Northeastern Nevada Stewardship Group
P.O. Box 1677
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North Fork Population Management Unit Assessment

Report Prepared for

Northeastern Nevada Stewardship Group, Inc., Elko County, and Nevada Division of State Lands

Report Prepared by

Great Basin Ecology, Inc.

April 2011

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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.

Preface

This report summarizes the assessment of the North Fork Sage-Grouse Population Management Unit (PMU) in Elko County, Nevada. The report is based on over 2,400 field data points taken in an area of over 1.7 million acres. The soil map units as determined by the Natural Resource Conservation Service were the field map units on which the assessment was based. There was an ecological site correlated to each soil in the soil map unit, and the ecological sites became the field sample units.

The assessment had two objectives: 1) to categorize sage-grouse habitat based on the Idaho BLM rapid habitat assessment method; and 2) to identify the sage-grouse habitats based on ecological site conditions. The latter objective facilitated identification of issues or problems on the landscape which affect watershed functionality and ecological site integrity. By grouping ecological sites into response groups – i.e., sites that respond similarly to disturbance or management - allowed for the development of general management guidelines. In addition, a management key was developed to allow the land manager to be aware of the steps necessary before conducting any management action.

Although an abundance of data was collected in this effort, a site-specific evaluation would be needed for any "management unit" to determine site-specific conditions to ensure that the actions that would be implemented are consistent with the site conditions and would achieve the desired results.

List of Acronyms

amsl	above mean sea level
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
ESA	Endangered Species Act
GIS	Geographic Information System
NDOW	Nevada Department of Wildlife
NRCS	Natural Resource Conservation Service
NNSG	Northeastern Nevada Stewardship Group, Inc.
p.z.	precipitation zone
PMU	Population Management Unit
PFC	Proper Functioning Condition
USFS	U.S. Forest Service

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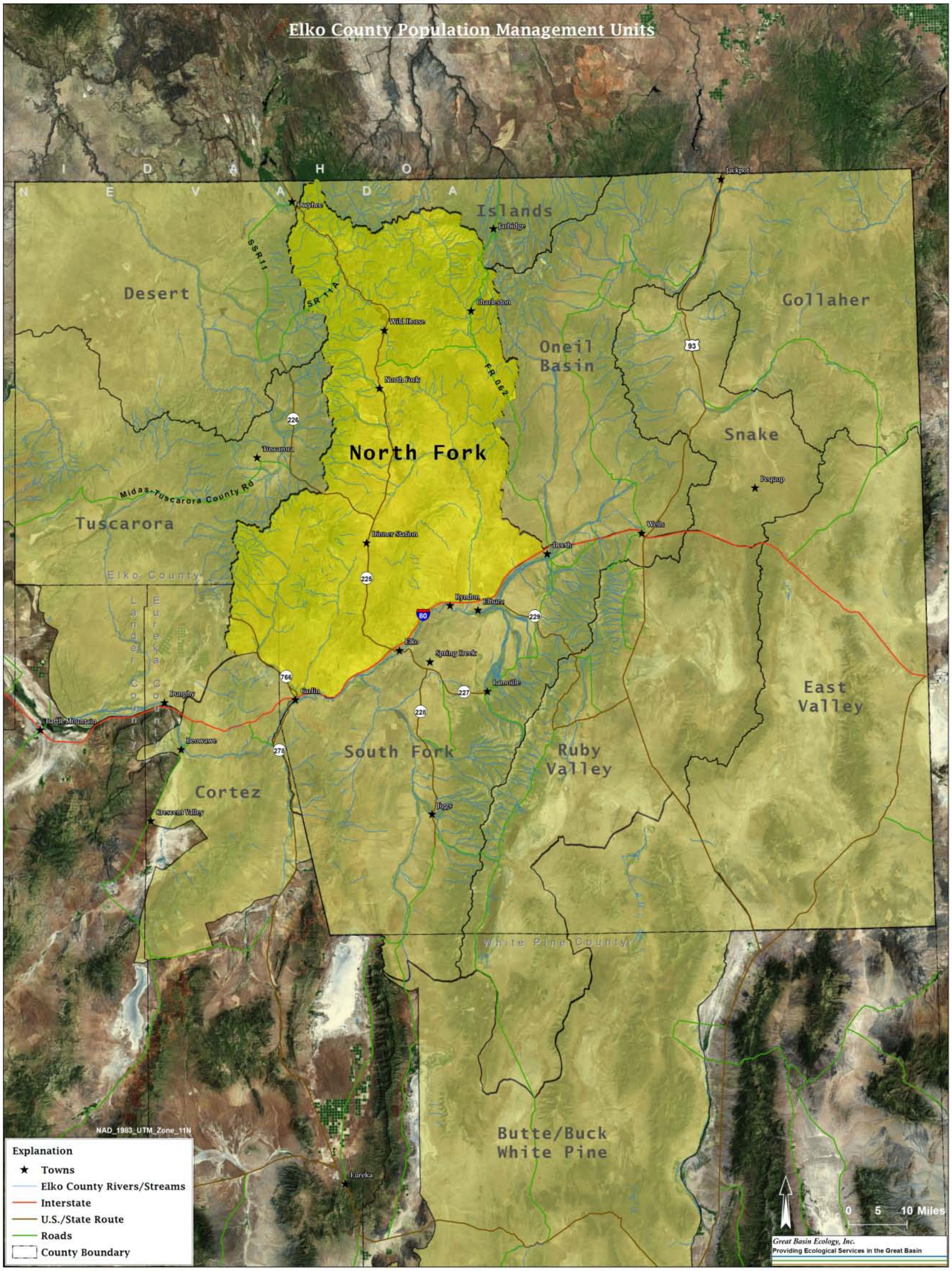
CHAPTER 1 – INTRODUCTION



1.0 INTRODUCTION

The Northeastern Nevada Stewardship Group, Inc. (NNSG) was established in the fall of 1998 as a citizen-based group which chose to implement a collaborative process to address natural resource and land use issues within Elko County. NNSG created a sage-grouse working group or pod in June 1999. The purpose of the pod was to examine the emerging issue of the potential listing of the Greater sage-grouse (*Centrocercus urophasianus*) as threatened or endangered under the Endangered Species Act (ESA) of 1970, as amended.

Because this issue had the potential to affect land users of every background; and therefore, had 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 existed for a successful collaborative effort and the citizens worked to resolve differences for the common good.

The emphasis changed from sage-grouse conservation to ecosystem conservation as it soon became apparent that sage-grouse were a landscape-scale species – a species that uses a variety of habitats over a large area throughout the year. Focusing on a single wildlife species, or one habitat type, was not sufficient to address the broader issue of ecosystem or watershed health. However, healthy, functioning watersheds were likely to provide the necessary seasonal habitats for sage-grouse and many other species.

In 2000 the State of Nevada, through then Governor Kenny Guinn's office, convened a statewide Sage-Grouse Conservation Team. NNSG was a participant in this process. The NNSG Sagebrush Conservation Strategy (NNSG Strategy) became northeastern Nevada's contribution to the Nevada-California Sage-Grouse Conservation Plan (State Plan).

Elko County includes portions of four of Nevada's 14 hydrographic regions or water basins (Figure 1-1). 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 45 hydrographic areas and sub-areas that are either partially or wholly within Elko

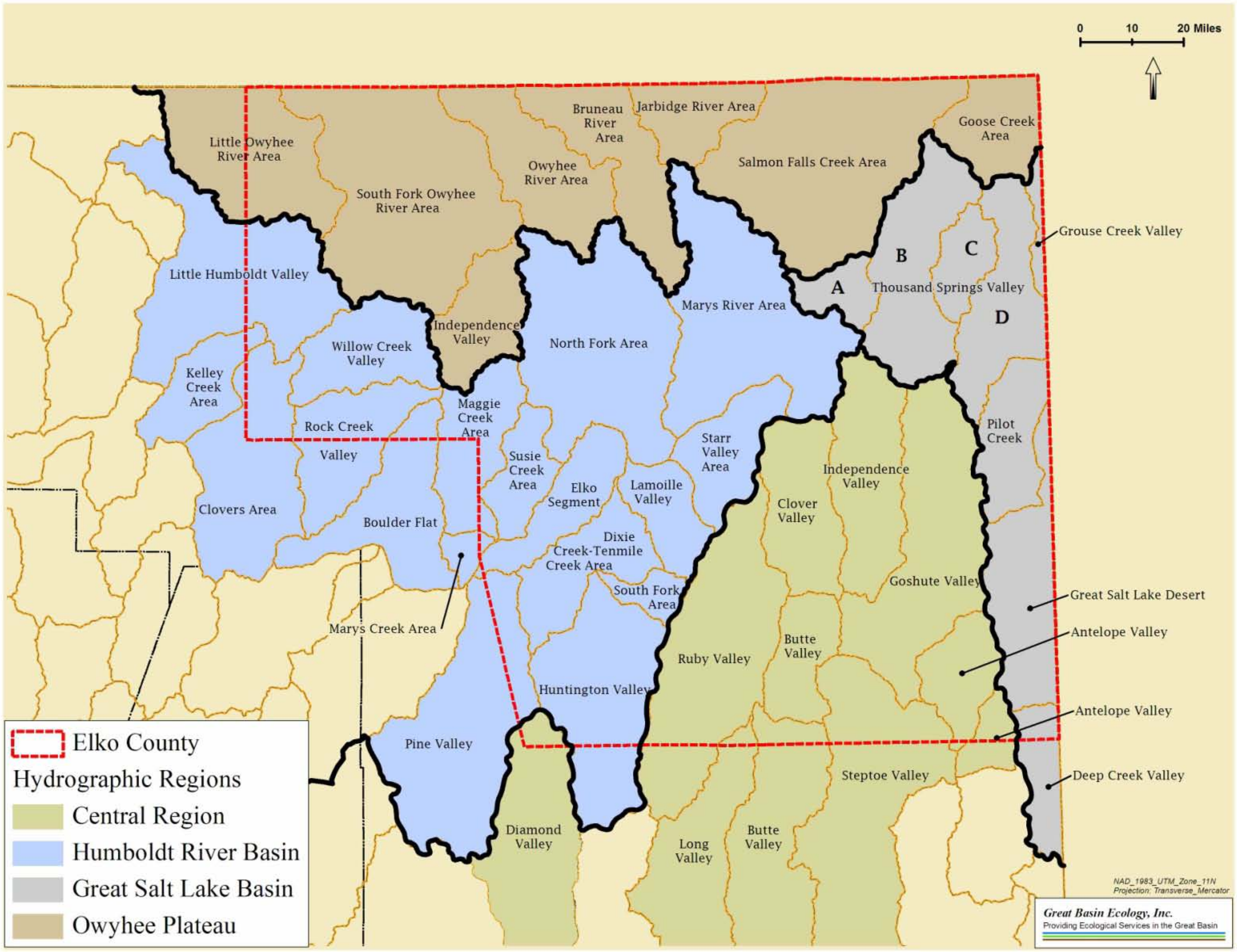


Figure 1 - 1: Hydrographic Basins and Sub-basins In Elko County

County (Figure 1-1). 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; 18 hydrographic areas lie within the Humboldt River Basin; eight hydrographic areas and three hydrographic sub-areas are within the Central Region Basin; and eight hydrographic sub-areas are contained within the Great Salt Lake Basin. The NNSG Strategy divided the planning area (Elko County) into 19 sub-basins, combining the hydrographic areas and sub-areas to create units of approximately equal size (Figure 1-2).

The State Plan divided the Elko County area into ten sage-grouse population management units (PMUs), as shown in Figure 1-3. The PMUs are best estimates of where populations of sage-grouse exist and are based on biologists' knowledge of the areas as well as natural topographic breaks that may tend to isolate populations from each other. The validity of these boundaries will be examined as additional data on sage-grouse movements is gathered over the coming years through radio-telemetry and banding studies. The PMU is the unit of interest for this assessment.

NNSG submitted grant proposals for watershed assessment funding through the Question One conservation bond program. However, because the focus of the NNSG plan was watersheds or sub-basins and the focus of the State Plan effort was PMUs, it was necessary to combine the PMU concept with the watershed concept to achieve funding to carry out the watershed assessments. The North Fork PMU includes portions of the Bruneau sub-basin (240,900 acres), North Fork Humboldt sub-basin (639,100 acres), Upper Humboldt sub-basin (560,300 acres), and Upper Owyhee sub-basin (291,300 acres); a total of approximately 1.7 million acres.

2.0 BACKGROUND

The initial purpose of developing the NNSG Strategy was to provide a process for improving watershed values and sage-grouse habitats as a way to preclude the need to list sage-grouse as threatened or endangered under the ESA, as amended. However, it became evident early in the process that many resources would be benefitted by improving the functionality of the sub-basins within Elko County. Therefore, the NNSG Strategy focused on upland health and riparian condition as they relate to watershed processes. In contrast, the State sage-grouse conservation plan focused on identifying categories of sagebrush habitat. The NNSG approach is one of maintaining ecological integrity and the State plan approach is one of single species management. The two approaches are discussed below, starting with the State plan approach.

The State sage-grouse conservation plan uses a rapid habitat assessment methodology that was developed by the Bureau of Land Management (BLM) in Idaho (see Section 3.2.3 for a detailed explanation). The basis of this plan is to identify existing quality

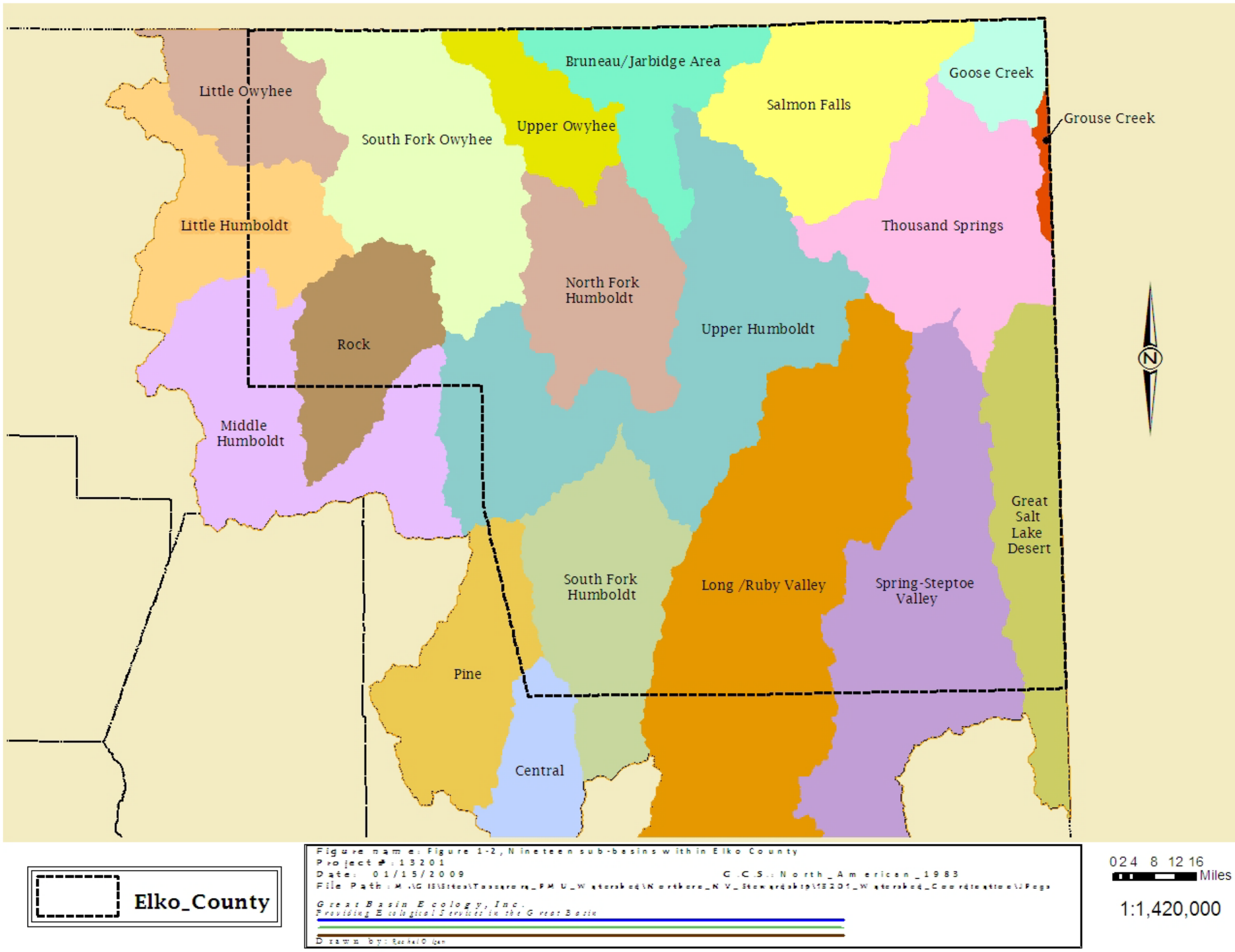


Figure 1 - 2: Combined Sub-Basins in Elko County

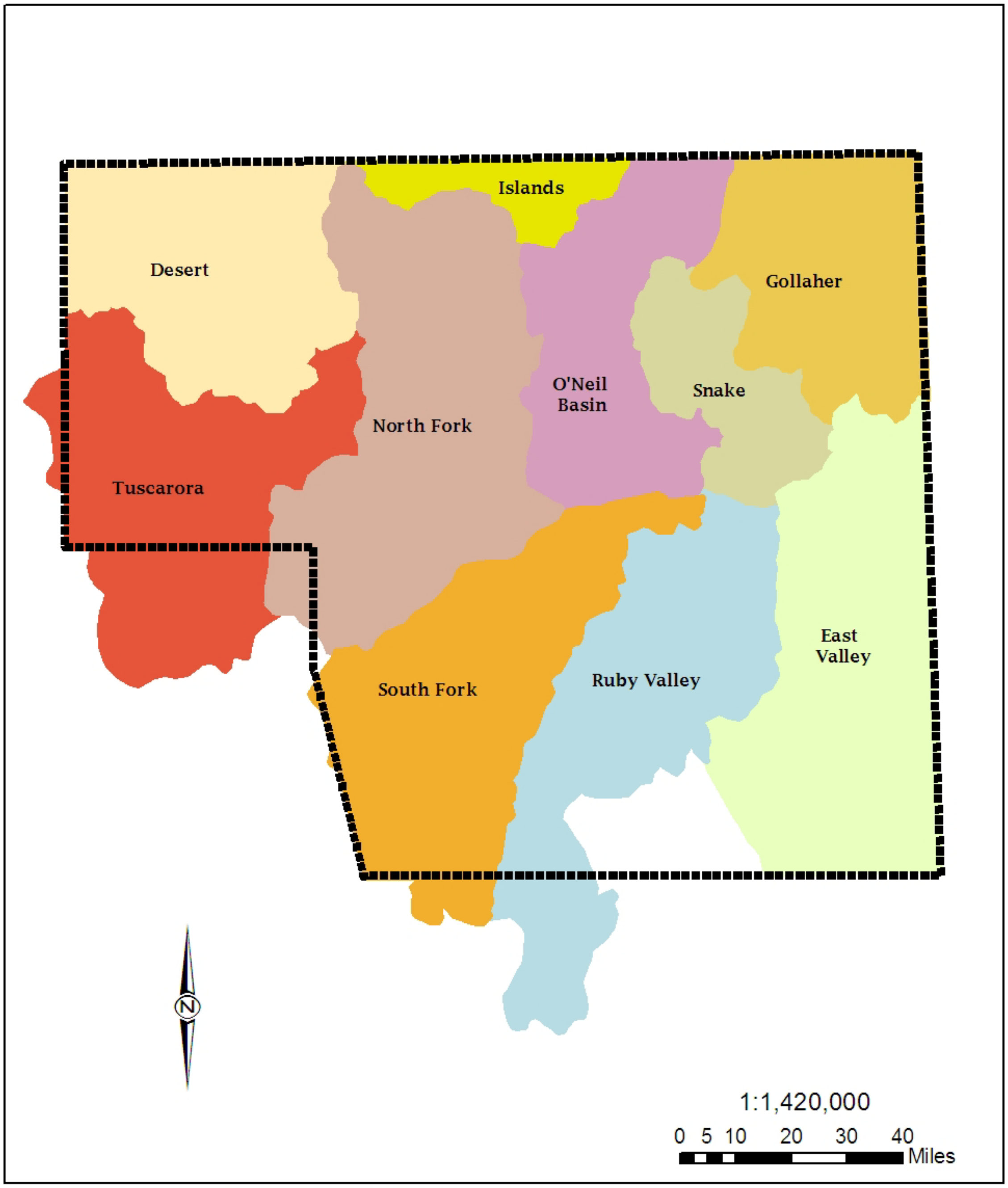


Figure name: Figure 1-3, Sage Grouse PMU's within the Elko County planning area
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Great Basin Ecology, Inc.
Providing Ecological Services in the Great Basin
Drawn by:

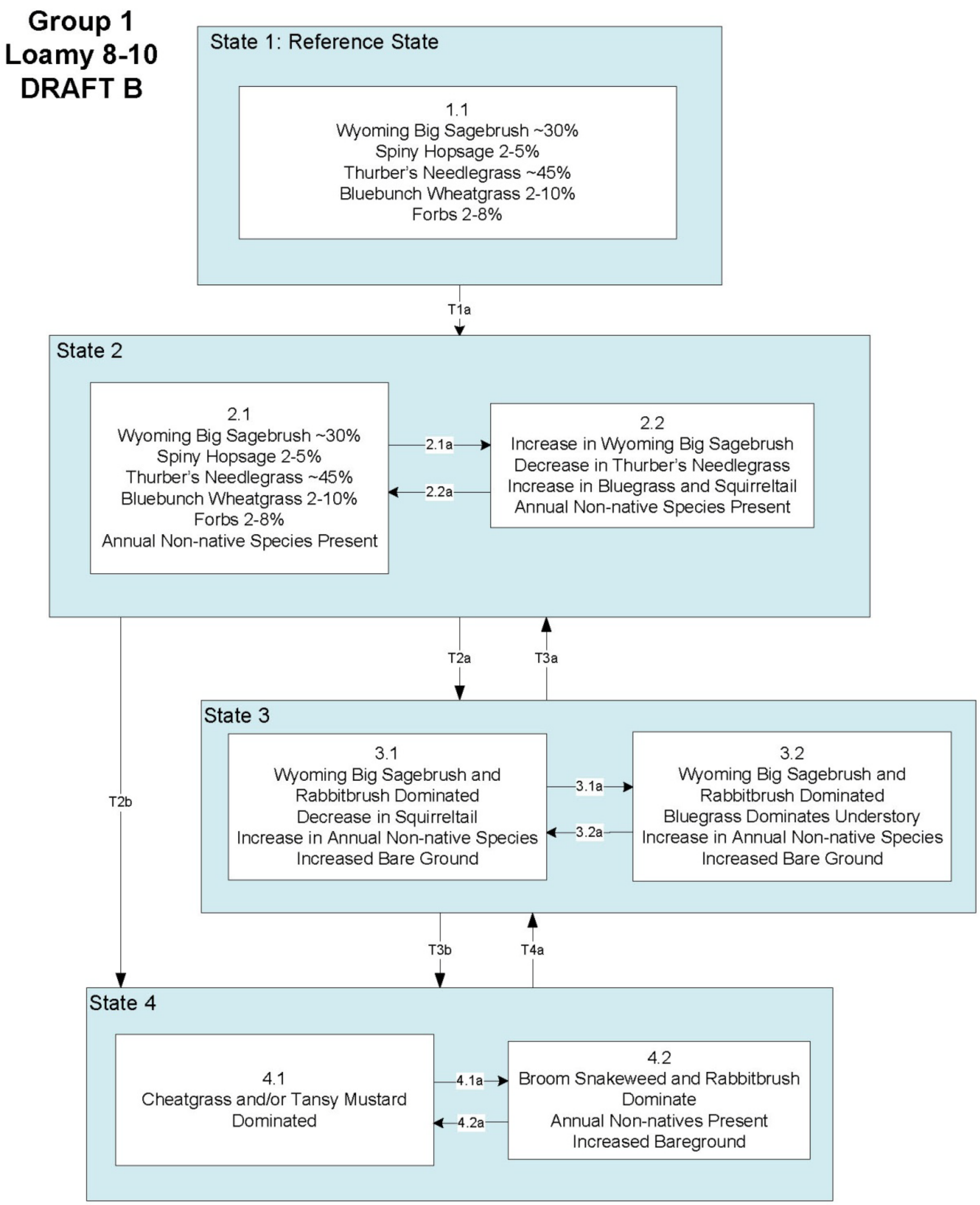
Figure 1 - 3: Sage-Grouse PMUs in Elko County

sage-grouse habitat and categorize other potential habitats based on the dominant land issue. The habitats or degraded habitats are placed into Restoration categories, or given "R" (i.e., Restoration) values. The existing quality habitat would be the focus of protection efforts, and the other degraded habitats would need some form of rehabilitation to make them suitable as sage-grouse habitat. Some of the values of this type of assessment are that the assessment is rapid and the various "R-values" relate to specific habitat issues. Therefore, this can be a first step in developing management strategies.

However, the R-values are not related to a specific ecological site, and therefore, management strategies cannot be applied as a "one size fits all" because different ecological sites will respond differently to the same management action. Therefore, this rapid assessment method provides some good, but limited data.

A discussion is included below that explains how watershed assessments relate to sage-grouse habitat, and how this approach can be used to achieve the State Plan sage-grouse conservation objectives.

The NNSG strategy focuses on the individual plant communities and ecological sites to determine the condition of upland health and riparian condition. Upland health and riparian condition are closely related to plant dynamics. The concept of succession, the orderly change in plant communities over time, is one of the plant community-specific changes that shaped the early grazing management and vegetation management policies. While useful in providing a basic understanding of plant community dynamics, the successional model is currently being replaced with the State and Transition models (Laycock 1991, West 1999) and other multi-trajectory models that reflect empirical field data. These models reflect that while there is a tendency for plant communities to go through various phases within a state, natural disturbance regimes maintain the plant community on the landscape. However, changes in the disturbance regime, management actions, non-native invasive species, and other change vectors can cause the plant community to transition to another state by crossing a threshold. The thresholds represent a point or range of conditions which, when crossed, can only be reversed by intensive management. The new or altered state of the plant community may result in long-term changes in the soils and biotic conditions. The altered state is often lesser quality habitat than the original state, and in some cases may have no habitat value for sage-grouse (i.e., an annual grassland). A draft example of a State and Transition Model for the Loamy 8-10 inch precipitation zone (Loamy 8-10 inch p.z.) is included as Figure 1-4. Note that State 2 is generally assumed to be the present state, as State 1 represents pristine conditions prior to European settlement. The non-native, invasive species are assumed to be widespread and present in almost every community. Therefore, it is assumed that pristine habitats no longer are widely distributed in Nevada and that State 2 is the starting condition for most Loamy 8-10 inch p.z. sites.



Models for the various Ecological Sites are being developed by an NRCS working group and contract with Dr. Tamzen Stringham, University of Nevada,

Figure 1 - 4: Draft State and Transition Model for the Loamy 8-10 inch p.z. Ecological Site

Two of the major stresses of 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 exceeds 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.

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 historic 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. The shrub-dominated community was not without grasses or forbs, but had less grasses and forbs than the other successional stages or phases of the plant community state. The abundance of forbs and grasses would have represented equilibrium of site capacity and short-term climatic conditions. Complete shrub dominance (i.e., nearly complete lack of forbs or grasses) was not likely to have occurred except at low elevation and low precipitation sites with poor soil productivity.

Rangeland ecological sites are ecological subdivisions of rangelands that are differentiated in terms of the natural plant community or the historic climax plant community that they are capable of supporting. A rangeland ecological site is the product of all the environmental factors responsible for its development, including soils, topography/land form, climate, and disturbance (e.g., fire, insects, disease). Each site supports a native plant community typified by an association of species that differs from that of other range sites in the kind or proportion of species or in total production. The natural plant community of an ecological site, in the absence of abnormal disturbances and physical deterioration, is referred to as the historic climax plant community for that site. It is the total plant community that is best adapted to a unique combination of prevailing environmental factors associated with the ecological site. The natural plant community was in a natural dynamic equilibrium with the historic biotic, abiotic, and climatic factors on its ecological site prior to the time of European immigration and settlement.

A slightly different concept is that of potential natural community (PNC) which is defined as the biotic community that would become established on an ecological site if all successional sequences were completed without interferences by man under the present environmental conditions. Natural disturbances are inherent in its development.

Both of these concepts, historic climax plant community and PNC, include disturbance as part of the defining condition. This is often misinterpreted as being some end point in plant dynamics in which the rangeland ecological site is dominated by shrubs. However, the natural disturbances would have interacted with the plant community, and species like sagebrush that are not fire tolerant, would not have been a dominant species except where the natural variation in disturbance regime provided conditions for sagebrush to dominate (i.e., a long period with no disturbance)[1]. Consequently, the ecological site descriptions for most rangeland ecological sites that have sagebrush as a principal member of the shrub component of the plant community indicate that sagebrush was generally less than 50 percent of the plant composition by weight. Therefore, historic climax plant community and PNC were generally mixtures of shrubs, grasses, and forbs, with grasses and forbs often exceeding sagebrush in percent composition by dry weight.

A conceptual model of the State and Transition process is provided in Figure 1-5 for a specific ecological site (Loamy 8-10 inch p.z.). Note that this is a graphical representation of State 2 in Figure 1-4. The PNC is indicated on the graph, not to the extreme right as some would assume, but toward the left of middle of the graph. Figure 1-5 is based on cover, rather than percent composition by weight. Although there is not a strong correlation between relative composition by dry weight and percent cover, PNC is likely to occur within the range indicated on the graph for this ecological site.

As indicated by the descriptions of the various ecological sites, different ecological sites have different capacities for annual production of biomass. Figure 1-6 is the conceptual model for a Shallow Loam 8-10 inch precipitation zone (Shallow Loam 8-10" p.z.). A comparison of Figure 1-6 with Figure 1-5 indicates that the Loamy 8-10 inch precipitation (Loamy 8-10" p.z.) ecological site is more productive than the Shallow Loam 8-10" p.z. site. The Shallow Loam 8-10" p.z. does not have the capacity to produce more than about 12 percent herbaceous cover (grasses and forbs combined) and about 22 percent shrub cover. In the absence of disturbance, it also takes longer for the Shallow Loam 8-10" p.z. to become shrub-dominated than the Loamy 8-10" p.z. site.

At the upper elevations where precipitation amounts are 14 inches or more per year, the shrub-dominated phase of an ecological site could be a combination of shrubs and herbaceous plants that may have 60 percent shrub cover and 20 percent

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[1] These periods of non-disturbance had to occur, and stands of shrub-dominated vegetation had to be present in sufficient acreage and frequency for wildlife species to specialize in using these habitats.

