening conditions for other species. In reality, this approach is analogous to cutting the proverbial pie into more pieces; emphasizing certain lands for one species or group of species at the expense of other species or land uses. This approach also pits "resource protection" against "resource use" by prioritizing one use (i.e., sage grouse or sage grouse habitat) at the expense of another (i.e., livestock grazing, hunting, recreation, etc.). This approach would ultimately bring the group back to the table at some future date to develop a conservation plan for the next species facing extirpation as a result of implementation of the sage grouse conservation plan, or would create controversy and conflict, rather than resolving issues.

The plight of sage grouse is symptomatic, and treating the symptom would not cure the ailment. Sage grouse can be viewed as a biotic indicator species, and their range-wide decline is an indication that the ecosystems on which sage grouse depend are not functioning properly. Therefore, on the grand scale, the task is to return functionality to the ecosystems. Consequently, the NNSG decided to expand the scope of the plan to be all encompassing. However, defining an ecosystem was not a simple task, and managing an ecosystem may even be an even more daunting task.

The first step was to realize that the Great Basin ecosystem was not within our capability to manage. The second step was to define the area of interest, Elko County (**Figure 1**). The County is defined by political boundaries, not ecological boundaries; therefore, some overlap with adjacent conservation plans is necessary and desirable. Elko County is located primarily within the Basin and Range Physiographic Province of the Great Basin, and the northern part of the county is within the Columbia Plateau Province. Major Land Resource Areas (MLRAs) as defined by the Natural Resource Conservation Service (NRCS 1987), include the Owyhee High Plateau (MLRA 25), Great Salt Lake Area (MLRA 28), and a portion of the Humboldt Area (MLRA 24) (**Figure 2**). Without a single "ecosystem" with which to work, but realizing that the vegetation communities in the various provinces and MLRAs were similar, the "sagebrush ecosystem" was selected as the ecosystem on which to focus. This included the riparian, woodland, and salt-desert shrub, although the primary focus of this strategy will be the lands currently supporting sagebrush-herb[1] or range sites capable of supporting sagebrush-herb communities.

This is not a strategy to create more sagebrush per se, but is a strategy to improve the functionality of the sagebrush-herb communities. This strategy also recognizes that perennial grasses and forbs are an essential component of the sagebrush community. As such, the maintenance of this herbaceous component is vital to the maintenance of the functionality of the system in terms of energy, nutrient, and water cycling, as well as being integral to the sustainability of the sagebrush-herb community. Thus the absence of sagebrush on a site and the dominance by grass and forbs on the site is a seral stage, or state in the transition from disturbance to sagebrush dominance. This is a necessary step in the development of the sagebrush community. Therefore, one of the essential concepts of this strategy is that periodic disturbance is required to maintain the sagebrush ecosystem. How, when, and where the disturbance should be introduced is to be determined through the watershed assessment.

[1]"Sagebrush-herb community" is a term borrowed from Dr. Alma Winward and is used to designate a community that has shrub (primarily sagebrush), perennial grass, and forb components. The latter two components make up the herbaceous layer, thus the use of the term "herb." While "sagebrush-herb" is synonymous with "sagebrush-grassland," sagebrush-herb adds emphasis to the important forb component.

REFERENCE	DESIGNED GB	12/01	FIGURE 1
	DRAWN akt	12/01	
	CHECKED		SAGEBRUSH ECOSYSTEM CONSERVATION STRATEGY PLANNING AREA
	APPROVED		
REVISIONS	No. DESCRIPTION BY	DATE	

PREPARED BY: SRK Consulting Engineers and Scientists

SCALE: AS SHOWN | REVISION A

JOB NO. 140701
DWG NAME 140701-102

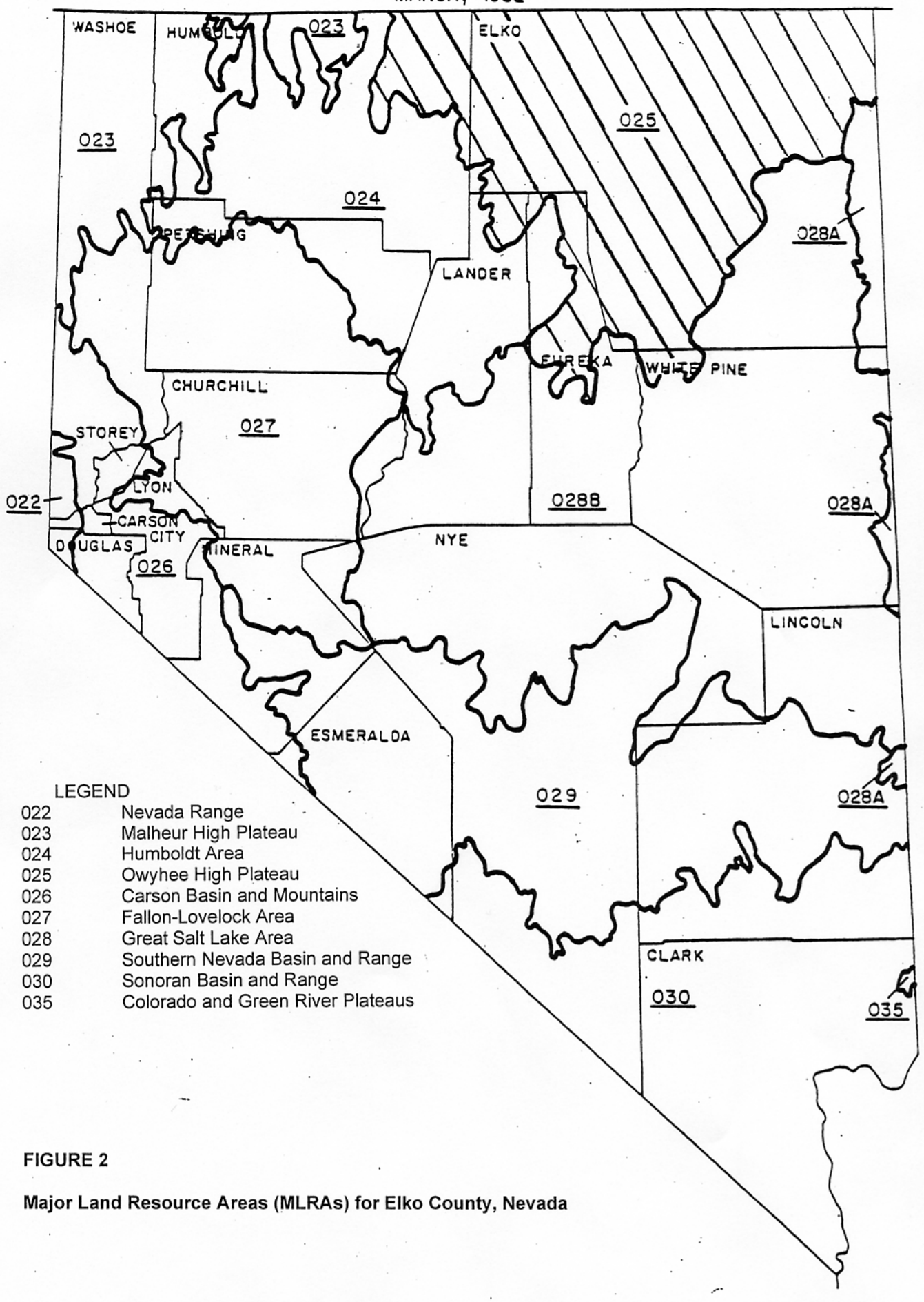


FIGURE 2

Major Land Resource Areas (MLRAs) for Elko County, Nevada

Recognizing that sage grouse are a landscape scale species (i.e., prone to inhabiting large areas, using a variety of vegetation communities, found on a variety of land forms, and with at least some extensive elevational and/or seasonal migrations), management must also be on a landscape scale. A logical and definable unit for management is the watershed. Watersheds tend to be extensive, contain a variety of vegetation communities, extend over a range of elevation, and include a variety of land forms. While not a true ecosystem in and of themselves, watersheds are systems that have connectivity - all parts contribute in some manner to the acquisition, retention, transport, quality, and flow of water. Thus, water quality and quantity can be viewed as two abiotic (non-living) indicators of the health of the ecosystem.

The importance of having abiotic indicators of the health of the ecosystem is that they may be less responsive to stochastic (i.e., random) events, such as weather, that can have large influences on the biotic (plant and animal) components of the ecosystem. For example, a cold, wet storm or late frost may influence the availability of forbs and insects critical for sage grouse chicks, resulting in a poor year for juvenile recruitment to the population. Just using population estimates as a measure of the management action in such a year would indicate that management may not be working. But this weather event is likely to have much less influence over the abiotic components of the ecosystem, such as water quality. Ultimately, the health of any particular species is dependent on the trends represented by the multitude of abiotic indicators, not on short-term population fluctuations.

As a result, the NNSG shifted the focus from doing only what would benefit sage grouse, to managing systems in a way that will restore or retain the processes that make systems work; a shift from treating the symptom to treating the ailment. The Sagebrush Ecosystem Conservation Strategy (Strategy), as provided below, emphasizes sage grouse as the featured species, but includes information on management of systems, of which sage grouse are a component. Specific actions to be taken for the restoration and retention of processes for a given watershed will be included in the individual watershed action plans.

1.2 Purpose

The purposes of the Strategy are to: 1) provide a framework for managing the rangelands to improve and maintain the diversity and sustainability of natural resources and land uses within Elko County; 2) focus on managing watersheds as the basic unit of management; 3) restore and retain the processes necessary to proper functioning of our watersheds; and 4) ensure the continued existence of healthy populations of plant and animal species dependent on the sagebrush-herb ecosystem.

1.3 Need

The need for the Strategy was first expressed as a response to the potential submission of a petition to list the sage grouse as threatened or endangered under the ESA. However, it became evident that a basic underlying need was to develop a better strategy for managing our rangelands. By developing an ecosystem-based strategy, the need to develop other species specific conservation plans in the future can be avoided. The need was to develop strategies for managing our rangelands on a sustainable basis, providing for socioeconomic values, as well as the natural values of the landscape. Developing such strategies in a collaborative process should also improve the stability of the solutions.

2 HABITAT CONSERVATION ASSESSMENT

2.1 Planning Area

Elko County is the second largest county in Nevada and the fourth largest county in the United States, covering 17,181 square miles, an area larger than each of the nine smallest states in the United States. The total surface area of 10,995,840 acres accounts for 15.5 percent of the total surface area of Nevada (**Figure 1**). Approximately 71 percent, or 7,852,280 acres, of the county is in public ownership, with approximately 6,778,200 acres administered by the Elko Field Office of the Bureau of Land Management (BLM), approximately 1,068140 acres administered by the Humboldt National Forest, U.S. Forest Service (USFS), and 5,926 acres administered by the U.S. Fish and Wildlife Service (USFWS).

The climate is described as a continental temperature regime with arid to semi-arid conditions in the valleys and lower mountain slopes and sub-humid conditions near the crests of the higher mountains. Precipitation is strongly orographically controlled. Air masses generally move eastward, with most of the precipitation originating from the Pacific Ocean. Average annual precipitation ranges from six inches on the valley floors to over 20 inches on the higher mountains (e.g., the Jarbidge, Independence, Ruby, and East Humboldt ranges). Arid conditions are due in large part to the rain-shadow effect created by the Sierra Nevada Range. Much of the precipitation occurs as snow, with over 100 inches occurring in the high mountains. Mean annual temperature ranges from 45^{o} to 50^{o} F, but summer temperatures can exceed 100^{o} F and winter low temperatures below 0^{o} F are not uncommon, especially in valleys where orographic ponding of cold air occurs.

Elko County includes portions of four of Nevada's fourteen hydrographic regions or water basins. The northern portion of the county (Owyhee Plateau) lies within the Columbia Plateau Province and the waters are part of the Snake River Basin. This portion of the county is characterized by rolling plateaus of low relief with steep, narrow canyons and interspersed with buttes. The remaining portion of the county includes portions of the Humboldt River Basin, Great Salt Lake Basin, and the Central Region Basin, and is within the Basin and Range Province. This area is characterized by a pattern of north-south trending mountain ranges and intervening alluvial valleys. Most of the county is more than 5,000 feet above mean sea level (amsl), with many mountain summits ranging from 8,000 to more than 10,000 feet amsl. Ruby Dome in the Ruby Mountains is the highest peak at an elevation of 11,387 feet amsl. In addition to the four major hydrographic regions in Elko County, there are forty-two hydrographic areas and sub-areas that are either partially or wholly within Elko County. These hydrographic areas and sub-areas are defined as hydrographic units within a major water basin and typically consist of a single valley or discrete drainage area. Eight of these hydrographic areas are contained within the Snake River Basin; seventeen hydrographic areas lie within the Humboldt River Basin; five hydrographic areas and four hydrographic sub-areas are within the Central Region Basin; and four hydrographic sub-areas are contained within the Great Salt Lake Basin.

The combination of climate and topography provides a variety of vegetative types, ranging from the saltgrass and salt desert shrub communities in the basins to the alpine community at the mountain peaks. The salt desert shrub communities consist of plant species with tolerance for alkali and salt affected soils and low precipitation. The northern desert shrub communities extend from intermediate to high elevations on non-saline, medium textured soils. The mountain brush communities occur at intermediate to high elevations on soils derived from volcanic and sedimentary parent material. Pinyon-juniper communities are located at intermediate elevations on limestone derived soils that are well drained, and range from shallow to deep. The forest communities consist of coniferous and shrub species on mountain slopes between 7,000 and 9,000 feet amsl with moderate to high annual precipitation. The alpine zone occurs above the timberline at approximately 10,000 feet. The extreme climatic conditions at these elevations are conducive to low growing, decumbent life forms, except for some tree species that survive on sheltered slopes. Riparian zones with deciduous trees, shrubs, and plants requiring higher soil moisture occur throughout the elevational and plant

zones. The "sagebrush ecosystem" includes elements of the forest, mountain brush, northern desert shrub, pinyon-juniper, and riparian communities.

The planning area is within the sagebrush biome, the largest semi-arid ecosystem in the western United States. The sagebrush biome consists of the sagebrush steppe ecosystem type and the more arid Great Basin sagebrush ecosystem type (Kuchler 1985). The northern portion of the planning area (Owyhee Plateau/Snake River Plain) is within the sagebrush steppe ecosystem type, which is characterized by an overstory of sagebrush (*Artemisia* spp.) and understory of perennial grasses and forbs. The southern portion of the planning area is within the Great Basin sagebrush ecosystem type and also has an overstory of sagebrush, but the herbaceous component of the understory contributes a minor portion of the total plant cover (West 1983). The more arid conditions of the Great Basin sagebrush ecosystem type result in longer recovery periods following fire, or other disturbances, and restoration of plant communities is less successful (West 1983). An extensive discussion of the potential natural flora of the two ecosystem types is presented by Miller and Eddleman (2000).

The diversity of vegetation within the planning area supports a variety of wildlife species, including 246 species of birds, 76 mammals, and 28 reptiles and amphibians. Numerous species of fish occur in the streams, lakes, and reservoirs. Most of the wildlife species use riparian zones for some portion of their life cycle, or as part of their seasonal or daily range. Other species are found only in one or two of the vegetative communities described above. The combination of landscapes, geologic features, soils, vegetative communities, wildlife species, and historical sites provide a variety of recreational and land use opportunities.

Prior to 1828 the area was inhabited by Western Shoshone and Northern Paiute Indians. European influence on the landscape began in 1828 with the arrival of French fur trappers and fur traders. Various trapping and exploration parties passed through the region between 1828 and 1843, when a wagon trail was established along the Humboldt River as part of the east-west movement to California and Oregon. Ranching began in 1859 when the first large herd was wintered on the flood plain of the Humboldt River. The Humboldt River continued to be the major travel route, as the Central Pacific Railroad Company established rail tracks in 1868. Elko developed as a railroad town, with lots available for sale in 1869, but mining north of Elko soon followed and the Idaho-Elko Toll Road was constructed to connect the community and railroad hub to the mining activities to the north. Railroad, ranching, and mining have been the cornerstone industries of the county through the present day, each industry having its own economic cycles, with the "boom and bust" nature of the mining industry perhaps the most extreme. Gaming and tourism have also been a part of the economic well-being of the county in recent decades.

Following World War II, increasing population and prosperity in the United States resulted in an increase in outdoor recreation and an increased awareness by the general public of the environment. Agencies once dominated by foresters and range conservationists began adding planners, biologists, botanists, archaeologists, recreation specialists, and other resource specialist positions to the local staffs. The close relationship between commodity users and the agencies that were charged with providing food and fiber for a growing and prospering nation was being widened by a public wanting more recreational opportunities and agencies developing policies to address a myriad of new public land laws. The focus from fiber and forage production began to shift, and changes in land uses accompanied the shift, as did changes in the way lands were managed and how the agencies arrived at management decisions. These changes created an environment of stress, pitting one resource advocate group against another, often times with very little common ground being apparent. Agencies developed policies in response to public demands that lead to on-the-ground changes in management. The environmental movement of the 1960s and 1970s was challenged by the sagebrush rebellion of the late 1970s and 1980s which also spawned a state's rights movement of the 1990s.

These controversies were, and continue to be, set in the "win-lose" arena; one side cannot win without the other side losing. These controversies divert attention from the functionality of the entire system and focus instead on how to allocate resources for various

interests. While the trend to "divvy up the pie" resulted in some short term improvements in range condition, the systems were still not functioning. The "divvy up the pie" strategy does not lend itself to restoring dysfunctional systems and does not lend itself to bringing interest groups to common ground. Ultimately, the win-lose system results in lose-lose because the focus is on symptoms and not processes. The move toward managing functioning systems and collaborative decision making was a response to resolving environmental issues as well as the social issues embroiled in these controversies.

The decision by the NNSG to focus on sage grouse was two-fold. First, this species is considered an indicator species for the health of the land, and it uses a variety of habitats. Second, the current focus on sage grouse, with potential for listing under the ESA, creates a window of opportunity to demonstrate that local planning groups can develop long-term solutions to these complex issues. Consequently, the strategy developed by the NNSG is based on an understanding of sage grouse and sagebrush ecology.

The following sections provide the basis for developing ecosystem plans. As indicated above, sage grouse are a landscape-scale species, as well as an indicator of the health of the landscape. The underlying assumption is that management that provides quality habitat for sage grouse is likely to provide quality habitat for other sagebrush-dependent species. This should not be interpreted to mean that all species have the same habitat requirements. However, by providing the variety of conditions on the landscape needed for the seasonal habitats of sage grouse, a continuum of habitat conditions would be available for other species as well.

Sagebrush is the major component of sage grouse habitat; it shelters, protects, and provides sustenance for the bird. The winter diet of sage grouse consists almost exclusively of sagebrush leaves. Because of this dependency of sage grouse on sagebrush, the ecology of both the sage grouse and sagebrush plant community need to be understood before management actions can be formulated. By understanding the plant community ecology and the plant-animal relationship, the need for ecosystem maintenance becomes more apparent.

The ecosystem approach is based on dynamic plant communities. As stated above, the landscape is heterogeneous. The heterogeneity is based in part on geologic, soil, landform, elevation, and precipitation factors, and in part on plant responses to these factors such that plant assemblages, or communities, can be identified. However, the plant communities are also dynamic and change over time. The change in plant communities over time is commonly referred to as plant or community succession. For example, a grassland that results from a fire today, may be a sagebrush-grassland community at some time in the future. Both the grassland and the sagebrush-grassland are part of the sagebrush plant community.

2.2 Sage Grouse Biology and Habitat Requirements

Sage grouse biology includes the basic information about the bird (i.e., taxonomy, distribution, and life history), the habits of the bird (i.e., food habits and habitat requirements), and the natural mortality factors affecting the bird (i.e., predators and diseases).

2.2.1 Taxonomy and Description

Sage Grouse (*Centrocercus urophasianus*), is a member of the family Phasianidae (grouse and ptarmigan) and is one of seven species of grouse found in North America. They are also known as the sage hen, sage chicken, or sage cock. Lewis and Clark provided the first written accounts of this species during their 1805 expedition. The species was formally described as *Tetrao urophasianus* by C.L. Bonaparte (1827) and later placed in a monotypic genus *Centrocercus*, meaning "spiny-tailed pheasant," by Swainson and Richardson (1832). The species was later differentiated into two subspecies, the Western Sage Grouse (*C. u. phaios*) and the Eastern Sage Grouse (*C. u. urophasianus*) (Aldrich 1946, 1963; AOU 1957). However, similarities in appearance and morphological measurements have resulted in poorly defined ranges. The Western Sage Grouse was considered to occur west of a contact zone traversing diagonally across southeast Oregon, northwest Nevada, and northeast California. The Eastern Sage Grouse was said to occur east of this zone (Schroeder et al. 1999). Recent genetic work has indicated

that differences between the two subspecies do exist (Oyler-McCance et al. 2001), but the difference is not sufficient to warrant a subspecies designation.

Additional DNA work has identified a small population in southwest Colorado with distinct genetic and behavioral characteristics. This population, referred to as the Gunnison Sage Grouse, has been recognized by the American Ornithologists' Union as a new species of grouse, *Centrocercus minimus*. *Centrocercus urophasianus* is now referred to as the Greater Sage Grouse, and this species is the focus of this strategy. Genetic testing has also identified a population of sage grouse in Mono County, California and Lyon County, Nevada that may be genetically distinct (Oyler-McCance et al. 2001). The small sample size available for analysis has provided inconclusive evidence of this population being a subspecies, but there is sufficient evidence to warrant additional work.

Largest of the North American grouse, sage grouse show strong sexual dimorphism. Males range from 27 to 34 inches in length and weigh five to seven pounds, while females are 18 to 24 inches in length and weigh from two to three pounds. They are a grayish-brown bird with a dark belly, and long, pointed tail feathers. The throat of the male is black, bordered with white at the rear. Two air sacs (esophageal pouches), covered with short, stiff, scale-like white feathers, are found on each side of the lower neck and upper breast. When the pouches are distended, two yellow, pear-shaped patches of bare skin (cervical apteria) are exposed. A yellow fleshy comb occurs above the eye, and long filoplumes arise from the back of the neck and head. The female has the same general appearance but lacks the air sacs and has a white throat. The feet are feathered to the toes on both sexes. Their dark belly and absence of white outer tail feathers distinguishes them from the sharp-tailed grouse during flight.

Sex ratios of male to female have been reported to range from 1:1.1 to 1:2.6 for adults (Braun 1984). Sex ratios are primarily based on information gathered from wing samples of harvested birds. Males have more conspicuous coloration than females and congregate for breeding display at the same locations for up to several months each year; therefore more adult males may be killed by predators than females, accounting for the disparity in the sex ratio. Sage grouse that reach adulthood are relative long-lived. However, the majority of young born in any given year will not reach the age of one. Birds that reach three or four years old are considered old birds (Wallestad 1975); however birds five years and older are not unusual (Rue 1973).

Sage grouse engage in a lek mating system. The males perform a strutting display (Bond 1900, Scott 1942, Gullion 1957, Schroeder et al. 1999) that includes fanning the tail feathers in an upright fashion that exposes white-tipped under tail feathers, expanding the esophageal pouches that expose the yellow skin patches, and erection of the yellow eye-combs and filoplumes. The expansion of the pouches also produces a series of "plops." These activities are accompanied by movements and postures directed at other males (Hjorth 1970, Wiley 1973a). The display is an active defense of the breeding territory by each male (Hartzler 1972). Only a few males on a lek or strutting ground do the majority of the mating (Gibson et al. 1991, Scott 1942, Lumsden 1968, Wiley 1973b, Hartzler and Jenni 1988). Mating is the only role males have in the mating system, having no incubation or parental care. Territorial behavior is not exhibited by males off the leks, and male flocks are not uncommon during the rest of the year (Beck 1977).

2.2.2 Distribution

Historically, sage grouse were found throughout most of the western United States (**Figure 3**), including portions of 16 states, and along the southern border of three western Canadian provinces (AOU 1983, Aldrich 1963, Johnsgard 1973). Sage grouse distribution closely paralleled the range of sagebrush (*Artemisia* sp.) from British Columbia, Alberta and Saskatchewan in the north; western Nebraska and the Dakotas to the east; Nevada, Utah, New Mexico and Oklahoma to the south, and eastern Oregon, Washington, and California to the west (Patterson 1952, Aldrich 1963, Guiquet 1970, Johnsgard 1973).

Sage grouse currently range from southeastern Alberta and southern Saskatchewan to the north; western North and South Dakota to the east; Colorado, Utah, and Nevada to the south, and western California, eastern Oregon and Washington to the west (Johnsgard 1983, Drut 1994). The core of sage grouse populations has

contracted to include land in Colorado, Idaho, Montana, Nevada, Oregon, and Wyoming with remnant populations in other states (**Figure 3**).

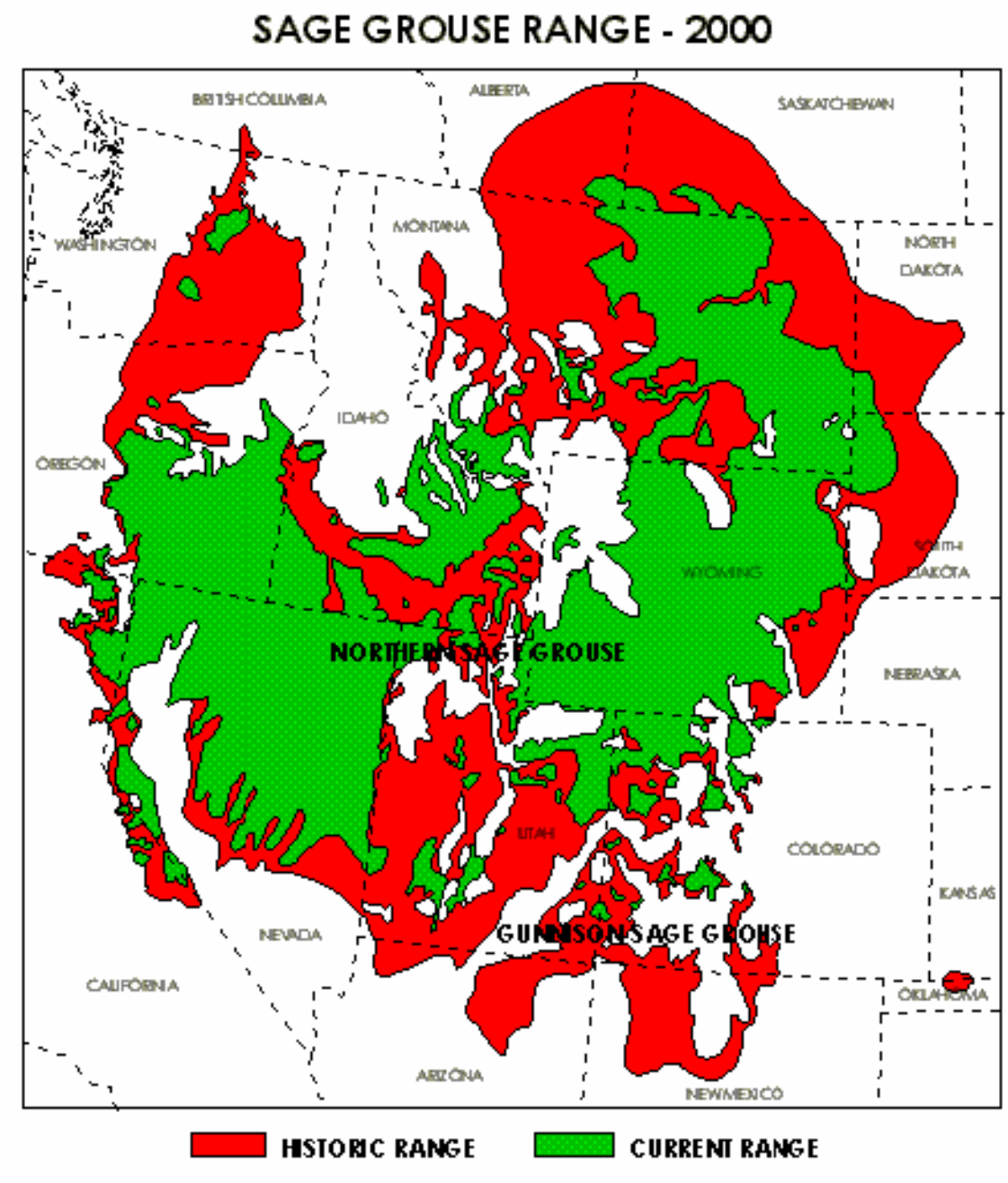


Figure 3. Historic and Current Distribution of Sage Grouse in North America

After Schroeder (in press).

Even within this remaining core area of their range, populations have dramatically declined (Braun 1998, Wisdom et al. 1998). Sage grouse have been extirpated in British Columbia,

Nebraska, New Mexico and Oklahoma (Braun 1991, 1993). Braun (1993) considered populations remaining in Alberta, North Dakota, Saskatchewan, South Dakota, California, Colorado, Utah and Washington to be "greatly reduced" or "marginal."

Within Nevada, sage grouse are presently distributed from the approximate center of Nevada northward, with the northeastern block of counties providing the most continuous habitat (Nevada Division of Wildlife [NDOW] 2000). The distribution of historic and current leks within Elko County suggests that sage grouse are found where sagebrush has dominated the landscape, historically or presently. Based on clusters of leks, known brood rearing areas, limited radio telemetry data, and professional judgment, ten Population Management Units (PMUs) were identified for Elko County (**Figure 4**). It is currently assumed that each PMU contains a sage grouse population. However, until more information is available, the PMUs provide a basis for planning and plan implementation[2]. These boundaries should be considered temporary and subject to change as more is learned about sage grouse distribution and movement patterns in the planning area.

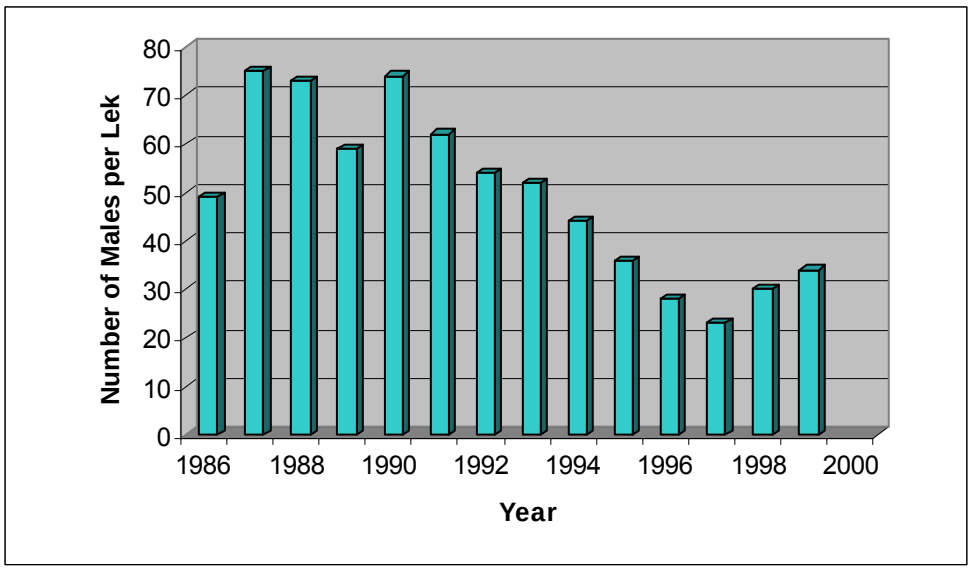
Numbers of sage grouse in Nevada and in Elko County are currently unknown; however, using a series of assumptions and numbers based on range wide population studies, the sage grouse population for each of the ten PMUs within the planning area was estimated (**Table 1**). Based on these PMU estimates, the current estimate of sage grouse within the planning area is between 37,600 and 45,100 birds. The assumptions and procedure for calculating each PMU estimate are provided in **Appendix B**
.

[2] The management unit for this Strategy is the watershed; however, in deference to the Nevada State Sage Grouse Conservation Strategy, NNSG has incorporated the PMUs into the Elko County Sagebrush Ecosystem Conservation Strategy. Most of the sage grouse population and habitat data are presented herein by PMU, but will be presented in the individual watershed management plans on a watershed basis.

Table 1: Population Estimate for Each Population Management Unit (PMU) within the Planning Area

PMU Designation	Total Known Leks	Low-end Estimate	High-end Estimate
Desert	14	696	836
East Valley	8	398	477
Gollaher	104	5,172	6,207
Northfork	202	10,046	12,055
O'Neil	167	8,305	9,967
Ruby Valley	35	1,741	2,089
Snake	53	2,636	3,163
Southfork	46	2,288	2,745
Tuscarora	105	5,222	6,266
Islands	22	1,094	1,313
Totals	756	37,598	45,118

Trend counts, derived from counting the same limited number of leks each year, indicate that the number of sage grouse in Elko County have been declining since the trend counts were initiated in 1986 (**Figure 5**).



Source: NDOW Region II Data

Figure 5. Elko County Sage Grouse Strutting Ground Trend Counts, 1986 – 2000

2.2.3 Movements/Migration

Sage grouse populations can be nonmigratory or migratory (Berry and Eng 1985, Connelly et al.1988, Wakkinen 1990, Fischer 1994, Beck 1975, Wallestad 1975), depending on location and associated land form. Nonmigratory or "resident" populations may spend the entire year within an area 39 $mi.^2$ (10,000 ha) or less in size. Where topographic relief allows, sage grouse will generally move up in elevation from spring through fall as snow melt occurs and

plant growth advances (Savage 1968, Klebenow 1985). Movements between seasonal ranges vary because of differences associated with gender, behavior, seasonal habitat quality and distribution, and weather (Connelly et al. 1988).

Brood movement from nesting/brood areas to summer area may be a function of desiccation of forbs in brood areas, which causes movement to higher elevations with later plant phenology (Pyrah 1954, Crawford 1960, Gill and Glover 1965, Savage 1968, Wallestad 1971, Connelly et al. 1988, Wakkinen 1990, Fischer et al. 1966). Mid-summer movements are uncommon because the birds are molting (Dalke et al. 1963). Movements to fall/winter range correspond to increasing use of sagebrush as the major food item, and movements may be related to food quality (Beck 1977, Remington 1983, Barrington and Back 1984). Movements during winter are related to snow depths and food quality/availability (Bean 1941, Crawford 1960, Beck 1977, Autenrieth 1981, Barrington and Back 1984). Winter and nesting areas may be close to one another if autumn movements retrace summer movements (Connelly et al. 1994). Some birds may move to nesting areas in mid-winter if the weather is mild (Berry and Eng 1985, Schroeder et al. 1999).

In migratory populations, seasonal movements may exceed 47 mi. (75 km) (Dalke et al. 1963, Connelly et al. 1988) and home ranges may exceed 579 $mi.^2$ (150,000 ha) (Connelly unpub. data). There may be two or more seasonal ranges in such cases. For example, there may be a breeding range, a brood-rearing range, and a winter range, indicating that migratory sage grouse populations depend on large expanses of habitat. The factors that initiate migratory movements may be the same factors that initiate seasonal movements in resident populations, especially considering that migratory populations and resident populations may share some seasonal habitats. Movements may be longer than necessary to locate acceptable habitat, suggesting site fidelity (Berry and Eng 1985, Connelly et al. 1988, Schroeder et al. 1999).

Radio telemetry data for Nevada, collected by NDOW, confirm that populations may be resident or migratory, and the movements and migration vary between and among populations. NDOW has found that migration occurs between leks, breeding areas, forage areas, and winter grounds. Some sage grouse do not migrate, wintering on the breeding grounds; others migrate following the breeding season and spend summer and fall nearly 40 miles from the breeding area, returning to the breeding area to winter, while other populations separate and migrate up to twenty miles to two different wintering grounds.

2.2.4 Life History

The seasonal activities of sage grouse and the use of sagebrush and other habitats are discussed below.

2.2.4.1 Breeding/Nesting

Each year, male sage grouse congregate in late winter through spring to display their breeding plumage and to attract hens for mating. Generally, the lek sites are traditional, with the same lek sites used year after year (Scott 1942, Batterson and Morse 1948, Wiley 1978, Autenrieth 1981). Leks are generally small open areas from 0.2 to 12 acres in size, with either low or no sagebrush and surrounded by taller more dense sagebrush. The big sagebrush on the outskirts of the leks is necessary as a food source, for escape cover, for nesting females, and for loafing during the day (Patterson 1952, Gill 1965, Klebenow 1985). Examples of lek sites include landing strips, old lake beds or playas, low sagebrush flats, and openings on ridges, roads, crop land, and burned areas (Connelly et al. 1981, Gates 1985).

Males begin displaying in the early predawn hours, retire during the mid-morning, and sometimes return to leks from dusk until late into the night, displaying by moonlight (Simon 1940, Scott 1942, Batterson and Morse 1948). According to Connelly et al. (2000), sage grouse appear to select breeding sites "opportunistically" within potential nesting habitat. Schroeder et al. (1999) state that there is no evidence that lek habitat is limiting for sage grouse.

As grouse populations decline, the number of males attending leks may decline or the use of some leks may be discontinued. Likewise, as populations increase, male attendance on leks increases, new leks may be established, or old leks may be re-occupied. New leks may be established when natural or prescribed disturbances result in suitable lek habitat in sage grouse range.

The lek is considered to be the center of year-round activity for resident sage grouse populations (Eng and Schladweiler 1972, Wallestad and Pyrah 1974, Wallestad and Schladweiler 1974). However, habitats that are located long distances from the leks are used by migratory populations of sage grouse and are essential to their survival (Connelly et al.1988, Wakkinen et al.1992). On the average, most nests are located within 4 miles (6.2 km) of the lek; however, some hens may nest more than 12 mi. (20 km) away from the lek (Autenrieth 1981, Wakkinen et al.1992, Fischer 1994, Hanf et al. 1994).

Females fly to the edge of the lek, and then walk through the lek, sometimes congregating with other females. Choice of when to mate seems to be solely a decision of the female, who indicates her readiness by crouching in front of the chosen male. After mating the female flies off to initiate a nest. Sage grouse males are polygynous, the only contribution made to reproduction is the mating act itself. All nest building, incubation and brood rearing is done by the female.

Nesting and early brood-rearing in Nevada generally occur from April through June. Habitats used by pre-laying hens are also part of the general breeding habitat. These areas provide forbs that are high in calcium, phosphorus, and protein, all of which are necessary for egg production.

The nest consists of a shallow depression on the ground, mostly under big sagebrush, with residual grasses or other vegetation for concealment of incubating hen (Terres 1991). Nest lining is sparse, consisting of dry grasses, sagebrush leaves and a few feathers (Batterson and Morse 1948, Autenrieth 1981). Heights of shrubs at nesting sites vary, but studies indicate that there is some preference for shrubs that are taller than the average shrub height for the given site (Keller et al. 1941, Trueblood 1954, Klebenow 1969, Wallestad and Pyrah 1974, Autenrieth 1981, Kerster and Willis 1986). Reported shrub height at nest sites range from 9 inches to 39 inches (Patterson 1952, Klebenow 1969, Autenrieth 1981, Gregg et al. 1994, Sveum et al. 1998a, Schroeder et al. 1999). Autenrieth (1981) found that a “bush providing an umbrella effect” was preferred.

Nesting habitat is characterized by primarily Wyoming big sagebrush communities that have 15 to 38 percent canopy cover and a grass and forb understory (Connelly et al. 1991, Gregg et al. 1994, Sveum et al. 1998a). Residual cover of grasses is also important (Klebenow 1969, Connelly et al. 1991, Gregg 1991, Gregg et al. 1994, Sveum et al. 1998a), ranging from 3 percent to 30 percent cover at successful nest sites. The importance of the residual cover may be relative to the structure of the shrub cover. Where the “umbrella effect” is sufficient, residual herbaceous cover may not add much protection to the nest in terms of detection by predators. However, Autenrieth (1981) found that nest sites with greater understory cover had a warmer microclimate than the ambient air temperature one meter above the nest, and that nest temperature dropped less at sites with greater understory than sites with less understory during periods when the hen was off the nest.

Winward (1991) found that herbaceous cover associated with potential nest sites, and sage grouse habitat in general, could be limited by excessive shrub canopy cover. When shrub canopy cover exceeded 10 to 12 percent in the Wyoming big sagebrush vegetation type, and approximately 15 percent in basin and mountain big sagebrush vegetation types, grass and forb cover needed for sage grouse cover and forage could decrease due to competition with shrubs. Therefore, maintenance of adequate nesting habitat is a function of shrub canopy cover.

Although the guidelines for maintenance of sage grouse habitat (Braun et al. 1977) recommended no sagebrush control within two miles (three kilometers) of a lek to protect nesting and brood areas, several studies have demonstrated that hens will nest at considerable distance from the lek (Peterson 1980, Autenrieth 1981, Fischer 1994). Wakkinen et al. (1992) concluded that nest sites were selected independent of lek location, and Autenrieth (1981) concluded that nest locations were related to quality of nesting cover.

Clutch size (number of eggs in one nest) of sage grouse is variable and relatively low as compared to other species of game birds (Edminster 1954, Schroeder 1997). Clutch size per nest normally ranges from seven to ten eggs (Connelly unpublished data, Schroeder 1997, Wakkinen 1990). These differences may be related to habitat quality and overall condition of

pre-laying females (Coggins 1998). Sage grouse eggs have olive or olive buff shells, marked with brown spots and dots. (Harrison 1978). Eggs are laid three to 14 days after copulation at a rate of two eggs every three days (Peterson 1980). Incubation by the female takes 25-28 days, and is initiated within two days after the last egg has been laid (Peterson 1980). During incubation the hen will leave the nest for up to approximately a half-hour, twice a day to feed and loaf (Autenrieth 1981). These recesses from incubation generally occurred during early morning and evening. Recesses during mid-morning or mid-afternoon are less common, and may be related to hen condition.

Nesting rates vary from year to year and from area to area (Schroeder 1997, Connelly et al. 1993, Gregg 1991, Bergerud 1988a, Coggins 1998). This variation is most likely a result of available quality forage (nutritional level) and the general health of pre-laying females (Barnett and Crawford 1994). At least 70 percent of the females in a population will initiate a nest each year. Higher nest initiation rates were recorded during years of higher precipitation as compared to nest initiation rates during periods of drought (Coggins 1998). Renesting rates by females who have lost their first clutch are 10 to 40 percent; far lower than that of other upland game birds (Connelly et al. 1993, Patterson 1952, Eng 1963, Petersen 1980, Bergerud 1988a). Renesting may do little to increase overall population numbers. Nest success of sage grouse also varies by area and year. Of all the birds that nest, 10 to 86 percent produce chicks (Trueblood 1954, Gregg 1991, Connelly et al. 1993, Schroeder 1997). Adult females may experience higher success rates than yearling females (Wallestad and Pyrah 1974), a characteristic that may be related to past nesting experience. Sage grouse show a strong nest site fidelity, and return to nest in the same area each year (Kerster and Willis 1986).

2.2.4.2 Brood Rearing

The entire clutch may hatch within one hour (Wallestad 1971). Young are precocial and can be led away from the nest as soon as the natal down is dry. Chicks weigh approximately one ounce (30 to 31 grams) at hatching (Peterson 1980), but gain weight quickly. Chicks begin feeding immediately after hatching. The hen broods the chicks during approximately 50 percent of the daylight hours during the first week after hatching, but rarely broods the chicks by the second week after hatching (Schroeder et al. 1999).

Early brood-rearing generally occurs close to nest sites; however, movements of individual broods may be highly variable (Connelly 1982, Gates 1985). When considered on a range-wide basis, optimum brood-rearing habitat consists of sagebrush stands that are 16 to 32 inches tall with a canopy cover of 10 percent to 25 percent and an herbaceous understory of 15 percent grass canopy and 10 percent forb canopy (this is consistent with nesting habitat). Ideally, this type of habitat will be found on at least 40 percent of the area that is considered brood-rearing habitat (Connelly et al. 2000). Hens with broods will use sagebrush habitats that have less canopy cover (about 14 percent) than that provided in optimum nesting habitat (Martin 1970, Wallestad 1971), but need at least 15 percent cover of grasses and forbs (Sveum et al. 1998b). Optimum canopy cover within brood-rearing habitat is specific to each vegetation type and range-site potential. The habitats used during the first few weeks after hatching need to provide cover to conceal the chicks, but more importantly, to provide the nutritional requirements of this period of rapid development. Brood-rearing habitats that have a wide variety of plant species tend to provide a corresponding variety of insects that are important chick foods.

Chicks are able to fly weakly at approximately 10 days, and are relatively strong fliers by five weeks (Girard 1937). At six to eight weeks, chicks acquire full juvenile plumage and resemble adult hens. When chicks are about six weeks of age, sage grouse hens will usually move the chicks from the early brood habitat/nest area to summer habitat, where the majority of brood rearing occurs. This movement occurs about two weeks after males and females without broods have moved to summer range (Connelly et al. 1988).

Summer habitat consists of sagebrush mixed with areas of wet meadows, riparian, or irrigated agricultural fields (Connelly et al. 2000). Sage grouse broods occupy a variety of habitats throughout the summer including sagebrush, wet meadows, farmland, and other irrigated areas adjacent to sage brush. As stated above, sage grouse chicks rely on insects early in their lives and gradually change over to succulent

forbs and shrub foliage as they mature (Patterson 1952, Klebenow and Gray 1968, Wallestad 1971, Klebenow 1985). In general, a sagebrush ecosystem with a good understory of grasses and forbs, and associated wet meadow areas, are essential for optimum habitat.

As upland habitats begin to dry up sage grouse broods move to more mesic wet meadows, where succulent grasses and insects are still available (Savage 1968, Schlatterer and Pyrah 1970, Oakleaf 1971, Neel 1980, Autenrieth 1981, Klebenow 1985, McAdoo et al. 1986). This can be especially important in drier years and during long drought periods. Klebenow (1982) found that sage grouse would stay on the uplands through late July in years when precipitation was sufficient to maintain forage. During drought years, grouse switched to using meadows earlier in the summer. In addition, Nevada sage grouse have a greater reliance on wet areas for their survival because Nevada normally receives less precipitation than other states supporting sage grouse (Klebenow 1985).

2.2.4.3 Fall and Winter

Sage grouse form flocks as brood groups break up in early fall. As the meadows dry and frost leads to the drying and killing of forbs, the sage grouse diet shifts primarily to sagebrush leaves (Patterson 1952, Connelly and Markham 1983, Connelly et al. 1988, Wallestad 1975). As fall progresses toward winter, sage grouse move toward their winter ranges. Exact timing of this movement varies depending on the sage grouse population, geographic area, overall weather conditions, and snow depth. Sagebrush is essential for survival during the fall, winter, and early spring months.

Fall habitat in northeastern Nevada consists of mosaics of low-growing sagebrush (*A. arbuscula, A. nova*) and Wyoming big sagebrush (*A. t. wyomingensis*). As with the other seasons of the year, a mosaic of sagebrush vegetation (different species, different cover values, different height classes, etc.) provides the necessary food and cover requirements during the fall period. Studies on the Saval Project (Barrington and Back 1984) found that low sage was the preferred foraging and night roosting habitat during the fall. Sage grouse roosted in the big sagebrush types during the day, or during nights when winds were strong or the weather consisted of rain or snow.

Seasonal movements are related to severity of winter weather, topography, and vegetative cover (Beck 1977). Sagebrush canopy at sage grouse winter use sites can be highly variable (Patterson 1952, Eng and Schladweiler 1972, Wallestad et al. 1975, Beck 1977, Robertson 1991). However, sage grouse habitats must provide adequate amounts of sagebrush because their winter diet consists almost exclusively of sagebrush. It is crucial that sagebrush be exposed at least 10 to 12 inches above snow level as this provides both food and cover for wintering sage grouse (Barrington and Back 1984, Hupp and Braun 1989). Wallestad (1975) found that in Montana less than 10 percent of the range was available when snow depth exceeded 12 inches. If snow covers the sagebrush, the birds will move to areas where sagebrush is exposed.

Winter use areas are determined by the amount of snow, rather than an affinity for a particular site (Beck 1977, Barrington and Back 1984). Low sagebrush was used as long as available in northeastern Nevada (Barrington and Back 1984) and Idaho (Crawford 1960), with birds moving to big sagebrush sites as snow depths increased.

2.2.4.4 Year Long Habitat

From the preceding discussion it is evident that although sage grouse are sagebrush obligates, they use a variety of habitats. Sagebrush habitats vary from low growing to taller sagebrush species, and from plant communities with sparse sagebrush cover to those with relatively high shrub cover. The amount of herbaceous cover also varies between seasonal habitats. There are also important seasonal habitats that do not have a sagebrush component (e.g., riparian meadows), but generally have sagebrush nearby. Sage grouse have also been observed in or near aspen stands and other areas with trees or very tall shrubs; however, these habitats are not used with any consistency, and they may be areas of high predation. The spatial arrangement of the habitats is also important. Leks generally have taller sagebrush cover nearby, and leks and nesting habitat generally need to be in close proximity (although instances of leks being separated from nesting habitat by long distances

have been documented). Early brood habitat and nesting habitat should also be in close proximity to one another. Meadows need nearby sagebrush cover to provide the escape cover and loafing cover during summer. The variety of height and cover classes of sagebrush used for winter should also be intermixed.

Therefore, sage grouse habitat, when considered over the period of a year, consists of a variety of habitats or habitat conditions. A mosaic of these habitat types or conditions must be available on the landscape to provide all of the sage grouse seasonal cover and nutritional needs. The mere presence of sagebrush alone, especially uniform stands over vast acreages, should not be considered quality sage grouse habitat. These stands may provide some seasonal habitat, but cannot provide all the habitat needs throughout the year.

2.2.5 Food Habits

Sage grouse is the only North American grouse species that does not have a muscular grinding gizzard. The sage grouse gizzard is the non-muscular portion of the stomach that secretes mucous, but is incapable of macerating the food. Therefore, food sources are limited to insects and soft plant parts. As discussed below, this is an adaptation for winter survival while feeding on sagebrush.

Chick diets include forbs and invertebrates (Klebenow and Gray 1968, Drut et al. 1994). Insects are an important component of early brood-rearing habitat (Drut et al. 1994, Fischer et al.1996a). Insects, primarily beetles and some ants, comprised over 50 percent of total diet the first week after hatching (Klebenow 1969). Savage (1968) reported that ants were a frequent food item, observing sage grouse feeding directly at the ant hill. Autenrieth (1981) found insect availability to be critical in the first three weeks after hatching. Johnson and Boyce (1990) determined through feeding trials that sage grouse chicks require 15 grams of insects per day to maintain one to three-week old chicks in healthy condition. Chicks greater than three weeks old survived without insects in the diet, but growth rates were significantly reduced. Insects occurring in juvenile sage grouse diets include beetles (Order Coleoptera; Families Scarabeidae, Chrysomelidae, Tenebrionidae, Carabidae, Coccinellidae), ants (Order Hymenoptera; Family Formicidae), grasshoppers (Order Orthoptera; Family Locustidae), weevils (Order Coleoptera; Family Curculionidae), and lace bugs (Order Hemiptera; Family Tingidae) (Rasmussen and Griner, 1938, Klebenow and Gray 1968, Peterson 1970). Proportion of each insect in the diet varied with age of the chicks, and may be reflective of the habitats used and the life stages of the insects.

Forbs increase in the diet after the first week and remain the major food item for juveniles throughout the summer. Some of the forbs found in quantity in the diets of juvenile sage grouse include common dandelion (*Taraxacum officinale*), common salsify (*Tragopogon dubius*), prickly lettuce (*Lactuca serriola*), pepperweed (*Lepidium densiflorum*), Harkness gilia (*Linanthus harknessii*), tapertip hawksbeard (*Crepis acuminata*), loco (*Astragalus convallarius*), phlox (*Phlox longifolia*), and common yarrow (*Achillea millifolum*) (Klebenow and Gray 1968, Peterson 1970). Sagebrush (*Artemisia* sp.) occurs in only trace amounts until chicks are about five weeks old (Klebenow and Gray 1968, Klebenow 1969, Peterson 1970).

The proportion of insects and plant material in the chick diet are indirectly proportional to each other. Insects make up the greatest proportion of the young chick diet and the percentage of insects declines as the percentage of plant material increases (Stiver personal communication). Plant use parallels the phenology of a given species (Klebenow and Gray 1968). As plants desiccate, sage grouse cease to feed on them.

Summer food habits of adult grouse are similar to juvenile food habits, with some differences in proportion of foods eaten. Plant material comprises a larger proportion of the adult diet in early and mid-summer and insects make up less of the adult diet during these periods. However, the actual food items (i.e., species of plant or insect) taken by adults overlaps considerably with juveniles (Rasmussen and Griner, 1938, Wallestad et al. 1975). Alfalfa (*Medicago sativa*) and sweet clover (*Melilotus* sp.) are eaten by sage grouse (Batterson and Morse 1948, Autenrieth 1981, Peterson 1970), but these species may be taken incidental to dandelion, salsify, prickly lettuce, and insects (Batterson and Morse 1948, Peterson 1970).

The use of sagebrush increases in late summer and continues to be the major food item until spring (Girard 1937, Rasmussen and Griner 1938, Patterson 1952, Leach and Hensley 1954, Klebenow and Gray 1968, Peterson 1970, Wallestad et al. 1975). Several species of sagebrush are used by sage grouse including Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), mountain big sagebrush (*A.t. vaseyana*), low sagebrush (*A. arbuscula longiloba*), black sagebrush (*A. arbuscula nova*), fringed sagebrush (*A. frigida*), and silver sagebrush (*A. cana*).

2.3 Sage Grouse Ecology

Sage grouse are considered a sagebrush ecosystem obligate species. Obligate species are those species which are restricted to certain habitats or to limited conditions during one or more seasons of the year to fulfill their life requirements. Sage grouse are only found where species of sagebrush exist and they feed on sagebrush exclusively during an extended period of the year. Sagebrush species provide nesting, brood, and fall/winter cover as well as forage throughout the year. Ecology of a species is based in part on the plant-animal relationships, and provides an understanding of why the animal species uses various habitats throughout the day or year. In the preceding sections the biology of the species was presented – what habitats are used, what foods are used, and what seasonal movements the birds undertake. In the following sections, the plant-animal and animal-animal (predator-prey) relationships are discussed, to provide an understanding of why the various habitats and foods are used; and therefore, why some of the seasonal movements occur.

2.3.1 Forage Quality

The dependence of sage grouse on sagebrush for food and cover has long been known (Patterson 1952). But only recently has the question of quality of forage been raised (Remington and Braun 1985). Optimal foraging theory predicts that animals forage in a way that maximizes their assimilation of energy and/or nutrients per unit time or per unit of energy expended (Schoener 1971). Because nitrogen is basic to most metabolic processes, cellular structure, and genetic coding, as well as a critical element in growth of all organisms (Mattson 1980), nitrogen assimilation, especially prior to and during reproduction, should contribute to forage selection.

However, plants contain compounds that make them less palatable or even toxic to animals, or may affect the digestibility of the plant tissue. Plant compounds may affect either herbivore fitness (increased mortality or lowered growth rate or fecundity) or herbivore foraging activities (Rhoades and Cates 1976). These effects appear to be achieved by two actions. The chemical compounds may act as digestibility-reducing agents. In this role they may form relatively indigestible complexes with plant proteins that reduce the rate of assimilation of dietary nitrogen, inhibit microbial digestive enzymes, and inhibit microbial activity in ruminants. Or, the compounds may act as toxins and act upon metabolic processes that are topologically internal to the herbivore. Since both effects and both types of chemical actions can impact herbivore inclusive fitness, plant defenses need to be considered in optimal foraging studies (Rhoades and Cates 1976).

Plants typical of resource limited habitats (e.g., sagebrush in arid rangelands) generally have a low maximum potential growth rate. These plants also have a low nutrient absorption capacity that limits their ability to acquire mineral nutrients, and have a low photosynthetic rate that limits their ability to acquire carbon. The limited ability of these species to absorb nutrients from the soil and to fix carbon reduces their ability to acquire the resources for regrowth after herbivory as the availability of resources in the environment declines (i.e., as soil moisture decreases during the growing season).

Availability of resources in the environment can be affected by competition. The lack of sagebrush growth or production in decadent stands is likely the result of competition for nutrients. The effect of insufficient mineral nutrition in older plants that have carbohydrate reserves, is to reduce growth more than photosynthesis. This results in an accumulation of carbohydrate reserves; and therefore, more carbon is available for production of carbon-based chemical compounds.

The dominant plant types in most arid and semi-arid habitats of North America are woody perennials, and the principal anti-herbivore compounds in the dominant woody perennials are the terpenoids and phenols. This is

consistent with the resource availability theory briefly outlined above (i.e., dominant plants in arid habitats will be slow growing because of nutrient and moisture deficiencies, and will accumulate carbon-based metabolites, such as terpenoids). Sagebrush, juniper, and rabbitbrush all contain large quantities of terpenoids. Terpenoids are mainly cyclic unsaturated hydrocarbons with varying degrees of oxygenated substituent groups attached to the basic carbon ring. The number of five carbon units determines the class of terpenoid (e.g., monoterpenoids, diterpenoids, etc.), and the oxygenated substituent group determines the specific compound (e.g., one of the many monoterpenes is camphor).

Monoterpenes have been identified as digestibility-reducing agents for deer (Nagy et al. 1964, Nagy and Tengerdy 1967, Oh et al. 1967, 1968, 1970, Radwan and Crouch 1974, Schwartz et al. 1980) sheep (Oh et al. 1967), and cattle (Eller 1971). These chemicals have also been linked to sage grouse forage preferences (Remington 1983, Barrington and Back 1984, Welch et al. 1991). These compounds are part of the group of compounds referred to as volatile oils and are found in highest concentrations in the leaf epidermal cells. The specific role of monoterpenes in the sagebrush energy budget and physiological processes is not completely known. However, the monoterpenes do appear to be part of the primary metabolic pathways. As such, they would be expected to have a primary function to the plant and be produced during the growing season. They have been suggested as storage compounds for the plant (Loomis and Croteau 1973) that can be hydrolyzed and translocated to other parts of the plant as needed (Rhoades 1979). Monoterpenes and other volatile oils may be used during winter to allow sagebrush to carry on photosynthesis during periods when the ground is frozen and nutrients are otherwise unavailable. Upon hydrolysis, they can provide the plant with nitrogen, carbon, and other elements.

Other plants use other means to store essential nutrients rather than as complex compounds like monoterpenes. However, a compound that also has defensive capabilities and can make the plant less likely to be selected by herbivores, would be more likely to evolve than a compound without defensive properties. If the compounds have defensive properties, the defensive role would be expected to vary during the various life stages of the plant in proportion to the amount of nutrients or energy required by the plant during these other life stages. Therefore, the level of activity of the metabolic pathway(s) that produces monoterpenes may be determined by the physiological state of the plant. This would result in variable concentrations of monoterpenes in the plant over time. Such a scenario would present herbivores with forage quality options, and we can make hypotheses regarding when a plant should be selected as forage and when it should be avoided.

As juvenile plants grow and increase in size and complexity, physiological aging occurs. This manifests itself when the rate of root growth falls below the rate of shoot growth, resulting in nutritional demands of the shoots exceeding the absorption capacity of the roots. At this stage of growth and/or aging, the growing points of the crown (apical and lateral buds) begin to compete for nutrients, and the growth of the internodes and leaves becomes progressively more nutrient limited than carbon limited. The changes in carbon/nutrient balance are then favorable for increased production of fiber (e.g., lignin) and carbon-based defensive compounds (e.g., monoterpenes). The result is that leaves of physiologically-aged plants are small, have a low nitrogen concentration, more cell wall (lignin), and are rich in carbon-based compounds in comparison to leaves of less physiologically-aged plants. As such, the physiologically-aged plants are lower quality forage than their counterparts.

It is important to note that physiological aging is not necessarily a function of time. It differs from maturity in one important respect. Whereas maturity (age at which the plant can reproduce) is under genetic control, physiological aging is a phenotypic response to an internal nutrient stress resulting from external conditions acting on normal growth processes. Or more simply stated, a mature plant can have the characteristics of an old plant if the mature plant is subject to nutrient stress. Conversely, an old plant can have the characteristics of a mature (younger) plant if nutrients are not limiting. More importantly for sage grouse, this means that forage quality can be managed.

