Tuscarora Population Management Unit/Independence Basin, Willow Creek Basin, and Rock Creek Basin Watershed Assessments

Report Prepared for

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

Report Prepared by

Great Basin Ecology, Inc.

January 2009

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Great Basin Ecology, Inc. Project Number: 13201
Report Number: 09-003

January 2009

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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 includes information on the Tuscarora Sage-Grouse Population Management Unit (PMU) and three sub-basins that underwent a watershed assessment process. The report is divided into four chapters – one for the PMU and one each for each of the sub-basins. The three chapters related to the sub-basins have parallel structure, whereas the PMU chapter is organized to only discuss the various habitat issues. All of the management recommendations are given in the sub-basin chapters, but these recommendations are relevant to the PMU area. However, the management recommendations for vegetation treatments are based on ecological sites, and these were only identified for the sub-basin areas. Therefore, any implementation of the recommendations within the PMU should be based on ecological sites.

The assessment is intended to identify issues or problems on the landscape that affect watershed functionality – i.e., identify "what is broken." Once the issues or problems are identified, the solutions are developed – i.e., "the fix." Both the issues and the solutions are ecologically site-specific, as the assessment is based primarily on ecological sites. Because of the enlarged scope of the assessment, the solutions are somewhat general and associated with some caveats. Before being implemented, a site-specific evaluation would be needed to determine the site-specific conditions to ensure that the actions to be implemented are consistent with the desired results.

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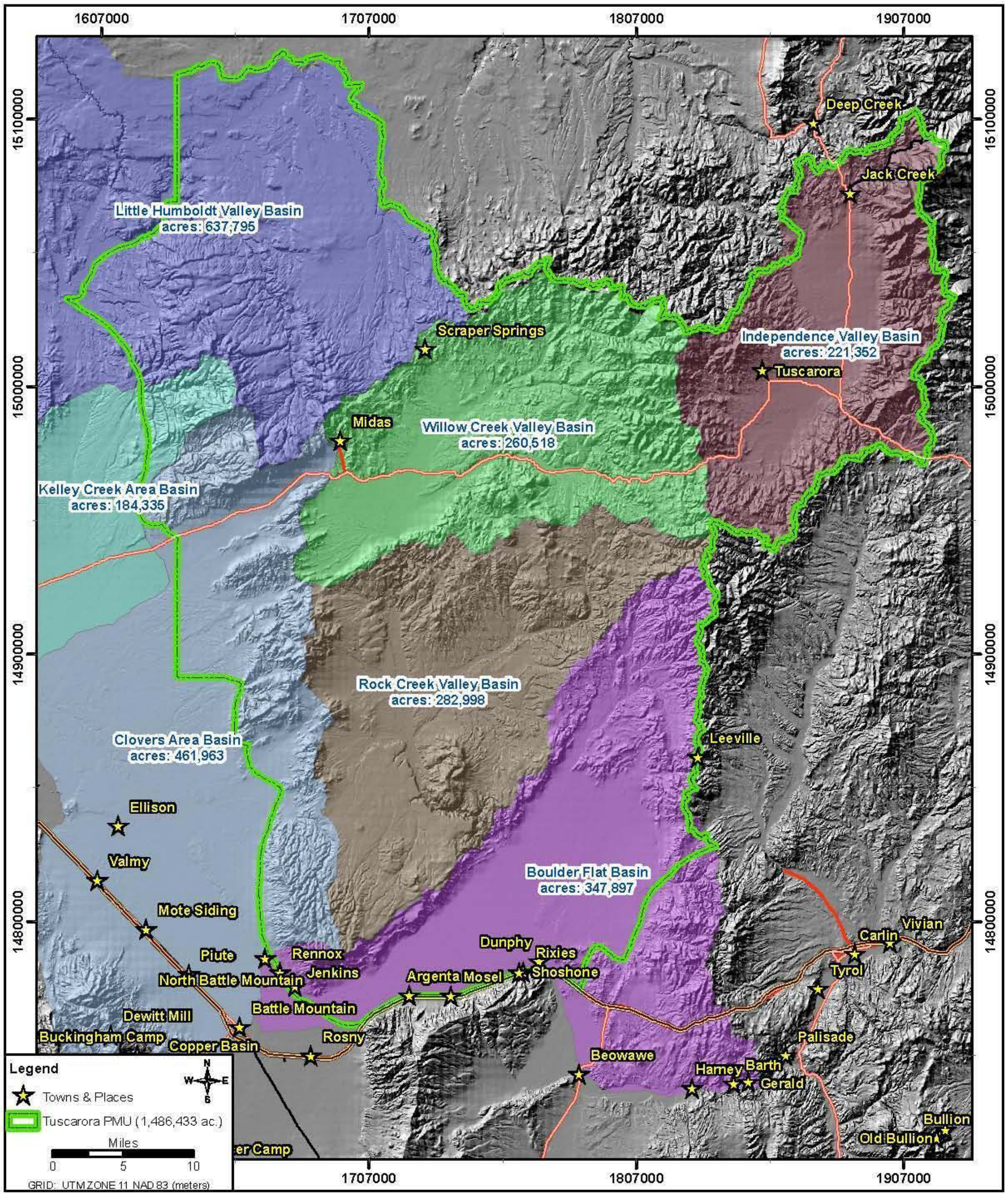
CHAPTER 1 - INTRODUCTION



Tuscarora Population Management Area and Watersheds Assessment Areas

1. INTRODUCTION

The Northeastern Nevada Stewardship Group, Inc. (NNSG) was established in the fall of 1998 to use a collaborative and citizen-based process to address natural resource and land use issues. 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 watershed or 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 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 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 fourteen 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 forty-five hydrographic areas and sub-areas that are either partially or wholly within Elko 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; seventeen hydrographic areas lie within the Humboldt River Basin; five hydrographic areas and four hydrographic sub-areas are within the Central Region Basin; and four hydrographic sub-areas are contained within the Great Salt Lake Basin. The 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.