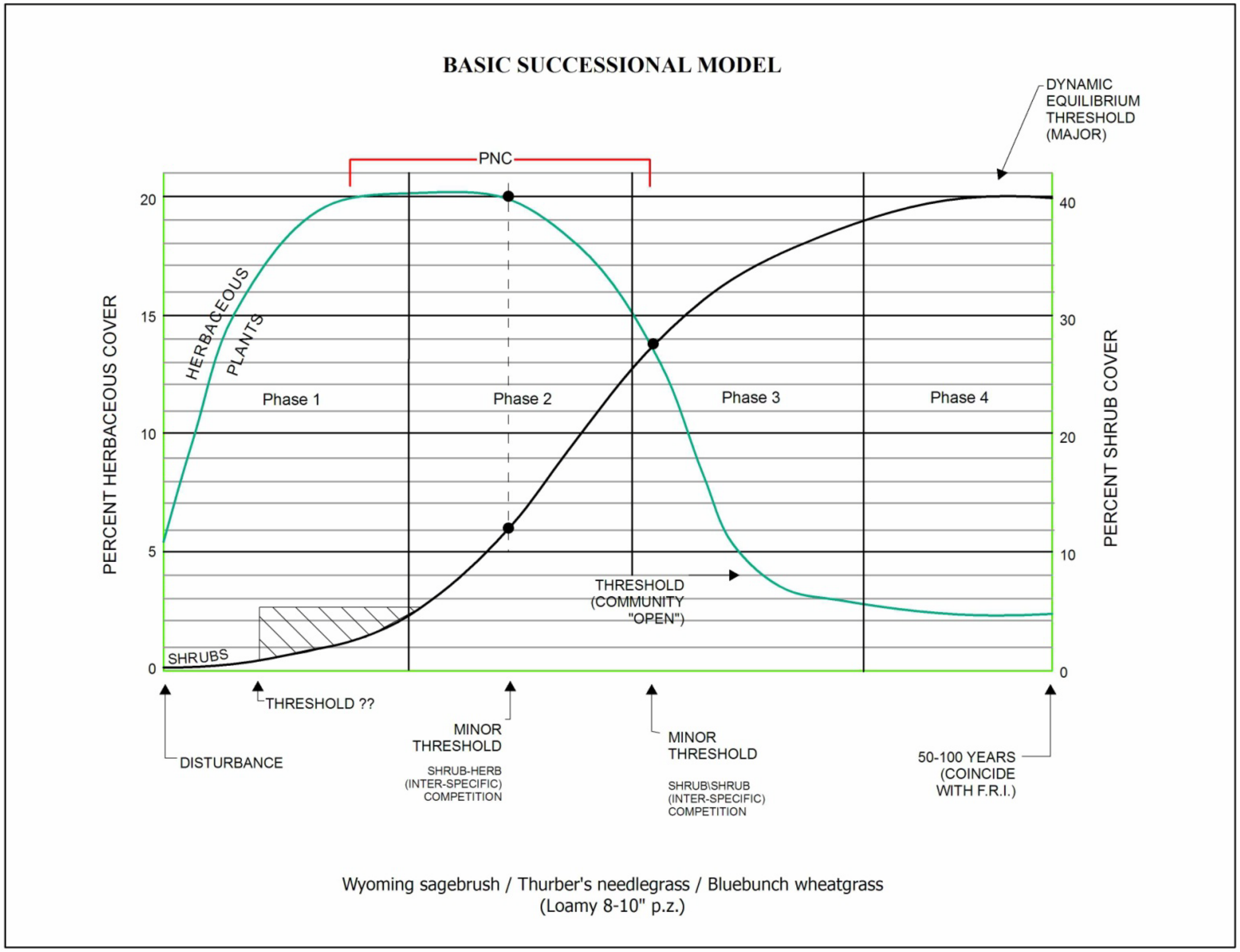

Figure 1 - 5: Basic Successional Model for the Loamy 8-10 Inch p.z. Ecological Site

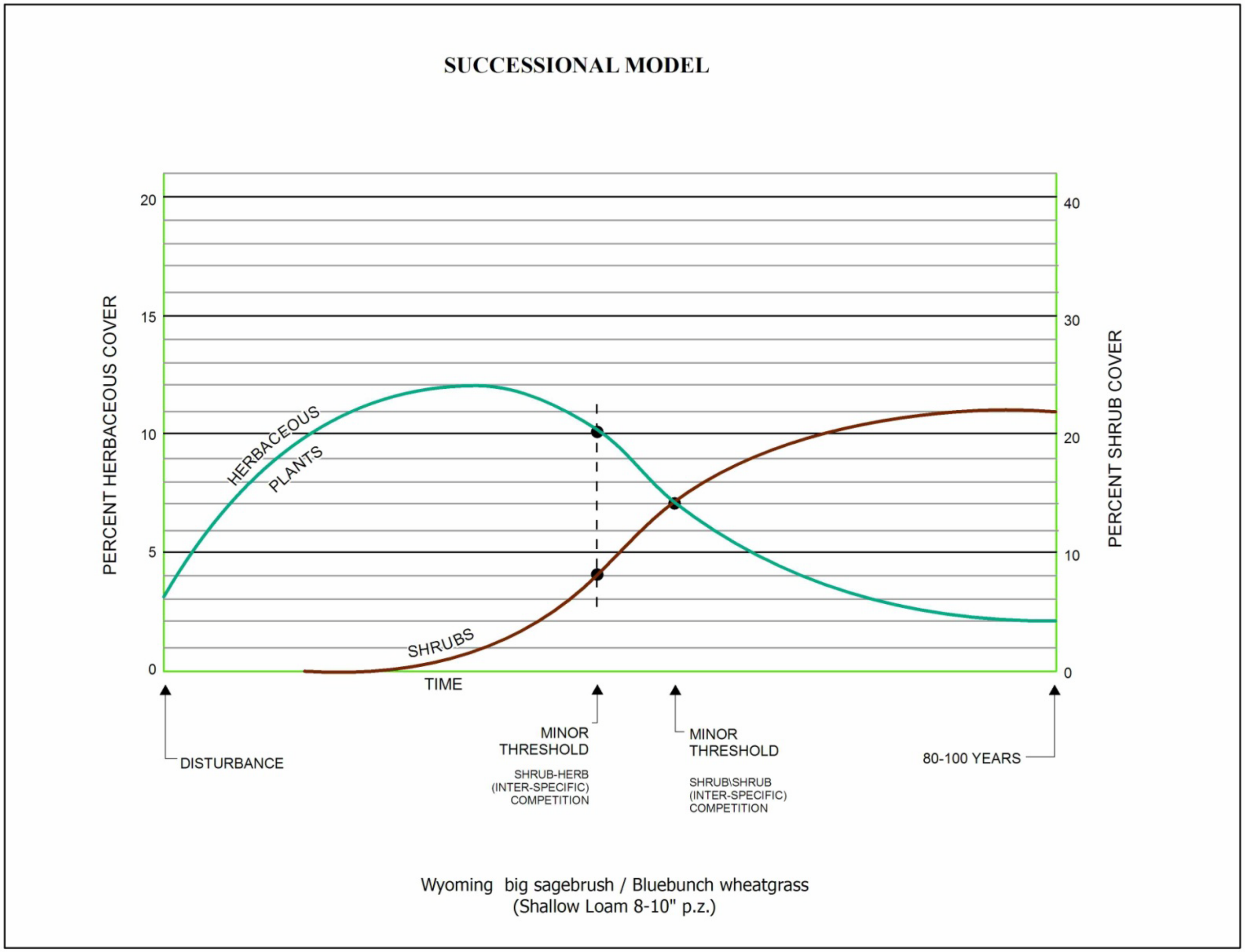

Figure 1 - 6: Basic Successional Model for the Shallow Loam 8-10 Inch p.z. Ecological Site

herbaceous cover. While this is still a shrub-dominated system, the percentage of herbaceous cover is high compared to a Loamy 8-10" p.z. ecological site, which may have 35-40 percent shrub cover and less than five percent grass/forb cover. The amount of "bare" ground that is available for cheatgrass to establish at the higher elevation/high precipitation ecological sites is also quite different than a lower elevation/lower precipitation zone site. The difference is related in part to the resiliency of the different ecological sites.

The importance to sage-grouse of these different phases (See Figure 1-5) in the dynamics of the ecological site models is demonstrated in Figure 1-7. A Loamy 8-10" p.z. ecological site has the potential to provide many seasonal habitats for sage-grouse, depending on where the plant community is on the continuum of development from immediately after disturbance to a condition of shrub dominance after 50 or more years of non-disturbance. However, note that every seasonal habitat for sage-grouse except lek habitat occurs in the area identified as PNC. The lek habitat is generally not found in Loamy 8-10" p.z. sites, but as indicated on the graph, sage-grouse may use an area that has been disturbed as a lek for a relatively short period of time. The PNC concept does not mean that the other phases were not present on the landscape, but it does mean that areas that were grass-dominated would eventually have shrubs establishing and areas that were shrub-dominated would be the most likely to burn and return to perennial grasses. For the Loamy 8-10" p.z. site, shrub cover from approximately four percent to 25 percent is adequate to provide all of the sage-grouse needs. Similarly, a herbaceous component of 15 to 20 percent appears to be optimal.

The difference in productivity of the ecological sites is also important to sage-grouse. A comparison of Figure 1-8 with Figure 1-7 demonstrates that some ecological sites do not have the potential to provide some or all of the habitat requirements for sage-grouse. The understanding of these concepts is critical to proper management of the ecological sites to sustain sage-grouse habitats; maintaining integrity of the ecological sites is imperative to the long-term sustainability of sage-grouse populations.

In contrast, riparian areas are assessed based on their functionality, rather than with respect to a reference plant community[2]. The proper functioning condition (PFC) is a qualitative method for assessing the condition of riparian areas, which considers hydrology, vegetation, and erosion/deposition attributes and processes to assess the condition of a riparian-wetland area.

The rangeland health and PFC assessments allow for an objective assessment of the landscape. The intent of both processes is to determine how the land area under consideration measures up to specific criteria, which then leads one to identify what changes need to be made to maintain health or condition of the landscape.

[2] However, the ecological site concept is currently being developed for riparian vegetation – see Stringham and Repp, 2010, *Ecological Site Descriptions: Consideration for Riparian Systems*.

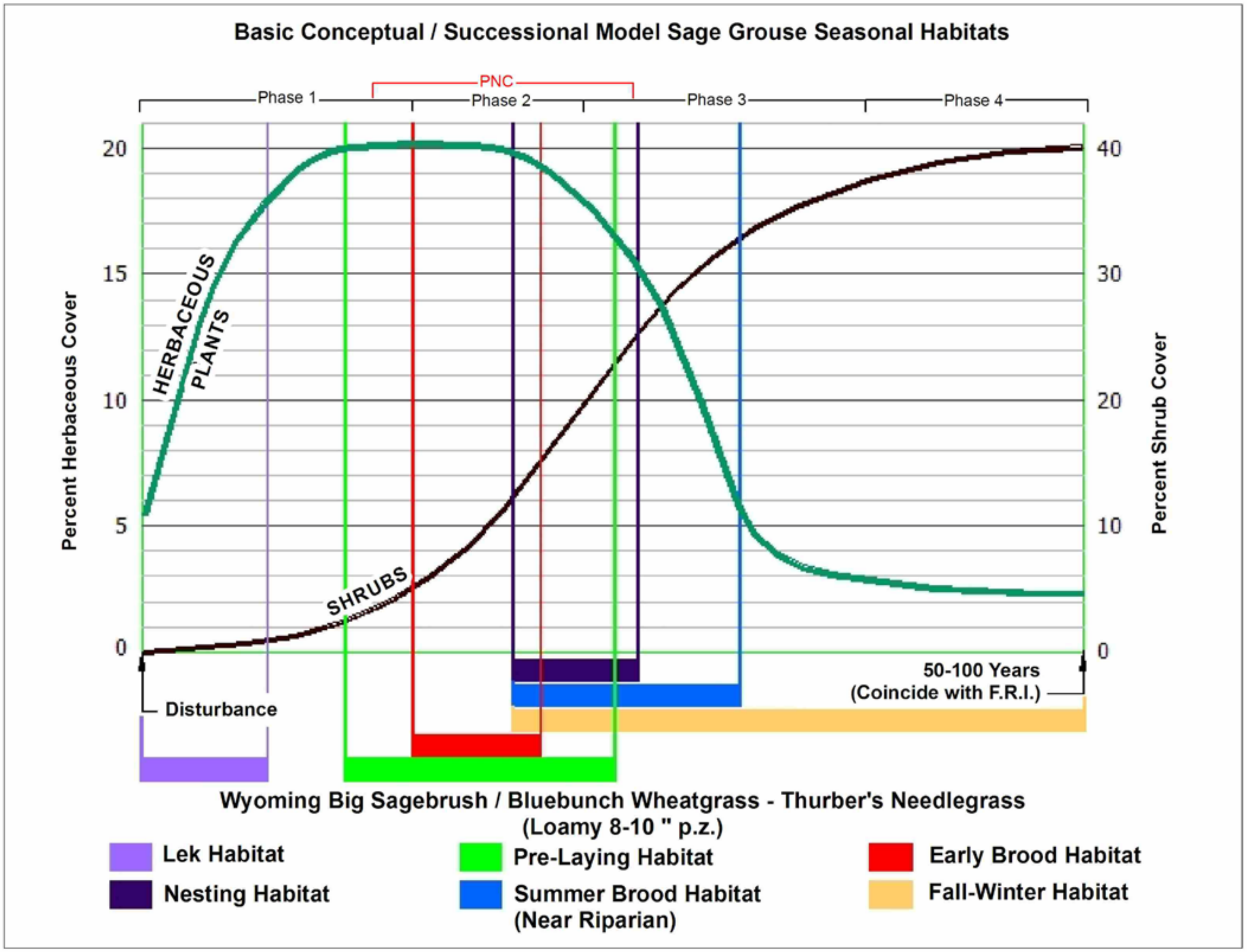

Figure 1 - 7: Basic Conceptual Model with Sage-Grouse Habitats

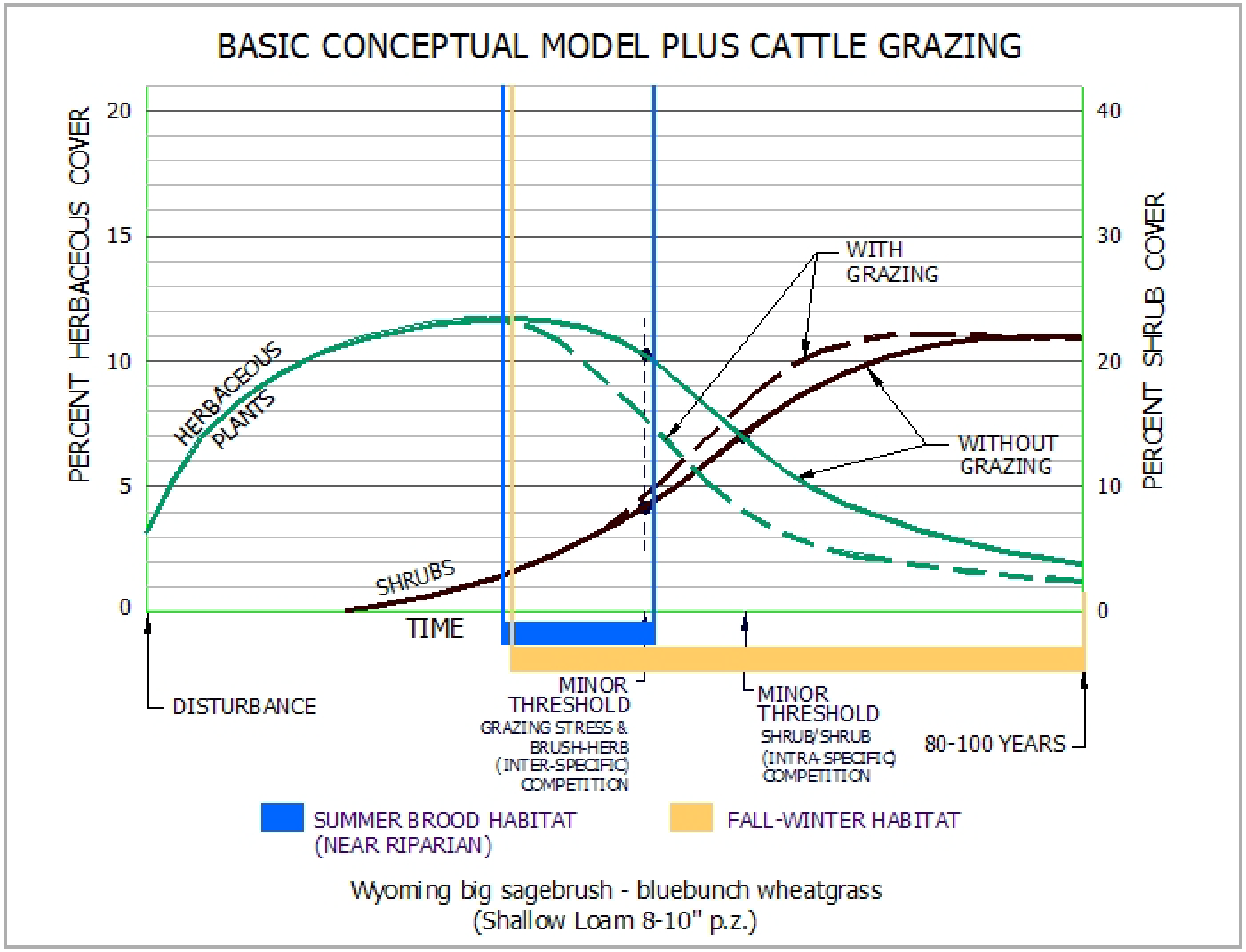

Figure 1 - 8: Basic Conceptual Model Shallow Loam 8-10 inch p.z. with Sage-Grouse Habitats

Consequently, the BLM rapid assessment method (i.e., R-values) is a starting point, but the rangeland health and ecological site identification/assessment process provides for the development of management strategies. The NNSG approach is a refinement of the BLM rapid assessment method, as it identifies specific sage-grouse seasonal habitats for each site and management strategies to sustain the habitat values that are readily determined based on information from the State and Transition models.

Therefore, Great Basin Ecology, Inc. has used the dual approach to satisfy the requirements of the State Lands grant and to provide management guidance for the NNSG as they move forward to implement sage-grouse conservation strategies based on maintaining the integrity of the ecological sites.

3.0 OBJECTIVES AND METHODS

3.1 Objectives

The overall objective of the PMU assessment was to refine the initial "armchair" assessment of sage-grouse habitat condition that was conducted as part of the NNSG Strategy.

The initial assessment and assignment of restoration values (R-values) focused on sagebrush habitats, whether sagebrush was present or not, whether the understory herbaceous vegetation was adequate for sage-grouse cover needs, whether the sagebrush was being replaced by pinyon-juniper (P-J) trees, or whether or not the sagebrush had been converted to other agricultural vegetation (e.g., irrigated meadow). The initial assessment was conducted without collecting any new data or field work; just "best guesses" of site conditions from agency biologists, ranchers, and others familiar with the PMU area.

The objective of the PMU assessment with respect to the State Lands contract was to determine:

- the R-values within the PMU.

As indicated above, the NNSG was interested in much more information from the assessment. The NNSG objectives were to:

- determine if vegetation at various ecological sites deviated significantly from the ecological site description;
- determine if riparian areas deviated significantly from the criteria for PFC;
- identify the amount and distribution of seasonal habitats within the PMU; and
- develop management options for the ecological sites.

This information was then used to determine recommendations for improving landscape conditions, where necessary. "Improvement" is defined herein as maintaining the integrity of the ecological site, or within the perspective of State and Transition models, maintaining the ecological site in an unaltered state and preventing the site from transitioning to an altered state.

While these objectives are fairly general and broad in scope, they do encompass issues such as fuel loading, livestock grazing management, sage-grouse habitat management, non-native invasive species, other wildlife species habitat requirements, watershed health, and soil conservation.

3.2 Methods

The overall assessment was conducted following a six-step process, which included the following steps:

1. Characterization
2. Issues and Key Questions
3. Current Conditions
4. Reference Conditions
5. Interpretation
6. Recommendations

3.2.1 Characterization

The objective of the Characterization step was to identify and collect existing data relevant to the PMU and enter the data into a database or other electronic program (i.e., GIS). This involved identifying dominant physical, biological, and human processes or features and included accessing public domain data. The Natural Resource Conservation Service (NRCS) soil survey map units and ecological site descriptions for all the ecological sites within the PMU boundary were obtained. Electronic data, such as soil survey and fire history data, was entered into the GIS system for preparation of resource maps. The available data was then used to prepare field maps for the rangeland health and riparian PFC assessments.

3.2.2 Issues and Key Questions

The objective of the identification of Issues and Key Questions is to focus on management issues and questions, objectives, human values, and resource conditions. The Issues and Key Questions had been previously identified in the NNSG Strategy through a risk assessment matrix. In addition, GBE held two stakeholder meetings to learn what issues residents of the PMU area identified. But most importantly, the Key Questions related to the "where, why, and how": where is the existing habitat, why is it in the current condition, and how do we improve the overall habitat condition?

3.2.3 Current Conditions

The objective of the Current Conditions phase is to collect the data that allows for the interpretation of the habitat conditions that exist today.

The assessment process for the PMU was conducted using a modification of the Sather-Blair et al. (2000) sage-grouse habitat assessment process that was consistent with the State Plan. This system focuses on Key Habitat, defined as all naturally occurring large-scale habitats currently, historically, or potentially capable of supporting sage-grouse populations. These habitats provide one or more of the seasonal requirements of the species in its life cycle. This does not imply critical, crucial, or high value/quality habitat, but only that the areas can, did, or could support sage-grouse populations. The Key Habitat is broken out into two major categories: Quality Habitats (R0) and Restoration Habitats.

Quality Habitats (R0): Areas of intact sagebrush-dominated habitats with good[3] understory components. Vegetation meets the acceptable criteria for both sagebrush canopy and grass/forb understory. These are high priority habitats for protection.

Restoration Habitats: Areas that currently are, historically were, or potentially could be sage-grouse habitat, and that if restored, would provide better habitat at some time in the future. This includes the following:

- R1: Areas with limited sagebrush, with acceptable grass and forb understory composition. This may include native and seeded perennial grass rangelands.
- R2: Areas with inadequate grass/forb understory composition, with or without adequate sagebrush cover. These areas require expensive management treatments for restoration.
    - R2a: Decadent sagebrush; cover exceeds the recommended levels.
    - R2b: Areas where perennial or annual invasive species are present and will likely establish and dominate after a disturbance event. This site is at risk, but the threshold has yet to be crossed.[4]

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[3] "Good" Understory: Preferred - $\geq$ 7 inches height, $\geq$ 10% grass, and $\geq$ 5% forb canopy. Acceptable - 5-7 inches height, 5-10% grass, and 3-5% forb canopy.
"Poor" Understory: < 5 inches height or < 5% grass, or < 3% forb canopy.
"Decadent" Sagebrush: > 35% canopy and /or > 40 inches in height.
"Inappropriate" or "Excessive" Grazing: < 5 inches height , or < 5% grass, or < 3% forb canopy.

[4] This is a significant difference between the Rapid Assessment and the Ecological Site concepts. The presence of annuals in the understory indicates an altered state for the Ecological Site concept – the threshold has been crossed.

  - R2c: Perennial or annual invasive species dominate the site due to a disturbance event. The threshold has been crossed.

  - R2d: Excessive or inappropriate disturbance on the understory grass/forb component.

- R3: Areas where natural sagebrush rangeland sites have been encroached upon by Pinyon/Juniper. These are sagebrush rangelands, not natural woodland sites that would predominantly favor trees.

  - R3a: Phase II of tree take over. Small trees of low density, with intact sagebrush/grass/forb understory. High management priority for alteration/maintenance.

  - R3b: Areas where tree density has eliminated sagebrush and the grass/forb understory. Management options to restore sagebrush/grass/forbs are limited and quite expensive.

- R-4: Areas where natural sagebrush rangeland sites have been type converted for private alternative use to agriculture uses/plants (e.g., alfalfa). Potential habitats for restoration to sagebrush, but only at the discretion of the landowner.

GBE also developed a system for assessing the current conditions with respect to suitability as seasonal habitats for sage-grouse and with respect to ecological site condition. This system consisted of visiting each soil map unit and the ecological sites within the soil map unit, as well as many of the springs and drainages. At the upland ecological sites, a rangeland health assessment was conducted, a range inventory worksheet was completed, and a watershed assessment form was completed. At the riparian sites (lentic or lotic), a Proper Functioning Condition (PFC) checklist was completed. The forms used in the field are included in Appendix A. The forms and the reference for the forms included:

- Great Basin Ecology Watershed Assessment Form – this was developed specifically for watershed assessments and is a modified version of the "Ecological Reference Area Worksheet" from Interagency Technical Reference 1734-6, *Interpreting Indicators of Rangeland Health*. This form also included space to record the R-value for the site and the phases of the ecological site for sagebrush communities. A description of sage-grouse seasonal habitats was available for each member of the field crew. At each site the field observer determined if the site was suitable as sage-grouse habitat and if so, determined which seasonal habitat was present. This was recorded on the form.

- Rangeland Health Evaluation Worksheet, also developed from Technical Reference 1734-6.
- Range Inventory Worksheet – this was modified from the NRCS form of the same name.
- The "Standard Checklist" for PFC assessment for lotic systems from Technical Reference 1737-15, *A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas*.
- The "Lentic Standard Checklist" for PFC assessment from Technical Reference 1737-16, *A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas*.

Consequently, by completing these forms at each site, the observer obtained general information about the site, condition of the vegetation, information about noxious weeds, fire history, grazing, disturbances, erosion, land use, R-values, ecological site phases with respect to State and Transition models, sage-grouse seasonal habitat, a list of primary concerns regarding the site, and potential recommendations. The Range Inventory Worksheet provided a plant list and estimates of cover, utilization, and other indicators of range use. The Rangeland Health Evaluation Worksheet was critical in evaluating the departure of the current condition of a site from the ecological reference (i.e., ecological site description). The data and interpretation from this effort provided insight for developing management recommendations and determining if thresholds had been crossed. The PFC checklists were completed, but the PFC determination was not made. PFC is set up to be conducted by an interdisciplinary team, not a single individual. However, the items on the checklist are useful in identifying issues that need to be addressed and for setting priorities.

Part of this assessment also involved the observer identifying the seasonal habitat which was present at each site. The habitat descriptions (Appendix B) were compared with the existing vegetation and habitats which were provided by the existing habitat were indicated on the data sheet. In addition, the phase of the State and Transition Model for that ecological site was indicated on the data sheet. The four phases for the Loamy 8-10 inch p.z. model are indicated on Figure 1-5. The phase, Rangeland Inventory Worksheet, and sage-grouse seasonal habitat had to be consistent and this information was checked for consistency during data entry. For example, if the phase was indicated as phase 1 (i.e., herbaceous dominated) and the Rangeland Inventory Worksheet indicated 35 percent shrub cover, then there was an obvious error and the photo of the site was used to make a correction.

As a result, the evaluation of current conditions went well beyond the rapid assessment system developed by the BLM and included much more information which had a greater scientific basis than the rapid assessment system, and provided a means from which to make management recommendations.

3.2.4 Reference Conditions

The reference conditions used in this assessment were the ecological site descriptions provided by the NRCS. For each soil association polygon that was mapped, the ecological sites correlated to the soils within the association were determined. Inclusions (soils and ecological accounting for less than five percent of the soil map unit) were not included in the assessment, except for riparian areas that had high value for sage-grouse. The approximate acreage of each ecological site within the map unit was calculated based on the correlated soil percentage for each map unit.

The observer went into the field with a map of the soil map units, and a list of ecological sites for each map unit. The observer then used GPS units to ensure that they were in the correct soil map unit and used the ecological site description to locate each of the ecological sites. At each site the information described in Section 3.2.3 was collected.

The Rangeland Health Evaluation Worksheet, the Rangeland Inventory Worksheet, and the ecological site descriptions were used for determining if the current vegetation was within the unaltered state for that ecological site and which of the phases of the ecological site were currently expressed at the sample location. If the site had been subject to a recent fire, then an attempt was made to collect data from a burned and unburned portion of the ecological site.

The reference condition for PNC was basically the riparian and channel condition that was capable of withstanding a 25-year, 24-hour event. As this is defined by the characteristics of the watershed, there are not written reference areas for each individual creek. However, the assessment protocol allows an inter-disciplinary team to determine if the system is functioning properly or functioning at risk (upward or downward trend), or not functioning.

During the assessment process, the field observers were most often working individually, and not in inter-disciplinary teams. Therefore, a final assessment of the riparian and channel condition was not recorded. Instead, the indicators on the field form were used to identify issues that could be addressed in the recommendations section.

3.2.5 Interpretation

The data was entered into a database and entered into the GIS system to allow data analysis and graphic/spatial representation of the data. In many cases data was recorded at only one location within an ecological site polygon and the data from that one site was assigned as an attribute to the polygon. For example, if one noxious weed patch was recorded, the entire polygon would be represented graphically as having noxious weeds; an obvious overstatement of the actual conditions. In contrast, a polygon that was visited and no weeds were observed was represented graphically as having no weeds. Because of the size of the polygons and the available time to spend within each polygon, it is highly likely that not all weeds were observed.

Thus, the polygons that were classified as "weedless" are probably an under-representation of the distribution of noxious weeds. And some polygons were not visited so the presence or absence of noxious weeds was not determined.

A similar situation exists for all of the data categories, such as the R-values for sage-grouse habitat, rangeland health assessment, etc. This does not invalidate the assessment, but just demonstrates the limitations – additional site-specific work will be needed before any management actions are implemented.

However, because an acreage estimate for each soil and each correlated range site within the soil map unit was available, the acreage could be assigned to the waypoint obtained in the field. Therefore, even though the ecological sites were not mapped in the field because of time constraints, the estimate of acreage of each ecological site was entered into the database. Consequently, if a polygon (i.e., soil map unit) had an ecological site that was determined to be an R0 (i.e., Quality Habitat), the entire polygon would be depicted on any mapping product that showed where R0 habitat was found, even though the ecological site only represented a fraction of that polygon. But the acreage of R0 habitat within the polygon used in the summary tables is an estimate of the area of the ecological site, and not the area of the entire polygon. Consequently, the maps tend to overstate the categories of habitats, but they show the general location of the various R-values, and the summary tables of acreages are an accurate estimate of the acreage for each R-value.

If that same polygon also had an ecological site that was determined to be in R1 condition, then that same polygon would show up on a map of R0 sites and a map of R1 sites, but the acreages of the R0 and R1 in the tables would be based on NRCS percentages of each ecological site in the map unit.

Data queries were then conducted to identify the field sites where various conditions occurred based on the rangeland health or PFC assessments. For example, the NNSG Watershed Assessment Form included a data field for "shrub condition" and all the sites with "decadent" shrubs were identified. These sites have certain habitat values for a variety of wildlife species, but also are approaching a threshold where they can be readily converted to an altered ecological state. All of the sites were then displayed on a map to determine the extent of this condition. This process was followed for the various data fields which allowed for interpretation of the watershed condition.

3.2.6 Recommendations

The observers in the field were able to make recommendations with respect to management actions after collecting the data for the site. In all cases where the site represented a phase of the ecological site State and Transition model, the recommendation was based on maintaining the integrity of the ecological site. If the site was approaching a threshold for transitioning to an altered state, then the recommendation was focused on preventing the site from crossing the threshold. If the site had already crossed a threshold to an altered state, then a recommendation was made for transitioning back to the unaltered state. The recommendations were primarily for vegetation treatments or grazing management changes, or both. For riparian areas, spring or stream protection may also have been recommended, depending on the potential for success.

The recommendations are general, and prior to any implementation, a treatment plan would require some additional site-specific evaluation. The timing of a treatment, or the conditions under which a treatment should be applied, are site-specific decisions that cannot be decided on the general scale of the data collected in this assessment.

The recommendations were not based on providing additional seasonal habitats for sage-grouse. Because the phases of the various sagebrush ecological sites provide habitat for sage-grouse, the first priority was to maintain the integrity of the ecological site. This is the first step in maintaining sustainability of the site, for sage-grouse, vegetation, forage, and habitat for a variety of plants and animals. The distribution of the treatments in both space and time could be used to address the needs of sage-grouse or other priority management species.

3.3 Project Team

The work conducted for this project was under the direction of Great Basin Ecology, Inc. (GBE). Field work was conducted by Mr. Gary Brackley, retired range ecologist, Mr. Jim Evans, range ecologist with Basin and Range Resources, and Dr. Gary Back, Principal Ecologist at GBE. Mr. Gerald Miller, NRCS also assisted with the field data collection. Ms. Rachel Olsen, GIS Specialist at GBE and Ms. Stefanie Adams, Technical Editor at GBE, conducted all of the data entry, quality control, and data analysis. Ms. Olsen was responsible for production of maps and figures, as well as all data queries. Technical editing of the report was conducted by Ms. Adams.

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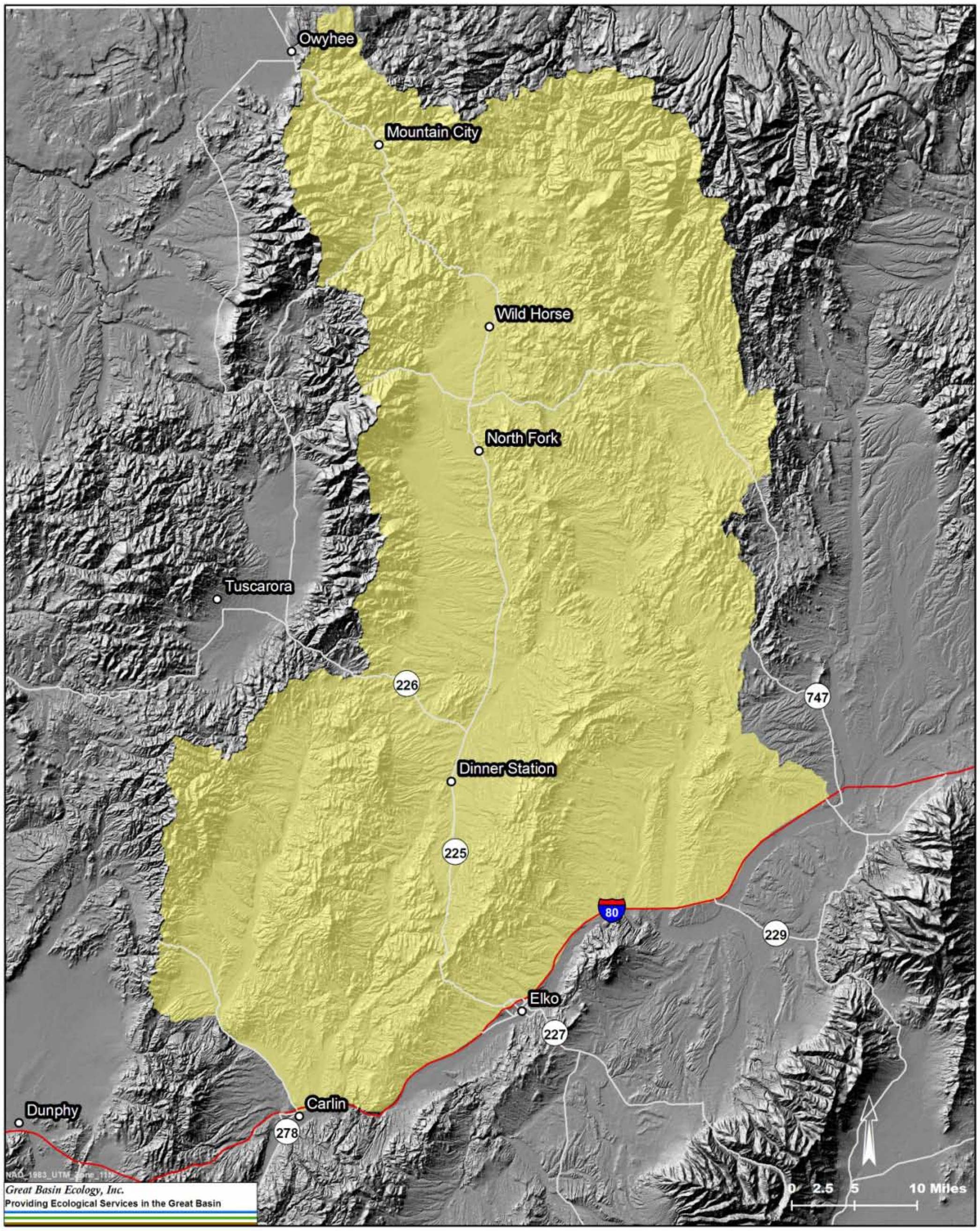
CHAPTER 2 – ASSESSMENT OF THE SAGE-GROUSE HABITAT IN THE NORTH FORK PMU



North Fork Population Management Unit Area

1.0 INTRODUCTION

The North Fork PMU encompasses 1,731,400 acres of which approximately 338,700 acres are administered by the U.S. Forest Service (USFS), 774,400 acres are administered by the BLM, 34,864 acres are administered by the Bureau of Indian Affairs (BIA), 581,300 acres are private lands, and 2,210 acres are water. Elevation ranges from about 4,900 feet above mean sea level (amsl) near Carlin to almost 10,000 feet amsl in the Independence Range and Jarbidge Mountains. Waters from this PMU drain to the Snake River drainage via the Upper Owyhee River Watershed and the Bruneau River Watershed and to the Humboldt River Basin.