A physiologically-aged (i.e., stressed) plant is not likely to have the energy or nutrients available for developing reproductive parts (e.g.,

flowers and seeds). Seeds generally have high nitrogen levels. Therefore, a plant that exhibits a high level of reproductive parts should have a carbon/nutrient balance that favors decreased production of carbon-based defensive compounds (i.e., will have lower volatile oil content). Decadent stands of sagebrush that produce little, if any, seed would have a carbon/nutrient balance that favors increased production of carbon-based compounds (i.e., will have higher volatile oil content). Consequently, the external appearance of the plant (i.e., presence or absence of reproductive parts) should be an indicator of the internal physiological state of the plant (i.e., level of carbon-based compounds).

2.3.2 Adaptations to the Sagebrush Ecosystem

The preceding discussion indicated that sagebrush habitats provide sage grouse with foraging choices that can improve their fitness. However, even in stands of sagebrush with the low levels of digestibility-reducing compounds, these compounds are still present and sage grouse must neutralize their effect. The following discussion reviews the behavioral, physical, and physiological adaptations that sage grouse use to exploit the sagebrush ecosystem. These adaptations, when considered together, allow sage grouse to not only survive the relatively cold winters, but also to prepare for the breeding season by increasing their energy reserves prior to breeding and egg laying. The significance of these adaptations to an ecosystem that is considered to be of relatively poor quality and low productivity should not be underestimated.

Behaviorally, sage grouse demonstrate the ability to select plants of different forage quality. Wyoming big sage was preferred over other species of sagebrush in Colorado (Remington 1983), low sage (*Artemisia arbuscula or nova*) was selected in Idaho (Crawford 1960, Dalke et al. 1963), and early sagebrush (*A. arbuscula ssp. longiloba*) was preferred in northeastern Nevada during the fall and early winter, until snow depths precluded the availability of this low growing species (Barrington and Back 1984).

Selection of individual plants of a given species has been demonstrated (Back et al. 1987, Welch et al. 1988, Welch et al. 1991). Remington (1983) found that selection of individual plants within a species at feeding sites results in a higher quality diet (i.e., higher protein content and lower oxygenated monoterpene content). The use of more vigorous plants growing on recently disturbed sites (road edges, mima mounds, mixed species seeding) has also been observed (Remington 1983, Back et al. 1984), and that these plants had higher protein content than sagebrush in monotypic stands of tall sagebrush (Remington 1983). Beck (1977) noted that quality of sagebrush (chemical composition) may determine why sage grouse used some sites and did not use other sites with similar vegetative characteristics.

While some animals have the ability to reduce the volatile oil content of their forage through masticating (chewing), where the oils volatilize and escape to the atmosphere, or through eructation (belching), where gases are released before entering the rumen, sage grouse do not have these capabilities. Their gross intake of terpenoids as a percentage of their diet is greater than that for any other vertebrate (Remington 1983). However, rather than releasing the terpenoids, sage grouse have several adaptations to avoid exposure to the terpenoids. Sage grouse are the only grouse species that does not have a muscular gizzard (the second compartment of the stomach). The non-muscular gizzard stores the food and secretes mucous that softens the food. This physical adaptation enhances the ability of sage grouse to digest sagebrush, but also precludes the use of hard foods (e.g., seeds, twigs, buds, dried berries) in winter. This is probably the single most important reason why sage grouse are sagebrush obligate species. The green leaves of sagebrush are perhaps the only soft food available to sage grouse during the winter months.

This physical adaptation is also related to the behavioral adaptation, or feeding habit, of sage grouse. Foraging consists of cutting the leaf, rather than plucking the entire leaf (Back, unpublished data). If the leaves were plucked, then grinding in the gizzard would be required to break down the outer cell walls of the leaf to allow the leaf contents to be digested. This would release the terpenoids within the digestive tract, which could then enter the caecum, decreasing the microbial activity and reducing the ability of sage grouse to extract the nutritional components of the sagebrush leaves. However, the exposed edge of a cut leaf

provides a point of entry for digestive fluids to enter the leaf and digest the soft-walled interior cells, leaving the outer cells with high lignin content intact. The outer cells are the storage sites for the terpenoids found in sagebrush. The intact leaves are unable to enter the caecum because of their large size relative to the caecal orifice (Fenna and Boag 1974). The caecum is where complex carbohydrates are broken down. Bypassing the caecum prevents breakdown of the lignin in the out leaf cells and the monoterpenes remain in the leaf. The "empty shell" of the leaf is then excreted in fecal droppings. High levels of terpenoids were found in sage grouse fecal droppings (Barber et al. 1969), and low levels of volatile oils were found in the caecal contents (Barber 1968, Barber et al. 1969), indicating that most of the volatile oils that pass through the sage grouse digestive system remain in the leaf tissue.

Another behavioral adaptation to the sagebrush ecosystem is the ability to conserve energy. Sage grouse have been observed using snow burrows (Back et al. 1987). Snow burrows provide a warmer microenvironment than the surrounding ambient air temperatures. Gullion (1970) found that temperatures under eight inches of soft snow were between 10^{o} F and 27^{o} F when ambient air temperature was as low as -31^{o} F. For an activity to contribute to energy saving, it must help maintain the body temperature above the lower critical temperature (LCT). This is the temperature below which a resting animal must increase its metabolic rate to meet the environmental demands for heat. The LCT for sage grouse has not been determined. However, the LCT for captive ruffed grouse ranged from a mean of 21^{o} F in February to 33^{o} F in March (Rasmussen and Brander 1973). If the sage grouse LCT is similar to the LCT for ruffed grouse, then it is common for sage grouse to be exposed to winter ambient air temperatures below the LCT throughout the much of their occupied range. In northeastern Nevada, snow burrowing was an effective energy conservation behavior for more than 50 percent of the nights between mid-November and mid-March of 1983-84 and 1984-85 (Back et al. 1987). Snow burrowing during this period was observed when temperatures were less than 14^{o} F in all but one instance (83 observations). Sage grouse will travel considerable distance to find suitable snow burrowing sites. In northeastern Nevada, sage grouse were observed leaving evening foraging sites at dusk and flying up to six miles distance and up to 2,000 feet in elevation to night roosting sites (Back, unpublished data). These sites consisted of deep, powder snow in which the birds would burrow.

2.3.3 Winter/Spring Nutrition and Reproductive Success

Remington (1983) found that winter energy reserves of fasting adult females and adult males were from three to four and a half days, and four to six days, respectively. While winter conditions are not likely to result in the need for sage grouse to fast for this period of time, breeding activities reduce the time available for feeding and these reserves reach maximum levels just prior to breeding. The importance of the snow burrowing behavior is underscored by the fact that sage grouse gain weight between January and March (Beck and Braun 1978). This indicates that the energy reserves are important for breeding and nesting activities. The breeding display conducted by males creates high energy demands and females spend little time feeding during incubation; both sexes lose weight during this time period (Beck and Braun 1978). Breeding and egg laying/incubation are the most significant activities conducted by sage grouse, and any behavior that increases the ability to be successful in these activities is inherently important to the population. Dry, cold winters may be more stressful to sage grouse because conditions for snow burrowing are not available and energy conservation would be limited.

Studies of red grouse (in Scotland) and ruffed grouse diets in relation to reproduction indicate that high quality diets result in greater production (Moss et al. 1974, 1975, Beckerton and Middleton 1982). The pre-laying period for females may also be critical to sage grouse populations. The nutritional and energy reserves gained in winter from a diet of sagebrush peak just prior to breeding (Beck and Braun 1978). As spring forbs begin to appear, females shift their diet to include forbs, and availability of forbs with high nutritional value appear to influence the productivity of sage grouse hens (Barnett 1993, Barnett and Crawford 1994). The hen must consume a diet with sufficient amounts of the essential amino acids, vitamins, and mineral to produce an egg, and to supply that egg with all of the nutrients needed by the egg throughout the incubation period. For optimum survival and

early growth of the chicks, the hen must also provide a yolk with sufficient reserves for the newly hatched chick (Scott 1972).

Two other points are essential to understanding the relationship between diet, egg production, egg quality, and quantity of eggs. First, to produce an egg, the female must have a dependable supply of total protein and essential amino acids to produce the follicle or yolk in the ovary and to secrete the albumen (egg-white) portion of the egg during passage of the yolk down the oviduct. Although there is some ability of an under-nourished female to borrow some of these requirements from her own tissue, the number of eggs produced will be less and the size of the eggs will be smaller under these conditions (Scott 1972). Secondly, the egg has an exact amino acid composition. If only one essential amino acid is lacking in the diet or cannot be obtained from the female's own tissue, no egg can be produced (Scott 1972).

Thus, it appears that winter diet contributes to the energy reserves that are needed to maintain a female during egg-laying and incubation, while the early spring diet of forbs contributes to egg quality and quantity. The interaction of these two periods of differing nutritional diets is not known; however, the quality of an egg may be of little consequence if the hen does not have the energy reserves to maintain long incubation bouts. Conversely, a high level of incubation of low quality eggs may result in high hatching success, but low chick survival. Therefore, winter-spring nutrition should be considered as a continuum of the breeding cycle, rather than two separate processes with separate underlying ecological outcomes (i.e., winter survival and breeding success).

This link extends beyond the nesting season. The nutritional requirements for egg production in birds are very similar to the requirements of young birds for survival and optimum growth from hatching to approximately three to six weeks (Scott 1972). As discussed above, the habitats used by female sage grouse prior to egg production, during incubation, and for early brood rearing are often the same habitat. The open sagebrush with abundant herbaceous vegetation provides the nutritional needs of the hen, cover requirements for the nest, and nutritional needs of the newly hatched chicks.

The transition between rapid growth of chicks and slow growth/maintenance of juveniles coincides with a change in diet and habitat use. During the first six weeks after hatching, the chicks grow very rapidly. The diet consists of foods high in protein and minerals (especially calcium). The variety of amino acids, minerals, and levels of vitamins required by chicks declines as they grow older (Scott 1972). However, as the chicks grow larger, more food is used for maintenance and less is used for growth. During this period, the quantity of insects in the chick diet declines. This coincides with movement to summer brood habitat where forbs remain available, especially on wet meadows. The use of sagebrush as a food item for juveniles begins to increase as summer ends. When the birds mature, the nutritional needs are for maintenance only, until the bird enters the breeding cycle (late winter). The level of insects and forbs in the adult diet remains relatively high during the summer as the adults replace feathers during the annual molt. When the molt nears completion, the adult maintenance diet is reflected by the proportion of sagebrush in the diet.

The habitats used by sage grouse throughout the year for foraging are a function of their differing nutritional needs and a function of where those needs can be obtained in a changing environment. The habitats used by sage grouse throughout the year for cover are a function of energy demands, predation pressure, and proximity to quality forage.

2.3.4 Predation Ecology

Predation is one[3] of the various animal-animal relationships that determine habitat selection and survival. Predation is discussed here because of the public concern regarding this process and to underscore the link between predation and habitat.

In terms of ecosystem energy pathways, prey species function to transform and concentrate energy from plant or animal sources into tissue of sufficient volume to make an efficient transfer of that energy to the next trophic level (i.e., little

[3] Competition, between members of the same species (intraspecific competition) and among different species (interspecific competition), is also a factor in determining habitat selection and survival. Other animal-animal relationships include symbiosis and parasitism.

fish are eaten by big fish). Therefore, predation is part of the ecology of every animal species, and it is the fate of every sage grouse embryo produced to be eaten during some stage of the life cycle. In contrast, it is the goal of each embryo to survive long enough to breed. For most prey species, very few of the young survive to breed; mortality is greatest during the early stages of development and decreases after young reach adult size or breeding age. This pattern applies to sage grouse.

Population increases occur when more young survive to adulthood (i.e., increased recruitment to the population), or when adult mortality declines (i.e., increased survival), or when both occur. Population declines occur when the number of young surviving to adulthood (i.e., recruitment) is less than the number of adults lost from the population (i.e, adult mortality). The factors that can influence these processes are numerous and their interrelationships are complex.

Any factor that detracts from the health of the individual sage grouse, interferes with the ability of an individual sage grouse to detect predators, decreases the ability of sage grouse to avoid detection by predators, or concentrates sage grouse into limited habitat areas, will decrease the probability that an individual sage grouse will survive. Conversely, any factor that contributes to the health of an individual sage grouse, increases the ability of an individual sage grouse to detect predators, increases the ability of sage grouse to avoid detection by predators, or results in sage grouse being distributed in space and time, will increase the probability that an individual sage grouse will survive. The relative number of predators to the number of sage grouse, and to abundance of other prey species, also influences the probability that a predator will encounter individual prey species. Many of the factors that contribute to sage grouse health, ability of sage grouse to detect predators, ability of sage grouse to avoid detection, and to the distribution of sage grouse in space and time, are habitat related. Those factors that contribute to the probability of encounter are more population related.

Consequently, when discussing predation as a factor in a declining prey population, there are two components to the "equation": 1) the quality of the habitat, which determines prey susceptibility (or conversely, predator efficiency); and 2) the relative population sizes of predator and prey species, including alternative prey species. In addition, these two components are interrelated, further complicating the understanding of predation ecology. These two components are discussed below.

2.3.4.1 Habitat Quality as Related to Predation

The role of diet selection and nutrition in relation to production was discussed above. A female that only leaves the nest twice per day to feed, defecate, and exercise (Petersen 1980) is less likely to be detected leaving or arriving at the nest than a hen that does not have sufficient energy reserves and leaves the nest more frequently. Predators such as ravens and crows that perch and detect movement probably locate nests by observing the hen and searching the area near the observation, or following her movements as the hen returns to the nest. Ravens also detect nests during the egg-laying period before the hen has initiated incubation by locating the unattended nest while searching on the wing (Autenrieth 1981). Nest predation by ravens has been cited as a major factor affecting sage grouse production (Batterson and Morse 1948, Autenrieth 1981). Nest site selection (habitat quality) would influence the ability of aerial predators to detect the nest and habitat quality would also influence the ability of perching predators to detect hen movements in the vicinity of the nest. Habitat quality has been related to nest success in several studies (Bean 1941, Wallestad and Pyrah 1974, Connelly et al. 1991, Gregg et al. 1994, DeLong et al. 1995, Sveum et al. 1998a). Therefore, improvement in the quality of nesting habitat over larger acreage should increase nest success and produce more juvenile birds.

The discussion of forage quality and sage grouse adaptations to the sagebrush ecosystem indicates that the quality of the winter forage and the availability of forbs in spring may directly influence the ability of the hen to produce quality eggs and to incubate the eggs with minimal time away from the nest. A poor quality egg that is successfully hatched results in a chick that may not have the yolk sac reserves to withstand wet, cold weather immediately after hatching, or may not have the ability to quickly develop and escape predators. These types of interactions between habitat quality and climate may be the

causal factors of decreased juvenile survival, and predation may be the manner in which the decrease is expressed. In other words, the poor quality nutrition for the hen may result in chicks that are more susceptible to effects of weather, but predators are able to remove the weakened chicks before they die directly from a weather event.

Annual reproductive success (proportion of hens that hatch one or more eggs) ranges from 15 percent to 70 percent (Schroeder et al. 1999). After hatching, the chicks are dependent on the hen for survival for the first week. Their ability to detect and escape prey is limited, and mortality during this stage of their life cycle is high. Therefore, a habitat that provides food and cover during this stage of their life cycle is critical to chick survival. As described above, this habitat is generally a mix of sagebrush with an open canopy and an abundance of forbs and grasses (see Section 2.2.4.2). The forbs and grasses provide habitat for insects that are the primary sage grouse chick food item, and the forbs, grasses, and shrubs provide cover for the chicks. The quality of the brood habitat would be one factor that determines how many of the additional juveniles survive to contribute to the breeding population.

As juveniles approach adult size, the species of predators to which they are vulnerable changes. Use of limited acreage of riparian habitat in late summer results in sage grouse being concentrated and often using open habitats (meadows). Avian predators and larger carnivores that frequent riparian habitats become the primary threats to survival. However, the ability of juvenile sage grouse to fly and escape predators is well developed, and open habitats may also increase the ability of sage grouse to detect approaching predators. Mortality rates reported for juvenile sage grouse vary; 62 percent between hatching and autumn in Colorado (June 1963), 40 percent from hatch to hunting season in Montana (Wallestad 1975), and 59 percent between June and early August in Colorado (Keller et al. 1941). The data collected by NDOW indicates that juvenile mortality between summer and the fall hunting season in northeastern Nevada is approximately 50 percent.

Movement to fall and winter range disperses the birds over a wider range of habitats, decreasing the probability of predator-sage grouse encounters. As winter snow depths reduce the availability of habitat (Beck 1977, Barrington and Back 1984), sage grouse once again congregate. Bean (1941) observed golden eagles attacking sage grouse in winter in Idaho, although Beck (1977) found eagle attacks of sage grouse to be relatively rare in Colorado, and Wallestad (1975) concluded that adult mortality was relatively insignificant. Winter conditions, availability of other prey species, and abundance of predators all contribute to the level of winter predation. Hogue (1954) found that rabbits and jackrabbits were the primary prey species of coyotes and eagles in winter and that sage grouse were a secondary prey species. This relationship is subject to change when jackrabbit populations decline.

The spring breeding season represents another period of time when sage grouse are concentrated on relatively small acreages. The traditional use of the leks each year provides a food resource for predators that is consistent over time and space. Although predators frequently attack sage grouse at leks, their success in securing a meal appears to be low (Scott 1942, Stanton 1958, Rogers 1964, Wiley 1973b, Autenrieth 1981). This is not totally unexpected because it is unlikely that this breeding strategy would have developed if mortality rates on the breeding grounds were consistently high. The selection of open sites adjacent to cover as leks, as well as the timing of the display activity, has been proposed as a response to predation pressure (Hjorth 1970, Hartzler 1974, Bergerud 1988b, Phillips 1990). Monitoring of ten leks in northeastern Nevada between 1982 and 1986 indicated that predation at the leks was less than one percent of the males each year (Back, unpublished data) except for 1986 when at least one predator-killed sage grouse was found at each active lek. The mortality at leks by the end of the 1986 breeding season was approximately 11 percent of the adult males. This indicates that at least periodically, predation at leks can be substantial and contribute to the imbalance in the sex ratio of adult birds (Schroeder et al. 1999).

The flocking nature of sage grouse and the movement between habitat patches over time distributes sage grouse “randomly” in both space and time. Habitat quantity influences the encounter rate between predator and prey under this scenario. The more prey habitat available, the longer the search time required to locate

prey when the prey species are not uniformly distributed throughout the habitat. Therefore, reduction of habitat quantity increases the effectiveness of predators. For example, lack of upland sagebrush sites with sufficient forbs to provide sage grouse insect and nutritional needs results in earlier use of riparian meadow habitats (this can also occur during drought), before chicks have the ability to effectively escape from predators. The limited abundance of this habitat type concentrates the birds into fewer acres, decreasing the time required for predators to locate the broods. Therefore, either poor habitat quality, insufficient quantity of habitat, or drought conditions can increase the level of predation on juvenile birds, affecting recruitment.

2.3.4.2 Predator and Prey Populations as Related to Predation

If habitat quality factors are held constant, it is simple probability statistics that either increasing the number of predators or the number of prey, or both, will increase the probability of predator-prey encounters. And conversely, decreasing the number of predators or the number of prey, or both, will decrease the probability of predator-prey encounters.

Although there is no hard data to confirm that there are more predators today than at some previous point in time, long time residents and ranchers were unanimous on this point during the issue discussions for this Strategy. Specifically, numbers of ravens and crows (corvids) appear to have increased more than other species. Evidence to support this position consists of the means by which these species benefit from human activities. Power transmission and telephone lines create nesting opportunities for corvids in habitats where none previously existed. The poles can also be used as perches from which these species can wait to observe habitats in search of ground or shrub nesting birds. Trees planted as part of rural landscaping where only shrubs previously existed create additional nesting sites. The increase in roads, especially improved roads, results in additional wildlife mortalities. These road kills may either be the mainstay diets of some corvids, or a supplement that allows the individuals to survive conditions that would otherwise be periods of food shortages and resulting in some population control. Similarly, these additional food resources may allow all the young in a corvid clutch to survive, when previously only one offspring may have successfully fledged. Landfills, including those associated with large communities and those associated with rural ranches and mining operations, are also dependable sources of food that can carry corvids through otherwise stressful periods.

Côté and Sutherland (1997) found that control of nest predators improved hatching success of breeding bird populations, but did not result in an increased breeding bird population. This is to be expected where the breeding bird population is stable; the increased hatching success results in more fledglings that are susceptible to other predators that prey on fledglings. Under circumstances of poor quality nesting habitat with adequate brood habitat, predator control may increase recruitment. However, the population would start to decline whenever predator control measures cease because the quality of the nesting habitat remains as the overriding factor affecting nest predation.

Perhaps a scenario that is more relevant to the current situation in Elko County is increasing predator populations (at least corvids) and declining sage grouse populations. Again, if habitat quality factors are held constant, then probability statistics would indicate that predation could rise to a level that increases the rate of decline in the sage grouse population. This would continue until sage grouse (nests, chicks, juveniles, and adults) are so scarce that predators cannot afford to spend the energy necessary to locate sage grouse, or until alternative prey populations are sufficiently high (relative to sage grouse populations) to cause predators to switch to alternative prey.

Predator control, or the reduction of predator populations, is more likely to be effective when habitat quality is relatively high, but the sage grouse population is low and the predator population is high. Under this scenario, the abundance of predators negates the effectiveness of habitat quality and the sage grouse population is not sufficiently high to produce enough chicks to maintain population levels. Due to the high number of predators, there aren't enough places to hide. Under this scenario, predator control that is focused around the nesting and early brood habitat may be highly effective in allowing more eggs to hatch and more chicks to survive to the juvenile age

class and eventually be recruited into the adult population.

The preceding discussion is not meant to imply that predation is not an issue, but puts predation in perspective. The effects of predation on population dynamics cannot be clearly understood until habitat quality is at "optimum," at which time the interaction between habitat quality and predation is minimized. Under optimal habitat conditions, nest success and juvenile survival should exceed the level needed to just maintain a stable population, and population increases would be anticipated. Where poor habitat quality is the overriding factor in determining predator efficiency, whether it be success at nest predation, chick predation, juvenile predation, or adult predation, predator control can only be a temporary measure to increase sage grouse populations. As soon as the predator control is removed, the predator numbers and predator efficiency will increase to pre-control levels. Where predator populations and survival have been artificially increased as a result of man's activities, improving prey habitat may not be a sufficient effort to offset the advantage that has been given to predators. Under these circumstances, predator control should be an effective measure in bringing the predator populations to near normal levels or below.

As stated above, recruitment must exceed adult mortality for populations to increase. The wing data and harvest data for Elko County indicates that recruitment of young sage grouse into the population is not in excess of the adult mortality in most years. A 37 percent nest success, combined with an estimated 50 percent juvenile mortality between hatching and late summer and estimated 50 percent juvenile mortality between late summer and the fall hunting season, would indicate that overall predation is a significant issue. What is not clear is what factors are contributing to these high mortality rates. Are there simply more predators? Are there habitat quality factors present that contribute to predator effectiveness? Are there habitat quality factors present that decrease sage grouse health, making them more susceptible to predation? Are there habitat quantity factors present that cause sage grouse to concentrate into small areas and contribute to predator effectiveness? Are there habitat quality and climatic factors interacting that cause high chick mortality? These questions need to be answered before the issue of predation can be adequately assessed and addressed. However, it is likely that all of the factors mentioned above are contributing to the predator-prey relationship, and measures necessary to address all the factors should be considered in the management strategy.

2.4 Sagebrush Ecosystem

Understanding sage grouse ecology also requires an understanding of the ecosystem and the dynamics of the ecosystem over time. Both long-term climatic cycles (i.e., glacial and interglacial periods) and short-term cycles (periods of above normal precipitation or periods of drought) influenced plant community dynamics. Long-term climate cycles caused large spacial shifts in plant distribution (Miller and Eddelman 2000). Plant species migrated, hybridized, or went extinct in response to changes in climatic conditions (Tausch et al. 1993). However, the plant communities did not respond to these changes as intact species assemblages (Nowak et al. 1994). The individual range of tolerance for temperature, moisture, and other factors, resulted in variation in the individual species' rates of migration and direction of the migration (Graham and Grimm 1990). During the past two million years (Pleistocene) several relatively long glacial periods (i.e., 50,000 to 100,000 years), separated by shorter interglacial periods (i.e., 10,000 to 20,000 years), have occurred (van Donk 1976). Interglacial periods have comprised only about 85,000 years of the last 850,000 years (Tausch et al. 1993). The significance of the long-term climate cycles is that the geologic processes of weathering, soil development, and stream hydromorphology occurred under "stable" conditions (i.e., long periods of time of either glacial or inter-glacial climates). These processes were the foundation for the plant and animal communities that now inhabit the Great Basin.

The Holocene (last 12,000 years) has had periods of climate that were warmer/wetter, warmer/drier, cooler/drier, and cooler/wetter than the present pattern (Miller and Wigand 1994). Even these periods were considered long-term due to the fact that they occurred long enough to change plant community dynamics, fire frequencies, and seasonal precipitation patterns (Whisenant 1990, Miller and Wigand 1994). The periods of most interest occurred

between 500 and 700 years ago and 400 to 500 years ago, prior to European settlement. Miller and Wigand (1994) indicate that a period of severe drought and fire occurred between 500 and 700 years ago. Pollen studies indicate that juniper woodlands were greatly reduced during this period, being replaced by grasslands-sagebrush communities that were able to tolerate the more xeric conditions. This was followed 400 to 500 years ago by a pattern of increased winter precipitation and lower temperatures that reversed the trend in declining woodlands and expanding grassland-sagebrush communities. The period, known as the Little Ice Age, ended about the mid-1800s (Ghil and Vautgard 1991), or coincident with settlement of the Great Basin. The rising temperatures following the Little Ice Age were associated with an increase in sagebrush abundance relative to grasses in eastern Oregon (Wigan 1987), based on pollen data. This would indicate that the fire interval (period of time between fires at a given site) increased, allowing sagebrush to dominate the grassland-sagebrush communities and juniper woodlands to expand into sagebrush sites.

Superimposed on these long-term and moderately long-term cycles of climatic pattern were the short-term cycles of drought (i.e., years with less than 85 percent of the mean annual precipitation) that occurred approximately 20 to 30 percent of the years (Miller and Eddelman 2000) and cycles of normal and above normal precipitation. The affect of these short-term cycles on plant production are well documented and incorporated into production estimates in the Natural Resource Conservation Service (NRCS) range site descriptions and soil surveys.

The vegetation communities occupying a given site are a function of climate, topography, soils, and disturbance, which are in turn a function of the cycles discussed above. The long-term cycles influence the particular plants that are likely to be found in space and time; the moderately long-term cycles influence the fire frequency that determines the community dynamics (succession); and the short-term cycles influence the productivity of a site and interact with the moderately long-term cycles in determining fire frequency and fire intensity. Fire intervals in low sagebrush communities may have been as long as 100 to 200 years (Young and Evans 1981, Miller and Rose 1999). Wright and Bailey (1982) estimate the fire interval of Wyoming big sagebrush sites to be 50 to 100 years in the shrub-steppe region, but may have been greater than 100 years in the Great Basin (Miller and Eddelman 2000). Fire intervals may have been as short as 12 to 25 years in the mountain big sagebrush communities (Burkhardt and Tisdale 1976, Gruell et al. 1994). The short-term cycles were also likely to have influenced reestablishment of sagebrush following fire and the continued recruitment of sagebrush into the plant communities (Perryman et al. 2001, Maier et al., 2001).

Using this understanding of climate cycles, one can create a description of the vegetation landscape of the pre-European settlement. The period of drought and fire between 500 and 700 years ago reduced the extent of pinyon-juniper woodlands, expanding the extent of the sagebrush-herb community. The pollen record from southeastern Oregon (Mehringer and Wigand 1987) indicates that grasses were more abundant preceding this period of drought and fire, and that sagebrush increased during this period. During this drought period fire would have created expanses of mountain big sagebrush in the areas of decreased pinyon and juniper woodlands. Lower precipitation would have resulted in the more drought tolerant Wyoming big sagebrush migrating higher in elevation and replacing mountain big sagebrush at the lower portion of the mountain pediments. Similarly, mountain big sagebrush would have migrated either in elevation or to north and east aspects where more mesic conditions would have prevailed. Fire in the Wyoming big sagebrush types would have been dependent on the age or condition of the stand. During prolonged drought, young stands of Wyoming big sagebrush on the more arid sites would have been less subject to fire due to the lack of production of fine fuels (i.e., herbaceous vegetation). However, the deep-rooted and drought tolerant sagebrush would have increased in total cover with episodic establishment during short-term periods of normal or above normal precipitation (Maier et al., 2001). Therefore, as stands of Wyoming big sagebrush increased in age and crown cover, the requirement of fine fuels to carry the fire between shrubs would have been reduced by competition from shrubs, and “crown fires” would have occurred.

An important distinction to make is that drought favors sagebrush dominance where sagebrush

already exists (i.e., established sagebrush plants are more efficient at nutrient and moisture assimilation than grasses), but reduces the potential for sagebrush seed to germinate and establish. Therefore, fire within the period of drought would favor grasslands and lack of fire would favor increase in woody dominance where woody species were previously established.

The resulting landscape would have included areas of pinyon-juniper at the higher elevations or north slopes at mid-elevations, with mountain big sagebrush on the sideslopes, Wyoming big sagebrush in the valleys and lower sideslopes, and low sagebrush on ridges or sideslopes where soils were not suitable for mountain big sagebrush. A variety of age classes of mountain big sagebrush was likely to have occurred due to the frequency of fires in this community.

During this drought and fire-prone period, fire at the upper elevation pinyon-junipers would have maintained open stands by decreasing shrubs and young seedlings of pinyon and juniper. The mountain big sagebrush communities generally recover quickly from fire, but the recovery time may have been increased due to the poor moisture conditions, which would have increased the fire interval. The general successional pattern would have been a grassland-forb dominated community following a fire, with sagebrush establishment occurring over a longer interval. Intermediate fires would have reduced the sagebrush cover, but due to the patchy nature of grass-fueled fires, patches of sagebrush would have remained as a potential seed source to hasten the shrub recovery.

In the more arid Wyoming big sagebrush sites, the lack of fine fuel production from poor moisture conditions would have led to the build up of dense stands of sagebrush. Once in this condition, fire would have been intense and probably occurred over large acreages. The successional pattern would have been a slow recovery of the grasses and forbs due to the effects of an intense fire on the soil, seed bank, and plant root systems. The reestablishment of sagebrush into these sites may have taken many decades. The poor moisture conditions and large size of the burns would have limited the opportunities for sagebrush establishment and required many years for sagebrush to migrate from the edges of the burns. Any intermediate fires would have added significantly to the time required for shrub dominance to reoccur. Unlike the patchy mosaic of mountain big sagebrush age classes, the Wyoming big sagebrush sites would have had age classes represented as ecotonal gradients with the older age classes at the edge of a burned area and the younger age classes at the interior of the burned area. Initially, the mosaic of these burned areas would have been on a larger scale than the mountain big sagebrush sites; perhaps involving entire basins between mountain ranges. However, as the ecotonal age classes developed, the fire pattern would have been dependent on fuel loading. The distribution of fuels along the ecotone would have limited the extent of the fires, resulting in a mosaic of age classes. The size of these patches would have been larger than the mountain big sagebrush age class patches, but smaller than the large expanses of old sagebrush stands that dominated the early phase of this climatic period.

With the initiation of the Little Ice Age, several hundred years of cold, wet conditions prevailed until the mid-1800s (Neilson 1986, Pielou 1991). The climatic conditions for fire ignitions were limited, but plant production was greater than the previous climatic period. Therefore, the fire interval during this period was controlled more by climate than by fuel loading. Expansion of the pinyon-juniper into the mountain big sagebrush sites reversed the trend that occurred during the drought and fire period. Wetter conditions favored a full understory of herbaceous species in the sagebrush community, slowing the establishment of pinyon and juniper. A patchwork of mountain big sagebrush, low sagebrush, and pinyon-juniper would have been present on the higher elevations and sideslopes. Pinyon-juniper woodlands would have been open, and a fire frequency of 12 to 25 years in the mountain big sagebrush community would have also hindered establishment or survival of pinyon-juniper seedlings during this period.

The mosaic of age classes that had been created in the Wyoming big sagebrush sites during the previous period of drought and fire would have been diminished during the early phase of the Little Ice Age. The effect of colder, wetter conditions at the lower elevation Wyoming big sagebrush sites would have been an increase in the herbaceous understory and increased sagebrush seedling establishment.

Fires under these conditions would have been less intense than the crown fires during the previous period of drought, and the herbaceous plants would have quickly responded to fire. The patchy nature of these types of fires would also have left islands of sagebrush that would have hastened the re-establishment of sagebrush into the grasslands. The succulent vegetation in the riparian zones would have had sufficient fuel moisture to control the spread of these grass-fueled fires, limiting the size of the patches. However, with climatic conditions that did not favor fire, the recruitment of sagebrush into the stand would have increased sagebrush crown cover over time, creating large expanses of older sagebrush. The increased fire interval of 50 to 100 years would have been sufficient for sagebrush to dominate the stands.

The longer fire interval in the Wyoming big sagebrush sites and the propensity of the "crown fires" to burn large acreages during short-term periods of drought, were likely to create a less distinct mosaic than in the mountain big sagebrush sites. The age classes occurred in the ecotone from the edge of the burn to the interior of the burn, rather than as distinct patches of age classes. The extent of the age classes was dependent on the time since the last fire.

Low sagebrush sites at the more arid lower elevation sites were not likely to burn very frequently due to the lack of herbaceous material, low shrub crown position, and less overall shrub crown cover than the Wyoming big sagebrush sites. However, small inclusions of low sagebrush within the Wyoming big sagebrush communities were probably impacted due to the intense heat of the crown fires.

When the early explorers entered the Great Basin near the end of the Little Ice Age, the landscape may have appeared to be sagebrush from the sideslopes of the mountain ranges across the valleys and up the sideslopes of the next mountain range, with pinyon-juniper at the moderate elevations, and other coniferous trees at high elevations to subalpine/alpine zones.[4] The sagebrush mosaic and age distribution would have been a result of the fire history of the preceding 500 years. What appeared to be a monoculture of sagebrush actually ranged from stands dominated by sagebrush, often quite extensive in nature, to grasslands (most recently burned areas). The highest diversity of age classes occurred in the mountain big sagebrush communities, and lower age class diversity occurred in the Wyoming big sagebrush communities. The amount of perennial grasses and forbs present would have been a function of the age class and cover condition of the sagebrush communities.

The changes discussed above are macro-changes that occurred over broad areas and long time intervals. The macro-changes were the result of many site-specific and plant community-specific changes over time and space. Succession, the orderly change in plant communities over time, was one of the plant-community specific changes that occurred. While useful in providing a basic understanding of plant community dynamics, the successional model is currently being replaced with the state and transition model (Laycock 1991, West 1999) and other multi-trajectory models that reflect empirical field data.

Two of the major stresses on plant physiology that drive plant community changes are competition for nutrients and moisture. In the absence of grazing, sagebrush will dominate a site at the expense of herbaceous plants. This sagebrush dominance is achieved through competition for nutrients and moisture. Sagebrush has an extensive near-surface root system that allows this shrub to effectively compete for nutrients and moisture near the surface where grasses and forbs obtain their moisture and nutrients. However, sagebrush also has a taproot system that provides access to soil moisture that has exceeded the depth of the herbaceous plant roots. This deeper root system allows sagebrush to continue growing throughout the year and during periods of drought. During each period of drought, the herbaceous species initiate growth using root reserves and soil moisture from winter storms. If spring moisture is not available, the plants shorten their growth cycle, which also decreases the amount of root reserves that can be replaced. Consecutive years of drought result in root reserves insufficient to sustain some plants, allowing sagebrush roots to take their place.

[4]Playas and salt-desert shrub communities were also part of the landscape, but their location on the landscape and extent were more a function of water levels and soils; and therefore, are not discussed.

The time interval over which this process takes place depends on the site productivity and the disturbance that may occur during the process. As implied above, the general direction of the plant community following fire was from a grass-forb dominated community, to a grass-forb-shrub community, to a shrub-grass-forb community, to a shrub-dominated community (**Figure 6)**. The shrub-dominated community was not without grasses or forbs, but would have had less grasses and forbs than the other successional stages. The abundance of forbs and grasses would have represented equilibrium of site capacity and short-term climatic conditions. Complete shrub dominance (i.e., a near complete lack of forbs or grasses) was not likely to have occurred, except at low elevation, low precipitation sites, with poor soil productivity.

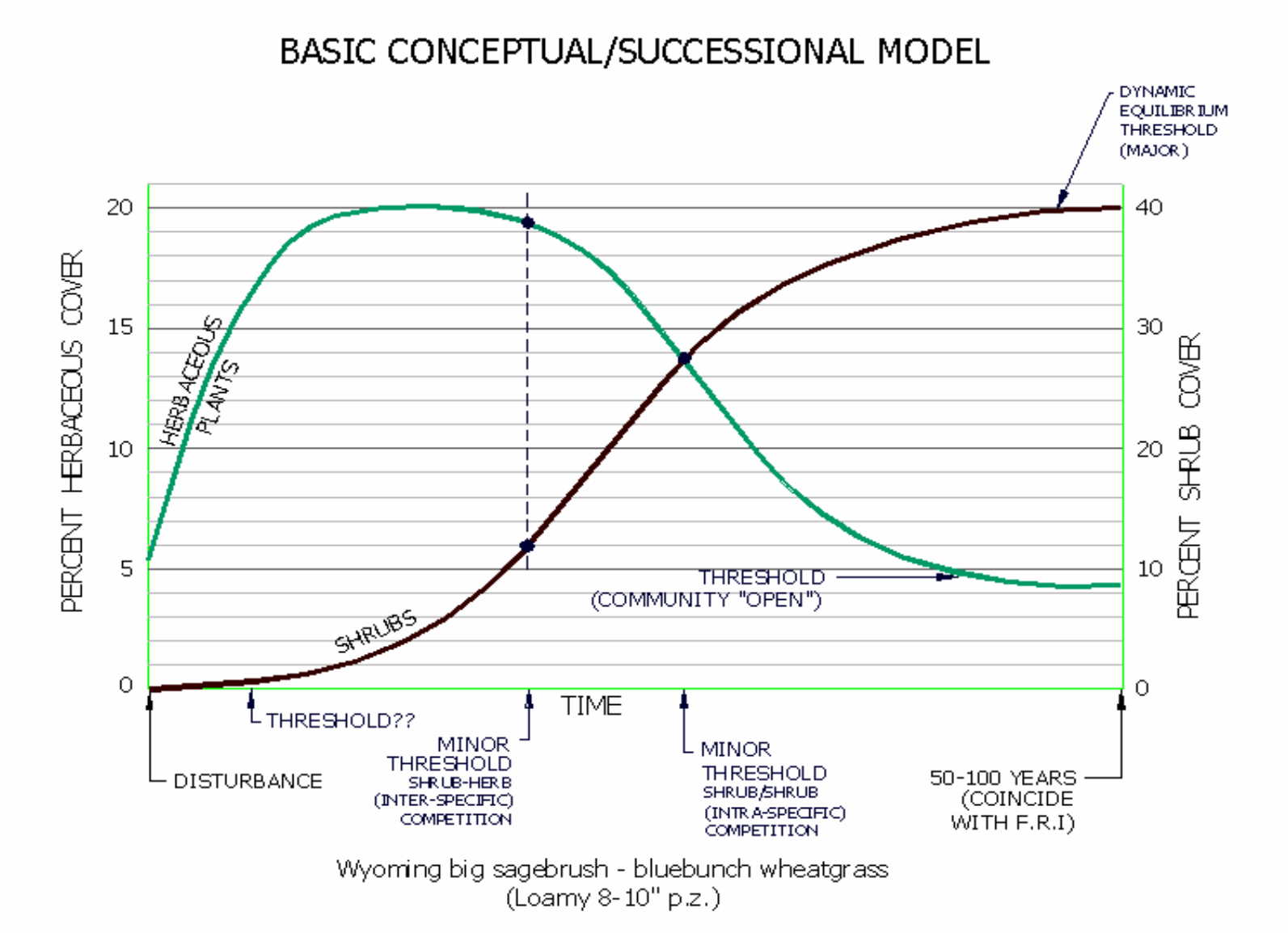


Figure 6: Basic Conceptual Successional Model for the Loamy 8-10” Precipitation Zone (p.z.) Range Site

If each of the four plant community phases discussed above is considered a state and the change from one to another is a transition, then the successional model begins to take on the state and transition model character. At each state, the transition to the next state can be modified by other factors. For example, the grass-forb dominated community could be maintained through short disturbance intervals, such as repeated fires or frequent drought cycles that prevented sagebrush from establishing. Similarly, the shrub-grass-forb state could have been modified to the grass-forb state or the grass-forb-shrub state, depending on the extent and intensity of the disturbance. The overall time interval required to achieve the shrub-dominated state is representative of the average disturbance interval for each range site.

2.5 Factors Affecting Sage Grouse Populations or Habitats

The following issues were identified by the NNSG membership as potential factors contributing to the decline in sage grouse throughout the West, and particularly in Elko County:

- Habitat Quantity
- Habitat Quality/Nutrition
- Habitat Fragmentation
- Changing Land Uses
- Livestock Grazing
- Fire Ecology
- Predation
- Disturbance
- Disease
- Hunting
- Cycles
- Climate/Weather

Some of the factors, such as habitat quantity, habitat quality/nutrition, habitat fragmentation, fire ecology, changing land uses, livestock grazing, and disturbance, are addressed in the Strategy. Specific actions can be implemented through a watershed plan to eliminate or reduce the potential impacts from these factors. Other factors, such as predation and hunting, fall under the specific jurisdictions and laws and the NNSG can develop recommendations for changes, but implementation would occur through other processes. Finally, factors such as disease and cycles are not within the control of the NNSG, but their impact on the populations needs to be considered.

Each PMU was assessed to determine the population and habitat risks. Each risk factor is discussed below. The rationale for the assignment of risk for each factor is included in **Appendix C**. The risks were based on local knowledge and other factors, and were averaged over the entire PMU. This risk assessment was for planning purposes only, and used to rank the PMUs.

2.5.1 Habitat Quantity

Changes in habitat quantity result from alteration of sagebrush habitats to other vegetation types. These changes may be short-term, or temporary, if the alteration results in sagebrush reestablishment over time, or they may be permanent if the alteration prevents sagebrush reestablishment (see Section 2.5.4. for a discussion of permanent changes). Wildfires, and to a lesser extent, historic livestock grazing practices, have resulted in the conversion of approximately 251,600 acres of sagebrush rangelands to annual grasslands in Elko County since 1980. The acreage converted has included sage grouse winter, breeding, nesting, and brood habitat. Once converted to annual grasslands, these areas will not revert back to a sagebrush community without extensive measures. The resulting annual grasslands create a greater risk of additional habitat loss due to the ease with which the annual grasslands can be ignited and spread fires into adjacent, intact sagebrush habitats. Within the Strategy area, large blocks of annual grasslands are most prevalent within the western portion of Elko County; however, cheatgrass is an understory component of many plant communities throughout the county.

The encroachment of pinyon-juniper woodlands from woodland sites to rangeland sites has also been responsible for loss of sagebrush habitats. Approximately 354,500 acres of pinyon-juniper encroachment has occurred within the planning area. Fire suppression or extended fire intervals allow pinyon-juniper to spread across the landscape (Tausch 1999). Chemicals in the foliage of the juniper trees prevent other species of grasses and shrubs from germinating or establishing under the juniper canopy. As the juniper begins to dominate the site, the shrub-herb community is essentially lost or greatly reduced, depending on the site conditions. Sage grouse do not use pinyon-juniper woodlands,

and the encroachment of this plant community into sagebrush-herb communities represents a loss of habitat for sage grouse. Due to the loss of understory in many of the pinyon-juniper stands, conversion back to sagebrush-herb communities is not a simple process. Where sagebrush still exists in the understory, several options for restoration are available. The issue of pinyon-juniper encroachment is most prevalent in the southern half of the Strategy area.

During the late 1950s and early 1960s, several varieties of crested wheatgrass were used to control halogeton and increase livestock forage production on western rangelands. These seedings were conducted primarily on gentle terrain at lower elevations (Wyoming sagebrush sites). The converted sites impacted nesting habitat, early brood habitat, and winter habitat. Although some seedings were used by sage grouse for breeding (leks), the overall impact has been considered to be detrimental to sage grouse (Braun 1998). Some seedings where sagebrush has reestablished have been noted as being used by sage grouse for winter use (Back et al. 1984) and nesting (K. McAdoo, personal communication). BLM records (Rich 1999) indicate that the cumulative acreage of rangeland seedings on BLM administered lands in the west increased from approximately 100,000 acres in 1962 to 2.75 million acres by 1997. This acreage does not include private land seedings. According to the BLM Elko Field Office, about 396,500 acres of public lands within the Elko Field Office area were converted to crested wheatgrass or other exotic species (not including fire rehabilitation projects). This represents about three percent of the land area in Elko County. Private land seedings were likely to have affected at least the same amount of acreage.

Not all sagebrush removal was followed by seeding of exotic grasses. Sagebrush control projects designed to remove sagebrush and allow native grasses to increase in abundance followed a pattern similar to crested wheatgrass seedings. Brush control projects on BLM administered lands in the west accounted for approximately 100,000 acres in 1962 and increased to approximately 1.4 million acres by 1976. Only about 300,000 acres of BLM administered lands have been converted to grasslands since 1976 (Rich 1999). Where sagebrush has been allowed to reestablish on these lands, sage grouse habitats have likely been reestablished. Where follow-up treatments have been conducted, sage grouse have been effectively removed from the acreage. Sagebrush rangelands have also been converted to a variety of other agricultural uses, including hay production, through various forms of irrigation. While this acreage has reduced the amount of winter or nesting habitat, much of the irrigated land has received use as summer foraging habitat.

The rapid expansion of the mining industry in and around Elko County starting in the 1980s also impacted sage grouse habitats. Environmental analysis of mining impacts for operations managed by Barrick Goldstrike Mines, Inc., Newmont Mining Corporation, AngloGold, Inc., Glamis Dee Gold Mining Co., and others have indicated loss of habitat, either temporary or permanent, due to mine development. While most of the acreage will be reclaimed to support sagebrush communities, some acreage has been converted to salt desert shrub or exotic grasses, and some acreage represented by the open pits will remain permanently unavailable to sage grouse. Some of these impacts have been mitigated by off-site projects intended to rehabilitate annual grasslands, and Barrick Goldstrike Mines, Inc. contributed mitigation funds to experimental land treatments that have been instrumental in developing management tools for this Strategy. Although mining disturbance is very visible during active mining, the actual acreage involved represents less than two percent of Elko County's land mass.

2.5.2 Habitat Quality/Nutrition

This factor was discussed above (Sections 2.3.1, 2.3.2, and 2.3.3). The quality of the habitat contributes to the effectiveness of many of the other factors. Disease, predation, hunting, and disturbance are less likely to effect populations when habitat quality is high and both the birds and the populations are resilient. Population impacts from unfavorable weather conditions are also somewhat ameliorated by having high quality habitats. Managing for quality habitats, while maintaining and restoring habitat quantity, are probably the two most important factors for long term sustainability of sage grouse populations.

Habitat quality also pertains to the integrity of the plant communities. Invasive weeds, annual grasses, and exotic species (desired or undesired) all detract from habitat quality. For each invasive weed, annual grass, or exotic species there is one less forb, native grass, or sagebrush seedling that can be supported within the community. These species also increase the risk of conversion from a shrub-herb community to an annual grassland-noxious weed community following catastrophic events (see habitat quantity, above).

Habitat quality was also addressed by conducting a habitat condition assessment. The purpose of the assessment was to determine five broad categories of habitat condition and mapping the location of habitats of each condition class within each PMU. The habitat condition assessment procedure is included in **Appendix D** and the habitat conditions are displayed in **Figure 7**.

The five habitat conditions (R-0, R-1, R-2, R-3, and R-4) are described as follows:

- R-0: Habitat areas with desired species composition that have sufficient, but not excessive, sagebrush canopy and sufficient grasses and forbs in the understory to provide adequate cover and forage to meet the seasonal needs of sage grouse.
- R-1: Habitat areas which currently lack sufficient sagebrush and are currently dominated by perennial grasses and forbs, yet have the potential to produce sagebrush plant communities with good understory composition of desired grasses and forbs.
- R-2: Existing sagebrush habitat areas with insufficient desired grasses and forbs in the understory to meet seasonal needs of sage grouse.
- R-3: Sagebrush habitat areas where pinyon-juniper encroachment has affected the potential to produce sagebrush plant communities that provide adequate cover and forage to meet the seasonal needs of sage grouse.
- R-4: Habitat areas which have the potential to produce sagebrush plant communities, but are currently dominated by annual grasses, annual forbs, or bare ground.

The acreage of each habitat condition rating by PMU is provided in **Table 2**. The habitat condition assessment will be used as a planning tool for the watershed assessments. Approximately 78 percent of the planning area is comprised of R-0, R-1, and R-2 habitats; therefore the potential exists to improve habitat quality on almost 8 million acres.

In addition to the upland habitats, the riparian meadows and springs are important habitats for sage grouse in late summer. The BLM Elko Field Office has rated 912 miles of riparian areas in terms of lotic proper functioning condition (PFC) and has estimated that 178 miles (19.5 percent) of the riparian areas were at PFC, 153 miles (16.8 percent) were functioning at risk with an upward trend, 122 miles (13.4 percent) were functioning at risk with a downward trend, 125 miles (13.7 percent) were functioning at risk and trend was not determined, and 335 miles (36.7 percent) were rated as not functioning. In addition, of the approximately 5,600 acres of lentic habitat within the planning area, approximately 2,700 acres have been evaluated with regard to PFC. Of the acreage evaluated to date, 2,137 acres (78.5 percent) were rated at PFC, 70.5 acres (2.6 percent) were functioning at risk with an upward trend, 97.1 acres (3.6 percent) were functioning at risk and trend was not determined, 288.2 acres (10.6 percent) were functioning at risk with a downward trend, and 130.2 acres (4.8 percent) were not functioning. These totals do not include riparian habitats on private lands and represent only the total riparian areas that have been assessed.

The habitat quality concept is illustrated in **Figure 8**. The habitat parameters from the Sage Grouse Guidelines (Connelly et al. 2000) were used to determine where sage grouse seasonal habitats occur within the basic conceptual successional model. Pre-nesting, early brood habitat, and nesting habitat all fall within the time period when herbaceous vegetation is dominant or co-dominant with sagebrush. The forbs and insects are important components of the pre-nesting diets of hens and early diets of chicks. The abundant herbaceous cover also provides the lateral screening cover for the nest site and to help conceal the hen when she leaves or

returns to the nest. Late summer and winter habitats have a higher component of shrubs than the “production” habitats associated with nesting and early brood habitat. Herbaceous vegetation in the uplands is not an important factor in late summer and winter.

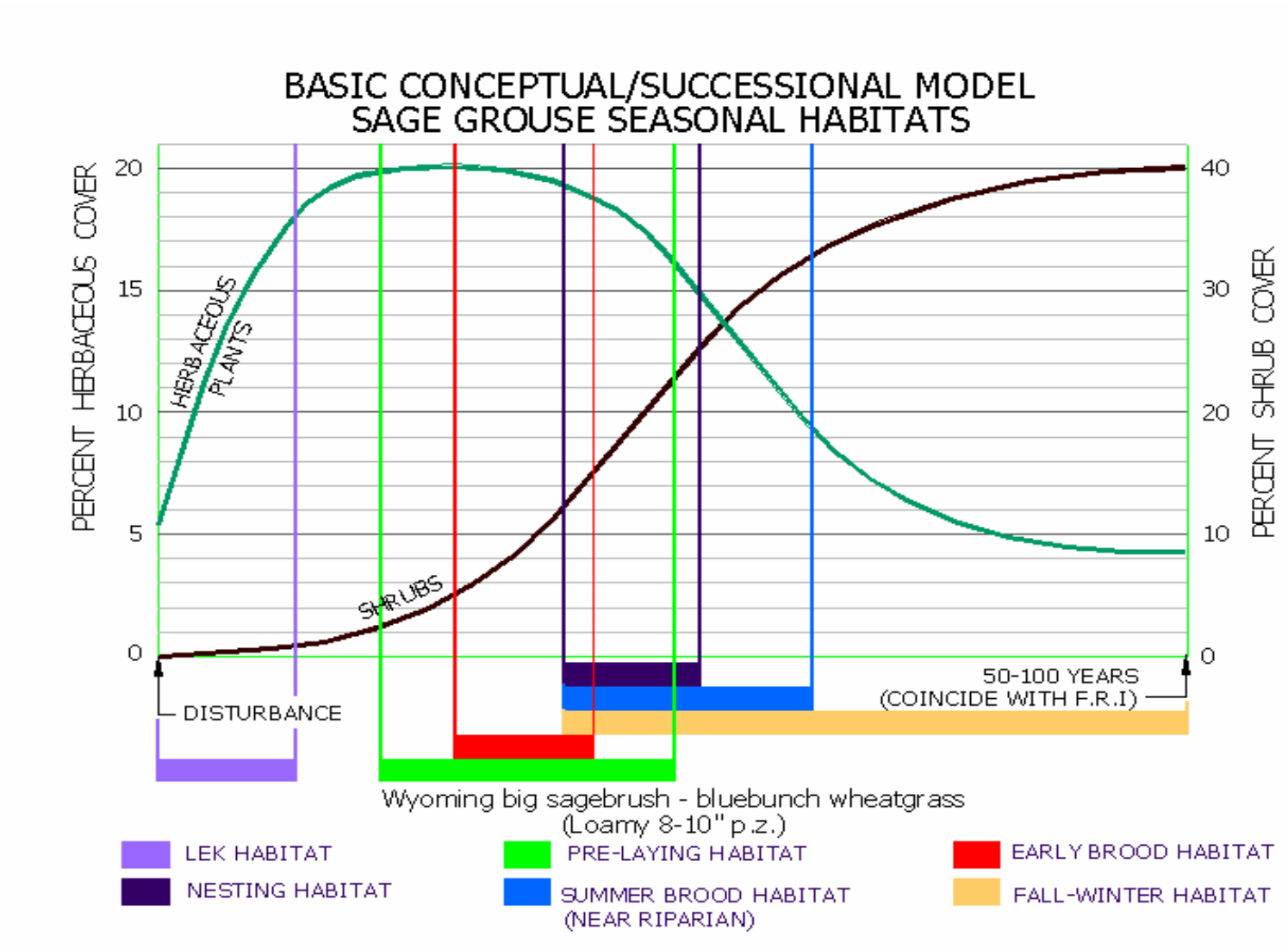


Figure 8: Sage Grouse Seasonal Habitats with Respect to the Basic Conceptual Model, Loamy 8-10” p.z. Range Site

Table 2: Estimated Acreage of Habitat Condition by Population Management Unit (PMU) within the Planning Area

PMU	R-0 (Intact)	R-1 (Perennial Grassland)	R-2 (Poor)	R-3 (P/J)	R-4 (Cheatgrass)	Non-Habitat	Total
Desert	568,272	17,860	438,631	0	7,856	75,963	1,108,582
Island	192,912	410	0	0	0	66,064	259,386
North Fork	1,261,252	92,011	189,240	2,485	19,119	167,124	1,731,231
Tuscarora	588,029	284,186	284,108	0	126,560	102,229	1,385,112
South Fork	364,428	272,808	187,934	57,022	37,573	450,171	1,369,936
ONeil Basin	630,096	144,535	130,189	4,033	2,926	102,342	1,014,121
Snake	245,647	103,340	119,904	11,078	14,524	43,627	538,120
Gollaher	366,148	204,442	162,402	139,454	0	39,771	912,217
Ruby Valley	253,339	41,233	318,979	62,080	4,332	435,077	1,115,040
East Valley	334,982	8,789	186,311	78,339	38,683	143,543	790,647
Total	**4,805,105**	**1,169,614**	**2,017,698**	**354,491**	**251,573**	**1,625,911**	**10,224,392**

2.5.3 Habitat Fragmentation

Habitat fragmentation consists of breaking up large areas of habitat into smaller, isolated areas of habitat. Species need to move through "non-habitat" to use the resulting patchwork of suitable habitats. The "non-habitats" can be physical/psychological barriers (e.g., roads or fences), blocks of unsuitable habitat (e.g., crested wheatgrass seeding or annual grassland), or other zones that a species avoids due to predation risks (e.g., adjacent to transmission lines). Fragmentation impacts vary by species due to the home range, daily range, and territorial requirements of different species. A species that spends an entire lifetime on only a few acres may not be impacted by the construction of a road or implementation of a crested wheatgrass seeding within a quarter mile of its home range, whereas a species that requires a large home range or seasonal habitat area may be impacted by breaking a large block of habitat into smaller patches. There is very little data pertaining to road density and sage grouse. There is evidence that sage grouse will use roads for leks, but the level of traffic would have to be light during the hours of breeding display for this to be successful. In general, the fewer the roads and the lighter the traffic level, the less impact there is to sage grouse from roads. Preliminary estimates of road mileage within the planning area include 775 miles of primary and secondary roads (paved Interstate highway and State highways, respectively), 2,511 miles of hard improved roads (gravel/county roads), and 17,833 miles of unimproved roads. This equates to approximately 1.2 miles of road per square mile.

Utility line support structures may also influence habitat use. There has been some suggestion that predation on male sage grouse at leks is increased by raptors using transmission line supports as perches near leks. This has not been demonstrated in a scientifically controlled study and seems very unlikely to occur. The premise by Hall (in press) that transmission line structures provide an advantage for raptors to prey on males at leks needs to be examined. Leks are used for many years. This consistency in time and space makes the lek a predictable resource. Raptors will attempt to exploit this resource with or without perches. A resource that is predictable in time and space can be hunted efficiently on the wing, using the element of surprise. Use of existing cover (i.e., flying low over the sage brush to decrease the angle of detection) and using the existing topography (i.e., approach from the blind side of the ridge) are more likely to be successful than initiating the attack from a perch in full view of ten to 50 prey. Although the literature indicates that attacks by eagles at leks are common, the attacks are most often unsuccessful (Scott 1942, Stanton 1958, Rogers 1964, Wiley 1973b, Autenrieth 1981). The timing of the breeding

display before dawn to shortly after sunrise has been hypothesized as a response to predation pressure (Hjorth 1970, Hartzler 1974, Bergerud 1988b, Phillips 1990). This is a period when sufficient light is present to effectively display but there is insufficient light to make the sage grouse highly visible. It is also the time when owls return to their day roosts and prior to initiation of hunting by eagles, although there is some overlap of the breeding display with the hunting period of both owls and eagles.

The addition of support towers or other perches into otherwise perch-free habitats does not necessarily equate to increased predation pressure on the leks. Avian predators can prey on males at the lek with or without the transmission line. However, where the support tower is relatively close to the lek, the presence of a predator in full view may be sufficient to make the males too "nervous" to display, resulting in lek abandonment. There is likely some "comfort zone" that sage grouse have with regard to elevated perches such as rock outcrops, woodlands, and transmission lines. Avoidance of these structures up to a distance whereby detection of a raptor leaving the perch allows sufficient time for escape would seem to be a prudent behavior.

In contrast to leks, nests are a resource that are unpredictable in space, but somewhat predictable in time (i.e., only during the breeding season). Detection is a necessary step to successful predation. A "perch and search" approach is an effective strategy for this type of resource, especially when there are cues to the nest location. The hen leaves the nest at least twice per day to feed, defecate, and exercise; this is accomplished by sneaking through the vegetation until some distance from the nest. At this point, the hen may fly to another area. If the flight is detected, or if the hen is detected while sneaking from the nest, ravens will investigate the area in search of the nest. This may be unsuccessful for several attempts; however, the hen leaves the nest by a different route during each recess, and the patient predator can narrow down the search area within a few days. The end result is a high level of nest predation.

Successful sage grouse hens have high nest site fidelity. However, if nest success in an area is low due to nest predation, fewer and fewer young would be produced. Eventually, over a period of years, the number of nesting hens in the vicinity of the transmission line would be expected to decline through natural mortality. Without replacement hens being produced, breeding opportunities for the males would decline, and subsequently, attendance at the lek would decline.

2.5.4 Changing Land Uses

Change in land use refers to a change from wildlife habitat or livestock grazing to another land use that represents a long-term or permanent change. This includes changes associated with construction of reservoirs, recreational developments, urban sprawl, or other developments. The impacts are similar to those discussed under Habitat Quantity, but because of the permanent or long-term nature of these changes, the habitat values are generally not recoverable.