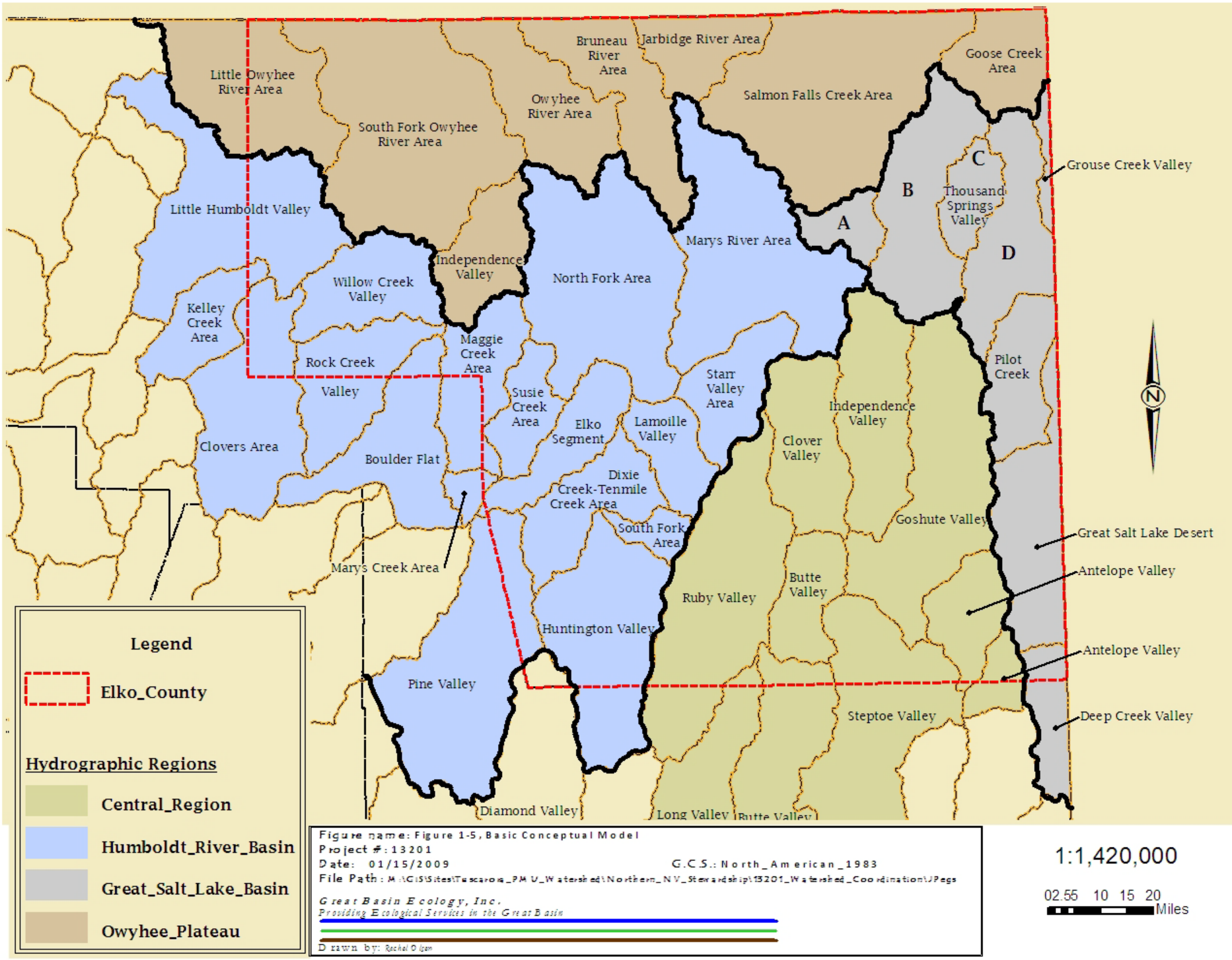


Figure 1 - 1: Hydrographic Regions and Hydrographic Areas/Sub-areas within Elko County