The area is characterized by hot summers, especially at lower elevations, and cold winters. Precipitation can occur in any month, but winter snow accumulation is the primary source of recharge to the system. Precipitation at the lower elevations is much less than at the higher elevations.

The range of elevations, topographic variation in slope and aspect, and variety of landforms combine with the soils to create a mosaic of ecological sites on the landscape. This mosaic supports a wide variety of vegetation, from sub-alpine fir to salt desert shrub, and a broad array of wildlife species.

Except for a few vegetation types (e.g., aspen, conifer, etc.), the majority of the PMU has supported sage-grouse over the years. Approximately 1,200,000 acres within the PMU (69 percent of the PMU) are capable of providing some seasonal habitat for sage-grouse.

The NNSG (2004) identified the six highest risks to sage-grouse populations and habitat within this PMU (in no particular order) as:

- Habitat fragmentation;
- Changing land uses;
- Fire ecology;
- Livestock grazing;
- Predation; and
- Disturbance.

These risks as they occur today are discussed in the next section (Section 2.0). The assessment of the habitat using the R-values (BLM rapid assessment method) is discussed in Section 3.0. The rangeland health/ecological site assessment is discussed in Section 4.0

2.0 ASSESSMENT OF SAGE-GROUSE HABITAT IN THE NORTH FORK PMU – HABITAT RISKS

2.1 Habitat Fragmentation

Habitat fragmentation occurs when "large" areas of suitable habitat are broken up and portions of the original area are replaced with non-habitat. Obviously, the definition of large is species-specific, as what is large to a rabbit may be small to a sage-grouse relative to the areas they use throughout the year. Also, the non-habitat is species-specific. By far the most important factor in habitat fragmentation in the PMU is fire. Since 1980, approximately 2,190,000 acres of the PMU have burned. Because the PMU is only 1,731,000 acres, this indicates that some acreage has burned multiple times. The area along the I-80 corridor between Elko and Carlin is probably the area that has burned the most times. As depicted in Figure 2-1, the fires since 1999 have been larger, but they have also occurred away from the I-80 corridor. Large areas of sagebrush habitat were replaced with grasslands, and fortunately many of these grasslands are areas where perennial grasses were released (Photo 1) or fire rehabilitation efforts were successful in establishing perennial grasses. These areas are the sage-grouse habitats of the future. While there are many islands of unburned vegetation within the burned areas, most of these islands consists of low sagebrush or black sagebrush. These two sagebrush species provide habitat for sage-grouse at different times of the year, but they are generally covered with snow during the winter and are unavailable. These low-growing sagebrush species generally do not provide quality nesting habitat. Therefore, the short-term (i.e., 10-30 years) impact of these fires through the removal of big sagebrush is a reduction in lek, nesting, brood, summer, and winter habitats.

However, these areas are not devoid of value for sage-grouse. During the field work in this area, and in other parts of Elko County, sage-grouse droppings are being observed in these burned areas (Photos 2 and 3). The majority of the use appears to be early spring, based on the content of the droppings. This is a time when the hen is seeking highly nutritious forage to prepare for egg-laying and the burned areas that are one or more years post-fire provide this nutrition in the forbs and the insects associated with the forbs.

The unburned islands of vegetation within the burns also appear to be attractive to sage-grouse. Sage-grouse droppings were observed in many of the unburned islands visited. Sage-grouse and their sign were also observed in the large blocks of unburned sagebrush. Because of their mobility, sage-grouse are more likely to use these widely spaced islands. Therefore, while these burned areas do not represent the typical sagebrush habitat for sage-grouse, these areas are in the process of following the plant dynamics depicted in Figure 1-5. Because many of the areas had sagebrush seedlings already established, these areas should be providing for sage-grouse nesting

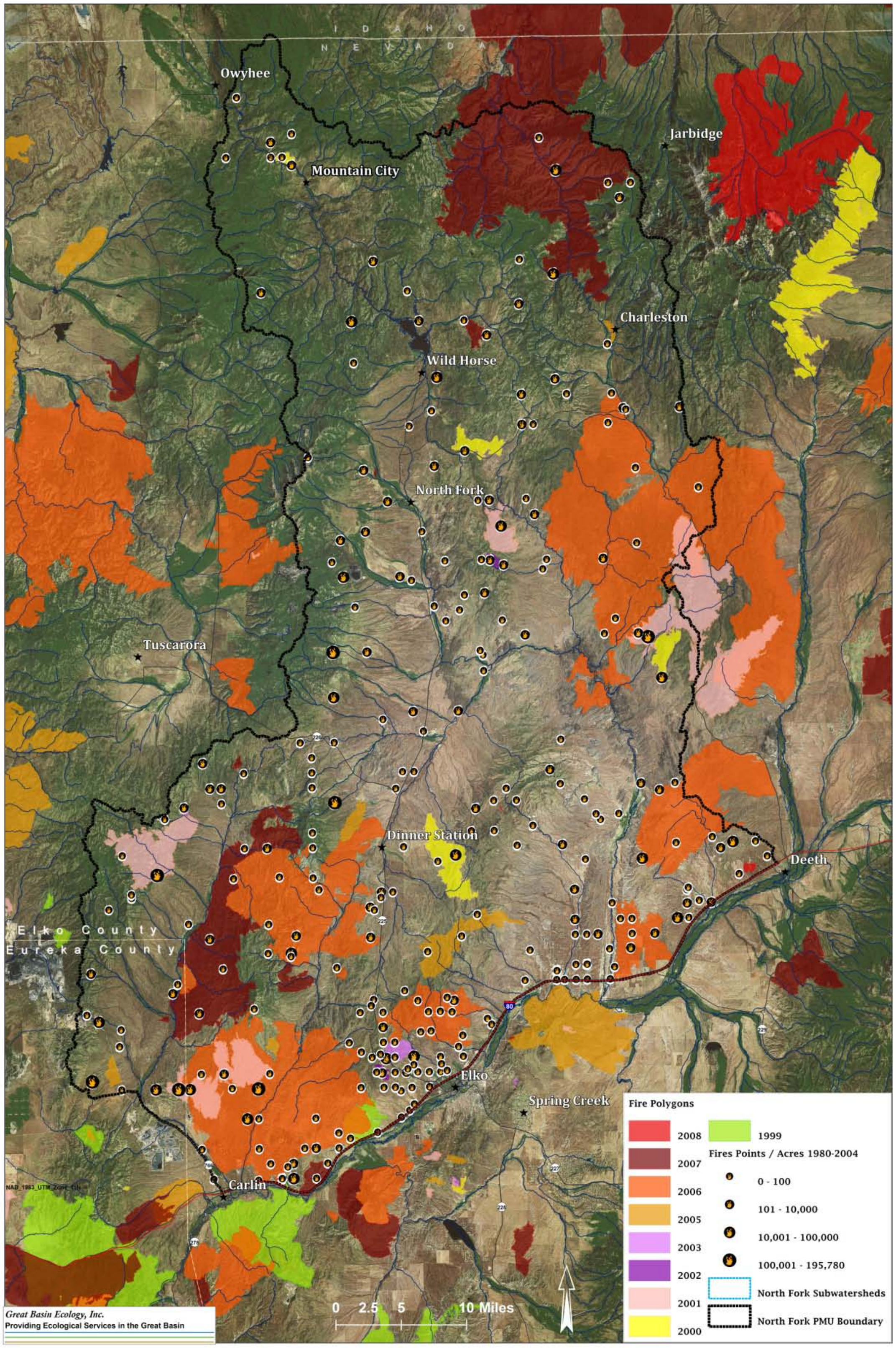


Figure 2 - 1 : Fire History within the North Fork PMU 1980-2008

Photo 1: Burned Area with Perennial Grass and Forb Release

Photo 2: Burned Area Used by Sage-Grouse in the Spring

Photo 3: Sage-Grouse Spring Roost Site At Site Depicted in Photo 2

in as little as ten years. Consequently, this type of fragmentation is of relatively short duration and temporary in space and time.

Fragmentation is also caused by roads (major paved roads, but not necessarily the two track roads), power lines, home sites, mining development and exploration, and conversion of sagebrush to crested wheatgrass.

Major roads, power lines, home sites, and conversion to crested wheatgrass can be permanent or long-term impacts. While crested wheatgrass seedings may have sagebrush reestablishment over time, these areas generally remain low in forb diversity and abundance for many years. The other factors listed above tend to be very long-term or permanent. Because sage-grouse are highly mobile, they can fly over some of these fragment habitats. However, power lines have been documented as hazards for flying sage-grouse and areas with a high density of homes or ranchettes are generally avoided by sage-grouse. This is due in part to the modification of the habitat, but also the presence of domestic dogs and cats.

These types of fragmentation factors tend to be concentrated near Elko, Carlin, and the I-80 corridor. But as solar and wind power technologies improve, homes are likely to be established wherever private land is available that is suitable for building.

2.2 Changing Land Uses

The expansion of the population in Elko County since the mid-1980s has resulted in more housing along the I-80 corridor and in areas away from the corridor (e.g., Adobe Ranchettes). This has been the major change in land use – from rangelands to residential. As discussed above, this generally results in a loss of habitat for sage-grouse and avoidance of the area because of the activity and domestic animals.

Mining has been the major stimulus for the population growth and mineral exploration and mine development are ongoing in the PMU. The Jerrit Canyon Joint Venture mine is the largest active mine in the PMU. Some exploration related to the Carlin Trend projects occurs in the PMU, but none of the Carlin Trend mines are located in the North Fork PMU. Exploration projects in the Independence Range and in the vicinity of Wild Horse Reservoir (i.e., 20-mile radius) are the primary areas where mining/exploration activity is occurring.

2.3 Fire Ecology

Basic fire ecology is discussed at length in the NNSG Strategy (NNSG 2004). The focus for the PMU is to relate how fire ecology has changed in the last 150 years.

Because grazing has been the dominant land use on most of the PMU for about 150 years, the potential exists for changes in fire ecology to have occurred. Changes in fire ecology are the result of changes in plant community composition (i.e., change of species) and/or a change in the relative abundance of the species (i.e., a shift in composition from one life form or fuel type to another). Both factors have been involved in the North Fork PMU.

Figure 2-2 depicts the fire ecology for the Loamy 8-10" p.z. ecological site. During the period that herbaceous vegetation is the dominant feature of the plant community fires are likely to be of low severity – very little mortality to most plants, except those that are highly susceptible to fire damage. Fires under these conditions are also likely to be relatively small as the fine fuels are low in stature and widely spaced. Therefore, unless burn conditions are extreme (i.e., low humidity, high air temperature, high winds, and low fuel moisture), burning the herbaceous vegetation results in small fires with little impact. Essentially, fires in this portion of Figure 2-2, "shift" the plant community to the left – back to a predominantly grass community with few shrubs.

If fire is kept out of the system for 15 to 25 years, the shrubs have an opportunity to increase to the point where they compete with the herbaceous plants, and the fuel loading (mix of fuel types and types of fuels) is such that the fires can impact more plant species as well as have effects on soil surface features. This includes seeds lying dormant on the ground, organic material in the soil, and soil organisms. However, the fuels are still widely spaced and fires would be expected to be larger than the grass fires, but not extremely large. Under these conditions, the grasses provide the fuel continuity between shrubs.

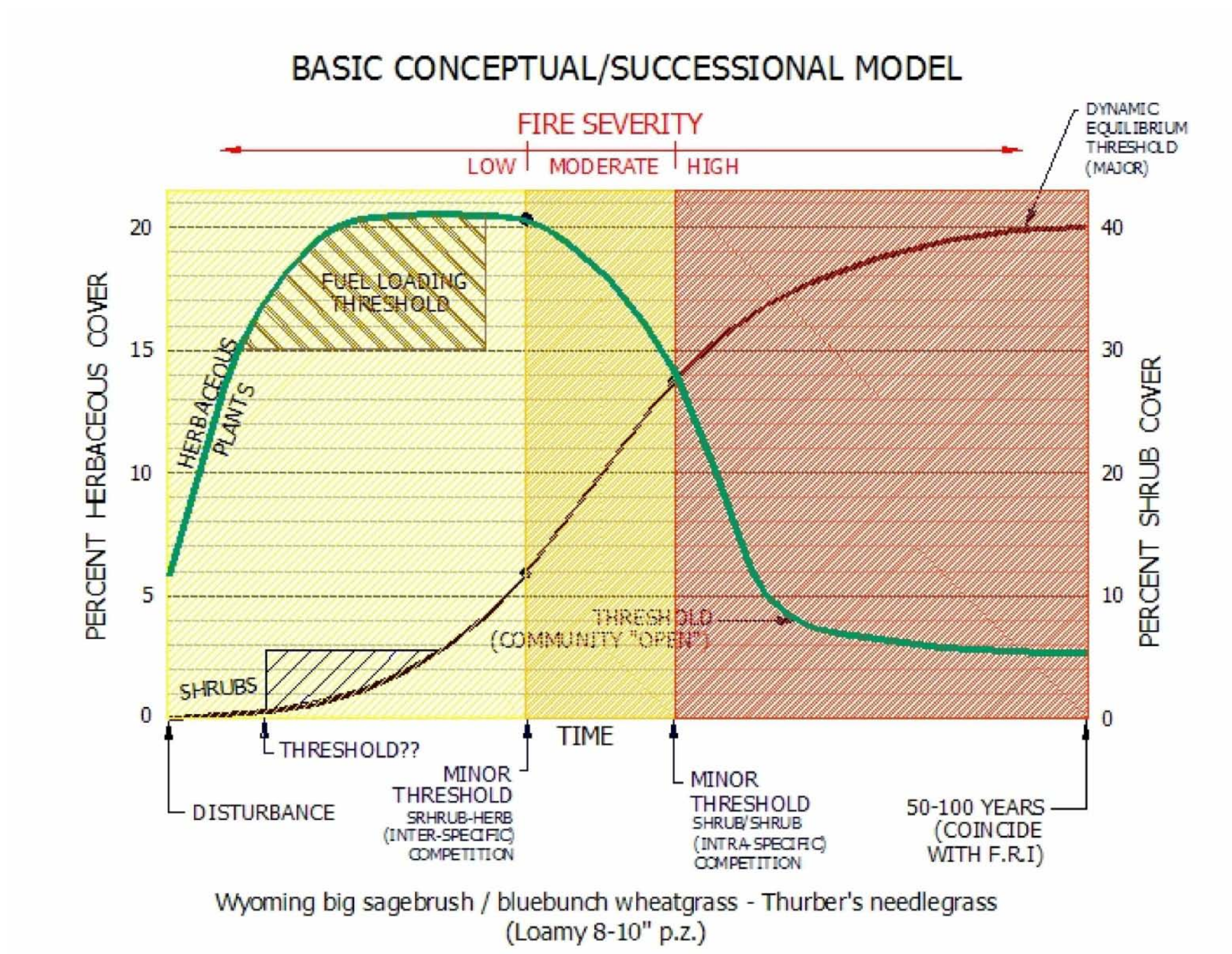


Figure 2 - 2: Loamy 8-10" p.z. Ecological Site - Fire Ecology

Once shrubs dominate the system, the fire severity increases. Plant mortality is common for shrubs as well as herbaceous species. Changes in the organic layer of the soil are common at the time of the fire and soil loss is common following the fire. In general, the higher the density or amount of shrub cover, the more severe the fire. The lack of grasses is not important to fire behavior as the fire behavior is primarily the result of shrub cover. The fires spread from crown to crown as the interspaces between shrubs is small relative to flame lengths in this fuel type.

Pre-settlement vegetation was a result of fire in these three fuel loading categories. Miller and Eddleman (2000) conclude that given the conditions prior to settlement, there would have been a range or mosaic of fuel loading conditions on the landscape. This would have resulted in fairly robust sage-grouse populations, as all of the seasonal habitats required by sage-grouse would likely have been on the landscape.

With the addition of livestock grazing in the 1860s, the fire ecology of the sagebrush communities was altered. Grazing the grass-dominated sites removed sufficient fuel such that fires rarely started in the grasses if they had been grazed into the late summer. Even under extreme conditions, the fuel would be too short and too widely spaced to allow this grazed vegetation to burn. As a result, sagebrush seedlings would not have been subjected to fire and the shrubs would have increased on the site more quickly than without grazing (Figure 2-3).

Even though the shrubs would have increased the fuel loading and increased the ratio of long-term to short-term fuels, the shrubs would have been widely spaced and the grazing would have reduced the potential for fires to carry except under extreme conditions. As a result, very few "moderate" intensity fires would have occurred and there would have been a shift toward larger acreages of mature sagebrush (Figure 2-3).

This shift in plant community composition would have created conditions for large, contiguous fires of high severity. Beginning in the 1960s fires began to get bigger in northern Nevada. In the 1980s the fires along the I-80 corridor between Elko and Carlin were considered large fires, but the trend since 1999 has been for increasingly larger fires.

The 1960s was also the time that cheatgrass began to appear in Elko County in large patches. Consequently, areas along the I-80 corridor crossed a threshold and changed states from a sagebrush-bunchgrass ecological site to an annual grass/annual weed ecological state. Thus in approximately 100 to 120 years, grazing and the introduction of cheatgrass were able to affect a change in fire ecology that resulted in a shift in the landscape from a mosaic of grass, grass-shrub, and shrub-grass patches to

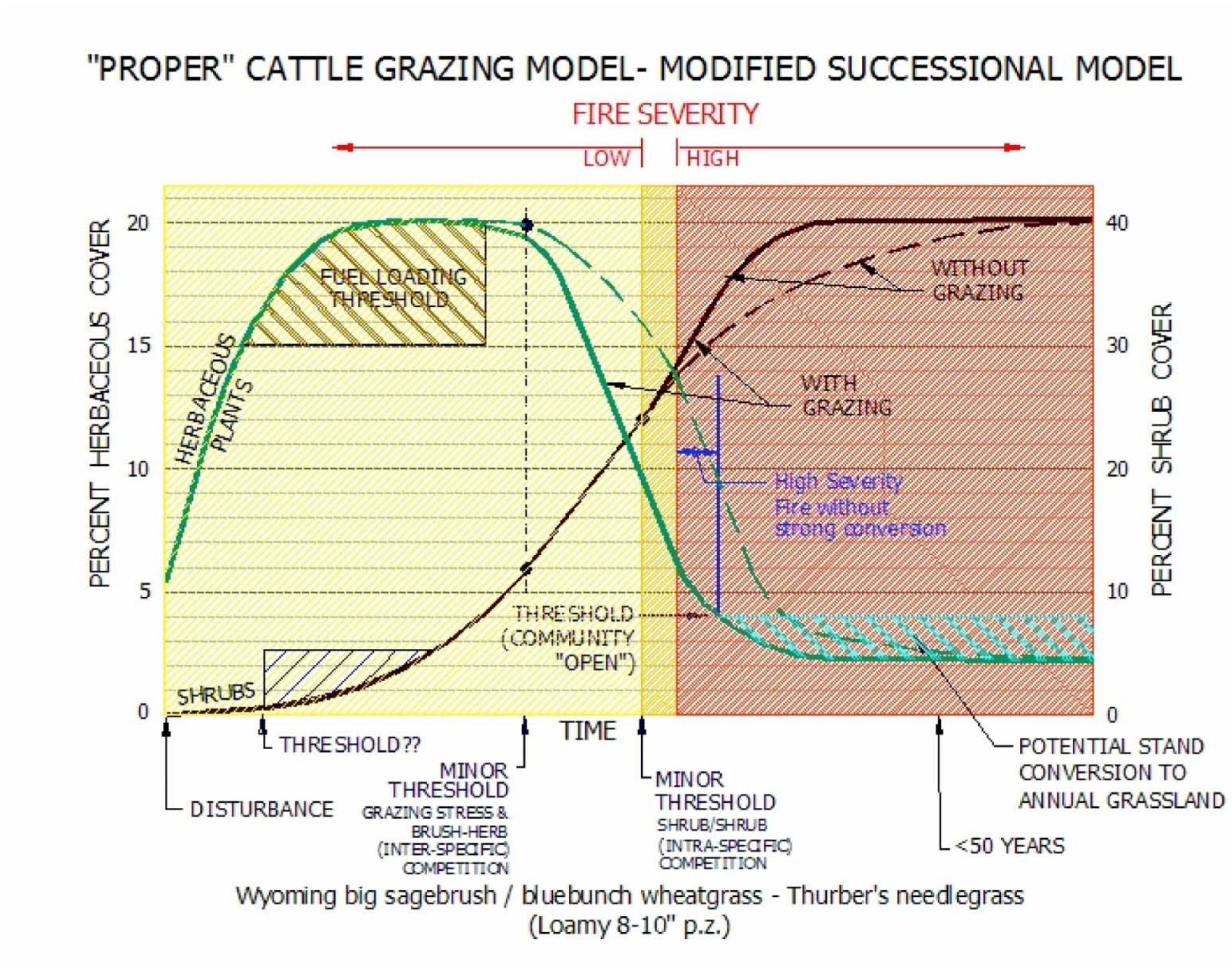


Figure 2 - 3: Fire Ecology of the Loamy 8-10 Inch p.z. Subject to Proper Grazing

predominantly a contiguous shrub-grass landscape, except where fires resulted in conversion to cheatgrass.[5]

The shrub dominance has resulted in larger fires because of the contiguous fuels and high fuel loading. The conversion to cheatgrass has resulted in more frequent fires, as well as larger fires, as the cheatgrass has established in the understory of the sagebrush communities prior to the fires, and then dominated in the post-fire area.

This is not to say that grazing was "bad," but rather to point out that these changes were occurring very slowly and subtly on the landscape and the natural resource managers were not aware of the magnitude of the shift in conditions until the large fires became common. Now that there is an understanding of how livestock can influence fire ecology of the various ecological sites, adjustments in the management of the vegetation can be implemented to prevent the crossing of thresholds and prevent conversion to cheatgrass.

The fires in the North Fork PMU over the last 11 years are much larger on average than the 11 years previous to 1999. Large fires are going to continue to occur, putting the remaining intact sagebrush at risk.

2.4 Livestock Grazing

The impact of livestock grazing on sage-grouse habitats has been a well-debated topic. The following discussion is an attempt to lend some understanding of how an impact occurs and to provide a basis for reducing potential impacts.

The quality of the remaining intact sagebrush areas within the PMU can be impacted by livestock grazing. As demonstrated in Figure 2-4, proper grazing has little impact on herbaceous plants until the plant community has reached the capacity of the ecological site to produce biomass. At that point, the grasses and forbs are in competition with each other for nutrients and moisture. Generally, sagebrush and other shrubs will also begin to increase in abundance, increasing the competition in the plant community. As demonstrated in Figures 1-5 and 1-6, the grasses and forbs begin to decline, in the absence of grazing, because of this competition with shrubs. At this point, grazing, even proper grazing, becomes an additional stress on the herbaceous plants. Therefore, the rate of decline of the herbaceous component of the plant community increases. This is depicted in Figure 2-4.

As the grasses and forbs decline in cover and abundance, there can also be changes in relative species composition. Depending on the grazing system, some grasses that are more palatable at certain times of the growing season may receive more of the forage removal (i.e., utilization) than other species. Therefore the "stress" of the herbivory is

[5] During this time period, changes were also occurring that resulted in a shift from sagebrush communities to P-J communities in other PMUs, but this occurred on only a small percentage of the North Fork PMU.

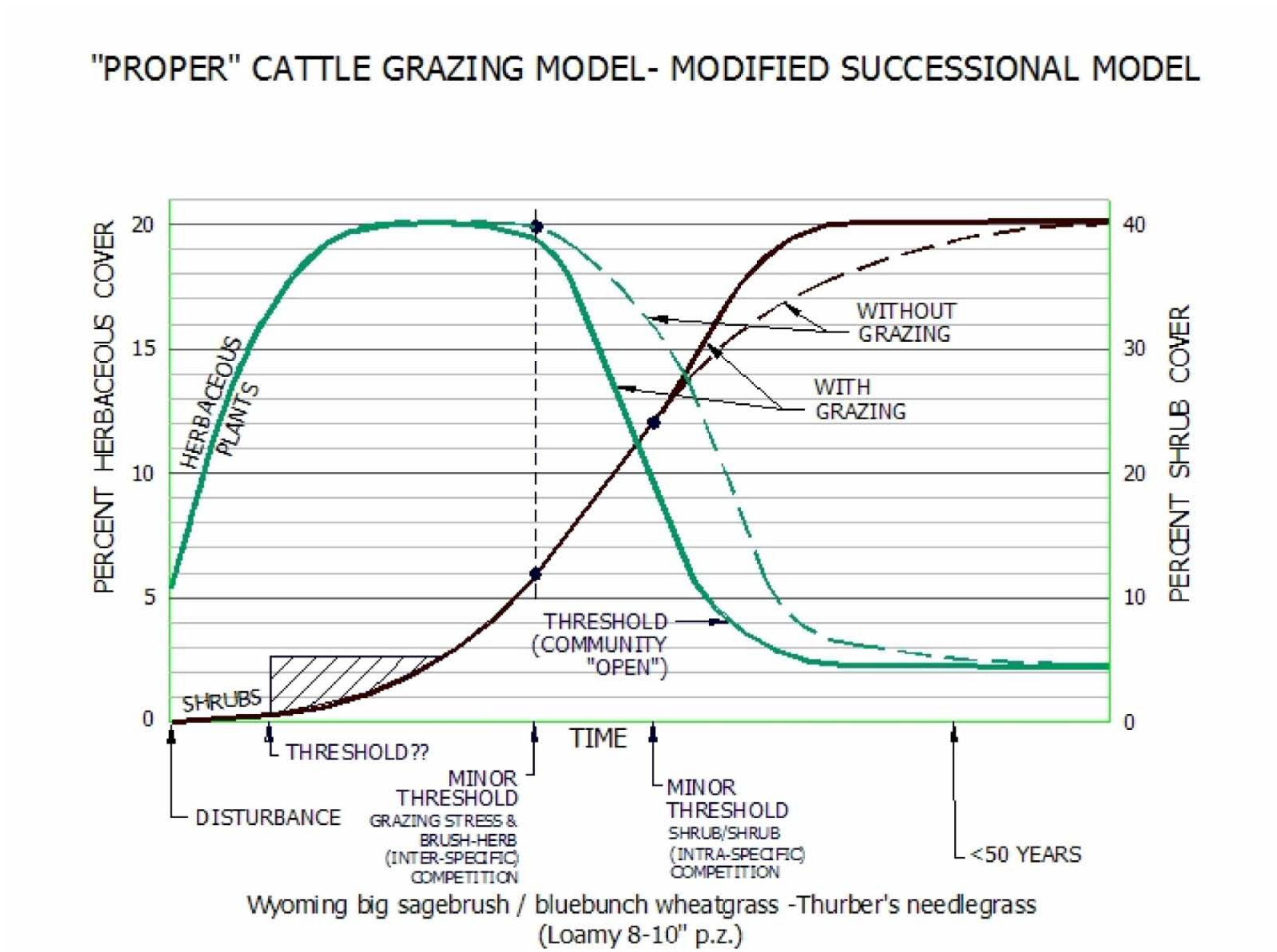


Figure 2 - 4: Loamy 8-10 Inch p.z. Model with Proper Grazing

not evenly distributed across the plant community. In addition, when the grass abundance approaches about ten percent, another grazing impact is likely to occur.

For the Loamy 8-10" p.z. ecological site, the herbaceous component approaches ten percent of the community composition (by cover) when sagebrush and other shrubs approach 22 percent cover. At this point, it may take the herbivore several steps to find the desired grass species. Prior to this, the herbivore may be able to obtain a bite per step. But once the herbivore has to take several steps to find a plant, then the herbivore is likely to take several bites before moving on. Simply put, the animal needs to take more bites per plant to maintain a constant rate of intake in s shrub-dominated community as compared to foraging in a more open community with more grasses. This is where utilization levels begin to reach unacceptable levels and the impact of this additional forage removal is added stress on the affected plants.[6]

This has the consequence of continuing the decline of the herbaceous component. While all of this seems quite "negative," examination of Figure 2-4 clearly shows that the impact of shrub competition with the herbaceous plant is the major driving force of this dynamic system. Livestock grazing has a minor effect, reducing the amount of herbaceous cover relative to the un-grazed graph by about eight or nine percent at the maximum level of impact.

Figures 2-5 and 2-6 show this grazing impact on the vegetation and on sage-grouse habitats. The magnitude of the impact varies based on which phase of the ecological site is available for grazing. Grazing a phase 1 condition has very little impact. The effects of grazing begin in phase 2 and continue through phases 3 and 4. The effects of grazing are additive to the shrub-herbaceous competition and are greatest as the shrub-herbaceous competition increases. Basically, livestock grazing accelerates the rate of change in the plant communities from a grass-dominated community to a shrub-dominated community. This shortens the period of time that the certain seasonal habitats will be available on the landscape at some specific location.

With respect to riparian areas, the impact of grazing is related to the forage quality and quantity that livestock can obtain away from these sites – generally within two miles of water, depending on topography. As demonstrated in Figures 2-5 and 2-6, the impact of grazing is minimal on upland sites when the vegetation is dominated by grasses. Livestock are more likely to use phase 1 of the model for each ecological site than phase 4 if both are available. Therefore, the creation of areas with abundant grass (i.e., phase 1) away from the riparian areas is likely to draw the livestock away from the riparian areas during the growing season, except for daily watering and some incidental foraging.

In contrast, when the area is shrub-dominated, the livestock are likely to spend spring and summer in the riparian areas because the riparian areas are the only places they

[6] The solution to the utilization issue is not to reduce the duration of grazing or number of grazing animals, but to manage the vegetation.