Human population growth and the trend for rural lifestyles have resulted in urban development within former sage grouse habitats. In Elko County this is best exemplified by the development of the Spring Creek area, approximately 30 square miles in extent, with zones of development and undeveloped zones. Similar, but less extensive developments have taken place around Jackpot, Wendover, Carlin, Osino, and Adobe Summit. Not all of these have impacted sage grouse habitat, but they do represent an expansion of human population into rangelands. South Fork Reservoir and the associated recreation area and housing developments are also examples of permanent land use changes that reduce the amount of habitat available to wildlife and change the other range uses of the area. These types of land use changes are anticipated to increase as the population of Elko County increases, or as demands for certain types of recreation increase.

In Elko County the opportunity for urban development is somewhat limited by the current land status. Most of Elko County is public land administered by federal agencies. The bulk of the private land is associated with the checkerboard land status along the railroad corridor and a few large blocks of private land created through various land exchanges. The private lands within the checkerboard corridor have been recently made available for purchase and rural developments and ranchettes have increased in these areas, or are likely to occur.

2.5.5 Livestock Grazing

Perhaps one of the most controversial but least understood issues is livestock grazing. Those who advocate listing sage grouse under the ESA portray livestock grazing as the major factor in sage grouse declines across the West (Kerr 2001, Braun 2001), while those who support the livestock industry portray livestock grazing as the major factor for the existence of sage grouse (and other wildlife) in the West. Both views have some substance, and both views have some fallacy.

Beck and Mitchell (2000) reviewed the limited information regarding livestock grazing impacts on sage grouse habitat and found that livestock grazing practices or range improvements that remove sagebrush from a site have adverse impacts on sage grouse, at least for the short-term. Long-term studies of these practices were not presented. Grazing levels that created poor conditions on rangelands or meadows also had adverse impacts on sage grouse. Livestock grazing resulted in some nest desertion and egg destruction. Potential population impacts were only related to practices that impacted nest success and early chick survival. Conversely, light to moderate grazing of meadows created conditions favorable for sage grouse by reducing dense grass growth and stimulating forb growth and nutritional content. Rest-rotation grazing systems promoted forb production, and practices that reduce sagebrush cover were associated with increased herbaceous cover (Beck and Mitchell 2000). Although the studies of these issues are limited in number, the general conclusion is that livestock grazing practices and range improvements that maintain healthy rangeland and riparian conditions are compatible with sage grouse management, and those practices or range improvements that degrade rangeland and riparian conditions create adverse impacts to sage grouse.

The Elko Field Office, BLM administers 226 grazing allotments within the planning area totaling approximately 8,585,000 acres. Ninety-five of these allotments, accounting for 5,313,000 acres (or 62 percent), have been through the allotment evaluation process and have had final multiple use decisions issued. These allotments are under grazing systems intended to improve rangeland health with regard to the RAC Standards and Guidelines.

One of the keys to understanding historic impacts and current grazing "impacts" is to understand plant physiology and how herbivory[5] interacts with the plant. Plant physiology varies with life form (e.g., shrubs, grasses, forbs), seasonal growth patterns (e.g., cool season grasses vs. warm season grasses), and life history (e.g., perennial plants vs. annual plants). The following discussion is applicable to perennial plants of the various life forms and seasonal growth patterns. Annual plants do not conform to this general pattern.

For established plants, growth at the beginning of the growing season is based on the carbohydrate reserves in the root system. As the above ground leaves develop, they begin to conduct photosynthesis and produce additional carbohydrates for plant growth. Eventually, the transfer of carbohydrates from the roots to the growing shoots ceases, as the above ground plant parts reach sufficient mass to support additional growth. At this point, additional growth results in carbohydrates transferred from the above ground plant parts to the roots, replacing the carbohydrates used thus far in the growing season. Nutrients and water continue to be transported to the above ground parts of the plant to be used for reproduction. The replacement of root reserves continues until the seeds (or fruits) are ripe and the plants begin to desiccate in advance of dormancy during the non-growing season (**Figure 9**).

The various grasses, forbs, and shrubs initiate growth at different times and go dormant at different times, or in the case of sagebrush, continue to conduct photosynthesis throughout the year. But in general, they follow the pattern of carbohydrate use and production described (simplified) above. From this discussion, it is apparent that a plant must have sufficient root reserves at the beginning of the growing season to support the plant until sufficient new growth is obtained so that the equilibrium between carbohydrate use and carbohydrate production is established. The level of root reserves for the current year is determined during the previous growing season by factors such as moisture and

[5]Herbivory is the removal of foliage or plant parts by animals, wild or domestic. Grazing in this document is used to indicate foliage removal by domestic livestock only.

nutrient levels, competition with other plants, herbivory, or disturbance (e.g., fire).

The carbohydrate cycle provides one mechanism for understanding how herbivory can affect plant condition and survival. Using the carbohydrate cycle model, the potential impacts of foliage removal can be analyzed. Grazing early in the season reduces the amount of above ground foliage, requiring more root reserves to be utilized before reaching the equilibrium point. Root reserves that are used to produce the early green up are removed as foliage by the herbivore. Repeated grazing of the same plant in the same year during the early growth period stresses the plant, perhaps to the level that formation of the reproductive parts cannot be achieved, especially if the growing season is not of sufficient duration to allow the plant to replenish the root reserves. Repeated early season grazing over subsequent years continually lowers the root reserves, reducing the ability of the plants to produce seeds (Laycock 1979). However, this requires that all plants be grazed and that all portions of the plant be removed. Any herbivory that results in only a portion of the plant being removed, or only affects a portion of the total number of plants, would have less of an impact. Repeated spring grazing by domestic sheep in southeastern Idaho resulted in a decrease in perennial forb cover and increases in the cover of shrubs and grazing-tolerant perennial grasses (Bork et al. 1998).

Not all plants initiate growth at the same time; therefore, the herbivore may switch among plants during the season. The more species of plants available, the less likely any one species will experience the bulk of the herbivory. Also, with a shorter the grazing period, it is more likely that some plants will be in a growth stage that is not impacted by herbivory. Altering the grazing period from one year to the next also reduces the likelihood that any one species would be impacted every year. Slight to moderate levels of grazing, with non-uniform distribution of the grazing, are likely to have less impact during the early season than heavy, repeated, and uniform grazing within a pasture.

Grazing during the latter portion of the growing season can limit reproduction and reduce the ability of the plant to replenish the root reserves. Regrowth of foliage is less likely as soil moisture declines, and the plant has switched physiological pathways to produce the reproductive parts. Without regrowth, the unused foliage must replenish the root reserves. The caveat provided above for early season herbivory also applies; partial removal of the foliage, or only grazing some of the available plants, will reduce the impact.

Grazing the above ground foliage during the dormant period does not impact the carbohydrate reserves. Foliage removal during this period does not impact the plant; however, the protein level of the foliage declines as the foliage dries out, reducing the value of the forage to the herbivore. Bork et al. (1998) found that repeated fall grazing by domestic sheep in southeastern Idaho decreased shrub cover and increased perennial grass and forb cover. Sheep utilized more brush in their diet during this time period because of the lowered nutritional value of the dormant herbaceous vegetation.

West et al. (1984) found no increase in total herbaceous production in big sagebrush range in Utah following 13 years without livestock grazing. In southeastern Idaho, 25 years without livestock grazing in the sagebrush steppe resulted in only a five percent increase in basal cover of perennial grasses (Anderson and Holte 1981). Neuman (1993) demonstrated that root stress (in the form of oxygen deficiency and root restriction), reduces leaf growth and results in increased starch concentration in the leaves (i.e., carbohydrates were not translocated to the roots). Therefore, in the absence of herbivory, the ability of the plant to replenish root reserves can be impacted by other factors, and thus the long-term changes in plant communities that result from plant-plant interactions can occur.

The previous discussion demonstrates that herbivory by wild or domestic animals can impact the herbaceous vegetation; however, it also demonstrates that herbivory can be conducted with minimal impact to the vegetation. By adjusting grazing systems to vary the seasonal timing and intensity of herbivory, and allowing plants to replenish the root reserves, grazing and other land use objectives can be achieved. These impacts and lack of impacts are put into historical perspective in the following discussion.

Over the last 150 years, the combination of plant-animal interactions (herbivory) and plant-plant interactions (competition) have resulted in changes in the plant communities on western

landscapes. The prevalence of grazing in the West has resulted in many people reaching the conclusion that all of the plant community changes have been the result of livestock

Figure 9. General Root Carbohydrate Cycle – Perennial Plants

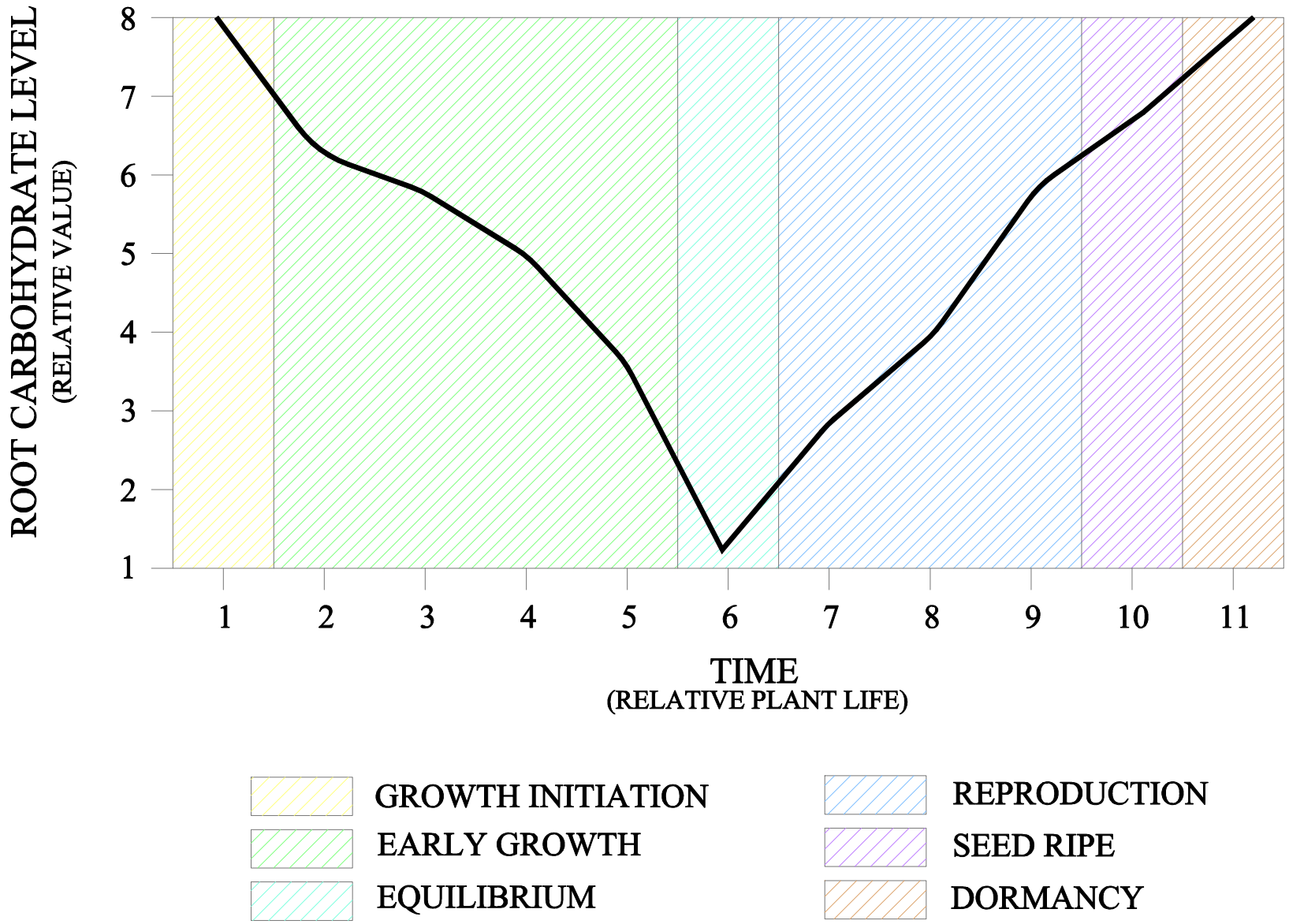


Figure 7. General Root Carbohydrate Cycle - Perennial Plants.

grazing. As the above discussion demonstrated, herbivory can impact vegetation, but the degree of impact is dependent on the intensity of herbivory (i.e., how much of each plant and what proportion of the total number of plants are consumed), the period of time that the herbivory takes place (i.e., early, late, or after the growing season), the duration of the herbivory (i.e., how long during the growing season the herbivory occurs), repeated herbivory at the same time of the year every year, and other stresses on plant physiology.

As discussed in detail in Section 2.4, major climatic changes were occurring at the time of European man's settlement of Nevada. The Little Ice Age was ending and the climatic regime experienced in the 300 years preceding about 1850 was changing from cold and wet to warm and dry. The climatic conditions that supported relatively high vegetation cover, including both sagebrush and herbs, changed to conditions that favored the competitive advantages of shrubs and trees, especially sagebrush (longer growing season, deeper root system, adaptations for retaining limited moisture). The season-long grazing practiced during the early part of this period, combined with a gradual shift to a warmer and drier climate, proved favorable for shrub dominance over most of the Great Basin. However, the introduction of intensive season-long grazing did not immediately create noticeable impacts. The seedbank of perennial grasses and forbs was extensive due to the lack of grazing and high moisture levels preceding 1850. The combination of available seeds and slowly changing climatic conditions allowed heavy grazing pressure to occur over a 20 to 50 year period without causing alarm. Some of the impacts were ameliorated by the removal of sagebrush for fuel in the vicinity of mining communities, reducing the competitive stress to herbaceous plants. Sheep grazing and winter grazing by cattle also impacted the amount of sagebrush on the landscape by the early 1900s. But as the climatic conditions became more favorable for shrubs, the combination of competition between shrubs and herbaceous plants, and season-long grazing depleted the understory of many range sites. The combination of sheep and cattle on the same ranges, either concurrently or sequentially, exacerbated the impacts to the vegetation.

Establishment of the Forest Reserves, precursors to the National Forests, and later the establishment of the Grazing Service, currently the Bureau of Land Management (BLM), resulted in changes to grazing on public lands. Although the initial missions of the Forest Service (USFS) and the BLM included forage production, the management objectives were to improve range condition that had deteriorated during the 1800s and early 1900s. The dominance of the shrub component of the plant communities eventually led to "range improvement" practices. Range improvements included sagebrush control, fencing to create pastures for livestock control, and eventually, crested wheatgrass seedings to increase forage production. Water developments, such as spring developments, water distribution systems, and wells were also completed to facilitate livestock distribution. Some of these range improvements, such as the water distribution systems, wells, and fences, had immediate benefits for wildlife. Where crested wheatgrass was established to replace halogeton, some improvement for wildlife occurred. However, where sagebrush lands were converted to crested wheatgrass, the net impact in the short-term was loss of wildlife habitat. Irrigated pastures also increased habitat values for wildlife, but degraded riparian areas decreased wildlife habitat values.

As the science of range ecology developed, the grazing systems were being designed based on an understanding of plant physiology. Rest-rotation and deferred-rotations systems were based, in part, on the carbohydrate model presented above. A three-pasture rest-rotation system limits the impacts of herbivory on the forage plants by allowing early grazing one year, complete rest the second year, and late or dormant season use the third year. This provides two full growing seasons out of every three years for the plants to complete the growth cycle to produce seeds and replenish root reserves. The one year of early season grazing may not stress the plants if the stocking rate, duration of grazing, and distribution of livestock are adjusted to the site. A deferred rotation basically changes the use from early season to late season from one year to the next. As with the rest-rotation system, this allows herbivory during one growing season, but eliminates livestock grazing during the growing season or until late in the growing season the following year. Short-duration, high intensity grazing and active herding of livestock are two other

practices that show promise for minimizing the impacts of herbivory on western rangelands.
These types of grazing systems have resulted in improvements in range condition. However, as indicated in Section 2.2.4.1, when Wyoming sagebrush exceeds 10 - 12 percent canopy cover, or mountain big sagebrush exceeds 15 - 20 percent canopy cover, sagebrush begins to out compete and displace the herbaceous understory (Winward 1991, 2000), even in the absence of grazing. The stress placed on the herbaceous plants affects the ability of the plants to replenish the root reserves, and eventually the herbaceous plants are greatly reduced within the community. The site-specific plant equilibrium discussed at the end of Section 2.4 would not be achieved in the presence of grazing. In the absence of grazing, the competitive interactions between shrubs and herbaceous plants would be expected to lead to shrub dominance, but not the complete absence of herbaceous plants. In the presence of grazing, the additional stress of herbivory would drive the system to a greater degree of shrub dominance, further decreasing the herbaceous understory (**Figure 10**). This movement beyond the historic plant equilibrium may represent crossing a plant community threshold, and is one "impact of grazing" on rangeland vegetation. However, this impact is largely from lack of vegetation management, rather than from grazing (i.e., lack of disturbance, such as fire, to remove the shrubs). Maintenance of the herbaceous understory is dependent upon disturbance to the sagebrush overstory; changes in grazing practices alone cannot prevent sagebrush from becoming the dominant vegetation. Once sagebrush is dominant, changes in grazing practices alone cannot restore the herbaceous understory.

As demonstrated in **Figure 10**, the "impact" of grazing is less when the grazing occurs in the grass-dominated stages, rather than in the shrub

A second "impact of grazing" on rangelands is the manner in which grazing can drive the system. As discussed above, competition between shrubs and the herbaceous understory occurs when shrubs obtain about 10 to 12 percent canopy cover in Wyoming big sagebrush communities and 15 to 20 percent in mountain big sagebrush communities (Winward 2000). Once that threshold is reached, the system will move to shrub dominance over time due to interspecific competition if disturbance does not occur. The introduction of livestock grazing into this plant community dynamic decreases the time necessary to reach shrub dominance. Therefore, the natural disturbance interval is no longer the appropriate interval for the system. A shorter interval must be imposed on the plant community if livestock grazing is present, at least in the Wyoming big sagebrush plant communities.

A third "impact of grazing" is the reduction of herbaceous fuels in the sagebrush-herb community, especially where season-long grazing is practiced. The removal of the fine fuels effectively prevents fires from spreading over large acreages, extending the fire interval. The absence of disturbance allows the woody fuels to accumulate in excess of "natural" levels. As the shrub density and/or crown size increases, the shrubs become sufficiently close that the fine fuels are no longer required to maintain fire spread. The resulting "crown fires" are generally of high intensity and severity, with high potential for type conversion to annual grasslands. This "impact" can be eliminated by implementing fuels management plans that break up the contiguous fuels created under this scenario.

Recently, emphasis has focused on the maintenance and rehabilitation of riparian systems. Riparian stability or instability is generally perceived to be the result of poor land management practices, including improper livestock grazing. While improper grazing can certainly create riparian damage, there may be other underlying factors that contribute to riparian degradation. As with the other issues affecting sage grouse, there are many factors involved. Masters et al. (1991) present the case that base level lowering within a hydrographic basin creates a steepened gradient, which then induces accelerated flow, causing the formation of a headcut. As a headcut migrates upstream, a corresponding downstream deposition of eroded material results in the creation of deltas, sandbars, or build up of flood plains. The areas of deposition often become wetlands and improve the functioning of the downstream system. However, the major impact of base level lowering is the general lowering of the water table. Areas that once supported riparian vegetation, such as stringer meadows and flood plains adjacent to the creeks, cease to function as riparian systems, and sagebrush,

rabbitbrush, or other shrubs establish on the elevated banks.

These changes in riparian areas resulting from base level lowering occur with or without

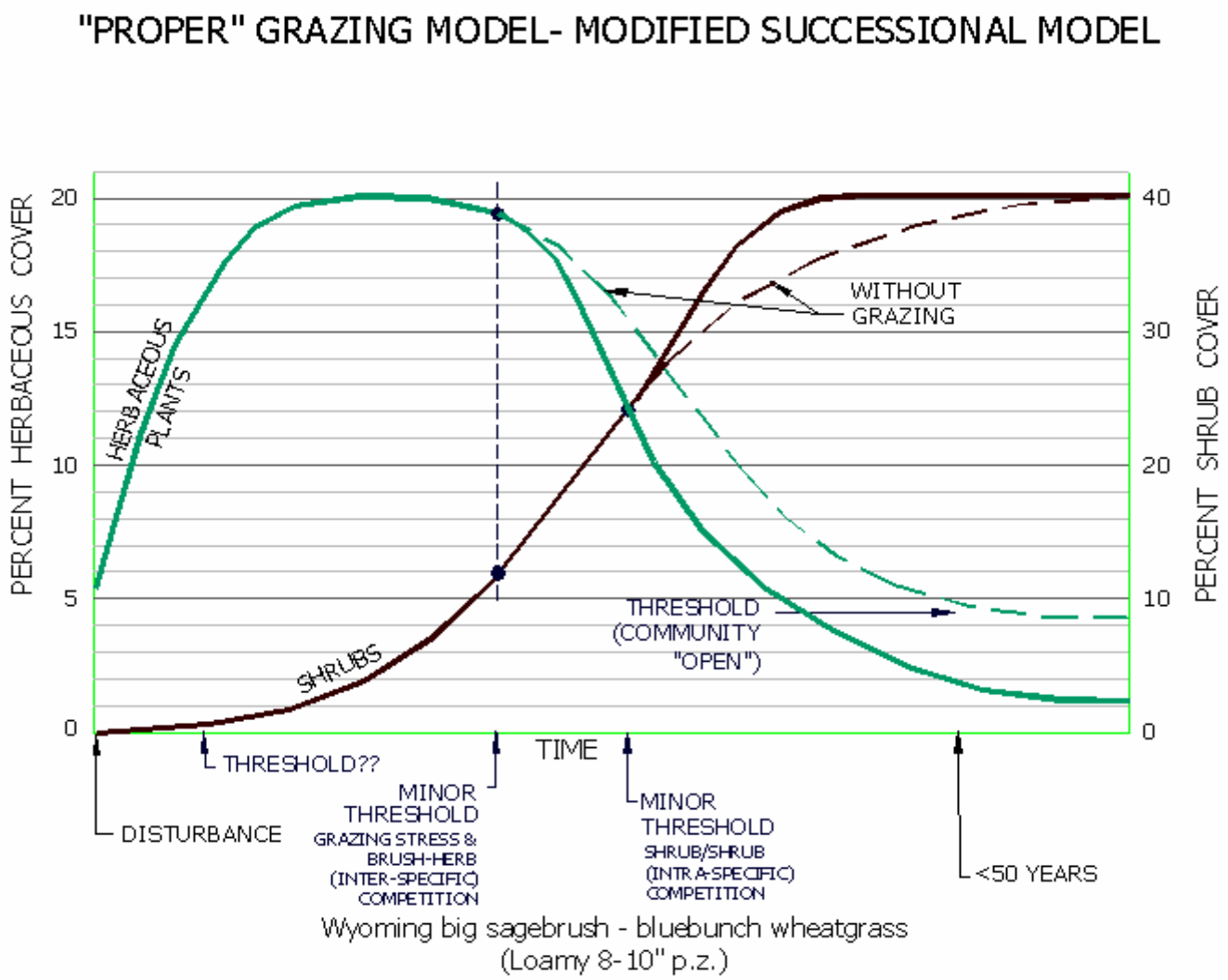


Figure 10: Basic Conceptual Model with Proper Grazing, Loamy 8-10” p.z. Range Site

livestock grazing, but can occur more rapidly with improper grazing. The prevalence of grazing in the West has tended to mask these other factors. But the 500 foot drop in base level in the Humboldt River system from where the Humboldt River emptied into Lake Lahontan and the current level of the Humboldt Lake (Sink) is still affecting the entire drainage system across northern Nevada (Masters et al. 1991). This is a process that initiated prior to European settlement of Nevada (Schumm and Hadley 1957, Davis and Elston 1972), and will continue into the future, irrespective of past, present, or future land use. Changes in grazing systems or removal of grazing from a meadow will not prevent the loss of the meadow if the erosion processes associated with base level adjustments are the driving factor.

Recently, studies in western and central Nevada have identified that some riparian issues may be the result of climatic factors occurring over 2000 years ago (Miller et al. in press). Deposition of wind blown sediments into drainages during extended drought may have built up the floodplains beyond the capacity of the streams to flush these sediments under drought conditions. Vegetation establishment on these areas of deep, fine sediments was sufficient to maintain the floodplain during normal events, but extreme events appear to cause these systems to seek the former equilibrium base condition (i.e., the channel level prior to sedimentation build up). Some of these extreme events that caused major headcutting occurred before the introduction of domestic livestock into Nevada. This could be evidence that some of the incised streams may be a result of factors other than livestock grazing, or a combination of factors, including livestock grazing. Suzie Creek and Dixie Creek in Elko County may be two examples of streams where downcutting is occurring through fine, wind deposited sediments that accumulated thousands of years ago.

This is not to imply that all riparian problems are the result of base level lowering and historic drought conditions. Utilization mapping of allotments in Elko County consistently demonstrate the heaviest utilization occurs on riparian areas and upland areas adjacent to water sources, especially where grazing occurs late in the season (or hot season). Because riparian systems have higher soil moisture levels, the plants have the ability to regrow after grazing and can replenish the root reserves, if grazing does not occur throughout the entire season. In addition, soil compaction occurs in moist soils as the result of concentrated use by livestock, reducing the water holding capacity of riparian soils. Bank trampling can also result in a change in the stream channel morphology, increasing the potential for erosion.

Rehabilitation of riparian systems has been the focus of livestock management over the last 20 years. Attempts to fence riparian zones resulted in drastic changes in the vegetation, but long-term maintenance of exclosures has been ineffective, and the “improvements” can be reversed in relatively short time if the fences fall into disrepair. In addition to creating a maintenance problem, fencing riparian areas also resulted in some areas converting from a riparian meadow to riparian shrub zones. The rank growth of grass and/or shrubs changed the wildlife values of these fenced areas, benefiting shrub-dependent species and decreasing the value of these areas for open meadow species, such as sage grouse.

Small exclosures around springs or riparian zones are being replaced with riparian pastures. This essentially creates a small pasture within a larger existing pasture. The riparian pasture is large enough to permit grazing under controlled or prescriptive conditions. By including some adjacent rangelands within the pasture, the pressure on fences is reduced because the livestock are farther away from the riparian vegetation and are not as persistent in trying to enter the pasture. The prescriptive grazing allows for management of the upland vegetation and the riparian zone.

Proper management of riparian systems requires an understanding of the ecological basis for the overuse that occurs in these systems. In northern Nevada, grazing occurs while the cow is lactating. A lactating cow has higher nutritional and water requirements than a steer. During the early part of the growing season, the nutritional needs can be met while grazing fresh grass on the uplands. The succulent herbaceous forage provides much, but not all of the water requirements. Therefore, some use of a riparian area or an area near a water source is anticipated. As the growing season progresses and the upland vegetation begins to lose moisture content, more of the cow’s water needs must be met by either free

water, or from more succulent vegetation found in riparian areas. This increased need for water coincides with higher daytime temperatures and increased solar radiation. The cows seek areas with shade, such as willow stands, aspen stands, pinyon-juniper woodlands, or areas of Basin big sagebrush. As the uplands continue to desiccate, the protein level of the herbaceous vegetation declines, and the nutritional demands of the lactating cow can no longer be met by grazing the uplands. The quantity of forage required to obtain the same level of nutrition increases as the forage dries in late summer. Foraging efficiency becomes a factor in where to forage. Steep hillsides with dry forage do not provide the same efficiency as valley bottoms with riparian vegetation, water, and shade. Therefore, the riparian areas become more attractive.

The situation with yearling steers is similar, but the nutritional and water requirements are not as great as for a lactating cow. Therefore, steers can and do get more of their water requirement from the upland vegetation longer into the season, and they can meet their nutritional needs from the upland vegetation until late summer. Steers are also more likely to feed on steep slopes. As a result of these factors, utilization mapping of yearling steer operations tend to show less concentrated use of the riparian zone and more extensive use of the uplands. However, steers left in one pasture for the entire grazing season, or for just the period of August through September, will increase their use of the riparian zone as the summer passes. The level of impact to the riparian zone depends in part on the extent of the riparian zone, as well as the number of steers in the pasture.

Riding to move livestock out of riparian areas and experiments with herding to keep livestock on the move have shown promise as techniques that can minimize impacts to riparian systems. However, to be effective, there must be another water source or riparian area to which the livestock can be moved. Using the uplands and riparian areas in conjunction with each other by moving livestock out of riparian areas or by herding, rather than using the uplands and riparian areas sequentially, has potential to decrease impacts to the riparian areas.

These techniques can be facilitated by proper vegetation management. Foraging efficiency is not only dependent on the nutritional level per bite of forage, but also on the number of bites of forage that can be obtained over time. Rangeland dominated by sagebrush with a depleted understory cannot be foraged as efficiently as the same landscape with less shrub cover and more herbaceous cover. Old, ungrazed plants are less palatable to livestock and have less nutritional value compared to younger plants or plants that have been moderately grazed the previous year. Consequently, portions of pastures that are distant from water are likely to have more older or ungrazed plants than areas closer to water. Herding livestock into these areas to force them to graze the plants will stimulate new growth in subsequent years, making the plants more nutritious and palatable to livestock. Shrub thinning to create opportunity for establishment of more herbaceous plants can also be used to attract livestock to these areas. As a result, some grazing pressure can be transferred from the riparian areas to the uplands.

As we develop a better understanding of the processes that affect landscape changes (i.e., geomorphic processes, plant-animal interactions, plant-plant interactions), the ability to manage these changes will increase. As we develop a better understanding of how these various processes interact, the “cause and effect” relationships that we perceive today are likely to change.

2.5.6 Fire Ecology

The trend toward increased size, intensity, and frequency of wildfires in recent years has focused attention on fire ecology. The discussion in Section 2.4 includes some historical information regarding fire ecology. The climatic, paleobotanic, and historic evidence indicates that fire was a factor in the sagebrush ecosystem long before European man’s arrival (Miller and Wigand 1994, Miller and Rose 1999, Miller and Eddleman 2000). The landscape that existed in the early 1800s was a result of the interaction of geomorphic conditions, climatic factors, and fire history. The role of Native Americans in modifying the landscape in northeastern Nevada is not well documented. Escaped fires from camps are likely to have occurred on occasion, but the intentional use of fire to affect vegetation change on the landscape may not have been a technique used by Shoshone and Paiute tribes in this area. The reliance on pine nuts as a food staple would

suggest that extensive burns in the pinyon-juniper woodlands would not have been beneficial in the short-term.

Geomorphic features, such as soil, topography, and drainage patterns influence fire behavior. Soils determine the productivity of a site, as well as the vegetation that exists on the site. Low sagebrush is generally associated with claypan soils. This plant community has low fuel loading, low structure, and wide spacing between plants, all factors that retard the spread of fire. Conversely, deep soils along drainages or valley bottoms often support dense vegetation, such as Basin big sagebrush and Great Basin wildrye. The heavy fuel loading, continuous fuels, and high structure are factors that create intense fire conditions. Topography can also influence the spread of fire. For example, south facing slopes generally are dry sites that do not support dense vegetation. These slopes can function as a fire break under some conditions. The more mesic north slopes support a higher fuel loading, such as the mountain brush type, and are more likely to carry a fire than the vegetation on a south slope.

Perhaps the major factor in presettlement fire patterns was the configuration of drainages on the landscape. The extensive dendritic patterns typical of the North Fork of the Humboldt River, consisting of many tributaries dissecting the landscape, were riparian areas of high fuel loading, but also areas of fuel with high moisture content. During “normal” years, these natural greenstrips probably acted as fire breaks, limiting the size of fires. The topography associated with these drainages may also have influenced the fire pattern. The drainages with east-west orientation would be bordered on the north side by a south-facing slope, further adding to the fire break potential. During drought years when fuel moisture would have been lower, the high fuel loading typical of riparian areas would have contributed to the fire intensity and allowed fires to continue across the landscape. Other areas, such as Ruby Valley and Independence Valley (east of Wells), were lacking the extensive dendritic drainage patterns. In these areas, mountain creeks become intermittent flows at the valley floor where the flows enter the ground water in the alluvial deposits. Fires in these closed basins probably burned the entire valley, depending on local winds and storm precipitation.

Climate changes also influenced fire ecology. The 300 years preceding European settlement of Nevada was a period of cooler temperatures and higher precipitation than currently exists (Miller and Eddleman 2000). The increased moisture would have favored plant production, and the combination of cooler temperatures and higher moisture conditions would have been less favorable for large, intense fires. In general, small, widely spaced fires are expected under these conditions, resulting in a mosaic of vegetation age classes on the landscape. However, even during this period known as the Little Ice Age, drought conditions occurred periodically. The high fuel loading created during the wet years would have created conditions for large, intense fires in the drought years.

Fire history also influences the vegetation that exists on a site at any given time. For example, in a Wyoming big sagebrush site, during the first ten years after a fire the site is generally dominated by grasses. During the next ten to 15 years, shrubs begin to establish and add to the fuel loading. From 15 to 40 years post-fire, the shrub component increases and the herbaceous vegetation decreases. After 40 years, the shrub component dominates the site and fuel loading is high. A lightning strike in each of these site conditions will result in different types of fires with different vegetation responses.

Each range site responds to varying fire intensities differently from other range sites. However, some general patterns exist that serve as a basis for understanding the role of fire frequency or fire interval. Fire frequency is the number of times a site burns over a specified number of years. For example, four burns in 100 years. Fire interval is the average time between burns. Using a fire frequency of four burns in 100 years equates to a fire interval of 25 years. In general, fire frequency and fire interval are related to fuel loading and the frequency of ignitions.

For a mountain big sagebrush community, historic fire intervals are estimated to be on the order of 25 years (Winward 2000, Gruell et al. 1994, Miller and Rose 1999). Following a fire in this community, mountain big sagebrush often establishes within the first few years. Within ten to 15 years, a brush community is well established and the site has sufficient fuel loading to burn again under “normal” conditions. This vegetation community is generally found

above 6,500 feet amsl and is subject to a higher frequency of storm events or ignition strikes. This results in a long term average fire frequency of approximately four fires every 100 years, or a fire interval of 25 years. Due to the random nature of lightning strikes and the variability of conditions (relative humidity, fuel moisture, wind speed, etc.) at the time of a lightning strike, there is considerable variability associated with the 25 year average fire interval.

The fire interval for Wyoming big sagebrush communities is somewhat longer, perhaps 50 to 100 years (Wright and Bailey 1982), or as short as 40 years (Winward 2000). Wyoming big sagebrush is found at lower elevations than mountain big sagebrush and on more xeric sites. Wyoming big sagebrush seedling establishment is also dependent on two consecutive years of normal or above normal winter precipitation (Maier et al. 2001); therefore, establishment of this species after a fire is weather dependent. Sagebrush seed does not establish far from the mother plant, which also limits the rate at which Wyoming big sagebrush recolonizes a burn. As indicated above, it may take up to 40 years before Wyoming big sagebrush is sufficiently established to provide fuel loading capable of sustaining a fire. Considering the combination of conditions suitable for ignition and time required to establish sufficient fuel loading, a 40- to 100-year fire interval for this vegetation community is a reasonable estimate.

Low sagebrush, as indicated above, does not burn often. Estimates of presettlement fire intervals for the low sagebrush community range from 100 to 200 years (Young and Evans 1981, Miller and Rose 1999). This may be less a function of fuel loading, which may reach optimum in less than 100 years, and more a function of ignition frequency under the extreme conditions (extremely low relative humidity with high winds) necessary to burn this vegetation type. The conditions under which low sagebrush communities burn are the conditions under which catastrophic fires occur, and every plant community burns.

At the end of the Little Ice Age and the introduction of livestock in the Great Basin, the conditions that led to these fire intervals changed. The Little Ice Age ended around 1850 and the climate started to shift from cool and wet to warm and dry. These climatic changes over the last 150 years, in the absence of grazing, would have resulted in less fuel production, but increased frequency of suitable burn conditions. More frequent burns would have resulted in less shrub dominance on the landscape and more areas dominated by herbaceous plants. The spacing of the bunch grasses would have been greater, due to the reduced moisture availability. However, livestock grazing also influenced the fire interval. Season-long grazing and the high stocking rates that were typical of the late 1800s and early 1900s reduced the availability of herbaceous fuels by late summer. Shrub removal as fuel for mining communities, shrub reduction by sheep grazing, and reduced shrub establishment due to drier conditions also reduced fuel loading. Consequently, lightning strikes, no matter how frequent or under all but extreme conditions, were not likely to start a fire, or the fires were not able to spread very far.

Changes in grazing following the creation of Timberland Reserves (1891), implementation of forest grazing regulations (1911), and passage of the Taylor Grazing Act (1934) resulted in fewer livestock and better distribution of livestock on public lands. Sagebrush was reestablishing in areas where it had been removed for fuel as the mining boom waned. By the mid-1900s sagebrush was a dominant plant on the rangelands and a variety of age classes existed. Fuel loading had increased by this time, but grazing was still sufficiently heavy to keep fine fuels in check. The lack of herbaceous understory and the abundance of sagebrush, along with the spread of halogeton, resulted in sagebrush control and crested wheatgrass seedings to increase livestock forage. Cheatgrass was becoming more common in the understory of many sagebrush communities and dominating disturbed sites, but was not a major concern in the 1950s.

Records of large wildfires between 1900 and 1960 are negligible. However, in the 1960s, several large fires occurred in northern Nevada. The northern portions of Lander and Eureka counties had large acreages burned, and cheatgrass began its domination of Boulder Valley and areas near Beowawe and Dunphy, Nevada. Over the next 40 years, areas that had historic fire intervals of 40 to 100 years prior to settlement and only small fires between 1850 and 1960, burned on average once every decade. The spread of cheatgrass from these areas to other sagebrush communities

increased the flammability of these communities, resulting in cheatgrass dominance as fires started in these altered plant communities. By 1999, the open stands of sagebrush of the 1950s had become dense stands of sagebrush, many with a cheatgrass understory. The extreme conditions in July and August of 1999, combined with thousands of lightning strikes, caused wildfires that burned over 1.7 million acres in the Great Basin. Similar situations occurred in 2000 and 2001, but involved less acreage in Nevada. Not all of the acres burned converted to cheatgrass and not all of the acreage required emergency rehabilitation; however, the acreage that was sagebrush is not likely to support sagebrush for the next 10 to 15 years or longer.

The major fire outbreaks that have occurred over the last four decades have been the result of changing conditions on the landscape (e.g., changes due to livestock grazing, cheatgrass expansion, sagebrush domination, cumulative impacts of historical fire suppression efforts, etc.) and changing climatic conditions. Consequently, the fire interval has decreased on large acreages of rangelands to a decade or less. This decreased interval (or increased fire frequency) is not favorable for shrub establishment. Continuation of this pattern will result in a change from sagebrush dominated rangelands to grass dominated rangelands; either perennial grasses, annual grasses, or a combination of both.

Since 1980, approximately 1.8 million acres of sagebrush habitats have been affected by fire in Elko County. Intact sagebrush remains on 9,809,800 acres, perennial grasslands (i.e., areas seeded to crested wheatgrass since the 1950s, areas seeded following fires since 1980, areas burned above 6,000 feet elevation in the past five years and not seeded following wildfire, and areas burned below 6,000 feet elevation in the past ten years and not seeded following wildfire) occur on approximately 1,342,000 acres, and annual grasslands (cheatgrass monocultures created by wildfires and to a lesser extend, livestock grazing) occur on 326,300 acres.

The pinyon-juniper woodland has undergone similar changes in fire ecology. Miller and Tausch (2001) estimated that juniper and pinyon woodlands have increased ten-fold during the past 130 years in the Intermountain West. Much of this acreage involves lands that formerly supported sagebrush and sage grouse habitats. Within the planning area, pinyon-juniper encroachment is estimated to have occurred on approximately 354,500 acres. The reader is directed to literature by Miller and Rose (1995, 1999), Miller and Wigand (1994), Miller et al. (2000), Gruell et al. (1994), and Neilson (1987) for discussions of fire history, fire ecology, and post-settlement changes in the pinyon-juniper woodlands.

2.5.7 Disturbance

Disturbance refers to direct interference with sage grouse, rather than a habitat disturbance, and can include many types of disturbance. Increased traffic on a road that formerly had little traffic and is located near a lek is an example of a disturbance that may cause the birds to abandon a lek. This has been documented near new mines when the traffic level increases. Similarly, a new housing development near seasonal habitats may result in sage grouse abandoning that habitat as people or their pets disrupt seasonal activities. The impact of military flyovers has been raised as a concern, but studies have not been conducted to determine if impacts actually occur. Recreational viewing of sage grouse at leks or on wintering grounds is also a concern if the number of visits becomes high or the actions of those viewing the birds are not appropriate. Very little work has been done to document these types of impacts or the extent to which they affect populations. However, disturbance is an issue that should be included in planning documents.

2.5.8 Predation

Section 2.3.4 discussed predation ecology as a general discussion. The following discussion focuses on predation specifically as it relates to sage grouse.

Predation is the most important proximate cause of sage grouse mortality (Braun 1975, Bergerud 1988a, Autenrieth 1986, Schroeder et al. 1999); almost every sage grouse will eventually be eaten. Sage grouse are known to be included in the diet of a variety of species **(Table 3).** Sage grouse eggs, new-born chicks, and juvenile birds have a greater number of predators and are more vulnerable to predators than are adult birds. The differential adult sex ratio also indicates that males have higher mortality than females (Schroeder et al. 1999).

Nest predation has been considered by some researchers to be the primary limiting factor for sage grouse populations (e.g., Batterson and Morse 1948, Autenrieth 1981, Gregg 1991, Gregg et al. 1994), and predation on eggs and

Table 3: **Sage Grouse Predators and Life Stage at which Predation Occurs**

Predator	Life Stage at which Predation Occurs			
	Nest/eggs	Chicks	Juveniles	Adults
Golden eagle		x	x	x
Red-tailed hawk			x	x
Ferruginous hawk			x	x
Swainson's hawk			x	x
Rough-legged hawk			x	x
Northern harrier		x	x	
Gyrfalcon				x
Northern goshawk				x
Cooper's hawk				x
American kestrel		x		
Merlin		x	x	
Common raven	x	x		
American crow	x			
Black-billed magpie	x			
Coyote	x	x	x	x
Red fox	x	x	x	x
Weasels	x	x	x	
Badger	x			
Bobcat			x	x
Ground squirrels	x			
Elk	x			

Sources: Girard (1937), Rasmussen and Griner (1938), Allred (1942), Carhart (1942), Batterson and Morse (1948), Patterson (1952), Presnall and Wood (1953), Hogue (1954), Nelson (1955), Hartzler (1974), (Beck 1977), Autenrieth (1981), Gill (1965), Holloran (1999), and DeLong et al. (1995).

birds was considered by Schroeder et al. (1999) as the primary cause of mortality. Reported nest success varies from less than 15 percent to as high as 86 percent (Schroeder et al. 1999), and is influenced by weather and habitat quality, as well as by predation. Studies have demonstrated that the primary nest predator species varies among study sites. Avian predators, primarily corvids (ravens, crows, and magpies), were the major predators of nests in Oregon and southern Idaho (Batterson and Morse 1948, Autenrieth 1981), while ground squirrels and badgers were the major predators in a study in Colorado (Gill 1965) and Wyoming (Patterson 1952).

Survival of newly hatched chicks may also be influenced by predation, but nutrition, habitat quality, and weather are also significant variables in chick mortality (Pyle and Crawford 1996, Sveum 1998b, Blake 1970, Rich 1985).

Survival between hatching and the end of summer varies from approximately 40 percent (June 1963) to 60 percent (Wallestad 1975). Although a greater number of predators are known to prey on juvenile sage grouse, several factors lower the mortality rate at this life stage. After about six weeks of age the juveniles are able to take advantage of cover, detect predators, and escape by flying. Due to these factors, successful predators are more likely to take an individual juvenile sage grouse as the birds increase in size and ability to escape, whereas a single predator is more likely to take an entire clutch of eggs or brood of newly hatched chicks.

Data from 1998 for Elko County indicate a 37 percent reproductive success rate. The mean brood size in Elko County between 1966 and 2000 was 3.9 juveniles per hen (NDOW Region II Files). The average clutch size for sage grouse is between 6.6 and 9.1 eggs (Schroeder et al. 1999). Using the mid-range of the average clutch size (i.e., 7.9) and the average brood size during summer, a mortality rate of approximately 50 percent occurs between egg-laying and summer. Wing data collected in Elko County during hunting seasons from 1996 through 2000

indicated that by fall, the average number of young per hen was 1.48 (range 0.78 young per hen in 1996 to 2.19 young per hen in 1999; NDOW Region II Files). This is well below the 1.75 young per hen ratio needed to just maintain the population level (Stiver, personal communication). Assuming the average clutch size is 7.9 (mid-range given above), the combined mortality rate of eggs and juvenile birds from April to October is approximately 80 percent.

Predation of adult sage grouse occurs, but overall survival of adult birds ranges from 55 to 67 percent for females and from 38 to 60 percent for males (Zablan 1993, Connelly et al. 1994, June 1963). Although there are several predators of adult sage grouse (Table 1), the relative impact of these predators on the population is less because the encounters may be less frequent during portions of the year and predators are less effective when preying on adults (Bean 1941, Beck 1977).

Connelly et al. (2000) found that although predation was the most common cause of death for adult sage grouse in Idaho, the high annual survival rate of adults (Connelly et al. 1994) and low mortality over winter indicated that predation had little impact on sage grouse populations. Even with low reproductive rates, sufficient recruitment of young birds to the population was occurring to maintain population levels.

As discussed in Section 2.3.4, predation rates need to be considered in conjunction with the habitat quality, and both factors may need to be addressed within a watershed to improve sage grouse populations.

2.5.9 Hunting

The axiom that upland species, being density regulated, are virtually unaffected by hunting pressure has a long history in the field of wildlife management (Errington 1945, Mardsen and Baskett 1958). Studies of hunting impacts on sage grouse in Colorado showed that harvest was a function of the total birds available in the fall (Braun and Beck 1985). Hunters generally harvested between 7 and 11 percent of the birds available in the fall, regardless of season length and bag/possession limits. The study concluded that hunting had no measurable impact on spring densities of sage grouse. Wallestad (1975) also concluded that hunting had little influence on sage grouse populations in Montana. Information from Idaho (Gray 1967, Autenrieth 1981), Oregon (Willis et al. 1993), and Wyoming (Patterson 1952) indicate that harvest rates range from less than 3 percent to approximately 25 percent.

Zunino (1987) and Stigar (1989) studied hunted and non-hunted areas over a four-year period in northern Washoe County, Nevada. The hunted area purposely received high hunting pressure and had a harvest rate of 25 percent, which is the upper value for the normal harvest rate of less than 3 percent to 25 percent. The number of birds increased on both the hunted and non-hunted areas, but the increase was greater on the non-hunted area. Artificial nest predation studies on the same area indicated that the populations were also withstanding severe nest predation by ravens (Stigar 1989, Alstatt 1995). The studies indicated that while hunting was the major cause of fall mortality, the populations were able to withstand some level of harvest, even while experiencing high levels of nest predation.

In contrast, studies on bobwhite quail (Robinette and Doer 1993), sharp-tailed grouse (Gregg 1990) ruffed grouse (Kubisiak 1984), and sage grouse (Johnson and Braun 1999) suggest that hunting may be an additive form of mortality. These conflicting studies may be the result of studying populations during different population trends (increasing or decreasing) or populations existing in different quality habitats, which could influence recruitment.

The early studies occurred during periods of population highs when the number of reproducing females was high and production would also have been high. A “surplus” of young is produced when populations are increasing (i.e., more recruitment than mortality), and such populations can withstand hunting pressure.

Connelly et al. (2000) analyzed band returns and radio-location/return data for Idaho sage grouse over a 23-year period. Harvest rates for females were greater than for males. Forty-six percent of the adult female mortality occurred in September and October compared to only 28 percent of the adult male mortality, with 95 percent of the combined September-October mortality due to hunting. The differential mortality rates during this time period were attributed to females with juveniles remaining on

meadows and riparian areas, while males and unsuccessful females were more dispersed in the upland vegetation. The relatively high rate of female mortality at this time of the year suggests that hunting may be additive to winter mortality, decreasing the size of the spring breeding population.

This study occurred during the decline in sage grouse across the west. A population that is declining by definition does not produce sufficient young to offset adult mortality. Therefore, additional mortality in the form of hunting leads to further population declines. Thus, this "new" science must be taken in context with the population dynamics and should not be interpreted that hunting will always cause population decreases. Population trend is an important factor in determining the level of hunting that is allowable.

Concern exists that local, isolated populations may be vulnerable to concentrated hunting pressure and some studies suggest that this is possible (Autenrieth 1981, Zunino 1987, Connelly et al. 2003). These populations may require special attention if they are to remain viable.

2.5.10 Disease

Sage grouse are known to harbor a variety of disease and parasitic organisms. Schroeder et al. (1999) provide a comprehensive listing of the parasites and disease agents. The mere presence of a disease organism or a parasite does not necessarily indicate a population level effect. Herman (1963) pointed out that a "healthy" wild animal carrying only a single pathogenic agent is a rare occurrence. Therefore, some background level of disease or parasites exists, but under most conditions these agents may be of little significance. However, under certain environmental circumstances, such as drought, one or more disease agents or parasites may increase to a level that impacts the local population (Herman 1963). The casual factors are likely to be different for different outbreaks and different localities.

Although disease outbreaks in sage grouse have been documented (Grover 1944, Batterson and Morse 1948, Honess and Winter 1956, Thorne 1969, Wallestad 1975), the conditions under which the outbreaks have occurred have not always been well documented. For coccidiosis, outbreaks appear related to drought, drying water holes, and/or contaminated water. As with most diseases, transmission is favored when sage grouse have a high probability of contact with other infected sage grouse, or when they are forced to use limited habitats. The concentration of birds at limited water sources may result in fecal contamination of the water and surrounding soils (Thorne 1969). A reversal of the conditions or seasonal dispersal of sage grouse can alleviate the problem (Wallestad 1975).

However, the West Nile virus, has been recently introduced to the United States and has been the documented proximal cause of death in many avian species, including sage grouse. No sage grouse mortality has been attributed to this virus in Nevada, and due to the arid conditions, the risk may be lower in Nevada than in some other states. This is due to the fact that the virus is carried and spread by mosquitoes. Until there are reported cases in Nevada, the impact of this virus on sage grouse populations is unknown.

2.5.11 Cycles

Rich (1985) analyzed 32 years of sage grouse lek counts in southern Idaho and determined that population peaks occurred about every ten years. Although Rich (1985) found some climatic factors that correlated with the population changes, cause and effect relationships were not evident. Braun (1998) reviewed population data throughout the area of sage grouse distribution and concluded that sage grouse populations do not fluctuate on a regular or cyclic basis.

In Nevada, the population data has indicated declining populations since the 1950s, with some rebound in the 1970s. If cycles are occurring in Nevada, they are being masked by the downward trend in the state population.

2.5.12 Climate/Weather

Long term climatic changes are discussed elsewhere in the document in relation to vegetation and sage grouse populations. Other than extended periods (i.e., hundreds of years) of drought, or periods like the Little Ice Age, where climatic changes drive plant community changes, climate is not a major factor in short-term population fluctuations. However, weather, which is a short-term expression of climatic factors, is likely to have influence on annual populations.

Weather can influence the availability and quality of sage grouse food and energetics. As discussed above, newly hatched chicks have limited reserves in the yolk sac and must acquire a high energy/high nutritional diet during the first few days after hatching. This diet is composed primarily of insects, and insect availability is highly dependent on weather. Cold, wet weather causes many insects to seek shelter and become inactive, reducing their availability to sage grouse chicks. Chicks that are stressed are more vulnerable to predators and to direct effects of weather. If chicks survive the first few days, warm, dry weather can reduce forb production on upland sites, forcing the birds to use riparian areas before they have developed sufficient mobility and flight capability to escape predators. During cold, dry winters sage grouse may not find suitable snow for snow roosting, reducing their ability to build up energy reserves for spring breeding. All of these factors can limit recruitment to the population in any given year. Because these types of weather events generally occur over a broad area, population effects can be realized.

In contrast, warm, wet springs that promote forb production and insect abundance, or wet summers that extend the growing season on the upland sites, and winters with abundant snow should all contribute to higher sage grouse population recruitment. Therefore, weather is a factor in sage grouse population changes, but not a factor that can be managed.

2.6 Historical Perspective - Sage Grouse and the Sagebrush Ecosystem

2.6.1 Presettlement

Sage grouse bones estimated to be 4,500 years old have been located in northeastern Nevada (Hockett, pers. comm.), and Schroeder et al. (1999) indicate that Pleistocene fossils of sage grouse have been found within the historical distribution of sage grouse, but are somewhat limited. This may be due to the relatively recent origin of grouse in general, or for sage grouse in particular (Short 1967), or due to the fact that bird bones are fragile and easily consumed by large mammalian predators, and that sage grouse spend most of the year in upland habitats where conditions for fossilization are less than optimum. Nonetheless, the discussion of sagebrush ecology over the last 12,000 years would apply to development or use of habitats by sage grouse.

The period of drought and fire that occurred between 500 and 700 years ago would have resulted in abundant breeding habitat, nesting habitat, and early brood habitat near the transition zone of Wyoming big sagebrush to the mountain big sagebrush communities. The drier conditions during this period would have created snow-free conditions at the moderate slope elevations where mosaics of mountain big sagebrush would have occurred. Stands with substantial understory of herbaceous vegetation would have been used for nesting and early brood use. The areas of low sage, or recently burned Wyoming big sage would have provided breeding habitat (leks) when adjacent to areas with mature sagebrush. Extensive areas of Wyoming big sagebrush sites that had not been recently burned would have provided winter cover. Areas that had been recently burned would have provided little habitat, other than leks, for sage grouse. Winter habitat was probably the habitat that was most unpredictable in space and time. During the early phase of this period, the large fires would have resulted in widely spaced patches of this tall, dense sagebrush. This would have either limited the size of local populations, or resulted in long movements between breeding-summer habitats and winter habitat. As a mosaic of age classes developed, winter habitat may have become

more predictable in space, but limited in the acreage available.

Where all of the habitats occurred in a local area, population levels were probably moderately high, depending on the availability of herbaceous understory in the nesting and brood rearing areas. The dry conditions during this period would have limited the herbaceous understory at the lower elevation Wyoming big sagebrush sites, but the impact of this dry period on the higher elevation mountain big sagebrush sites is not clear. Lack of herbaceous production could have limited the insect populations on which sage grouse chicks depended. Annual recruitment of sage grouse may have been highly variable during this climatic period.

With the advent of the Little Ice Age, sage grouse habitat use would have shifted. The lower temperatures and increased precipitation, especially winter snow, would have precluded the use of the mountain big sagebrush sites as nesting and early brood use habitat. However, the increased production of the Wyoming big sagebrush sites would have improved nesting and early brood rearing habitat. The mountain big sagebrush sites and riparian zones would have provided summer brood habitat, and the lower elevation mosaic of Wyoming big sagebrush age classes and low sagebrush would have provided fall and winter habitat. As sagebrush stands aged and were subject to intense crown fires during short-term drought cycles, winter habitat, breeding habitat, nesting habitat, and early brood rearing habitat became less predictable in time and space. The large fires associated with the older sagebrush stands would have reduced the mosaic of habitat types and the longer fire interval would have created sagebrush dominated stands over time.

According to this reasoning, the landscape that occurred at the time of European contact would have been dominated by sagebrush from the mountain sides, across the valleys, to the mountains of the adjacent range. Upper elevation vegetation would have varied with elevation and fire history, but pinyon-juniper, aspen, subalpine fir, limber pine, whitebark pine, and other tree species were found in the various mountain ranges (Charlet 1998). The understory of herbaceous plants would have been a function of the time lapse since fire; large areas of grassland from recent fires would have been widely scattered across the landscape and grassland-sagebrush or sagebrush-grassland would have dominated most of the lower elevation sites.

2.6.2 Settlement and Post-Settlement

The records of the early fur trappers and explorers vary in their accounts of the condition of the western landscape. Some of this variation can be attributed to their purpose for traveling the area and their frame of reference after experiencing the grasslands of the Great Plains. Lands dominated by sagebrush, especially older sagebrush with a depauperate understory, would not have appeared to be productive for grazing animals and would not support large populations of wildlife. Conversely, the areas that had recently been burned and meadows would have appeared as viable grazing lands and supported higher levels of wildlife. Part of the variation can be attributed to the time of year when individuals traveled through the area. Due to the length of the journey and the weather constraints for making the journey, early travelers to Oregon and California often traversed the Great Basin at the end of, or after the growing season when herbaceous plants were not very succulent, and many forbs had lost their above ground parts. Part of the variation can also be attributed to the travel routes followed. Although the fur trappers were inclined to explore the mountains, the travelers to Oregon and California avoided the arduous mountain passes when possible. Their travels were through the valleys and along the river courses. The valleys tend to be the drier range sites, with lower site potential than the higher precipitation zone range sites. Part of the variation must also be attributed to the site-specific landscape condition. As described above, areas of plentiful grass existed where fire had been recent and areas almost devoid of grass would have existed where fire had not occurred for 70 to 80 years, or where precipitation was low.

The history of settlement of the Great Basin is well documented and only highlighted below to establish baseline conditions for predicting sage grouse populations. For each period of time, significant ecological events are discussed and related to vegetation on the landscape.

The period of exploration and travel across the Great Basin had few ecological implications.

The numbers of explorers and fur trappers were too few to have much of an impact, except for reducing beaver populations where they could be found. Similarly, the early travelers were confined to the trails and their time at any one location was brief.

The era of livestock use of the Intermountain West began with the Mormon settlements in Utah and spread to Idaho, Nevada, and California (Stewart 1941). These early settlers practiced subsistence agriculture because there were no transportation systems to existing markets. However, with the mining boom, starting in 1849 in California and 1859 in Nevada, subsistence agriculture gave way to agricultural production to supply newly created markets (Short 1965). Construction of the railroad soon followed, expanding the market and providing a means of transportation to distant markets. In 1863, overstocked ranges and drought conditions in California led to cattle drives through the Sierra Mountains to the Great Basin (Short 1965). The livestock industry continued to expand and the use of rangelands occurred in an unconfined, uncontrolled manner of grazing. Very little supplemental winter feed (hay) was harvested, and livestock depended on the open range for year-long forage. During this period, the perennial native grasses were greatly reduced and sagebrush and other shrub species increased in dominance (Young et al. 1979).

Mining operations sprang up throughout the state, and these new communities needed fuel. Forests in the Jarbidge area and Tuscarora/Independence Mountains were virtually removed to provide timbers for buildings and mine supports, and fuel for heating and cooking. When trees became too scarce, sagebrush was harvested by the wagon load. This removal of sagebrush was the first major shrub reducing activity since initial settlement. In other parts of Nevada, pinyon-juniper woodlands were cut down to provide charcoal for precious metal processing. Vast tracts of woodlands were denuded to supply the demand for wood, leaving only the seedlings that eventually re-established woodlands on these sites (Tausch, pers. communication).

In addition to fuel, mining towns needed food. Sheep and cattle were grazing the rangelands during this period, and great numbers of sheep were herded through Elko County during the late 1800s and early 1900s. Although some sheep operators had a base ranch, many sheep bands ranged over wide areas, creating conflicts with cattle operators. By 1890, the potential of many range sites had been greatly reduced. The perennial grasses were extremely susceptible to intensive, season-long grazing pressure, and seed banks built up during the presettlement period would have been depleted. As a result, shrubs dominated most of the western rangelands (Young et al. 1979). Sheep grazing was reduced in the West with the establishment of forest reserves, the precursors to national forests. During the first decade of the 20th century, forest reserves were created in most western states, providing some control over the nomadic sheep operations.