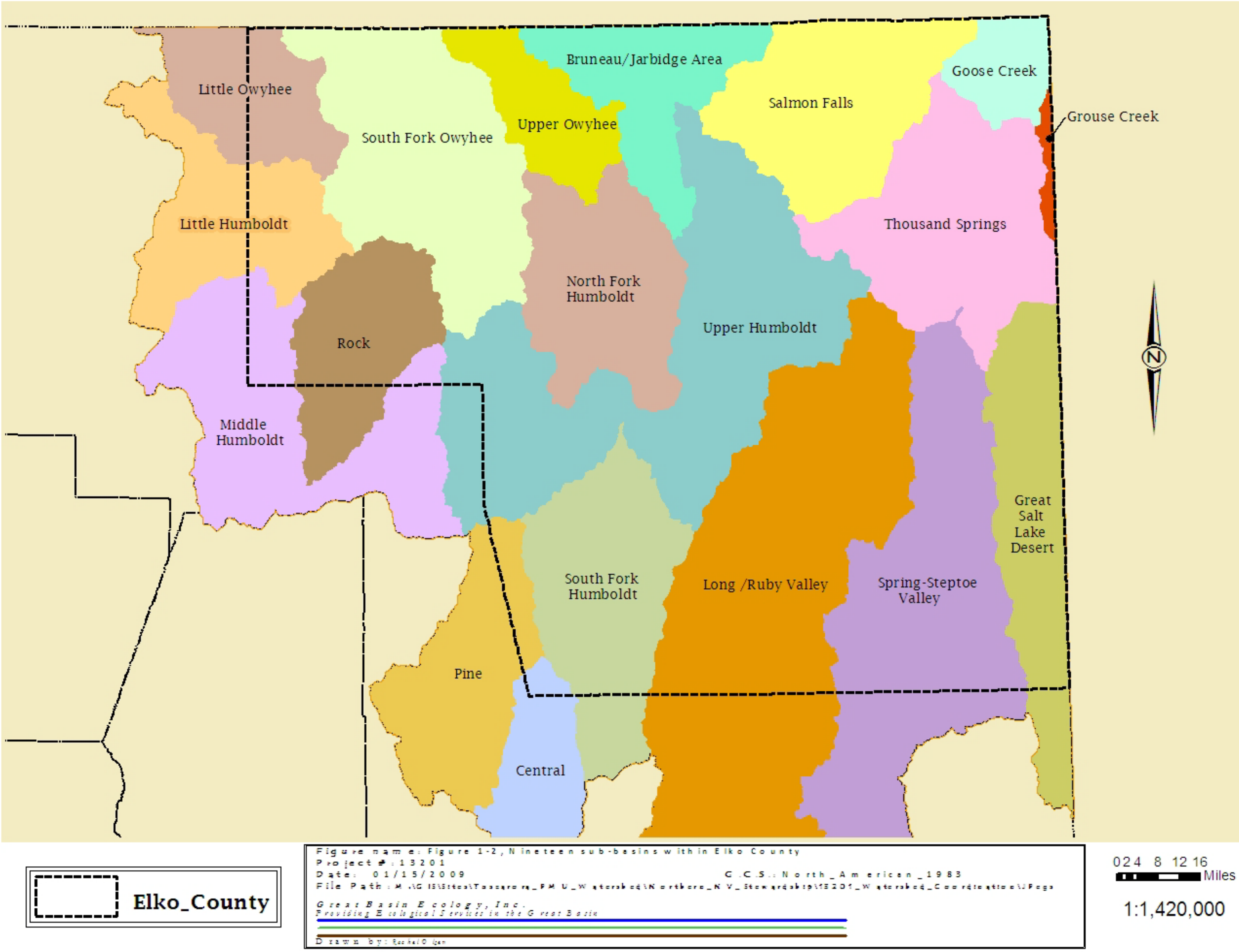


Figure 1 - 2: Nineteen Sub-basins within Elko County

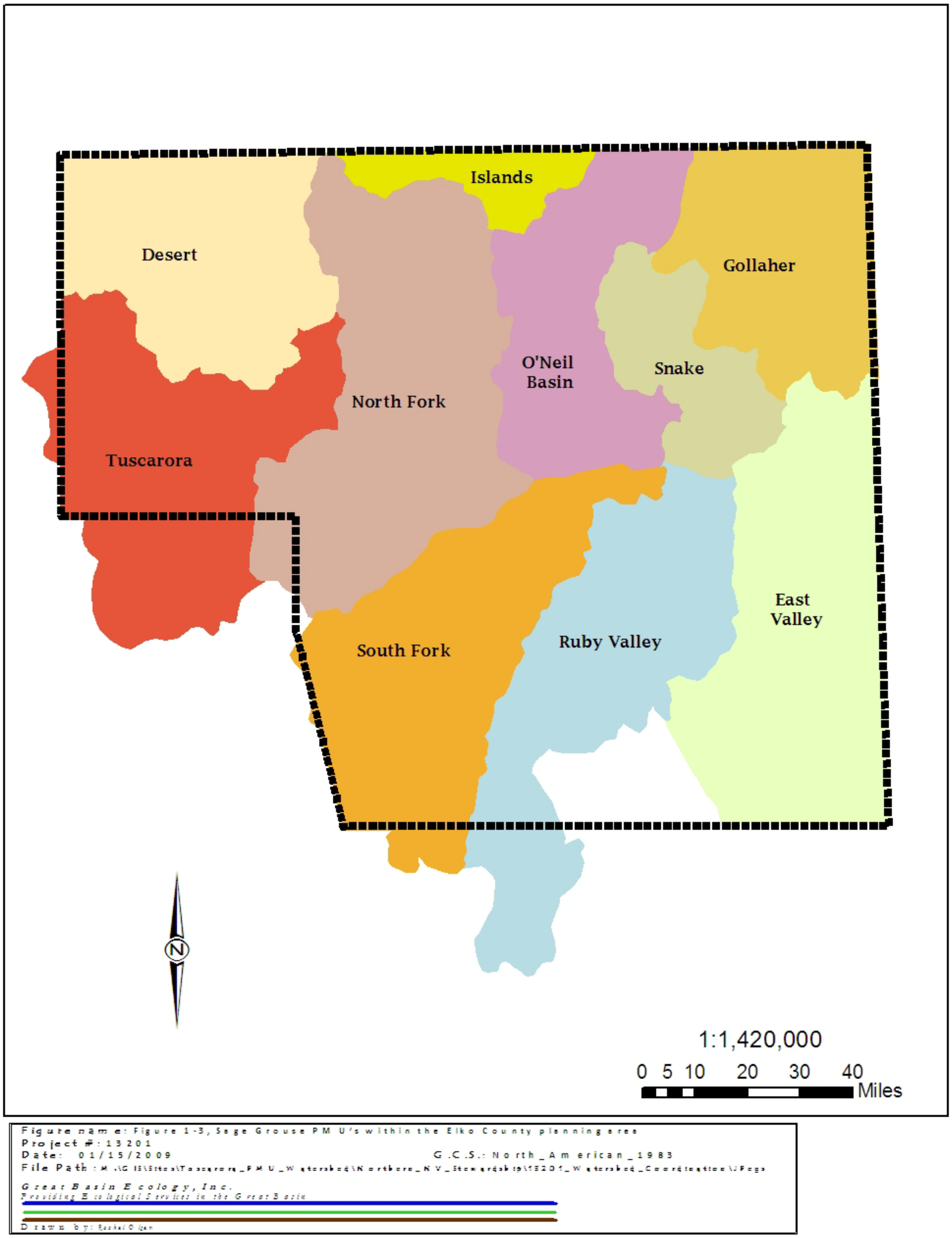


Figure 1 - 3: Sage-Grouse Population Management Units (PMUs) within Elko County

NNSG submitted grant proposals for watershed assessment funding through the Question One conservation bond program. However, because the focus of the NNSG plant 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. Consequently, the initial NNSG submission to conduct a watershed assessment on the Upper Rock Creek Sub-basin (approximately 544,000 acres) was expanded to include the Tuscarora PMU (approximately 1,486,000 acres), a 2.7-fold increase in acreage. However, the budget was not increased at all. Therefore, the level of data collection and analysis was reduced accordingly. It was also decided to only assess the three sub-basins that were entirely within the PMU boundary: Independence Sub-basin, Willow Creek Sub-basin, and Rock Creek Sub-basin. The other four[1] sub-basins did not undergo the watershed assessment process. However, these partial sub-basin areas were included in the PMU assessment for sage-grouse. As a result, approximately 765,000 acres were the subject of the watershed assessment and sage-grouse habitat value assessment and approximately 722,000 acres were only assessed with regard to habitat values for sage-grouse.

2. 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 focuses on upland health and riparian condition as they relate to watershed processes, but the discussion of how this relates to sage-grouse is included to achieve the sage-grouse conservation objectives of the State.

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 model (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.

Two of the major stresses on plant physiology that drive plant community changes are competition for nutrients and moisture. In the absence of grazing, sagebrush will dominate a site at the expense of herbaceous plants. This sagebrush dominance is achieved through competition for nutrients and moisture. Sagebrush has an extensive near-surface root system that allows this shrub to effectively compete for nutrients and moisture near the surface where grasses and forbs obtain their moisture and nutrients. However, sagebrush also has a taproot system that provides access to soil moisture that 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

[1] Little Humboldt Valley Basin, Kelley Creek Area Basin, Clovers Area Basin, Boulder Flat Basin

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 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 would have 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., a near 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 historic climax plant community they are capable of supporting. A rangeland ecological site is the product of all the environmental factors responsible for its development, including soils, topography, 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 was the total plant community that was 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. 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 1-4 for a specific ecological site (Loamy 8-10 inch precipitation zone). The PNC is indicated on the graph, not to the extreme right as some would assume, but toward the middle of the graph. Figure 1-4 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 definitions of PNC and historic climax community, different ecological sites have different capacities for annual production of biomass. Figure 1-5 is the conceptual model for a