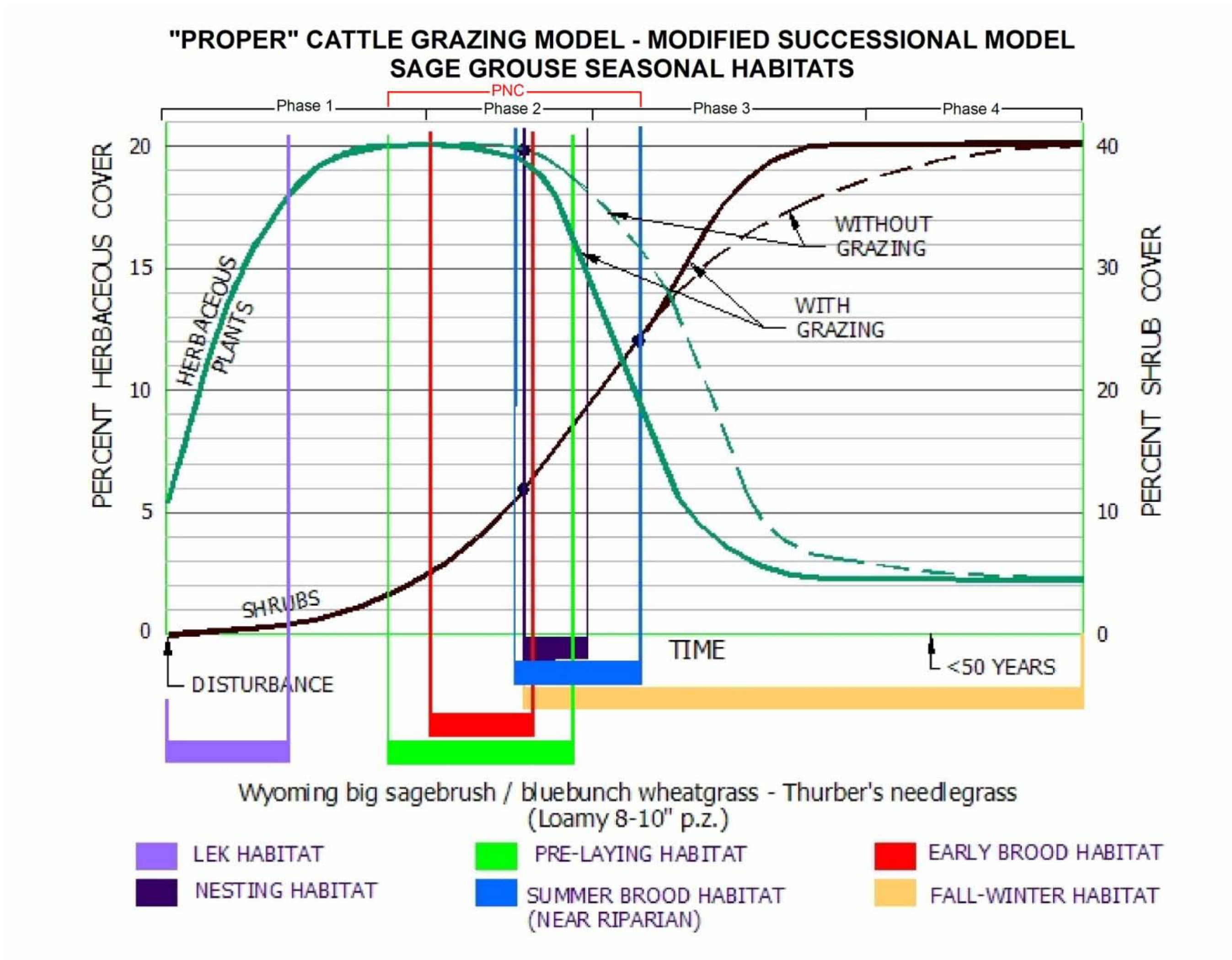


Figure 2 - 5: Grazing Impact to Sage-Grouse Seasonal Habitats - Loamy 8-10" p.z. Ecological Site

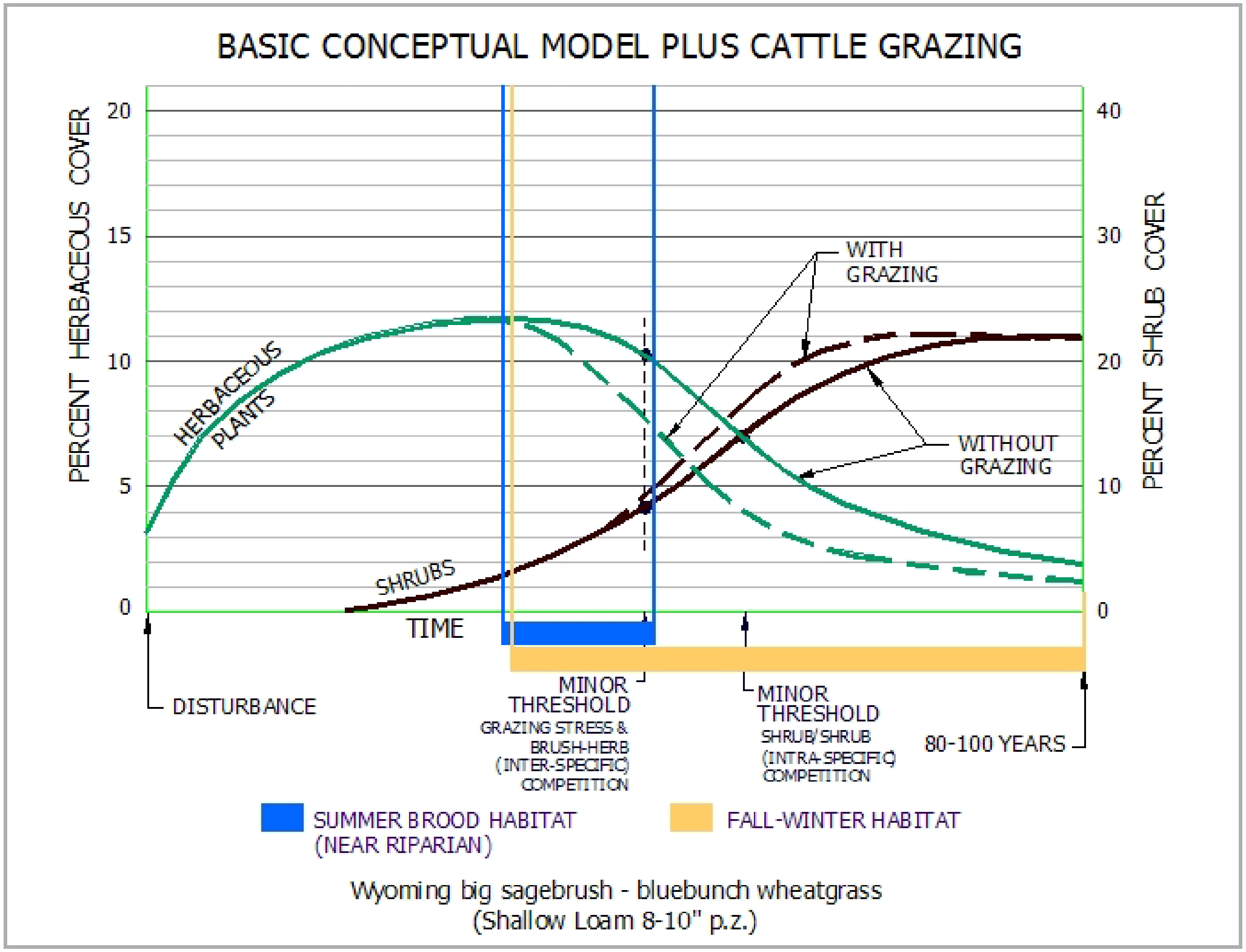


Figure 2 - 6: Grazing Impact to Sage-Grouse Seasonal Habitats – Shallow Loam 8-10" p.z. Ecological Site

can meet their water and nutritional requirements in a timeframe that allows them to maintain or gain weight. The livestock don't have to "search" for grasses in between the shrubs within the riparian area. This was evident during the field work. Almost every spring that had been impacted by livestock was located adjacent to dense, decadent sagebrush with very little understory.

Certainly the adjacent topography, class of livestock, and season all factor into the amount of livestock use at springs and riparian areas, but a portion of this use can be reduced by changing the vegetation on the landscape.

The important aspect of livestock grazing impacts to riparian habitat is how the grazing lowers the energy threshold required to cause channel erosion. As part of the PFC evaluation, the observer is to evaluate the system with respect to the 25-year, 24-hour precipitation/runoff event. Implicit in this concept is that large events are going to cause channel changes; one should not look at the riparian vegetation as needing to withstand all events. Therefore, if the existing vegetation and channel morphology are such that the system could withstand a 25-year, 24-hour event, then the grazing impacts are not significant. However, if the grazing modifies the degree to which the site can withstand the 25-year, 24-hour event, then this lowering of the threshold to resistance becomes a significant impact with respect to the functionality of the riparian system. The greater the threshold is lowered, the greater the anticipated effects of a large event.

Another important aspect of livestock grazing impacts to riparian habitat is how the grazing can delay the recovery of a system following a 25-year, 24-hour event. Vegetation that establishes on point bars and other areas of aggradation, begins to stabilize the system by reducing stream energy, resulting in deposition of sediment. Willows and cottonwoods are two such species that can colonize these point bars and eventually provide important value to the riparian area. However, sedges, rushes, and meadow grasses are also stabilizing species. The young woody sprouts and grass or grass-like species are susceptible to grazing impacts. Therefore, management of upland vegetation to provide alternative forage for livestock is an important aspect of riparian management.

2.5 Predation

Predation is the most controversial aspect of assessing the health of sage-grouse populations. Many are of the opinion that predator control is the only remedy necessary to prevent sage-grouse from being listed as threatened or endangered. Others are of the opinion that predator control is overrated and is not likely to provide any long-term relief to sage-grouse populations unless continued into perpetuity. The science of predation ecology is quite complex and involves understanding many variables that determine when a predator selects a specific prey and how effective the predator will be in detecting and pursuing the prey species.

Given the analysis of wing data collected by the Nevada Department of Wildlife (NDOW), an insufficient number of eggs and young are surviving their first year to maintain a stable population. Annual variation in survival rates seems to be providing an occasional year or years where a slight increase in population may be observed, but the long-term trend in population is downward. The mortality rate of adults is less than mortality rates of eggs and young. Therefore, increasing the survival of eggs and young birds needs to be one of the components of any sage-grouse management plan.

Because the focus of this assessment is habitat quality, quantity, and distribution, improvement of pre-laying, nesting, and early brood habitat, referred to in the remainder of this document as the "production habitats" is the key habitat aspect to dealing with predation.

2.6 Disturbance

The NNSG Strategy (2004) defined disturbance as human activities that do not impact the habitat, but directly interfere with sage-grouse. This would include activities that disrupt breeding, or cause birds to abandon certain habitats close to human activity.

Within the PMU the following disturbance activities have been identified:

- Mining and exploration;
- Power lines;
- Ranchettes/subdividing; and
- Off-road vehicle abuse.

Mining and exploration within the PMU are confined to certain areas. Mining and exploration in the Independence Range has been ongoing since the early 1980s. This is primarily in summer habitats and winter roost habitat for sage-grouse. Much of the habitat in the Independence Range consists of aspen or conifer woodlands and is not considered sage-grouse habitat. Reclamation of completed facilities has been ongoing and the level of human activity has declined in recent years. The exploration projects are spread out over the mountain range and other areas of the PMU. Where the projects occur on public lands, they are generally subject to seasonal restrictions to prevent or reduce disturbance impacts to sage-grouse.

Power lines traverse the PMU with a major line crossing the southern end of the Independence Range near Taylor Canyon and continuing through the PMU. A spur from this line extends northward along the foothills of the Independence Range to the Jerritt Canyon Mine. Many smaller lines convey power to the mines, communities (Owyhee, Mountain City, Wild Horse), as well as the ranches throughout the area. Many of the lines follow existing roads, but the larger lines cross expanses of roadless areas. Due to the fires, much of the areas where power lines exist do not currently support sage-grouse habitat.

Similarly, the Ruby Pipeline construction is a temporary disturbance. This includes disturbance from trucks delivering pipe, as well as equipment digging the trench, placing the pipe, and covering the pipe. The duration of the disturbance is short-term, and it is anticipated that the level of activity will be greatly reduced after the first year of construction. After which, there will be maintenance and monitoring activity of pumping stations.

Subdivisions and ranchettes are most common along the I-80 corridor, but development near Wild Horse Reservoir and in the Adobe Range are the two areas where most of the development is occurring. Expansion around Elko is also occurring, but much of the land around Elko has been subject to fire or other disturbance that has precluded use by sage-grouse.

Off-road vehicle abuse/use is currently an issue. Many of the roads created for ranching activities are generally used a few times a year to check fences, put out mineral supplements, inspect/repair water developments, etc. When only used a few times a year, the vegetation remains intact, or at least in sufficient amount to keep the roads from eroding. However, with the advent of all-terrain vehicles (ATVs and UTVs), these roads get more use, especially during hunting season. When there is a high level of soil moisture in the fall, after fall storms or early snowfall, these roads are easily disturbed. The ruts created by this use become the routes for runoff and the ruts are easily eroded. The result is a gully, which causes people to expand the road by driving around the eroded site. Consequently, the problem grows in size. There is not much information on the impact of these vehicles traveling on roads through sage-grouse habitat; however, the birds generally flush and leave the site. The impact would seem to be determined by the amount of traffic and the amount of use that sage-grouse make of a specific area. The higher the traffic and the more use by sage-grouse, the greater the odds for encounters and an impact. Whereas, the occasional use by ATVs is not likely to cause sage-grouse to avoid the area.

3.0 Assessment of Sage-Grouse Habitat in the North Fork PMU – Rapid Assessment/R-Values

The objective of the PMU assessment was to refine the habitat assessment conducted by the NNSG, which was a very cursory assessment. At each "waypoint" where an observer stopped within an ecological site to take data, the vegetation was evaluated with respect to the criteria described in Section 3.2.3 of Chapter 1. This value was assigned to all the acreage within the ecological site, unless there was a compelling reason to believe the point was not representative (i.e., if a portion of the site was burned and a portion was not burned). If this occurred, then a second waypoint was taken in the portion of the ecological site that was in a different condition and the acreage associated with the second point was estimated and entered into the database.

As a result, an estimate of the acreage of each habitat condition or R-value was obtained. The location of the acreage was not mapped, but associated with the soil association polygon. Therefore, in the figures that follow, the distribution of R-value or habitat conditions is displayed by soil association polygon. Because a soil association polygon is made up of three soils, and each soil is correlated to an ecological site, the same soil association polygon can have more than one R-value assigned to it. Therefore, the figures show the approximate location of the habitat condition, but not the precise location. However, the acreages are accurate to the degree possible with the field data collection methods.

In addition the areas that are "currently, historically, or potentially capable of supporting sage-grouse populations" there are habitats that are not suitable sage-grouse habitat. Aspen, conifer, and mahogany woodlands are examples of such non-sage-grouse habitat. The PMU included approximately 726,100 acres of non-habitat. This was primarily high elevation woodlands within the National Forest, private lands which have been developed primarily along the I-80 corridor, and open water.

3.1 R0 Areas

The R0 is the quality habitat category. This category provides some combination of shrubs and herbaceous vegetation to support sage-grouse. The R0 category does not indicate which seasonal habitat is provided at the given location, but just that the habitat is suitable for some seasonal use by sage-grouse. Photo 4 is an example of the R0 habitat condition. The R0 condition was found on approximately 235,000 acres within the PMU. This represents approximately 13.6 percent of the PMU area.

The soil association polygons with R-0 condition habitat are depicted on Figure 2-7. Of the 235,000 acres of this habitat condition, 76,400 or 32.5 percent occurred at elevations greater than 6,500 feet amsl. The significance of the 6,500 foot elevation is that in Elko County, areas above this elevation are generally snow covered during the end of April and into the month of May and not available for nesting or early brood cover. Therefore, only 158,600 acres or 67.5 percent of the R-0 condition habitat would be available as nesting and early brood habitat. This represents only 9.2 percent of the total PMU, and not all of this acreage is high quality nesting or early brood habitat.

The area above 6,500 feet elevation is generally considered summer habitat and can be used as winter night roost habitat. The birds fly to these high elevation areas at dusk after feeding and spend the night in a snow burrow in the deep powder conditions at these elevations. They will also use wind-swept ridges on calm nights for roosting if air temperatures are at or above freezing. Because of the higher moisture during the growing season at these elevations, the sagebrush habitats provide high quality cover and also foraging habitat. Generally these high elevation habitats, especially on north slopes, provide adequate herbaceous forage and insects, reducing the dependency on springs and riparian areas. However, this habitat represents only 4.4 percent of the total PMU area.

Photo 4: Example of R0 Habitat Condition

The areas below 6,500 feet may provide summer habitat if adjacent to springs or riparian areas. At these lower elevations, the upland forbs desiccate by late June or early July. The riparian vegetation at the springs and creeks becomes the main forage base during the mid-summer to fall period. After frost kills the remaining forbs, the low elevation sagebrush stands of low sagebrush, black sagebrush, and Wyoming big sagebrush become the primary forage areas.

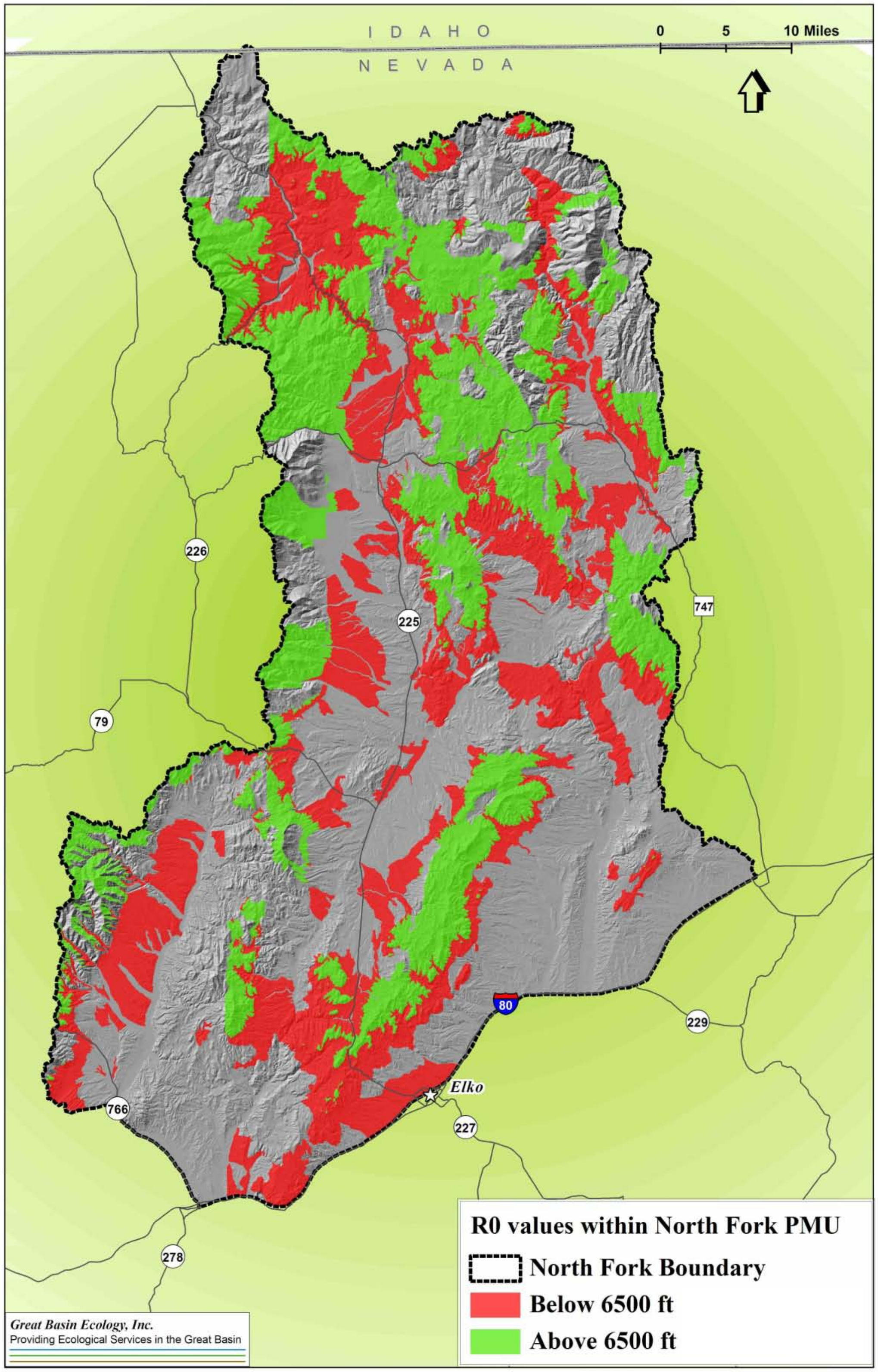


Figure 2 - 7: Polygons With R0 Value Habitats Within the North Fork PMU

Photo 5: Example of R1 Habitat Condition

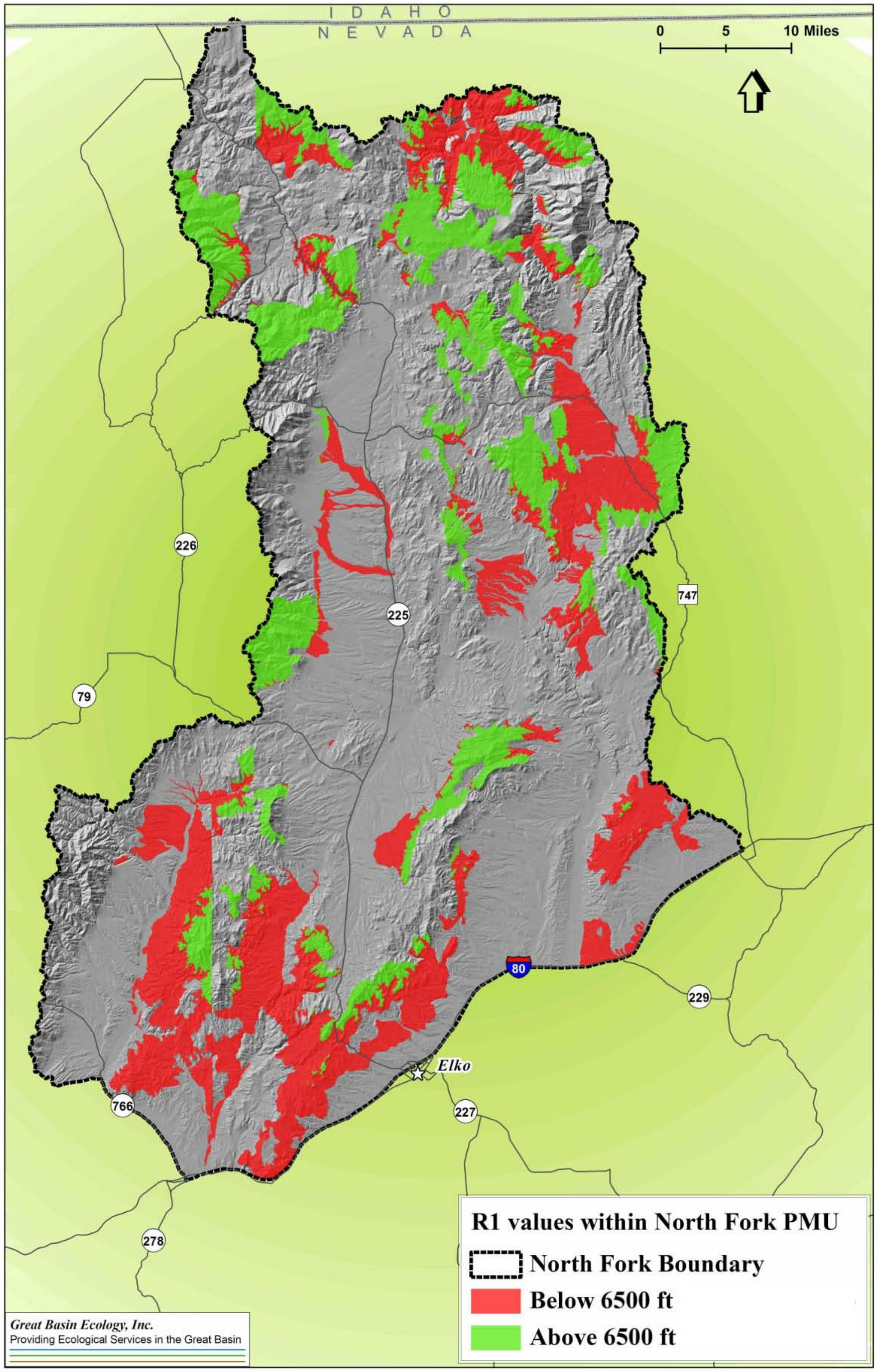


Figure 2 - 8: Polygons With R1 Value Habitats Within the North Fork PMU

3.2 R2a Areas

The R2a areas consist of decadent sagebrush that exceeds the recommended values (i.e., 35% canopy cover and/or > 40 inches tall). These areas generally have less than 10 percent herbaceous cover in the understory (Photo 6). While these habitats have some value as winter habitat, they do not provide suitable habitat for the other seasons of the year. The R2a value habitats are indicated on Figure 2-9. This habitat condition accounts for approximately 350,900 acres or 20.3 percent of the PMU. With proper management, these areas have potential to provide a variety of seasonal habitats for sage-grouse.

However, these areas are at high risk for wildfire and subsequent conversion to cheatgrass. The sparse understory is open for establishment of cheatgrass and when burned, the cheatgrass will dominate these sites. If the vegetation burns before cheatgrass establishes, the high percentage of bare ground after the fire will be a suitable seedbed for cheatgrass and other annual invasive species.

Photo 6: Example of R2a Habitat Condition

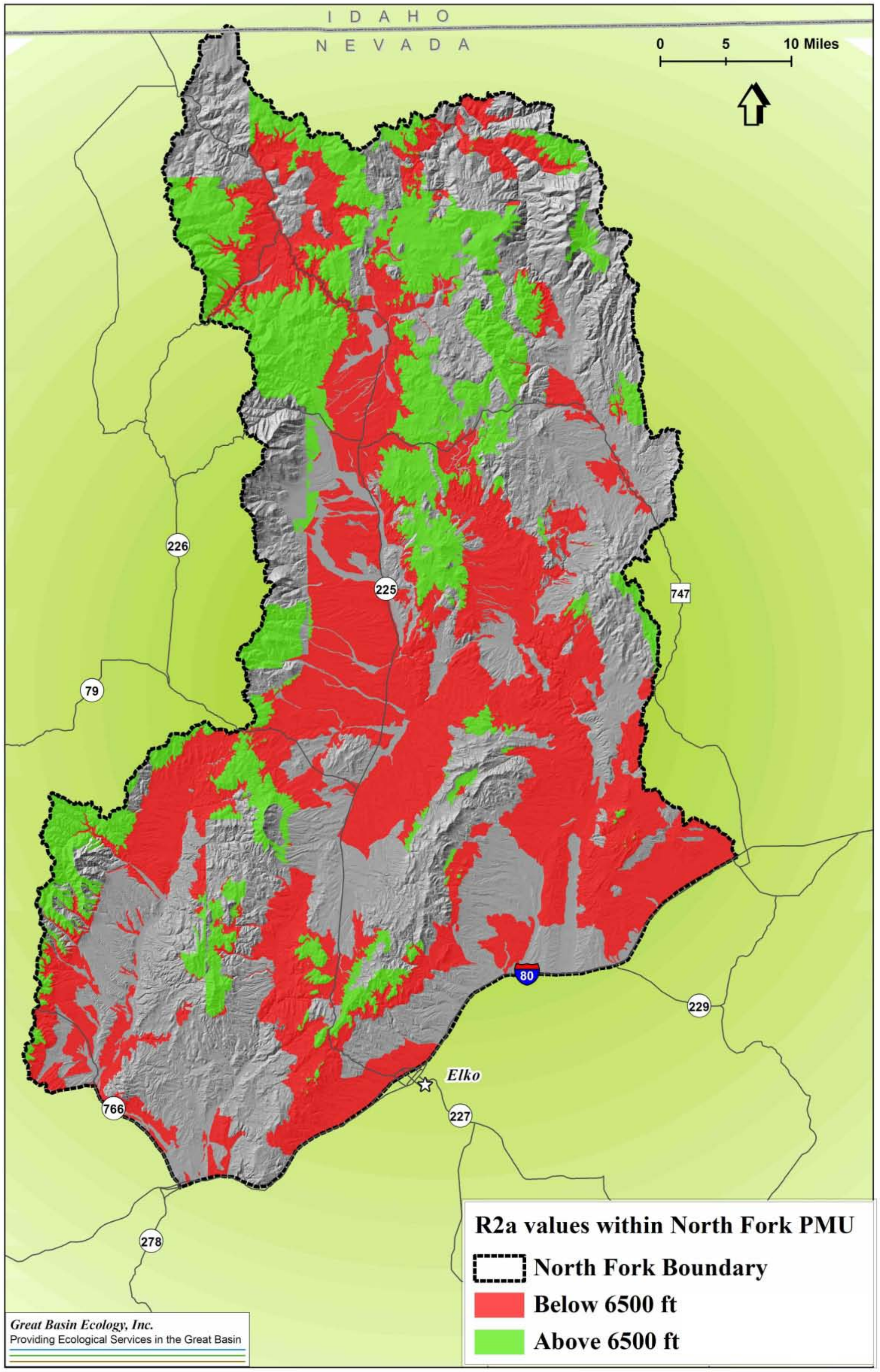


Figure 2 - 9: Polygons With R2a Value Habitats Within the North Fork PMU

3.3 R2b Areas

The R2b category includes areas where perennial or annual invasive species are present and will likely establish and dominate after a disturbance event (Photo 7). Most of the R2a acreage can readily convert into the R2b category and likely will in the absence of aggressive management. The R2b category accounts for 89,100 acres or only 5.1 percent of the PMU. The soil association polygons with this condition habitat are displayed on Figure 2-10. Note that most of this acreage is in areas where conversion to cheatgrass has already occurred along the I-80 corridor and the cheatgrass has established in the open understory of the heavy sagebrush cover.

As with the R2a areas, the R2b areas are at high risk for wildfire and when burned they will convert to cheatgrass and other annuals. These two habitat conditions account for 25 percent of the PMU area.

Photo 7: Example of R2b Habitat Condition with Cheatgrass in the Understory

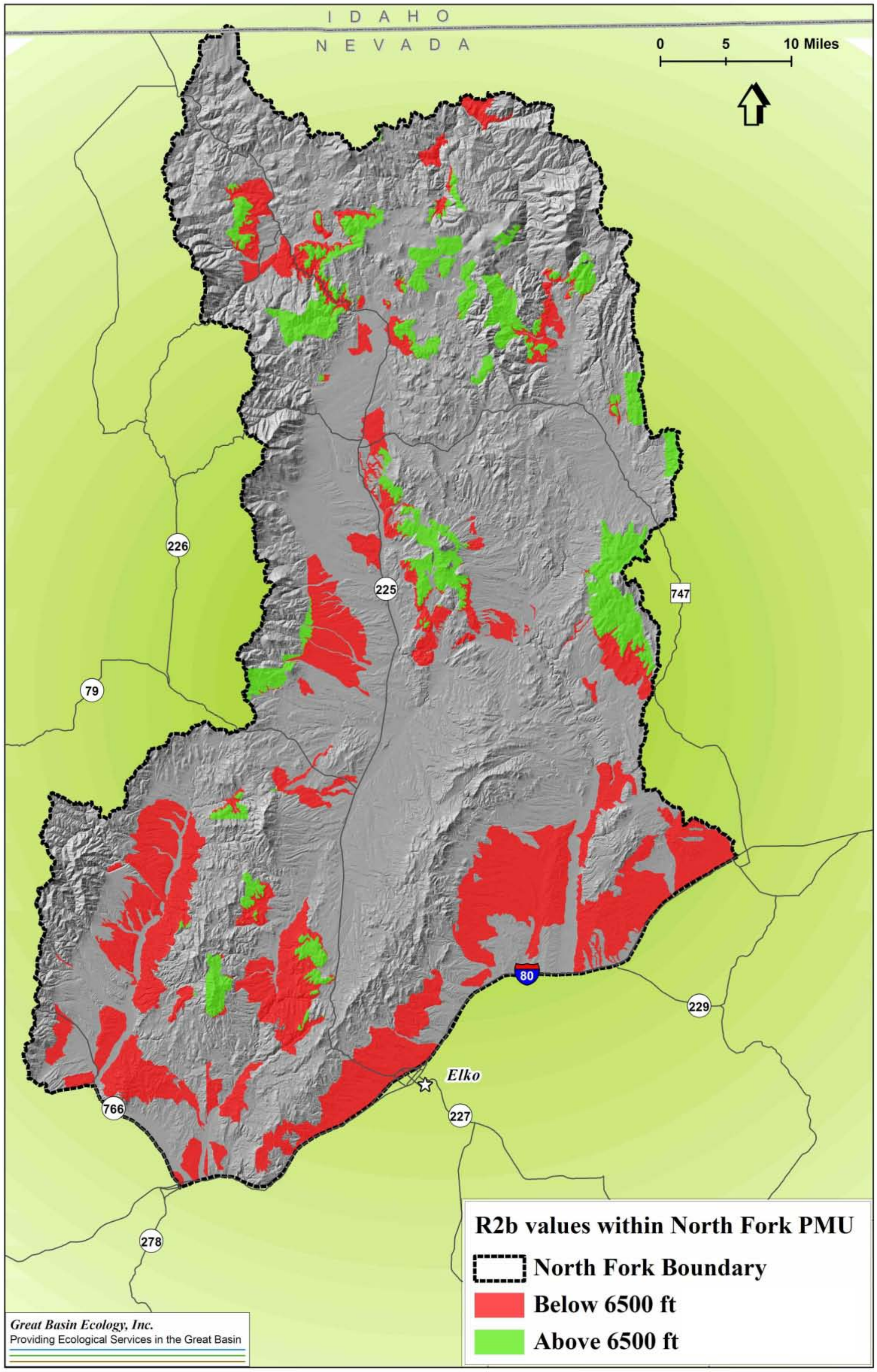


Figure 2 - 10: Polygons With R2b Value Habitats Within the North Fork PMU

3.4 R2c Areas

R2c areas consist of vegetation where perennial or annual invasive species dominate the landscape after a disturbance event (Photo 8). The R2c category accounts for 126,600 acres of the PMU (7.3 percent) (Figure 2-11) and the majority of this acreage (76 percent) is below 6,500 feet amsl. Most of this is along the I-80 corridor, but there is some acreage of this habitat condition scattered throughout the PMU. The R2b condition is just one fire away from converting to the R2c condition, and the R2a is also susceptible to converting to R2c condition. Therefore, approximately 566,600 acres of the PMU (33 percent) could be in the R2c condition after one fire year like 1999.

Photo 8: Example of R2c Habitat Condition

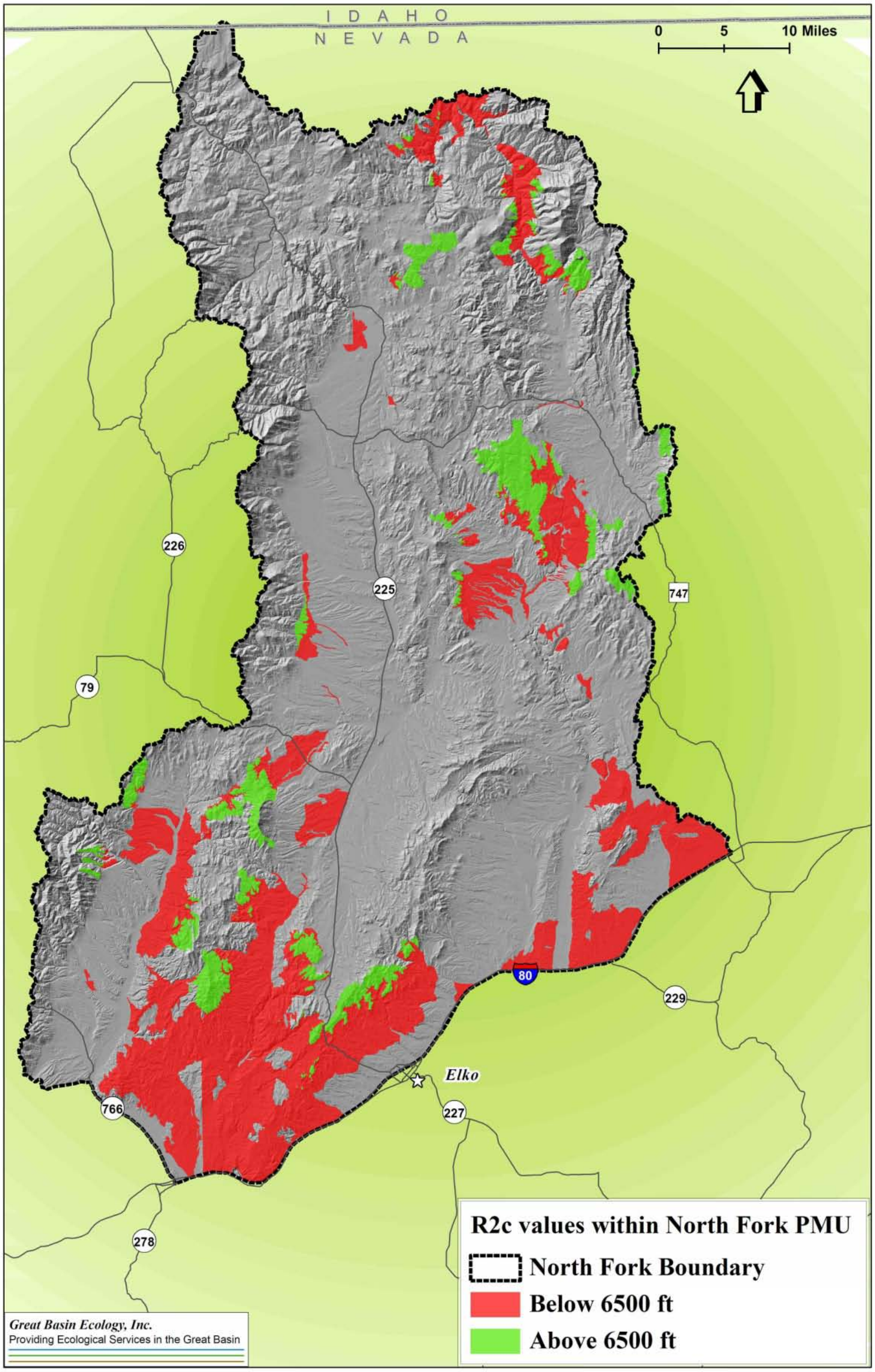


Figure 2 - 11: Polygons With R2c Value Habitats Within the North Fork PMU

3.5 R2d Areas

The R2d habitat condition is similar to R2a, as both are shrub-dominated. However, the lack of herbaceous vegetation in the understory of the R2d areas is due to excessive or inappropriate disturbance on the understory herbaceous component (Photo 9). This generally results when a pasture consists primarily of habitat condition R2a and continued livestock grazing removes most of the remaining herbaceous vegetation. The R2d habitat condition will readily convert to an R2c condition following fire or other disturbance of the shrub canopy. The distribution of R2d is displayed in Figure 2-12 and accounts for approximately 28,600 acres (1.7 percent) of the PMU.