The winter of 1889-90, known as White Death, was a culmination of events that changed the livestock industry. Regional drought occurred in the spring-summer of 1889, resulting in low grass production. The heavy rains in November came too late to provide fall regrowth, and heavy snows in December stranded livestock across the range. The animals soon used whatever standing forage was available, or the limited hay that had been harvested if they could negotiate the deep snows to return to the ranches. A spring blizzard that started with rain and snow was followed by falling temperatures; this was too much stress for animals that had been on starvation diets for months. In northern Nevada alone, it was estimated that approximately 250,000 head of livestock perished that winter and spring (Hazeltine et al. 1961). The flooding that occurred in the spring of 1890 was not noted as causing soil or stream channel erosion (Blackburn, personal communication) in contrast to what may have been expected from such an event. The prior grazing of the watersheds had not caused deterioration of the watersheds to the point where the vegetation could not attenuate flows, and the riparian systems functioned to trap sediment, rather than contribute to the sediment load. The aftermath of White Death was a change in livestock grazing operations. Hay production began in earnest, and irrigation to increase hay production was initiated (Young et al. 1979). The meadows were cut for hay in the summer and grazed in the fall, stressing the Great Basin wild rye and causing deterioration of the meadows. By 1910, much of the upland range had also been depleted and the 1910 spring flood produced stream channel

cutting and entrenchment; a trend that continues during major high flow events.[6]

Predator control was initiated with the introduction of livestock, but was not formalized into an organized program until after 1900. In 1915 the first rabies cases in Nevada were documented in Humboldt and Elko counties (Sans 1915), resulting in state and federal programs to control predators in an effort to prevent livestock losses to rabies. The programs have included hunting, trapping, poison baits, and aerial shooting. Use of poisons was restricted by presidential order in 1972. Coyote, bobcat, and mountain lion were the major target species, but badger, fox, raccoon, skunk, and porcupine were also included in the program. Between 1915 and 1979, over 373,900 coyotes, bobcats, and mountain lions were killed in Nevada. Coyotes comprised the bulk of the predator killed through the control program, accounting for more than 301,000 of the total predator removal. Over a 24-year period for which data were recorded by county (1937 to 1962, exclusive of 1940 and 1958), approximately 35 percent of the statewide predator removal occurred in Elko County. Assuming that this percentage applies to the period 1915 to 1979, it is estimated that 131,700 predators were killed in Elko County. The data are presented in tabular and graphic format in **Appendix E**.

Predator control efforts varied considerably over the years. During the period 1915 to 1933 the mean annual predator removal was 5,400 animals, during 1934 to 1939 the mean dropped to 1,000 per year, but increased to 7,600 per year during 1935 to 1948. The mean declined between 1949 and 1952 to 2,500 per year, increased to 7,500 per year between 1952 and 1959, and reached the highest mean during the period 1960 to 1965 with an average of 10,300 predators killed per year. The mean declined to 5,100 between 1966 and 1979. The variability was due in part to changes in budget, which translated to a change in effort during some years, or different in techniques, and shifts in public attitude.

Fire suppression was also initiated, probably informally at first, but eventually in an organized campaign by the U.S. Forest Service. Smokey Bear became a national icon representing the effort to prevent forest (and range) fires. Fire suppression efforts continue to the present, although fire policy has undergone some revision in recent years.

Non-native, invasive species were also introduced into the rangelands during the period of settlement and in the years that followed. Halogeton and downy brome (cheatgrass) were two species that received attention in Nevada during the 1950s and 1960s. Cheatgrass has since become a dominant species on millions of acres of rangeland in Nevada. Other exotic invasive species, including perennial noxious weeds, have established within Elko County in recent years and may be expected in the future to dominate areas that currently support cheatgrass monocultures.

The Taylor Grazing Act was passed in 1934 to protect public grazing lands, develop public domain lands for grazing, and stabilize the public range-dependent livestock industry. The recognition of rangelands as a national resource and the creation of the Grazing Service (later to become the BLM) provided the link to manage the lands between national forest lands. The implementation of the Taylor Grazing Act and management of the national forests led to establishment of grazing districts, allotments, and range improvements. The range improvements included fencing to control livestock movements and implement livestock grazing systems, water developments, sagebrush control, exotic grass seedings, weed control programs, and sagebrush preservation (as discussed in Sections 2.5.1 and 2.5.5). Rangeland seedings and brush control activities on public lands peaked in the 1960s. The acreage of public lands managed by the BLM (western states) on which brush control was practiced increased from approximately 100,000 acres in 1962 to approximately 1,380,000 acres by 1970 (Rich 1999). Seeded acreage increased from approximately 100,000 acres in 1962 to

[6]Research conducted by the Rocky Mountain Research Station indicates that hillslopes were stripped of sediment during a severe drought about 2000 years ago. Consequently, streams are currently sediment limited, resulting in degradation. The most recent incision began about 300 years before present, and major episodes of incision have occurred during most high flow events in the last 50 years (Miller et al. in press). Although many stream systems have a natural tendency to incise, human disturbance and improper grazing have increased both the rate and magnitude of these events.

approximately 2,250,000 acres by 1982 (Rich 1999). While portions of this acreage may now provide some sage grouse seasonal habitats, the removal of sagebrush and conversion to crested wheatgrass had an immediate impact on sage grouse distribution.

Mining activity waxed and waned over the years, but continued in one form or another into the mid-1900s. The resurgence of mining resumed with the development of processes to extract microscopic gold from large quantities of low-grade ore. This resulted in a mining boom in the mid-1980s that is currently continuing, but at reduced levels due to the current price of gold.

The period of 1950 to 1980 was a time of slow to moderate growth in Elko County. The livestock industry and railroad were the major employers and mining (primarily the Carlin Mine) was a minor industry. The roles soon changed, with the mining boom of the 1980s that was accompanied by unprecedented growth in Elko County.

2.6.3 Effects of Settlement on Sagebrush Ecosystem/Sage Grouse Habitat

Changes to the sagebrush ecosystem started with the trapping of beavers, but the grazing and mining associated impacts during the latter 19th and early 20th centuries were significant in terms of sage grouse habitat. Increased mining and the development of ranching led to environmental change. Shrub and tree removal made room for new shrubs and understory plants. These disturbances were distributed in time and space as mining districts and their associated populations developed. For some areas, the removal of shrubs represented the first disturbance to these shrublands in more than 100 years. Although sage grouse broods may have responded to the release of the understory grasses and forbs, use by broods would not have been significant until the shrub canopies began to develop. Therefore, the initial response may have been a reduction in sage grouse numbers accompanying the reduction in acres of suitable habitat, followed by an increase in sage grouse numbers as the habitat recovered to a grass-shrub community. The creation over time of grassland, grass-shrub communities, shrub-grass communities, and shrub communities on the landscape would have provided the seasonal habitats required by sage grouse in a local area. Therefore, sage grouse were locally abundant, but regionally rare during the period following mining and ranching activity.

Following the winter of 1889-90, ranchers used irrigated meadows to provide winter feed. Livestock grazing reduced dense meadow vegetation, resulting in regrowth of the herbaceous plants, and the accompanying insects provided grouse with a dependable late summer food supply. The combination of removal of sagebrush, pinyon pine, and juniper from mining activity and grazing by livestock meant less old, dense sagebrush, more grass and grass-shrub communities, and improved summer habitat. Farming and ranching also led to predator control efforts that led to increases in prey populations, including sage grouse. In response to these factors, sage grouse populations began to increase, becoming regionally abundant, rather than only locally abundant.

These gains may have been short-lived due to the numbers of livestock, especially sheep, that grazed the rangelands in the late 1800s and early 1900s. In areas were the mosaic of grass and grass-shrublands existed, the forbs and insects required for sage grouse chicks were not abundant due to the grazing pressure. Where old stands of sagebrush existed, trampling by livestock may have actually opened up the stands, but the herbaceous plants thus released were soon consumed. The expectation is that sage grouse numbers were regionally low during this period, fluctuating in response to spring weather events, but declining overall.

The exception may have been in some portions of northern Elko County. Gruell (1998) recounts the recollections of three individuals whose families homesteaded in the area during the late 1800s. All three recall abundant grass and very little sagebrush in the Bruneau River country. Sagebrush was more common in the Independence Mountains and the Adobes, but cutting hay from the ridges was common (probably Basin wildrye). Sage grouse were also reported to be common in the Bruneau region. Based on the amount of grassland, one would have to assume that the observation of sage grouse in the area was related to summer use. In the areas of higher brush cover near Gance Creek and elsewhere along the Independence

Mountains, sage grouse were "plentiful." These descriptions indicate that fire or other disturbance had occurred previous to the time that these homesteaders lived in these areas. The abundance of grass began to change in the 1890s and early 1900s with the high numbers of sheep introduced into this region. Gruell (1998, page 114) states that there were 560,000 sheep running in the Independence Mountains, and all three individuals interviewed indicate that grasslands declined with the heavy use.

During the period of high sheep numbers, shrubs were on the increase, but grasses still remained. Although grazed down by the end of summer, the spring growth was probably sufficient to provide insects for sage grouse chicks. Nesting cover would have been limited, but nest success was not as dependent on nest cover because of the extremely active predator control programs. Therefore, while habitat conditions were less than ideal, predators were not present in sufficient numbers to keep the sage grouse populations suppressed.

Another effect from heavy livestock grazing at this time was the reduction in fine fuels. During the period of time that shrubs were recovering from the shrub harvest as fuel for mining camps or previous range fires, grazing with high numbers of livestock reduced the fuel loading and fine fuels needed to maintain fire. This combination of grazing and fire suppression eventually led to shrub dominance in these rangelands. This occurred over a long period of time between 1910 and 1950. The increased shrub cover provided better nesting habitat for sage grouse, especially where combined with adequate spring growth of herbaceous vegetation. Heavy grazing of the uplands would have reduced their value as early summer brood habitat, but winter habitat would have been increasing in both quality and quantity during this period. The summer habitat of meadows and riparian areas would have been adequate, but stream incisions following extreme events continued during this period and some water tables were dropping. Pre-laying hen nutrition was likely a stress factor on the population due to the degree of grazing and lack of early spring forbs, especially at the latter portion of this period. However, predator control was operating at peak level, and sage grouse chick recruitment was probably high for the number and quality of eggs produced. Weather during winter, breeding season, and immediately after hatching would have been a major factor in population fluctuations. The low quality habitat could support relatively high populations of sage grouse when combined with predator control, but a few years of poor weather would have reduced recruitment and populations would have declined drastically, only to rebound when the weather conditions were favorable.

During the 1930s, cheatgrass and halogeton were also becoming noticeable, but cheatgrass did not expand explosively until the fire years in the 1960s. By then, cheatgrass had established in the depleted understories of sagebrush dominated communities, poised to dominate these sites when the fires occurred. Following fire, the ability of this species to form a closed community or steady state[7] (Laycock 1991, West 1999), has prevented sagebrush and other perennial plant species from reestablishing, eliminating sage grouse habitat from these sites. Apparently brush was sufficiently abundant in the 1940s to warrant mechanical and chemical control as rangeland improvement practices. Shrub control activities peaked in the 1960s (Rich 1999, Miller and Eddleman 2000). Where native understory herbaceous plants existed prior to treatment, an improvement in grass and forb production was realized. Sagebrush eventually reestablished in these treatment areas with a corresponding increase in sage grouse populations. Where the understory was depleted prior to treatment, invasive annuals established with the few surviving perennial plants. However, varieties of introduced wheatgrasses, collectively known as crested wheatgrass, were seeded on rangelands with depauperate understories in order to establish perennial grasslands. These monocultures dominated rangelands for many years where soils were productive, effectively eliminating sage grouse, except for some breeding display activities. Through natural establishment (secondary succession over time), many of these seedings currently have sufficient stands of sagebrush and adequate herbaceous cover to provide nesting habitat for sage grouse. This use of older seedings by other shrub-associated

[7]A steady state is defined as a system that has resistance to change from external forces and returns to the original steady-state after being disturbed (e.g., an annual grassland disturbed by wildfire returns to an annual grassland and resists change to a perennial plant community).

bird species has been scientifically documented (McAdoo et al. 1989).

The period from 1960 to the present represents a period when sagebrush continued to increase on many rangelands, except where fire converted these areas to annual grasslands or where pinyon-juniper encroachment occurred. In areas where sagebrush dominance increased and understory vegetation decreased, the value of these areas as nesting and early brood habitat decreased. These stands of sagebrush provided winter cover, but as discussed above, the quality of the forage was low. Conversion of sagebrush lands to agriculture (e.g., irrigated meadows, irrigated hay production, crested wheatgrass seedings), home sites and urban expansion, and other non-rangeland uses reduced the quantity of habitat available to sage grouse. Although range improvements and changes in grazing systems have been implemented, changes in grazing, and even the elimination of grazing, cannot completely restore the herbaceous vegetation to these sites (as discussed in Section 2.5.5). This combination of habitat conversion to non-sage grouse habitat and the continuing decline in the quality of remaining habitat has contributed to the downward trend in sage grouse numbers since the 1960s.

2.6.4 A Model of Sage Grouse Populations - 1850 to 2001

The events discussed in Section 2.6.2 are depicted on a time line in **Figure 11**. The predicted sage grouse population as discussed in Section 2.6.3 is depicted on the graph in **Figure 11**. This represents a model of sage grouse populations from the time just prior to settlement through the present. There is little scientific evidence to support or refute the model for the early part of the time line, but there are indications of sage grouse abundance (or lack thereof) from anecdotal accounts in the personal journals, newspapers, and publications of the period.

McQuivey (2000 and in preparation)[8] reviewed the available documents and provides some insight regarding the fluctuations in grouse numbers. For the latter part of the 20th century, data collected by the NDOW are available from which sage grouse abundance can be estimated.

An historical review of personal journals, newspapers, and publications indicates that prior to settlement and during early settlement by European man, Nevada had low sage grouse populations (McQuivey 2000). This view contrasts with the popular view that the period prior to settlement was a land of plenty and nature was in balance. Both views are correct. The events leading up to the time of settlement were “random” events in both time and space. The colder and wetter climate limited the number and location of fires, but during the short-term drought cycles, fires did occur. Where the combination of habitats for a given species was available, including sage grouse, local populations were abundant. However, due to the randomness of the fires, these combinations of habitats were relatively rare and most of the landscape was dominated by older sagebrush. The populations of sage grouse across the Great Basin probably fluctuated drastically, depending on the long-term and short-term climate cycles that influence the temporal and spacial distribution of habitats. The references from 1826 to 1860 reviewed by McQuivey support this premise; game, including sage grouse, was scarce (i.e., widely scattered), but when found, “they came into camp loaded” with sage grouse (i.e., locally abundant). Similarly, the description of the habitat varied from sagebrush that was extensive and up to eight feet tall, to grasslands that resembled meadows.

From 1861 to 1885, the references to sage grouse are few, but references to game shipped in from other states are common. Market hunting was occurring outside of Nevada, but there was no indication that game was

[8]Robert McQuivey has been, and continues to, review historic documents in preparation of publishing a history of Nevada wildlife. On September 13, 2000 he presented his preliminary findings as related to sage grouse to the Governor’s State Sage Grouse Conservation Plan Team. The history of sage grouse in Nevada is taken from this presentation.

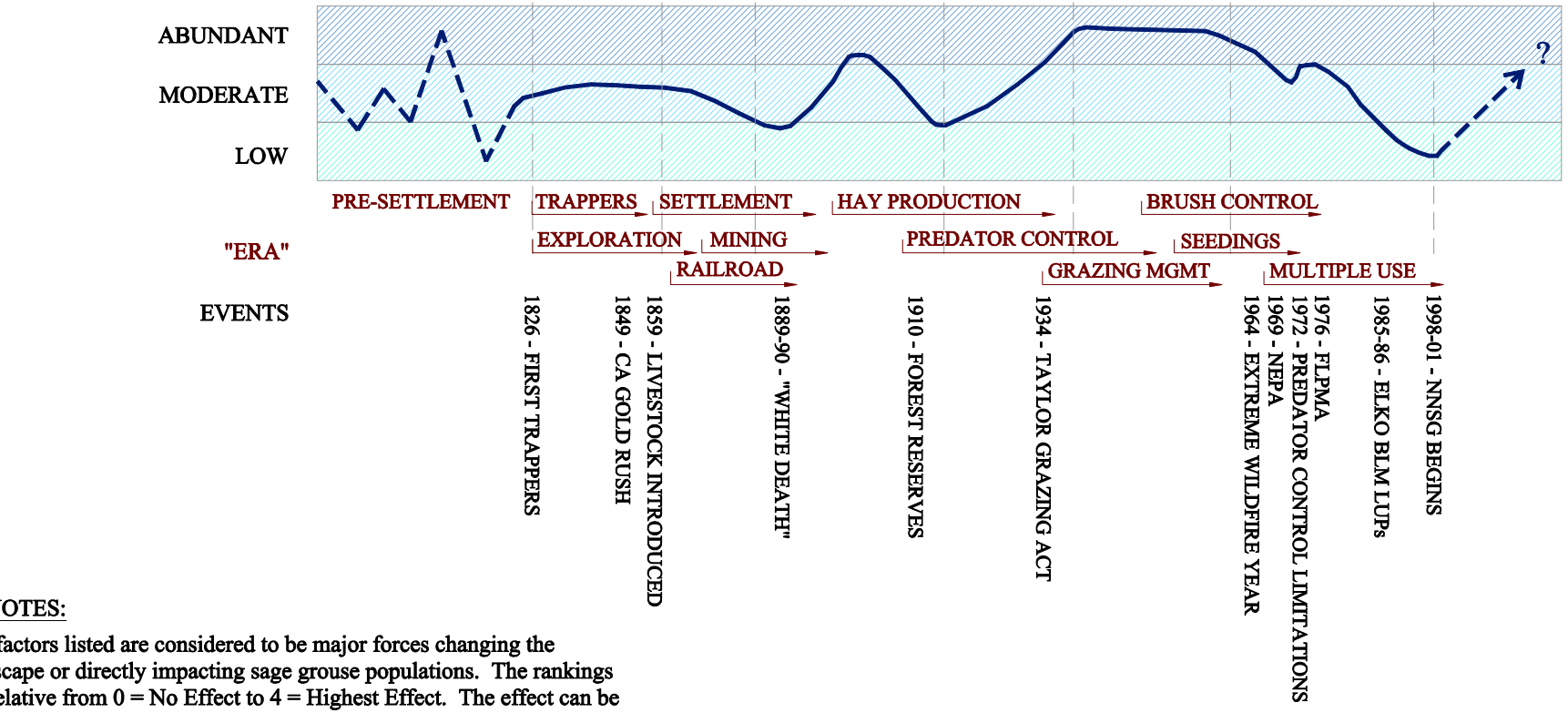
sufficiently plentiful for market hunting in Nevada. This was also the time of pinyon-juniper harvesting for charcoal and sagebrush for fuel. The sagebrush harvest in the Tuscarora area prompted a reference to the possibility of sagebrush "ultimately becoming extinct." This was a period of locally extirpated sage grouse populations, with other populations widely scattered throughout the state.

The period 1886 to 1920 saw sage grouse populations fluctuate. Hunting seasons varied from one and a half months to eight months in length. Following the winter of "White Death" (1889-90), livestock numbers were drastically reduced, allowing portions of the range to recover, and sage grouse numbers rebounded. By 1900, the grazing levels had increased and mining was on the increase. But in 1906, sheep were numbers were greatly reduced on the forest reserves and wild horses were removed from the forests. Local increases in sage grouse populations occurred as shrubs, grasses and forbs recovered. Habitat quality was probably a factor in fluctuations of yearly populations, with weather being indicated as the proximal cause of sage grouse shortages in 1904 (cold, wet spring) when birds were scarce. This population low occurred only three years after reports of four individuals bagging 96 sage grouse in one day and another party of four bagging 140 sage grouse on another day. The pattern in 1910 was one of regional scarcity and local abundance in the Ely area. A rabies epidemic in 1915 killed more than 30,000 coyotes in an 18-month period, and predator control and poisoning of prey by livestock operators was common. The general trend in sage grouse numbers varied with local environmental conditions.

FACTORS [1]

	UP TO 1825	1826-1859	1860-1885	1886-1920	1921-1946	1947-1960	1961-2001	2002+
WILDFIRE	4	1	1	1	1	2	3	
FIRE SUPPRESSION	0	0	1	2	3	3	3	
EXOTIC PLANTS	0	0	0	1	2	3	4	
MINING (LOCALLY)	0	0	4	2	2	1	3	
PREDATOR CONTROL	0	0	1	2	3	3	3	
GRAZING	0	0	3	4	3	3	2	
WEATHER	2	2	2	2	2	2	2	

POPULATION LEVEL [2]



FOOTNOTES:

1. The factors listed are considered to be major forces changing the landscape or directly impacting sage grouse populations. The rankings are relative from 0 = No Effect to 4 = Highest Effect. The effect can be positive or negative.

2. Population levels are relative and the population "line" indicates trends, not specific values for any given year. Actual population level for any year could be much higher or lower. The population "line" indicates overall general changes within the specified "ERA".

REFERENCE			
	DESIGNED	GB	1/02
	DRAWN	akt	1/02
	CHECKED		
	APPROVED		

REVISIONS	No.	DESCRIPTION	DATE

FIGURE 8

MODEL OF SAGE GROUSE POPULATION TRENDS IN NORTHERN NEVADA

PREPARED BY: SRK Consulting Engineers and Scientists

SCALE: NONE

REVISION: A

JOB NO. 140701

DWG NAME 140701-fig8

From 1921 to 1947, seasons were reduced from months to 15 days or less. Sage grouse populations were generally increasing during this period, although fluctuations were still common. Passage of the Taylor Grazing Act in 1934 initiated range management, and with it some changes in grazing and then initiation of range improvements. Although these improvements were directed primarily at sustaining the livestock industry, there were also some benefits to wildlife.

Peak sage grouse populations were reported throughout Nevada in the 1950s, and populations remained relatively high through the 1960s. Sage grouse populations declined in the 1970s, with some rebound in the late 1980s and early 1990s, followed by a decline to lower levels in the mid 1990s. The century ended with a slight upturn in sage grouse numbers, but the overall trend from 1950 to 2000 has been downward. Predator control was greatly reduced after the banning of chemical poisons in 1972. The combination of less predator control and continued decline in habitat quality (winter and spring habitat) has resulted in less recruitment to the sage grouse populations and more influence from weather events.

Mr. McQuivey reviewed 211 journals, diaries, and letters, 171 newspapers from 79 different communities in Nevada (primarily covering the period 1859 to 1900), state statutes from 1861 to 1947, and other sources of information. Although these sources are primarily anecdotal in nature, they provide the only written record available. The NNSG sage grouse pod developed a model of sage grouse populations (**Figure 11**), independent of Mr. McQuivey's work, based on historic events and how these events would have impacted sage grouse habitat or sage grouse survival. The model is general in nature, assuming that events and activities occurred throughout the county, except where noted. The model should not be interpreted as providing a specific population level of sage grouse in the state or Elko County for any given year, but provides the general trend over periods of time. For example, since the 1900s there are State Fish Commission records that indicate specific years when sage grouse populations were extremely low (e.g., 1912-13, 1926-27, 1936). These represent variations from the general trend, but do not negate that a general trend was occurring. Indeed, these short-term but drastic changes in population lend credence to the model and the interpretation that weather was a major factor in determining population levels when habitat conditions were poor and predator control was intensively practiced.

The earliest scientific survey of Nevada occurred in 1867. Ornithologist Robert Ridgeway, part of the survey team for the exploration of the 40th Parallel, chronicled wildlife species as the team traveled from San Francisco, California to the Wasatch Mountains, east of Salt Lake City, Utah. His description of the sagebrush vegetation is that of an extensive community covering the valley floors and foothills "farther than the eye can reach" (Ridgeway 1877). The sagebrush was generally about three feet or less in height, occasionally taller, and uniform in its density over large expanses. This indicates a relatively long period of time since the last fire. Ridgeway (1877) summarizes his observations of sage grouse as follows: "Although this large and well-known grouse was met with throughout the sage-brush country between the Sierra Nevada and the Wahsatch, we saw it so seldom that little was learned of its habits, particularly during the breeding season. It came under our notice only late in summer and during the autumn, when it was found to be abundant in certain localities, but by no means uniformly distributed." These observations support the contention that the species was locally abundant where quality habitat was available, but regionally rare due to large expanses of low quality, or only one seasonal habitat.

There is general correspondence between the habitat based model (**Figure 11**) and the historic accounts. Differences are primarily related to specifics for a given locality (e.g., the population in Austin, Nevada may have been high in a given year when the prediction for the Elko area may have been low), but these may have been due to the timing of events related to mining or livestock grazing activities, which varied in time throughout the state. One important factor that was not included, except for 1889-90, was weather. Many of the severe annual fluctuations may have been due to the influence of weather when habitat quality was below optimum.

However, by arriving at similar indices of population levels from two independent methods lends some credence to the general. More importantly, the model integrates the major

factors affecting sage grouse, providing some understanding as to why sage grouse numbers were high in the 1950s when livestock numbers were also high. The correlation is due to events that preceded the population highs by decades, setting up the future habitat, and due to other factors acting at the time of the population highs (e.g., predator control). The model also indicates that habitat quality and quantity are generally the underlying basis for sage grouse population trends.[9] If this is truly the case, then habitat management is the key to bringing back healthy, sustainable populations of sage grouse. The following conservation strategy is first and foremost a strategy for managing habitats.

[9]However, because the model is based on an estimate of habitat conditions resulting from these other factors, some circular reasoning is involved when concluding that habitat is the driving force.

3 CONSERVATION STRATEGY

The preceding sections of this document have provided the necessary background information for understanding sagebrush and sage grouse ecology. In this section, the ecological basis for managing the sagebrush ecosystem, with emphasis on sage grouse, is presented. This is followed by the goals (the desired outcomes), objectives (measurable and with time frames), and strategies (specific steps required to reach the objectives).

3.1 Ecological Basis for Management Strategies

In the absence of noxious weeds and other invasive annual species, the traditional successional models of range ecology (e.g., Clements 1916, Sampson 1919, and Dyksterhuis 1949) may be the appropriate models on which to base the management of the habitats. The Clemensian model of succession assumed that the stages of secondary succession on improving rangelands were the reverse of stages or processes of degradation and that these successional stages were the same for all sites at all times for a given range site.[10] Laycock (1991) discussed the concepts of ecological thresholds and steady states of vegetation that occur when certain thresholds are crossed. The type of disturbance and the plant community in place at the time of the disturbance interact to determine the state or transition that occurs as a result of the disturbance. When the combination of factors result in a threshold being crossed, a new steady state is created. Reversing the trend when a threshold has been crossed requires more than just removing the disturbance. For example, as discussed above, the presettlement fire regime created a cycle of:

grassland ↔ grassland-shrubs ↔ shrub-grassland ↔ shrubland.

Interjecting fire at any stage of the cycle abruptly reversed the cycle (e.g., set back succession) to an earlier stage, or in the case of the grassland stage, perpetuated the grassland for a longer period of time. The introduction of intensive livestock grazing resulted in stress on the understory species, creating a threshold and the potential for a new steady state:

grassland ↔ grassland-shrubs ↔ shrub-grassland ➡ shrubland.

The dominance of shrubs and loss of understory species creates a steady state of sagebrush dominance with eventual changes in the soil and seed bank that prevent reversal of the situation with the removal of livestock. Additional inputs of energy and plant material are needed to change the steady state to some other state once a threshold has been crossed. The shrub-dominated rangelands are susceptible to intense wildfires that are likely to cause the plant community to cross another threshold and convert to annual grasslands. The shrubland community is also open to establishment of pinyon-juniper, resulting in conversion from shrubland to woodland.

The introduction of annual grasses, such as cheatgrass, and invasive plants (weeds) such as leafy spurge or the knapweeds provides the potential for many new pathways and thresholds, and therefore new steady states that are dominated by these undesirable species. The successful management of the current landscape requires some knowledge of which state exists on the site, whether or not a threshold has been crossed to achieve the existing state, how the proposed management action will influence the existing state, and what preemptive actions should be taken to prevent undesirable states from occurring.

State and transition models for the six primary ecological range sites that comprise the majority of sage grouse habitat have been developed by the Natural Resource Conservation Service (NRCS), and are included as **Appendix F**. These models are untested, but are based on current ecological knowledge of the plant communities within the planning area. Part of the adaptive management incorporated into this strategy will be to test the models and make

[10]This is a simplistic overview; a close examination of Clement's work indicates that the type of disturbance and the plant community present at the time of the disturbance could influence the subsequent stages of succession. However, the end points of these different successional paths were always the climax community.

revisions based on the field results. The models represent a hypothesis for what we expect to occur as a result of our management actions. If our hypothesis is correct, the model will not be modified significantly. If the hypothesis is not supported by the field results, then the new data will be incorporated into the model and tested (i.e., we will proceed based on current, albeit imperfect knowledge, and learn from our mistakes and our successes).

The discussion of the state and transition model is not meant to imply that the models are the basis for the management strategies provided below. Rather, the model is useful in that it causes one to be aware that not all sites will respond similarly to the same treatment, that the same range site at two different locations may not respond similarly to the same treatment, and that the same treatment conducted under different conditions on the same range site at two different locations may not get similar results. The model is useful in facilitating an understanding of the range site, current condition (including vegetation composition and soil seed bank), and potential response to any proposed treatment (i.e., that "one size does not fit all"). The models represent hypotheses for what we expect to occur as a result of management actions designed to reduce sagebrush densities and improve sage grouse habitat quality.

Fortunately, sage grouse are a landscape scale species that use a variety of habitats, including riparian zones. Therefore, management of the landscape must include consideration of other habitats and must be based on the understanding that what occurs on the uplands affects the riparian habitat, and management of the riparian habitat affects the upland habitat.

3.2 Goals

A goal is a statement of what we envision for the future. The goal of this strategy is to manage watersheds, basins, or subbasins in a manner that restores or enhances (as appropriate) the ecological processes necessary to maintain proper functioning ecosystems inclusive of the sage grouse. These processes include, but are not limited to: soil building, nutrient and energy cycling, water retention and cycling, maintenance of complex trophic pathways, and establishment of vegetation disturbance regimes that emulate presettlement disturbances in function and interval. Through these processes the plant, animal, and habitat diversity of the rangelands can be perpetuated for generations to follow.

The goal also includes statements of the desired outcomes, which are specific to individual resources. Based on the preliminary evaluation of the watershed conditions in the planning area, the following are examples of goals that may be developed for one or more watersheds:

- Sage grouse. Improve juvenile recruitment for local populations. Fall harvest data indicates that juvenile recruitment is insufficient to replace annual adult losses. Improvement of juvenile recruitment should halt the decline in sage grouse populations and with sufficient improvement, population increases are anticipated.

- Sage grouse. Restore sage grouse habitat on areas currently occupied by annual grasslands and encroached upon by pinyon-juniper. Annual grasslands do not provide habitat for sage grouse, and by occupying sites of one or more seasonal habitats for sage grouse, these annual grasslands may prevent local populations of sage grouse from establishing or increasing. Encroachment of sagebrush range sites by pinyon-juniper woodlands not only eliminates the occupied acreage as sage grouse habitat, but sage grouse may avoid sagebrush or riparian areas in proximity to pinyon-juniper stands because the woodlands include raptor perching habitat. Reestablishment of sagebrush on these range sites will increase the quantity of habitat over that which exists today.

- Vegetation/wildlife. Improve the macro diversity of habitats, and therefore the diversity of plants and wildlife. Creation of a mosaic of plant community transition stages on the landscape results in a variety of habitats and niches (for plants and animals) that do not exist when the land is dominated by one age class or condition of sagebrush.

- Vegetation/wildlife. Increase numbers or distribution of special status species where appropriate. Special status species will be included in all watershed plans where any special status species exist, or have the potential to exist, on the range sites being managed.

- Vegetation. Maintain high levels of productivity and diversity of perennial herbaceous plants to reduce the risk of establishment by exotic, invasive species.

- Livestock. Improve forage quality and quantity within the managed basins. Implement vegetation treatments and grazing systems that provide flexibility and promote vegetation diversity.

- Recreation. Improve recreational opportunities by increasing watershed values. Increases in plant and wildlife diversity, water quality and quantity, and range condition will improve the recreational opportunities over conditions which exist today.

- Mining. Maintain opportunities for mining and the short- and long-term habitat changes created by mining. Increasing the quantity of habitat for special status species and other wildlife will reduce pressure on mining operations that desire to mine in existing habitats for these species. Active land management provides opportunity for effective mitigation of unavoidable impacts.

- Fuels Management. Combine vegetation, wildlife habitat, and livestock forage treatments with fire management goals to achieve fuel breaks on the landscape. These fuel breaks/habitats will have a spatial and temporal component that will provide for a variety of land uses.

3.3 Objectives

The objectives are statements that provide measurable quantities or units of the desired outcomes. The objectives listed below are general objectives applicable to this Strategy. The measurable amounts (e.g., acres of annual grassland to be rehabilitated) and the time frames for achieving the objectives will be specific to each watershed plan. For example, pinyon-juniper encroachment is not an issue for all watersheds, and where encroachment is an issue it varies in magnitude among watersheds. Therefore, the specifics of how much to treat and over what time frame the treatments will occur has to be related to specific watershed/landscape goals.

The objective of this Strategy is to implement a watershed analysis process on the watersheds within the planning area by initiating the assessment of three watersheds each year and development of a watershed plan for each watershed within one and one-half years of the initiation of the process.

The watershed assessment will follow the process developed by BLM, US Geological Survey, NRCS, and Agricultural Research Service *Interpreting indicators of Rangeland Health* (BLM Technical Reference 1734-6, 2000), BLM's *Process for Assessing Proper Functioning Condition* (BLM TR 1737-9, 1993), the interagency Federal Guide for Watershed Analysis: *Ecosystem Analysis at the Watershed Scale*, and may be supplemented by other assessment methodologies as determined by the watershed assessment team. The assessment will include watershed-level quantification of the factors affecting sage grouse that were identified and discussed in Section 2.5. Specific objectives will be identified for each watershed based on the results of the assessment. These objectives will include sage grouse habitat objectives as well as more general watershed objectives, such as:

- Rehabilitate annual grasslands to perennial plant communities capable of supporting diverse land uses.
- Create a mosaic of vegetation age classes on the landscape to meet the needs of sage grouse and to allow for natural watershed functions and processes.
- Restore the sagebrush-herb community on range sites currently encroached upon by pinyon-juniper woodlands.
- Improve water quality and quantity within the managed basin.
- Manage uplands and riparian vegetation to improve systems at risk and restore

non-functioning systems to proper functioning condition.

3.4 Management Strategies

Management strategies are the specific actions necessary to achieve the stated objectives. The management strategies will be specific to each watershed and based on the assessment of each watershed. However, the preliminary evaluation of vegetation and issues for the planning area resulted in some general management strategies which are presented below. The vegetation treatments described below are not the only strategies to be implemented, but at this point in the planning, the need for vegetation management has been identified for each watershed and PMU. As stated above, the assessment results will be used to identify and/or develop other strategies specific to the watershed issues within each watershed.

Several of the management strategies discussed below are presented in the context of creating a mosaic of age classes of sagebrush on the landscape. For each strategy presented below, there are constraints which must be understood before treatments are applied. Although each of the four brush treatments will achieve similar results, there are significant ecological differences among the treatments. These differences must also be understood to ensure that the specific watershed management goals are achieved. A full discussion of the constraints and ecological factors of each treatment are presented in a summary at the end of this section. Other strategies, such as focused predator control, changes in livestock grazing systems, and greenstripping may also be implemented as necessary.

The vegetation treatments are intended to perpetuate the sagebrush plant community through periodic disturbance to provide the various successional stages associated with this plant community, from grass-forbs through shrub dominance, on a spatial and temporal scale that meets the overall objectives of the watershed. To be effective, the treatments need to be distributed in time and space. Treatments should be spaced in time to create at least four age classes (realizing that there is really a continuum of change, rather than four distinct conditions). The age classes should be five to 15 years apart as determined by the site potential, existing condition of the vegetation, and the specific watershed goals (to be determined during the watershed analysis). In general, the target should be to treat at least 20 percent of the acreage of the suitable range sites within the watershed within a treatment period (five to 15 year interval) and treat the entire acreage of suitable sites over 40 or more years, but probably not to exceed 60 years, as determined in the watershed assessment. Individual treatments should be at least 100 acres in size, but not exceed 400 acres, until some adaptive management feedback has been obtained and evaluated. A guideline that can be used at the pasture level within a watershed is: 1) for small pastures (i.e., less than 1,000 acres), no more than half of the pasture acreage in sagebrush range sites should be treated in any one time interval, and treatments should be no less than one quarter of the total pasture acreage; 2) for large pastures (i.e., greater than 1,000 acres), the treatment within any one time interval should not exceed one quarter of the total acreage of sagebrush range sites and individual treatments should not exceed 400 acres. Once the mosaic has been created, the interval can be shortened or lengthened, as appropriate, but the current condition of most sagebrush habitat in Elko County dictates an accelerated time frame to avoid the need to seed following the treatments.

The size of the treatment should take into consideration that treatment of a 400-acre “treatment block” does not mean all vegetation within the area will be treated. The “treatment” includes leaving sagebrush, either as strips, patches, or buffers (as needed for sediment control), and the shape of the treated area should be irregular so as not to resemble blocks. Thus a 400-acre treatment area that has the objective of thinning sagebrush density by 50 percent may result in the removal of 50 percent of the sagebrush plants on 70 percent of the area, leaving more than one-half of the pre-treatment sagebrush plants within the entire 400-acre treatment area.

The distinction between sagebrush control (i.e., eradication) and sagebrush thinning (i.e., opening a closed stand of sagebrush) must be understood. In the past, sagebrush control removed many acres of habitat and converted the land to grasslands. The size of these projects and the level of sagebrush control achieved prevented sagebrush from

reestablishing on the sites for many years. The strategy proposed herein is not to create large expanses of shrubless areas, but rather create large expanses of herb-shrublands. This can be accomplished by controlling or prescribing the degree of sagebrush removal.

3.4.1 Prescribed Burning

This treatment is recommended for mountain big sagebrush and Wyoming big sagebrush sites in precipitation zones with ten or more inches of precipitation annually. Prescribed burning may also be used for restoration of some annual grasslands or areas of pinyon-juniper encroachment; however, the following discussion focuses on using prescribed fire as a means of rehabilitating existing stands of sagebrush. Prescribed burning can also be used to reestablish aspen stands within the watershed, but such use would be established in the watershed analysis and watershed management plans.

Prior to settlement, fire and climate interacted to determine the vegetation on the landscape. Since settlement, man, domestic animals, and introduced species (especially invasive plants) have been added to the equation. Fire and climate remain the major factors, but the other factors also influence the outcome when fire occurs under various climatic conditions. Because many of these outcomes have not achieved desired land use objectives, fire has become viewed as being destructive. However, desired land use objectives can be achieved by the judicial use of fire under the appropriate conditions. The timing and intensity of the fire, as well as the size of the fire are important factors in achieving desired outcomes.

Timing is a combination of season of year as well as site conditions. Burning at the "correct time" but under the wrong conditions will not achieve the desired outcome. Spring or fall burning can be just as intense and detrimental as late summer wildfires if conditions at the time of burn are not monitored. Fall moisture can be sporadic, and when insufficient moisture is received, burning must be delayed until spring conditions are evaluated, or until the following year. Fall moisture allows dormant perennial grasses to "greenup" with some regrowth at the root collar. The increased fuel moisture is sufficient to protect the root collar from the detrimental effects of fire, allowing the stubble (dried material from the current year's growth) to burn without killing the plant. Spring burning can accomplish the same results; however, spring moisture conditions may prevent access to the sites when the proper burn window is available. "Burning on snow" or winter burning, is recommended for extremely dense stands of sagebrush. The blanket of snow protects the seed reservoir, soil organic matter, and herbaceous plants from the intense heat generated when burning dense stands of sagebrush. Winter burning requires that the shrub crowns be relatively close and that sufficient wind is present to spread the fire. This may be the most successful method for treating Basin big sagebrush (*Artemisia tridentate* ssp*. tridentata*) due to the extreme fuel loading that can occur in the loamy bottoms where this species is found.

The established root system of the perennial plants can benefit from the nutrients that are recycled in the process of burning, generating vigorous and nutritious forage in the spring. As discussed above, the new growth when nutrients are abundant is tender and palatable to wildlife and livestock. The regrowth following prescribed burning has lower lignin content and higher nutrient levels than that found in older ungrazed plants. Carbon accumulation (i.e., high lignin content) occurs in older, "wolfy" plants that are nutrient stressed. Thinning the stand of sagebrush to create openings for herbaceous vegetation increases nutrient cycling by allowing the carbon and other nutrients to return to the soil as litter or dung by the end of the growing season. Without thinning of the sagebrush, herbaceous plants are outcompeted by the sagebrush and the carbon and nutrients become tied up in the woody plants, unavailable for other plants. Thinning reverses the trend and the increased soil organic material increases soil water capacity, soil microbial activity, and soil productivity.

In addition to the conditions under which the prescribed burn is conducted, the manner in which the burn is ignited can also be used to achieve a desired outcome. To achieve a low intensity prescribed burn (referred to as a "cool" fire), the key is to prevent an extensive united fire front (the wall of flame advancing the fire) and long fire runs (the distance from the ignition point to the end of fuel, measured parallel to the wind direction). The fire front is controlled by using spot ignitions; spacing the ignitions along

the fire line to prevent the ignition points from converging. This type of ignition disperses the fire front and prevents mass heating ahead of the flames. Limiting the fire run is accomplished by creating a backfire at the downwind side of the treatment area to create a fuel break known as a blackline. The width of this break is determined by the fuel loading and burn prescription, but for most low intensity burns, twenty feet of complete blackline is likely to be sufficient. The rest of the treatment area is burned by igniting a series of spaced lines of spot ignitions, with the lines running perpendicular to the wind direction. The ignition lines should be spaced at 100- to 200-foot intervals. The fire ignition lines should be started in sequence, starting at the blackline (downwind) side of the treatment area and not igniting each successive line until after the preceding line has burned one-half of the spacing interval. This method of burning limits the intensity of the fire and significantly reduces the potential for the burn to escape the prescribed perimeter. As with all prescribed burns, a complete fuel break or foam line should be established around the perimeter prior to any ignition. The site specific burn plans for each treatment area will include specific measures for containing the fire within the prescribed treatment area.

The sagebrush plants that remain after the treatment are released from competition and will not be nutrient stressed. The plants switch from the production of fiber and carbon-based compounds to the production of nitrogen based reproductive parts. The consequences for sage grouse are two-fold. First, the plants improve as winter forage and contribute to the assimilation of energy and protein needed for the breeding season. Second, abundant seed production occurs to establish the next stand of sagebrush that will eventually provide nesting, early brood, and winter habitat. The overall effect is to improve the quality of one seasonal habitat and set the dynamics for perpetuation of the site as future habitat for other seasonal uses.

The stands that are treated will provide the grassland and grassland-shrub habitats needed by a variety of animal species (see **Appendix G** - Sagebrush Obligate Species) and increase forage for herbivores (wild and domestic) where forage was previously less abundant. When included in a mosaic of other sage grouse habitats, livestock grazing generally will graze the treated areas first. This allows spring growth of herbaceous plants found in nesting habitat to grow without grazing while sage grouse are on the nest. Depending on the grazing system, sufficient residual growth and/or stubble height will be maintained in the untreated areas (i.e., the nesting habitat) because the livestock are removed from the pasture after grazing the treatments or lightly grazing the untreated areas. In areas where the pre-treatment understory of herbaceous plants is relatively high, the existing herbaceous plants will be released. These plants have existing root systems and protection from grazing is not required (provided the treated area is under a grazing system). The normal pasture grazing system can be maintained.

In areas where the herbaceous understory is determined to be insufficient to properly dominate the site within one to three years after treatment, seeding following the fire with the appropriate seed mix is an option that should be determined prior to the prescribed burn. Due to the charred stems of sagebrush (skeletons) that should remain standing if the fire intensity is controlled, broadcast seeding or aerial seeding may be the only method of seeding available. Plants that can establish by broadcast seeding and that do not require a soil cover should be considered for the seed mix. Without seeding, invasive species may establish on the site. Post-treatment grazing management may be required under these conditions to allow the seeded species to establish prior to grazing.

3.4.2 Herbicide Applicaton

Herbicide application for purposes other than sagebrush thinning, such as control of annual grasses, control of invasive noxious weeds, or control of other undesirable plant species may be incorporated into the specific watershed management plans, as appropriate. However, for this Strategy, herbicide application is only being discussed as a means of rehabilitating existing stands of sagebrush.

The use of tebuthiuron for control of sagebrush is not a new practice. This selective herbicide has been used for years. However, in the past the goal was usually to achieve a very high rate of mortality of sagebrush. To rehabilitate the rangelands, complete shrub removal is not the desired goal. As with the prescribed burning discussed above, the goal is to open up a stand

to allow perennial grasses and forbs to reestablish. The degree of sagebrush mortality depends on the rate of application, the amount of rainfall after application, and the amount of clay and organic material in the soil. NRCS has developed an information sheet for tebuthiron (**Appendix H**), which provides specific application rates for various levels of soil organic matter and desired level of canopy cover reduction. When applied properly, tebuthiuron will not kill herbaceous plants.

To achieve a herb-shrub community through the application of tebuthiron, one can choose from two different options. The first option is a uniform application at the recommended rate to achieve a desired level of thinning. This will result in the vegetation within the treated area appearing somewhat uniform: shrubs widely spaced with grasses and forbs dominant. A rate sufficient for a 75 percent reduction in shrub cover is recommended for this option. The second option is to apply the herbicide in a less uniform manner, but at a slightly higher rate. This will result in patches of shrubs being distributed throughout the treatment area and less shrub cover between patches. Both options will provide the desired results for sage grouse; opening of the stand and providing a new generation of sagebrush. The only difference for sage grouse is that the shrubs that are released using the uniform application option are likely to provide higher quality forage than those shrubs that are left in patches (depending on the size of the patches). However, the patches provide loafing cover for the birds following a feeding period. The patch option may be more conducive to creating openings in the sagebrush as habitat for wildlife species that nest in grasslands and prefer little or no shrub canopy at the nesting sites.

Leaving strips of sagebrush perpendicular to the prevailing winds will create natural snow “fence” to increase the capture of winter moisture, facilitating seedling establishment of grasses, forbs, and shrubs. Establishing natural “snow fences” should be considered at the lower elevation sites where moisture is a potential limiting factor. The strips will create some visual contrasts with the surrounding landscape for several years, requiring careful consideration of the moisture requirements when in visually sensitive areas.

3.4.3 Aerating

Aeration consists of rolling a large drum across the treatment area to crush or break the brush. The drum has blades spaced around it to achieve some imprinting of the vegetation into the soil. The weight of the drum can be changed by varying the amount of water used to fill the drum. The less weight the lower the impact on the vegetation. The drum acts to crush or break the stem of the woody plants, but does not have much impact on herbaceous plants. The blades push some of the material into the soil, enhancing levels of soil organic material. Reported herbaceous plant response to this treatment has been favorable.

As with the application of herbicides, the aerator can be used to create a uniform vegetation community or to create patches of sagebrush within the treated area. The aerator can also be operated in a manner that will create natural “snow fences.” A one-pass aeration and seeding operation can be accomplished where necessary by mounting a broadcast seeder directly on the aerator or on the tractor used to pull the aerator. This is recommended for sites where the sagebrush is of such high cover that the herbaceous understory is depleted. The litter created by this method provides protection from grazing for emerging seedlings.

3.4.4 Disking

Disking is a mechanical control method of some annuals or invasive noxious weeds which may be appropriate. Use of this tool for these purposes should be considered at the watershed management plan level. Disking is only being discussed below as a means of rehabilitating existing stands of sagebrush.

Disking, like the application of herbicides, has a relatively long history of use for brush control. Where intensive disking has been conducted, sagebrush eradication has been achieved. However, where disking was conducted “improperly” or purposely conducted less intensively, the control of brush was less “successful.” As stated for the other treatments, the purpose of disking is to thin the stand of sagebrush, not eradicate the sagebrush. Disking is conducted with a rangeland disk, of which there are many versions. Whichever equipment is used, the level of disking should be minimal, and the pattern of disking should be such that unplowed rows of sagebrush remain as “leave

strips." The leave strips should not be more than six feet wide and spaced at approximately 60-foot intervals. Patches can be left to provide cover for sage grouse, and nesting habitat for other bird species. Jackrabbits are also likely to inhabit these patches and feed on the treatment areas.

Disking is limited to soils that do not have a lot of cobble or boulders and to landscapes that are not very steep. This treatment is the most invasive of the treatments so far discussed, and the potential for undesired results is high. Established understory vegetation is generally uprooted and an initial decline in herbaceous cover may occur with this treatment. Soil disturbance increases the potential for invasive species to establish and for greater water or wind erosion. However, this treatment also incorporates organic material into the soil and may create a favorable seedbed for desired species. Therefore, it is necessary to have a good understanding of the site potential, current site conditions, and surrounding vegetation before implementing this treatment.

As with aerating, disking and broadcast seeding can be achieved, where appropriate, in a one-pass operation by mounting a broadcast seeder on the disk unit or the tractor.

3.4.5 Seeding

Seeding can be used for restoration of degraded rangelands, for rehabilitation of older, decadent stands of sagebrush, to reestablish grasses and forbs on range sites previously occupied by pinyon-juniper, and for burned area rehabilitation. Seeding will most often be used in conjunction with some other treatment that is designed to prepare a suitable seedbed or to remove competing or undesirable vegetation.

The seed mix to be used will be selected to meet the objectives of the watershed management plan and will consist of species that are adapted to the specific sites to be seeded. In keeping with the overall goal of the Strategy and the Northeast Great Basin Standards and Guidelines to restore or maintain natural processes of the watershed, native species will be selected over non-native species whenever the two species are equally adapted to the site and have similar establishment characteristics. In some instances, the selection of species may be a result of the type of seeding method available because one species has a higher establishment rate when a specific method of seeding (e.g., broadcast seeding vs. drill seeding) is used. Two exceptions to the preference for native species should be noted. Greenstrips, discussed below, have a specific purpose, and a combination of native and exotic species may be used to achieve these specific purposes. The other exception is burned area rehabilitation. Currently, establishment of native species in areas of low precipitation that have been subject to intense fires and/or had little herbaceous understory preceding the fire, has met with limited success. Until seeding techniques, seedbed preparation methods, and plant materials have been sufficiently developed for these arid sites, adapted exotic species are recommended for site stabilization and noxious weed control. The use of some exotic species has been shown to provide for long-term reestablishment of native grass and shrub species. However, as new technology or plant cultivars develop, the dependence on exotic species should be eliminated.

Each seeding of sagebrush range sites should be designed to provide for the establishment of plant communities that will provide the structure and diversity of plants to support a variety of wildlife species over time. This can be accomplished in one of two ways. On sites with relatively high potential (i.e., deeper soils with water holding capacity, higher precipitation zones, and topographic diversity) that have either burned or have a depleted herbaceous understory, a seed mix of a few grasses and forbs may be the most appropriate. Seeding following a wildfire or after one of the sagebrush thinning treatments is designed to supplement the natural processes that lead to plant species diversity. The simple plant community thus created will become more diverse with time as native species suited to the site establish (i.e., achieve diversity from the "bottom up" approach). Stabilization of the site to prevent erosion or the establishment of invasive or noxious weeds should be a first priority. A diverse plant community cannot be developed where soils are eroded or where invasive or noxious weeds dominate the site. Conversely, diversity may be achieved by the "top down" approach. Using a diverse seed mix on a site with a variety of microsites will allow many of the species in the mix to establish where the conditions for each species are favorable.

On rangelands with low potential (i.e., poor soils, low precipitation zones, low topographic diversity), a simple seed mix is generally the most effective. These sites do not have the potential for a highly diverse community; therefore using a seed mix with eight or more species is not cost effective.

The use of shrubs in the seed mix should be carefully considered. On sites where sagebrush thinning is part of the treatment, sagebrush seed will be produced on site and need not be included in the seed mix. Generally, seeding in combination with a sagebrush thinning treatment will be designed to increase grasses and forbs, not shrubs. The objective is to allow the shrubs to establish over time and create nesting and early brood habitat where a healthy component of herbaceous plants has already established. On sites that are restored after years of dominance by either annual grasses or pinyon-juniper, the soils may be lacking the mycorrhizae necessary for sagebrush establishment. For these sites, a second overseeding with sagebrush (with or without supplemental species) five or more years after the initial seeding may be both more cost effective and more successful than seeding immediately after the removal of the annual grasslands. The objective of overseeding is not to establish sagebrush uniformly over the entire seeding, but rather to create patches of sagebrush throughout the entire seeding. This prevents the single age class monoculture of sagebrush from developing and creates variable fuel loading to keep wildfires from burning large acreages.

This same concept should be considered for burned area rehabilitation. Large burned areas that supported sagebrush at the time of the fire should be spot seeded with sagebrush as a second seeding (i.e., overseeding) effort the first fall/winter after the fire, or have sagebrush seed loaded into the drill seeder or aerial seeder intermittently (e.g., every fourth load) to create strips or patches of sagebrush within the burned area. These plants will mature quickly in the absence of dense herbaceous competition and start the natural progression of sagebrush establishment and age class creation over a 30- to 40-year period. This should result in a variety of sage grouse seasonal habitats developing within the burned area, rather than having one large age class develop that only provides one seasonal habitat at any given time.

The other factors to consider when seeding sagebrush are the cost and the conditions needed for establishment. Seeding intermittently reduces the overall cost, allowing more burns to be seeded with some sagebrush seed. Establishing small patches over many burned areas may have greater benefit than completely seeding only a few burns. In addition, conditions suitable for sagebrush germination and establishment do not occur every year (Perryman et al. 2001, Maier et al., 2001). Therefore, intermittent seeding should be planned as a two-phase effort. The first phase should be during the fall or winter following the burn. If unsuccessful, a second seeding two or three years later may be more successful. During periods of extended drought, sagebrush seeding should not be conducted because the chances of successful establishment are extremely low during dry springs.

Where sage grouse habitat, or potential habitat, and mule deer crucial winter range overlap, careful consideration of restoration and fire rehabilitation seed mixes is necessary. Currently, prostrate forage kochia (*Kochia prostrata*) is recommended for mule deer crucial winter range. This species provides forage for mule deer, pronghorn antelope, and livestock, but has not been shown to be of value to sage grouse or other species of the sagebrush ecosystem. Prostrate forage kochia is an aggressive species that establishes easily in some of the lower precipitation zones and has demonstrated the ability to compete favorably with cheatgrass. While there is no doubt that this species provides important forage for mule deer and can be effective in greenstrips (see below), not much is known about how this species interacts with native vegetation over the long term. Where kochia and sagebrush can be successfully established on the same sites, will kochia prevent sagebrush from reaching the cover percentages required for sage grouse seasonal habitats? Will the presence of kochia extend the fire interval in sagebrush stands, leading to depletion of the native herbaceous plants? Will kochia demonstrate the long-term environmental adaptations that we now observe for cheatgrass? Without answers to these and other questions, some caution should be exercised when using kochia in sage grouse/deer habitats. Where mule deer crucial winter range does not overlap with sage grouse habitat, kochia could be included in the seed mix

to restore mule deer habitat values. Where the two species' habitats overlap, restoration of sagebrush and other native shrubs should be the management goal.

3.4.6 Greenstripping

Greenstrips are linear seedings (strips) of plant species that have some resistance and tolerance to fire. Fire resistance means the plants are less likely to burn than other plants. For most greenstrip species, this means that they retain fuel moisture, and therefore a green appearance later into the summer than many of the cool season grasses and forbs common to the Great Basin. Fire tolerance indicates that a plant recovers following a fire. The plant may have adaptations to protect growing points, resprout from root nodules, or have seed that requires exposure to heat or altered soil chemistry to germinate. The concept of greenstripping is to provide a strip of fire resistant, fire tolerant species at a strategic location to either prevent the fire from spreading from one side of the greenstrip to the other side, or to slow the spread of the fire to allow suppression crews to arrive, or to provide fire suppression crews with a fuel break from which to anchor their suppression efforts.

Another factor to be considered when planning a greenstrip is palatability of the greenstrip species to livestock and wildlife. While these species may be fire resistant, they do eventually dry out and become potential fuel. Grazing the greenstrip late in the growing season reduces the amount of standing fuel within the greenstrip during fire season, increasing the effectiveness of the greenstrip. Greenstrips can be used wherever there are habitats or facilities that need some protection from unplanned, dry season fires.

There is some indication that by breaking the fire cycle, cheatgrass loses some vigor and seed production decreases, resulting in increased effectiveness of control efforts. These grasslands are highly flammable and fire dependent communities. By breaking large areas into smaller areas, an ignition in one block can be maintained within the block, rather than re-burning the entire annual grassland. Greenstrips are one method commonly used in annual grasslands to break up the grassland into smaller blocks.

The greenstrips must be planned with the "end in mind." Breaking up large annual grassland into future management units should consider the landscape features and surrounding vegetation. The greenstrips can be positioned on the landscape where they are less visible, or where they would be protected from prevailing winds. The leeward side of a ridge away from a road or other major observation point would achieve both of these objectives. The snow accumulation on the leeward side of the ridge would also favor establishment and functionality of the greenstrip. The management units created by the greenstrips should be irregular in shape to allow the eventual vegetation mosaic to mimic natural vegetation communities. Using soil map unit boundaries as the greenstrip boundary will help achieve this affect. Greenstripping with the topographic contours is also effective.

Greenstrips can also be used to reduce the risk of fire spreading from an annual grassland to sagebrush habitats or other desired plant communities. The greenstrip is normally placed at the contact zone between the annual grassland and the sagebrush habitat. The reduction in fuel within the greenstrip slows the fire and reduces the fire intensity, giving suppression crews an opportunity to keep the fire from the sagebrush habitats. Greenstrips may also be appropriate to break up extensive areas of sagebrush. These extensive stands are vulnerable to wildfires, especially when they are decadent, in which case the intensity of the fires is generally quite high and the potential for annual grasses to become established following wildfire is high. This use of greenstrips should be considered in watersheds that are not at the top of the priority list for watershed plan development. The greenstrips would help maintain the sagebrush resource until watershed plans can be developed.

The watershed assessment and watershed management planning would determine the applicability of greenstrips, as well as the specific plant species to be used in establishing greenstrips. Some cultivars of crested wheatgrass, prostrate forage kochia, an upland cultivar of western yarrow, and some exotic forbs are effective and commonly used species. Research to develop cultivars of native species is ongoing, with some promising preliminary results. As native species cultivars are developed, they should be used wherever

suitable to reduce the visual and ecological impacts of greenstripping.

Greenstrips, while providing benefits for restoration and fire suppression activities, can also be viewed as fragmenting habitats (i.e., breaking up large blocks of habitats into smaller parcels). Therefore, some thought needs to be given to the placement of greenstrips on the landscape. Here are some guidelines to consider:

- Plan greenstrips to complement existing features. Roads can be considered fuel breaks and are more effective if a greenstrip is placed adjacent to the road. The presence of the road also reduces the width of the greenstrip necessary to achieve effective results. The greenstrip should include both sides of the road, with two-thirds of the greenstrip width on the upwind side (for the prevailing winds) and one-third of the width on the downwind side. Other features that can be used in combination with greenstrips are fences, transmission lines, and drainage features. The added benefit of greenstrips along fences and transmission lines is that wooden fence posts and power poles are less likely to be burned, reducing costs of wildfire rehabilitation. Greeenstrips along ephemeral or intermittent drainages may reduce soil erosion and incision of the drainages by maintaining vegetation adjacent to the drainages. However, the greenstrip should not be placed in the drainage itself.

- Plan greenstrips in sagebrush communities to coincide with the long-term plans for the watershed. At the outset, a desired mosaic can be mapped and greenstrips can be used to break up the large expanses of sagebrush along the edges of the blocks of the mosaic. The greenstrips thus function as fuel breaks and can eventually be used as the fire line to control prescribed burns.

- Use the minimum width necessary. Greenstrips will present visual contrasts with adjacent vegetation and may create potential predator traps for prey species crossing the greenstrip. Visual contrasts have been previously discussed. A greenstrip created to break up a continuous block of sagebrush creates a strip with minimal cover between the resulting sagebrush blocks. Small mammals, birds, and reptiles crossing these strips will be vulnerable to predation.

- Where the visual contrast between exotic fire resistant species and native perennial species is undesirable, opt for removing shrubs from native perennial vegetation to create a greenstrip that will reduce the contrast by consisting of the native grasses and forbs.