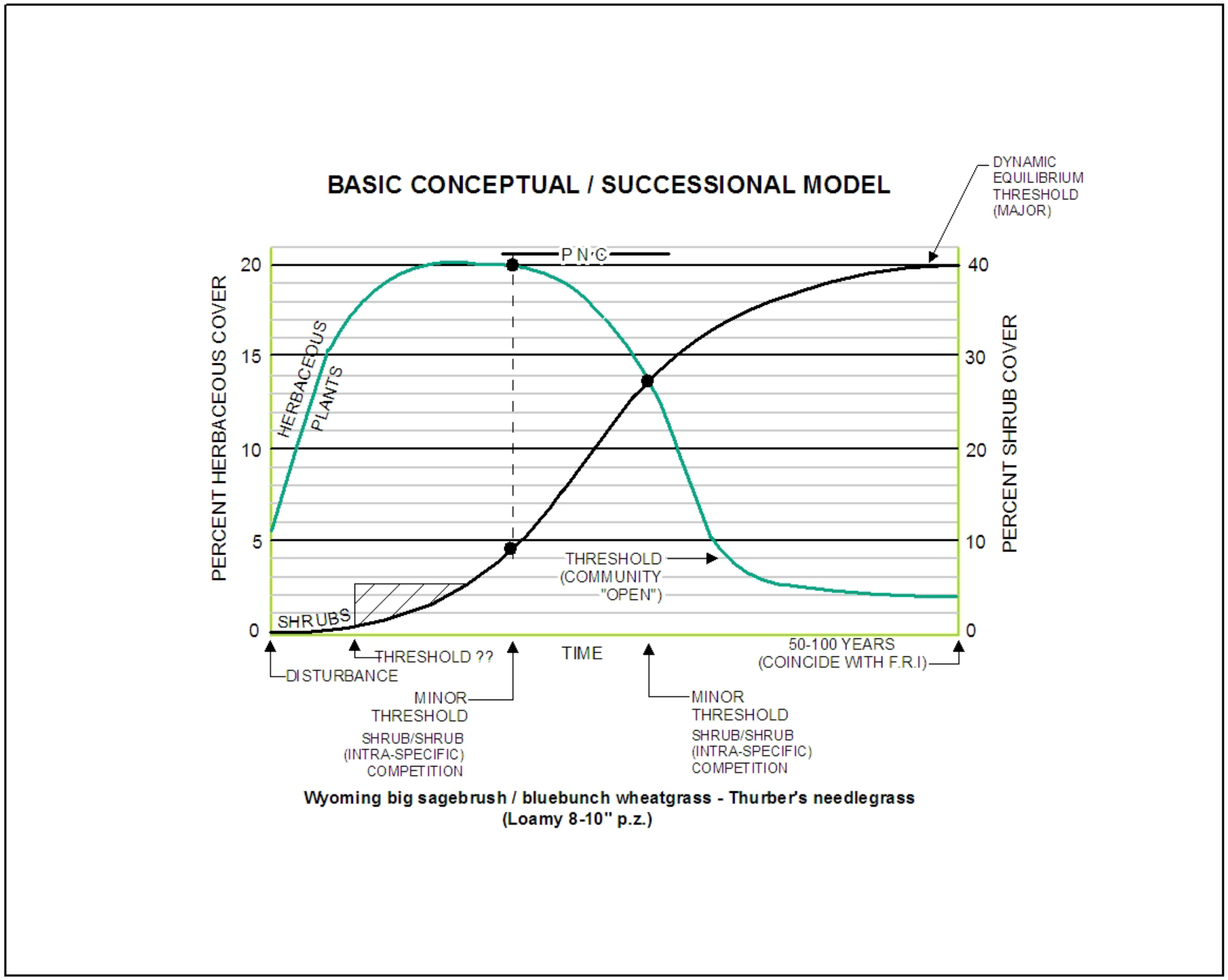


Figure 1 - 4: Basic Conceptual Successional Model for the Loamy 8-10” Precipitation Zone Ecological Site