Photo 9: Example of R2d Habitat Condition

3.6 R3a Areas

The R3a areas consist of sagebrush sites that have been encroached upon by pinyon-juniper trees. The trees are relatively scattered, young, and there is still an abundant sagebrush/herbaceous understory. This category only occurred on approximately 183 acres of the PMU. This habitat type was located west of Elko along the I-80 corridor and in the Owyhee Canyon area and north. Much of this habitat condition along the I-80 corridor burned in the 1980s and converted to the R2c (annual grassland) condition.

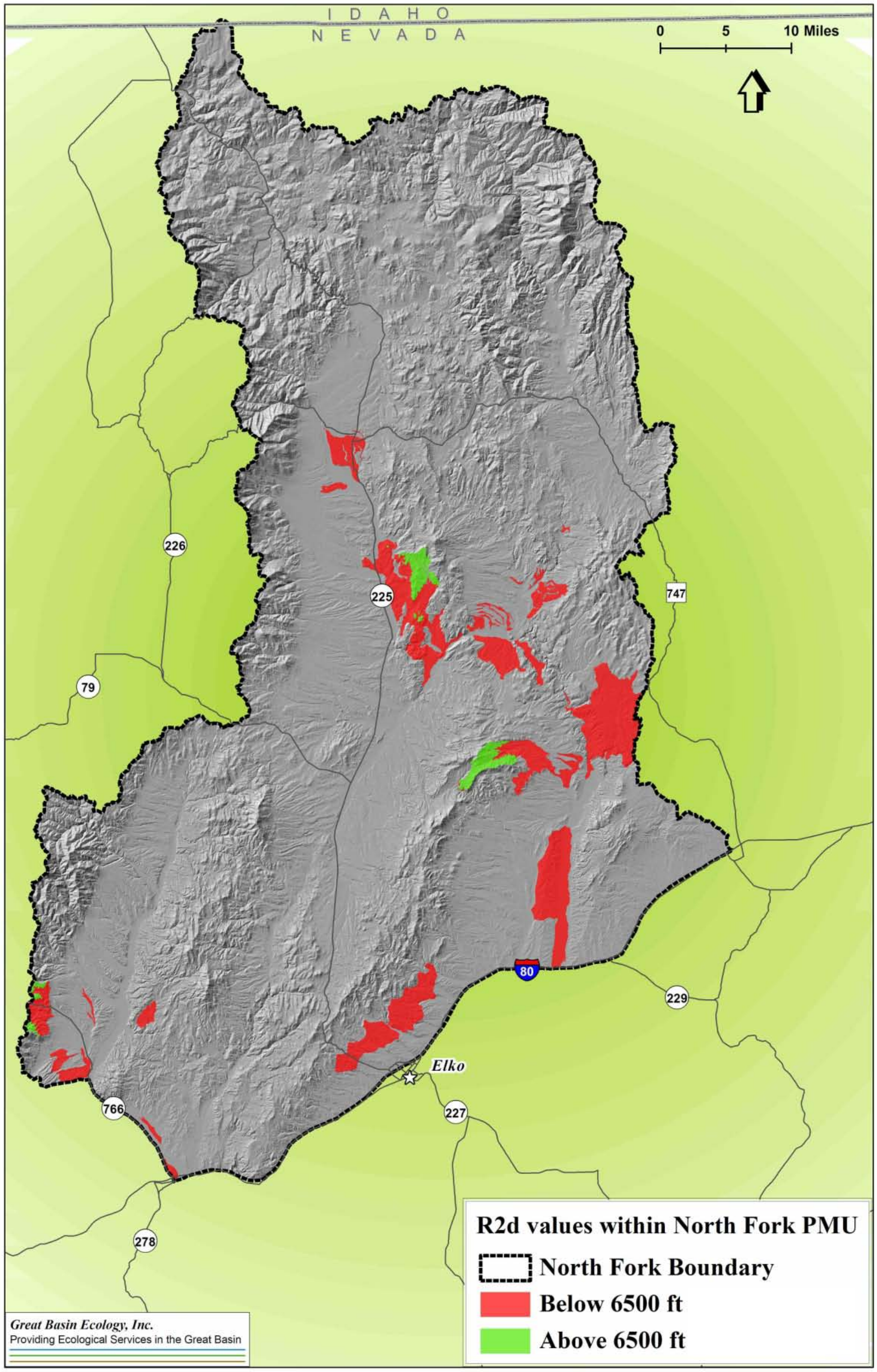


Figure 2 - 12: Polygons with R2d Habitat Condition in the North Fork PMU

3.7 R3b Areas

The R3b habitat condition was located north of Wild Horse Reservoir along the Owyhee River and the foothills and canyons adjacent to the river. Data was not collected in these areas because this does not represent sage-grouse habitat.

3.8 R4 Areas

The R4 habitat condition consists of areas that previously supported sagebrush but have been converted to agricultural uses, such as alfalfa hay (Photo 10). These areas occur on less than one percent of the PMU.

Photo 10: Example of R4 Habitat Condition - Sagebrush Converted to Agricultural Use

4.0 ASSESSMENT OF SAGE-GROUSE HABITAT IN THE NORTH FORK PMU – RANGELAND HEALTH/ECOLOGICAL SITES

4.1 Rangeland Health

Assessment of rangeland health using the 17 indicators of rangeland health (Appendix A) resulted in most of the ecological sites visited having minor or no deviation from the ecological site description (Figure 2-13). However, in most of the situations where there was some deviation, there were invasive species found at the site. For those areas where there was a high deviation from the ecological site description, the primary factors which deviated were:

- Invasive plants;
- Functional/structural groups;
- Plant mortality/decadence;
- Annual production;
- Plant community composition and distribution relative to infiltration; and
- Litter amount.

The last four factors listed indicate the plant community is in Phase 4 (See Figure 1-5) and approaching a threshold where a catastrophic fire could alter the community into another ecological state. These factors also indicate that the treatment of these sites will need to be done with caution to not cause the community to cross the threshold. These sites were found at high elevations as well as low elevations, but more often at lower elevations.

The presence of invasive plants can indicate a threshold has already been crossed, depending on the percent cover that the invasive species contribute to the site. Generally, less than five percent cover of the invasive species is considered tolerable, although there is still a risk of conversion. The soil association polygons that demonstrated moderate-extreme and extreme deviations from normal for invasive plants are displayed in Figure 2-14. Polygons in which noxious weeds were observed are displayed in Figure 2-15.

For most of the sagebrush ecological sites, the functional and structural groups consist primarily of perennial grasses, with shrubs and forbs in lesser amounts (using above-ground dry weight as the unit of comparison). For example, the Loamy 8-10 inch p.z. ecological site at PNC consists of: deep-rooted, cool season, perennial bunchgrasses much greater than tall shrubs (Wyoming big sagebrush), which are much greater than other associated shrubs, which are greater than shallow-rooted, cool season, perennial grasses, which are greater than deep-rooted, cool season perennial forbs, which are about equal in abundance to fibrous, shallow-rooted, cool season, annual and perennial forbs.

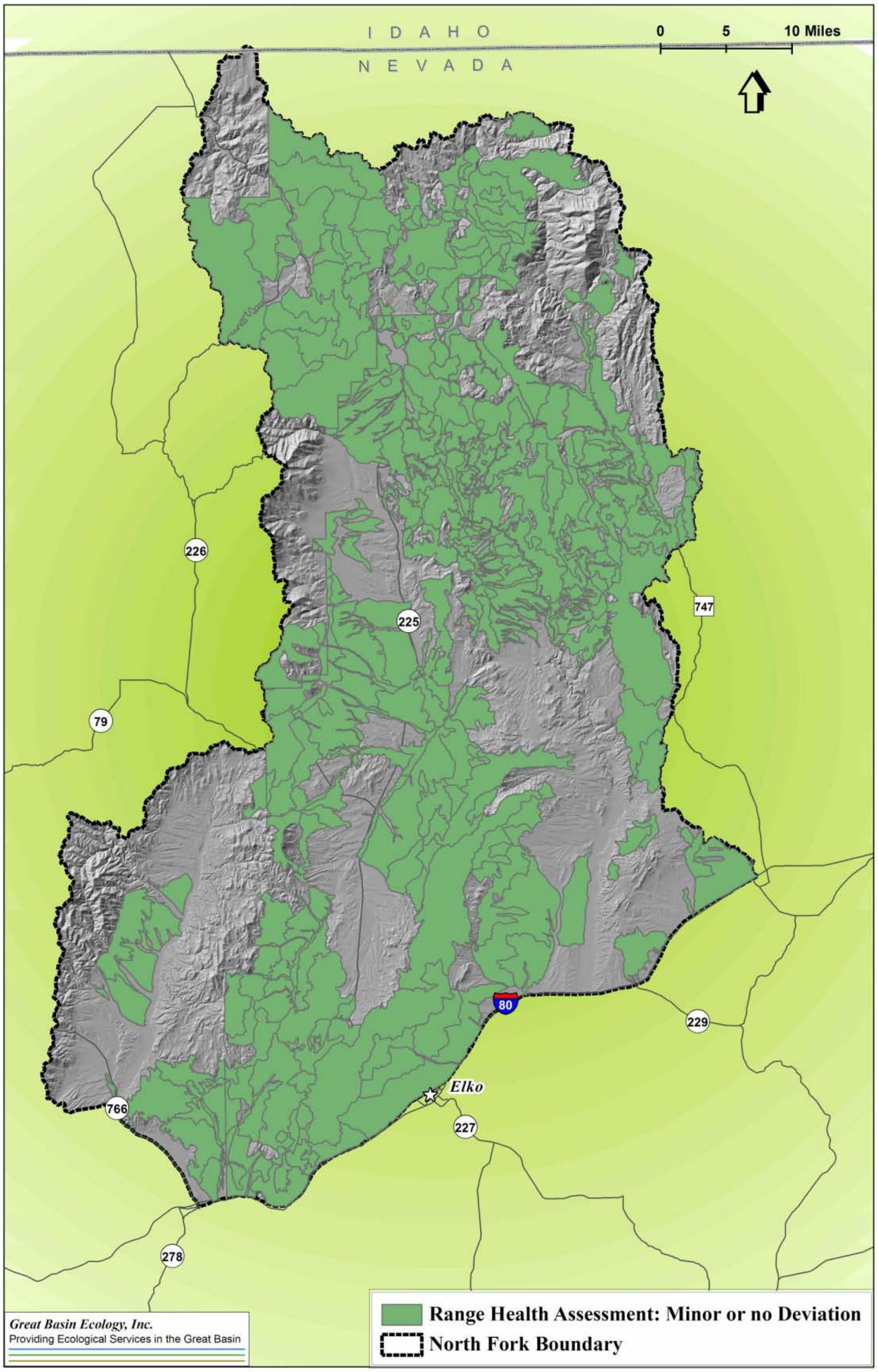


Figure 2 - 13: Polygons with Ecological Sites With Little or No Deviation from the Reference Condition

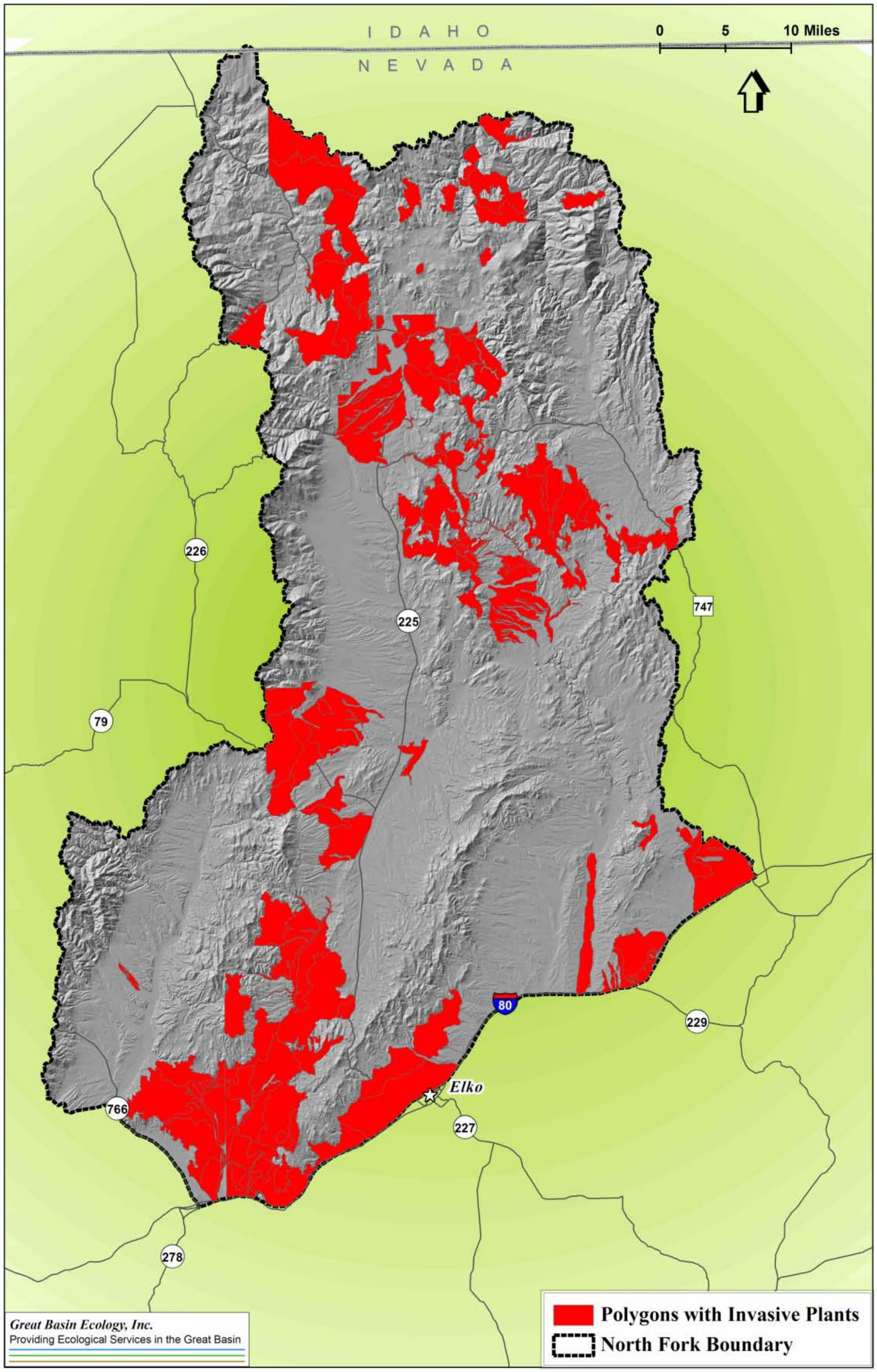


Figure 2 - 14: Polygons with Significant Deviation from the Reference Condition for Invasive Species

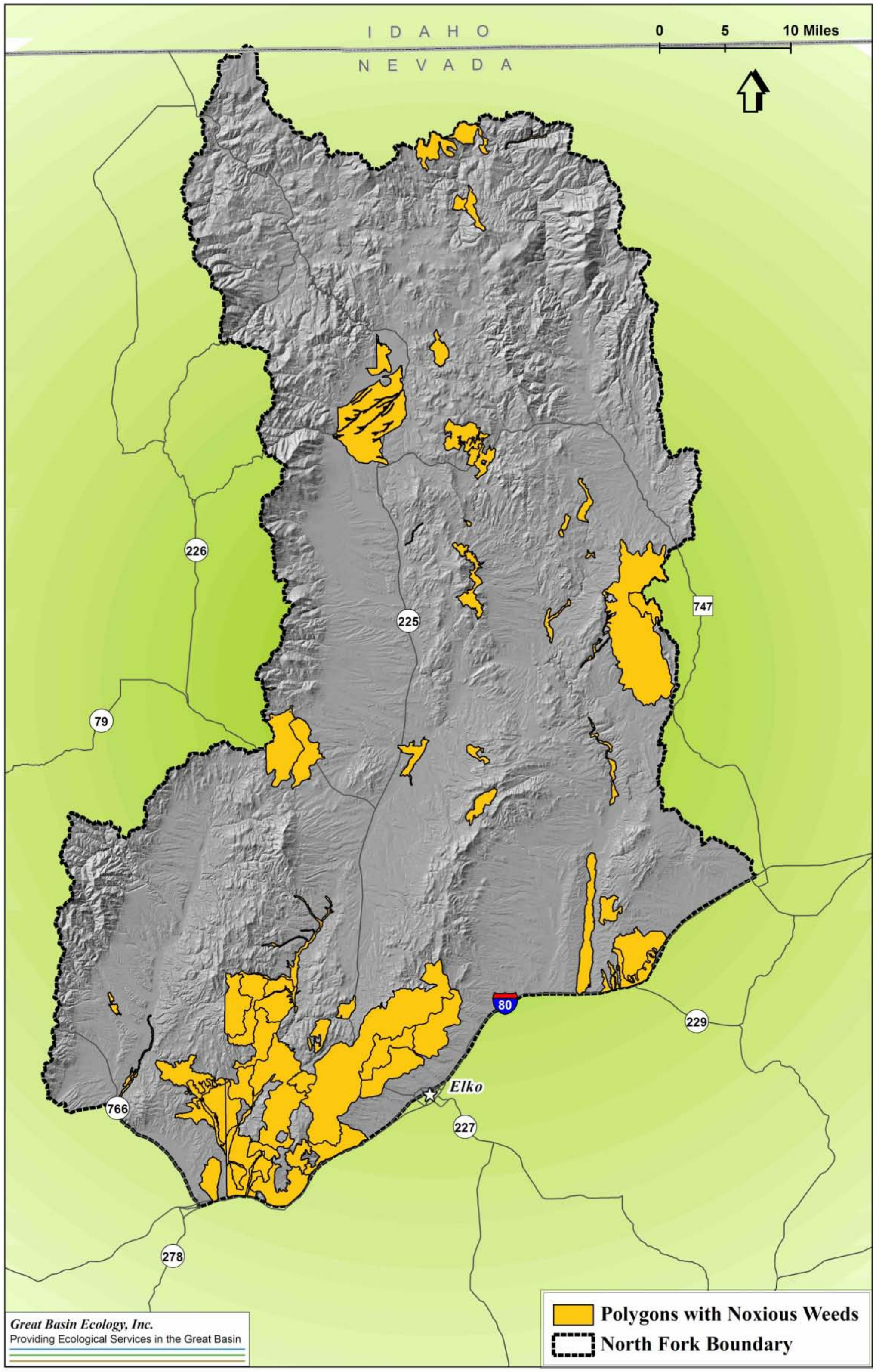


Figure 2 - 15: Polygons In Which Noxious Weeds Were Observed

The sites that had been recently burned deviated from this description by having a lack of shrubs and some of the forbs. But for sites that had not been burned for several decades, the deviation from normal or PNC was due to shrub dominance and lack of deep-rooted, cool season, perennial bunchgrasses and cool season perennial forbs/shallow-rooted, cool season, annual and perennial forbs.

Phase 2 (See Figure 1-5) is the phase of the sagebrush ecological sites that provides the functional and structural groups in the ratios that meet the reference condition. Phases 1, 3, and 4 represent deviations from the reference condition.

The amount of plant mortality and decadence for the sagebrush ecological sites is generally less than 35 percent of the woody canopy and for the perennial bunchgrasses, less than 20 percent should have dead centers. Phases 2 and 3 generally have vegetation that has the least deviation from the reference condition and phase 4 has the greatest deviation.

Deviation from the reference condition for annual production (i.e., total above-ground production) is based on the pounds of production for the growing season through the end of May. For each ecological site, the NRCS has provided a range of production estimates. Comparison of the field observation to the NRCS estimate is used to determine the deviation. Phase 1 and phase 4 generally have the lower production values, while phase 2 and phase 3 represent the reference condition.

The effect of plant community composition and spatial distribution relative to infiltration and runoff is related to the plant community's ability to infiltrate precipitation and reduce runoff. Deep-rooted perennial grasses promote infiltration and slow down surface flow. Shrubs intercept rain drops and reduce the physical impact of the droplets' ability to dislodge soil particles. Therefore, a combination of shrubs and grasses/forbs (i.e., phase 2) is the best community for promoting infiltration. A grass/forb-dominated community (i.e., phase 1) or shrub dominated communities (i.e., phases 3 and 4) are not as efficient in promoting water infiltration.

Litter cover is also important for facilitating water infiltration and nutrient cycling. As with the other indicators of rangeland health, phase 2 produces the greatest amount of plant interspace litter, and the other phases produce less, with phase 4 producing the least amount.

Of the six indicators of rangeland health discussed above, five are indicators of biological integrity and one is an indicator of hydrologic function. Rangeland health evaluations were conducted at 1,243 sites within the PMU and the indicators of biotic integrity deviated moderate-extreme to extreme from the reference condition at 419 sites (34 percent). The indicators of hydrologic function deviated moderate-extreme to extreme from the reference condition at 95 sites (eight percent), and the indicators of soil/site stability deviated moderate-extreme to extreme from the reference condition at only two sites (0.2 percent).

This makes a lot of ecological sense. Because the biological components of the system are integral to the hydrological functions and to soil stability, the hydrological functions and soil stability would not be expected to start deviating from the reference condition unless the site was approaching a threshold. Once the biological integrity is extremely different than the reference condition, the site is likely to transition to an altered state. Crossing the threshold would be accompanied by significant deviations in the hydrologic function and soil stability. The deviations in the latter two indicators of rangeland health are the reason that it requires significant cost and effort to restore altered states to the original community state. When water is not infiltrating the soil the site production is reduced, and plants succumb to droughty conditions. This allows invasive species to enter the plant community. In addition, if the water is not being infiltrated into the soil, the water flows across the surface. The movement of the water across the surface removes soil and organic matter. The decrease in plants or a shift in the life form of plants on the site facilitates water runoff, soil loss, and nutrient loss.

The soil association polygons that exhibited moderate-extreme to extreme deviation from the reference conditions for biotic integrity are displayed in Figure 2-16.

4.2 Ecological Sites Assessment

The assessment of ecological sites was an examination of the base unit for management – the ecological site. One of the major distinctions among ecological sites is that they respond differently to management; therefore, any vegetation management must include an evaluation of how each ecological site in the project area will respond to the proposed management activity. Generally, this level of management is not the norm and management actions occur across ecological site boundaries. The landscape or vegetation responses to wildfire are a prime example. The various ecological sites included in the burned area and the phases of each site at the time of the fire are two important factors in determining the post-fire plant community. For example, a South Slope 12-14 inch p.z. site with perennial grasses and less than five percent cheatgrass in the understory (i.e., phase 4) and a Loamy Slope 12-16 inch p.z. site with abundant shrubs but also a healthy herbaceous understory (i.e., phase 3) that are burned in the same wildfire under the same conditions will result in very different post-fire plant communities. The South Slope 12-14 inch p.z. site will be a mixture of widely-spaced perennial grasses and cheatgrass, with cheatgrass dominating the interspaces between the perennial grasses. This would be an altered state. In contrast, the Loamy Slope 12-16 inch p.z. site will be dominated by perennial grasses and also include shrubs that sprout, such as snowberry and serviceberry. This would be a healthy phase 1.

Therefore, evaluation of the ecological site with respect to indicators of healthy rangelands not only indicates the current ecological health of the site, but also allows for a prediction of how that site will respond to man-induced management and natural vectors of disturbance. By indicating which phase the current vegetation

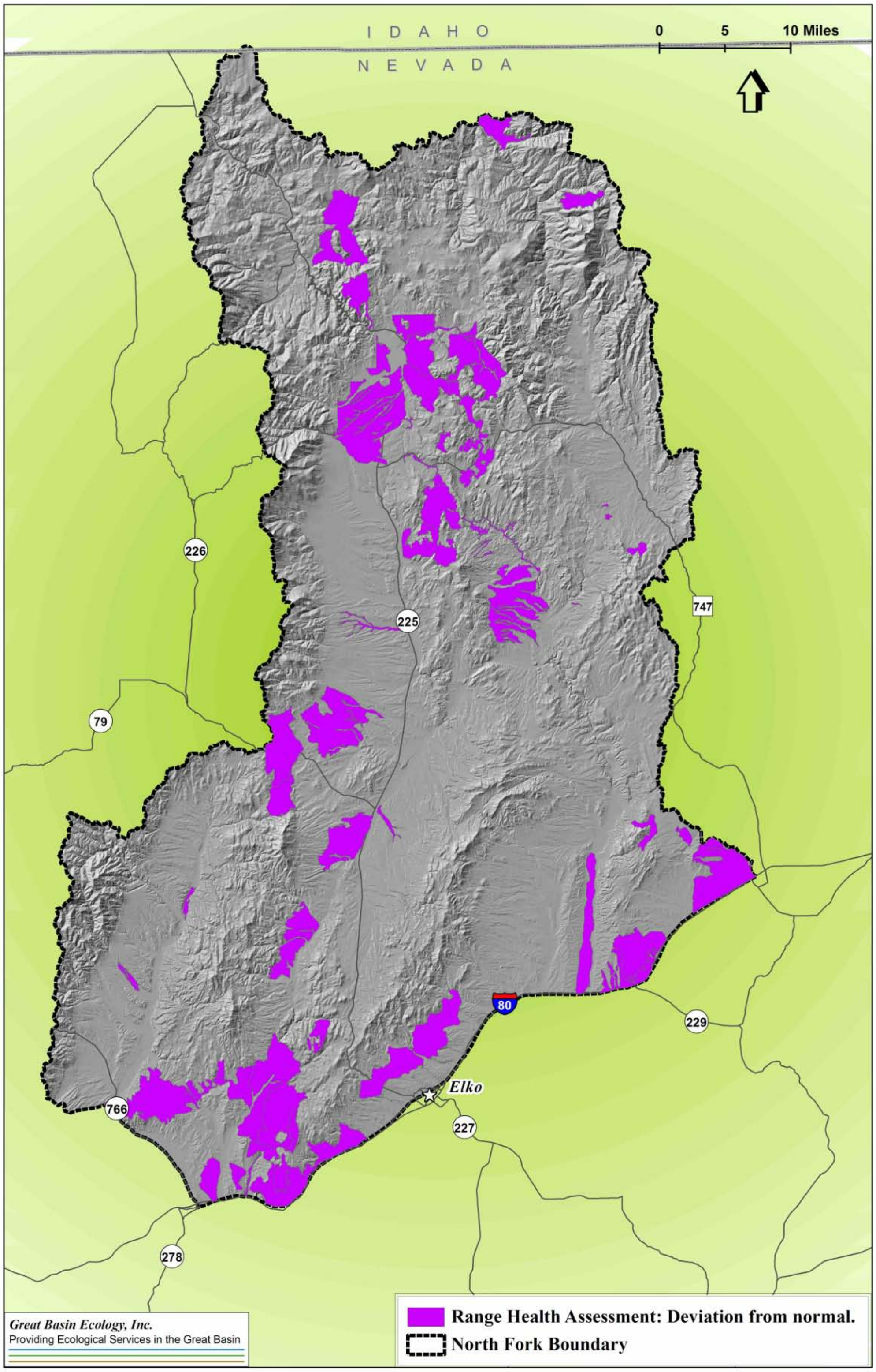


Figure 2 - 16: Polygons with Ecological Sites that have Significant Deviations from the Reference Condition for Biotic Integrity

represents in the State and Transition Model for a given ecological site, then predictions can be made as to how the site will respond to various management options and under various conditions. This information is critical to making informed management decisions.

4.2.1 Ecological Site Phases

As indicated in Chapter 1, Section 2.0 and Figure 1-5, for each model of each sagebrush ecological site[7], the general pattern is a grass/forb-dominated plant community following disturbance which is phase 1 (Photo 11). Phase 2 consists of a grass/forb-dominated plant community, but sagebrush and other shrubs are present, but not dominant (Photo 12). Phase 2 is generally correlated with the PNC concept. During phase 3 the shrubs become the dominant life form and grasses and forbs begin to decline in abundance (Photo 13). There is also likely to be some changes in the relative composition of the herbaceous component – changes in the ratios of various grasses and forbs with respect to phase 2. By phase 4 the shrubs dominate the plant community and forbs and grasses are a minor component of the community (Photo 14).


Photo 11: Phase 1 Condition for a Loamy 8-10" p.z. Site (left) and a Loamy Slope 12-16" p.z. Site (right)

Figure 1-5 and Figure 1-6 indicate that each ecological site has a different level of productivity; the more xeric sites having less productivity than mesic sites. A figure depicting the model for a Steep North Slope would show that the phases occur over a shorter time span, probably less than 50 years to move from phase 1 to phase 4. The model would also have higher maximum values for the herbaceous and shrubs, and also higher minimum values for herbaceous vegetation. The higher minimum

[7] It should be noted that State and Transition Models have been and are being developed for non-sagebrush ecological sites. However, because of the focus of this assessment on sage-grouse habitats, only the sagebrush ecological sites are discussed.

Photo 12: Phase 2 Condition - Loamy Slope 12-16 inch p.z. Ecological Site

Photo 13: Phase 3 Condition for a Loamy 8-10" p.z. Site (left) and Loamy Slope 12-16" p.z. Site (right)

Photo 14: Phase 3 Condition for a Loamy 8-10" p.z. Site (left) and South Slope 8-12" p.z. Site (right)

values for herbaceous is of ecological significance as it indicates that there generally is about 15 percent or more grass/forb cover in phase 4. This is quite adequate for generating a healthy and diverse phase 1 following disturbance. However, because of the higher shrub cover, and therefore, the higher fuel loading, these sites can be vulnerable to herbaceous plant mortality if burned under extreme drought conditions. Under "normal" conditions, there is sufficient soil and fuel moisture to prevent high levels of mortality to the herbaceous component. Consequently these mesic sites are more resilient to disturbance than xeric sites.

The paired photos above are presented to show that the various phases for different ecological sites are similar in overall structure, but the productivity between mesic and xeric sites can be quite different.

4.2.2 Ecological Site Phases and Sage-Grouse Habitat

Approximately 692,000 acres of the PMU were considered to be non-habitat for sage-grouse. The majority of this acreage occurred as woodland habitat and as residential areas or other lands with high levels of human activity (i.e., mines, gravel pits, etc.). The remaining 1,039,000 acres was identified as potential sage-grouse habitat (Table 2-1).

Figure 1-7 is repeated below as Figure 2-17 to facilitate reference to the figure for the reader. The four phases of the Loamy 8-10" p.z. ecological site model are indicated on Figure 2-17, as are the various sage-grouse seasonal habitats. The herbaceous dominated vegetation of phase 1 provides pre-laying nutrition for the hen early in the spring prior to egg production. This nutrition is important in producing quality eggs and subsequently, chicks with a high potential for survival. This habitat condition or phase may also provide lek habitat, but generally, the low sagebrush and black sagebrush sites provide conditions suitable for the lek.

Table 2 - 1: Acreage of Phases within the PMU

Phase	Acres per Phase	Percent of PMU	Percent of Potential Habitat in PMU	Acres Above 6,500 ft	Percent of Phase	Acres Below 6,500 ft	Percent of Phase
Phase 1	161,471	9.3	15.5	44,908	27.8	116,563	72.2
Phase 2	53,498	3.1	5.1	16,023	29.9	37,476	70.1
Phase 3	459,419	26.5	44.2	171,356	37.3	288,064	62.7
Phase 4	161,401	9.3	15.5	37,345	23.1	124,058	76.9
Alt. State	203,661	11.8	19.6	58,940	28.9	144,721	71.1
Totals	**1,039,450**	**60**	**100**	**328,572**		**710,882**	

Phase 1 is distributed over approximately 15.5 percent of the potential sage-grouse habitat within the PMU (Table 2-1 and Figure 2-18). However, approximately 28 percent of this habitat is located above 6,500 feet amsl. Therefore, this portion of phase 1 may not be available in spring because of snow cover, but these high elevation grass/forb communities are used as summer brood habitat (Photo 15). Photos 2 and 3 (Section 2.1, Chapter 2) show that sage-grouse also use these sites in the spring.