- Existing and planned transmission line corridors and fence lines should receive high priority for greenstrips. Transmission lines may result in habitat fragmentation and rather than create more fragmentation by creating separate greenstrips, the two features can be combined. As mentioned above, greenstrips may reduce the loss of wooden poles and fence poles to wildfires. In addition, prey species are already scarce along transmission lines due to the increased predator use of the poles for hunting perches; therefore, planting non-habitat (i.e., a greenstrip) where animals are less abundant has less impact. Transmission lines and fence lines generally have access points for maintenance, which can be used as access for fire suppression crews. As new transmission lines or fences are constructed, the greenstrip can be created as part of the reclamation requirements for construction disturbance.

3.4.7 "Brownstrips"

"Brownstrip" is a new termed coined by the NNSG to differentiate between a greenstrip created with non-native species that are fire tolerant and fire resistant (i.e., retain greenness longer into the growing season) from fuel breaks that have reduced shrub abundance (either devoid of shrubs or very widely spaced shrubs) and occupied by native perennial herbaceous species that are brown or tan when cured at the end of the growing season. Brownstrips are an

alternative to eradicating existing native perennial vegetation and seeding fire resistant or fire tolerant species. While not as effective as planting fire resistant species, this practice is more cost effective, and at lower precipitation zones, may have higher potential for success than a seeding.

Brownstrips can be created in a number of ways, including brush mowing, aerating, disking, prescribed fire, herbicide, and through prescription grazing. The choice of technique will depend on terrain, rockiness of the soil, and current condition of the vegetation. The brownstrip is a tool for breaking up large contiguous tracts of sagebrush to limit the size of wildfires that may start in these intact habitats. The intent of the brownstrip is to release the herbaceous understory and reduce the woody (long-term) fuels. Grazing brownstrips is strongly recommended due to the lower fire resistance of these types of fuel breaks. These open areas, when grazed, reduce the standing fuel to a level that is insufficient to carry a fire.

Brownstrips are recommended along fence lines, roads, and power lines until watershed plans are completed. The power lines and fence lines can be created by aerial application of herbicide (tebuthiron). An 80-foot swath along fence lines (using the fence line as the center line) or roads (one side of the road), and two 80-foot swaths along power lines (one on either side of the power line) is recommended. This would create approximately 10 acres of brownstrip per linear mile of road or fence line and 20 acres of brownstrip per linear mile of power line.

Any of the native vegetation treatment to achieve the sagebrush succession, sage grouse habitat, fuels management, and livestock objectives stated above will be brownstrips during the herbaceous phase of the plant succession. These treatment areas do not necessarily need to be “strips”, but can be any shape as long as they serve to break the contiguous woody fuels on the landscape.

3.4.7 Chaining, Woodcutting, and Wood Harvesting

Chaining consists of dragging an anchor chain across the landscape between two bulldozers. The chain breaks or uproots shrub and tree vegetation and rolls over herbaceous vegetation. The technique is commonly used in pinyon-juniper woodlands. As with disking, soil disturbance occurs and the opportunity is created for invasive species to become established. In the semi-arid and arid regions of the Great Basin, woody material does not decay readily; therefore the rate of incorporation of organic material into the soil can be quite slow.

When applied to areas with established understory vegetation, the herbaceous plants can be released. However, where understories are meager, chaining should be followed with seeding. The litter that is left after chaining does not provide much in the way of sage grouse habitat, but the downed trees can provide habitat for a variety of other species. Burning the down litter or slash would generally favor sage grouse if sagebrush and herbaceous plants are expected to establish on the site.

As with the sagebrush ecosystem, the pinyon-juniper woodlands have a complement of wildlife species, some of which may be considered obligates. Therefore, conversion of pinyon-juniper to sagebrush needs to be accomplished while still providing the necessary habitat requirements for the pinyon-juniper obligates. This can generally be accomplished by identifying the woodland sites and the rangeland sites during the watershed assessment. Managing the pinyon-juniper on the woodland sites, through appropriate management strategies as proposed herein for sagebrush, would result in healthier woodland sites and maintenance of the associated fauna and flora.

Where markets exist, woodcutting for fence posts and firewood may be appropriate alternatives to chaining. Although some of the organic material is removed from the site, the slash that is left decays more readily than tree trunks. Soil disturbance is often less after woodcutting than after chaining. Woodcutting may not result in the complete removal of pinyon-juniper, because smaller diameter trees are passed over. The combination of woodcutting and chaining may provide the best overall treatment of pinyon-juniper. An area planned for pinyon-juniper removal could be opened up for commercial or non-commercial woodcutting for two or three years and the residual trees could be chained at the end of that period. This would allow for harvest of the

useable wood fiber and reduce the amount of slash left after chaining.

Other uses of the pinyon-juniper biomass should be considered. An industry that can be sustained by removing these woodlands and using the biomass, while providing for the renewal of these woodlands over time, would benefit rural economies and make use of a potentially valuable resource, rather than on-site burning or chaining. An industry solution would generate income, rather than require funding like the burning and chaining options. A wood pellet or wood cube factory, wood-fueled power plant, or other wood products industry needs to be considered and developed where appropriate.

Normal woodland harvest operations generally leave the seedlings and saplings of the woodland species. Therefore, the stock necessary to regenerate the woodland is likely to be in place. Where sage grouse or other watershed values require a longer interval before the pinyon-juniper woodland reestablishes, prescribed burning after the removal of the mature trees may be a cost-effective means of removing the seedlings.

3.4.8 Grazing

Grazing can be a tool to achieve land use objectives or it can be an impact that detracts from achieving land use objectives. As discussed in Section 2.5.5, herbivory is not the issue, it is the timing, intensity, and duration of herbivory that needs to be managed.

3.4.8.1 Grazing As A Tool

Sagebrush thinning can be achieved through livestock grazing. Winter feeding of hay on upland sites concentrates the livestock in a relatively small area, resulting in breakage of shrubs and thinning of the sagebrush stand. In order to implement this practice, pathways need to be established within the dense sagebrush to allow vehicle access during winter for hay distribution. An aerator, disk, or brush hog (brush mower) can be used to create the access. In addition to thinning the sagebrush, residual hay and concentrated dung provide organic material that can be incorporated into the soil, improving the nutrient levels and water holding capacity of the soil. Trampling of the cow pies promotes rapid breakdown and incorporation of the manure into the soils. This technique is only applicable to lands with moderate to level topography that exists close to hay production areas.

Winter feeding on uplands is also likely to improve water quality. Currently, many operators use the aftermath on hayfields as fall and winter forage. Prior to hard frost, this practice provides fertilization of the meadows. Soil organisms remain active and contribute to the incorporation of this material into the soil. But once the ground is frozen, soil organisms either cease functioning or function at a greatly reduced rate. The urine and manure build up on the soil surface and are washed into the creeks and streams during the spring runoff. By feeding on the uplands when the ground is frozen, these impacts to water quality can be reduced.

Winter feeding on the uplands should be rotated among sites, both within and between years. Continuous feeding at the same site throughout the winter is likely to cause sagebrush eradication. Annual use of the same area is also likely to cause impacts to herbaceous plants through hoof action, eliminating the potential increase in herbaceous vegetation production resulting from the initial thinning. Therefore, several areas should be established for winter feeding and a site rotation system implemented. Or, the treatment can be applied to a new site each year to accomplish additional acreage of habitat management.

Moderate livestock grazing of meadows has also been shown to improve sage grouse forage and to make meadows more attractive to sage

grouse than ungrazed meadows (Neel 1980, Evans 1985, Klebenow 1985). Utilization that reduces rank growth, but leaves clumps of tall grass distributed throughout the meadow, creates optimum habitat conditions for sage grouse and leaves sufficient stubble of grass to replace root reserves. The stubble also serves to trap sediment during high flows (e.g., spring runoff), improving the meadow, stream channel morphology, and water quality. Extreme use or abuse of the meadow results in degradation of the meadow, stream channel morphology, and water quality.

Grazing can also be used to improve the effectiveness of greenstrips. Even though the species used to create greenstrips are relatively fire tolerant, they still provide some fuel during high fire danger conditions. Grazing the greenstrips during the growing season reduces the amount of fuel available. Herding and placement of mineral supplements are techniques that can facilitate grazing of greenstrips.

This same concept can be used on upland sites to reduce fine fuels and decrease the potential for the spread of wildfires. However, this only applies to stands of sagebrush that are open and need the fine fuels to carry the fire, and to grasslands created by the treatments discussed above. Most of the existing sagebrush communities have sagebrush cover values that are too high to make grazing an effective tool. These communities need to be managed before grazing will be an effective tool. Repetitive early spring “flash grazing” in cheatgrass-dominated sites may be used to reduce cheatgrass over time.

3.4.8.2 Grazing As A Land Use

As discussed in Section 2.5.5, livestock grazing can be a compatible land use of the sagebrush ecosystem. However, changes in livestock management are necessary to maintain ecosystem sustainability and sustainability of the livestock industry.

One necessary change is in the manner in which range condition is determined. The current method involves determining if the existing vegetation resembles the desired plant community. The desired plant community is related to a seral stage of plant community succession. However, the current system appears to be based on the linear successional models that inappropriately assume that removal of a stressor will allow the community to proceed to the next climax condition or return to a lower seral stage. As discussed in Section 2.5.5, when Wyoming sagebrush reaches approximately 10 to 12 percent canopy cover and mountain big sagebrush reaches approximately 15 percent canopy cover, herbaceous vegetation cover begins to decline, and species richness decreases with additional increases in sagebrush canopy cover, with or without livestock grazing (Winward 2000).

When sagebrush cover reaches 20 to 25 percent, most rangeland sites will be classified as being in poor to fair condition because of the lack of herbaceous species, especially forbs. There is probably no growing season grazing system that can reverse this trend (but see Section 3.4.8.1 for winter feeding benefits). The sagebrush canopy must be reduced to achieve the desired condition because succession, or plant-plant interactions, is driving the system, not livestock grazing impacts.

If range condition is to remain the standard for making adjustments to livestock grazing operations, then the assumptions of linear successional models and livestock grazing as the major stressor must be modified. The concept of range condition must be modified to recognize that perturbations to the vegetation are necessary to achieve the desired plant community.

Another necessary change is to adjust grazing systems (timing, intensity, and duration) to the specific vegetation communities being grazed. As the landscape is modified to create a mosaic of vegetation communities and transitional stages, current grazing systems may need modification to reach the land use goals. Some modifications that may be incorporated are:

- Creation of additional pastures to allow rotation or deferment systems;
- Changes in the timing of grazing within a pasture to accommodate carbohydrate cycles or seed production;
- Changes in the duration of grazing within a pasture to achieve riparian objectives;

- Modification of an existing rotation system to achieve long-term aspen management objectives; and
- Other modifications which are appropriate to reach specific objectives.

However, these types of changes, when necessary, need to be implemented in a manner that minimizes the impact to the livestock operator; the operation must remain viable.

As the landscape is managed, and monitoring or research provides new information, the adaptive management process will provide for additional information and techniques to be incorporated into the goals, objectives, and strategies for conserving the sagebrush ecosystem.

In Section 2.5.5, the focus was on grazing with cow-calf pairs. Consideration should be given to using winter ranges in other parts of Nevada (or adjacent states), rather than over-wintering in Elko County. This would reduce the amount of hay production necessary under the current system, or provide Elko County ranchers with a cash crop by selling the hay they currently use for winter feeding. If the meadows are not used for hay production, they would be available for late season grazing or emergency grazing during drought or after a wildfire on other parts of the allotment. Late summer grazing of large meadows can be used to relieve hot season pressure on riparian habitats in smaller drainages.

The topography in much of Elko County is suited to yearling steer or sheep grazing. Changes in class of livestock may be effective where riparian issues are the major obstacle to reaching watershed objectives. As mentioned previously, herding and high-intensity, short-duration grazing may also be techniques employed to reach some land use goals.

As with the other management strategies, a change in grazing, if necessary, will be identified during the watershed assessment. The change would have to be related to achievement of a specific objective. Changes in grazing on public lands are made through the allotment evaluation process with respect to the Standards and Guidelines for Rangeland Health. The NNSG will make recommendations to the agencies based on the watershed assessment and watershed plans, but the NNSG also recognizes that implementation of any recommendation regarding grazing is subject to the agency process, schedules, and time frames. Any change in grazing management would be implemented through issuance of a grazing decision and/or agreement, in order to progress toward attainment of Standards and LUP objectives, or site specific watershed objectives determined to be consistent with Standards and Guidelines or LUP objectives.

3.4.9 Predator Control

As discussed in Section 2.3.3 and 2.5.8, predation has been identified as one factor affecting sage grouse populations, primarily through impacts to nest success and early chick survival. Therefore, predator control programs that focus on areas that have been identified as nesting or early brood habitat should be considered in the watershed management plans.

Specific predators need to be identified as the offending animals prior to initiating any predator control program. In addition, the contribution that each predator species makes to the ecosystem needs to be considered to avoid creating additional problems as a result of predator control. Although there may be evidence that predators are impacting sage grouse populations, these same predators may be controlling ground squirrel, poisonous snake, or jackrabbit populations. Wholesale extermination of predators is not compatible with the ecosystem management concept.

An example of a focused predator control program would be related to the concern with nest predation by ravens and/or crows using power transmission lines as perches from which to search for nests. The placement of chicken eggs injected with a corvicide (i.e., a poison specific to ravens, crows, and magpies) along segments of a transmission line route that pass through sage grouse nesting habitat at the beginning of the sage grouse breeding season is one means of achieving focused predator control. This would target the primary avian nest predators in areas where sage grouse nesting occurs, and at a time when the action would provide immediate results. This technique could also be used along fence lines. Livestock winter feed lots are another area where corvids concentrate in the late winter and could be used to focus a predator control effort.

3.4.10 Land Exchanges

Land exchanges can be used to address two of the major factors affecting sage grouse: habitat fragmentation and changing land uses.

Utility corridors, primarily transmission lines and distribution lines, which traverse sage grouse habitats create physical and psychological barriers for sage grouse that result in habitat fragmentation. Planning corridors for future utility needs would be one means of avoiding or minimizing this type of impact. Elko County already has an abundance of utility lines in existence. Based on an incomplete data base, approximately 550 miles of major transmission lines traverse the county. Routes for future lines should be adjacent to existing road or utility corridors, rather than in non-fragmented habitats. Planning, including creation of a utility corridor parallel to the railroad, state or interstate highways within the "checkerboard" land status area should be initiated. The planning for such corridors should include discussions with the utility companies to identify potential long-term needs and where transmission line corridors may be needed to meet these needs. Such a corridor could be created through a series of land exchanges to create a public land corridor designated for such utility activities. Outside of the checkerboard lands, utility corridors should be designated in the public land management and county land use plans. These corridors should be identified by examining a variety of resources in addition to potential sage grouse habitat. Corridors identified through this process would reduce costs of permitting (and costs of utilities to the end users), such as condemnation procedure costs and environmental permitting costs, and provide utility companies with direction for their planning process. This would replace the more reactionary process that is currently in place.

As with habitat fragmentation, there is an opportunity to plan for land exchanges that would accommodate growth around existing communities, rather than create new intrusions into non-fragmented or undeveloped areas due solely to the current availability and distribution of private lands. Although the current trend in the County population is stable or decreasing, the appeal of rural lifestyles will continue to attract those wishing to leave highly urbanized areas. Therefore, it is likely that additional development into these undeveloped areas will continue and some form of planning for such development is recommended. Such planning provides for the future population increases while maintaining the integrity of the natural resources to support the needs of the population.

3.5 The Watershed Planning Process

The 42 sub-basins in Elko County presented too large a task to undertake as individual planning units. Therefore, sub-basins were combined into 19 major watersheds (**Figure 12**). Each major watershed will be the subject of a watershed assessment and subsequent watershed plan. The 19 major watersheds include many more acres of land to actively manage than can be treated with existing funding and manpower. Therefore, the first task was to develop criteria to prioritize the watersheds or sub-basins. The following criteria were developed:

- Land status - percentage of the watershed in public ownership, level of landowner cooperation, and number of permittees.
- Management systems currently in place.
- Sage grouse population distribution and population trend.
- Fire history - percentage of watershed recently burned, percentage of watershed in need of restoration/rehabilitation, percentage of watershed currently supporting sagebrush communities.
- Other issues - other special status species present, water quality, degree of disturbance (noxious weed infestations, annual grasslands, pinyon-juniper encroachment), etc.
- Sage grouse population management unit - percentage of PMU within the watershed.
- Population Management Unit - priority ranking of the PMU based on the State Conservation Strategy

A matrix for assigning values to each criterion was developed and is included as **Appendix I**. The Rock Creek Watershed, Little Humboldt Watershed, and the Upper Humboldt Watershed were ranked as the top three watersheds. The planning worksheets for the watershed assessments are also included in **Appendix I**.

The formal watershed assessment will be conducted by an inter-disciplinary team of specialists and interested parties (e.g., citizens, representatives of organizations, etc.). Appropriate skill levels would be represented or recruited. The watershed assessment/planning team will use the assessment to identify specific management strategies to be implanted to improve the functionality of the watershed. These projects will focus on improving the indicators of rangeland, riparian, and sage grouse habitat health, with the eventual goal of achieving a fully functional watershed.

The watershed assessment will also be useful in evaluating public and private land management actions that have been previously implemented. These actions, such as specific range improvements or management strategies, will be evaluated in the context of the overall functionality of the watershed and also with respect to sage grouse habitat guidelines.

This approach, while not focused only on sage grouse, will improve overall watershed conditions, which should increase the potential for improving sage grouse populations, provide for other sagebrush obligates, improve water quality and quantity, and increase water, nutrient, and energy cycling. Due to the importance of sage grouse in this process, each management action will be evaluated as to its overall affect to sage grouse population dynamics and habitat parameters.

The watershed assessment will combine the methodology included in *Interpreting Indicators of Rangeland Health*, USDI and USDA Technical Reference 1734-6 (2000) and *Ecosystem Analysis at the Watershed Scale* (Federal Guide for Watershed Analysis). The watershed team will also have the opportunity to add variables to the assessment process, as appropriate to the specific watershed. The initial watershed assessment may identify specific field measurements that are required before a specific management action can be planned (e.g., fuel loading, plant community composition, existence of a seed bank, etc.). These types of activities will be identified during the assessment

process and a schedule for obtaining the needed information will be developed and implemented.

The team will use the watershed assessment to identify the issues and management opportunities within the watershed. The assessment would include general vegetation mapping (distribution and acreage of existing plant communities), condition rating of existing plant communities (proper functioning condition assessment of uplands and riparian communities as well as refinement of the restoration ["r-values"]), identification of the ecological range sites and soil mapping units, and other information related to grazing, wildlife habitats, special status species, cultural and historic values, etc. This information will be organized into a data base compatible with GIS.

The product of the watershed assessment will be a report that summarizes the existing data and watershed condition, including quantity and quality of sage grouse habitats. "Watershed analysis provides understanding of the watershed context that is essential to guide project planning and decision making. Watershed analysis is not a decision-making process, and a watershed analysis report is not a decision document, a planning document requiring NEPA review, or a regulatory prescriptive document. Watershed analysis contributes, however, to efficiently meeting land management and regulatory requirements at the watershed scale" (*Ecosystem Analysis at the Watershed Scale*, 1995). The assessment will be used to set goals and objectives for the specific watershed management plan, based on the issues identified in the assessment. These goals will be consistent with the goals of this Strategy. The goals are the characteristics of a functioning watershed, the vision of success. The objectives are the specific targets that need to be met to reach the goal. The objectives are related to the issues identified in the watershed assessment. The management strategies are the actions than need to be implemented to fulfill the objectives. There may be several management strategies associated with each objective. A schedule for implementing the actions identified in the watershed management plan will be included as part of the plan.

This process will be conducted in cooperation with the federal and state agencies, private landowners, and interested parties that have either the legal authority or the interest to participate. The watershed assessment and the watershed plan will help coordinate and prioritize federal and private land management activities. For example, if the watershed assessment identifies the need for fuel loading reduction, the watershed plan would include a project with management strategies appropriate to produce sage grouse habitat in conjunction with the reduction in fuel. Such a project could be included in the annual work plan/budget process for the appropriate land management agency. Once included in this process, the project would be implemented based on agency priorities and funding availability. In addition, NNSG could apply for grants or partner with other organizations to provide matching funds for the project, increasing the probability of meeting the agency priority and budgetary constraints.

The NNSG will act as the project proponent with responsibility for project proposal development, and compliance with applicable laws, regulations, and policy. There may be opportunity to combine actions already planned by the land management agency with the watershed plan actions, where these actions are mutually beneficial. In such cases, the public land management agency may be the lead for all or portions of the project with regard to planning, compliance, and implementation.

The watershed plan will also identify the appropriate variables to monitor to determine if the objectives are being met. These will include both quantifiable (e.g., acres treated, numbers of birds, etc.) and systematic (e.g., proper functioning condition monitoring, water quality monitoring) variables. The schedule for conducting the monitoring will also be included in the plan. The watershed plan will have an implementation schedule with an approved budget, as well as identified funding source(s).

The next step would be plan implementation. This may involve contract work, agency actions, or private landowner actions, but the responsibility for each action will be clearly identified in the plan. Implementation of the plan will also include monitoring of the response variables mentioned above. Evaluation of the monitoring results will be used to determine the appropriateness of the management strategies and the need to modify the management

strategies that do not achieve the desired results.

Within each watershed, the watershed management plan will consider sagebrush habitats that are currently intact, annual grasslands, and pinyon-juniper encroachment as the three major sage grouse habitat issues. These issues are individually discussed below.

3.5.1 Existing Sagebrush Habitats

For watersheds that have sagebrush communities, riparian vegetation, and native perennial vegetation that is considered non-sage grouse habitat (e.g., conifer forests), the potential of these vegetation communities as sage grouse habitat will be determined based on range site potential and existing vegetation. The goals for the watershed will be reviewed to determine the long-term vegetation management objectives. In other words, a determination will be made whether all potential sagebrush range sites be managed as appropriate for sage grouse or managed for other uses. Where vegetation treatment is necessary to meet watershed or sage grouse habitat needs, the NRCS soil survey data will be used to identify the range sites present. The transition/state of each area to be treated will be determined in order to select site specific goals and appropriate treatments. An implementation schedule for conducting the treatments and monitoring will be developed. The plan will be subjected to the necessary agency approval process (i.e., NEPA), followed by implementation if plan modification is not required through the approval process. Monitoring will be conducted as provided for in the monitoring schedule.

Grazing of treated areas will be evaluated on a case by case basis. Where a rest-rotation system is in place, timing of the treatment can be coordinated with the grazing system. Applying treatments following the year of early season use would allow two growing seasons (the normal year of rest and the growing season rest of the year scheduled for late use) without affecting the livestock operation. This would be preferable for sagebrush stands with minimal understory or where seeding is part of the treatment. For stands that have a good understory component, the treatment may be scheduled following the year of rest to take advantage of seed production. The existing perennial plants would not need two years of non-grazing following the treatment, and the scheduled late season use the year following treatment would allow seedlings to establish without grazing pressure. Alternatively, the treatment of areas with a good understory component could follow the late season use. Seed production would be greater than following the early season use, but less than when the treatment is applied following the season of rest.

On areas with a deferred-rotation system, the treatments would be scheduled to follow the year of early season use, providing spring rest the year following the treatment. If seeding is included as part of the treatment, adjustments in the grazing system may be necessary. Where rest-rotation or deferred-rotation systems are not in place, timing of the treatments will be coordinated with the grazing operation to the extent possible. Closure of a pasture would be the last option.

3.5.2 Annual Grasslands

Rehabilitation of annual grasslands will be based on the best available science and techniques available. NRCS soil survey and range site data will be used to determine the appropriate plant materials to be seeded. Field inspections will be conducted to determine if any desirable perennials, noxious weeds, or undesirable species are present prior to any treatment, and the treatment will be modified to address any of these plant species issues. Once the appropriate treatment is determined, the standards for evaluating the treatment and variables to monitor will be determined. The necessary permitting/approval will be obtained, and an implementation schedule will be developed. The monitoring schedule will also be developed prior to treatment.

As with the sagebrush communities, treatments will be coordinated with the existing grazing system where practicable. However, conversion of annual grasslands to perennial vegetation will require seeding, and some period of non-grazing will be necessary to allow seedlings to establish. Appropriate criteria will be used to determine when livestock grazing may be resumed, and monitoring will be implemented to determine when the criteria have been met. Temporary fencing may be used where the seeding is only a portion of a pasture, to

minimize impacts to the livestock operation. Temporary, non-renewable grazing permits may also be used to provide alternate forage when entire pastures must be closed.

For large areas of rehabilitation (i.e., > 300 acres), sagebrush should be seeded in patches scattered throughout the treatment area. These patches, when mature, will serve as the seed source for expansion of the sagebrush. Ultimately, this gradual conversion over time will result in a mosaic of sagebrush age classes throughout the treated area. For small areas, seeding the entire area with sagebrush or seeding in patches is appropriate.

The rehabilitation or restoration of annual grasslands is not likely to be a "one-treatment" project. Controlling the cheatgrass is one step, establishing a desired plant community is another, and both of these processes may require the integrated use of several tools. This process may also take a number of years to allow the various steps to proceed to a point where the next step can be conducted.

3.5.3 Pinyon-Juniper Encroachment Areas

Rehabilitation of pinyon-juniper encroachment areas will be based on the best science and techniques available. NRCS soil survey and range site data will be used to distinguish the woodland sites from range sites. Range sites will be considered for rehabilitation to sagebrush-grasslands, and the woodland sites will be managed as woodlands. The soil surveys and range site data will also be used to determine the appropriate plant materials to be seeded. Field inspections will be conducted to determine if any desirable perennials, noxious weeds, or undesirable species are present prior to any treatment, and the treatment will be modified to address any of these plant species issues. The transition/state of each area to be treated will be determined in order to select site specific goals and appropriate treatments. Once the appropriate treatment is determined, the standards for evaluating the treatment and variables to monitor will be determined. The necessary permitting/approval will be obtained and an implementation schedule will be developed. The monitoring schedule will also be developed prior to treatment.

As described above for annual grasslands, treatments in areas of pinyon-juniper encroachment will be coordinated with the existing grazing system where practicable. However, conversion of pinyon-juniper to shrub-herb vegetation will require seeding, and some period of non-grazing will be necessary to allow seedlings to establish. Appropriate criteria will be established to determine when livestock grazing may be resumed and monitoring will be implemented to determine when the criteria have been met.

Many of the pinyon-juniper sites occur on mountain sides and alluvial fans where soil erosion must be addressed. Treatments and seeding methods will be selected to reduce erosion, and sediment basins or sediment barriers will be used to protect drainages as necessary. Buffer zones of vegetation may be left in place adjacent to drainages for sediment control, or alternatively, the areas adjacent to drainages may be treated first to establish more soil cover prior to treating the larger area. Erosion control will also be a factor in determining the size of the area to be treated.

Where permitted by agency policy, wooded areas scheduled for treatments will be opened to Christmas tree cutting or greenwood cutting prior to treatment. On areas where chaining is conducted, post-treatment wood cutting would also be allowed, as per agency policy, providing that the removal of firewood or posts does not conflict with the vegetation establishment.

Potential for biomass utilization as an alternative fuel or other wood fiber products should also be considered. This type of industry would have economic benefits to rural communities. However, careful planning is required to determine the allowable annual harvest to sustain the industry while maintaining the woodland values over time.

3.5.4 Other Habitats/Issues

The watershed management plan will include management of other plant communities in addition to sagebrush, annual grasslands, and pinyon-juniper. The riparian vegetation, including aspen woodlands along streams and in upland sites, are examples of other plant communities or management zones that must be considered. These are beyond the scope of this Strategy, but are appropriate for the

watershed management plans. The management strategies to be developed for each of these habitats or plant communities will be based on the best available science, ecological hypotheses, and past experience. These will be documented in the watershed management plan.

3.5.5 Sagebrush-Obligate Species

In addition to sage grouse, 20 other species have been identified as either sagebrush-obligates or sagebrush-dependent, and the management strategies discussed above will be evaluated in terms of their short- and long-term impacts to these species. A literature review relative to the habitat requirements of these species was conducted by the Biological Resources Research Center, University of Nevada-Reno and is included as **Appendix G**. For most of the species, the habitat requirements are not well documented, but the potential impacts of continuing under the current management and implementing any of the four sagebrush treatment strategies discussed above were evaluated.

The current management consists of continued livestock grazing with little active vegetation manipulation[11]. Basically, this is a strategy that will favor the creation or maintenance of sagebrush in dense, uniform stands with limited understory vegetation - "old growth" sagebrush. Rehabilitation of areas burned by wildfires is the primary means of creating young stands of sagebrush, where conditions are favorable.

The sagebrush management strategies include prescribed burning, herbicide application, aeration, and disking. Seeding may be used in conjunction with any of these treatments, but is not discussed as a separate treatment. These treatments are designed to create herb-dominated communities immediately after treatment. Wyoming big sagebrush is anticipated to begin establishing within one or two years following treatment, but may require up to 10 years. Between 10 and 20 years after the treatment, sagebrush should be well established on the site, but probably not exceeding 10 - 12 percent canopy cover. Herbaceous vegetation is expected to be abundant. During years 20 and 30 following treatment, sagebrush should begin to dominate the site and herbaceous cover would begin to decline. After 30 years, sagebrush would be dominant and herbaceous vegetation would be limited. A similar scenario would occur for mountain big sagebrush sites, but the time frames are likely to be approximately half the time outlined for Wyoming big sagebrush. The current vegetation and anticipated vegetation following treatment were compared to the habitat requirements for each of the sagebrush obligate species to determine when a site would provide suitable habitat for each species. The results of the evaluation are provided in **Table 4**. Impacts to the other obligate species would be considered on a case by case basis through the permitting process for public land actions. Monitoring of species responses to the treatments over time will add to the information about the habitat requirements of these species, and to the development of habitat management strategies specific to these species.

[11]This is a gross simplification, the BLM, USFS, and private landowners are currently involved in limited active vegetation management, but cumulatively this accounts for less than one percent of the planning area each year.

3.6 Monitoring and Evaluation

There are three levels of monitoring that will be implemented. The first is monitoring of the watershed plan implementation schedule. This level of monitoring is to identify that the watershed plans are being implemented on schedule to achieve the desired goals of the watershed plan. The NNSG will undertake this monitoring role to ensure that planned actions are implemented and that plan implementation activities are reported to all parties involved.

The second level of monitoring is to monitor the goals and objectives of the watershed plan. If a goal is to increase juvenile recruitment, then there must be monitoring of population data to determine if the ratio of young to adults has increased and that the population has increased. For each goal and objective of the watershed plan, specific monitoring will be developed and the responsibility for conducting the monitoring will determined.

The third level of monitoring is the project-specific level. For example, if a vegetation treatment is implemented, the treatment will have specific objectives (e.g., percentage of

shrubs to be removed, increase the amount of forbs desired by sage grouse, reduce soil erosion, etc.). Each watershed management plan will specify the monitoring for each action included in the plan. The variables to be monitored, the schedule for conducting the monitoring, and the standards for success, will be included in the monitoring section. Emphasis will be placed on existing monitoring efforts

Table 4: Predicted Species Response[1] to Habitat Treatments[2]

Species	Pre-treatment	Immediately Post-treatment	10-years Post-treatment	20-years Post-treatment	30-years Post-Treatment	40-years Post-treatment
Black Rosy Finch	breeding - not present; winter - low	breeding - not present; winter - moderate to high	breeding - not present; winter - moderate	breeding - not present; winter - low	breeding - not present; winter - low	breeding - not present; winter - low to not present
Black-Throated Sparrow	breeding - not present; winter - low	breeding - low; winter - moderate to high	breeding - moderate; winter - moderate to high	breeding - moderate; winter - moderate	breeding - low to moderate; winter - low to moderate	breeding - not present to low; winter - low
Brewer's Sparrow	breeding - moderate to high; winter - moderate	breeding - not present; winter - moderate	breeding - not present; winter - moderate	breeding - low to moderate; winter - moderate	breeding - moderate to high; winter - moderate	breeding - high; winter - moderate
Burrowing Owl	breeding - not present; winter - migrant	breeding - moderate to high; winter - migrant	breeding - moderate to high; winter - migrant	breeding - low to moderate; winter - migrant	breeding - low; winter - migrant	breeding - not present; winter - migrant
Calliope Hummingbird	breeding - not present; winter - migrant	breeding - not present, but may feed; winter - migrant	breeding - not present, but may feed; winter - migrant	breeding - not present, but may feed; winter - migrant	breeding - not present; winter - migrant	breeding - not present; winter - migrant
Ferruginous Hawk	foraging habitat - low	foraging habitat - moderate to high	foraging habitat - moderate to high	foraging habitat - moderate to high	foraging habitat - moderate to high	foraging habitat - low to moderate
Gray Flycatcher	breeding - not present to low; winter - migrant	breeding - not present; winter - migrant	breeding - not present to low; winter - migrant	breeding - low to moderate; winter - migrant	breeding -moderate; winter - migrant	breeding - moderate; winter - migrant
Green-Tailed Towhee	breeding - moderate; winter - migrant	breeding - not present; winter - migrant	breeding - not present; winter - migrant	breeding - low to moderate; winter - migrant	breeding - low to moderate; winter - migrant	breeding - moderate; winter - migrant
Kit Fox	low	moderate	moderate to high	moderate to high	moderate to high	moderate
Loggerhead Shrike	breeding - moderate; winter - low or migrant	breeding - not present; winter - low or migrant	breeding - low; winter - low or migrant	breeding - low to moderate; winter - low or migrant	breeding - moderate; winter - low or migrant	breeding - moderate; winter - low or migrant
Prairie Falcon	foraging habitat - low	foraging habitat - moderate	foraging habitat - moderate to high	foraging habitat - moderate	foraging habitat - low to moderate	foraging habitat - low
Pronghorn Antelope	not present	high	high	moderate to high	moderate	low
Pygmy Rabbit	moderate to high	not present	not present	low	low	moderate to high
Sage Sparrow	breeding - high; winter - migrant	breeding - not present; winter - migrant	breeding - not present; winter - migrant	breeding - not present to low; winter - migrant	breeding - low; winter - migrant	breeding - moderate to high; winter - migrant
Sage Thrasher	breeding - high; winter - migrant	breeding - not present; winter migrant	breeding - not present; winter - migrant	breeding - not present to low;	breeding - low to moderate; winter -	breeding - moderate to high; winter - migrant

				winter - migrant	migrant	
Sagebrush Lizard	moderate	not present	not present	low to moderate	moderate	moderate to high
Sagebrush Vole	not present to low	not present to low	low to moderate	moderate to high	high	moderate
Swainson's Hawk	foraging habitat - low	foraging habitat - moderate to high	foraging habitat - high	foraging habitat - moderate to high	foraging habitat - moderate	foraging habitat - low
Vesper Sparrow	breeding - not present; winter - migrant	breeding - moderate to high; winter - migrant	breeding - high; winter - migrant	breeding - moderate to high; winter - migrant	breeding - low to moderate; winter - migrant	breeding - low; winter - migrant
White-Tailed Jackrabbit	not present	moderate to high	high	moderate to high	moderate	low
Number of species for which habitat is optimum	4	6	8	7	4	5

[1]Response is in terms of relative population. High populations would be limited to optimum habitat quality; Moderate population levels would be associated with good habitat quality; Low population levels would be associated with poor habitat quality; and Not Present would be associated with unsuitable habitat quality.
[2]Treatments consist of shrub thinning or removal from a pre-treatment condition of >25% sagebrush shrub canopy cover, < 10% perennial grass basal cover, and < 5% forb cover (desirable perennial and annual). Immediately Post-treatment would consist of a grass-forb community with little or no sagebrush. 10-years Post-treatment would consist of a grass-forb community with less than 10% shrub canopy cover. 20-years Post-treatment would consist of sagebrush-herbaceous community with 10-15% shrub canopy cover. 30-years Post-treatment would consist of a sagebrush-herbaceous community with 15-20% shrub canopy cover. 4-years Post-treatment would consist of a sagebrush dominated community with 20-25% shrub canopy cover.

currently being conducted for allotments, riparian zones, or wildlife habitat; however, additional monitoring specific to each watershed plan is anticipated.

The schedule for reporting progress on the implemented actions will be based on the anticipated time for measurable changes to occur. However, a reporting schedule of every two or three years is anticipated. The monitoring reports will provide a brief description of the action taken, the variables selected for monitoring, the standards for success, and the desired outcome of the action/treatment. The actual field data will be included in appendices, and the report will include a summary of the data and data analysis. A discussion of the monitoring results in relation to the standards for success and the desired outcome of the action/treatment will also be included. If progress toward the desired outcome is adequate, no modification will be made to the action/treatment, and monitoring will be continued. The monitoring information will be made available to other watershed planning groups to promote additional successful actions/treatments.

If the progress toward the desired outcome is inadequate, then the desired outcome, the action/treatment, the scientific basis for the action/treatment (i.e., hypothesis), the monitoring variables, and monitoring methods will all be reviewed as part of the adaptive management process. Based on the evaluation, changes to one or more of these items will be made. The information gained from the evaluation will be provided to other watershed planning groups to avoid repetition of the same situation in other watersheds.

3.7 On-Going Efforts

Actions to benefit sage grouse and sage grouse habitats will be ongoing during the watershed assessment process. The BLM, USFS, and private landowners will continue to operate under their LUPs or ranch plan while the assessments are being completed. NDOW will also continue efforts to monitor the bird populations during this period. As stated previously, the land management agencies have included sage grouse as a Sensitive Species, thereby affording it protection and consideration in the actions undertaken by these agencies. For example, the Proposed Multiple Use Decision for the Squaw Valley Allotment in the Rock Creek Watershed has specific actions for enhancing sage grouse habitats, both upland and riparian habitats that can be implemented as soon as the Final Multiple Use Decision is issued. The watershed assessment can be used to determine where these actions can be implemented, but there is no reason that the BLM cannot move forward without the assessment being completed. **Appendix J** includes a summary of the activities that will be ongoing by the agencies.

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Figure 4 - Sage Grouse PMUs within the Elko County Planning Area

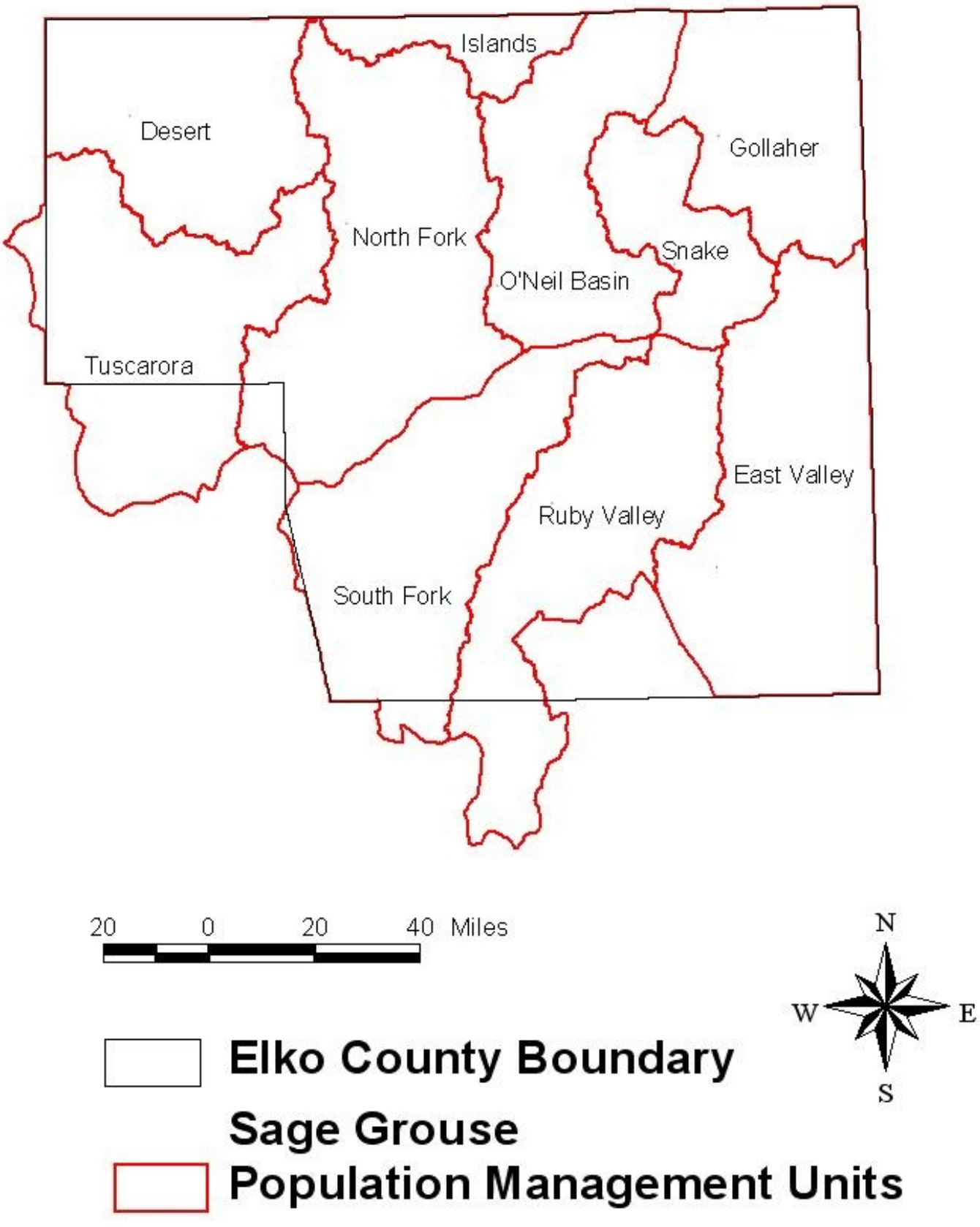


Figure 6 - Sage Grouse Habitat Condition Ratings

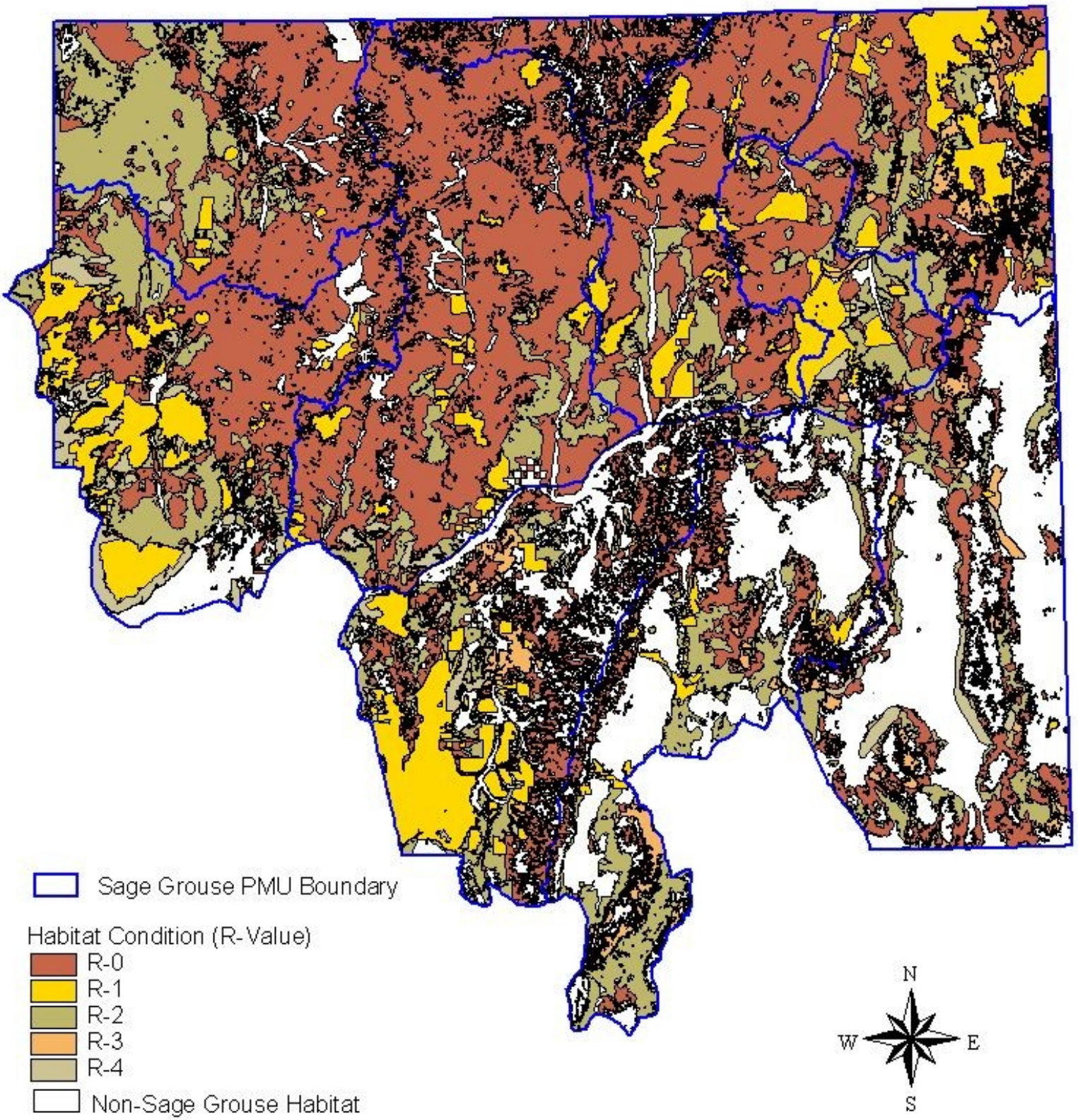
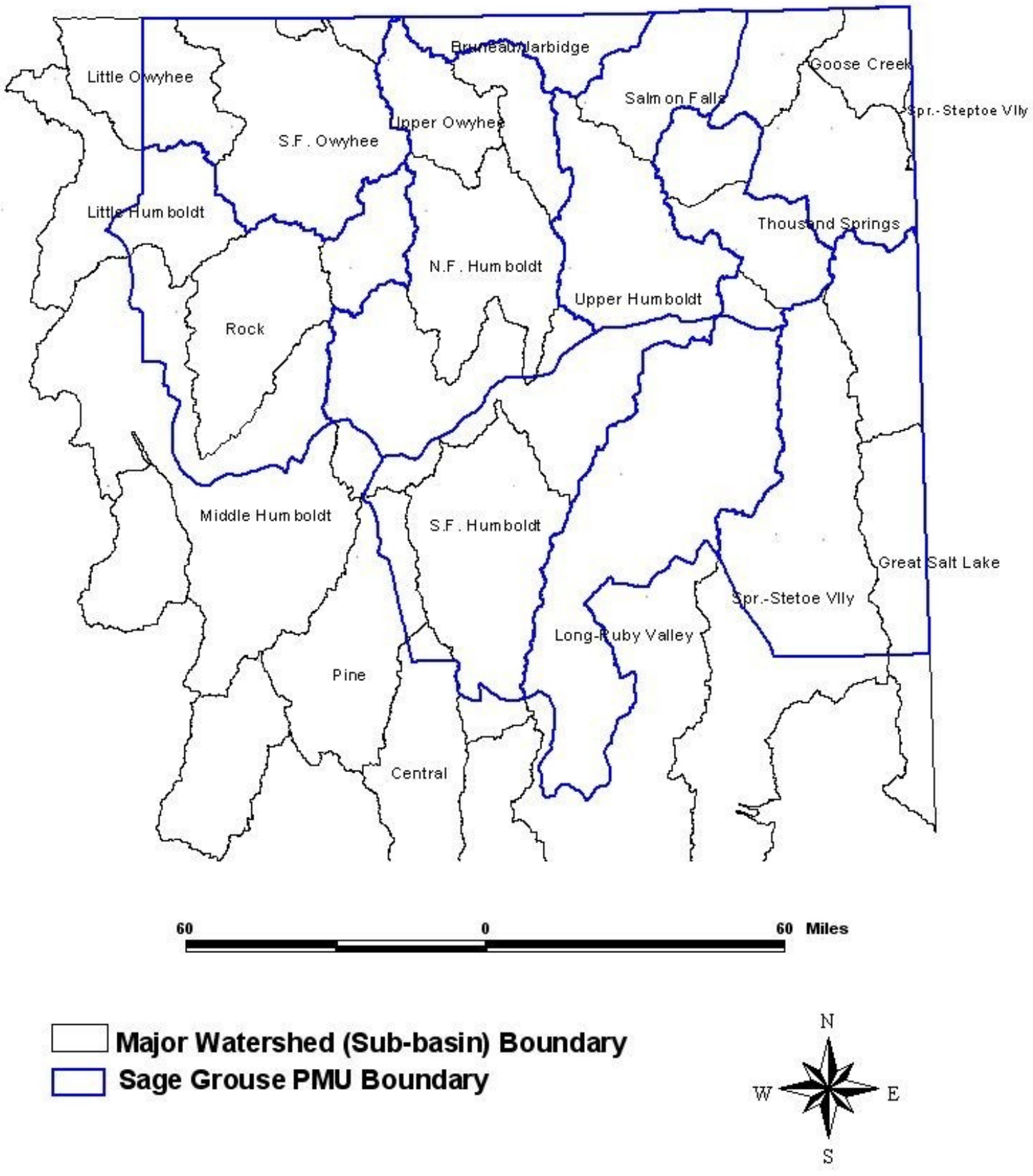


Figure - Major Watershed (Sub-basin) Boundaries



APPENDIX A

List of Pod Members

NNSG - SAGE GROUSE POD MEMBERS

The following individuals attended one or more of the Sage Grouse Pod Meetings and were contributors to the Sagebrush Ecosystem Conservation Strategy:

Name	Affiliation
Will Amy	USFS, Wells
Kevin Atchley	USFS, Elko
Gary Back	SRK Consulting, Inc.
Harvey Barnes	Rancher, Jiggs
Jim Baumann	Rancher, Eureka County
Paul Blackburn	NRCS, Elko
Steve Boyce	Citizen/Sportsman, Spring Creek
Sheri Eklund-Brown	Elko County Commissioner, Elko
Leland Campsey	NRCS, Elko
John Carpenter	Assemblyman, Elko
Charles Chester	Sportsman, Elko
Doug Clarke	USFS, Elko
Leta Collord	Citizen, Elko
Patrick Coffin	USFWS/BLM
Mike Creek	Bald Mountain Mine, Spring Creek
Lucy Downer	Barrick Goldstrike Mines, Elko
Sid Eaton	NDOW, Elko
Steve Foree	NDOW, Elko
Derril Fry	Wildlife Services, Elko
Bill Gibbs	North East Elko Conservation District, Wells
Larry Gilbertson	NDOW, Elko
Dan Gralian	Rancher, Nv Cattlemen's Association
Carrie Hernandez	USFWS, Reno
Larry Hislop	Conservationist, Elko
Cheri Howell	USFS, Wells
Jon Hutchings	Eureka County, Eureka
Portia Jelinek	USFS, Elko
Martin Larraneta	Nv Dept. Agriculture, Winnemucca
Ray Lister	BLM, Elko Field Office
Lucia Machado	NDEP, Carson City
Kent McAdoo	UNR, Cooperative Extension, Elko
Merlin McColm	Conservationist, Elko
Shammy McClain	Rancher
Neil McQueary	Rancher, Ruby Valley
Peter Mori	Rancher, Owhyhee Conservation District, Tuscarora
Chuck Petersen	NRCS, Elko
J.D. Radakovich	Rancher, Tuscarora
Bob Reed	Rancher, Jiggs
Jake Reed	Rancher, Jiggs
Lisa Reed	Rancher, Jiggs
Lyle Rosendahl	North East Elko Conservation District, Wells
Alan Sharp	Rancher, Ruby Valley
Tom Talley	Sportsman, Spring Creek
Kevin Tomera	Rancher, Jiggs
Carl Uhlig	Elko Co. Association Conservation Districts, Montello
Bill Upton	Placer Dome U.S.A., Elko
John Wright	Rancher, Deeth
Fred Zaga	Rancher, Elko County PLUAC, Jiggs

APPENDIX B

Calculations of PMU Sage Grouse Population Estimates

CALCULATIONS OF PMU SAGE GROUSE POPULATION ESTIMATES

The table on the following page provides two examples to follow while reading the text below.

Base populations of sage grouse are estimated by starting with the known leks in an area. That number is multiplied by the percent of active leks to give the total number of leks expected to be active (active leks). The percent of active leks is determined by recent lek counts of known leks and the percentage of those documented as active.

The next step is to calculate the average number of cocks/lek from the most recent lek counts (total number of cocks observed divided by the number of leks). The average number of cocks/lek is multiplied by the total number of active leks, which equals the total number of cocks one could expect to observe on all leks, if all leks were counted.

The next step is to expand the number observed on leks by 2X based on sage grouse marking studies that indicate no more than 50% of cocks are observed on leks because of their attendance patterns. This provides the base population of males.

The next step involves estimating the base population of females. In the past, the number of cocks was multiplied by 2. This was based on sage grouse population studies. More recent population studies in Colorado suggest there are 2.73 females/male in the spring population. Obviously this number could vary and it would be acceptable to use almost any number between 2.0 and 2.73. NDOW is currently using 2.73.

The next step merely adds the base numbers of males and females to provide a total unexpanded base adult population.

One last step provides for a range of estimates that is derived from the estimated detection rate for leks. The biologist estimates a percentage range he expects leks have been detected in the area, (i.e. 50-80% or 80-90% or x% to xx%). This step requires the biologist to make an assessment of lek work conducted over the past 30+ years and to provide an estimate of the relative percentage of the area that has been adequately surveyed and leks subsequently documented. Example: If 1,000 birds is the base population and the biologist's detection rate suggests only 50% to 75% of the leks in the area have been detected, the estimated grouse population is between and 1,333 - 2,000.