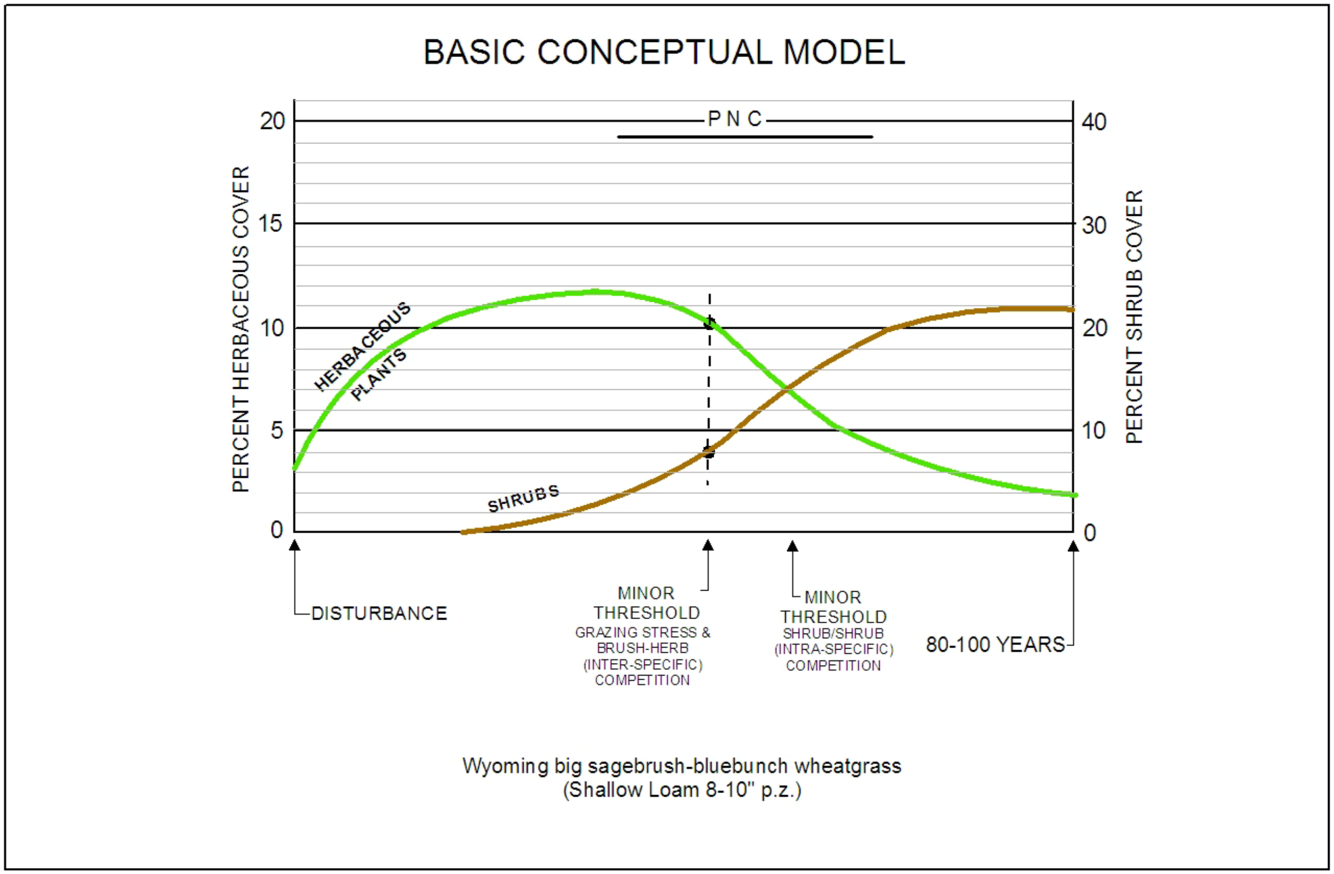


Figure 1 - 5: Basic Conceptual Successional Model for the Shallow Loam 8-10" Precipitation Zone Ecological Site

Shallow Loam 8 -10 inch precipitation zone (Shallow Loam 8-10" p.z.). A comparison of Figure 1-5 with Figure 1-4 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.

In contrast, riparian areas are assessed based on their functionality, rather than with respect to some reference plant community. 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.

3. OBJECTIVES AND METHODS

3.1 OBJECTIVES

The 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 (i.e., irrigated meadow). The initial assessment was conducted without collecting any new data or field work; just "best guesses" of site conditions.

The objective of the watershed assessment was to determine:

- if vegetation at various ecological sites deviated significantly from the ecological site description; and
- if riparian areas deviated significantly from the criteria for PFC.

This information was then used to determine recommendations for improving landscape conditions, where necessary.

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

Characterization. The objective of the Characterization step was to identify and collect existing data relevant to the watershed and enter the data into a database or other electronic program (i.e., GIS). This involves identifying dominant physical, biological, and human processes or features. This included accessing public domain data, such as Natural Resource Conservation Service (NRCS) soil survey map units and ecological site descriptions for all the ecological sites within the watershed boundary. Electronic data, such as soil survey and fire history data, was entered into the GIS system for preparation of resource maps. Hard data in agency files was copied and summarized, to the extent relevant to the project (i.e., recent data was considered useful for summarization, but 20-year old data was not considered relevant to the current effort). The available data was then used to prepare field maps for the rangeland health and riparian PFC assessments.

Issue and Key Questions. The Issues and Key Questions had been previously identified in the NNSG Strategy through a risk assessment matrix.

Current Conditions. Current Conditions involved the data or field work. This consisted of visiting most of the perennial drainages, springs, and ecological sites and performing the appropriate assessment (PFC or rangeland health) or taking photographs to document conditions. For this effort, several field forms were used (Appendix A). The major forms used were:

- NNSG Watershed Assessment Form – this was developed specifically for this project as a modified version of the "Ecological Reference Area Worksheet" from Interagency Technical Reference 1734-6, *Interpreting Indicators of Rangeland Health.*
- Rangeland health evaluation sheet, also from Technical Reference 1734-6.
- 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.*

Other forms for recording photo points, stubble height, utilization, or other landscape features were used as appropriate, but not at each location.

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 included five categories of sagebrush habitat condition and/or restoration or R-values. The R-values used in this assessment were:

- R-0 Habitat areas with desired species composition that have sufficient, but not excessive, sagebrush canopy and sufficient grasses and forbs in the understory to provide adequate cover and forage to meet the seasonal needs of sage-grouse.
- R-1 Habitat areas which currently lack sufficient sagebrush and are currently dominated by perennial grasses and forbs yet have the potential to produce sagebrush plant communities with good understory composition of desired grasses and forbs.
- R-2 Existing sagebrush habitat areas with insufficient desired grasses and forbs in the understory to meet seasonal needs of sage-grouse.

- R-3 Sagebrush habitat areas where pinyon-juniper encroachment has affected the potential to produce sagebrush plant communities that provide adequate cover and forage to meet seasonal sage-grouse needs.
- R-4 Habitat areas which have the potential to produce sagebrush plant communities, but are currently dominated by annual grasses, annual forbs, or bare ground.