Photo 15: Sage-Grouse Young of the Year Using Phase 1 in Summer

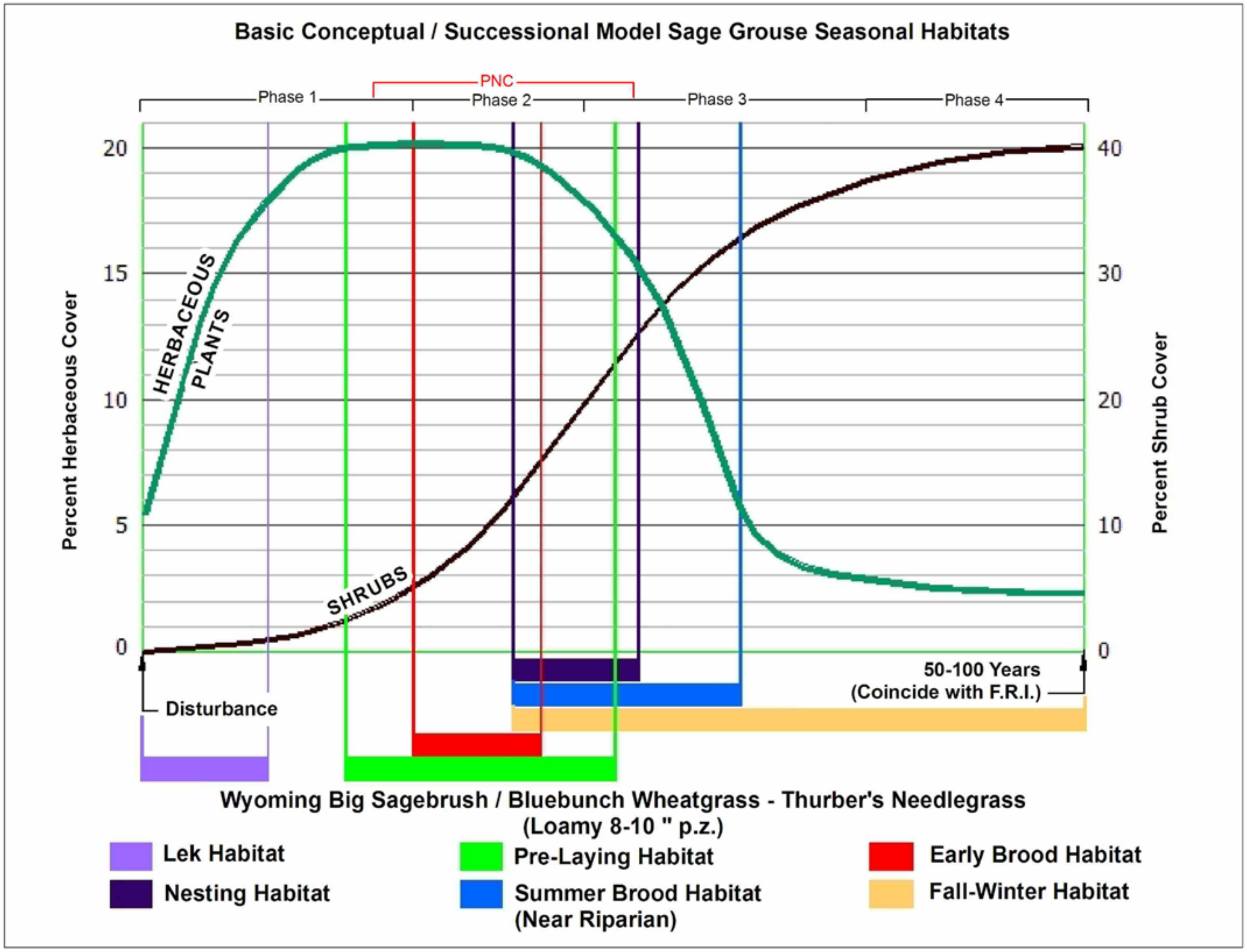


Figure 2 - 17: Sage-Grouse Seasonal Habitats and Ecological Site Phases

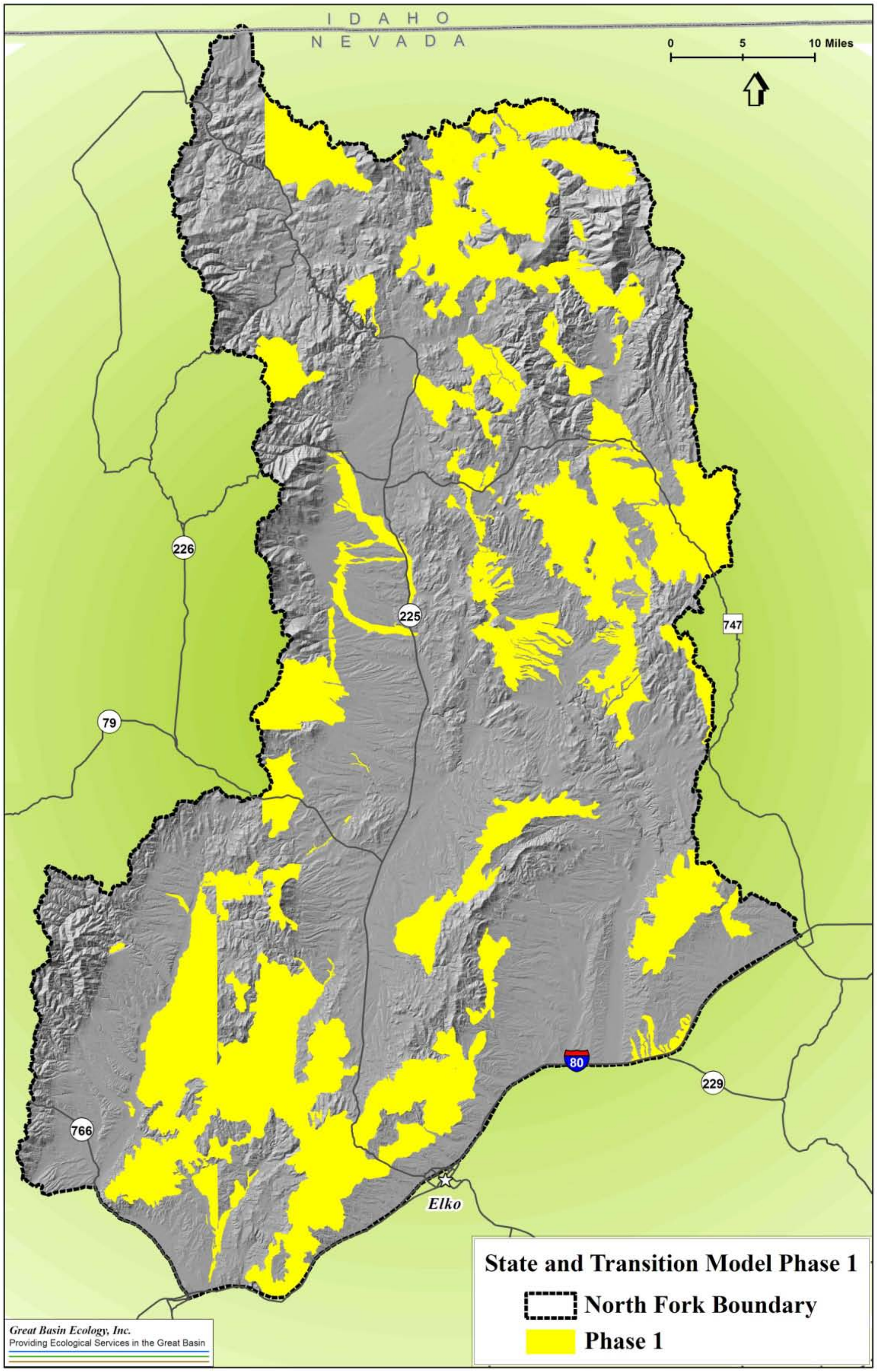


Figure 2 - 18: Polygons with Phase 1 Habitat in the North Fork PMU

Phase 2, which closely corresponds to the PNC condition is the most important phase with respect to sage-grouse habitats (Photo 16). This phase includes pre-laying habitat, early brood habitat, nesting habitat, summer brood habitat, and to some extent, winter habitat (Figure 2-17). The first three seasonal habitats listed are the "production habitats," as these are the habitats that are used to produce the eggs and chicks, and to raise the chicks in the summer. As indicated in Table 2-1, phase 2 habitat occurs on only 3.1 percent of the PMU and only 5.1 percent of the potential sage-grouse habitat. As with phase 1 habitats, almost one-third of the phase 2 habitat is found above 6,500 feet amsl, and therefore, is not likely to be available for nesting due to snow cover. Consequently, only 37,476 acres of the PMU provides high quality nesting habitat (Figure 2-19).

Photo 16: Phase 2 - Pre-Laying, Nesting, Early Brood, Summer, and Winter Habitats

Most of the potential sage-grouse habitat in the PMU is in Phase 3 (Table 2-1 and Figure 2-20). Phase 3 provides conditions suitable for summer and winter habitat (Figure 2-17). However, given the scarcity of phase 2 conditions, it is highly likely that much of the phase 3 habitat is being used by sage-grouse for nesting and early brood use (Photo 17). Because of the inherent variability within the ecological sites, there will be small areas of suitable nesting habitat within the overall marginal nesting habitat condition found in phase 3. However, as this phase continues to age and develop, the amount of suitable area will continue to decline.

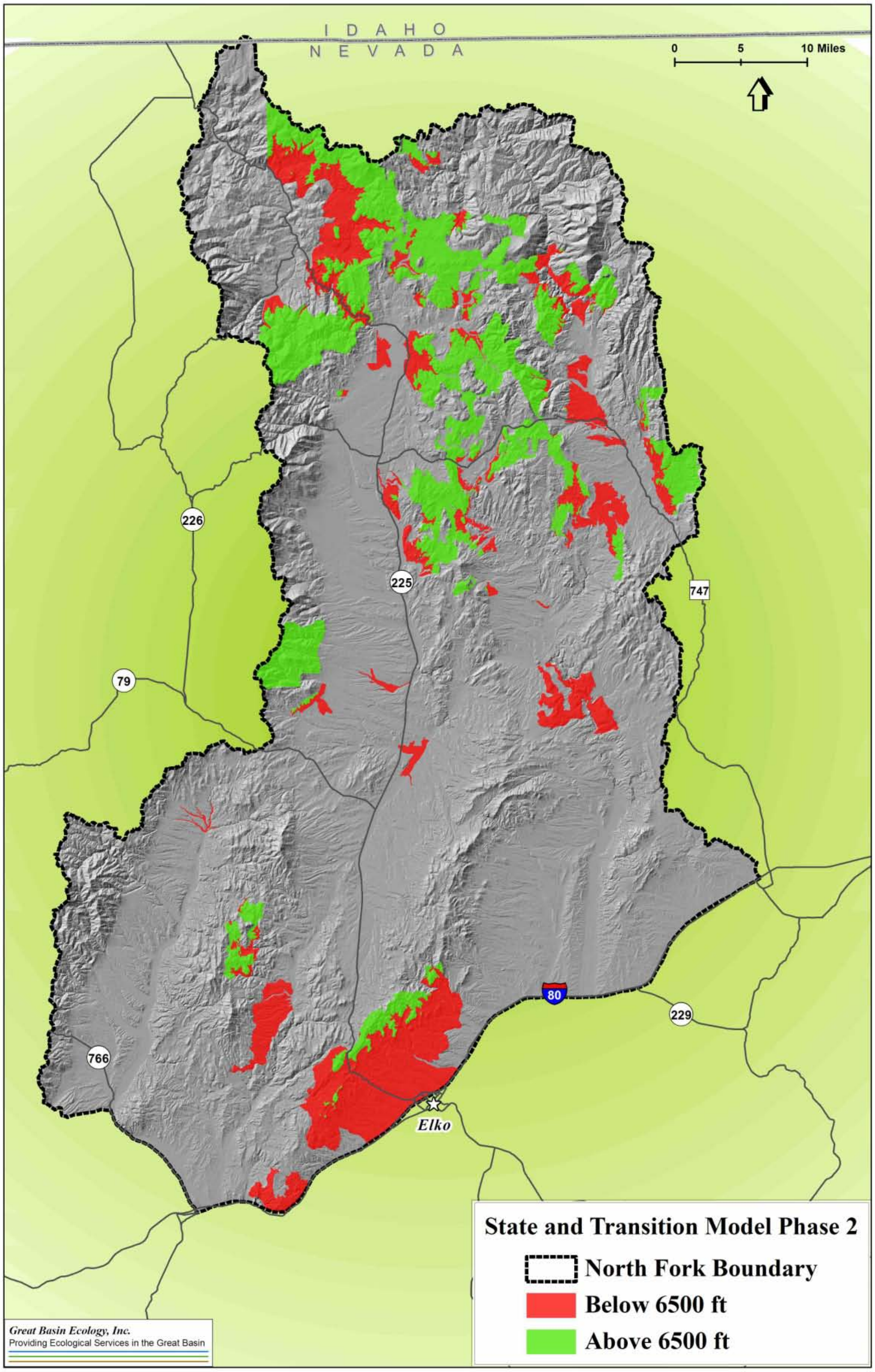


Figure 2 - 19: Polygons with Phase 2 Habitat in the North Fork PMU

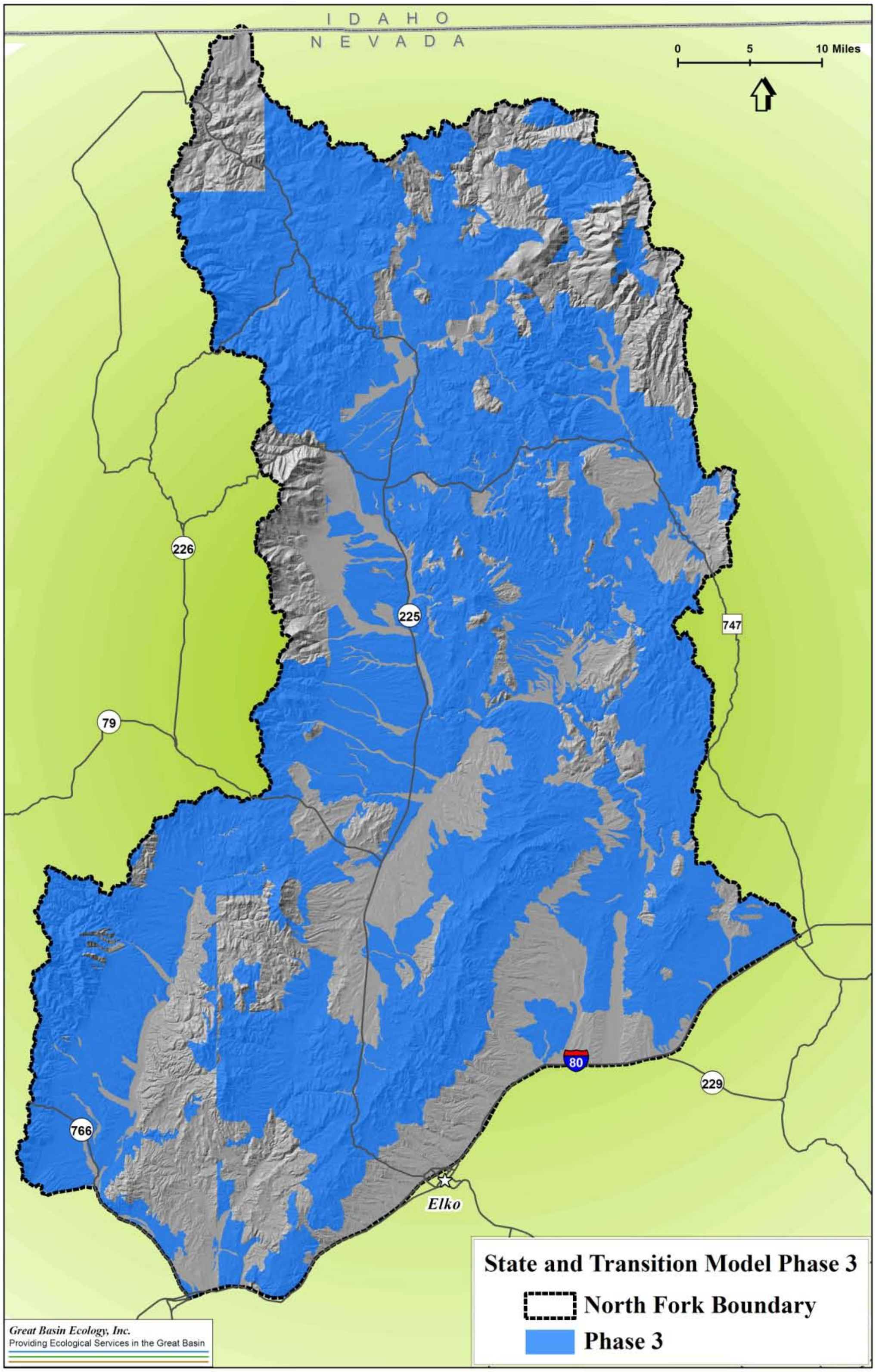


Figure 2 - 20: Polygons with Phase 3 Habitat in the North Fork PMU

Photo 17: Phase 3 Condition Which is Marginally Suited for Nesting and Early Brood Habitat

Phase 4 is approximately as abundant as phase 1 (Table 2-1). This phase provides winter habitat (Figure 2-17). This habitat can be important in years of heavy snow accumulation, as the phase 4 areas generally have the tallest sagebrush and provide a forage base that generally exceeds the depth of the snow accumulation (Photo 18). The distribution of phase 4 is fairly well distributed across the PMU with an abundance of this condition below 6,500 feet amsl (Figure 2-21).

Approximately 20 percent of the potential habitat area for sage-grouse within the PMU exists in an altered state (Table 2-1). This includes sagebrush areas that are over five percent cheatgrass in the understory (Photo 19), or areas where the shrub component has been removed or reduced and annual invasive species dominate the site (Photo 20). These areas generally require extensive and expensive rehabilitation to restore the sage-grouse habitat values. These sites are predominantly below 6,500 feet amsl (Figure 2-22).

Photo 18: Phase 4 Condition with High Sagebrush Cover and Limited Herbaceous Understory

Photo 19: Phase 4 With Cheatgrass In the Understory

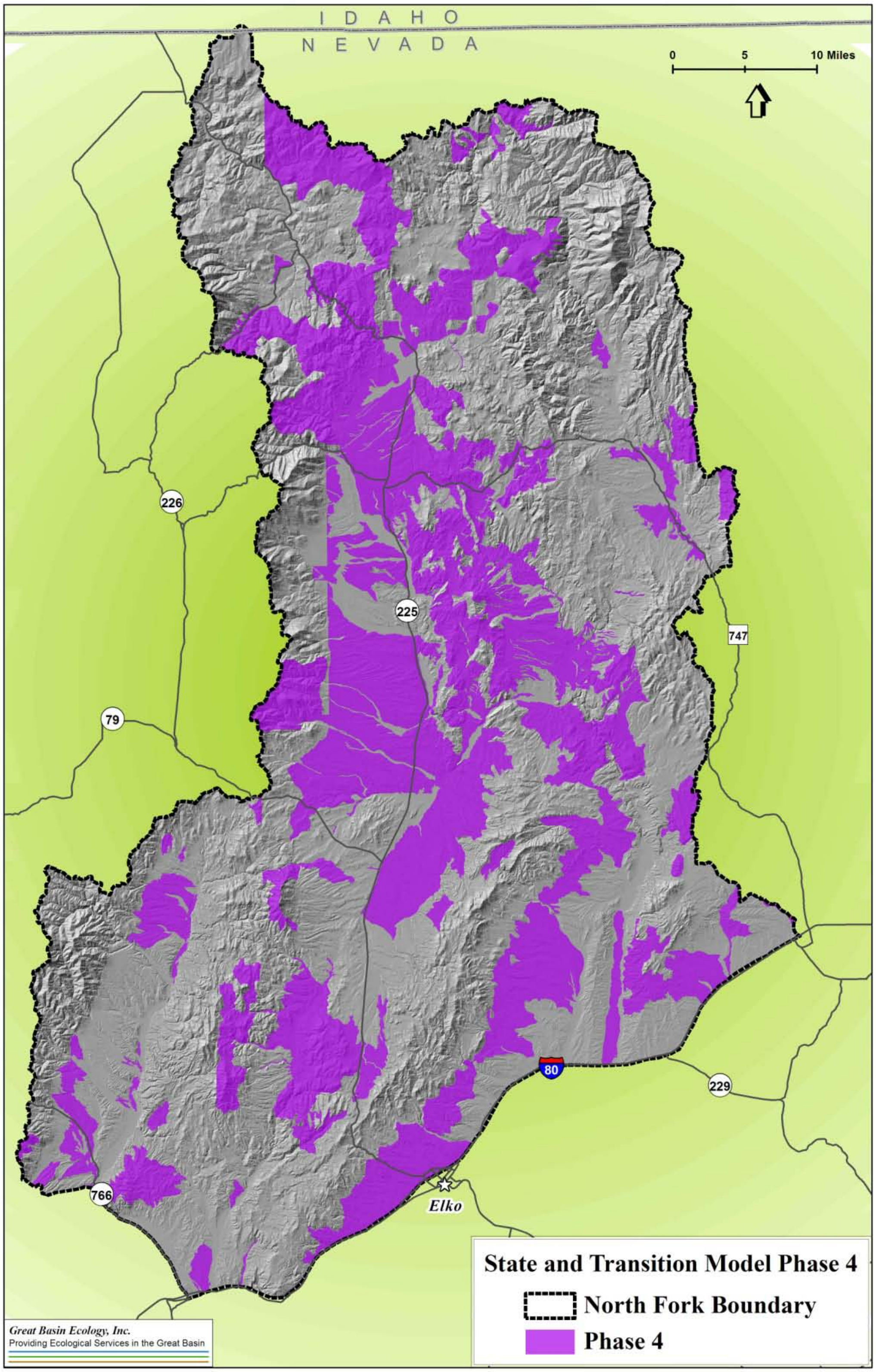


Figure 2 - 21: Polygons with Phase 4 Habitat within the North Fork PMU

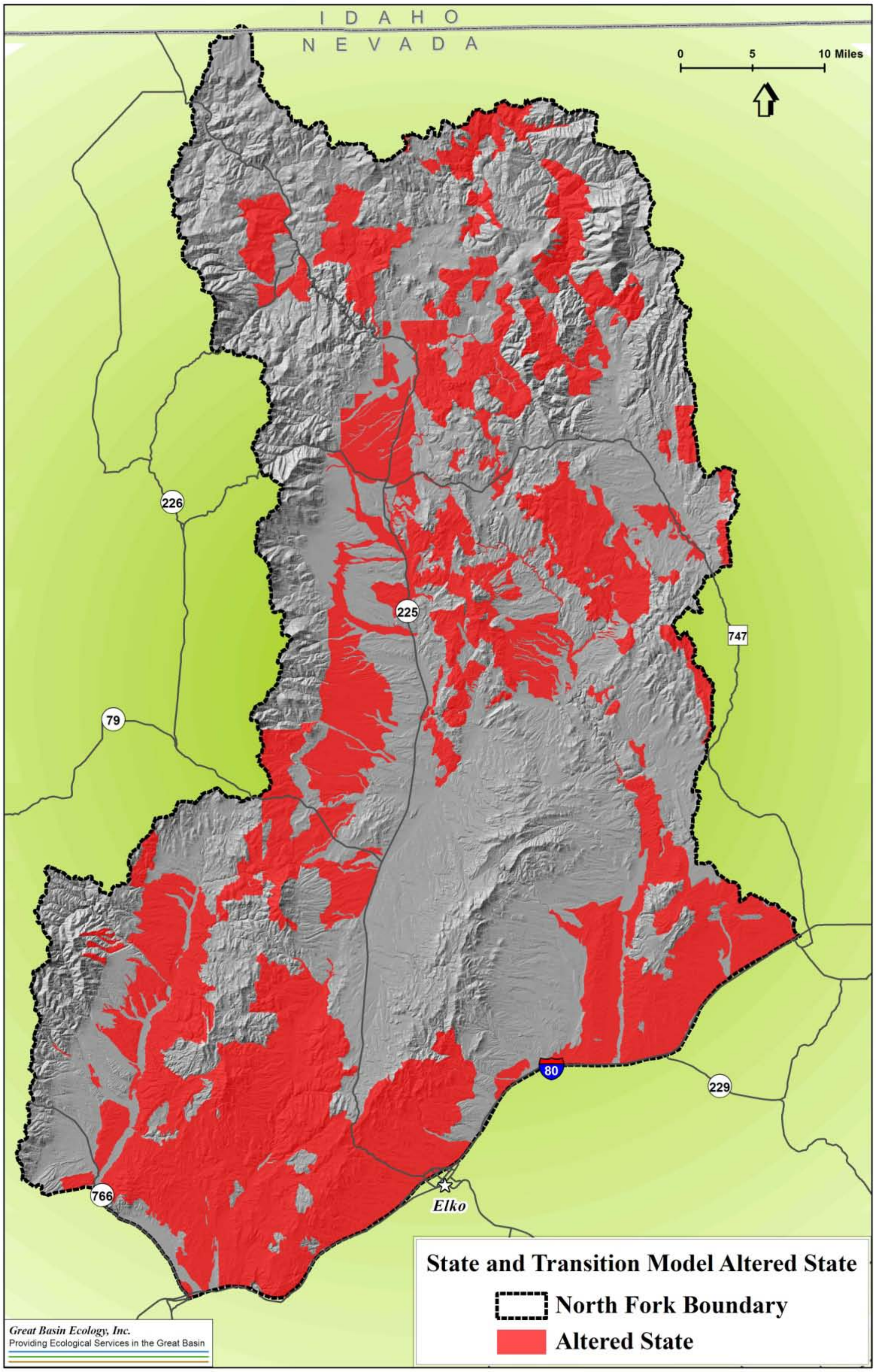


Figure 2 - 22: Distribution of Altered State Ecological Sites within the PMU

Photo 20: Altered State of the Loamy 8-10 Inch p.z. Following Disturbance

4.2.3 Loamy 8-10 Inch p.z. Ecological Site

The Loamy 8-10" p.z. ecological site is the dominant site in the PMU. This ecological site is found on approximately 293,000 acres or 17 percent of the PMU. But more importantly, this ecological site accounts for 28 percent of the potential sage-grouse habitat in the PMU and almost all of this acreage is below 6,500 feet amsl. This ecological site is at great risk to be converted to annual grassland. The site occurs on the lower end of the precipitation spectrum for big sagebrush and the sites are readily invaded by cheatgrass when in the phase 4 condition, and even in the phase 3 condition. Management of the Loamy 8-10 inch p.z. sites that are in healthy condition (i.e., more than ten percent perennial grasses, the majority of which are deep-rooted bunch grasses, and three to five percent forb cover) is a critical action to maintain viable sage-grouse populations within this PMU.

Most of the potential nesting, early brood, pre-laying, and early summer habitats can be provided by this ecological site. Therefore, maintaining the integrity of this ecological site on as much acreage as possible should be the goal of any land manager. However, managing this ecological site is not without risk. Recommendations for managing this ecological site are included in Chapter 3.

4.3 Ecological Site Phases and R-Values

The discussions above and in Chapter 1 regarding the phases of the ecological sites and the R-values of the rapid assessment method were intended to show the differences in these two means of categorizing habitats. The R-values apply without regard to ecological sites; if the shrub and understory characteristics meet the criteria for one of the R-value categories, then that is how the site is categorized. Therefore, there is no direct link to management of the area. In contrast, the phases are directly related to the State and Transition Model for a given ecological site and the management options for the ecological site, or for a group of similar ecological sites, is directly related to the phase for each site.

The rapid assessment method categories are not linked by any ecological processes. It is not clear what an R0 site, or other R-value sites, will transition to in the future. Whereas, the State and Transition Models for each ecological site provide direct information on how the vegetation will develop in the future; the phases are linked through the concepts of plant community dynamics.

If the R2a sites were to be treated, the outcome would be quite variable because the R2a label indicates only a general condition of the vegetation, not the ecological site or sites to which the label or condition applies. Therefore, a South Slope 12-14 inch p.z. that is in the R2a condition and a Loamy 12-14 inch p.z. that is in the R2a are likely to result in two very different plant community responses if the treatments involve prescribed burning, herbicides, or other shrub reduction treatments. The South Slope 12-14 inch p.z. site is likely to develop into a perennial grass/annual grass mixture, whereas the Loamy 12-14 inch p.z. site is likely to develop into a perennial grass/forb community. The amount of perennial grass in the understory of these two communities in the R2a condition, as well as the potential presence of some cheatgrass in the understory will be quite different. Therefore, treatments of vegetation cannot be based on the R-value of an area.

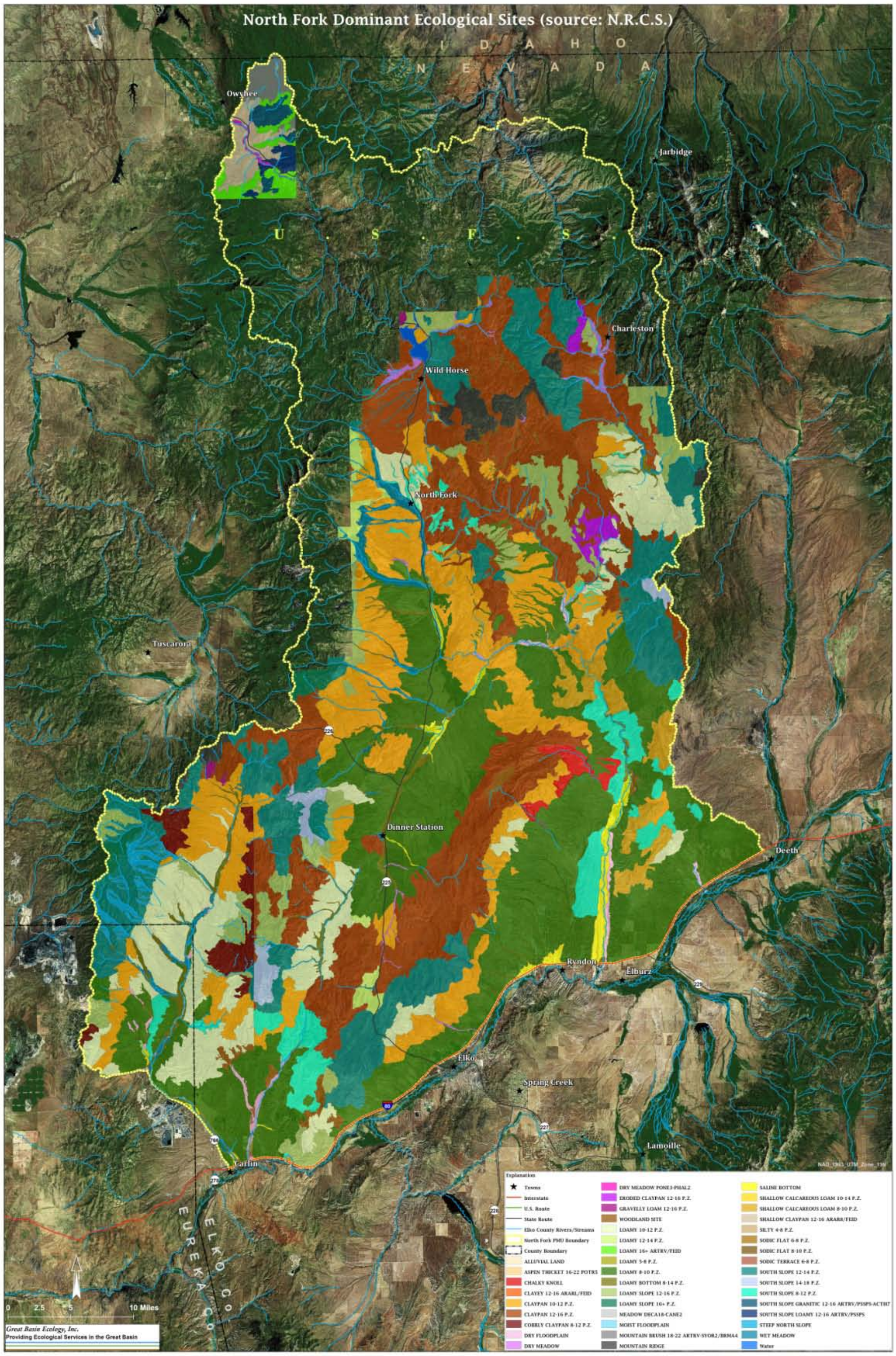
The time required to get to the sites is generally much greater than the time required to collect the data for either the rapid assessment method or the ecological site health method. Therefore, the extra time required to collect the rangeland health, rangeland inventory, watershed assessment or PFC data does not add significantly to the field effort, but does add significantly to the database and ability to make management recommendations.

5.0 References

Miller, F.M. and L.L. Eddleman. 2000. Spatial and Temporal Changes of Sage Grouse Habitat in the Sagebrush Biome. Tech. Bulletin 151. Oregon State University, Corvallis.

Northeastern Nevada Stewardship Group, Inc. (NNSG), 2004. Elko County Sagebrush Ecosystem Conservation Strategy. Elko, Nevada

CHAPTER 3 – CONCLUSIONS AND RECOMMENDATIONS



1.0 CONCLUSIONS

1.1 Current Habitat Conditions

Examination of Table 3-1 provides the focus for the issues and the path forward. As discussed in Chapter 2, the acreage that is currently in phase 1 will eventually become phase 2, phase 2 will progress to phase 3, etc. This provides some good news and bad news.