Example Table of Calculations to Estimate PMU Sage Grouse Populations

PMU	Total Known Leks	% Active	% Active X Total Known Leks	Average Cocks/ Lek	% Active Leks X Average Cocks/ Lek	X 2 = Total Males (50% of cocks obs)	X 2.73 (females/male on lek) = Total Hens	Males + Females = Total Adults (before detection rate)	Highest Expected Detection Rate 1 (use decimal for %)	Lowest Expected Detection Rate 2 (use decimal for %)	X detection rate 1 = Low pop est	X detection rate 2 = High pop est.
Area 1	18	0.85	15.3	10.0	153.0	306	835	1141	0.9	0.75	1268	1522
Area 2	240	0.6	144.0	11.6	1670.4	3341	9120	12461	0.7	0.6	17802	20769

APPENDIX C

PMU Risk Factor Matrix and Definitions

Population and Habitat Risks		Population Management Units - Elko									
		Desert	Islands	Tuscarora	N. Fork	O'Neil Basin	Snake	Gollaher	S. Fork	Ruby Valley	East Valley
Habitat Quantity	Low-1	2	1	3	1	2	1	3	2	2	3
	Mod-2										
	High-3										
Habitat Quality	Low-1	2	1	3	1	1	1	3	2	2	3
	Mod-2										
	High-3										
Habitat Fragmentation	Low-1	1	1	3	2	2	2	3	2	1	1
	Mod-2										
	High-3										
Changing Land Uses	Low-1	1	1	2	2	1	2	1	2	1	1
	Mod-2										
	High-3										
Livestock Grazing	Low-1	2	1	3	3	2	1	2	3	1	1
	Mod-2										
	High-3										
Fire Ecology	Low-1	1	1	3	2	1	2	1	2	1	1
	Mod-2										
	High-3										
Predation	Low-1	1	1	2	2	1	2	1	2	1	1
	Mod-2										
	High-3										
Disturbance	Low-1	1	1	3	2	1	1	1	3	1	1
	Mod-2										
	High-3										
Disease/Pesticides	Low-1	1	1	1	1	1	1	1	1	1	1
	Mod-2										
	High-3										
Hunting/Poaching	Low-1	1	1	1	1	1	1	1	2	2	2
	Mod-2										
	High-3										
Cycles/Populations	Low-1	1	1	1	1	1	1	1	2	2	3
	Mod-2										
	High-3										
Climate/Weather	Low-1	2	1	2	1	1	1	1	1	1	3
	Mod-2										
	High-3										
Risk Factor Total		**16**	**12**	**27**	**19**	**15**	**16**	**19**	**24**	**16**	**21**

SAGE GROUSE POPULATION RISK FACTORS

DESERT PMU (Rating: 16)

Habitat Quantity (2)

- Insufficient water and poor distribution
  - guzzlers, solar wells
  - improve springs and mesic areas
  - repair riparian zones
- Vast amounts of sagebrush
  - selective fire suppression

Habitat Quality (2)

- Large areas of old age class sagebrush
  - selective fire suppression
  - prescribed burns, beating, chemicals
- Poor understory
  - vegetal manipulation
- Mesic and riparian zones in poor to fair condition
  - protect, rehabilitate, reestablish historic meadows
- Annual Grass Invasion
  - rehab following fire events

Habitat Fragmentation (1)

- Not perceived to be a problem

Changing Land Uses

- Not perceived to be a problem

Livestock Grazing (2)

- Wild horse numbers may be high for available habitat
  - continue monitoring to adjust population estimate
  - control horse numbers
- Livestock distribution may be a problem during dry season
  - establish more watering sources
- Allotment evaluations need to be updated
  - (add BLM data)

Fire Ecology

- Potential exists for extremely large wildfires
  - selective fire suppression
  - vegetal manipulation for fire breaks
  - green strips

Predation (1)

- Not determined to be a problem

Disturbance (1)

- Not determined to be a problem

Disease/Pesticides (1)

- Not determined to be a problem

Hunting/Poaching (1)

- Not determined to be a problem

Cycles/Populations (1)

- Population range 696 to 836
- Not determined to be a problem
  -lack of historical data

Climate/Weather (2)

- Subject to extreme weather
  -protect sufficient amounts of seasonal habitat

ISLANDS PMU (rating : 12)

Habitat Quantity (1)

- Not a problem at present time
  -coordinate with Idaho to insure sufficient wintering habitat for Nevada birds during extreme winters

Habitat Quality (1)

- Not determined to be a problem
  -brooding and summer use areas need to be evaluated

Habitat Fragmentation (1)

- Not a problem in Nevada
  -need to coordinate with Idaho to prevent fragmentation of winter use areas

Changing hand uses (1)

- Not a problem

Livestock Grazing (1)

- Allotment evaluations need to be updated
  -need to coordinate with USFS and BLM (Idaho) to insure compliance

Fire Ecology (1)

- Not a problem
  -fire suppression recommended

Predation (1)

- Not a problem

Disturbance (1)

- Not a problem

Disease/Pesticides (1)

- Not a problem
  -no data

Hunting/Poaching (1)

- Not a problem

Cycles/Populations (1)

- Population range 1,094 to 1,313
- Not a problem
  -need to conduct surveys and share data with Idaho

Climate/Weather (1)

- Subject to extreme winter conditions
  -coordinate with Idaho to preserve ample wintering areas

TUSCARORA PMU (rating : 27)

Habitat Quantity (3)

- Loss of large tracks of habitat to wildfire
  -rehabilitate with sage grouse requirements considered
  -prevent large wildfires ; total suppression, green strips, etc.
- Loss of large tracks of habitat to mining
  -mitigate
  -rehabilitate disturbance
- De-watering due to mining
  -mitigate
  -continue monitoring
  -artificial water sources, if needed

Habitat Quality (3)

- Conversion of sage grouse habitat to annual grass
  -rehabilitate damaged areas with consideration for sage grouse needs
  -protect remaining unburned areas
- Riparian zones and mesic areas in poor to fair condition
  -protect and repair
- Loss of water sources possible
  -minimize net loss of water from PMU

Habitat Fragmentation (3)

- Large tracks of habitat lost to fires
  -rehabilitate, protect remaining area
- Water distribution may limit seasonal use
  -protect water sources, install guzzlers
- Large expanses of annual grass
  -rehabilitate

Changing Land Uses (2)

- Mining
  -mitigate losses of public land lost
- Land exchanges
  -recommend no net loss of sage grouse habitat

- Agricultural conversion (hay farms)
  -probably no net loss of habitat

Livestock Grazing (3)

- Allotment evaluations outdated
  -sheep trailing through critical use areas
  -some brooding habitat needs improvement

Fire Ecology (3)

- Vast acreage lost to wildfires, high risk of reburn
  -rehabilitate burns to enhance sage grouse habitat
  -protect remaining sagebrush zones

Predation (2)

- Moderate concern of increased predation due to reduced quality of habitat
- Major powerlines provide perches for avian coyotes

Disturbance (3)

- Mining and exploration activity
  -restrict season of use in critical habitat
  -rehabilitate abandoned travelways
    -render unusable
- Powerlines
  -restrict utility routes to existing corridors
  -retrofit powerlines with antiperching devices as sage grouse use data is updated
  -restrict use of maintenance roads to maintenance or emergency vehicles
- Ranchettes/subdividing
  -consider sage grouse on all zoning processes
  -restrict land exchanges that will change land use patterns
  -mitigation for all lost sage grouse habitat
- Off real vehicle abuse
  -consider road closures and vehicular restrictions in land use planning
  -create realistic, enforceable laws to regulate ORV use.
- Sheep trailing
  -should not pass through critical sage grouse use areas

Disease/Pesticide (1)

- No known problems
  -chemical hazards associated with mining are generally addressed for all wildlife species through environmental assessments and mitigation

Hunting/Poaching (1)

- Not a problem

Cycles/Populations (1)

- Population parameters indicate general downward trend over past two decades
  -continue population monitoring

Climate/Weather (2)

- PMU is subject to extreme weather
  - define and protect winter use areas

NORTH FORK P.M.U. (19)

Habitat Quantity (1)

- Large blocks remains intact
  -will need to be protected to prevent large scale loss

Habitat Quality (1)

- Habitat contains adequate mixture of sage types and age classes and water sources
- Seasonal habitat types well distributed and represented
  -Nesting and brood rearing use areas should be monitored to detect any needed improvements or changes in trend

Habitat Fragmentation (2)

- Some fragmentation has occurred due to fires, powerlines, urbanization, ranchettes and seedings
  -sage grouse needs must be considered in all scoping of these types of projects. mitigation may be necessary
  -no net loss of sage grouse habitat should occur

Changing Land Uses (2)

- Increased urbanization will have negative impacts to sage grouse habitat
  -land exchanges should result in no net loss of habitat
  -zoning processes should consider sage grouse values
  -potential may exist for conservation easements to be established for important habitat now under private ownership

Livestock Grazing (3)

- Allotment Evaluations - need updates
  -(list dates, needs)

Fire Ecology (2)

- Potential exists for large scale loss to fire
  -projects to prevent large scale loss needed
- Potential exists for annual grass and weed invasion
  -rehabilitate burned areas

Predation (2)

- Avian predation compounded by multiple powerlines, providing perches
  -retrofit with anti-perching devices
  -raven control may be necessary in some nesting areas
  -could coordinate coyote control for livestock with sage grouse needs near leks and nesting

Disturbance (2)

- Vehicular access overabundant throughout all season of use areas
  - consideration should be given to seasonal road closures
  - " " off road vehicle restrictions
- Mining and Exploration
  - season of use restrictions necessary
  - all travelways must be rehabilitated so as to preclude access by any vehicle
- Powerlines
  - may cause abandonment of leks and negatively impact sage grouse survival
  - should be routed away from leks, breeding complexes and wintering ground areas
  - anti-perching devices when needed
  - no net gain of vehicular access due to construction or maintenance
- Ranchettes/Subdivisions
  - all land exchanges should have no net loss of sage grouse habitat
  - zoning process should consider sage grouse needs
  - powerlines should meet BLM wildlife standards

Disease/Pesticides (1)

- No known disease problems
- Pesticide use could negatively impact sage grouse
  - all pesticide use on public lands should adhere to NEPA process
  - pesticide users on private lands should be advised of any potential risks to wildlife

Hunting/Poaching (1)

- ♦ Not a known problem
  - hunting provides valuable data on sage grouse population (hunting should be used as a management tool and monitored closely)

Cycles/Populations (1)

- ♦ Population well above viable minimum
  - Population range 10,046 to 12, 055
- ♦ Population presently static with long term downward trend
  - monitoring needs: leks, production values, harvest distribution

Climate/Weather (1)

- ♦ Area subject to extreme weather conditions and wide array of weather patterns

O'NEIL BASIN (15)

Habitat Quantity (2)

- ♦ Wildfire has consumed vast acreages of sage grouse habitat
  - rehabilitation efforts have been initiated on most affected areas
  - extensive areas of sage grouse habitat remain available

Habitat Quality (1)

- ♦ Habitat remaining has potential to provide high quality year-long sage grouse habitat
  - the PMU possesses adequate water, optimum elevation parameters, extensive, desirable topographic features and a fair component of desirable sagebrush species
  - fire rehabilitation efforts should benefit sage grouse in future years
  - some opportunities exist for vegetal manipulation to enhance existing range conditions

Habitat Fragmentation (2)

- ♦ Wildfire have fragmented portions of PMU
  - negative impacts should lessen as rehabilitation of vegetal communities progress
- ♦ Ranchette communities pose potential threat to contiguous expanses of habitat
- ♦ Major utility corridors bisect PMU
  - use existing corridors for future needs
  - retrofit utility towers with anti-perching devices in zone of influence to sage grouse

Changing Land Uses (1)

- Open space – agricultural land being converted to residential
  - all land exchanges and zoning regulations should consider sage grouse habitat
  - no net loss of sage grouse habitat
- Increased off-road vehicle use may have negative impacts
  - leks and wintering areas could be disturbed

Livestock Grazing (2)

- Land use plans need to be updated
- Post fire monitoring and analysis will be incorporated into management schemes

Fire Ecology (1)

- Wildfires have burned important areas of sage grouse habitat
  - restoration efforts mostly completed
  - fire suppression should be a priority in key sage grouse habitat
  - fire breaks should be incorporated into fire plans and restoration projects
- Opportunities exist in some areas for vegetal manipulation for rejuvenation of sagebrush habitats

Predation (1)

- Not a major concern in PMU in general
  - utility corridors could have had negative impacts on leks and wintering areas, but not documented
  - raven numbers may be at artificially high levels near human developments and dumps

Disturbance (1)

- Many lekking areas accessible by vehicle
  - disturbance by vehicular traffic may disrupt breeding activities
  - ease of access may encourage visitation of leks
- Wind power generation may disturb or kill sage grouse
  - monitoring, analysis and mitigation necessary
- Presence of utility corridors have been kept to a minimum
  - use existing corridors for future use
- Increased off-road vehicle use a concern
  - public education needed
  - regulations may be necessary if negative impacts are documented

Disease/Pesticides (1)

- ♦ It is unknown if diseases affect sage grouse in PMU
- ♦ No known pesticide problems
  - all applications on public land must meet NEPA standards
  - landowner awareness programs may be beneficial

Hunting/Poaching (1)

- ♦ Hunting not a significant impact
  - hunting is a good management tool to collect production and age class data
- ♦ Poaching not documented as a serious problem

Cycles/Populations (1)

- ♦ Population range 8,305 to 9,967
  - static with long term downward trend

Climate/Weather (1)

- ♦ PMU subject to extreme weather
- ♦ Precipitation patterns generally sufficient to benefit sage grouse habitat

SNAKE PMU (16)

Habitat Quantity (1)

- ♦ Majority of PMU contains sage grouse habitat of varying seral stages and quality
- ♦ Wildfires have consumed several important portions
- ♦ Large tracts of private lands exist within PMU

Habitat Quality (1)

- ♦ A large portion of the PMU still contains fair to good yearlong sage grouse habitat
  - fires have been rehabilitated
  - monitoring will determine need for future manipulation to improve sage grouse habitat
  - older seedings now have enough sagebrush present to provide limited sage grouse habitat
- ♦ Range management strategies are in place and being explored that should improve habitat quality
- ♦ Water distribution is widespread and generally consistent
  - water quality should be monitored and protected
- ♦ Large tracts of potential winter use areas exist
  - winter use areas should be defined and protected

- telemetry studies are ongoing to determine season of use habitat characteristics

Habitat Fragmentation (2)

- ♦ PMU divided by interstate highway
- ♦ PMU divided by utility corridor
  - all future utility need(s) should be contained in existing corridors
  - option of underground utility lanes should be explored
  - existing poles and towers should be retrofitted with anti-perching devices where lek or wintering ground existed in past or are documented in future
- ♦ PMU divided by main country roads
  - speed limits should be conservative and enforced

Changing Land Uses (2)

- ♦ Presently not a problem
  - due to extensive private land potential exists for increased agricultural practices, subdivisions or land exchanges
  - impacts to sage grouse should be considered during analysis of land exchange proposals
  - zoning regulation changes should consider future impacts to wildlife habitats
- ♦ Mining activity quiet at present time
- ♦ Power generation, wind or other types may be proposed in the future

Livestock Grazing (1)

- ♦ Grazing management plans are current and being refined to enhance range condition

Fire Ecology (2)

- ♦ Wildfires have affected large areas of habitat
  - rehabilitation complete but needs continued monitoring to determine success and future needs for enhancing sagebrush habitat
  - annual grass invasion is a potential problem
  - fire breaks needed
  - full suppression recommended

Predation (2)

- ♦ Predation, both avian and terrestrial, documented as a problem to grouse nesting and brood survival in PMU
  - predator control (ravens, coyotes) was being conducted in conjunction with sharptail grouse reintroduction efforts (predator control cancelled by DOW predator control committee)
  - utility towers pass through breeding complexes and wintering areas providing perches for avian predators

Disturbance (1)

- Interstate highway and major county roads bisect PMU
- Utility corridor bisects PMU
- Vehicular access abundant yearlong to most of the PMU
  - increased recreational use by both full size and off-road vehicles
- Proposed wind power generators may cause disturbance of sage grouse

Disease/Pesticides (1)

- Disease not a documented problem
- Pesticide use not a documented problem

Hunting/Poaching (1)

- Poaching, hunting not a documented problem or negative impact on PMU population

Cycles/Populations (1)

- Population range 2,636 to 3,163
- Population static with long term downward trend
  - monitoring of leks, production, harvest and habitat use ongoing
  - telemetry research ongoing

Climate/Weather (1)

- PMU subject to extreme weather conditions
- Overall weather patterns are generally favorable for sage grouse habitat maintenance and bird survival

GOLLAHER PMU (19)

Habitat Quantity (3)

- Vast amounts of sage grouse habitat burned
  - rehabilitation projects complete
  - monitoring needed to determine additional needs for sage grouse
  - manipulation of livestock use criticizal for recovery
  - may need to improve habitat in older burns to speed up recovery of PMU
- Water availability adequate

Habitat Quality (3)

- Fires have eliminated vast amounts of sagebrush
  - cumulative effects of fires have reduced the quality of sage grouse habitat dramatically
  - need to evaluate all burned areas and formulate vegetative manipulation plan to enhance sage grouse habitat
- Water sources in varying degrees of degradation
  - water sources, mesic areas and what few riparian areas exist need to be protected and rehabilitated
  - due to private land holdings, land exchanges, purchases or mitigation may be necessary

Habitat Fragmentation (3)

- PMU crossed by major utility corridor
  - use existing corridor for all future needs
  - retrofit existing towers with anti-perching devices if determined beneficial
- Fires have fragmented sage grouse seasonal use areas
  - rehabilitation plans should consider need of corridors and connecting blocks of remaining habitat
- Main county roads meander through PMU
- Hundreds of miles of fencing are present
  - all future fencing modification or construction must consider sage grouse use areas

Changing Land Uses (1)

- Not seen as a problem at current time
  - future expansion of Jackpot could have some impacts
  - conversion of range land to agriculture is a possibility considering the amount of private land in PMU
  - proposed power plant could affect land use dramatically

Livestock Grazing (2)

- Allotment evaluations need to be updated
  - continual monitoring needed to determine recovery of burned areas
- The amount of private land within PMU will influence grazing strategies available to improve overall condition of sage grouse habitat

Fire Ecology (1)

- Fires have already affected large areas
  - full suppression recommended
  - green stripping recommended

Predation (1)

- ♦ Not a major concern
  - predation may have increased due to habitat degradation

Disturbance (1)

- ♦ Proposed power plant and associated disturbance may be a potential problem
- ♦ Wind power generators may be a problem
  - research on effects of generators should be required with permits
- ♦ Military aerial maneuvers
  - unknown disturbance levels

Disease/Pesticides (1)

- ♦ Not a known problem at this time

Hunting/Poaching (1)

- ♦ No impacts presently

Cycles/Populations (1)

- ♦ Population range 5,172 to 6,207
  - downward trend due to habitat loss
  - monitoring needed

Climate/Weather (1)

- ♦ PMU subject to weather extremes
  - need to protect wintering areas

SOUTHFORK PMU (24)

Habitat Quantity (2)

- ♦ Fire has greatly reduced quantity of sagebrush habitat
  - -rehabilitation accomplished
    - -may need further efforts to meet sage grouse need in some areas
    - -monitoring of recovery essential
    - -fire suppression recommended
    - -measures to protect remaining habitat needed
- ♦ Water distribution limited on some areas of PMU
- ♦ Past seedings removed large tracks of sagebrush
  - -recommend planning seeding maintenance with sage grouse needs considered

- Urbanization has reduced quantity of suitable sage grouse habitat
  -several communities exist within PMU and have expanded considerably in recent years resulting in direct loss of habitat, fragmentation, and disturbance

Habitat Quality (2)

- Fires have destroyed vast amounts of prime habitat
  - continued reclamation recommended
- Past seedings were large blocks converted to grass
  - maintenance should be planned with sagebrush obligate species considered
- Some riparian and springs are degraded and in less than desirable condition
  - protection and managed use needed
- Aspen stand regeneration less than optimal in places
  - all aspen should be inventoried, analyzed and put under proper management
- Water distribution limited in southern portion
  - possible opportunity for artificial water sources
- P J encroachment occurring in Unit 103
  - minimal problem currently but may need to be addressed in future

Habitat Fragmentation (2)

- Urbanization has fragmented habitat
- Major roads and transmission lines throughout PMU
- Fires have left large voids in previously contiguous habitat

Changing Land Uses (2)

- Urbanization a concern
  - community expansion and rural developments will continue to reduce amount of sagebrush habitat
  - zoning regulations should consider net loss of habitat
- Private lands being converted from open range to agriculture may increase
- Designated recreational areas, such as South Fork State Park, have changed use patterns for surrounding lands
  - increased human activity associated with recreational demands will continue to affect sage grouse

Livestock Grazing (3)

- Allotment plans need to be updated
  - seasonal habitat requirements of sage grouse need to be considered during planning process
- Post fire grazing needs to be monitored and analysis made to determine if desired range conditions are being achieved

Fire Ecology (2)

- Fire has destroyed and fragmented vast areas of PMU
  - annual grass and weed invasion a concern
  - total suppression recommended
  - protection of remaining habitat critical

Predation (2)

- Predation probably increased considerably due to loss of good habitat
  - raven populations at inflated levels due to human activities and urbanization

Disturbance (3)

- Disturbance levels high in many portions of PMU due to close proximity to urban and rural communities and designated recreational use areas
- Major roads throughout PMU
- Off-road access plentiful
  - may need in future to limit off-road use
- Regional airport increases aerial traffic over PMU

Disease/Pesticides (1)

- Not a known problem
  - chance of domestic fowl disease higher in this PMU due to human development and occupancy
- Pesticide contamination not a known problem

Hunting/Poaching (2)

- Due to close proximity to communities hunting pressure and poaching could potentially have negative impact on localized populations of sage grouse
  - this PMU should be considered separately from the rest of Elko County when establishing sage grouse hunting seasons
  - special consideration should be given this PMU for law enforcement activities

Cycles/Populations (2)

- Population adversely affected by loss of habitat in recent years
  - overall loss of habitat and especially loss of critical breeding and brood rearing areas have negatively impacted local sage grouse populations
  - population will not recover until habitat is restored

Climate/Weather (1)

- Normal climatic patterns are usually conducive to maintaining healthy range conditions and water sources

RUBY VALLEY PMU (16)

Habitat Quantity (2)

- Several sections of this PMU do not possess good sage grouse habitat or only limited quantities
  - Maverick Mtns., Delcer Buttes, Long Valley, Pequop Mtns., Valley Mtn., Wood Hills, Spruce Mtn
  - water distribution limited
  - P J encroachment
  - lake playas etc.,
  - potential exists in some areas to enhance habitat or provide water

Habitat Quality (2)

- Water distribution limited in some areas
- P J encroachment
- Past fires or seedings not yet fully recovered

Habitat Fragmentation (1)

- Not a problem within PMU
  - mountain ranges within PMU may not be barriers, bird movements not identified

Changing Land Uses (1)

- Not a problem at present time
  - changes from open range to agriculture has been expanding, but slowly
  - limited subdivision of private land to date

Livestock Grazing (1)

- Most land use plans up to date
  - monitoring ongoing
  - grazing strategies being analyzed

Fire Ecology (1)

- Wildfire has claimed some key areas but recovery is occurring
  - recommend suppression in critical sage grouse habitat
  - recommend limited suppression in P J zones

Predation (1)

- Not a problem

Disturbance (1)

- Not a widespread problem
  - recommend limited season of use near leks (gravel pits and exploration)

Disease/Pesticides (1)

- Not a documented problem

Hunting/Poaching (2)

- This PMU has a few rather localized populations that should be considered separately when establishing hunting seasons
- Poaching is a potential problem due to close proximity to human developments and activity

Cycles/Populations (2)

- Population range 1,741 to 2,089
  - population trend downward for many years

Climate/Weather (1)

- PMU subject to extreme weather
  - protection of winter use areas critical
  - winter use areas need to be better defined

EAST VALLEY PMU (21)

Habitat Quantity (3)

- PMU has limited sage grouse habitat
  - this portion of Elko County begins transition to desert scrub community divided by high, dry, mountain ranges
  - geologic, topographic and climatic zones preclude major portions of PMU from ever being high quality sage grouse habitat

Habitat Quality (3)

- Same as above

Habitat Fragmentation (1)

- Mountain ranges may prevent movement between isolated populations
  - no data, PMU needs to be surveyed

Changing Land Uses (1)

- Not a problem at this time

Livestock Grazing (1)

- Land use plans up to date
  - specific sage grouse use areas may deserve attention with regard to grazing after use areas are better defined

Fire Ecology (1)

Predation (1)

- Not a known problem
  - special concern may develop if isolated populations are defined and appear to be affected by predation

Disturbance (1)

- Not a problem

Disease/Pesticides (1)

- Not a known problem

Hunting/Poaching (2)

- Due to very low numbers of birds and localized populations this PMU should receive special consideration when determining hunting seasons

Cycles/Populations (3)

- Limited, isolated populations may be extremely vulnerable to cyclic events
- Population range 398 to 477
  - much of PMU unsurveyed

Climate/Weather (3)

- Drier portion of Elko County

APPENDIX D

Population Management Unit Habitat Condition Risk Factor Rating Description

HABITAT CONDITION ASSESSMENT
For the
NORTHEAST NEVADA
SAGEBRUSH CONSERVATION STRATEGY

Utilizing the best available information, sagebrush habitat conditions within seasonal sage grouse habitats in Northeast Nevada Population Management Units were evaluated and categorized into five different condition classes consistent with the Governor's Sage Grouse Conservation Strategy. The following describes each condition class and the methodology utilized to determine the current habitat condition rating.

R-0 Habitat areas with desired species composition that have sufficient, but not excessive, sagebrush canopy and sufficient grasses and forbs in the understory to provide adequate cover and forage to meet the seasonal needs of sage grouse.

Sagebrush cover types within the BLM Elko Field Office area of administration were identified utilizing regional vegetation cover data from the SAGEMAP GIS data base ("stitch map"). This data base made available a map depicting the current distribution of 10 sagebrush cover types generated from readily available data on vegetation, elevation, and soil characteristics. Using this regional sagebrush cover type information as the starting point, additional local information (i.e. fire history, soil survey data, land treatment records, current ecological condition data, and professional judgment) was utilized to assess and categorize these areas into the appropriate R-Value category as described below. If a sagebrush cover type area was not categorized as R-1, 2, 3 or 4, it was categorized as R-0 by default. Therefore, it was assumed to currently have the desired sagebrush canopy and understory composition to adequately provide for the seasonal needs of sage grouse.

Regional sagebrush cover type data indicate sagebrush habitats exist within certain areas which have not been currently designated as seasonal sage grouse habitat. Although sage grouse are not known to currently occupy these areas, these areas were included in the assessment process, thus assuming they could potentially be occupied at some later date.

Soil survey data was not available for the Humboldt National Forest, the Duck Valley Indian Reservation and those portions of the Ruby Valley PMU and the South Fork PMU located in White Pine County. In the absence of other historical information (i.e. ecological condition data, wildfire history records, and land treatment records, etc.), the SAGEMAP cover type data ("stitch map") was utilized to assess habitat conditions within these areas. Sagebrush cover types designated as mountain sage and mountain brush were categorized as R-O.

R-1 Habitat areas which currently lack sufficient sagebrush and are currently dominated by perennial grasses and forbs yet have the potential to produce sagebrush plant communities with good understory composition of desired grasses and forbs.

Elko BLM land treatment records were utilized to map crested wheatgrass seedings within the planning area. Without considering the age or current condition of these seedings, it was automatically categorized as R-1. This assumed that the seeding project has been continuously managed to maintain a perennial grass dominated condition.

Fire history information for the period 1980-2002 was mapped utilizing available GIS data. Those areas above 6,000 feet elevation which have burned within the last five years were categorized as R-1. Those areas below 6,000 feet elevation which have burned within the last ten years were also categorized as R-1. These assumptions were based on the potential for range sites within these elevation ranges to naturally re-establish sagebrush dominated communities following wildfire events. Local knowledge of each burned area was utilized to verify these assumptions. Burned areas which have become dominated by annual vegetation (typically those burned areas below 6,000 feet elevation) were categorized as R-4.

Fire history and land treatment information was not available for sagebrush habitats within the Humboldt National Forest, the Duck Valley Indian Reservation, or public lands in White Pine County. Therefore, the SAGEMAP cover type data ("stitch map") was utilized to assess sagebrush habitat conditions within these areas. There were no areas categorized as R-1.

R-2 Existing sagebrush habitat areas with insufficient desired grasses and forbs in the understory to meet seasonal needs of sage grouse.

Based on existing ecological condition data and professional experience, it was determined that Loamy 8-10 inch range sites within the planning area are most likely to meet this category description. Therefore, the available soil survey data was queried to identify all soil mapping units in which 50% or greater of the area is comprised of Loamy 8-10 inch range sites (i.e. *Artemisia tridenta Wyomingensis* dominated sagebrush types). These areas, less any area previously categorized as R-1, R-3, or R-4 based on other available information, were categorized as R-2.

Soil survey information was not available for sagebrush habitats within the Humboldt National Forest, the Duck Valley Indian Reservation, or public lands in White Pine County. Therefore, the SAGEMAP cover type data ("stitch map") was utilized to assess sagebrush habitat conditions within these areas. Sagebrush cover types designated as black sagebrush, low sagebrush, and Wyomingensis sagebrush/Basin big sagebrush were categorized as R-2.

R-3 Sagebrush habitat areas where pinyon-juniper encroachment has potentially affected the potential to produce sagebrush plant communities that provide adequate cover and forage to meet seasonal sage grouse needs.

Utilizing existing soil survey data, soil mapping units were identified in which 50% or greater of the area is comprised of Woodland types. Pinyon-juniper woodlands are not assumed to be sage grouse habitat. However, sagebrush habitats located adjacent to pinyon-juniper woodland types are potentially affected by the encroachment of pinyon-juniper into these areas. The initial query depicting soil mapping units where 50% or greater is comprised of woodlands was assumed to be those areas of true woodlands. The soil survey data was then queried to identify those soil mapping units which are comprised of 25% or greater woodlands. This resulted in a larger polygon area generally situated adjacent to the true woodlands, thus verifying the assumption that these areas would be located adjacent to the true woodlands. The true woodland areas (queried as 50% or greater of the soil mapping unit) were then subtracted from the larger polygon (queried as 25% or greater of the soil mapping unit), leaving only those areas assumed to be potential encroachment areas. Basically, this was a polygon depicting soil mapping units in which woodland types comprise 25-49% of the soil mapping unit. Because the soil survey data could not be queried based on specific woodland type, it included other woodlands such as aspen, mountain mahogany, mixed conifer, etc. Therefore, professional judgment was utilized to identify and delete those areas other than pinyon-juniper types.

Because true woodlands are typically located on slopes greater than 15%, these areas were then deleted from the potential encroachment polygon. The resulting area (i.e. soil mapping units in which woodland types comprise 25-49% of the soil mapping unit and are less than 15%), less any area previously categorized as R-1 or R-4 based on other available information, was categorized as R-3. The true woodland types were not included in the habitat assessment.

Soil survey information was not available for lands within the Humboldt National Forest, the Duck Valley Indian Reservation, or public lands in White Pine County. Therefore, the SAGEMAP cover type data ("stitch map") was utilized to assess sagebrush and sagegrouse habitat conditions within these areas. Land cover types designated as pinyon/juniper were categorized as R-3.

R-4 Habitat areas which have the potential to produce sagebrush plant communities, but are currently dominated by annual grasses, annual forbs, or bare ground.

Fire history information for the period 1980-2002 was mapped utilizing available GIS data. Local knowledge of each burned area was utilized to verify any assumptions relative to natural re-establishment of sagebrush communities as described under R-1 above. Those burned areas which have become dominated by annual vegetation (typically those burned areas below 6,000 feet elevation where herbaceous understory vegetation was insufficient to ensure a desirable and/or predictable post burn successional response) were categorized as R-4. Local knowledge of other sagebrush habitat areas currently dominated by annual vegetation resulting from surface disturbances other than fire were also mapped and categorized as R-4.

Fire history information was not available for sagebrush habitats within the Humboldt National Forest, the Duck Valley Indian Reservation, or public lands in White Pine County. Therefore, the SAGEMAP cover type data ("stitch map") was utilized to assess sagebrush habitat conditions within these areas. There were no areas categorized as R-4.

APPENDIX E

Nevada Predator Control Program Data 1915 - 1979

Predator Control Efforts 1915-1979 - Statewide and Elko County						
Year	Coyote	Bobcat	Mountain Lions	Total (1)	Elko County (2)	Elko County %
1915	648	26	0	674		
1916	8,866	1,259	3	10128		
1917	6,570	1,130	7	7707		
1918	6,009	1,138	8	7155		
1919	4,651	1,023	5	5679		
1920	4,662	780	1	5443		
1921	4,801	781	0	5582		
1922	4,939	622	1	5562		
1923	4,436	598	0	5034		
1924	5,924	813	4	6741		
1925	4,331	546	3	4880		
1926	5,031	781	3	5815		
1927	2,933	529	1	3463		
1928	4,736	1,131	5	5872		
1929	4,682	1,000	5	5687		
1930	2,738	578	1	3317		
1931	1,506	392	3	1901		
1932	5,134	674	0	5808		
1933	6,069	760	2	6831		
1934	1,377	115	0	1492		
1935	923	164	0	1087		
1936	792	128	0	920		
1937	725	76	0	801	339	42.3%
1938	846	53	3	902	533	59.1%
1939	794	48	8	850	401	47.2%
1940	5,508	555	10	6073	n/a	
1941	7,460	735	5	8200	3171	38.7%
1942	7,806	897	10	8713	3276	37.6%
1943	8,571	821	4	9396	3486	37.1%
1944	9,790	704	3	10497	4471	42.6%
1945	7,798	512	1	8311	3237	38.9%
1946	6,387	257	6	6650	2477	37.2%
1947	6,168	296	2	6466	1709	26.4%
1948	3,860	279	5	4144	914	22.1%
1949	1,410	370	5	1785	606	33.9%
1950	1,212	744	54	2010	814	40.5%
1951	1,865	971	77	2913	1114	38.2%
1952	2,233	966	58	3257	1187	36.4%
1953	2,388	2,573	66	5027	1808	36.0%
1954	4,091	3,484	81	7656	2293	30.0%
1955	4,529	3,191	92	7812	1690	21.6%
1956	4,612	3,257	155	8024	1550	19.3%
1957	4,246	3,442	116	7804	1765	22.6%
1958	3,654	3,465	181	7300	n/a	
1959	5,018	3,629	108	8755	2549	29.1%
1960	6,005	4,077	133	10215	2562	25.1%
1961	8,183	3,756	116	12055	5587	46.3%
1962	8,145	2,175	69	10389	3841	37.0%
1963	6,373	2,707	87	9167	n/a	

1964	7,774	2,636	97	10507	n/a	
1965	7,414	2,162	99	9675	n/a	
1966	6,775	1,844	50	8669	n/a	
1967	5,271	1,125	51	6447	n/a	
1968	3,704	1,029	70	4803	n/a	
1969	3,480	632	61	4173	n/a	
1970	2,433	443	46	2922	n/a	
1971	4,044	382	20	4446	n/a	
1972	2,792	515	14	3321	n/a	
1973	6,272	268	7	6547	n/a	
1974	5,066	128	9	5203	n/a	
1975	6,734	34	10	6778	n/a	
1976	5,447	29	20	5496	n/a	
1977	4,112	11	23	4146	n/a	
1978	4,280	27	16	4323	n/a	
1979	4,447	35	32	4514	n/a	
Totals	301,480	70,308	2,132	373,920	131,708	35.2%
Mean	4,638	1,082	33	5,753		
	(1) Statewide total of coyotes, bobcats, and mountain lions.					
	(2) The individual county totals were not available for all years; the numbers only represent coyotes, bobcats, and mountain lions					
	(3) Percent of statewide total of coyotes, bobcats, and mountain lions taken in Elko County					

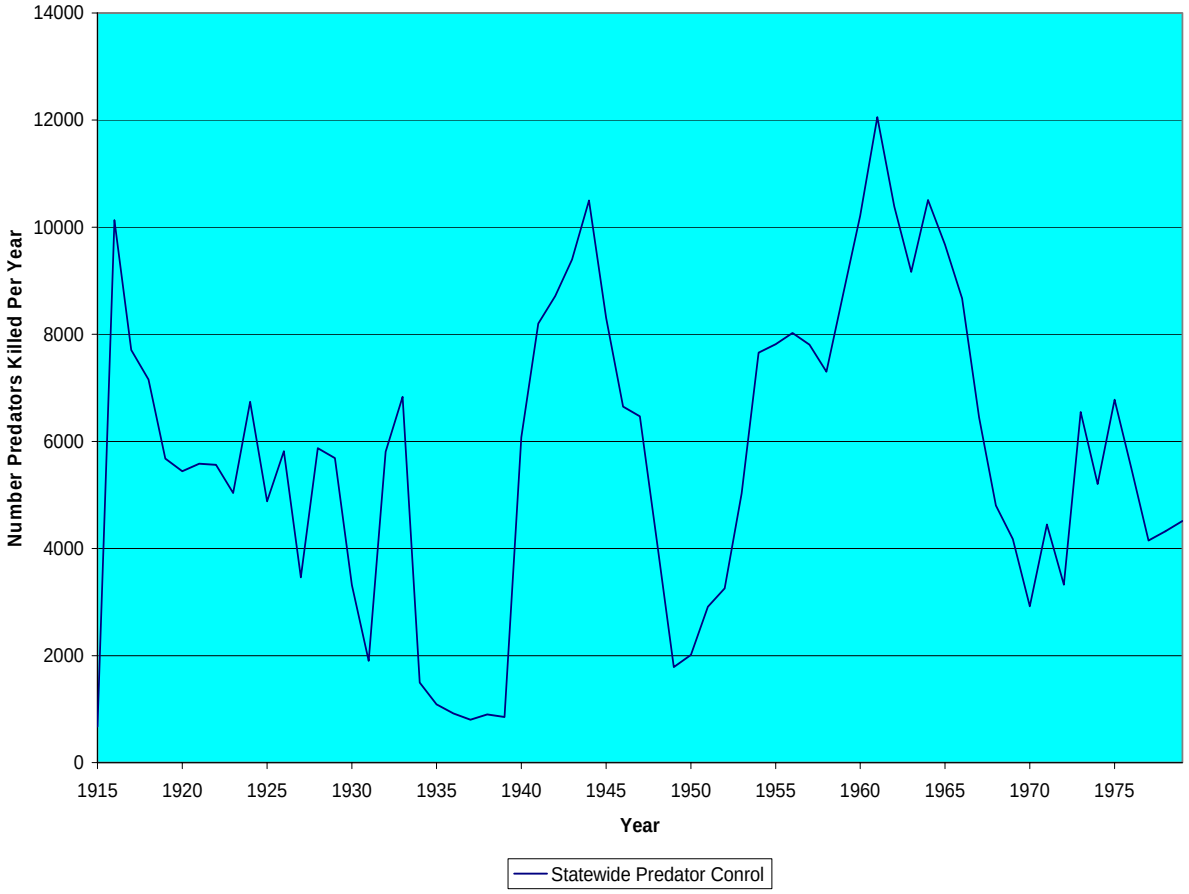


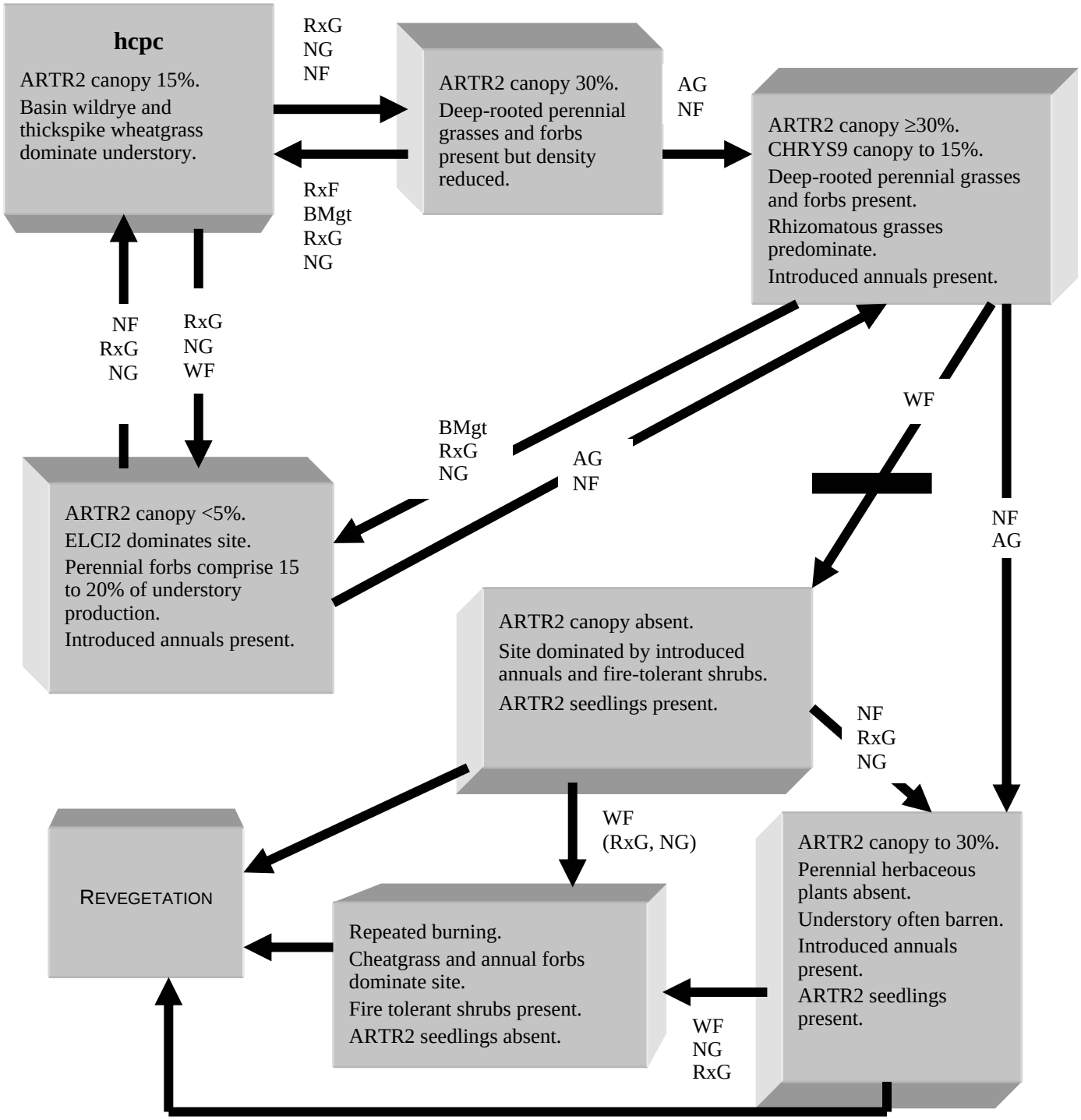
Figure B-1: Nevada Statewide Predator Control Data, 1915-1979

APPENDIX F

State and Transition Models for Six Sagebrush Range Sites - Prepared by NRCS

LOAMY FAN 8-10” p.z.
025XY070NV

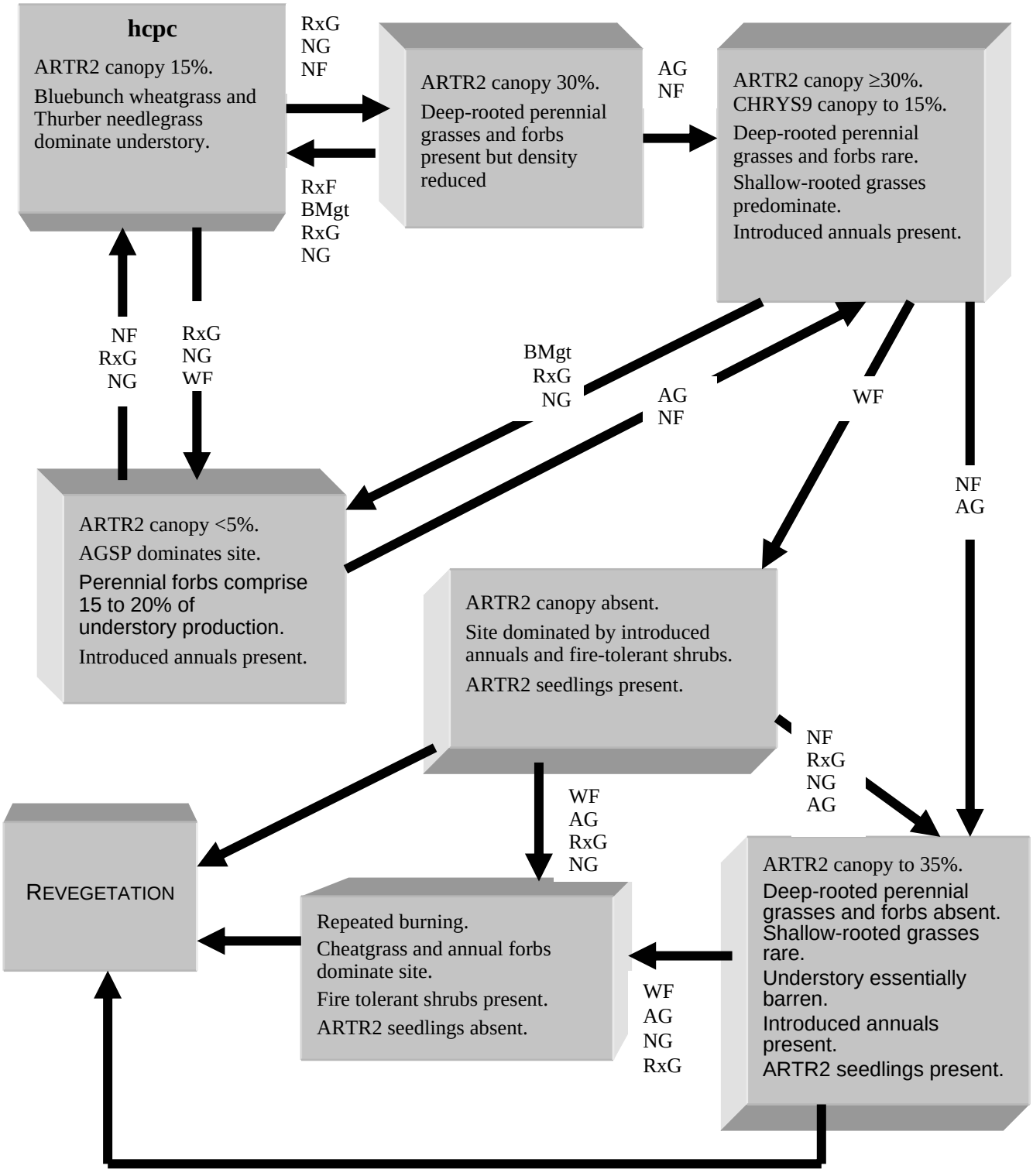
Steady States and transitional pathways



AG - Abusive Grazing
BMgt - Brush Management
HCPC - Historic Climax Plant Community
NG - No Grazing
NF - No Fire
RxF - Prescribed Fire
RxG - Prescribed Grazing
WF - Wildfire

LOAMY 10-12” p.z.
025XY014NV

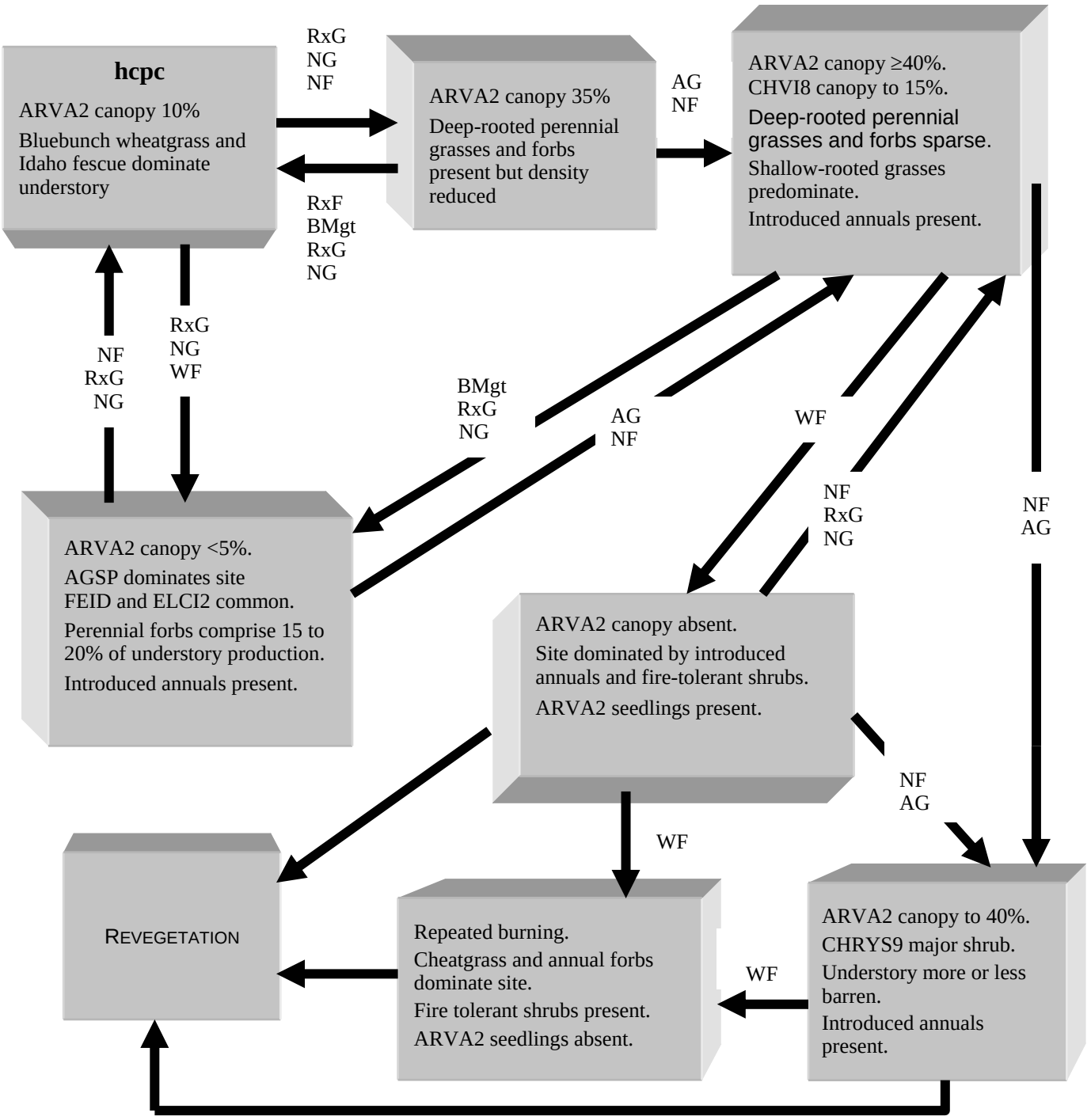
Steady States and transitional pathways



AG - Abusive Grazing
BMgt - Brush Management
HCPC - Historic Climax Plant Community
NG - No Grazing
NF - No Fire
RxF - Prescribed Fire
RxG - Prescribed Grazing
WF - Wildfire

LOAMY SLOPE 12-16” p.z.
025XY012NV

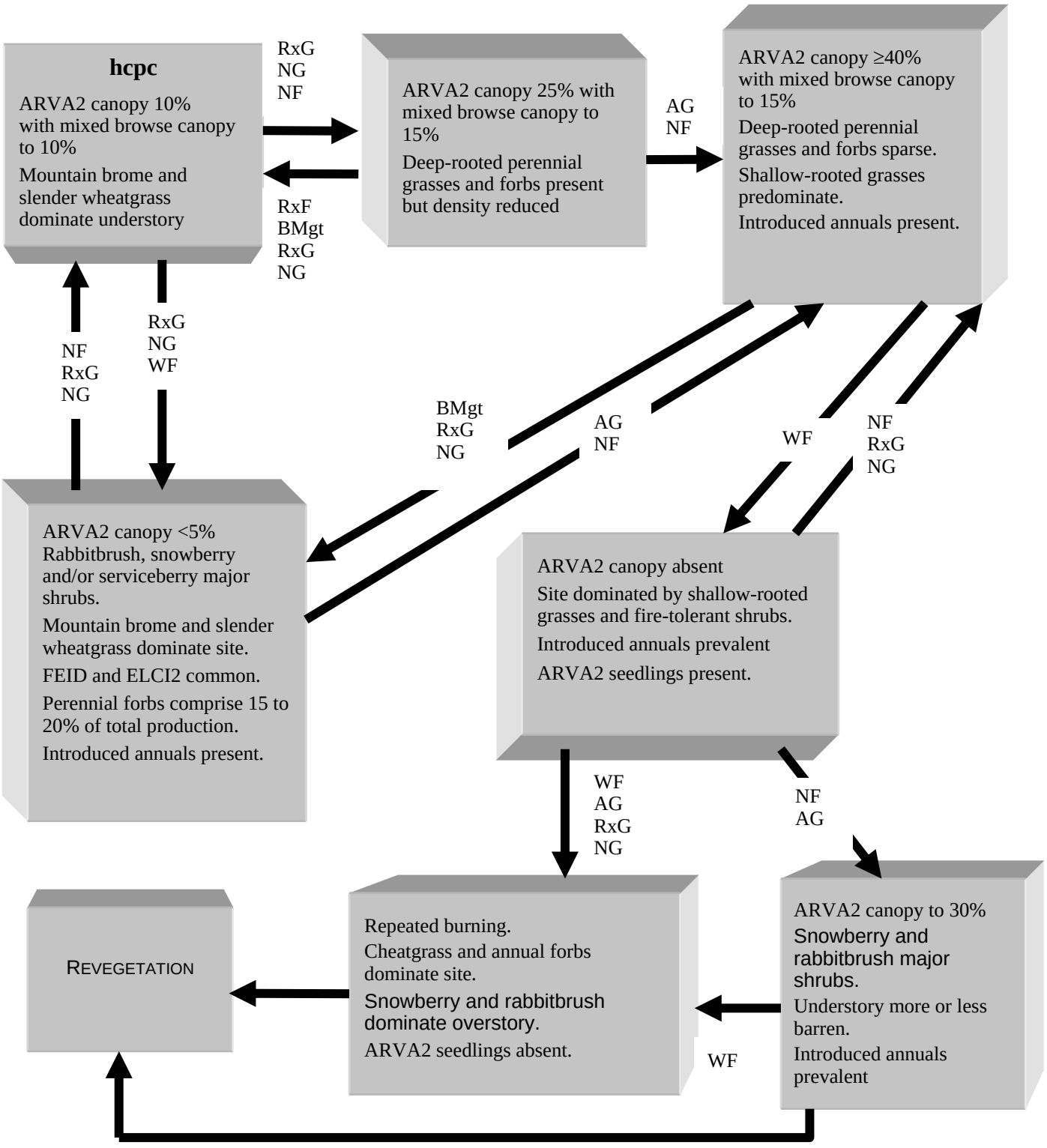
Steady States and transitional pathways



AG - Abusive Grazing
BMgt - Brush Management
HCPC - Historic Climax Plant Community
NG - No Grazing
NF - No Fire
RxF - Prescribed Fire
RxG - Prescribed Grazing
WF - Wildfire

LOAMY SLOPE 16+" p.z.
025XY004NV

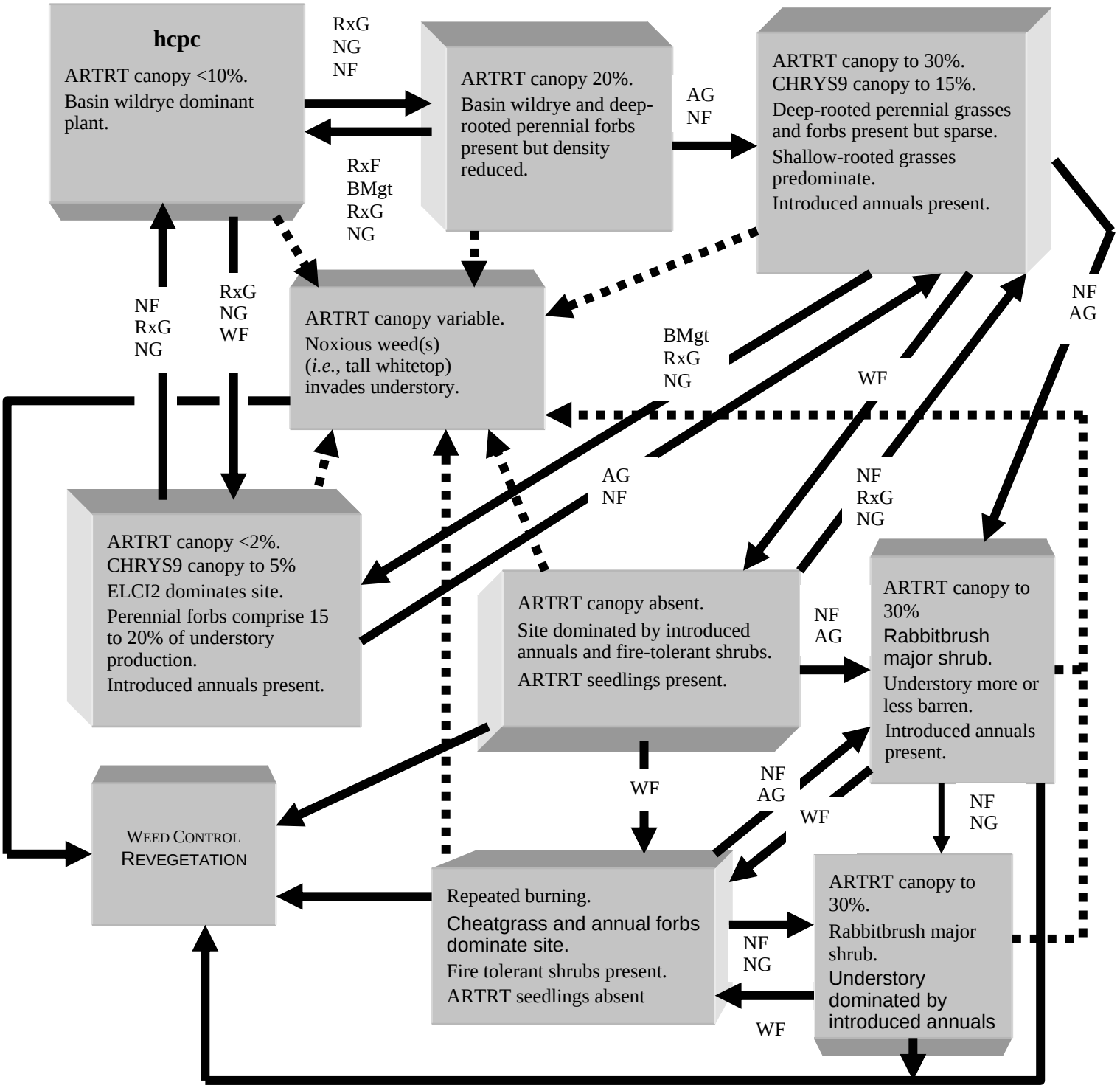
Steady States and transitional pathways



AG - Abusive Grazing
BMgt - Brush Management
HCPC - Historic Climax Plant Community
NG - No Grazing
NF - No Fire
RxF - Prescribed Fire
RxG - Prescribed Grazing
WF - Wildfire

LOAMY BOTTOM 8-14” p.z.
025XY003NV

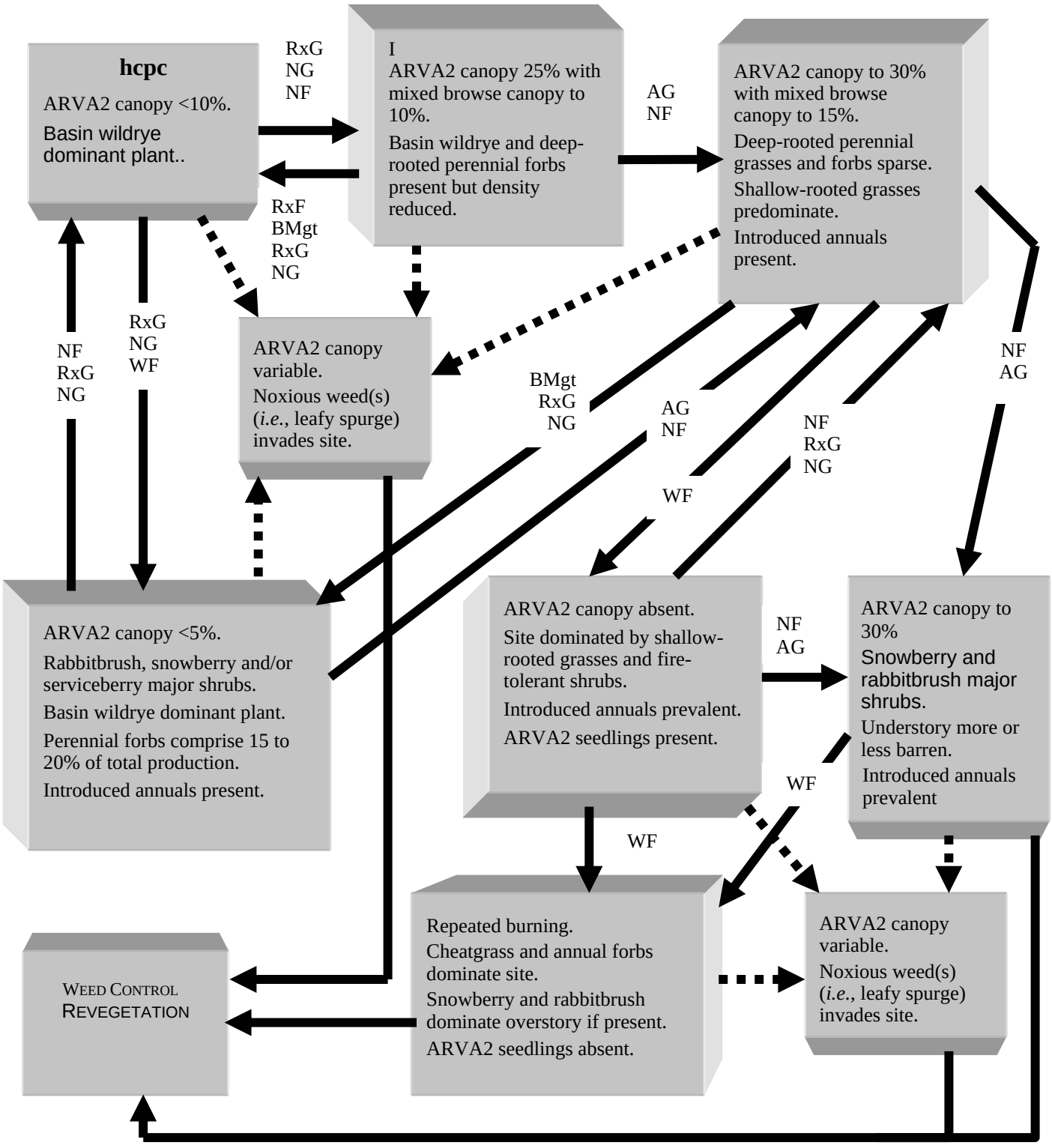
Steady States and transitional pathways



AG - Abusive Grazing
BMgt - Brush Management
HCPC - Historic Climax Plant Community
NG - No Grazing
NF - No Fire
RxF - Prescribed Fire
RxG - Prescribed Grazing
WF - Wildfire

LOAMY BOTTOM 14+" p.z.
025XY081NV

Steady States and transitional pathways



AG - Abusive Grazing
BMgt - Brush Management
HCPC - Historic Climax Plant Community
NG - No Grazing
NF - No Fire
RxF - Prescribed Fire
RxG - Prescribed Grazing
WF - Wildfire

APPENDIX G

Sagebrush-Obligate Species and Sagebrush-Using Species of Conservation Concern in Elko County, Nevada

Summary of Habitat Requirements for Sagebrush Obligates to be added in final version.

APPENDIX H

Recommendation for Application Rates of Spike™ 20P Herbicide to Thin Big Sagebrush

USDA NRCS
Natural Resources Conservation Service
5301 Longley Lane, F-201
Reno, NV 89511

Big Sagebrush Management with Spike* 20P Herbicide

*Trademark of Dow AgroSciences, LLC[1]

What is Spike 20P Herbicide?
Spike 20P is a pelleted herbicide used to control woody plants. The active ingredient in Spike 20P is tebuthiron which makes up 20% of the pelleted formulation. Inert ingredients comprise the remaining 80%.

What are the ecological benefits of using Spike 20P to control big sagebrush?
Big sagebrush (Artemesia tridentata), a woody shrub dominant on many acres of western rangeland, is an integral part of the plant and wildlife communities when combined with a balanced mixture of grasses and forbs. However, as its density increases, the vast root system of big sagebrush can reduce soil moisture resulting in lowered water tables, decreased water volume in creeks and springs, and degraded riparian areas. Decreases in big sagebrush stand density not only provide more forage to livestock and wildlife, but also give way to greater grass and forb cover, which results in lower surface erosion potential and higher soil moisture retention during drought periods. The competitive ability of dense big sagebrush stands also decreases desirable herbaceous understory species, negatively impacting biodiversity and forage availability for wildlife and livestock. As a result of accurate aerial application made possible with Spike 20P pellets, range managers can create mosaic patterns of variable brush stand densities in order to increase fringe areas preferred by many species.

What are some other advantages of using Spike 20P to control big sagebrush?

- Pellet formulation provides a herbicide application that essentially is not affected by sunlight and temperatures as well as an application with a higher potential for accuracy (low drift potential).
- Application flexibility: The timing of application is not dependent on plant growth stage and can be applied when native grasses are dormant or to fit wildlife nesting habits.
- The partial big sagebrush kill that results from the use of low application rates of Spike 20P creates a visual picture that is non-distinguishable from a big sagebrush stand in a normal die-back cycle.
- The gradual kill of sagebrush (usually 2-3 years) with the use of Spike 20P, allows wildlife and plant species to adjust to habitat changes over an extended period of time compared to the drastic, one-season change from prescribed burning or a 2,4-D treatment.
- The impact of reduced or "thinning" application rates on desirable forbs and brush is negligible.

Why should big sagebrush be thinned?
Big sagebrush is thinned to improve productivity, vegetative mosaic patterns, plant diversity, wildlife habitat, and soil protection on rangeland. Leading ecologists recommend a big sagebrush canopy cover between 10-15% for optimum biodiversity. However, the desired density of big sagebrush varies greatly according to management objectives for the site. In addition, it is generally accepted that having a variety of sagebrush densities over a large area of land may provide for optimum biological diversity on a landscape scale. Within limits, this concept in using Spike 20P to thin big sagebrush stands can accommodate these various objectives.

What are the available application methods for Spike 20P?
While fixed wing and rotor (helicopter) aircraft are the main options for applying Spike 20P, in most cases an applicator mounted to a fixed wing aircraft appears to be the most cost effective. A fixed wing aircraft generally provides a larger coverage area per load compared to a helicopter and is therefore faster in job completion. This results in a lower cost per acre with the use of fixed wing aircraft. Treatment area topography and other operational factors may dictate the need for the use of helicopter in order to allow for application flexibility.