This system does not adequately address the value of an area as seasonal habitat for sage-grouse. For example, winter habitat is sagebrush-dependent and forbs and grasses are not a factor in determining adequate winter habitat. Consequently, many areas rated as R-2 would provide winter habitat, but not other seasonal habitat requirements. Similarly, some R-1 habitats (grass/forb dominated) may be used by sage-grouse hens in the early spring as pre-laying foraging habitat to acquire essential proteins and amino acids needed to produce eggs, and by broods in the first few weeks after hatching. These areas of use would be near sagebrush habitats, especially for brood habitat, but this system ranks these sites as non-habitat because sagebrush is absent or insufficient. However, given these minor shortcomings, it was decided by the NNSG to incorporate this system into the NNSG Strategy (See Appendix D of the NNSG Strategy), which is the document on which this assessment is based.

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 dominant ecological site was determined and assigned to the polygon. The soil map was then modified to show the dominant ecological site polygons. While in the field, the observer needed to ensure that he or she was within the correct ecological site when conducting the rangeland health assessment, as the sub-dominant sites that had not been mapped were present within the dominant ecological site polygon.

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.

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.

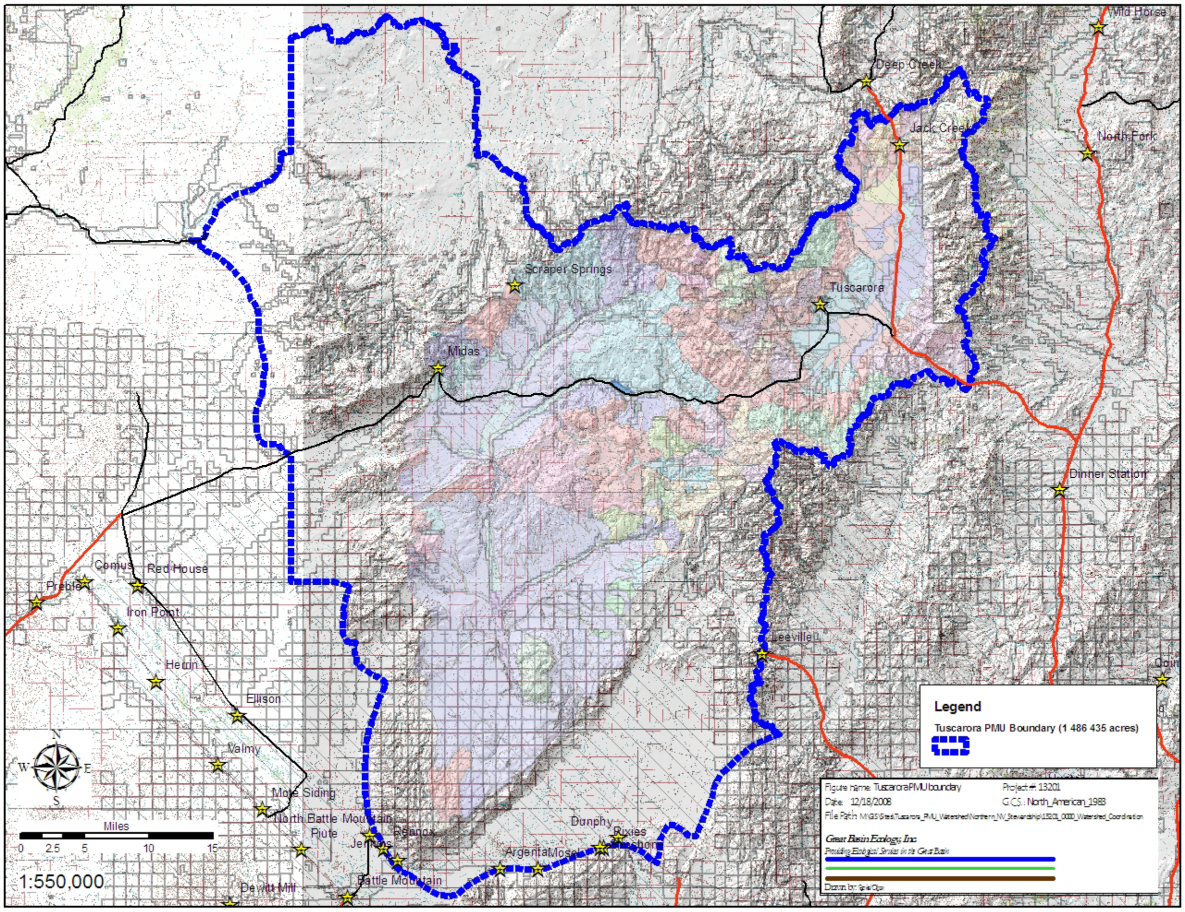
Data queries were then conducted to identify the field sites where various conditions occurred based on the rangeland health or PFC assessments. For example, the NNSG Watershed Assessment Form included a data field for "shrub condition" and all the sites with "decadent" shrubs were identified. These 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.