Table 3- 1: Existing and Desired Acreage of Habitats in the North Fork PMU

Phase	Existing Acres per Phase	Existing Percent of PMU	Existing Percent of Potential Habitat	Desired Percent of Potential Habitat
Phase 1	161,471	9.3	15.5	25
Phase 2	53,498	3.1	5.1	25
Phase 3	459,419	26.5	44.2	25
Phase 4	161,401	9.3	15.5	25
Alternate State	203,661	11.8	19.6	0
Totals	**1,039,450**	**60**	**100**	**100**

Not many years ago, sage-grouse populations in Elko County and the North Fork PMU were greater than they are today. While fires and the spread of annual, non-native invasive species has been part of the problem, the data in Table 3-1 is also very enlightening. The preponderance of acreage in the phase 3 category explains a lot with respect to changes in sage-grouse populations. In the last 30 years much of this acreage has converted from phase 2 to phase 3. As discussed above, phase 2 includes the "production habitats;" pre-laying, nesting, early brood and early summer habitats which provide the cover and forage required to raise young sage-grouse for recruitment into the population. Phase 3 does not provide the same quality habitats as does phase 2. There are now nine times more phase 3 habitats than phase 2 habitats. The ability to raise sage-grouse eggs to become members of the adult population has declined over the last 30 years. The lack of production is the major factor in the decline of sage-grouse in this PMU.

The good news is that there is a substantial amount of acreage in Phase 1 that will soon become nesting and early brood habitats (phase 2); habitats that are currently in short supply within the PMU. Over the next ten to 20 years the availability of nesting and early brood habitat should increase, with concomitant increases in survival rate and sage-grouse populations.

The bad news is that the phase 3 acreage is going to move into the phase 4 category. The last column of Table 3-1 is an indication of the desired condition on the landscape; the percentages of each of the phases that are needed to sustain sage-grouse populations over time. The disparity between column 4 and column 5 is our land management challenge. Rehabilitating the almost 20 percent of potential habitat that has become altered states of one or more of the ecological sites will be the most challenging, but 203,661 acres of potential sage-grouse habitat, livestock forage, mule deer and/or pronghorn antelope habitats, and recreational opportunities is too significant to ignore. Waiting to restore these areas to productive sites that provide value to sage-grouse and other resource uses is not an option as this category has the potential to increase rapidly.

Much of the phase 3 acreage can be managed to create additional phase 2 habitats. Low intensity treatments can reduce shrub cover to release the perennial grasses and forbs and promote regeneration of sagebrush. The NNSG demonstration plots north of Deeth, Nevada have responded in the ten years since treatment with a new generation of sagebrush that has replaced the older, decadent sagebrush. Managing the phase 3 acreage before it becomes phase 4 acreage is the most cost-effective means of creating more phase 2 habitats. This is also the most rapid way to achieve these results.

Prevention of the phase 4 acreage from transitioning to an altered state(s) of the ecological sites also has to be considered a priority. Given the expense and effort, the time that rehabilitation may take, and the lower probability of success for restoring the altered states to productive habitats, keeping ecological sites from crossing thresholds that create altered states should be a very high priority. The data collected for this assessment provides the location and condition of these phase 4 areas. Therefore, management of these areas is possible in the short-term.

The presence of medusahead in the northern tier of counties to the west of Elko County is all the incentive needed to move forward on this type of landscape management. This species is more difficult to control and eradicate than cheatgrass and many of the other non-native invasive species. If we cannot act now to improve and maintain the integrity of our ecological sites, then listing sage-grouse as threatened or endangered under the Endangered Species Act will be a foregone conclusion.

1.2 Major Risk Factors

1.2.1 Predation

In Chapter 2 the risk factors for the North Fork PMU identified by the NNSG were identified and described. The impacts of these risk factors are discussed below.

There can be no discussion of sage-grouse populations in Elko County without addressing predation. While the focus of this assessment effort has been an assessment of habitat, predation has been the number one issue for many, as evidenced by recent articles and news items in the Elko Daily Free Press. This issue was addressed in the NNSG Strategy (NNSG 2004). However, this assessment would be remiss if some mention of predators and predation was not included.

There is general consensus that predator numbers are greater today than 30 years ago, at least for some predators. The raven, crow, and magpie seemed to have prospered by adapting to civilization. Increased population has led to increased road kills, a mainstay of most raven, crow, and magpie diets. There does not seem to be any shortage of food for these species as would have occurred prior to European settlement, when these species relied on the vagaries of nature to provide food. As with all species, there would have been years of plenty and years of scarcity. The populations of these scavengers/predators would have been impacted by the variability in food availability. However, this seems to be less variable now as road kills, garbage, and other human activities provide a steady and reliable source of food.

In addition, the spread of power and communication lines has provided nesting habitat where none existed before. So the potential has increased for more nests and more young of these species. The perches provided by these lines has also provided ravens and crows with places from which to perch-hunt – a place where they can wait and observe the landscape to find prey, such as sage-grouse nests. When the sage-grouse hen leaves the nest, usually twice a day, she is potentially providing clues to the location of the nest. A perched raven or crow or magpie that detects her movement as she leaves or returns to the nest will search the area where the sage-grouse was observed. Over a period of days, the search area can be narrowed and eventually the nest can be located and the eggs destroyed.

While there are other predators that prey on sage-grouse nests, the ravens, crows, and magpies appear to be the most successful, and most persistent. Therefore, it is safe to conclude that given the poor quality of habitat for nesting and early brood rearing, finding a sage-grouse nest is not very difficult for these predators. Improving the habitat quality is one way of reducing predation. Another way is to reduce the predator population.

1.2.2 Livestock Grazing

There are also those that hold livestock grazing as the major factor in the demise of sage-grouse. While there can be no doubt that improper grazing, supplementing, and watering can be detrimental to sage-grouse habitats, the discussion in this assessment of habitat changes resulting from plant dynamics for each ecological site appears to interact with livestock grazing. When livestock are faced with a phase 1 condition in a pasture, selecting the most nutritious diet and obtaining sufficient amounts of forage can be readily achieved. This probably continues through phase 2 and begins to be an issue as the vegetation transitions to phases 3 and 4. The total biomass of herbaceous vegetation declines in phases 3 and 4, and at some point along that decline, the herbivore must take a higher percentage of biomass from each forage plant to maintain forage intake as compared to foraging in phases 1 and 2. It is simple math that to maintain constant biomass intake as the number of plants declines, more biomass must be taken from each plant. When the amount of biomass taken has a significant negative effect on the plant, "overgrazing" is occurring. As discussed in Chapter 2, under a proper grazing system, the overall impact of grazing on the herbaceous community is minimal compared to the changes in the plant community that result from the plant community dynamics; competition for nutrients, light, and moisture. There is an additive effect from grazing, even proper grazing.

The "easy fix" is to change the grazing system, number of animals that are permitted to graze, and the duration of grazing. While these actions may help the health of the herbaceous plants, they do not change the plant community dynamics. The biomass of grass and forbs will continue to decrease as the biomass of shrubs continues to increase. Only when the biomass of shrubs is at the capacity of the site to produce biomass will the long-term equilibrium be reached. However, as has been the focus of this assessment, that equilibrium can be upset by the establishment of cheatgrass and/or other non-native, invasive species. Therefore, the management of the vegetation must be the major management action to prevent ecological sites from crossing thresholds and transitioning to altered states.

As the vegetation is managed, the livestock management must also be modified to continue to maintain the integrity of the ecological site. If a phase 4 condition is treated to create a phase 1 condition, uncontrolled or abusive grazing can cause the plant community to transition to an altered state. Managing the vegetation and the herbivores (domestic and wild) must occur simultaneously to be successful.

1.2.3 Fire Ecology

There are three primary factors that have been responsible for changes in the fire ecology of the sagebrush ecological sites: livestock grazing, introduction and spread of cheatgrass, and plant dynamics.

When livestock grazing was introduced to northeastern Nevada, there was some mixture on the landscape of the various phases that have been discussed. Certainly the amount of perennial grass was much less than was present in the Midwest and prairies, or some of those traveling the California trail would have settled in Nevada and raised livestock. But there had to be sufficient amounts of grass to at least have some entertain the notion that livestock grazing could be conducted in northern Nevada. The exact ratio of shrubs, grasses, and forbs will never be known, but the climate was cooler and there was more precipitation than today. The Little Ice Age ended around 1850. This was 300-year period of cold with enough precipitation to have small glaciers in the high elevations. In 1850 the climate did not suddenly change to what we have today, but gradually warmed and dried. Therefore, one would expect that the vegetation was at peak production – similar to two or three years of above normal precipitation during our present climate. When such periods of above normal precipitation occur, the amount of production per acre will nearly double that of a normal year on some ecological sites.

Over the first 80 years of livestock grazing in Nevada there were high numbers of livestock, as well as a mixture of sheep and cows. The high level of herbivory removed most of the herbaceous biomass, but sheep also browsed on sagebrush in the fall. As livestock numbers increased, it is likely that cattle also browsed on sagebrush when herbaceous vegetation was in short supply. In areas that were equivalent to the phase 1 and phase 2 discussed above, the livestock grazing would have removed sufficient fuel, especially the fine fuels, to reduce the continuity of the fuel. In areas of phase 3, the fine fuels would have been removed, but the density of shrubs may have been sufficient to carry fire under extreme conditions. And in phase 4 conditions, there would have been some reduction of fuels, but not enough to prevent the spread of fire. Depending on the ration of the various phases on the landscape, the frequency and size of fires would have been quite low. As mining towns sprang up throughout the area, sagebrush was harvested for fuel for heating and cooking. Large areas were laid bare of shrubs and insufficient continuous fuel remained to facilitate the spread of fires.

As livestock numbers were reduced and grazing allotments were created, the shrubs returned to the landscape. Still the numbers of sheep and cattle were sufficient to keep fuel levels such that large fires were not common. As sheep numbers started to decline and crested wheatgrass seedings were planted to rehabilitate areas dominated by halogeton, and later planted to improve early spring forage and overall forage availability, shrubs had an opportunity to rebound. During this rebound, the phase 2 habitats would have increased and sage-grouse populations also increased with high populations occurring in the 1950s to 1980s. The change of phase 2 to phase 3 conditions would have decreased the amount of suitable nesting habitat, and sage-grouse populations would have decreased from 1980 to the present time. The increase in phase 3 and eventually phase 4 created higher fuel loadings. But livestock continued to keep the fine fuels low, so fires in the phase 1 and 2 sites were still uncommon. Cheatgrass was slowly moving into areas where livestock concentrated – sheep bedding areas, salt areas, around troughs and reservoirs, along fenceline trails, and other areas of concentrated use where the vegetation was trampled and the soil was disturbed.

By the early 1960s cheatgrass was providing continuous fuels in some areas and with severe lightning storms in 1964, some "large" fires occurred. The areas burned were sufficiently large that they exceeded the capacity for BLM to conduct emergency fire rehabilitation or were in areas of multiple ownership and rehabilitation seedings were not conducted. As a result, cheatgrass establishment exploded. Cheatgrass not only expanded into the burned areas, but began to establish in the understory of the phase 4 sagebrush stands. By 1999, shrub densities and cheatgrass-dominated lands were so extensive that a two-week period in late July and early August burned over a million acres in northern Nevada.

The synergism among livestock grazing, cheatgrass establishment, and plant dynamics created conditions that at first prevented fires, but later facilitated ignitions and spread of fire. As shown in Table 3-1, there is a large acreage of phase 3 and altered states in the North Fork PMU and more large fire years are likely to occur. Once the phase 4 conditions exist on the landscape, grazing by cattle is not sufficient to reduce the heavy fuels, which are sufficiently contiguous to carry a fire in the absence of herbaceous vegetation.

In 160 years the fire ecology has changed from one of small, infrequent fires to that of large fires with very short return intervals, burning the same areas repeatedly. This should be sufficient reason to change the way vegetation is managed from a passive system that relies on livestock to an active system that actively controls fuel loading.

2.0 RECOMMENDATIONS

2.1 Vegetation Management

The basis for the assessment, as previously discussed, has been the condition of the ecological sites occurring within the PMU boundary. Therefore, the management recommendations are made at the ecological site level. This approach is appropriate when making recommendations for vegetation management, as different ecological sites will respond differently to the same treatments, and treatments can often be applied on the ground to individual ecological sites. However, for grazing management, the pasture and allotment levels are generally the level of management; livestock generally don't graze by ecological site.

As shown in Table 3-2, ecological sites can be grouped into response groups based on how similar these various communities are with respect to community phases within their respective State and Transition models. Consequently, the management recommendations will be made at the response group level (appropriate at the pasture or allotment decisions) and at the individual ecological site level (appropriate for vegetation management decisions).

There is also a discussion of priorities for management. The priorities that are discussed are based on maintaining or restoring the ecological integrity of the sites. The priorities listed herein are management actions that need to be implemented prior to other management actions if the ecological site integrity or restoration is to be accomplished cost-effectively.

An ecological site Management Key (Management Key) has been developed that leads the manager through a series of decisions, with the end result being a management pathway that can be used to implement management decisions (Appendix C). The purpose of the Management Key is to avoid implementing management strategies that are not suitable for the landscape condition or a given ecological site. For example, the use of prescribed burning is not suitable or desirable

Table 3- 2: Response Groups and Ecological Sites in the North Fork PMU

Response Group[1]	Ecological Site	Acres	Number of Community Phases	Disturbance Interval (years)
Wyoming Big Sagebrush	Loamy 8-10" p.z.	295,431	4	40
	Loamy 10-12" p.z.	123,728		
	Loamy 12-14" p.z.	21,107		
	Sandy 8-10" p.z.	2,130	4	60
	South Slope 8-12" p.z.	58,447	3	80-120
	South Slope 12-14" p.z.	89,829		
	Chalky Knoll	17,648	3	100+
Dwarf Sagebrush – High Precipitation	Claypan 12-16" p.z.	183,936	3	100+
	Mountain Ridge	57,668		
	Shallow Calcareous Loam 10-14" p.z.	29		
	Shallow Claypan 12-16" p.z.	5,894		
Dwarf Sagebrush – Low Precipitation	Claypan 10-12" p.z.	109,146	2	150+
	Cobbly Claypan 8-12" p.z.	7,928		
	Shallow Calcareous Loam 8-10" p.z.	19,976		
Mountain Big Sagebrush	Gravelly Loam 12-16" p.z.	7,613	3	25-50
	Loamy 14-16" p.z.	19,671		
	Loamy 13-16"p.z.	3,373		
	Loamy 16+" p.z.	3,379		
	Deep Loamy 14+" p.z.	817		
	Loamy Slope 12-14" p.z.	24		
	Loamy Slope 12-16" p.z.	126,173		
	Loamy Slope 16+" p.z.	42,459		
	Shallow Loam 14-16" p.z.	8,182		
	Mountain Brush 18-22" p.z.	2,531		
	North Slope Loamy 16+" p.z.	1,197		
	South Slope 12-16" p.z.	161,414		
	South Slope Granitic 12-16" p.z.	4,147		
	South Slope Loamy 12-16" p.z.	1,197		
	Steep North Slope	12,973		
Basin Big Sagebrush	Dry Floodplain	5,573	3	40-60
	Dry Meadow	2,124		
	Loamy Bottom 8-14" p.z.	24,722		
	Loamy 12-16" p.z.	393		
Meadow	Moist Floodplain	2,096	1	10-15
	Wet Meadow	48,737		

[1]The name of the response group is based on the modal site

on all ecological sites and the Management Key helps the manager avoid the use of fire on these particular ecological sites.

2.1.1 Priorities

The primary guidance for management actions is to *maintain the integrity of the ecological sites*. As has been discussed previously, once a threshold has been crossed, the cost of restoring the integrity of an ecological site goes up and the probability of success goes down. Therefore, the number one priority is to keep ecological sites from crossing thresholds. By doing this the flexibility for long-term management is maintained.

The second priority for this PMU is to manage the phase 3 condition vegetation to create more phase 2 condition acreage and more phase 1 condition acreage. However, this needs to be done in the context of the adjacent vegetation condition. For example, if there is phase 3 vegetation adjacent to a recently burned area that is in phase 1, then no more phase 1 is needed, but creating phase 2 vegetation condition would be appropriate.

The third priority is to rehabilitate the altered states. This can be done through facilitated succession on sites that are on the low end of the precipitation zone. Facilitated succession involves controlling the annual vegetation and seeding crested wheatgrass or other aggressive perennial grass that is drought tolerant to establish a perennial grass community. Over time this area can be overseeded with native perennial grasses and forbs to increase the habitat quality and plant diversity. Eventually, shrubs will reestablish or can also be seeded to create a phase 2 community.

Other means of rehabilitating altered sites will depend on what vegetation is currently on the site, in which precipitation zone the site is located, and which equipment can be used to conduct the treatment.

2.1.2 Management Recommendations by Response Group

The response groups identified in Table 3-2 are preliminary, as the modeling effort for the MLRA 25 has not yet been completed. In each response group, the general management recommendation is based on maintaining the ecological site integrity (i.e., maintaining the community phases of State 1 or State 2). Where altered states for any of the response groups occur within the PMU, the rehabilitation pathways will be developed as the management actions to return the community from the altered state to State 2.

A general Management Treatment Key has been developed for the North Fork PMU (Appendix C). This treatment key takes the manager through a series of conditions or issues and for each condition/issue there are options. The treatment key is designed to ensure that the big issues that are within management's control and that will determine the success or failure of a vegetation treatment are considered before any treatment is implemented. Ultimately, the climatic conditions at the time of the treatment and the first two or three growing seasons after the treatment, the conditions under which the treatments are implemented, and the post-treatment grazing management are three key elements in determining treatment success.

Management can control only the last element. Therefore, the potential for failure exists even if everything is done properly. However, doing things properly increases the chance of success significantly.

NRCS has also developed soil suitability criteria for rangeland seedings (Appendix D) that should be considered when seeding is a management option. These criteria pertain to soil characteristics such as moisture regimes, effective moisture, surface texture, soil chemistry, wind erosion factor, and others. These factors help determine the method of seeding and potential limitations for seeding.

The following discussion of management by response group assumes that the conditions/issues in the treatment key will be addressed and focuses primarily on the management tools and how to implement them for each group.

Wyoming Sagebrush Group

State 1 and State 2 of this group consist of perennial grasses and forbs with Wyoming big sagebrush as the dominant shrub. State 2 includes the presence of non-native, invasive species such as annual grasses (e.g., cheatgrass) or annual forbs (e.g., mustard species) in the understory, but State 2 also has a perennial grass and forb component. The definition of State 2 allows for the presence of non-native, invasive species but as a minor component of the vegetation (i.e., less than ten percent cover, all non-native, invasive species combined). As the percentage of non-native, invasive species increases, the fewer management options that are available to conduct vegetation management. The goal of vegetation management for these sites is to prevent the plant community from crossing a threshold that allows the annual grasses and forbs to dominate the understory and to maintain healthy sagebrush plants. When perennial grass and forb cover decreases to near ten percent and shrub cover approaches 25 to 35 percent (depending on the ecological site), it is likely that the plant community is close to crossing the threshold. The presence of non-native, invasive plant species should also be a threshold consideration.

Maintenance of the grass phase of this community state can be accomplished by periodic prescribed (Rx) burning. Rx burns should not occur more frequently than once per decade to prevent cheatgrass from increasing to a high risk level. The objective of this treatment should be to reduce shrub establishment; however, the community pathway to a grass-shrub phase is desirable and the site should not be maintained in a grass phase for an extended period of time.

All burns should be conducted in the fall or early spring, and should be conducted in pastures or grazing areas that were rested during the grazing season prior to the treatment. This allows sufficient standing fuel to carry the fire without high winds. Fall burns should ***only*** be conducted after fall precipitation has occurred in sufficient amount to allow green-up of the base of the perennial grass plants[8]. Burning without

[8] "Cool" burns are not "cool" because of the ambient air temperature at the time of burning, but instead are based on the heat emitted during burning. A fall burn after precipitation

this level of soil/plant moisture is likely to result in higher than acceptable perennial grass mortality and an increase in non-native, invasive plant species. Spring burns should be conducted early in the growing season to take advantage of the standing residual biomass and high fuel moisture of the perennial grasses and forbs. Because leaf growth is initiating at this time, the leaf buds or growing points are highly susceptible to high temperatures. Ignitions should be widely spaced and the indication of a successful Rx burn will be patches of unburned vegetation intermingled with about an equal amount of burned patches. The conditions under which a "cool" burn is conducted should not allow for 100 percent burn (either 100 percent of the treatment area or 100 percent of the vegetation).

Maintenance of the perennial grass/forb phase is only recommended for the more mesic ecological sites in this group (i.e., South Slope 12-14" p.z., Loamy 10-12" p.z., and Shallow Loam 10-14" p.z. sites). These sites are likely to support sufficient perennial grass plants to respond favorably to this treatment. Aerial seeding before or after this treatment can supplement the existing native seed bank or can be used to increase the abundance of desired perennial grass or forb species.

Phase 2 of this community state, the perennial grass/forb-shrub mixture, can be maintained by Rx burns, aeration, mowing (brush hog), or herbicide application. The goal of the treatment is to slow the establishment of shrubs and maintain the mixture of shrubs and perennial grasses/forbs. Slope, precipitation zone, and abundance of non-native, invasive species all need to be considered when selecting a treatment of the perennial grass/forb-shrub phase. As discussed for the perennial grass/forb phase, treatments are likely to have a higher degree of success if conducted while soil and plant moisture are relatively high. Because of spring mud conditions, early spring mechanical treatment (e.g., mowing or aeration) may be difficult to implement, but should be carried out once the soil can support the equipment and be ended before soil moisture is depleted. Dormant season (i.e., late summer) mowing or aeration can also be successful. If the soils have a relatively high clay content, aeration may have to be conducted under low soil moisture conditions to prevent the clay from accumulating on the aerator drum. This causes surface disturbance and uprooting grasses and forbs with the clay soil.

Phase 3 of this community state, the shrub-dominated phase, can be maintained by very low intensity treatments that allow for quick reestablishment of the shrub component with some increase in the perennial grass/forb component. Aeration or mowing with widely spaced strips, or Rx burning under high fuel moisture, low wind conditions, or very light herbicide application are examples of low intensity treatments. Aerial seeding of desired perennial grasses and forbs can be conducted where the perennial herbaceous abundance is approaching a threshold.

creates high fuel moisture that prevents the burn from generating high temperatures (i.e., "hot" fire) by burning fuel completely or at high intensity. Therefore, fuel moisture is critical to achieving a successful treatment.

Rather than maintain this community phase, more often the goal will be to implement treatments to cycle this shrub-dominated phase to a phase 1 or phase 2 condition. The same treatments discussed above for maintenance of this community phase, only at higher intensity levels, will accomplish this goal. By increasing the intensity of the treatment, a perennial grass/forb phase can be achieved and by using a moderate level of treatment intensity, a perennial grass/forb-shrub phase can be achieved. Drill seeding or aerial seeding can be conducted if the goal is the phase 1 condition. If aerial seeding, then some means of covering the seed (i.e., harrowing) should be considered to improve seeding success. If the goal is a phase 2 condition, then aerial seeding should also be considered; however, harrowing is unlikely to be possible with the remaining shrub cover. Where slope or rocky surfaces prevent mowing or aerating, then Rx burn and herbicide are the treatments available. Treatments on slopes should be of intermediate level to maintain a perennial grass/forb-shrub mixture. This level of treatment will prevent unacceptable soil erosion rates as compared to a higher intensity treatment that removes most of the vegetation.

The drier ecological sites in this group (i.e., Loamy 8-10" p.z., and Sandy 8-10" p.z.) are less likely to respond well to Rx burning or treatments of large size (i.e., > 200 acres). Any disturbance in these ecological sites will favor non-native, invasive plant species establishment, especially a high severity/intensity fire. Mechanical treatments, such as aerator or brush hog (mower), should be used with low intensity; do not treat the entire treatment area, but leave strips or rows of intact vegetation to serve as seed sources and as collectors of winter snow (i.e., create drifts). Always treat these lower precipitation zone sites when soil and plant moistures are high. If Rx burn is to be used, burning on snow is the recommended method. Snow cover of one to two inches protects the herbaceous plant growing points (which are near the ground), but any standing residual leaf material (stubble) would be burned and help carry the fire between shrubs. Because of the high fuel moisture and soil moisture, these fires can only be conducted when wind speed is over ten miles per hour. Because these sites are generally lower elevation sites, suitable conditions for burning on snow may not occur each year. Therefore, the fuel/fire breaks need to be set up prior to the winter and the burn should take place whenever suitable conditions occur. These types of burn will be very patchy and may require multiple ignitions to get sufficient acreage treated. However, the protection of the limited amount of perennial grasses and forbs is the priority for this type of treatment.

An altered state on these sites is likely to consist of a sagebrush overstory with an annual grass/forb understory (State 3) or a site dominated by annual grasses and forbs with very little, if any shrub presence (State 4).

The rehabilitation pathway for State 3 is control of the annual grasses/forbs with herbicide, removal of the shrubs after the annual plants are controlled, and seed with annual grasses. At the lower precipitation zones, seeding with varieties of introduced wheatgrasses is recommended as a first stage of rehabilitation. These perennial wheatgrasses are very competitive with cheatgrass and mustard and can be used to prepare the site for later seeding with native perennial grasses and forbs, and with sagebrush. At the upper precipitation zones, a mixture of native grasses/forbs and introduced wheatgrasses may be desirable. An experimental treatment of Rx burning after the fall precipitation stimulates cheatgrass germination can also be attempted. The fire conducted at this time results in a very high mortality rate on the cheatgrass seedlings, allowing the seeded, desired species to establish in the absence of cheatgrass competition. However, this should be done on a small scale with very close monitoring to ensure the treatment is successful. Seeding before or after the burn will be necessary when treating State 3 to ensure adequate perennial grass response.

The rehabilitation of State 4 is essentially the same as for State 3, except the shrub removal is not necessary. The experimental burn is also applicable to this state. Herbicide application to achieve sufficient control of the annual species is expensive, and micro-site conditions across the landscape can affect the efficacy of the treatment. It may be necessary to treat more than once to get sufficient control of the annual species. Complete eradication of the annuals is not likely, but a very high level of control will allow establishment of the perennial wheatgrasses.

With respect to the overall PMU landscape, the ecological sites in this response group should be treated over time to establish the three (or four) community phases of State 1 or 2 in approximately equal proportions. Once this multiple-phase condition is established, treatments will generally consist of treating phase 3 (or phase 4) to reestablish phase 1. The natural community pathways from phase 1 to phase 2, and from phase 2 to phase 3 (and phase 3 to phase 4), will eliminate the need for treatments to these other phases. Consequently, the overall vegetation management will be simplified once the desired community phases are established.

Mountain Big Sagebrush Group

This group has higher levels of annual production than the Wyoming big sagebrush group. However, some of the plant dynamics are similar. Over time the perennial grass/forb phase becomes a perennial grass/forb-shrub mixture phase, and eventually a shrub-dominated phase. However, the total shrub and perennial grass/forb cover is higher than the Wyoming big sagebrush group because of the more mesic conditions. The goal for this group is to create a mosaic of community phases on the landscape where these sites occur.

Management options are limited by topography more than by precipitation. Rx burning and herbicide application are the two primary shrub control methods. On north slopes, mesic sites, fall Rx burns or spring burns will result in release of native perennial grasses and forbs. Spring burns may be limited by access during most years. On more xeric sites, burning on snow is recommended to protect the perennial grasses and forbs. Size of the treatment will depend on the condition of the herbaceous understory. If perennial grasses are less than ten percent of the cover, then treatments on slopes should be small and less intense than on sites with greater than ten percent perennial grass cover, and burning on snow is recommended.

Because of the higher fuel loading on these sites, Rx burning should be done in strips, starting near the top of the burn area and working downhill. This results in each successive burn strip burning uphill to a previously burned strip. This prevents the fire from generating too much heat and reduces mortality to the perennial grasses. Burning on snow should follow the same procedure. Width of the strip to be burned is dependent on slope steepness and fuel loading; the steeper the slope or higher the fuel loading, the narrower the burn strip should be to control treatment intensity.

Herbicide, such as tebuthiron (trade name Spike) should be applied aerially to achieve a shrub thinning. Follow up treatments should be considered to achieve the desired shrub density, rather than increasing the application rate. Applications should be separated by at least one full growing season to allow perennial grasses to be released and to recover from herbicide stress.

Pre- or post-treatment seeding is generally not required at these high elevation sites, except for south slope sites. However, if seeding is determined to be necessary, then aerial application is generally the only option. Native grass species should be the choice for these sites, rather than introduced wheatgrass species, as cheatgrass control and seeding establishment are not generally issues on these sites, except on south slope sites.

Basin Big Sagebrush Group

Most of the Basin big sagebrush group sites are in deep soils associated with bottoms and fans. These soils are very productive and fuel loading is often high, even if the site is grass-dominated. These sites are often associated with moving water, either perennial creeks or ephemeral and intermittent creeks. Therefore, erosion of creek channels is a major consideration when applying treatments.

As with the Wyoming big sagebrush and mountain big sagebrush groups, the community phases are similar for the Basin big sagebrush group. However, transition to an altered state in the Basin big sagebrush group can occur by a change in the water table resulting from incision of the creek channel. Drying of the floodplain or bottom site will generally allow cheatgrass and other annual species to establish on the site and create a transition pathway to an altered state dominated by annuals.

Proper grazing (see Section 2.1.3) is an important consideration for this group. Other treatments include Rx burn, aeration, mowing, and herbicide. Treatments should be small relative to the size of the site and treatment intensity should be moderate to prevent high mortality rates to perennial grasses. Where Basin wildrye or other perennial grasses are present, release of the grass species is anticipated.

The goal of management for this group is to create a mosaic of perennial grass/forb, perennial grass/forb-shrub, and shrub-perennial grass/forb phases on the ecological site. Treatment size should always be small enough to prevent significant erosion.

Post-treatment grazing management is important because of the drainage features of these sites. Creek bank vegetation establishment is a key to determining when grazing can be resumed, and utilization levels are a key to determining when seasonal grazing should be curtailed in any given year.

Coordination of treatments at these sites with treatment of other adjacent upland sites is necessary to prevent excessive sediment contribution to the Basin big sagebrush sites that have been treated. Without sufficient perennial grasses or forbs on these sites, additional sediment from the adjacent uplands would cause severe channel erosion and change in the water table.

Dwarf Sagebrush[9] – High Precipitation Group

Because of the low productivity of the sites and low growing stature of the shrubs, fire is relatively infrequent. However, because of the higher elevation of these sites, small patchy fires from lightning strikes in association with precipitation can maintain these sites.

Proper grazing (see Section 2.1.3) is the primary management action for this group. Under severe fire conditions, these ecological sites can burn and generally Sandberg's bluegrass (*Poa sandbergii*) will dominate the sites after fire. Shrubs return after an extended time period. Annual grasses and weeds can establish and make this site more susceptible to fires. Rehabilitation after severe fires to control annual grasses and weeds is an important step in maintaining site integrity.

Dwarf Sagebrush – Low Precipitation Group

Because of the low productivity of the sites and low growing stature of the shrubs, fire is relatively infrequent. The spacing of shrubs and grasses is not conducive to frequent fires. However, establishment of cheatgrass can increase the fire frequency in the group. Shrub spacing controls the severity of fire in these ecological sites and generally perennial grasses will respond to fire, if present.

Proper grazing (see Section 2.1.3) is the primary management action for this group. Where black sagebrush (*Artemisia nova*) is present, pinyon pine or juniper may establish and remove the shrubs and perennial grasses/forbs through competition. Control of the tree species is an important management consideration. Rehabilitation after severe fires to control annual grasses and weeds is an important step in maintaining site integrity.

Meadow Group

This group is characterized by mesic conditions that can support high levels of herbaceous production. Shrub control is not generally a consideration, unless there is a change in the water table (e.g., prolonged drought, headcut or other cause of an

[9] Dwarf sagebrush is used here to group the black sagebrush and low sagebrush species. Although the sites on which these two species grow are quite different with respect to soils, there is some similarity in response to management.

incised channel, or other man-induced changes to the water table) that allows shrubs to establish.

Proper grazing (see Section 2.1.3) is the primary method for managing these ecological sites. Monitoring desired grasses and forbs over time to determine changes in meadow composition will be the data on which management actions will be decided. Improper grazing or changes in the water table will be associated with a change in species composition. Noxious weeds, wild iris, shrubs, and changes from wet meadow grasses to dry meadow grasses are all indications of the need for change in the grazing management.

Occasionally, Rx burning could be applied to these sites to favor certain perennial grass species and facilitate nutrient cycling. As with the other treatments discussed for other groups, the entire meadow site should not be treated at one time. The unburned areas remain as buffers to control sediment movement and limit upper soil desiccation. Post-treatment grazing management should also be considered when burning these sites. The released vegetation will be very palatable to livestock (as well as to wildlife and wild horses) and excessive grazing can occur very quickly.

Because the soils associated with these sites are wet or moist most of the year, compaction from prolonged periods of grazing can occur. The soil compaction affects root development and surface soil moisture. Consequently, periods of rest are needed to maintain the soil conditions. This can be achieved by grazing the area in an annual rotation where different parts of the meadows are grazed in sequence during the growing season and every portion receives some period of non-grazing during the growing season. The entire area will be grazed each year, but not continuously throughout the grazing season.

Many of the smaller meadows associated with springs and creeks are too small to manage as separate units, but the need exists for management of these small areas. Compaction of soils in these riparian meadows allows the upper soil layer to dry sufficiently to change the plant species composition and eventually Basin big sagebrush will establish on these sites. When sagebrush begins to occupy the site, an ecological threshold has been crossed and generally there will be a change in the channel morphology that results in a lowered water table. The restoration pathway back to a meadow condition involves channel restoration and vegetation management.

Water distribution within the pastures is one practice that can reduce the pressure on these stringer meadows. Rest rotation or deferred grazing that allows the riparian area to recover are also management tools to address this issue.

The general management recommendations for the Response Groups discussed above are general management guidelines for the groups. However, while in the field, certain conditions occurred at different sites within these Response Groups that require an extra measure of consideration when applying the general management guidelines. For example, a Loamy Bottom 8-10” p.z. with a high percentage of rubber rabbitbrush or a Droughty Loam 8-10" p.z. with a high percentage of Douglas rabbitbrush both need to have the rabbitbrush addressed as part of the treatment. An Rx burn under either of these conditions could have deleterious consequences relative to forage production or wildlife habitat.