What are the environmental effects of using Spike 20P?
It has been demonstrated in animal toxicity and safety studies that Spike 20P (tebuthiron-20% active ingredient) has a relatively low order of toxicity. Spike 20P is virtually harmless to livestock and wildlife. Due to its high soil particle binding potential, Spike 20P has not been found to appear below 24 inch soil depths and therefore poses little to no threat to groundwater. Application rates that are in excess of recommended levels as outlined in the application rate tables on the reverse, could result in unacceptable impacts on non-target species.

(over)

How much Spike 20P should be applied to reduce big sagebrush?
The following tables show recommended application rates of Spike 20P (presented with permission from Dow AgroSciences, LLC) to achieve various reductions in big sagebrush canopy cover.

Table 1 - Spike 20P Application Rates Required to Achieve Specified Levels of Big Sagebrush Canopy Cover Reduction *by Percent Soil Organic Matter.*

Percent Organic Matter	Desired Percentage Reduction In Canopy Cover			
	40%	50%	75%	85%
	Spike 20P Application Rate Per Acre in Pounds			
<3	NR	1.0	1.5	2.0
3 to 4.5	1.0	1.5	2.5	3.5
4.5 to 5	1.0	2.0	NR	NR
>5	2.0	3.0	NR	NR

NR = not recommended due to lack of data showing percent reduction under these conditions. Soil organic matter and to a lesser extent, the amount of clay in the soil, are the major factors that determine how effectively Spike thins big sagebrush. Higher organic matter and clay content require higher Spike application rates to achieve the same results. Soil texture and organic matter are determined by laboratory analysis of samples taken from the top 10 inches of soil profile located under the drip line of the sagebrush canopy.

Table 2 - Spike 20P Application Rates Required to Achieve Specified Levels of Big Sagebrush Canopy Cover Reduction *by Big Sagebrush Subspecies and Site Elevation.*

Subspecies / Site Elevation	Desired Percentage Reduction In Canopy Cover			
	40%	50%	75%	85%
	Spike 20P Application Rate Per Acre in Pounds			
Wyoming / <6,500'	NR	NR	1.0	1.5
Wyoming / >6,500'	NR	1.0	3.0	NR
Mountain / <6,500'	1.5	2.0	3.0	3.5
Mountain / >6,500'	1.5	2.5	NR	NR

NR = not recommended due to lack of data showing percent reduction under these conditions. The subspecies of big sagebrush that is present at a site, in combination with site elevation, can serve as an indicator of soil texture and organic matter, and can be used to predict the rate of Spike required to achieve the desired level of thinning. Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) typically grows at higher elevations and at sites with higher organic matter. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) typically grows at lower elevations with lower soil organic matter.

It is important to realize that Spike 20P is effective in thinning stands of big sagebrush (*Artemisia tridentata*), but its effect on other species of sagebrush is variable. If you are unsure which species of sagebrush you are dealing with, please consult a range specialist for positive identification. Please note: it is important to be accurate in the application of Spike 20P. Unacceptable impact on non-target species may occur at application rates that exceed the site recommendations shown above.

Here are some examples of how to determine the proper rate of Spike 20P for your job:

Example 1: The site has 4% organic matter in the top ten inches of soil profile. Present canopy cover of big sagebrush is 20%. The objective is to obtain 10% canopy cover. To achieve this, the canopy cover must be reduced by 50%. Table 1 shows that to obtain a 50% reduction in canopy cover at 4% OM, the recommended application rate is 1.5 lbs. of Spike 20P per acre.

Example 2: The site supports mountain big sagebrush and is over 6500 ft. in elevation. Present canopy cover is 30%. It is desirable to reduce density by 50% thereby leaving 15% canopy remaining. Table 2 shows that to obtain a 50% reduction in canopy cover, the recommended application rate is 2.5 lbs. of Spike 20P per acre. Note that higher levels of canopy reduction cannot be achieved at recommended rates in this situation.

Your local USDA Natural Resources Conservation Service Nevada field office can provide assistance to evaluate environmental risks associated with application of pest management recommendations.

[1] Trade names are used solely to provide specific information. Mention of a trade name does not constitute a guarantee of the product by the U.S. Department of Agriculture nor does it imply endorsement by the Department or the Natural Resources Conservation Service over comparable products that are not named.

APPENDIX I

Watershed Prioritization Matrix and Matrix Definitions

Elko County Sagebrush Ecosystem Conservation Strategy Watershed Prioritization Matrix

Watershed ID	Land Status (% public land and private land)	Existing Management Plans	Population Distribution and Trend	Fire History (% watershed in need of rehabilitation; % sagebrush)	Other Issues - (SSS, Water Quality, etc.)	PMU Priority	Total
Rock Creek	(7+10) = 17	5	10	1	5	27	65
Little Humboldt	(10+5) = 15	5	5	10	2	27	64
Upper Humboldt	(4+1) = 5	5	10	10	10	24	64
S.F. Owyhee	(7+1) = 8	5	10	5	7	27	62
Steptoe Valley	(10+1) = 11	10	5	10	4	21	61
S.F. Humboldt	(7+1) = 8	5	10	5	9	24	61
N.F. Humboldt	(10+1) = 11	5	10	5	9	19	59
Goose Creek	(10+5) = 15	5	10	5	2	19	57
Salmon Falls	(10+1) = 11	5	10	5	6	19	56
Great Salt Lake	(10+1) = 11	10	1	10	2	21	55
Long/Ruby Valley	(7+1) = 8	5	10	10	6	16	55
Little Owyhee	(10+10) = 20	5	1	10	2	16	54
Central	(10+10) = 20	5	1	1	1	24	52
Upper Owyhee	(7+1) = 8	5	10	5	4	19	51
1000 Springs	(7+1) = 8	5	10	5	3	19	50
Bruneau/Jarbidge	(10+1) = 11	5	1	5	8	19	49
Grouse Creek	(7+10) = 17	5	1	5	1	19	48
Middle Humboldt	(4+1) = 5	5	1	5	4	27	47
Pine Creek	(4+1) = 5	5	1	1	3	24	39

MATRIX DEFINITIONS DRAFT

Watershed ID - Each watershed or subbasin will be given a name that will serve as the watershed ID.

Land Status - Watersheds with higher percentages of public land will be given preference over watersheds dominated by private land. Land status will include the following:

Percent of watershed that is in public ownership; 0 - 25% = 1, 26 - 50% = 4, 51 - 75% = 7, 76 - 100% = 10;

Number of permittees - 1 - 3 = 10; 4 - 6 = 5; >6 = 1

The score for public ownership and the score for number of permittees will be combined and the total score entered into the matrix.

Existing Management Plans - Watersheds with allotments that have existing grazing decisions, habitat management plans, or other management plans will be given preference over watersheds that have not yet been evaluated.

Entire watershed under existing management plans = 10; watershed partially under existing management plans = 5, watershed has no existing management plans = 1.

Population Distribution and Trend - Watersheds with numerous strutting grounds and with stable or increasing populations of sage grouse will be given preference over watersheds with few strutting grounds or declining populations.

Watershed has 25 or more active strutting grounds = 10; watershed has 10 - 25 active strutting grounds = 5; watershed has less than 10 active strutting grounds = 1.

Fire History - Watersheds that have not had any recent fire history and have decadent stands of sagebrush will have the highest ranking - manage the "good stuff" where sage grouse currently exist and the potential return for effort expended is likely to be high. Annual grasslands that have been created in the last 40 years will have the second highest priority. Watersheds with pinyon-juniper encroachment onto rangeland sites will have the lowest priority, unless the amount of existing sagebrush is high and the watershed can be ranked under the first priority.

Watersheds with intact sagebrush = 10

Watersheds with high percentage of annual grasslands = 5

Watersheds with high percentage of pinyon-juniper encroachment = 1

Other Issues - The focus of the strategy is for ecosystem management with sage grouse as the featured species; however, where other special status species (plant or animal) are an issue, or where water quality is of high concern, or where other

issues exist that need to be addressed, this category provides for these issues to enter into the prioritization process.

Multiple issues of high concern = 10; one or two issues of high concern = 5; no issues of high concern = 1.

Percent of Population Management Unit in the Watershed - Population Management Units (PMUs) were identified in the Nevada Sage Grouse Conservation Strategy. Watersheds that have a high percentage of one or more PMUs will have preference over watersheds with only a portion of, or no PMUs.

PMUs are a high percentage of the watershed = 10, PMUs are less than 50% of the watershed = 5; no PMUs in the watershed = 1.

Population Management Unit Priority - The Nevada Sage Grouse Conservation Strategy also includes a matrix for prioritizing actions. The priority is based on PMU characteristics. The ranking of the PMUs within the NNSG Planning Area will be entered into the NNSG matrix.

Total - The score for each criteria for each watershed will be totaled and the watersheds ranked from highest to lowest score. This will provide the final prioritization.

APPENDIX J

On-Going Sage Grouse Population and Habitat Improvement Actions

Nevada Department of Wildlife

NDOW continues to do and/or has done the following for sage grouse habitats and resources:

1. Assess Elko County sage grouse populations via annual attendance of males on 10-15 trend leks throughout the county. Many other leks are visited on a yearly basis, but the focus remains on these trend leks. Additional population inventory work has been conducted on a frequent basis with Elko BLM. A significant effort has been undertaken during the last several years to identify new grounds using GIS models to predict lek locations. Both helicopter and ground surveys have been employed to identify new leks. These efforts have utilized both volunteer labor and agency personnel. This continuing collaborative effort between agencies has allowed BLM/NDOW personnel to visit nearly 1,500 leks and identify nearly 300 new leks over the last four years in Elko County alone!

2. Collect age/sex/recruitment data on Elko County sage grouse populations on a yearly basis via hunter harvest. Wings from harvested sage grouse are collected on a yearly basis from approximately 20 traditional, key locations around the county. Brood survey information is collected yearly on a limited basis throughout the county. Emphasis on this data and associated seasonal distribution information will increase in the future.

3. Identification of sage grouse wintering grounds remains a priority and will take on added emphasis as the Elko County sage grouse plan is implemented. At present, most documentation of wintering grounds comes as a result of incidental information from other survey work. Directed efforts specifically for wintering ground detection will increase in the future. GIS modeling will aid in these efforts.

4. Over the last 10 years, NDOW has implemented restoration work on nearly 40,000 acres in the western portion of the county where the wildfire and cheatgrass issue has impacted nearly 90% of historic deer winter range for the MA 6 deer herd. Almost all of this project work is within historic or existing sage grouse habitat. One of the strategic goals of these 27 projects has been to reestablish sagebrush in areas where wildfires have effectively eliminated this essential element of mule deer and sage grouse habitat. Costs associated with these projects have exceeded $1,000,000. Additionally, NDOW has taken an active role in the rehabilitation of burned areas elsewhere in the county. With collaborative efforts involving BLM, USFS, and private landowners, NDOW has taken an active role in the rehabilitation of important sagebrush habitats following wildfires. Over the last four years, NDOW has spent over $250,000 in Elko County in efforts to restore sagebrush to 30,000 acres impacted by fire, all of which have value to sage grouse.

5. NDOW will continue to work in the collaborative arena in Elko County whether it is with the NNSG, the Shoesole HRM groups, the Tomera or South Buckhorn working groups for the betterment of wildlife habitats and resources.

Forest Policies and Projects that benefit Sage Grouse in Northeastern Nevada

Humboldt-Toiyabe National Forest
Ruby Mountains/Jarbidge and Mountain City Ranger Districts

Introduction

The following is a list of policies and projects that have or will have benefit to sage grouse habitat on National Forest System Lands in northeastern Nevada.

Policies:

In November of 2003, the Intermountain Region of the U.S. Forest Service added the Greater Sage Grouse to the Region's list of sensitive species. This designation results in the species inclusion into all Biological Evaluations for all authorized activities conducted on National Forest System lands. BEs will recommend avoidance and mitigation measures for projects that potentially effect sensitive species.

Amendment Number 2 (1990) of the Humboldt National Forest Land and Resource Management Plan (LRMP) identifies sage grouse as a management indicator species (MIS). This designation requires the agency to address potential impacts to the species in National Environmental Policy Act (NEPA) documentation.

Projects:

In 2000, the Camp Fire burned over 30,000 acres of National Forest, BLM, and private lands. The Forest Service cooperated with the Nevada Department of Wildlife (NDOW) to seed 3,000 acres of Forest System lands on the Jarbidge Ranger District with sagebrush and bitter brush to benefit sage grouse, mule deer, and elk.

In 2001, about 500 acres of land burned on the east side of the E. Humboldt range of the Ruby Mountains District. The Forest Service cooperated with NDOW to seed those acres with sagebrush and bitter brush to benefit sage grouse and mule deer.

In 2002, the Mountain City Range District completed a draft Area Analysis for the Jack Creek and Bull Run area of the district. In the document, several recommendations were made to improve habitat conditions for several species including sage grouse.

Upcoming Planning Efforts:

Currently, the Jarbidge Ranger District is conducting a NEPA analysis to comply with the 1995 Range Rescissions Act. During this process, sage grouse will be evaluated in both the NEPA document as well as the biological evaluation process.

The Mountain City Ranger District is scheduled to start the Range Rescissions Act NEPA process in 2005.

SUMMARY OF LAND MANAGEMENT ACTIONS THAT CONTRIBUTE TO SAGE GROUSE HABITAT AND/OR SAGEBRUSH CONSERVATION ON PUBLIC LANDS IN THE BLM ELKO FIELD OFFICE

INTRODUCTION

The BLM, through its broad legislative, regulatory and policy mandates, has the responsibility for the management of the public land resources under the principles of sustained yield and multiple use. The BLM is committed to working collaboratively with public land users, and state and federal agencies to accomplish its public land management responsibilities. The BLM's commitment to working collaboratively with local working groups to help conserve sage grouse and sage grouse habitat, is further emphasized in the 2000 Memorandum of Agreement signed by BLM, Forest Service, U.S. Fish and Wildlife Service, and Western Association of Fish and Wildlife Agencies.

The BLM Elko Field Office has been an active participant in the development of the Northeast Nevada Sagebrush Conservation Strategy (as well as the Central Nevada Conservation Plan) and continues to support the efforts of the Northeast Nevada Stewardship Group to address important issues related to resource stewardship and the informed management of public lands. To the extent that staffing and funding allows, the BLM will assist in the development of watershed assessments and the implementation of conservation actions identified through the watershed assessment process proposed by the Northeast Nevada Sagebrush Conservation Strategy. From the BLM's perspective, the local conservation plans, and in the case of the Northeast Nevada working group, the watershed assessments, will provide important recommendations and tools that the BLM will consider as we develop management strategies for conserving sage grouse habitats on public lands.

BLM's management strategies and decisions to conserve sage grouse must comply with existing laws, policies, regulations and management plans while considering the needs or implications to other species and multiple uses. BLM decisions that affect resource uses and allocations on public lands must be evaluated in accordance with NEPA and provide opportunities for wide public review. Based on our participation in the plan/strategy development to date, the Elko Field Office anticipates that most habitat restoration and improvement activities will typically be in conformance with our existing land use plans.

The BLM Elko Field Office has addressed the protection and management of sage grouse habitat by identifying multiple use objectives and decisions through land use plan development and implementation beginning in 1985. Therefore, the BLM Elko Field Office feels strongly that public land management decisions implemented since that time should be given full consideration when evaluating past, present, and future sage grouse population and habitat conservation efforts. In addition, we feel that it is imperative that these multiple use decisions and/or actions be evaluated and incorporated into the proposed watershed assessment process to ensure their

effectiveness in addressing the sage grouse habitat and/or population risks that have been identified and prioritized in the local conservation strategy.

The following summary (also summarized in Attachment 7) serves to outline the current management strategies and actions implemented through the BLM's land use plan development and implementation process, as well as other various initiatives, that contribute to sage grouse habitat and/or sagebrush conservation on public lands in the Elko Field Office.

A. LAND USE PLANNING (Resource Management Plans)

Resource Management Plans (RMPs) were developed for the Wells and Elko Resource Areas of the Elko Field Office in 1985 and 1987, respectively. These RMPs were developed in response to Section 202 of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1712) and address management for more than 7 million acres of public lands in Elko, and portions of Lander, Eureka, and Humboldt counties.

The regulations developed for implementing RMPs were designed to comply with the provisions of environmental legislation, particularly the National Environmental Policy Act of 1969 (NEPA) by incorporating an environmental impact statement (EIS) into the planning process. The most important and fundamental aspect of the RMP process is that it was designed to be issue oriented and driven. In other words, the RMPs were prepared to guide managers in making decisions on solving specific problems on certain areas of public land.

The Wells and Elko RMPs made the following types of range and wildlife management decisions:

1. Livestock Grazing:
    a. Identified objectives for vegetation goals.
    b. Determined where livestock grazing would and would not be allowed.
    c. Identified the degree of range improvements.
    d. Identified kind of livestock to be permitted by area.
    e. Identified goals for authorized levels of livestock use.
    f. Identified "initial levels" of authorized livestock grazing.
    g. Identified that "monitoring" would be used to adjust livestock grazing if it was determined that the existing authorizations were not meeting the LUP objectives.

2. Wild Horse and Burros:
    a Identified Herd Management Areas.
    b. Identified "initial levels" of Wild Horse and Burros.
    c. Identified that "monitoring" would be used to adjust Wild Horse and Burro levels.

3. Wildlife:
    a. Identified habitat objectives by kind and area or wildlife.

b. Identified "reasonable numbers" of wildlife by kind and area.
c. Identified aquatic habitat objectives.
d. Identified that "monitoring" would be used as the basis for recommending adjustments in wildlife population levels to the Nevada Department of Wildlife.

Although sage grouse and/or sagebrush habitat conservation was not specifically identified as an issue during the development of the Wells and Elko RMPs, sage grouse habitat is addressed and considerations are provided for in terms of overall wildlife habitat objectives and standard operating procedures for the various authorized land management programs designed to protect and/or enhance crucial habitats for sensitive species, including sage grouse. A summary of the programmatic considerations included in each of the RMPs which benefit sage grouse and/or sagebrush conservation are included in Attachment 1A and 1B. In addition, the general guidance provided by the existing RMPs direct that more site specific activity plans such as Habitat Management Plans be developed for specific sites or areas with high priority competing uses. Specific sage grouse and/or sagebrush habitat issues, objectives, standards, and monitoring activities are provided for in these site specific activity plans.

B. STANDARDS AND GUIDELINES

1. Rangeland Health Standards

The BLM grazing regulations that became effective on August 21, 1995, required that the terms and conditions of grazing permits and leases must ensure conformance with the standards and guidelines. Terms and conditions generally include the kind and number of livestock, the period(s) of use, the allotment(s) to be used and the amount of use described in animal unit months (AUM) (the amount of forage to sustain a cow and calf for one month). On February 12, 1997, the Secretary of the Interior approved Standards and Guidelines for Nevada. These standards for rangeland health and the guidelines for grazing management were developed in consultation with Nevada's three resource advisory councils to help ensure productive sustainable rangelands. The standards and guidelines provide clear direction to achieve properly functioning ecosystems for both uplands and riparian areas. They also provide for managing rangelands in a manner that will achieve or maintain ecological health, including the protection of habitats for threatened or endangered species and the protection of water quality. The standards and guidelines were reviewed in 1997 and an Administrative Determination of NEPA Adequacy was completed which determined that they were consistent with the management decisions and objectives for all existing land use plans.

The BLM utilizes the allotment evaluation process to ensure multiple uses for grazing allotments are meeting or making progress toward meeting land use plans, allotment specific objectives, and the standards and guidelines. In accordance with the grazing regulations, if the allotment evaluation process determines that existing grazing permit terms and conditions are not meeting those standards, and livestock grazing is a significant factor in not meeting the standards, then as soon as possible or no later than

the start of the next grazing year, the terms and conditions of the permit or lease will be modified.

Current policy direction is to complete an assessment of all grazing allotments to determine progress toward attainment of the standards for rangeland health by 2008. See discussion below regarding the allotment evaluation and multiple use decision process.

2. Western Association of Fish and Wildlife Agency Guidelines to Manage Sage Grouse Populations and Their Habitats

In addition to the many other management objectives and/or standards that apply to sage grouse and/or sagebrush habitats, both the Wells and Elko RMPs require that alterations of sagebrush areas will be in accordance with the 1977 Western States Sage Grouse Guidelines, as amended, and as future studies might dictate. In 2000 the Western Association of Fish and Wildlife Agencies (WAFWA) finalized an update of the 1977 guidelines. The Bureau of Land Management (BLM), US Forest Service, and US Fish and Wildlife Service signed a memorandum of agreement to consider these guidelines in their respective planning efforts, utlizing local expertise and quantitative data. In addition, the agencies are urged to "use an adaptive management approach, using monitoring and evaluation to assess the success of implementing these guidelines to manage sage grouse populations". In accordance with the existing land use plans and the 2000 Memorandum of Agreement, the BLM will consider the WAFWA guidelines in all sage grouse and/or sagebrush habitat enhancement projects that occur on public lands and/or are federally funded. These guidelines are not viewed as "hard and fast" standards in lieu of working collaboratively to improve range health. We recognize that these guidelines need to be adapted to local environments and based on scientifically credible ecological data collected and analyzed at the local level.

3. Nevada BLM Management Guidelines for Sage Grouse and Sagebrush Ecosystems

In Nevada, the BLM has recognized that generally lower moisture regimes prevail throughout the majority of Nevada's sagebrush ecosystem. Therefore, BLM developed a set of sage grouse management guidelines designed to be consistent with the WAFWA guidelines, yet adapted to Nevada to provide interim guidance to BLM field managers without restricting options currently being explored for local sage grouse conservation planning. The Nevada BLM Guidelines apply the most current sage grouse science to BLM activities, within the context of a multiple use mandate (see Attachment 2). Because they were developed to be consistent with the WAFWA guidelines and more specific to Nevada, the Elko Field Office will continue to consider the NV guidelines, together with the WAFWA guidelines, in all sage grouse and/or sagebrush habitat enhancement projects that occur on public lands and/or are federally funded. Nevada BLM Guidelines specific to Fire Management, Emergency Fire

Rehabilitation, and Vegetation Treatments have been incorporated into the Elko/Wells Resource Management Plan Fire Amendment as standard operating procedures.

C. LAND USE PLAN IMPLEMENTATION (Activity Plans)

1. Habitat Management Plans

Implementation of the wildlife/riparian management objectives outlined in the Wells and Elko RMPs is accomplished through the development of step-down activity plans in priority designated order. The development of Habitat Management Plans (HMPs) was accomplished for many areas of the Elko Field Office until the allotment evaluation process was implemented for Nevada, beginning in the late 1980's. The allotment evaluation process is consistent with the implementation description and management decisions outlined in the RMPs and blends the evaluation of resource conditions and identification of needed changes in management for the range, wildlife, and wild horse programs.

The BLM Elko Field Office has completed three HMPs which specifically identify sage grouse habitat objectives (North Fork, O'Neil/Salmon Falls and Cherry Creek HMPs) covering approximately 1,404,683 acres. The Marys River Riparian/Aquatic HMP was developed to address riparian issues in the Marys River Watershed. Although this HMP does not specifically identify management objectives for sage grouse, riparian enhancement objectives for the Marys River watershed are expected to significantly benefit sage grouse populations in this 421,562 acres area. All four HMPs were developed in cooperation with the NDOW under the authority of the Sikes Act. Each plan is viewed as a Sikes Act cooperative federal-state management plan to improve wildlife habitat on public lands. Table 1. outlines the amount of sage grouse habitat addressed by each HMP:

Table 1. Summary of Elko Field Office Habitat Management Plans.

Habitat Management Plan	Year Completed	Level of Consideration for Sage Grouse and/or Sagebrush Habitats	Acres of Sage Grouse and/or Sagebrush Habitat
O'Neil/Salmon Falls	9/8/86	Emphasis placed on improvement of riparian habitats essential for brood rearing. Objective to improve 43 springs and/or wet meadows within the HMP area.	682,532 acres
Cherry Creek	9/30/87		362,136 acres
North Fork	9/30/87	Emphasis placed on improvement of riparian habitats essential for brood rearing. Ojective to improve 42 springs and/or wet meadows within one mile	360,015 acres

		radius of known lek areas.	
Marys River	9/30/87	Designed specifically to improve riparian and aquatic habitats for Lahontan cutthroat trout with significant benefits also realized by livestock permittees, recreationists, and other fish and wildlife species, including sage grouse.	421,562 acres
Total Acres			1,826,245 acres

2. Allotment Management Plans

The BLM Elko Field Office administers livestock grazing on 241 grazing allotments (226 allotments are located in Elko County). The Wells and Elko RMPs established multiple use objectives and initial stocking levels for livestock, wild horses, and wildlife from which adjustments would be based on monitoring. Therefore, the rangeland management program has focused on monitoring, evaluating, and making any necessary changes in livestock grazing management to achieve stated objectives.

The Wells and Elko RMPs directed implementation of the range management objectives to be accomplished through the development of step-down activity plans in priority designated order. Allotment Management Plans (AMPs) were developed to prescribe the manner in and extent to which livestock grazing is conducted and managed within specific grazing allotments to meet multiple use, sustained yield, economic, and other needs and objectives as determined through the land use planning process.

A selective management approach was utilized to determine priorities for AMP development. This approach classified grazing allotments into three categories ("M" maintain, "I" improve, or "C" custodial) according to their management needs, potential for improvement, and Bureau funding/manpower constraints. The selective management process identified 83 "I" category allotments and 93 "M" category allotments. Generally, emphasis is placed on implementation of step-down activity plans for these "I" and "M" allotments.

Until the allotment evaluation process was implemented for Nevada, beginning in the late 1980's, the Elko Field Office had completed AMPs for 12 "I" category allotments and 20 "M" category allotments, totally 1,998,435 acres. These AMPs were prepared with the appropriate participation by various resource specialists to ensure that resource management guidelines identified in land use plans were properly considered and mitigating measures are included, as necessary, in the selection of allotment specific management actions.

3. Allotment Evaluations and Multiple Use Decisions

In the late 1980's, BLM in Nevada shifted its energies from implementing land use plan objectives through the development of program specific activity plans (AMPs, HMPs, etc.) to an allotment evaluation process. In a priority schedule order, grazing allotments are evaluated to determine progress toward attainment of multiple use objectives (including sage grouse) and the standards for rangeland health. The allotment evaluation process consists of or involves:

a. The evaluation of current grazing use by all users (livestock, wild horses, wildlife) based on monitoring data analysis and interpretation;
b. Recommendations to change or adjust grazing systems;
c. Recommendations to change or adjust stocking levels; and
d. Establishment of stocking levels for wild horses.

Any needed changes in grazing, wildlife, and/or wild horse and burro management are implemented through issuance of a multiple use decision. To date, the Elko Field Office has completed the allotment evaluation and multiple use decision process for 101 allotments, totaling 4,158,694 acres (61% of the Elko Field Office area of administration). A map depicting existing grazing allotments which currently have prescriptive management in place to address attainment of multiple use objectives (including sage grouse habitat objectives) and standards for rangeland health are shown on the map in Attachment 3A. The map in Attachment 3B outlines the current schedule for completion of evaluations through 2007.

Beginning in the late 1980's, grazing allotments were evaluated individually, utilizing the selective management criteria to establish the priority schedule. In the late 1990's, the BLM Elko Field Office began grouping allotments with similar management issues and completing the evaluation and multiple use decision process for a "complex" of allotments. In some instances, this included up to six or more allotments. More recently, evaluations have been completed for groupings of allotments within an entire watershed (i.e. Marys River).

It is important to clarify that the schedule for completing allotment evaluations is based on the selective management criteria established in the land use plans, as well as changes in resource issues that have occurred during implementation of each RMP. The Elko Field Office has placed a high priority on completing evaluations within wild horse and burro herd management areas and Lahontan cutthroat trout (LCT) habitats. To date, all grazing allotments within wild horse and burro herd management areas have been completed. All evaluations for allotments within LCT habitat have been completed with changes in grazing management in place except the Tuscarora and North Fork Group complexes.

In some instances, an allotment evaluation will be completed for an allotment where an AMP or HMP is already in place. In such cases, the evaluation process serves to assess progress toward attainment of the land use plan objectives, standards for rangeland health, and the specific activity plan objectives. Any necessary changes in the management prescribed in the AMP or HMP are then implemented through issuance of the multiple use decision.

The allotment evaluation and standards and guidelines assessment schedule for high priority allotments in the Elko Field Office is outlined in Attachment 4. This schedule is subject to modification based on changes in staffing, funding and other workload priorities.

The Elko Field Office fully expects that the watershed and population management unit priorities established in the Northeast Nevada Sagebrush Conservation Strategy will result in adjustments to the attached schedule, ultimately directing BLM's efforts to complete required evaluations and standards and guideline assessments. Currently the Elko Field Office has completed the allotment evaluation for the Rock Creek Allotment affecting 345,279 acres of sage grouse habitat in the Rock Creek Watershed/ Tuscarora PMU. The Tuscarora Complex Allotments, also located in the Rock Creek Watershed/ Tuscarora PMU is scheduled for completion in 2005 and would affect an additional 81,161 acres.

The map in Attachment 3A shows that allotment evaluations have been completed in nearly every watershed and/or population management unit. The watershed assessment process proposed by the Northeast Nevada Sagebrush Conservation Strategy will include these existing management actions and serve to assess their effectiveness in addressing overall watershed and/or sage grouse habitat issues. Any necessary changes in the existing management would implemented through BLM's decision process.

4. Range Improvement Projects and Funding

The available rangeland improvement funding is a function of annual grazing receipts. During the past ten years, the Elko Field Office has had as much as $500,000 available annually for rangeland improvement development. During the past ten years available funding has been utilized to implement expensive Allotment Management Plans (AMPs) and Multiple Use Decisions (MUDs) which have been designed to implement changes in management to meet specific multiple use objectives. During the past ten years, we have been experiencing many factors which have resulted in a marked decrease in available range improvement funds (i.e. reduced grazing fees and reduced active use due to drought and other economic reasons, etc.).

Currently, the Elko District has approximately $400,000 to spend on project development each year. Because less funding is available, range improvement funding has been committed for the next three to five years. The Elko Field Office has responded by working harder to identify ways to implement needed changes in management to meet our objectives which will require less monetary investment and require less effort to implement than many of our previous AMPs and MUDs. In addition, the Elko Field Office has developed a project evaluation process which ranks each proposed project utilizing ecological and planning criteria to determine implementation priorities. Utilizing this criteria, projects that are part of an interdisciplinary planning effort (i.e. allotment evaluation/multiple use decision, conservation plan, burned area

emergency rehabilitation plan, etc.), address special status species habitat enhancement, and have a high degree of cooperative funding will receive a higher priority for implementation.

D. POPULATION INVENTORIES

The BLM Elko Field Office has worked closely with the Nevada Department of Wildlife (NDOW) Region II office to maintain an up to date inventory and GIS data themes for sage grouse leks and winter grounds. In cooperation with NDOW, BLM has assisted in ground and aerial lek surveys. In addition, the Elko Field Office has assisted NDOW in incorporating nearly forty years of site records into the GIS data base. The BLM has secured $30,000 to $50,000 each year through annual budget appropriations and its Challenge Cost Share program to support this effort. This work has been in concert with NDOW's annual lek trend counts and brood surveys. During the past four years, BLM and/or NDOW personnel have conducted 1,452 site visits, identifying 274 new leks. There are currently 942 known leks within Elko County. Table 2 summarizes the number of known leks visited and new leks found during 2000-2003 in Elko County.

Table 2. 2000-2003 Elko County Lek Survey Summary.

Year	Number of Known Leks Visited	Number of New leks Found
2000	193	24
2001	544	118
2002	571	74
2003	144	58
Total	1,452	274

Survey work during the past four years has focused mainly on presence/absence documentation at known lek locations and monitoring the impacts of recent wildfires. In 2003, existing information was utilized to build a GIS model to predict locations where lek sites might be found. Utilizing this GIS model, 58 new leks were identified in 2003. Future inventory efforts will be directed toward locating new leks or wintering areas based on predictive modeling. Special attention will be given to gathering new information within high priority watersheds and/or PMUs identified in the Northeast Nevada Sagebrush Conservation Strategy.

The BLM Elko Field Office's continued participation in population inventories is always subject to available funding. However, BLM views this information as essential to making sound land management decisions. Therefore, a high priority will continue to be placed on funding requests for cooperative efforts such as this.

E. FIRE MANAGEMENT

1. Fire Management Pan Amendment

Wildfires have had a significant impact on sage grouse habitats in the Elko Field Office, affecting nearly 1.9 million acres during the past 20 years (see map Attachment 5). To address the increasing amount and cost of wildfire suppression, the 1995 Federal Wildland Policy (reviewed and updated in 2001) directed Federal agencies to develop Fire Management Plans for all areas subject to wildland fires. These plans were to address all potential wildland fire occurrences and include a full range of fire management actions, use new knowledge and monitor results to revise fire management goals, objectives and actions, and be linked closely to land and resource management plans. A Fire Management Plan was first developed by the BLM Elko Fire Management Officer in 1998. Since the existing RMPs did not provide adequate direction for fire management, an RMP amendment was determined necessary.

On November 10, 2003 the BLM Elko Field Office issued a Proposed Elko/Wells Resource Management Plan Fire Management Amendment. This amendment to the existing Wells and Elko RMPs incorporates current direction for responding to wildfires and using fire to achieve resource management objectives. The intensity and size of wildfires have increased compared to pre-settlement conditions, and wildfires pose a significant threat of risk to life, property, and resources. Vegetative communities have high fuel loads that are extremely flammable, especially at the height of the fire season in July and August. The proposed plan amendment prescribes a strategy for responding to fires and reducing hazardous fuel loads at a landscape level, with an objective of improving the condition of public lands throughout the region.

The proposed plan amendment is expected to reduce adverse impacts through the reduction of hazardous fuel loads, resource-focused response strategies, and new procedural guidelines. The proposed plan amendment identifies that fire prevention actions such as vegetation manipulation, fuels reduction, green strips, fuel breaks and thinning should be maximized through the use of prescribed burning, mechanical, chemical and biological (including grazing) treatments to reduce wildfire fuel hazards. Nevada BLM Management Guidelines for Sage Grouse and Sagebrush Ecosystems specific to Fire Management, Emergency Fire Rehabilitation, and Vegetation Treatments have been incorporated into the proposed plan amendment as standard operating procedures. The proposed plan amendment identifies 24,000-60,000 acres to be treated annually utilizing appropriate fuels management techniques. The proposed acreage would vary by year dependent on project planning, funding and staffing levels.

Vegetation treatment projects are generally consistent with the Wells and Elko RMPs and are guided by the Vegetation Treatment on BLM Lands in Thirteen Western States EIS (1991) and the site specific NEPA document prepared for each individual project. The Elko Field Office has also completed a programmatic Elko/Wells District Vegetation Treatment by Fire environmental assessment (2000). Funding for earlier vegetation treatment projects has been through available rangeland improvement program and/or cooperative cost share funds. Most recently, fuels treatment funding has been made available through the National Fire Plan and Healthy Forest Initiatives. The BLM Elko Field Office has completed nearly 46,000 acres of vegetative treatments to meet multiple use and fuels management objectives since 1991. These projects are

summarized in Table 3 and are included in the map showing seedings and treatments in Attachment 5. Each project was designed and evaluated through a site specific environmental assessment to ensure beneficial impacts to sage grouse and/or sagebrush obligate species were achieved.

The BLM Elko Field Office feels that the fire/fuels management program objectives are consistent with the objectives for sage grouse and/or sagebrush habitat management outlined in the Northeast Nevada Sagebrush Conservation Strategy. The effectiveness of these projects will be included in the proposed watershed assessment process with respect to overall watershed functionality and meeting sage grouse and/or sagebrush habitat objectives. In addition, the integration of these programs will maximize available fuels program funding to accomplish common goals. In other words, the watershed assessment process will have a major influence in establishing priorities for future fuels management projects.

Table 3. Summary of Elko Field Office Vegetation Treatment Projects.

Name Of Project	Year(s)	Acreage
Stud Creek	1991-1993	1,000
Stormy	1995-2001	2,900
Frenchy	1999	2,283
Frenchy-Scott	1999	537
Rose	1999	1,131
Mineral	1999 - 2000	986
Sadler-Garcia	1999	2,107
Clover	2000	172
Clover 2	1999	6,755
Cross Ranch	2001	600
Clover Green Strip	2002	10,200
Izzenhood	2002-2003	4,974
Beaver Creek	2002-2003	660
Palamino	2003	1,155
Liza Jane	2003	2,036
East Highway	2003	1,094
Gravel Pit	2003	698
Little Humboldt	2003	1,350
Long Field	2003	800
Spruce	2003	1,439
South Spruce	2003	1,078
Owyhee	Planned	3,000
Elko South	2003	800
Elko North	2003	800
Total Acres Treated		48,555

2. Wildfire and Emergency Stabilization and Rehabilitation

Following each wildfire event, interdisciplinary resource management teams evaluate and develop appropriate Burned Area Emergency Rehabilitation plans to address specific resource concerns. Fire rehabilitation is directed by the guidelines for rangeland health, the Normal Fire Rehabilitation Plan Environmental Assessment (2000), and the Interagency Burned Area Emergency Stabilization and Rehabilitation Handbook (2001), as amended. The extent to which a burned area is reseeded is governed by several variables which are evaluated on a site specific basis, such as burn intensity, soil stability, pre-burn conditions, etc. Reseeding following wildfire events has occurred at varying degrees through out Elko County in the past 20 years however, efforts since 1999 have been the most extensive. Since 1999, nearly 800,000 acres have burned in the Elko Field Office area of administration. As a result of rehabilitation efforts, approximately 270,000 acres have been reseeded with appropriate seed mixes based on site potential, seed availability, and specific resource issues or objectives. Site evaluations following these wildfire events determined that the remaining 530,000 acres could rehabilitate naturally due to pre-fire vegetative conditions, elevation, precipitation zone, and site potentials. A summary of the acres treated for each fire from 1999-2003 is included in Attachment 6.

The Interagency Burned Area Emergency Stabilization and Rehabilitation Handbook provides for post treatment monitoring up to three years following treatment to evaluate effectiveness and identify the need for further treatments. Treatment objectives are also established and monitored prior to allowing livestock grazing. Post fire grazing management is also considered to ensure treatment success. The effectiveness of these projects will also be included in the proposed watershed assessment process with respect to overall watershed functionality and meeting sage grouse and/or sagebrush habitat objectives. Additional restoration projects may be identified through the watershed assessment process.

G. GREAT BASIN RESTORATION INITIATIVE

The Great Basin Restoration Initiative (GBRI) began following the devastating 1999 fire season with two reports, “Out of Ashes, An Opportunity” (August 1999), which explained the threats and ecological status of the Great Basin, and “The Great Basin: Healing the Land” (April 2000), which proposed guiding principles and outlined goals and actions in five key areas to help direct restoration work. Since then, an expanded team representing many disciplines has continued to meet regularly and work on strategies and products to assist restoration work in the Great Basin.

The GBRI team defines restoration as “implementation of a set of actions that promotes plant community diversity and structure that allows plant communities to be more resilient to disturbance and invasive species over the long term”. This definition gives field offices the latitude to conduct a wide range of activities under the label of restoration, as long as the actions promote diversity and the ability of the restored community to better resist or recover from disturbances such as weed invasion or

repeated wildland fires. Use of native plants in restoration projects is emphasized where the seed is available and adapted to the site being restored. Many activities (fire rehabilitation, hazardous fuels reduction, implementation of standards and guidelines, wildlife habitat restoration, etc.) currently funded under other programs meet this definition, and therefore may be included under the umbrella of GBRI.

There is no permanent funding tied specifically to GBRI. Restoration funding arises through several avenues including numerous BLM subactivities and the National Fire Plan. For example, many of the vegetation treatment projects listed in Table 3 above are funded under the umbrella of GBRI. In addition, BLM's noxious weed program secures substantial funding through the GBRI. As a result, during 2002 and 2003 the Elko Field Office has completed 5,868 acres of noxious weed treatment, directly benefiting sage grouse habitat restoration. GBRI is consistent with existing and new land use plans and the National Fire Plan. The bottom line is, what's good for sage grouse will be provided for through restoration efforts associated with GBRI. While some of these efforts will overlap, coordination among the various initiatives will minimize duplicate efforts and ensure maximum use of available resources.

H. HABITAT INVENTORY AND MONITORING

1. Upland Habitats

The objective of BLM's monitoring program is to gather data that can be used in the planning process, in the development of activity plans (HMPs, AMPs, multiple use decions, etc.), and in evaluating the effectiveness and impacts of land management decisions. Management objectives dictate the monitoring studies that need to be initiated and the evaluations dictate management actions needed to meet the objectives. The monitoring program includes wildlife, watershed, range, riparian, and wild horse studies. The data collected includes actual grazing use reports, utilization, climate, and condition and trend studies. All monitoring data is collected, stored, and utilized in accordance with the Elko Field Office Monitoring Plan, together with policy directives. The Elko Field Office has upland habitat monitoring established on all "I" and "M" category grazing allotments. This data serves as the basis for evaluating attainment of habitat objectives, including those for sage grouse, as well as developing desired future condition objectives. This data will also be an integral part of the proposed watershed assessment process.

The Nevada Rangeland Monitoring Handbook (1984) outlines the minimum monitoring methods that will be used. Additional monitoring methods which may be determined appropriate (depending on the issues and management objectives involved) are included in the BLM and Interagency Technical Reports and various BLM Manual Handbooks and Supplements.

A recent example of how the Elko Field Office has addressed sage grouse habitat objectives through the evaluation and monitoring program is the Hubbard Vineyard

Allotment in northeastern Elko County. The BLM recently completed an evaluation of resource conditions for the Hubbard Vineyard Allotment which provides critical seasonal habitat for sage grouse and is the site for an on-going sharp-tailed grouse reestablishment study. In order to ensure significant progress toward attainment of resource objectives the BLM has implemented an adaptive management approach, utilizing the principles of holistic management to involve the interested public in the decision making process. Critical sage grouse and sharp tailed grouse nesting habitat within the Hubbard Vineyard allotment occurs within three separate pastures. A grazing system has been designed that would allow for grazing in each of the pastures during the critical nesting season one year out of three. Each pasture would be rested two years out of three. The grazing system has been designed to improve degraded riparian habitat conditions within the three pastures, ultimately improving summer and late brood-rearing habitat for sage grouse. The WAFWA guidelines outline the critical need for residual nesting cover to ensure nesting success. Therefore, concern has been raised regarding the potential effects the proposed grazing system might have on nesting sage grouse and sharp tailed grouse.

Given the plan for adaptive management of sage grouse and specifically the concern, a study was initiated to:

1. Locate critical nesting areas within the Hubbard Vineyard Allotment.
2. Describe sage grouse nesting habitat use in relation to grazed and ungrazed pastures.
3. Identify selected habitat conditions within occupied nesting areas in relation to sage grouse management guidelines, life history, and habitat requirements.
4. Define seasonal sage grouse movements and critical habitat areas to assist in the holistic management process and adaptive grazing management within the Hubbard Vineyard Allotment.
5. Evaluate satellite telemetry technology against conventional radio telemetry and evaluate the effectiveness this technology in tracking sage grouse annual movements.
6. Apply this information to habitat evaluations and adaptive management strategies elsewhere in Elko County.

The Hubbard Vineyard allotment is an example of the adaptive management process being utilized by BLM to address sage grouse habitat issues. The Elko Field Office expects data from this study and others in Elko County to formulate the quantitative local knowledge base referred to in the WAFWA Guidelines as integral to adapting them to the local area.

2. Riparian Habitats

In addition to the multiple use mandate outlined in FLPMA (1976), numerous laws, regulations, policies, Executive orders, and Memorandums of Understanding direct BLM to manage its riparian-wetland areas for the benefit of the nation and its economy. The Wells and Elko RMPs both outline specific objectives for the management of riparian habitats. The minimum standard of “proper functioning condition” was established for all

riparian areas by the Northeast Nevada Resource Advisory Council through approval of the Standards and Guidelines for Rangeland Health in 1997. As described above under Upland Habitats, riparian monitoring data is essential to the planning process, the development of activity plans, and in the evaluation of the effectiveness and impacts of land management decisions. Riparian habitats provide an essential component of sage grouse brood rearing habitat, providing succulent vegetation during late summer and fall when upland sites begin to dry up. Therefore, managing for healthy riparian areas is consistent with the needs and objectives for sage grouse habitat management.

The Elko Field Office collects aquatic/riparian habitat data on nearly 250 miles of high and medium priority streams. There are over 900 miles of perennial stream habitats on public lands in the Elko Field Office area of administration. A functionality assessment was completed on all lotic areas (perennial streams) in 2001. The Elko Field Office continues to collect aquatic/riparian habitat data and reassess functionality conditions on all riparian areas as part of ongoing monitoring plans and rangeland health or management evaluations. Table 4 summarizes the current condition ratings for these lotic habitats.

Table 4. Elko Field Office Summary of Lotic Riparian Functionality Ratings.

Functionality Rating	PFC	FARup	FARdn	FARna	NF	Unknown	Total Miles
Stream Miles	178 (20%)	153 (17%)	122 (13%)	125 (14%)	335 (37%)	0	912

PFC=Proper Functioning Condition
FARup=Functioning at Risk with an upward trend
FARdn= Functioning at Risk with a downward trend
FARna=Functioning at Risk with trend not apparent
NF=Non Functional

The Elko Field Office initiated a functionality assessment survey of public land lentic (springs, seeps, and wetlands) in 1998. Table 5 summarizes the current condition ratings for these lentic habitats.

Table 5. Elko Field Office Summary of Lentic Riparian Functionality Ratings.

Functionality Rating	PFC	FAR up	FAR na	FAR dn	NF	Unkown	Total
Acres	2137.2	70.5	97.05	288.2	130.15	2893.9	5617

PFC=Proper Functioning Condition
FARup=Functioning at Risk with an upward trend
FARdn= Functioning at Risk with a downward trend
FARna=Functioning at Risk with trend not apparent
NF=Non Functional

I. SURFACE MINING AND MITIGATION

Mining activity, primarily in the Carlin Trend, creates disturbances to existing wildlife habitat and also the opportunity to rehabilitate and reclaim disturbed areas for the benefit of wildlife and other multiple uses. Creative solutions to both short and long term problems continue to be developed in conjunction with the mining companies, Nevada Department of Wildlife, and BLM. Monitoring of the dewatering activities to determine if impacts are occurring, determining what those impacts may be, and developing mitigation if the impacts occur are major issues. In addition to mitigating direct impacts associated with surface mining activities, creative solutions have often included off-site mitigations to address impacts to sage grouse and/or sagebrush habitats. Table 6 summarizes some of the major mining operations permitted on public lands in the Elko Field Office and the mitigations developed to benefit sage grouse and/or sagebrush habitats.

Table 6. Summary of Off-site mitigations associated with surface mining which directly or indirectly benefit sage grouse and/or sagebrush habitats.

1991 – Newmont Gold Quary Project	•Funded **3,400 acres** (5 yr project) mule deer/sagebrush habitat restoration project in Dunphy Hills. •Installed artificial wildlife water developments to mitigate dewatering impacts.
1991 – Barrick Betze Project	•Mitigation fund established in amount of **$660,000** to addressed potential impacts to **330 acres** of riparian/wetlands resulting from dewatering activities •Financial assurances for: **$40,000** in accelerated riparian/wetland re-vegetation projects. **$50,000** toward development of alternative wildlife water sources. **$50,000** toward habitat development projects for sage grouse. **$125,000** for mule deer/sagebrush habitat enhancement projects. •Pursue a land exchange offering valuable wildlife habitat(s) in exchange for long term loss of wildlife habitat within the boundaries of the Betze Pit.
Newmont Mining Company 1993 – South Operations Area Project (SOAP) Mitigation Plan, as amended by 2002 – SOAP Amendment Mitigation Plan, also carried out through the 2002 – Leeville Project	•Maggie Creek Watershed Restoration Project: -Riparian area fencing/development -Vegetation management plan -Conservation easement •Susie Creek Riparian enhancement project: -riparian exclosures •Marys River Riparian Project: -stock watering well development away from Marys River riparian habitats •Spring/Seep enhancement: -fence/development **six (6) identified springs/seeps plus 25 additional** •Established a **"habitat mitigation bank"** to offset direct impacts associated with mine activities, by restoring **3,487 acres** of mule deer/sagebrush habitat in the Dunphy Hills. •Funding for **139 acres** of sage grouse habitat enhancement (applied to habitat mitigation bank). •Funding for **139 acres** of mule deer/sagebrush habitat enhancement (applied to habitat mitigation bank). •Donated sagebrush seeder equipment to NDOW for use in future projects.
1993 - Barrick Meikle Mine Project	•Funding committed for sage grouse and mule deer/sagebrush habitat improvement programs. •Construction of artificial water sources for wildlife.

1994 - Independence Mining Company – Jerritt Canyon Mine Expansion Project	•MOU between USFS, IMC and NDOW allowing for **contributed funds to NDOW** to mitigate past, present, and future impacts to mule deer/sagebrush habitat. •California Mtn. Mine Sage Grouse Mitigation Plan, allowing for **45 acres** of habitat to be treated to benefit sage grouse •Wetlands mitigation plan allowing for development of **20 acres** of offsite wetlands.
1995 – Newmont: Section 36 Project	•Funding for **211 acres** of mule deer transition/sagebrush habitat restoration (applied to habitat mitigation bank).
1996 - Independence Mining Company – DASH Project (mostly USFS lands)	•MOU between USFS, IMC and NDOW allowing for **contributed funds to NDOW** to mitigate past, present, and future impacts to mule deer/sagebrush habitat. •Off-site wetlands mitigations
1996 – Bootsrap Mine Project	•Funding to **300 acres** mule deer transition/sagebrush habitat restoration (applied to habitat mitigation bank).
1996 – Newmont Lantern Mine Project	•Funding for **75 acres** of mule deer transition/sagebrush habitat restoration (applied to habitat mitigation bank).
2002 – Newmont Pete Project	•Funding for **264 acres** of mule deer/sagebrush habitat restoration (applied to habitat mitigation bank). •Funding for off-site enhancement of **74 acres** of sage grouse habitat.
2003 – Barrick Betze Project	•Improve **15 springs** in cooperation with NDOW and BLM •Restore **635 acres** of riparian habitat through the Willow Creek Riparian Enhancement Project •Provide **$50,000** for sage grouse habitat enhancement projects

J. LAND TENURE ADJUSTMENTS

The Elko and Wells RMPs classified the public lands into three management categories based on their suitability for land tenure adjustments. These include sales, transfer primarily by exchange, and retention. Public lands identified for transfer primarily by exchange are generally suited for exchange for private lands within those areas classified for retention. Those areas classified for retention are high resource value public lands that are to be retained and managed intensively and consolidated where possible to enhance management opportunities. Consistent with the decisions outlined in the Elko and Wells RMPs, the Elko Field Office has engaged in an active land exchange program since the mid 1980's to consolidate land ownership within high resource value retention areas for the public benefit. Over 200,000 acres containing valuable riparian and wildlife habitat values have been incorporated into public ownership as a result of the land exchange program.

Each proposed land exchange is subject to detailed analysis, including preparation of an environmental assessment/land report, a cultural resources evaluation, a report on

mineral potential, and an appraisal to establish fair market value. The following criteria are considered during the analysis process:

1. Public resource values or concerns, including but not limited to: threatened, endangered, or sensitive species habitat; riparian areas, flood plains, and wetlands; fisheries, nesting/breeding habitat for game birds or animals, key big game seasonal habitat.
2. Accessibility of the land for public uses.
3. Amount of public investment in facilities or improvements and the potential for recovering those investments.
4. Difficulty or cost of administration (manageability).
5. Significance of the decision in stabilizing business and social and economic conditions.
6. Encumbrances or conflicts or record.
7. Suitability and need for change in land ownership.

Table 7 below outlines those land exchanges which have resulted in private lands containing high resource values (i.e. critical wildlife habitats, riparian or wetland habitats, etc.) being transferred to public ownership.

Table 7. Land Exchanges completed with high resource values.

Proponent	**Date**	**Acres**
Glaser Land & Livestock	1/30/1985	10,063.12
Harvey Dahl	7/25/1985	1,978.26
Boyd Ranch	11/12/1985	4,891.78
FS/Loyd & Alta Sorensen	3/19/1987	5,064.12
Loyd & Alta Sorensen	5/26/1987	960.00
Newmont Gold Company	9/25/1987	1,027.64
Ray Corta	9/15/1988	1,920.00
Lands of Sierra	10/11/1988	3,383.55
Olympic Nevada Inc	5/29/1991	46,968.57
Newmont Gold Company	5/29/1992	280.00
Olympic Nevada Inc	11/25/1992	11,252.02
Barrick Goldstrike	6/14/1995	403.32
Independence Mining	1/29/1996	4,132.64
Simplot	7/12/1996	21,736.02
Barrick Goldstrike	6/19/1997	344.68
BSR Associates	5/26/1999	70,498.39
Western Resource Mgmt	1995-2001	30,504.47
FS/Kenneth Jones	7/17/1998	400.00
Total		215,808.58

ATTACHMENT 1a

Programmatic Considerations in Land Use Plans That Benefit Conservation of Sage-Grouse and/or Sagebrush Habitat

Plan Name: Elko RMP

Major Land Use or Activity that Affects Habitat	Plan standards and/or prescriptions that contribute positively to on-the-ground SAGE-GROUSE HABITAT conservation	Plan standards and/or prescriptions that contribute positively to on-the-ground SAGEBRUSH conservation
Energy (Fluid minerals, solid minerals, wind, etc.)	"Apply restrictions on leasable and/or saleable mineral developments to protect crucial deer winter range, sage grouse strutting and nesting habitats, and antelope kidding areas." "Provide for oil/gas and geothermal leasing as follows: a) Designation: Limited-subject to no surface occupancy. Purpose: Protection of Special Recreation Management Areas and sage grouse strutting grounds… b) Designation: Limited – subject to seasonal restriction. Purpose: Protect crucial deer winter range, crucial antelope yearlong habitat, and sage grouse brood rearing areas…." "Maintain public lands open for exploration, development, and production of mineral resources while mitigating conflicts with wildlife [including sage grouse], wild horses, recreation, and wilderness resources."	
Fire	Evaluate recent prescribed burns and wildfires to determine if rehabilitation is necessary to achieve habitat management objectives. Review district fire management plans annually, incorporate new sage grouse habitat information, and distribute to fire dispatchers for initial attack planning. Where practical, locate fire camps, staging areas, and heli bases	"Prescribed burn plans will be developed before any planned burning occurs on any native vegetation or seeded areas." Assure that long-term wildfire rehabilitation objectives are consistent with the potential natural vegetation community. Seedings should include an appropriate mix of grasses, forbs, and shrubs, including sagebrush, that will recover the ecological processes and habitat features of the potential natural vegetation.

	at least 1 km. (0.6 mile) away from known sage grouse habitat. Also, as part of any preparedness planning process, identify the possible location of these temporary facilities on a map. Ensure known sage grouse habitat information is incorporated into each Wildfire Situation Analysis to assist in determining appropriate suppression plans and prioritizing fires during multiple ignition episodes. Minimize the amount of sage grouse habitat burned: Give wildfire suppression in sage grouse habitat appropriate consideration within the framework of the Federal Wildland Fire Policy (human life and safety as the first priority, with property and natural resources as equal second priorities) (USDI and USDA 1995). Use direct attack when it is safe and effective. Retain, if possible, unburned areas (including interior islands and patches between roads and the fire perimeter) of sage grouse habitat. When modifying water sources for the temporary purpose of fire suppression, ensure that all impacts are reclaimed as soon as practicable following fire suppression activities. Evaluate all wildfires as soon as possible to determine if reseeding is necessary to recover ecological processes and achieve habitat objectives appropriate for the biological needs of sage grouse and prevent the invasion of noxious weeds or other exotic invasive species. Align long-term objectives for seedings with the habitat needs of sage grouse.	Emphasize native plant species when these species are adapted to the site, are available in sufficient quantities, and are economically and biologically feasible. Reseed all burned lands occurring in sage grouse habitat within 1 year unless natural recovery of the native plant community is expected. “Fire Prevention: Vegetation manipulation, fuels reduction, green strips, fuel breaks and thinning should be maximized through the use of prescribe burning, mechanical, chemical, and biological (including grazing) treatments to reduce wildfire fuel hazards….[Annual target acreage levels for the proposed action would be 24,000-60,000 acres.]” “…Conduct fire rehabilitation activities to emulate historic or pre-fire ecosystem structure, functioning, diversity and/or to restore a healthy stable ecosystem.”
Grazing	“Maintain or improve the condition of the public rangelands to enhance productivity for all rangeland values [including sage grouse].”	"...The following chart shows the allowable use level guidelines for five plant categories by season-of-use: Degree of Allowable Use Guide

	"Monitor the interaction between wildlife habitat condition and other resource uses and make adjustments in season-of-use for livestock to improve or maintain essential and crucial wildlife habitats [including sage grouse]." "The short and long-term range objectives of the grazing management program are to maintain or improve the condition of the public rangelands to enhance productivity for all rangeland values through the following: a) Maintain or improve a sufficient quantity, quality and diversity of habitat and forage for livestock, wildlife [including sage grouse] and wild horses through natural regeneration and/or artificial methods. b) Improve the vegetation resource by providing for the physiological needs of key management species [including sage grouse]. c) Reduce soil erosion and enhance watershed values by increasing ground cover and litter and the density of stabilizing riparian vegetation. d) Improve and maintain the condition of aquatic and riparian habitat. e) Improve the health and productivity of wild horses by maintaining a natural ecological balance of wild horses on public lands. f) Improve rangeland habitat to attain reasonable numbers of big game." "Maintain or improve the condition of the public rangelands to enhance productivity for all rangeland values [including sage grouse]" "Techniques which would result in a minimum improvement of 30 percent in [meadow and riparian area] condition in the short term from the date of implementation would be used. Utilization levels will not exceed 50 percent on meadow and riparian areas."	Plant Grazing Seasons Category Spg Summ Fall Wtr Ylg Annual Grasses 60% 90% 90% 90% 83% Perennial Grasses & Grasslike Plants 50% 50% 60% 60% 55% Annual Forbs 60% 90% 90% 90% 83% Perennial Forbs & Biennial Forbs 50% 50% 60% 60% 55% Shrubs, Half Shrubs, & Trees 30% 50% 50% 50% 45% "In the short-term, maintain or enhance native vegetation with utilization levels not to exceed 50% on key species." "..utization levels of 25 percent by livestock and 25 percent by mule deer will be established on bitterbrush throughout crucial winter habitat..." "To improve ... springs and associated wet meadow riparian areas, livestock grazing systems (rest rotation and deferred) will be developed within all allotments that have been identifed as having sage grouse strutting grounds. Grazing prescriptions should limit utilization on these meadows to less thatn 55 percent prior to June 1 of every other year and rest those same key meadows every other year..." On all vegetation treatments, manage livestock for the long-term health of the vegetation community and the attainment of the treatment objectives.
Realty	"Land tenure adjustment would be subject to a detailed analysis….The following ….criteria…are considered during the analysis process:1. Public resource values or concerns, including but not limited to: threatened, endangered, or sensitive species habitat [including sage grouse]; riparian areas, floodplains, and	

	wetlands; fisheries, nesting/breeding habitat for game birds or animals…." "Time-of-day and/or time-of-year restrictions will be placed on construction activities associated with transmission and utility facilities that are in the immediate vicinity or would cross crucial sage grouse, crucial deer and pronghorn antelope winter habitats, antelope kidding areas, or raptor nesting areas."	
Vegetation (sagebrush) management	"Manage rangeland to protect or enhance crucial sage grouse strutting or nesting habitat." "Improve and maintain meadow and riparian areas for mule deer, sage grouse, and native trout ..." "Conserve and enhance terrestrial, riparian, and aquatic wildlife habitat [including sage grouse]." "Activities that could adversely affect threatened, endangered, or sensitive species [including sage grouse] habitat will not be permitted. Actions in threatened, endangered, or sensitive species habitat will be designed to benefit these species through habitat improvement. All project work will require a threatened, endangered, or sensitive species clearance before implementation. Consultation with the U.S. Fish and Wildlife Service as per Section 7 of the Endangered Species Act is necessary if a threatened, endangered, or proposed threatened or endangered species, or its habitat may be impacted. Other species considered sensitive, but not under the protection of the Act, are given special management considerations through Bureau policy. If adverse impacts to these other sensitive species are identified during project planning, the project will be modified or possibly abandoned to avoid these impacts." Consider the habitat needs of sage grouse when planning vegetation treatments and maintenance projects. Take appropriate precautions to minimize the possibility that noxious weed eradication activities directly impact sage grouse populations or affect sagebrush stands.	"Alteration of sagebrush areas either through application of herbicides, prescribed burning, or by mechanical means will be in accordance with procedures specified in the Western States Sage Grouse Guidelines, the Memorandum of Understanding between the Nevada Department of Wildlife and the Bureau of Land Management, as amended, and as future studies might dictate." "Vegetation manipulation projects will be designed to minimize impacts on wildlife habitat and to improve it whenever possible. Projects that would alter the potential natural plant composition will not be allowed in riparian areas." "Consistent with the Elko RMP...there will be no vegetative type conversions to provide livestock forage within any seasonal crucial big game habitat." "Minimal clearing of vegetation will be allowed on project sites requiring excavation." "A site specific soils analysis will be completed prior to planning vegetation type conversions to determine land treatment feasibility." "Disturbed areas will be treated, where such action is necessary and practical, to replace ground cover and prevent erosion." "The selection and use of herbicides as a means to remove brush will be deferred until completion of a Bureau Environmental Impact Statement on the use of herbicides on the public lands."