2.1.3 Grazing System Recommendations

A management recommendation for all response groups is proper grazing management. While there is no single system of grazing that is appropriate for all situations, the grazing system should consider the effect of grazing on the forage plants. The effect of herbivory on plants is a function of the time, duration, and intensity of grazing (Briske and Richards 1995). The time refers to the annual plant life cycle and when herbivory takes place (i.e., during initiation of leaf growth, during leaf growth, during dormancy, etc.). Duration is the length of time over which the herbivory occurs. Intensity is a measure of the amount of plant material removed by herbivory and is normally separated by current year's growth and previous year's growth. There are some general principles that relate to these three factors and should be the component of any proper grazing system:

1. Keep early defoliation periods short or delay initial defoliation;
2. Ensure adequate leaf area and woody stems remain at the end of the grazing period;
3. Provide adequate time between defoliation events to permit leaf area and carbohydrate reserves to build; and
4. Ensure adequate residual leaf area and time late in the growing season to permit carbohydrate build up and bud development.

These principle guidelines are based on plant physiological responses to grazing and plant physiological development.

Early in the growing season keeping the defoliation periods short, or delaying the initial grazing period, protects the growing points on the grass plant. In the spring, the growth of a leaf blade occurs from the root collar and continues from this point until the first leaf node is produced. The leaf node then becomes the point of growth. When plants just initiate their growth, the growth points are vulnerable to grazing. Removal of the growth point requires the plant to create a new bud. This draws on the root system at the time of the year when the roots are supplying energy for leaf growth. Therefore, developing new growth points creates a stress on the plant by depleting the root reserves. The key is to keep the grazing period short so that the livestock do not need to take second or third bites of the same plant.

Delaying the initial grazing until the growing point is at the first leaf node allows more forage to be produced and if the leaf node is removed, the root collar growing point is still intact to resume leaf blade production.

If the grazing is ended during the growing season in a given pasture, then the plants generally have sufficient soil moisture to continue plant growth. Therefore, ensuring that adequate leaf area and woody stems (of shrubs) remain at the conclusion of a grazing period allows the plant to produce additional leaf area, thus providing more energy to the root reserves and for bud development for the next year.

If the grazing is ended during the dormant season in a given pasture, then there is generally going to be very little additional plant growth. Therefore, leaving residual stubble height ensures that the leaf buds or growing points for the next year are present.

Providing adequate time between defoliation events to permit leaf area and carbohydrate reserves to build is a basic reason for rotation systems. If a plant is grazed early, then there is time to re-grow and produce seed and restore carbohydrates for next spring. If the plant is then grazed later the next year, the early season growth allows the plant to produce seed and completely restore root reserves. If the plant is grazed late in the season, then grazing early the next year could stress the plant if there is not enough leaf area for fall green-up and carbohydrate production.

Leaving adequate residual leaf area and time late in the growing season allows the plant to take advantage of fall moisture to replace root reserves and for bud development. The residual stubble is also important for creating a micro-climate to keep the buds from freezing and for trapping winter moisture (i.e., snow) to promote growth the following spring.

These principles are critical for the burned areas and areas undergoing rehabilitation. The vegetation following low or moderate intensity/severity burns is quite robust, but can quickly deteriorate if the grazing is improper. Improper grazing will promote loss of grasses at a pace more rapid than a proper grazing system. In addition, the plant community is likely to approach and cross the threshold where cheatgrass or other non-native invasive species readily establish and create a transition pathway to an altered state. In contrast, areas undergoing rehabilitation following high intensity/severity burns or other disturbance need some initial protection from grazing to allow seeds to germinate, establish, and become securely anchored in the soil before grazing is initiated. Once established, proper grazing is critical to maintaining the herbaceous vegetation on the site.

While the discussion above pertains primarily to big sagebrush sites, the grazing principles apply to any ecological site where grazing is a major factor in plant foliage harvest.

Emphasis must be made that many of the ecological sites on the PMU cannot be rehabilitated by only implementing a proper grazing system. Vegetation treatments, as discussed above, are a necessary part of the overall management approach. However, the reverse is also true; implementation of only the vegetation treatments cannot restore the productivity of the various ecological sites. Proper grazing and vegetation management are complementary approaches to rehabilitating the condition of the PMU. One won't work without the other, at least not in reasonable timeframes.

2.1.4 Predation

The primary risk from predation of sage-grouse appears to be nest predation – the destruction of eggs – and the loss of chicks early in their life cycle. There are a variety of predators that prey on sage-grouse, but as discussed earlier, ravens, crows, and magpies (i.e., corvids) seem to be the major predators of nests.

While there are those that would like to implement a broad scale predator control system in the name of sage-grouse conservation, this does not seem justified. However, a focused predator control program that targets the nest predators and is implemented in and around nesting habitat would be more cost-efficient and more beneficial to sage-grouse.

While all predators are much maligned, at least some predators that prey on sage-grouse also prey on other species that may also prey on sage-grouse (e.g., ground squirrels prey on sage-grouse nests) and on other species that may be considered pests (e.g., snakes, rodents, and jackrabbits). Therefore, any wholesale predator control program can have unintended consequences.

But by targeting the major culprits in the areas where sage-grouse nesting takes place is likely to provide a substantial increase in nest success and early chick survival. Such a program can be carried out as a follow up to any vegetation treatment that creates phase 2 conditions. Placing eggs laced with a corvicide along power or communication lines will be readily discovered by the corvids. The corvicide causes renal failure. Timing the placement of the eggs after the corvids have laid their own eggs is likely to cause nest failure when one or more of the adult corvids are not available to incubate the eggs or care for the young.

Where transmission lines are not available, then placement of the eggs containing the corvicide within or near nesting habitat without any attempt to conceal the eggs will ensure that the corvids can discover the eggs.

Such a program would need to be reviewed by the USFWS and NDOW to ensure compliance with state and federal laws. But a focused program such as this where the effort is expended in the area where the issue exists and the area where successful predator reduction should have some measurable effect on sage-grouse populations is more likely to be accepted by the regulatory agencies than a wholesale predator control program.

3.0 REFERENCES

Briske, D.D., and J.H. Richards. 1995. Plant Responses to Defoliation: A Physiological, Morphological and Demographic Evaluation. *In:* D.J. Bedunah and R.E. Sosebee (eds.) Wildland Plants: Physiological Ecology and Developmental Morphology. Soc. Range Management. Denver, CO.

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APPENDICES

Appendix A

Field Data Sheets

ID No: ________ Polygon ID ____________ Date Entered: ____________

Great Basin Ecology Watershed Assessment Form

Date ________________ **GPS** (UTM NAD 83) **Point** __________ E ________________ N ________________

Observer(s) ____________________ **Photo Number(s)** ____________________ (Vertical & Landscape) **Camera** __________

Watershed North Fork PMU__________________ **Sub Watershed** ______________________________

Site Type: *Upland* or *Riparian* **Site** (e.g. Creek, Spring, Ridge, Etc.) ______________________________

Ecological Site: ____________________________ **Current Veg. Com.:** ____________________________

Soil Map Unit: ____________________________ **Notes:** ____________________________

Tree Condition: *Seedlings* *Saplings* *Mature* *Decadent*

Shrub Condition: *Seedlings* *Mature* *Decadent*

Grass Condition: *Seedlings* *Mature* *Decadent*

Forage Conditions: *Grazed* or *Not Apparent*

Grazing Species: *Cattle* *W. Horse* *Deer* *Antelope* *Elk* *Rabbit* ***Other:*** ____________________________

Weeds *Yes* or *No* **Species:** ________________________ **Patch Size/Type:** ________________________

Fire History*: Unburned / Burned (Yr.)* _______ **Notes** ______________________________________

Plant Mortality *Grasses* *Shrubs* *Trees* **Wildland Fuels:** *Low* *Average* *Excessive* **Type:** *Herbaceous* or *Woody*

Disturbances (e.g. ATVs, Livestock, etc.): *No* or *Yes* ______________________________________

Influential Features (e.g. geologic, culvert, diversion, road, fence, beaver dam, etc.) Other: ______________________

Erosion Features*: None Sheet Rill Gully Incised Channel Wind Slumping Headcut Other:* ____________________

Erosion Status: *Active* *Recent* *Historic* *Stable*

Pollutants: *Potential* *Existing* *N/A* **Water Quality:** *Turbid* *Clear* *Warm* *Cool*

Assessment Performed: *No/Yes* **Method:** *PFC-Lentic* *PFC-Lotic* *Rangeland Health* **Results:** *PFC* *FARU* *FARD* *NF*

Channel Type: *Aa+* *A* *B* *C* *D* *DA* *E* *F* *G*

Primary Land Use *Grazing* *Recreation* *Wildlife* **Other Use** ______________________________________

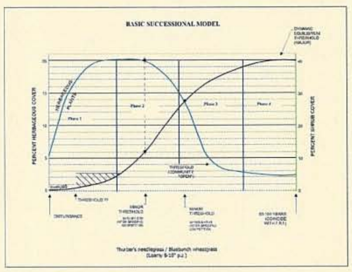
Potential Impacts to: *Water Supply* *Water Quality* *Roads* *Agriculture* *Homes* *Air Quality* *Soil Stability* *None*

Sage Grouse Habitat R-Value: *R0* *R1* *R2a* *R2b* *R2c* *R2d* *R3a* *R3b* *R4* Not a sagebrush community

Suitable Habitat for: *Lek* *Pre-Laying* *Early Brood* *Nesting* *Summer Brood* *Fall-Winter* *Not Suitable*

Primary Sage-Grouse Habitat Concern(s): *Insufficient Herbaceous* *Decadent Shrubs* *Poor Shrub Structure* *Insufficient Stubble* *Shrub Dominance* *Lack of Shrubs* *Unsuitable Ecological Site*

State and Transition Model Community Phase or Altered State: Comm. Phase - 1 2 3 4 Altered State



For sagebrush communities, indicate the community phase on the graph at left. If the community has transitioned to an Altered State, indicate by drawing an arrow that points down and to the right (i.e., ↘). Then describe the Altered State:

____

____

____

Site Needs Further Investigation *No* or *Yes* **Reason:** ______________________________

____

____

____

Primary Concern(s): *Excessive Erosion* *Excessive Sedimentation* *Drainage* *Flooding* *Vegetation* *Terrestrial Ecology* *Soil Productivity* *Aquatic Ecology* *Fuels* *Weeds* *Cheatgrass* *Other:* ______________

____

Potential Recommendations/Alternatives: ______________________________

____

____

____

____

____

WRITE-UP No. ______

RANGE INVENTORY WORKSHEET

Date: ______ Observer: ______

Watershed: ______ Project: ______

"Pre-Selected" Way Point No.: ______ Soil Survey Area: ______ Map Unit: ______

Ecological Site Name and/or Number: ______

Present Plant Community State/Phase: ______

(1) PLANT GROUP PERCENT COMPOSITION	PHENOLOGY (2)	(3) PLANT SYMBOL, SCIENTIFIC NOMENCLATURE, or COMMON PLANT NAME	CANOPY COVER (4)	PLANT HEIGHT (5)	WEIGHT (lbs/ac) (6)	ALLOWABLE (lbs/ac) (7)
GRASSES and GRASS-LIKE PLANTS			%	in.		
			%	in.		
			%	in.		
			%	in.		
			%	in.		
			%	in.		
			%	in.		
___% WEIGHT			%	in.		
			%	in.		
			%	in.		
___% COVER			%	in.		
			%	in.		
FORBS			%	in.		
			%	in.		
			%	in.		
			%	in.		
			%	in.		
			%	in.		
___% WEIGHT			%	in.		
			%	in.		
___% COVER			%	in.		
			%	in.		
SHRUBS and TREES			%	ft.		
			%	ft.		
			%	ft.		
			%	ft.		
			%	ft.		
			%	ft.		
			%	ft.		
			%	ft.		
			%	ft.		
___% WEIGHT			%	ft.		
			%	ft.		
___% COVER			%	ft.		
			%	ft.		
			%	ft.		
		TOTALS:				

(8) PRESENT UTILIZATION ______ % of ______ ; ______ *(key species)*

Way Point No.: ______

*e*UTM: ______ *n*UTM: ______

Photo No.: ______

SIMILARITY INDEX: ______

TREND INDICATORS			
PLANT VIGOR: DECREASERS	______	**APPARENT TREND** (Circle One)	
AGE CLASS DISTRIBUTION: DECREASERS	______	IMPROVING	
INCREASERS/INVADERS	______	DECLINING	
PLANT RESIDUE: DECREASERS	______	NOT APPARENT	
SOIL SURFACE FEATURES:	______		
TOTAL:	______		

Sum of all columns indicates ***Apparent Trend:*** >3 = *improving*, 0 to 3 = *Not Apparent*, <0 = *Declining*.

SITE HISTORY	
KIND(s) OF GRAZING ANIMAL:	
USE HISTORY:	NONE SLIGHT MODERATE HEAVY
SEASON OF USE:	SPRING SUMMER FALL WINTER UNKNOWN
WILDLIFE SPECIES:	
BURNING HISTORY:	UNKNOWN RARELY SYSTEMATICALLY
LAST BURN (years before present):	
LOGGING HISTORY:	UNKNOWN NOT LOGGED LOGGED ___ yrs ago

PHYSICAL SETTING		
ELEVATION: feet	SLOPE: %	AZIMUTH:
MAJOR or COMPONENT LANDFORM:		
SLOPE COMPONENT: (Circle One) Crest Summit Shoulder Backslope Footslope		
KIND OF SLOPE: (Circle One) Straight Concave Convex		
WATER TABLE DEPTH/DRAINAGE CLASS:	ft /	
FREQUENCY/DURATION of FLOODING or PONDING:	yr / mo	

GROUND COVER		
BASAL AREA (perennial herbaceous plants):		%
CRYPTOGAMS:		%
SURFACE ROCK FRAGMENTS:		
GRAVELS	2mm to 75mm diameter (1/16" to 3")	%
COBBLES	75mm to 250mm diameter (3" to 10")	%
STONES	250mm to 600mm diameter (10" to 24")	%
BOULDERS	≥ 600mm diameter (≥ 24")	%

NOTES: ______

TREATMENT NEEDS: ______

ASSOCIATED SITES: ______

RANGELAND HEALTH EVALUATION WORKSHEET

RANGELAND HEALTH INDICATOR RATING

Attribute	Indicators	Departure From Ecological Site Description or Ecological Reference Area(s)				
		Extreme	Moderate to Extreme	Moderate	Slight to Moderate	None to Slight
S,H	1. **Rills**					
Comments:						
S,H	2. **Waterflow Patterns**					
Comments:						
S,H	3. **Pedestals and/or Terracettes**					
Comments:						
S,H	4. **Bare Ground**					
Comments:						
S,H	5. **Gullies**					
Comments:						
S	6. **Wind-Scoured, Blowouts, and/or Deposition Areas**					
Comments:						
H	7. **Litter Movement**					
Comments:						
S,H,B	8. **Soil Surface Resistance to Erosion**					
Comments:						
S,H,B	9. **Soil Surface Loss or Degradation**					
Comments:						
H	10. **Plant Community Composition and Distribution Relative to Infiltration and Runoff**					
Comments:						
S,H,B	11. **Compaction Layer**					
Comments:						
B	12. **Functional/Structural Groups**					
Comments:						
B	13. **Plant Mortality/Decadence**					
Comments:						
H,B	14. **Litter Amount**					
Comments:						
B	15. **Annual Production**					
Comments:						
B	16. **Invasive Plants**					
Comments:						
B	17. **Reproductive Capability of Perennial Plants**					
Comments:						

Indicator Summary

	Rangeland Health Attributes	Departure From Ecological Site Description or Ecological Reference Area(s)					
		Extreme	Moderate to Extreme	Moderate	Slight to Moderate	None to Slight	Σ
S	Soil/Site Stability *(Indicators 1-6, 8, 9 & 11)*						9
H	Hydrologic Function *(Indicators 1-5, 7-11, & 14)*						11
B	Biotic Integrity *(Indicators 8, 9, 11-17)*						9

Attribute Summary - Check the category that best fits the "preponderance of evidence" for each of the three attributes relative to the distribution of indicator ratings in the preceding *Indicator Summary* table.

Attribute	Extreme	Moderate to Extreme	Moderate	Slight to Moderate	None to Slight
Soil/Site Stability *Rationale:*					
Hydrologic Function *Rationale:*					
Biotic Integrity *Rationale:*					

ID No: ________ Date Entered:____________

Lotic Standard Checklist

Name of Riparian-Wetland Area: ____

Date: ________________ **Area/Segment ID:** __________ **Acres:** __________

ID Team Observers: ______________________ **Miles:** ______________________

Waypoint No. ______

Yes	No	N/A	HYDROLOGY
			1) Floodplain above bankfull is inundated in "relatively frequent" events
			2) Where beaver dams are present they are active and stable
			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
			4) Riparian-wetland area is widening or has achieved potential extent
			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
			7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
			10) Riparian-wetland plants exhibit high vigor
			11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
			12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
			14) Point bars are revegetating with riparian-wetland vegetation
			15) Lateral stream movement is associated with natural sinuosity
			16) System is vertically stable
			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1998)

ID No: ________ Date Entered: ____________

Remarks

Summary Determination

Functional Rating:

Proper Functioning Condition ________
Functional – At Risk ________
Nonfunctional ________
Unknown ________

Trend for Functional – At Risk:

Upward ________
Downward ________
Not Apparent ________

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes ________
No ________

If yes, what are those factors:

________ Flow regulations
________ Channelization
________ Augmented flows
________ Mining activities
________ Road encroachment
________ Other (specify)
________ Upstream channel conditions
________ Oil field water discharge

____
____
____
____
____

Lentic Standard Checklist

Name of Riparian-Wetland Area: ______________________________
Date: __________________ **Area/Segment ID:** ___________ **Acres:** ____________
ID Team Observers: ______________________________
Waypoint No.

Yes	No	N/A	HYDROLOGY
			1) Riparian-wetland area is saturated at or near the surface or inundated in "relatively frequent" events
			2) Fluctuation of water levels is not excessive
			3) Riparian-wetland area is enlarging or has achieved potential extent
			4) Upland watershed is not contributing to riparian-wetland degradation
			5) Water quality is sufficient to support riparian-wetland plants
			6) Natural surface or subsurface flow patterns are not altered by disturbance (i.e., hoof action, dams, dikes, trails, roads, rills, gullies, drilling activities)
			7) Structure accommodates safe passage of flows (e.g., no headcut affecting dam or spillway)

Yes	No	N/A	VEGETATION
			8) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
			9) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
			10) Species present indicate maintenance of riparian-wetland soil moisture characteristics
			11) Vegetation is comprised of those plants or plant communities that have root masses capable of withstanding wind events, wave flow events, or overland flows (e.g., storm events, snowmelt)
			12) Riparian-wetland plants exhibit high vigor
			13) Adequate riparian-wetland vegetative cover is present to protect shoreline/ soil surface and dissipate energy during high wind and wave events or overland flows
			14) Frost or abnormal hydrologic heaving is not present
			15) Favorable microsite condition (i.e., woody material, water temperature, etc.) is maintained by adjacent site characteristics

Yes	No	N/A	EROSION/DEPOSITION
			16) Accumulation of chemicals affecting plant productivity/ composition is not apparent
			17) Saturation of soils (i.e., ponding, flooding frequency, and duration) is sufficient to compose and maintain hydric soils
			18) Underlying geologic structure/soil material/permafrost is capable of restricting water percolation
			19) Riparian-wetland is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)
			20) Islands and shoreline characteristics (i.e., rocks, coarse and/or large woody material) are adequate to dissipate wind and wave event energies

Lentic Standard Checklist

Name of Riparian-Wetland Area: ______________________________
Date: ____________ **Area/Segment ID:** ________ **Acres:** ________
ID Team Observers: ______________________________
Waypoint No.

Yes	No	N/A	HYDROLOGY
			1) Riparian-wetland area is saturated at or near the surface or inundated in "relatively frequent" events
			2) Fluctuation of water levels is not excessive
			3) Riparian-wetland area is enlarging or has achieved potential extent
			4) Upland watershed is not contributing to riparian-wetland degradation
			5) Water quality is sufficient to support riparian-wetland plants
			6) Natural surface or subsurface flow patterns are not altered by disturbance (i.e., hoof action, dams, dikes, trails, roads, rills, gullies, drilling activities)
			7) Structure accommodates safe passage of flows (e.g., no headcut affecting dam or spillway)

Yes	No	N/A	VEGETATION
			8) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
			9) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
			10) Species present indicate maintenance of riparian-wetland soil moisture characteristics
			11) Vegetation is comprised of those plants or plant communities that have root masses capable of withstanding wind events, wave flow events, or overland flows (e.g., storm events, snowmelt)
			12) Riparian-wetland plants exhibit high vigor
			13) Adequate riparian-wetland vegetative cover is present to protect shoreline/ soil surface and dissipate energy during high wind and wave events or overland flows
			14) Frost or abnormal hydrologic heaving is not present
			15) Favorable microsite condition (i.e., woody material, water temperature, etc.) is maintained by adjacent site characteristics

Yes	No	N/A	EROSION/DEPOSITION
			16) Accumulation of chemicals affecting plant productivity/ composition is not apparent
			17) Saturation of soils (i.e., ponding, flooding frequency, and duration) is sufficient to compose and maintain hydric soils
			18) Underlying geologic structure/soil material/permafrost is capable of restricting water percolation
			19) Riparian-wetland is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)
			20) Islands and shoreline characteristics (i.e., rocks, coarse and/or large woody material) are adequate to dissipate wind and wave event energies

Appendix B

Sage-Grouse Habitat Descriptions

SAGE-GROUSE HABITAT DESCRIPTIONS

Lek

Areas without big sagebrush. Low or black sagebrush sites are suitable. Open areas with little vegetative structure. Adjacent to big sagebrush vegetation.

Pre-laying

Areas that have a high forb component. Shrub may or may not be present, but if not present, perennial grasses should be abundant. Shrub cover generally less than 15 percent.

Early Brood

Areas that have a high forb component. Shrub cover generally present, but generally less than 20 percent (10-15 percent is optimum). Generally gentle slopes.

Nesting

Areas with big sagebrush with range of shrub cover between 10 – 25 percent (less than 20 percent is optimum) and abundant perennial grasses and forbs. Shrubs should have foliage that goes to the ground. If the stems are readily visible, then the shrub structure is incorrect for nesting. Grass/forb height during nesting season (April-May) should be greater than 7 inches. Note: pre-laying, early brood, and nesting habitat have considerable overlap in vegetative characteristics; therefore, one site may provide all three habitat values.

Summer Brood

Areas with sagebrush (big sagebrush and/or low/black sagebrush) that are near (i.e., within ½ mile) springs or creeks with riparian vegetation. The more perennial grass and forb cover the better the habitat quality.

Fall - Winter

Low and black sagebrush sites are preferred fall habitats, but have highest quality when mixed with islands of big sagebrush. Sage-grouse continue to use these habitats as long as the sagebrush is available above the snow. When snow depths are sufficient to cover the low/black sagebrush, then sage-grouse seek out large stands of big sagebrush. Forbs and grasses are not much of a habitat consideration during winter. Wyoming big sagebrush that is over three feet tall can be important in some winters with extreme snow accumulations. Black and low sagebrush areas may be used for snow roosting when they are not suitable for feeding.

Wind-swept ridges at high elevations can also be used for feeding or night roosting. Generally these are low/black sagebrush habitats.

High elevation areas that receive deep snow accumulation are suitable for snow roosting. These areas may be used when no sagebrush is available above the snow. At lower elevations, snow drifts and swales where snow accumulates can also be used for snow roosting. Snow roosting areas are not related to vegetation, but rather to areas of snow accumulation.

APPENDIX C

MANAGEMENT KEY

North Fork PMU – Management Treatment Key

A. Land Status (permit limitation)

- A. Public Land – prepare a project proposal and submit to BLM or USFS
  - i. BLM or USFS accepts proposal – initiate baseline, cultural, etc. and prepare NEPA document – Go to 2.
  - ii. BLM or USFS rejects proposal – end project; or revise project and Go to A

B. Private Land – prepare a project proposal and initiate Project – Go to 2

2 Cultural Resources (treatment limitation)

- A. Cultural properties present – avoid the site or modify the management action to avoid impacts – Go to 3.
- B. Cultural properties present, avoidance is not possible – end Project
- C. Cultural properties not present – Go to 3

3 Livestock/Feral Horse Control (management limitation)

- A. Control of feral horses and livestock possible (fencing or removal) – Go to 4
- B. Control of feral horses and livestock not possible (no fencing or no removal) – end Project

4 Noxious Weeds (treatment limitation)

- A. Noxious weeds present – control noxious weeds before applying vegetation treatments – Go to 5
- B. Noxious weeds not present – Go to 5

5 Non-native, Invasive Species (treatment limitation)

- A. Non-native, invasive species present, then use pre-treatment control or consider a treatment that can control the non-native, invasive species and achieve treatment results – Go to 6
- B. Non-native, invasive species present but cannot be controlled – end Project.
- C. Non-native, invasive species not present – Go to 6

6 Special Status Species (treatment limitation)

A. **Special status species or their habitats are present – consider the effects of the treatment on the species or their habitat and conduct the management treatment on a small portion of the area to avoid impacting all of the habitat at one time – Go to 7**

B. **Special status species or their habitats not present – Go to 7**

7 Precipitation Zone (vegetation establishment limitation)

A. **Precipitation less than 8 inches – do not conduct brush control by Rx burn, brush hog, aerator, disking, or other surface disturbing method – Go to 8**

B. **Precipitation between 8 inches and 10 inches – Rx burn with caution and under special burn conditions; aerator, brush hog, herbicide, chaining, and drill seed acceptable; keep treatment areas small (i.e., less than 200 acres) – Go to 8**

C. **Precipitation greater than 10 inches – Rx burn, aerate, brush hog, herbicide, chaining, drill seed or aerial seed; treatment areas can be large (i.e., greater than 200 acres) – Go to 8**

8 Soil Suitability[10] (treatment limitation – this is ecological site-specific)

A. **NRCS Range Seeding Suitability Rating = Good – proceed with treatment. Got to 9**

B. **NRCS Range Seeding Suitability Rating = Fair – proceed with treatment and facilitate the seeding with other management actions if possible. Go to 9**

C. **NRCS Range Seeding Suitability Rating = Poor – consider the size of the treatment and anticipate follow up treatments for non-native, invasive plant species control, supplemental seeding, or other method to facilitate treatment success. Go to 9**

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[10] *Soil texture, soil depth, soil alkalinity, and/or salinity, as well as soil surface crust type (if present) are important considerations in assessing suitability of a given soil for revegetation activity. Soil erodibility should be considered when planning for equipment use or treatments resulting in removal of present vegetation cover. NRCS soil surveys provide ratings of soil suitability for seeding of soils recognized in a soil map unit. See Appendix D for criteria used in developing soil suitability ratings.*

9 Shrub Cover (herbaceous release limitation – this is ecological site-specific)

A. **8-10 inch p.z. and shrub cover greater or equal to 25 percent - consider shrub thinning or shrub removal in sagebrush response groups**

i. **Deep-rooted perennial grasses (warm or cool season species) make up less than 10 percent of the foliar cover – consider seed application before (aerial seed) or after (aerial or drill seed) treatment; cover seed by harrow or some other method if application is aerial to increase probability of success – Go to 11**

ii. **Deep-rooted perennial grasses (warm or cool season species) make up 10 percent or more of the foliar cover – consider native release, or native release with supplemental seeding before (aerial seed) or after (aerial or drill seed) treatment Go to 11**

B. **10-16 inch p.z. and shrub cover greater or equal to 30 percent – consider shrub thinning or removal**

i. **Deep-rooted perennial grasses (warm or cool season species) make up less than 10 percent of the foliar cover – consider seed application before (aerial seed) or after (aerial or drill seed) treatment – Go to 11**

ii. **Deep-rooted perennial grasses (warm or cool season species) make up 10 percent or more of the foliar cover – consider native release - Go to 11**

10 Tree Cover (shrub and herbaceous release limitation – this is ecological site specific)

A. **Tree cover - greater than five percent and less than 20 percent and trees greater than five feet tall; shrubs and grasses present in the understory and well distributed throughout the treatment area – remove trees through cutting, chaining, Rx burning, herbicide, or other method. Aerial seed if needed.**

B. **Tree cover – greater than 20 percent, limited understory of shrubs and grasses; no evidence of soil erosion – remove trees through cutting, chaining, herbicide, or other method. Use Rx burning with caution. Aerial seed following treatment.**

C. **Tree cover – greater than 20 percent, limited or no understory of shrubs and grasses; evidence of soil erosion – remove trees through cutting, chaining, herbicide, or other method. Rx burning not recommended. Will need seedbed treatment if herbicide is used or cutting is conducted on snow. Upper six inches of soil needs to be broken to allow seedling establishment.**

11 Topography (equipment limitation)

A. **Slope greater than 30 percent – aerial herbicide, Rx burn, aerial seed**

B. **Slope less than or equal to 30 percent – aerate, brush hog, disk, aerial herbicide, Rx burn (with higher wind specifications), drill seed, aerial seed, harrow – Go to 12**

12 Rock Fragments in Surface (i.e., to 7-inch depth) (equipment limitation)

A. **Gravel greater than 35 percent, or cobble greater than 15 percent, or stones greater than 3 percent – aerial herbicide, Rx burn, aerial seed**

B. **Gravel less than or equal to 35 percent, or cobble less than or equal to 15 percent, or stones less than or equal to 3 percent – aerate, brush hog, disk, aerial herbicide, Rx burn, drill seed, aerial seed, harrow**

APPENDIX D
MANAGEMENT KEY

APPENDIX D

Soil Suitability for Range Seeding

Property	Limits			Restrictive Feature
	Good	Fair	Poor	
1. Moisture regime	Aquic, xeric, ustic, and xeric and ustic bordering on aridic or torric.	Aridic and torric bordering on aquic, xeric or ustic.	Aridic and torric.	Too arid.
2. Effective moisture[11]	>10 in. (25 cm)	7-10 in. (17.5 – 25 cm)	<7 in. (17.5 cm)	Too arid.
3. Available water capacity	Surface 10 in. (27 cm) >1.25 in. (3.2 cm). Soil profile > 4 in. (10.2 cm).	Surface 10 in. (25 cm) 0.75 – 1.25 in. (1.9 – 3.2 cm). Soil profile 2.5 – 4 in. (6.4 – 10.2 cm).	Surface 10 in. (25 cm) <0.75 in. (1.9 cm). Soil profile < 2 – 5 in. (6.4 cm).	Droughty.
4. Texture surface 7 in. (17.5 cm)	LVFS, COSL, SL, FSL, VFSL, L SIL, SCL, and CL SICL with <35% C.	VFS, LFS, SC, SIC, C and CL and SICL with >35% C.	LS, LCOS, FS, COS.	Too sandy. Too clayey.
5. Rock fragments in surface 7 in. (17.5 cm)	GR <35%; CB <15%; ST <3%. Total rock fragments <35%.	GR <35%; CB 15-35%; ST 3-15%. Total rock fragments <35%	GR >35%; CB 35%; ST >15%. Total rock fragments >35%.	Small stones. Large stones.
6. Depth to abrupt A-B texture boundary[12]	>10 in. (25 cm)	>10 in. (25 cm)	<10 in. (25 cm)	Rooting depth.
7. Depth to bedrock or hardpan	>20 in. (50 cm)	10-20 in. (25-50 cm)	<10 in. (25 cm)	Depth to rock/pan.
8. Electrical conductivity – saturation extract -25ºC	<2 mmhos/cm (0.2 s/m) in upper 20 in. (50 cm).	2-4 mmhos/cm (0.2-0.4 s/m) in upper 10 in. (25 cm) and 4-8 mmhos/cm (0.4-0.8 s/m) in 10-20 in. (25-50 cm).	>4 mmhos/cm (0.4 s/m) in upper 10 in. (25 cm) and/or >8 mmhos/cm (0.8 s/m) in 10-20 in. (25-50 cm).	Excess salt.
9. Sodium adsorption ratio	<8 in upper 20 in. (50 cm).	8-13 in upper 10 in. (25 cm) and <20 in 10-20 in. (25-50 cm).	>13 in upper 10 in. (25 cm) and/or >20 in 10-20 in. (25-50 cm).	Excess sodium.
10. K x % slope[13]	<4[14]; <6[15]	4-6[4]; 6-8[5]	>6[4]; >8[5]	Erodes easily.
11. 1 x C[16]	<60	<60	>60	Soil blowing.
12. Soil surface morphological types[17]	Types I and II >60%; Type IV <5%; or with mollic epipedon[18]	Types I and II 20-60%; Type IV <10%[8]	Type III <60%; Type IV >10%[8]	Too crusty.

Source: NRCS Soil Survey of Lander County, Nevada, North Part, May 1992, Reno, Nevada.

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[11] Moisture from precipitation, run-on, and ground water budgeted to actual evapotranspiration.
[12] Rate Vertisols and Vertic subgroups as poor.
[13] Sheet and rill erosion hazard (bare soil).
[14] For ustic bordering on aridic or torric, and aridic or torric bordering on ustic moisture regimes.
[15] For xeric, xeric bordering on aridic or torric, and aridic or torric bordering on xeric moisture regimes.
[16] Wind erosion hazard (bare soil).
[17] See: (a) Final Report. Properties, Occurrence and Management of Soils with Vesicular Surface Horizons, 1977. Contract No. 52500-CT 5(N). USDI-BLM and UNR-Ag. Exp. Sta. Eckert, Peterson, Wood, and Blackburn; and (b) Final Report. Properties, Occurrence and Management of Soils with Vesicular Surface Horizon –Effects of Trampling on Seedling Emergence. 1979. Contract No. YA 512-CT-7-14. USDI-BLM and UNR-Ag. Exp. Sta. Stephens, Eckert, and Peterson.
[18] Soils without crusting morphology are to be included in Types I and II for rating.