	Develop and maintain cumulative records for all vegetation treatment projects to determine and evaluate site specific and cumulative impacts to sage grouse habitats and identify best management practices for successful vegetation treatments. Create sites suitable for leks where current leks are compromised by roads and other facilities. Use vegetation treatments to maintain or improve known habitats. Avoid vegetation treatments in known habitats when birds are present.	"A variety of methods, including structural, may be employed to maintain, improve, protect, and restore watershed conditions and to provide for various water improvements. Meeting emergency needs will be the first priority. The BLM will comply with state water laws and will coordinate with local, state, and Federal agencies in designing and locating watershed projects." "…Implement 500 acres of vegetation treatment….within crucial big game habitat." Type conversions of pinyon pine/juniper stands to improve livestock and/or wildlife forage production will be limited to areas where forage production is the most beneficial (and has the greatest cost/benefit ratio)." Vegetation treatments in areas highly susceptible to, or currently dominated by, cheatgrass should be accompanied by rehabilitation. Rehabilitation should include site preparation techniques and seed mixtures appropriate for the soils, climate, and landform of the area. Use appropriate vegetation treatment techniques to remove junipers/conifers that have invaded sage grouse habitat. Whenever possible employ vegetal control techniques that are least disruptive to the stand of sagebrush. Take appropriate precautions to minimize the possibility that noxious weed eradication activities directly impact sage grouse populations or affect sagebrush stands. Implement effective monitoring plans to determine the effectiveness of vegetation treatments. When native plant species adapted to the site are available in sufficient quantities, and it is economically and biologically feasible to establish or increase them to meet management objectives, emphasize them over non-native species.

Wild Horse & Burros	"Manage wild horse populations and habitat in the established herd areas consistent with other resource uses [including sage grouse]."	
Other Potentially Applicable Standards	"Manage ... high priority riparian/stream habitat to provide good habitat condition for wildlife [including sage grouse] and fish." "Livestock water improvements will include bird ramps in watering troughs, and as needed, drinkers along pipelines, overflows at troughs, and protected seep areas. Spring developments will be fenced to prevent trampling of adjacent vegetation and provide escape areas for small wildlife. A portion of the water at these spring developments will be maintained at the source ensuring that wildlife which have used the water will have access to it as per Nevada Revised Statues 533.367." “Habitat management plans will be written for specific purposes including management of crucial habitats to provide for threatened, endangered, or sensitive species where present; ….improvement of riparian, wetland, and aquatic habitats; and management of other habitats to meet the needs of upland game and nongame animals.” Riparian and wetland areas exhibit a properly functioning condition and achieve state water quality criteria. Habitats exhibit a healthy, productive, and diverse population of native and/or desirable plant species, appropriate to the site characteristics, to provide suitable feed, water, cover and living space for animal species and maintain ecological processes. Habitat conditions meet the live cycle requirement of threatened and endangered species.	

ATTACHEMENT 1b

Programmatic Considerations in Land Use Plans
That Benefit Conservation of Sage-Grouse and/or Sagebrush Habitat

Plan Name: Wells RMP

Major Land Use or Activity that Affects Habitat	Plan standards and/or prescriptions that contribute positively to on-the-ground SAGE-GROUSE HABITAT conservation	Plan standards and/or prescriptions that contribute positively to on-the-ground SAGEBRUSH conservation
Energy (Fluid minerals, solid minerals, wind, etc.)	"Apply time of year restrictions on leasable and/or saleable mineral development to protect crucial deer winter range and sage grouse strutting and nesting habitats." "Time-of-day and/or time-of-year restrictions will be placed on construction activities associated with transmission and utility facilities and leasable and salable mineral exploration and/or development that are in the immediate vicinity or would cross crucial sage grouse, crucial deer and pronghorn antelope winter habitats, antelope kidding areas, or raptor nesting areas." "Time of year restrictions would be imposed ... to protect sage grouse breeding activities." "Closely manage new road construction and mining activities within riparian zones to minimize or eliminate impacts." "Time of year restrictions would be imposed on 170,800 acres in the ONeil/Salmon Falls RCA, 42,200 acres in the Goos Creek RCA, and 56,300 acres in the Ruby/Wood Hills RCA, all to protect sage grouse breeding activities." "The District Oil, Gas, and Geothermal Environmental Assessment will be amended to protect high use recreation areas and crucial wildlife habitat [including sage grouse]."	

Fire	Evaluate recent prescribed burns and wildfires to determine if rehabilitation is necessary to achieve habitat management objectives. Review district fire management plans annually, incorporate new sage grouse habitat information, and distribute to fire dispatchers for initial attack planning. Where practical, locate fire camps, staging areas, and helibases at least 1 km. (0.6 mile) away from known sage grouse habitat. Also, as part of any preparedness planning process, identify the possible location of these temporary facilities on a map. Ensure known sage grouse habitat information is incorporated into each Wildfire Situation Analysis to assist in determining appropriate suppression plans and prioritizing fires during multiple ignition episodes. Minimize the amount of sage grouse habitat burned: Give wildfire suppression in sage grouse habitat appropriate consideration within the framework of the Federal Wildland Fire Policy (human life and safety as the first priority, with property and natural resources as equal second priorities) (USDI and USDA 1995). Use direct attack when it is safe and effective. Retain, if possible, unburned areas (including interior islands and patches between roads and the fire perimeter) of sage grouse habitat. When modifying water sources for the temporary purpose of fire suppression, ensure that all impacts are reclaimed as soon as practicable following fire suppression activities. Evaluate all wildfires as soon as possible to determine if reseeding is necessary to recover ecological processes and achieve habitat objectives appropriate for the biological needs of sage grouse and prevent the invasion of noxious weeds or other exotic invasive species.	"Public rangelands are managed to: enhance the productivity of the rangelands….provide for inventory and categorization based on conditions and trends, and provide for orderly use, improvement and development. Short term management actions: prescribe burn (without seeding) 27,000 acres…" Assure that long-term wildfire rehabilitation objectives are consistent with the potential natural vegetation community. Seedings should include an appropriate mix of grasses, forbs, and shrubs, including sagebrush, that will recover the ecological processes and habitat features of the potential natural vegetation. Emphasize native plant species when these species are adapted to the site, are available in sufficient quantities, and are economically and biologically feasible. Reseed all burned lands occurring in sage grouse habitat within 1 year unless natural recovery of the native plant community is expected. "Fire Prevention: Vegetation manipulation, fuels reduction, green strips, fuel breaks and thinning should be maximized through the use of prescribe burning, mechanical, chemical, and biological (including grazing) treatments to reduce wildfire fuel hazards….[Annual target acreage levels for the proposed action would be 24,000-60,000 acres.]" "…Conduct fire rehabilitation activities to emulate historic or pre-fire ecosystem structure, functioning, diversity and/or to restore a healthy stable ecosystem."

	Align long-term objectives for seedings with the habitat needs of sage grouse.	
Grazing	"The livestock grazing use level will be consistent with other resource users [including sage grouse]." "Continue to monitor the interaction between wildlife habitat condition and other resource uses and consider adjustments in livestock seasons of use to improve or maintain essential and crucial wildlife habitats [including sage grouse]." "The short and long-term range objectives of the grazing management program are to maintain or improve the condition of the public rangelands to enhance productivity for all rangeland values through the following: a) Maintain or improve a sufficient quantity, quality and diversity of habitat and forage for livestock, wildlife [including sage grouse] and wild horses through natural regeneration and/or artificial methods. b) Improve the vegetation resource by providing for the physiological needs of key management species [including sage grouse]. c) Reduce soil erosion and enhance watershed values by increasing ground cover and litter and the density of stabilizing riparian vegetation. d) Improve and maintain the condition of aquatic and riparian habitat. e) Improve the health and productivity of wild horses by maintaining a natural ecological balance of wild horses on public lands. f) Improve rangeland habitat to attain reasonable numbers of big game."	"Deferment of livestock use will be in effect for a minimum of two growing seasons following brush control projects so vegetation may be re-established." On all vegetation treatments, manage livestock for the long-term health of the vegetation community and the attainment of the treatment objectives.
Realty	"Time-of-day and/or time-of-year restrictions will be placed on construction activities associated with transmission and utility facilities …that are in the immediate vicinity or would cross crucial sage grouse, crucial deer and pronghorn antelope winter habitats, antelope kidding areas, or raptor nesting areas."	
Vegetation (sagebrush)	"Manage ... high priority riparian/stream habitat to provide good	"Alteration of sagebrush areas either through application of

management	habitat condition for wildlife [including sage grouse] and fish. Techniques which would result in a minimum improvement of 30 percent in habitat condition in the short-term from the date of implementation would be used...." "Manage areas in good or better habitat condition so that further declines in habitat quality do not occur." "The Bureau will manage habitat so as to protect animal and plant species which are of particular concern to both the Federal and State Governments." Consider the habitat needs of sage grouse when planning vegetation treatments and maintenance projects. Take appropriate precautions to minimize the possibility that noxious weed eradication activities directly impact sage grouse populations or affect sagebrush stands. Develop and maintain cumulative records for all vegetation treatment projects to determine and evaluate site specific and cumulative impacts to sage grouse habitats and identify best management practices for successful vegetation treatments. Create sites suitable for leks where current leks are compromised by roads and other facilities. Use vegetation treatments to maintain or improve known habitats. Avoid vegetation treatments in known habitats when birds are present.	herbicides, prescribed burning, or by mechanical means will be in accordance with procedures specified in the Western States Sage Grouse Guidelines, the Memorandum of Understanding between the Nevada Department of Wildlife and the Bureau of Land Management, as amended, and as future studies might dictate." "Crested wheatgrass seedings will generally not be located in crucial big game habitats." "Proposed seedings for livestock management will be composed primarily of crested wheatgrass although other species, including grasses, forbs, and shrubs, may be included on a case-by-case basis." "Emphasis will be placed on the management of browse on crucial mule deer winter range." "Physiological requirements for the management of different vegetation types will be determined by BLM based on the best available scientific information. Methods of management to meet these requirements will be determined through consultation, coordination, cooperation, and public involvement. The preferred method to accomplish this consultation and coordination is through the Coordinated Resource Management and Planning (CRMP) process." "Minimal clearing of vegetation will be allowed on project sites requiring excavation." "Achieve annual utilization of the ... bitterbrush population which does not exceed 45 percent of twig length ... (maximum of 25 percent for livestock). "Chain or burn, and seed 5,500 acres to improve crucial big game habitat." "Identify, in coordination with woodland products management, about 50,000 acres of crucial deer winter habitat for improvement."

		Vegetation treatments in areas highly susceptible to, or currently dominated by, cheatgrass should be accompanied by rehabilitation. Rehabilitation should include site preparation techniques and seed mixtures appropriate for the soils, climate, and landform of the area. Use appropriate vegetation treatment techniques to remove junipers/conifers that have invaded sage grouse habitat. Whenever possible employ vegetal control techniques that are least disruptive to the stand of sagebrush. Take appropriate precautions to minimize the possibility that noxious weed eradication activities directly impact sage grouse populations or affect sagebrush stands. Implement effective monitoring plans to determine the effectiveness of vegetation treatments. When native plant species adapted to the site are available in sufficient quantities, and it is economically and biologically feasible to establish or increase them to meet management objectives, emphasize them over non-native species.
Wild Horse & Burros	"Continue management of the six existing wild horse herds consistent with other resource uses [including sage grouse]." "...manage wild horses within HMAs...to maintain a thriving natural ecological balance consistent with other resource needs [including sage grouse]."	
Other Potentially Applicable Standards	"Protect, enhance and/or develop 250 spring sources for their wildlife values [including sage grouse]." Generally, spring developments will be fenced to prevent trampling of adjacent vegetation and to provide escape areas for small wildlife. Water at these spring developments will be maintained at the source."	

	"The Bureau seeks to improve stream habitat for fish, resulting in benefits not only to the fisheries, but to other resources such as watershed, wildlife [including sage grouse], erosion, flood control, water quality and recreation." "Wetland, Riparian Management: As a part of wetland-riparian management, consider all measures to minimize damage and to preserve and restore the area in accordance with the 6740 manual, and in adherence with Executive Orders No. 11990 and No. 11988." "The Bureau will manage habitat so as to protect animal and plant species which are of particular concern to both the Federal and State governments." "The Nevada Department of Wildlife will be consulted when sensitive species are involved." Riparian and wetland areas exhibit a properly functioning condition and achieve state water quality criteria. Habitats exhibit a healthy, productive, and diverse population of native and/or desirable plant species, appropriate to the site characteristics, to provide suitable feed, water, cover and living space for animal species and maintain ecological processes. Habitat conditions meet the live cycle requirement of threatened and endangered species.	

ATTACHMENT 2

Nevada BLM
Sage Grouse/Sagebrush Ecosystem Management Guidelines

These management guidelines and supportive background information establish interim policy for the Bureau of Land Management in Nevada. The guidelines have been developed to be consistent with the WAFWA Guidelines within the inherent constraint of generally lower moisture regimes throughout the majority of Nevada's sagebrush ecosystem. Many Nevada sagebrush range sites may not have the potential to achieve the optimum sage grouse habitat conditions described in the WAFWA Guidelines. These guidelines will be incorporated, as appropriate to site specific conditions, into the long-term Sage Grouse/Sagebrush Ecosystem Conservation Assessment and Strategy Plan(s).

Throughout this document the terms *known habitat* and *potential habitat* are used. *Known habitats* are those habitats that are known to be currently occupied and used by sage grouse for breeding, nesting, brood-rearing or wintering. Knowledge of sage grouse occupancy is unknown for large expanses of sagebrush areas. *Potential habitat* refers to the kinds of land, land forms, and plant communities that may support or potentially support sage grouse during breeding, nesting, brood-rearing, or wintering. These habitats may be vitally important to sage grouse, but we lack information about sage grouse occupancy. BLM will treat all historical habitats (leks, breeding, brood-rearing and winter) as potential habitat unless BLM, in cooperation with the Nevada Division of Wildlife, determines that they no longer can function as sage grouse habitat and cannot be reasonably rehabilitated. It is important to maintain the historical baseline of sagebrush ecosystems.

Management guidelines described herein (concerning size of buffers, time frames, etc.) may be modified based on monitoring, site-specific local knowledge, professional judgement, or the need to protect/accommodate other resources.

GOAL

The goal of these management guidelines is to initiate actions that effectively promote the conservation of sagebrush habitats on BLM-administered public lands in Nevada. While these guidelines focus on conservation of sage grouse and their sagebrush habitats, conservation of sagebrush habitats needed by sage grouse will benefit a multitude of other sagebrush habitat species of concern (Wisdom et al. in press). Sage grouse are considered to be an umbrella species, so management of sagebrush ecosystems to meet the life cycle needs of sage grouse is expected to achieve sagebrush ecosystem health and sustainability and provide for the needs of other sagebrush obligate and associated species.

These guidelines will be implemented in concert with Nevada's allotment evaluation and multiple-use decision process established to implement the BLM Nevada standards and guidelines for rangeland health and other applicable laws, regulations, and policies. The guidelines represent the interpretation of the standards and guidelines as they apply to the management of uses affecting sage grouse habitats and sagebrush ecosystems.

These goals will also be implemented in concert with reclamation standards as described in *Final Guidelines for Successful Mine and Exploration Revegetation in Nevada*.

OBJECTIVES

The following objectives are intended as guidance for implementation of existing land-use plan activities and development of long-term conservation management plans. The objectives are applicable to sagebrush habitats in Nevada managed by BLM. Neither these objectives nor the guidelines derived from these objectives are intended to supercede the National Environmental Policy Act (NEPA) or any other applicable laws or regulations.

1. Identify and map, in cooperation with the Nevada Division of Wildlife, known sage grouse habitats.

2. Maintain and enhance known sage grouse habitats, paying particular attention to areas of high ecological integrity.

3. Minimize net loss of sage grouse habitat as a result of new actions authorized by BLM; minimize habitat losses resulting from natural disturbances (wildland fire, insects, disease, etc.).

4. Provide sage grouse habitats that are secure from direct human disturbance during the winter and breeding seasons (when birds are concentrated and susceptible to harassment).

5. Restore sage grouse habitats.

Management Actions

SPECIFIC GOALS

•Where possible, manage all historical habitat so that these habitats may one day be used again by sage grouse.

•Provide secure sage grouse breeding habitat with minimal disturbance and harassment.

•Maintain and improve existing leks or create sites suitable for additional leks.

•Manage sagebrush communities, based on best available science, to achieve optimal nesting habitat conditions within site potential to insure nesting and early brood-rearing success.

•Manage vascular and non-vascular plant communities and macrobiotic crusts to provide a diversity of high quality plant and insect food sources.

•Promote habitat conditions that support growth and survival of young sage grouse in late brood-rearing habitat.

•Maintain or improve known winter sage grouse habitat.

PROGRAM SPECIFIC GUIDELINES

Grazing by livestock, horses and burros, and wildlife

•Coordinate with livestock permittees to locate the placement of salt or mineral supplements appropriate distances from leks to avoid livestock concentrations and reduce the potential for harassment and displacement of birds during the breeding season.

•Designate livestock trailing routes, turnout locations, sheep bedding grounds/camp/sheep sheering facilities, and corral locations to ensure attainment of objectives for known sage grouse habitat. Evaluate existing livestock trailing routes and sheep bedding ground locations and make appropriate adjustments where such uses are precluding attainment of habitat objectives.

•Apply livestock grazing management to accomplish the four fundamentals of rangeland health, as described in the standards and guidelines: (1) watersheds are properly functioning, (2) ecological processes are in order, (3) water quality complies with state standards, and (4) habitats of protected species are in order, and to attain desired future condition objectives where applicable.

•Where grazing use by wildlife (e.g. elk, deer, antelope, etc.) is determined to be adversely affecting sage grouse populations or habitat, suggest appropriate adjustments to the Nevada Division of Wildlife.

•If it is determined through assessment/monitoring/observation that sage grouse habitat quality conditions (as described in the WAFWA guidelines and in relation to the specific site potential) are not being met, and livestock is determined to be a significant contributing factor, institute appropriate changes in grazing management prior to the next grazing year to ensure significant progress toward

attainment of appropriate habitat objectives and the standards for rangeland health.

•During drought periods (i.e., a specified period of time in which the precipitation received is less than 75 percent of average) of two or more years, reduce stocking rates or change management practices for livestock if nesting cover and brood-rearing habitat requirements are not being met.

•Grazing in non-riparian sage grouse habitats should not exceed moderate use (see Appendix II, excerpted from Nevada Rangeland Monitoring Handbook, 1984, for a description of utilization levels) at the end of the growing season and throughout the dormant period. This applies to regularly authorized use, temporary non-renewable use (TNR), and grazing use during periods of drought and may be adjusted to lower levels as necessary to optimize nesting, brood rearing and winter habitat characteristics relative to site potential.

•Coordinate livestock use on wetland-riparian and streambank-riparian habitat to ensure known late season brood-rearing habitats are in optimal condition.

•Determine grazing use levels on that portion of the pasture which is known habitat. Grazing use levels should not be determined by “average use” throughout the entire pasture or grazing unit.

•Avoid supplemental winter feeding of livestock in known winter sage grouse habitat.

•Where wild horse and burro populations are adversely affecting the sage grouse population or habitat, evaluate herd populations and adjust numbers as necessary.

•Locate wild horse and burro capture facilities at appropriate distances from known sage grouse habitat to avoid adverse impacts to the habitat.

Range Improvement Projects

•Ensure that existing spring developments maintain, and new spring developments are designed and constructed to maintain, their free-flowing nature and wet meadow characteristics.

•Where necessary, modify existing water developments in cooperation with livestock permittees and other cooperators to restore natural ecological functions and processes at the source.

•Where necessary, modify, reconstruct, or relocate existing livestock facilities, in cooperation with livestock permittees, or other cooperators, to mitigate any adverse impacts to known sage grouse habitats.

•Install wildlife escape ramps in new water troughs. Retrofit existing troughs with wildlife escape ramps as needed.

•Construct new livestock facilities (livestock troughs, fences, corrals, handling facilities, “dusting bags”, etc.) at appropriate distances from known sage grouse habitats based on WAFWA sage grouse management guidelines, and on site-specific conditions, to avoid concentration of livestock, collision hazards to flying birds, or avian predator hunting perches.

•Construct new livestock water developments outside of known sage grouse habitat unless it can be demonstrated that the development will not adversely affect the habitat.

•Consider off-site mitigation on a case-by-case basis in evaluating construction activities.

Vegetation Treatment

•Consider the habitat needs of sage grouse when planning vegetation treatments and maintenance projects.

•On all vegetation treatments, manage livestock for the long-term health of the vegetation community and the attainment of the treatment objectives.

•Vegetation treatments in areas highly susceptible to, or currently dominated by, cheatgrass should be accompanied by rehabilitation. Rehabilitation should include site preparation techniques and seed mixtures appropriate for the soils, climate, and landform of the area.

•Use appropriate vegetation treatment techniques to remove junipers/conifers that have invaded sage grouse habitat. Whenever possible employ vegetal control techniques that are least disruptive to the stand of sagebrush.

•Take appropriate precautions to minimize the possibility that noxious weed eradication activities directly impact sage grouse populations or affect sagebrush stands.

•Implement effective monitoring plans to determine the effectiveness of vegetation treatments.

•Develop and maintain cumulative records for all vegetation treatment projects to determine and evaluate site specific and cumulative impacts to sage grouse habitats and identify best management practices for successful vegetation treatments.

•Evaluate recent prescribed burns and wildfires to determine if rehabilitation is necessary to achieve habitat management objectives.

•Create sites suitable for leks where current leks are compromised by roads and other facilities.

•Use vegetation treatments to maintain or improve known habitats. Avoid vegetation treatments in known habitats when birds are present.

•When native plant species adapted to the site are available in sufficient quantities, and it is economically and biologically feasible to establish or increase them to meet management objectives, emphasize them over non-native species.

Recreational Use

•Identify conflict areas, assess the significance of impacts, and implement appropriate actions (e.g. emergency seasonal or area closures, educational programs to increase public awareness, etc.) as necessary to protect known sage grouse habitat.

•Construct new facilities (i.e., kiosks, toilets, signs, etc.) appropriate distances from known sage grouse habitats, based upon site-specific conditions and evaluation, to minimize disturbance to and displacement of birds and habitat loss and/or fragmentation.

•Limit development of new roads and trails to minimize impacts to known sage grouse habitat.

•Select sites, routes, and times for motor vehicle, OHV, competitive/commercial recreational events, etc., which minimize impacts to known breeding, nesting, brood-rearing and/or wintering habitat.

•Avoid the use of temporary horse corrals in riparian areas and meadows, and in known sage grouse habitat. Encourage use of pelleted feed or certified weed-free hay for horses to discourage the spread of noxious and invasive weeds.

•Plan and design the development of new recreational facilities to control recreational impacts to known sage grouse habitats and to riparian and wet meadow areas.

Lands and Realty

•Implement appropriate time-of-day and/or time-of year restrictions for future construction and/or maintenance activities in known sage grouse habitat to avoid adverse impacts.

•Wherever possible, locate new utility corridors a minimum 3.3 km (2 miles) from known sage grouse habitat, or appropriate distance based on site-specific conditions. Aerial structures should be modified to prevent avian predator perching or nesting.

•In evaluating land and realty actions, consider off-site mitigation on a case-by-case basis.

•In land exchanges or property transfer actions, consider such factors as: 1) loss or fragmentation of known or potential habitat 2) acquisition of equal or better quality habitat 3) consolidation of public lands for secure populations 4) direct impacts to sage grouse populations.

•Avoid authorizing rights-of-way that would result in significant habitat loss, habitat fragmentation, or population disturbance.

•Reseed all areas requiring reclamation with a seed mixture appropriate for the soils, climate, and landform of the area to ensure recovery of the ecological processes and habitat features of the potential natural vegetation, and to prevent the invasion of noxious weeds or other exotic invasive species.

•Work with existing rights-of-way holders in an attempt to install perch guards on all poles where existing utility poles are located within 3.3 km (2 miles) of known leks, where necessary. Stipulate these requirements at grant renewal.

•Authorize new rights-of-way at least 3.3 km (2 miles) or other appropriate distance (based on features such as type of project, topography, etc.) from leks.

•Use existing utility corridors and consolidate rights-of-way to reduce habitat loss, degradation, and fragmentation. Whenever possible, install new power lines within existing utility corridors. Otherwise, power lines should be located at least 3.3 km (2 miles) from breeding, nesting, brood-rearing and winter habitat.

•Allow land disposals in sage grouse habitats only if the land is identified as containing no known breeding, nesting, brood-rearing or winter habitat or where determined that those lands are not manageable as sage grouse habitat.

Energy and Minerals B locatable, leasable, salable
(*Leasable is oil, gas, and geothermal; salable is sand and gravel or common rock; and locatable is gold and silver.)*

•Avoid permitting or leasing energy or mineral-associated facilities or activities in known sage grouse habitat, as practicable (e.g. modifying location, implementing time-of-year and/or time-of-day restrictions, etc.)

•Reseed all areas requiring reclamation with a seed mixture appropriate for the soils, climate, and land form. Attempt to restore the ecological processes and potential natural vegetation, and prevent the invasion of noxious weeds or other invasive species.

•Consider the habitat needs of sage grouse when developing reclamation plans, as appropriate.

•Consider, on a case-by-case basis, off-site mitigation when evaluating energy and mineral activities.

•Avoid permitting or leasing mineral and energy-related activities within 3.3 km (2 miles)or other appropriate distance based on site-specific conditions, of leks, or within 1 km. (0.6 mi.) of known nesting, brood-rearing and winter habitat.

•For notices acknowledged under 43 CFR § 3809, inform the operator if the proposed exploration is within 3.3 km (2 miles) of known sage grouse habitat and make recommendations to avoid or mitigate potential impacts.

Fire Management

•Review district fire management plans annually, incorporate new sage grouse habitat information, and distribute to fire dispatchers for initial attack planning.

•Where practical, locate fire camps, staging areas, and helibases at least 1 km. (0.6 mile) away from known sage grouse habitat. Also, as part of any preparedness planning process, identify the possible location of these temporary facilities on a map.

•Ensure known sage grouse habitat information is incorporated into each Wildfire Situation Analysis to assist in determining appropriate suppression plans and prioritizing fires during multiple ignition episodes.

•Minimize the amount of sage grouse habitat burned:

•Give wildfire suppression in sage grouse habitat appropriate consideration within the framework of the Federal Wildland Fire Policy (human life and safety as the first priority, with property and natural resources as equal second priorities) (USDI and USDA 1995).

•Use direct attack when it is safe and effective.

•Retain, if possible, unburned areas (including interior islands and patches between roads and the fire perimeter) of sage grouse habitat.

•When modifying water sources for the temporary purpose of fire suppression, ensure that all impacts are reclaimed as soon as practicable following fire suppression activities.

Emergency Fire Rehabilitation

•Evaluate all wildfires as soon as possible to determine if reseeding is necessary to recover ecological processes and achieve habitat objectives appropriate for the biological needs of sage grouse and prevent the invasion of noxious weeds or other exotic invasive species.

•Assure that long-term wildfire rehabilitation objectives are consistent with the potential natural vegetation community.

•Align long-term objectives for seedings with the habitat needs of sage grouse. Seedings should include an appropriate mix of grasses, forbs, and shrubs, including sagebrush, that will recover the ecological processes and habitat features of the potential natural vegetation. Emphasize native plant species when these species are adapted to the site, are available in sufficient quantities, and are economically and biologically feasible.

•Reseed all burned lands occurring in sage grouse habitat within 1 year unless natural recovery of the native plant community is expected.

Implementation Monitoring

Critical to BLM's success in meeting responsibilities and implementing these guidelines for the management of sage grouse habitat is the ability to measure and report on-the-ground results. Pursuant to this end, field offices, in cooperation with the Nevada Division of Wildlife, will maintain annual records of the following:

Baseline Information

- •Total district acreage (# of acres)
- •Known sage grouse habitat (acres)
- •Total number of leks

Sage Grouse Monitoring

- •Total number of leks (#)
- •Number of leks surveyed (#)
- •Estimated sage grouse population (#)

Grazing Monitoring (livestock, wild horses and burros, and wildlife)

- •Number of allotments assessed for rangeland health (annual and cumulative #)
- •Acres assessed for rangeland health (annual and cumulative # acres)
- •Number of allotments meeting wildlife standard for sage grouse habitat
- •Acres which meet wildlife standard for sage grouse habitat (annual and cumulative # acres)
- •Number of allotments not meeting wildlife standard for sage grouse habitat - due to livestock (annual and cumulative #)
- •Acres which do not meet wildlife standard for sage grouse habitat - due to livestock (annual and cumulative # acres)
- •Number of allotments not meeting wildlife standard for sage grouse habitat - other causes (annual and cumulative #)
- •Acres which do not meet wildlife standard for sage grouse habitat - other causes (annual and cumulative # acres)
- •Number of allotments where corrective action was taken (annual and cumulative #)
- •Number of acres where corrective action was taken (annual and cumulative #)

Recreational Use

- •Road or area closures required in known sage grouse habitat (# of roads and acres)
- •New roads and trails restricted in known sage grouse habitat (# of roads and acres)
- •Recreational permits that include restrictions for sage grouse habitat (# of permits)

Lands and Realty

- •Land tenure adjustments involving sage grouse habitat (#)
- •Net gain/loss of sage grouse habitat (# acres)
- •Rights-of-ways authorized in known sage grouse habitat (#)
- •Rights-of-ways authorized in known sage grouse habitat with restrictions (#)

Energy and Minerals

•Management actions taken relative to energy/minerals with respect to sage grouse habitat (#)
•Description

Range Improvements

•Range improvements constructed in sage grouse habitat (#)
•Range improvements constructed which incorporate sage grouse guidelines (#)
•Modification of existing range improvements to meet sage grouse guidelines (type and #)

Wildfire

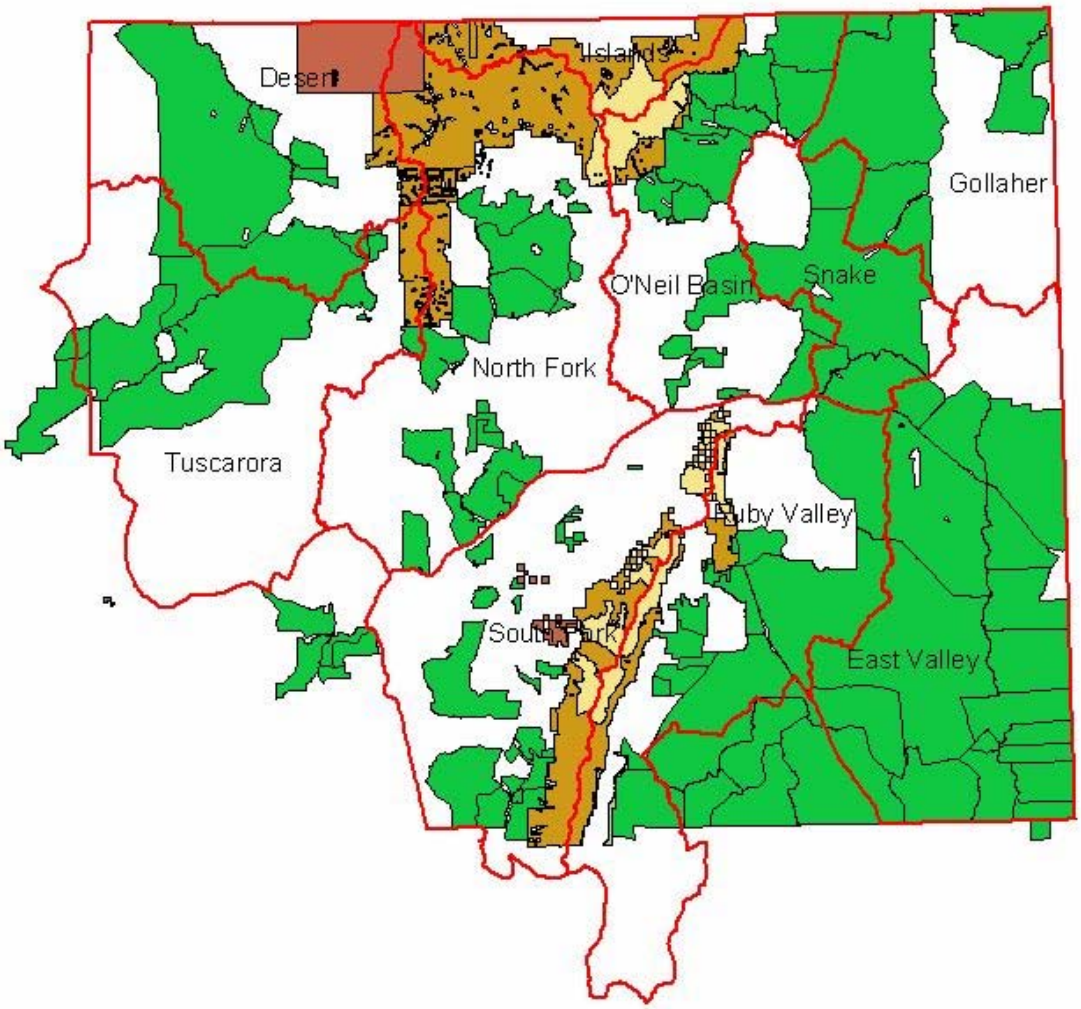
•Sage grouse habitat burned (acres)
•Known sage grouse habitat burned (acres)
•Sage grouse habitat requiring reseeding (acres)
•Sage grouse habitat rehabilitated and reseeded (acres)

Vegetation Treatment

•Vegetation Treatments in sage grouse habitat (#, type, acres)

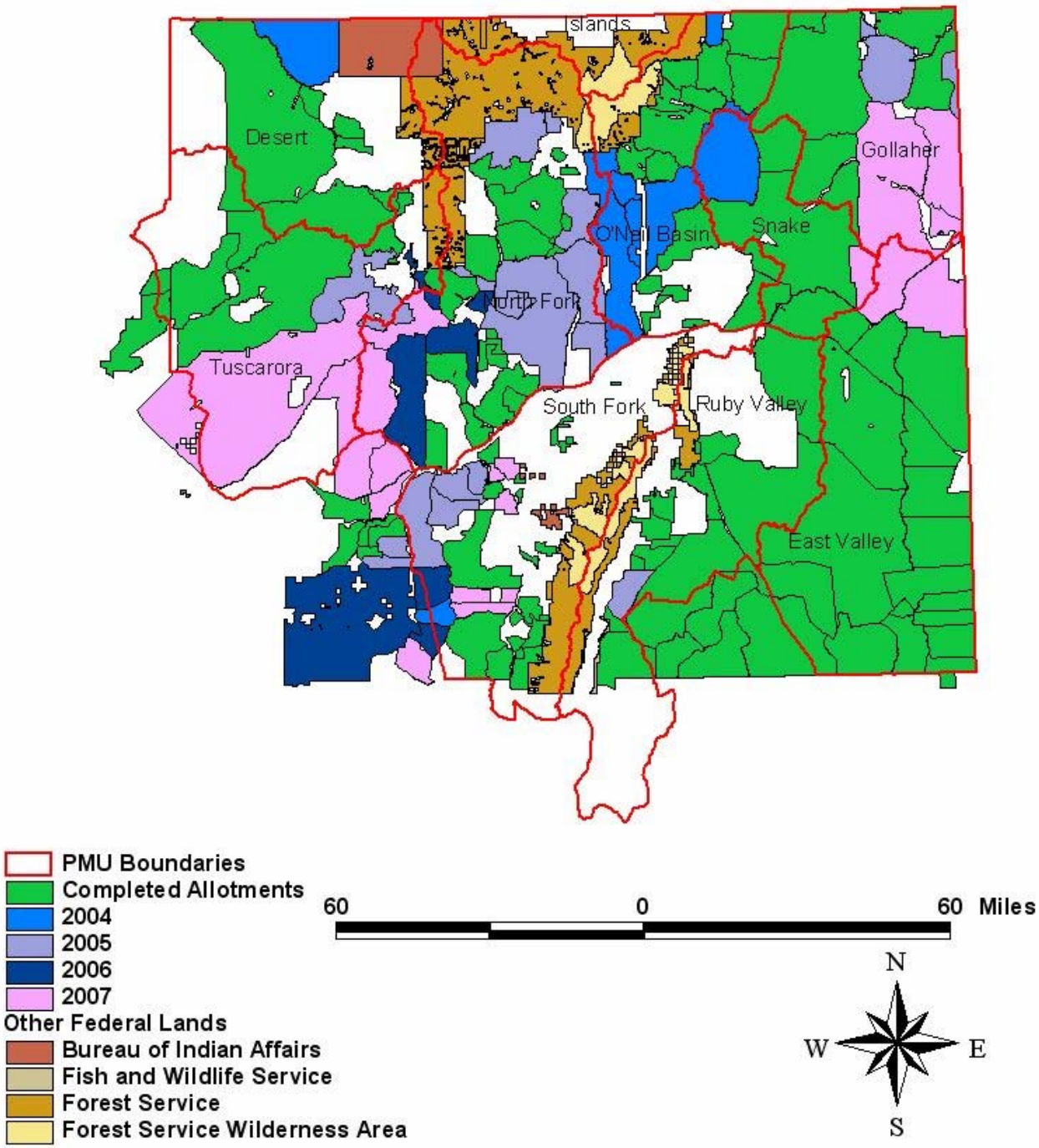
Attachment 3A

Completed Allotment Evaluations and Standards and Guidelines Assessments



Attachment 3B

Completed and Proposed Allotment Evaluations and Standards and Guidelines Assessments



ATTACHMENT 4

ELKO DISTRICT
ALLOTMENT EVALUATION – STANDARDS AND GUIDELINES ASSESSMENT SCHEDULE
February, 2004

Complex/ Allotment (Category)	Resource Issues R = High/Med Priority Stream Riparian WQ = Water Qual. LCT = Lahontan cutthroat trout RB= Redband Trout SF= Spotted Frog SG= Sage Grouse. CBG= Crucial Big Game Habitat WH = Wild Horses	First Time Evaluations			Re-Evaluations (yr. first evaluated)		Acres		
		AE In-House Draft w/S&G Assess	AE to Public w/ S&G Assess	S&G Determination,MASR, PMUD, FMUD	S&G Assess	S&G Deter.	Public	Private	Total
Rock Creek	R	1997	1997	2003			**356,510**	**85,497**	**442,007**
Spanish Ranch	LCT, SG, CBG WH						139,847	42,741	182,588
Squaw Valley							216,663	42,756	259,419
Little Humboldt	R	2002	2002	2003			**112,485**	**46,478**	**158,963**
Little Humboldt	LCT, SG, CBG WH						68,880	16,705	85,585
Tall Corral							9,568	0	9,568
Jakes Creek							34,037	29,773	63,810
Hubbard/Vineyard	R, WQ, RB, SG, CBG	1997	1997	2003			112,214	6,891	119,105
Cottonwood	R, WQ, RB, SG, CBG				2003 (93)	2003	16,689	133	16,822

Complex/ Allotment (Category)	Resource Issues R = High/Med Priority Stream Riparian WQ = Water Qual. LCT = Lahontan cutthroat trout RB= Redband Trout SF= Spotted Frog SG= Sage Grouse. CBG= Crucial Big Game Habitat WH = Wild Horses	First Time Evaluations			Re-Evaluations (yr. first evaluated)		Acres		
		AE In-House Draft w/S&G Assess	AE to Public w/ S&G Assess	S&G Determination,MASR, PMUD, FMUD	S&G Assess	S&G Deter.	Public	Private	Total
Lindsay Creek	R, SG	2002	2002	2002 Deter. 2003 M/MUD			9,314	20	9,334
Frost Creek	R, SG, LCT			2002 Deter. 2004 M/MUD	2002 (93)	2002	11,110	350	11,460
L. Goose Creek	R, SG, CBG	2005	2005	2005			69,447	3,450	72,897
Marys River	R	2003	2003	2004			**236,532**	**42,479**	**279,011**
Deeth	WQ						125,398	1,806	127,204
Pole Creek	LCT, SG,						5,302	2,544	7,846
Antelope Basin							16,744	0	16,744
Anderson Creek					2003 (91)	2004	21,560	1,869	23,429
Hot Creek							16,856	1,052	17,908
Stormy							50,672	35,208	85,880
Gulley	R, WQ, SG, CBG	2004	2004	2004			11,202	2,100	13,302

Complex/ Allotment (Category)	Resource Issues R = High/Med Priority Stream Riparian WQ = Water Qual. LCT = Lahontan cutthroat trout RB= Redband Trout SF= Spotted Frog SG= Sage Grouse. CBG= Crucial Big Game Habitat WH = Wild Horses	First Time Evaluations			Re-Evaluations (yr. first evaluated)		Acres		
		AE In-House Draft w/S&G Assess	AE to Public w/ S&G Assess	S&G Determination,MASR, PMUD, FMUD	S&G Assess	S&G Deter.	Public	Private	Total
N. Diamond	SG, CBG	1998	1998	2004			**85,496**	**966**	**86,462**
Red Rock	WH						66,324	966	67,290
Browne							19,172	0	19,172
YP	R, WQ, SG		1998	2004 FMUD			96,634	1,515	98,149
Ruby 8		2005	2005	2005			28,900	0	28,900
Tuscarora/Eagle	R	2005	2005	2005			**76,988**	**45,274**	**122,262**
Tuscarora	WQ						49,303	40,494	89,797
Eagle Rock	LCT, RB, SG						27,685	4,780	32,465
Adobe Hills	R, LCT	2004	2004	2005			23,007	26,317	49,324
Stag Mountain	R	2005	2005	2005			**103,449**	**45,463**	**148,912**
Stag Mtn.	WQ						39,999	1,375	41,374
Devils Gate	SG						49,797	29,128	78,925
Morgan Hill							13,653	14,960	28,613

Complex/ Allotment (Category)	Resource Issues R = High/Med Priority Stream Riparian WQ = Water Qual. LCT = Lahontan cutthroat trout RB= Redband Trout SF= Spotted Frog SG= Sage Grouse. CBG= Crucial Big Game Habitat WH = Wild Horses	First Time Evaluations			Re-Evaluations (yr. first evaluated)		Acres		
		AE In-House Draft w/S&G Assess	AE to Public w/ S&G Assess	S&G Determination,MASR, PMUD, FMUD	S&G Assess	S&G Deter.	Public	Private	Total
N. Fork Group	R	2005	2005	2005			**125,087**	**98,160**	**223,247**
N. Fork Group	LCT(historic)						116,337	90,140	206,477
Coal Mine Basin	SG, CBG						8,750	8,020	16,770
Rough Hills	R, SG	2004	2005	2005			5,233	837	6,070
Wildhorse Group	R, SG	2004	2005	2005			25,578	41,909	67,487
Jackpot	R, WQ, SG				2005 (91)	2005	67,406	3,766	71,172
Tomera	R	2005	2005	2005			**78,578**	**67,632**	**146,210+**
Devils Gate FFR	WQ						3,026	+	3,026+
Thomas Creek	SG, CBG						4,858	13,785	18,643
Thomas Creek FFR							203	+	203+
Emigrant Spring							13,246	10,546	23,792
Pine Mtn.							30,493	29,828	60,321
Grindstone							6,486	7,713	14,199
Tonka							20,266	5,760	26,026

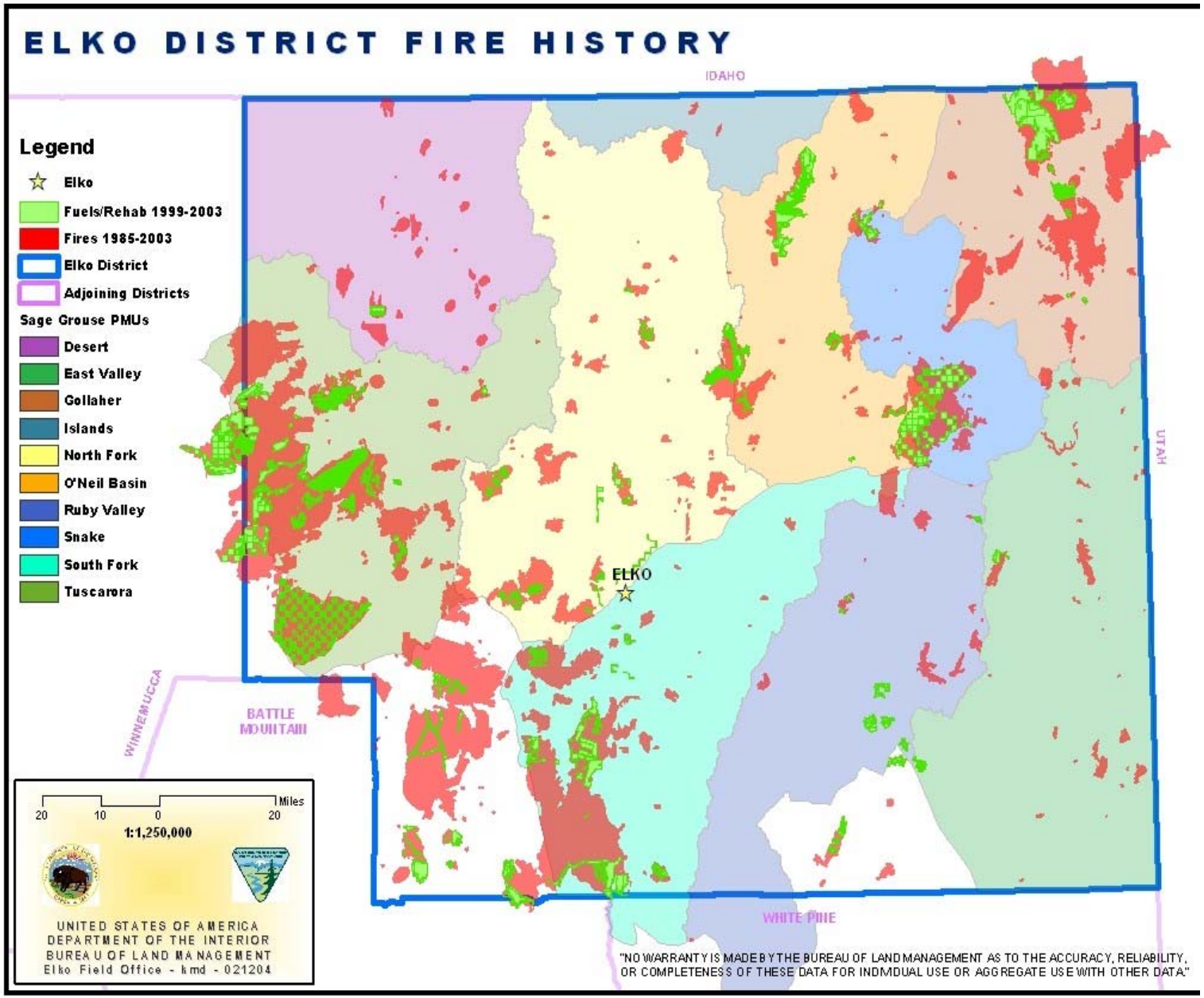
Complex/ Allotment (Category)	Resource Issues R = High/Med Priority Stream Riparian WQ = Water Qual. LCT = Lahontan cutthroat trout RB= Redband Trout SF= Spotted Frog SG= Sage Grouse. CBG= Crucial Big Game Habitat WH = Wild Horses	First Time Evaluations			Re-Evaluations (yr. first evaluated)		Acres		
		AE In-House Draft w/S&G Assess	AE to Public w/ S&G Assess	S&G Determination,MASR, PMUD, FMUD	S&G Assess	S&G Deter.	Public	Private	Total
Goose Crk	R	2005	2005	2005			**189,762**	**15,874**	**205,636**
Bluff Creek	SG, CBG				2006 (91)	2007	51,166	5,192	56,358
Barton							2,939	954	3,893
Grouse Creek							16,903	345	17,248
Big Bend							49,307	9,383	58,690
South Buckhorn	R	2005	2006	2006			**276,445**	**108,682**	**385,127**
South Buckhorn	WQ						222,823	92,319	315,142
Indian Springs	SG, CBG						19,046	14,650	33,696
Bruffy							18,400	428	18,828
Pony Creek							16,176	1,285	17,461
Suzie Creek	R	2006	2006	2006			**124,363**	**85,802**	**210,165**
Hadley	LCT						27,323	41,162	68,485
Carlin Field	SG						18,798	3,982	22,780
Blue Basin							36,642	0	36,642
Taylor Canyon							8,672	40,658	49,330
Lone Mountain							32,928	0	32,928

Complex/ Allotment (Category)	Resource Issues R = High/Med Priority Stream Riparian WQ = Water Qual. LCT = Lahontan cutthroat trout RB= Redband Trout SF= Spotted Frog SG= Sage Grouse. CBG= Crucial Big Game Habitat WH = Wild Horses	First Time Evaluations			Re-Evaluations (yr. first evaluated)		Acres		
		AE In-House Draft w/S&G Assess	AE to Public w/ S&G Assess	S&G Determination,MASR, PMUD, FMUD	S&G Assess	S&G Deter.	Public	Private	Total
TS	R	2006	2006	2007			**84,605**	**17,962**	**102,567**
T Lazy S	WQ						68,797	0	68,797
Mary's Mountain	LCT						15,808	17,962	33,770
South Fork	R	2006	2006	2007			**14,867**	**12,780+**	**27,647+**
Ten Mile Creek	WQ						5,636	3,545	9,181
Bullion Road	LCT						4,128	3,595	7,723
White Flats FFR							2,520	+	2,520+
River							4,979	2,880	7,859
Cut-Off							2,583	2,760	5,343
Winecup/Gamble	R	2006	2007	2007			**543,560**	**375,793**	**919,353**
Gamble Ind.	SG, CBG						209,800	139,849	349,649
Dairy Valley							51,770	37,139	88,909
Pilot Valley							43,825	56,400	100,225
HD							238,165	142,405	380,570
O'Neil	R				2006	2007	**85,143**	**4,668**	**89,811**
O'Neil	WQ				(92)		66,100		
Canyon	LCT, RB, SG				(92)		19,043		

Complex/ Allotment (Category)	Resource Issues R = High/Med Priority Stream Riparian WQ = Water Qual. LCT = Lahontan cutthroat trout RB= Redband Trout SF= Spotted Frog SG= Sage Grouse. CBG= Crucial Big Game Habitat WH = Wild Horses	First Time Evaluations			Re-Evaluations (yr. first evaluated)		Acres		
		AE In-House Draft w/S&G Assess	AE to Public w/ S&G Assess	S&G Determination,MASR, PMUD, FMUD	S&G Assess	S&G Deter.	Public	Private	Total
Palisade	WQ	2007	2007	2007 Deter.			**18,608**	**12,091**	**30,699**
Safford Canyon	CBG			2008			7,973	1,192	9,165
Palisade				MASR &			10,635	10,899	21,534
				MUDs					
Mineral Hill	CBG	2007	2007	2007 Deter.			24,907	1,341	26,248
				2008					
				MASR &					
				MUDs					
25	R	2007	2007	2007 Deter.			293,286	215,759	509,045
	WQ			2008					
	LCT, CBG			MASR &					
				MUDs					
Robinson Mtn	R	2007	2007	2007 Deter.			18,662	680	19,342
	SG			2008					
				MASR &					
				MUDs					

Complex/ Allotment (Category)	Resource Issues R = High/Med Priority Stream Riparian WQ = Water Qual. LCT = Lahontan cutthroat trout RB= Redband Trout SF= Spotted Frog SG= Sage Grouse. CBG= Crucial Big Game Habitat WH = Wild Horses	First Time Evaluations			Re-Evaluations (yr. first evaluated)		Acres		
		AE In-House Draft w/S&G Assess	AE to Public w/ S&G Assess	S&G Determination,MASR, PMUD, FMUD	S&G Assess	S&G Deter.	Public	Private	Total
Robinson Creek	R SG	2007	2007	2007 Deter. 2008 MASR & MUDs			17,264	0	17,264
							Total	**Total**	**Total**
							3,341,100	**1,370,669**	**4,711,769**

Attachment 5



ATTACHMENT 6
SUMMARY OF WILDFIRES AND RESEEDING EFFORTS
ELKO FIELD OFFICE 1999-2003

1999 Elko Fires

Fire Name	Total Acres Burned	Acres Seeded	Acres Managed for Natural Response
Ajax	1,087	0	1,087
Bispo	750	9	741
Clover	73,073	21,048	52,025
Frenchie	54,676	15,315	39,361
Hansel	2,494	14	2,480
Hunter	4,563	1,069	3,494
Izzenhood	28,594	50	28,544
Pilot	4,104	219	3,885
Rain	21,730	8,754	12,976
Rose	48,479	16,834	31,645
Sadler	199,199	128,283	70,916
Wagonbox	21,622	854	20,768
Dido	15,699	0	15,699
Mitchell Crk.	2,925	827	2,098
No School	11,271	0	11,271
Welches Crk.	10,815	2,000	8,815
TOTAL	501,081	195,276	305,805

2000 Elko Fires

Fire Name	Total Acres Burned	Acres Seeded	Acres Managed For Natural Response
Alazon	200	0	200
Basin	3,669	1,653	2,016
Beowawe	13,929	9,575	4,354
Big Springs	1,624	1,624	0
Hogan	1,870	0	1,870
Kelly Creek	37,716	11,891	25,825
Linka	3,298	775	2,523
Mary's	58	0	58
Morris	79	0	79
Omni	420	340	80
Railroad Pass	827	827	0
Rodriques	269	0	269
Squaw Valley	601	0	601
Adobe	6,860	1,767	5,093
Camp Creek	31,194	7,391	23,803
Charlie	3,021	0	3,021
Choke Cherry	31,051	20,363	10,688
Cold Springs	8,393	4,155	4,238
Gamble	22	0	22
Mahogany	214	0	214
Mule	69	0	69
Patty Jack	35	0	35
Rabbit	5,837	3,571	2,266
Sheep Pen	2,496	0	2,496
South Cricket	66,487	14,534	51,953
Three Mile	3,379	2,274	1,105
Vega	2,697	0	2,697
West Basin	33,221	11,954	21,267
Wimpy	2,869	0	2,869
18 /21Mile	642	420	222
TOTAL	236,362	66,429	169,933

2001 Fires

Fire Name	Total Acres Burned	Acres Seeded	Acres Managed. For Nat.\Rel.
Bailey	1,201	213	988
Buffalo	21,188	4,410	16,778
Coyote	11,675	1,799	9,876
Dee Gold	316	0	316
Dunphy	9,061	260	8,801
Hot Lake	70,910	8,320	62,590
Mile Marker	578	79	499
North Delano	8,827	5,041	3,786
Ranch	18,966	14,826	4,140
Rodeo Crk.	5,529	1,571	3,958
*Sheep	83,670	33,080	50,590
Stag	19,579	10,202	9,377
Tabor Crk.	7,004	1,022	5,982
Bishop	2,887	360	2,527
Bob's Flat	580	21	559
Buckhorn	749	200	549
Double Mtn.	3,397	845	2,552
Egbert	1,955	362	1,593
Isolation	14,032	525	13,507
Maggie Crk.	11,434	2,291	9,143
Metropolis	1,138	0	1,138
Mud Springs	546	273	273
Neptune	1,513	0	1,513
Upper Clover	1,993	869	1,124
West Bullion	337	185	152
West Pequop	3,496	0	3,496
Wine Cup	9,345	811	8,534
Dry Hills	1,900	1,900	0
Shale	1,079	0	1,079
TOTAL	53,402	6,742	46,660

2002 and 2003 Elko Fires

Fire Name	Total Acres Burned	Acres Seeded	Acres Managed for Natural Response
2002 Fires			
Adobe	440	130	310
Belmont	599	20	579
2003 Fires			
Schell	1,723	881	842
Savannah	1,443	664	779
Totals	4,205	1,695	2,510

ATTACHMENT 7

SUMMARY OF LAND MANAGEMENT ACTIONS THAT CONTRIBUTE TO SAGE GROUSE HABITAT AND/OR SAGEBRUSH CONSERVATION ON PUBLIC LANDS IN THE BLM ELKO FIELD OFFICE

Land Use Plan Conformance	•Both the Elko and Wells RMPs contain objectives and standards that pertain to sage grouse and/or sagebrush habitat conservation. •The sage grouse conservation planning effort is consistent with both RMPs.
Standards and Guidelines for Rangeland Health	•Sage grouse conservation planning efforts are consistent with S&Gs
WAFWA Sage Grouse Guidelines	•Consistent with both RMPs. •Will be considered in conservation planning efforts as per national interagency MOU.
NV Sage Grouse Guidelines	•Consistent with WAFWA guidelines and adapted for Nevada for use in conservation planning and implementation.
Habitat Management Plans	•Elko Field Office has 1.8 million acres under HMP which considers sage grouse habitat objectives (some overlap with completed AMPs and allotment evaluations).
Allotment Management Plans	•Elko Field Office has 32 AMPs in place (covering 1.9 million acres) which consider multiple use management objectives, including sage grouse habitat.
Allotment Evaluations/S&G Assessments and Multiple Use Decisions	•Elko Field Office has completed 101 allotments covering 4.1 million acres (61% of the total field office acreage). •Remainder to be completed by 2008.
Range Improvement Funds	•Ecological criteria utilized to prioritize implementation of Multiple use Decisions, giving special status species habitat and cooperative funding projects higher priority.
Population Inventories	•Elko Field Office has coordinated with NDOW to accomplish nearly 1,500 site visits and locating nearly 300 new leks during the past 4 years.
Fire Management Plan Amendment	•Approved plan to be issued in 2004. •Calls for 24,000-60,000 of fuels reduction projects consistent with other multiple use values, including sage grouse. •NV Sage Grouse Guidelines incorporated as SOPs. •Nearly 46,000 acres of vegetation treatments completed 1991-2003.
Wildfire and Emergency Stabilization and Rehabilitation	•1.9 million acres affected by fire in Elko Field Office since 1980 •800,000 acres burned since 1999 •270,000 acres reseeded •530,000 acres determined suitable for natural re-vegetation
Great Basin Restoration Initiative	•GBRI has been the foundation for funding of many recent fuels, restoration, and noxious weeds projects. Nearly 6,000 acres noxious weeds treatments funded

	under the umbrella of GBRI since 2002
Upland Habitat Monitoring	•This is the foundation for allotment evaluations and S&G Assessment process. •This information is crucial to future watershed assessment efforts and to support local site specific implementation of sage grouse conservation plans.
Riparian Habitat Monitoring	•Also serves as the foundation for allotment evaluations and S&G Assessment process. •Riparian habitat is key component to sage grouse brood rearing habitat. •PFC inventory for streams complete in Elko Field Office. •PFC inventory for springs, seeps, and wetlands is ongoing.
Surface Mining	•Direct and indirect impacts from surface mining activities in the Carlin Trend have been resolved through creative approaches in cooperation with NDOW and the mining companies. •Off site mitigations for sage grouse habitat conservation has been substantial. •Offsite mitigations have ranged from cash deposits for future on the ground projects to land exchanges to allow for critical habitats to come under public ownership and management.
Land Tenure Adjustments	•Over 200,000 acres of public lands with high resource values have been consolidated through land exchanges directly benefiting sage grouse habitat conservation.