Recommendations. The recommendations that are presented are general recommendations to specific rangeland health or riparian/wetland conditions, rather than site-specific recommendations. As indicated above in the Interpretation description, the conditions are broadly mapped by dominant ecological site polygons. However, every acre of a given polygon may or may not have the condition that needs to be rectified. For example, a polygon for which shrubs were removed by wildfire may have a recommendation for seeding shrubs, but many islands of shrubs may exist within the boundary. In such a case, only the acreage in need of shrub seeding (i.e., the burned areas) would actually be seeded if a treatment was implemented. As stated above, before any action could be implemented to a specific area, the area would need to be quickly surveyed to determine the extent of the area suitable for the treatment.

3.3 PROJECT TEAM

The work conducted for this project was initiated while the author was Principal Ecologist at SRK Consulting, (U.S.), Inc. (SRK). Others at SRK that assisted with the field work included Mr. Ryan Shane (Range Ecologist, currently with Nevada Division of Forestry, Elko) and Ms. Angel Nicholson (Biological Consultant). While at Great Basin Ecology, Inc. (GBE) the author was assisted with field work by Ms. Andrea Mori (Range Technician), Ms. McKenzie Smith (Range Technician), and Ms. Angel Nicholson (currently with SRK). Mr. Gerald Miller, Range Specialist with USDA, NRCS and Mr. Chris Jasmine, Biologist with U.S. Fish and Wildlife Service also assisted with field work. Ms. Rachel Olsen, GIS Specialist and Ms. Stefanie Adams, Technical Editor, assisted with data entry and data analysis. Ms. Olsen was responsible for production of maps and figures, as well as all data queries. Ms. Adams provided technical editing of the report.

CHAPTER 2 –TUSCARORA POPULATION MANAGEMENT UNIT ASSESSMENT



1. INTRODUCTION

The Tuscarora PMU encompasses 1,486,000 acres. The elevation ranges from about 4,500 feet above mean sea level (amsl) near Battle Mountain to over 10,400 feet amsl at McAfee Peak in the Independence Range, but the majority of the mountains in the Tuscarora Range and Independence Range are between 7,000 and 8,500 feet amsl. Waters from this system drain to the Owyhee Plateau (Snake River drainage) and the Humboldt River Basin.

Rocks of the Tertiary System underlie most of the uplands in the area. These are volcanic rocks consisting of andesite, rhyolite, and related pyroclastic rocks, laid down primarily during the Miocene and Pliocene epochs. However, the northern parts of the Tuscarora Mountains are dominated by rocks of the Ordovician System, consisting of interbedded chert, shale, sandstone, and greenstone.

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.

In 2004 the population estimate provided by Nevada Department of Wildlife (NDOW) was between 5,200 and 6,300 sage-grouse, or approximately 14 percent of the estimated sage-grouse population in Elko County (NNSG 2004). This equates to approximately one sage-grouse every 235 acres if the birds were evenly distributed throughout the PMU. There were 105 leks (i.e., strutting grounds) in 2004.

The majority of the PMU has supported sage-grouse over the years. Some of the salt desert shrub vegetation in Boulder Valley and along the Humboldt River near Battle Mountain would not be considered sage-grouse habitat. This occurs on less than 20 percent of the PMU. Except for riparian vegetation/zones, forested areas, and irrigated pastures (approximately 10 percent), the remaining approximately 70 percent or more of the PMU is capable of providing 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 quality;
- Habitat quantity;
- Habitat fragmentation;
- Livestock grazing;
- Fire ecology; and
- Disturbance.

These risks as they occur today are discussed in the next section.

2. ASSESSMENT OF SAGE-GROUSE HABITAT IN THE TUSCARORA PMU

2.1 HABITAT QUALITY

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 to take data, a general description of the vegetation type was made as well as a rating of the condition of the shrubs and grasses (seedlings/mature/decadent), whether or not the site had been grazed (and by which species), whether or not noxious weeds were present and in what quantity, and whether or not the site had been recently burned, and the level of mortality to grasses and shrubs if burned. An estimate of the wildland fuels (low, average, excessive) and the type of fuels (herbaceous or woody) were also recorded.

From this information, the observer classified the habitat into one of the R-values:

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

Figure 2-1 displays the results of the habitat R-value assessment. The areas identified as R-0 are generally areas where sagebrush was still present and the understory was adequate to provide cover for nesting. The amount of understory (i.e., herbaceous) cover was quite variable. Consequently, the depiction of R-0 habitat on Figure 2-1 may be an overestimation. However, even where the understory was insufficient to provide nesting cover, the areas could still have provided other seasonal needs, such as winter habitat.

The areas identified as being R-1 on Figure 2-1 are based on the field observations and maps of burned areas. This includes meadows, irrigated pastures, and crested wheatgrass seedings that are dominated by grasses (Photo 1). Perennial grasses had to be dominant, but cheatgrass was often present.

The R-2 habitats included any areas of intact sagebrush where the understory was lacking or insufficient to provide much benefit to sage-grouse (Photos 2 and 3). These tended to be areas where disturbance of the system had not occurred in many years. Figure 2-1 indicates that this tends to occur in large patches.

No R-3 habitat was observed within the PMU.

R-4 is defined as areas dominated by annual grasses, annual forbs, or bare ground. Much of Boulder Valley on the southeast portion of the PMU and the valley bottoms on the southwest and south portions of the PMU have burned repeatedly in the past and tend to be dominated by cheatgrass.

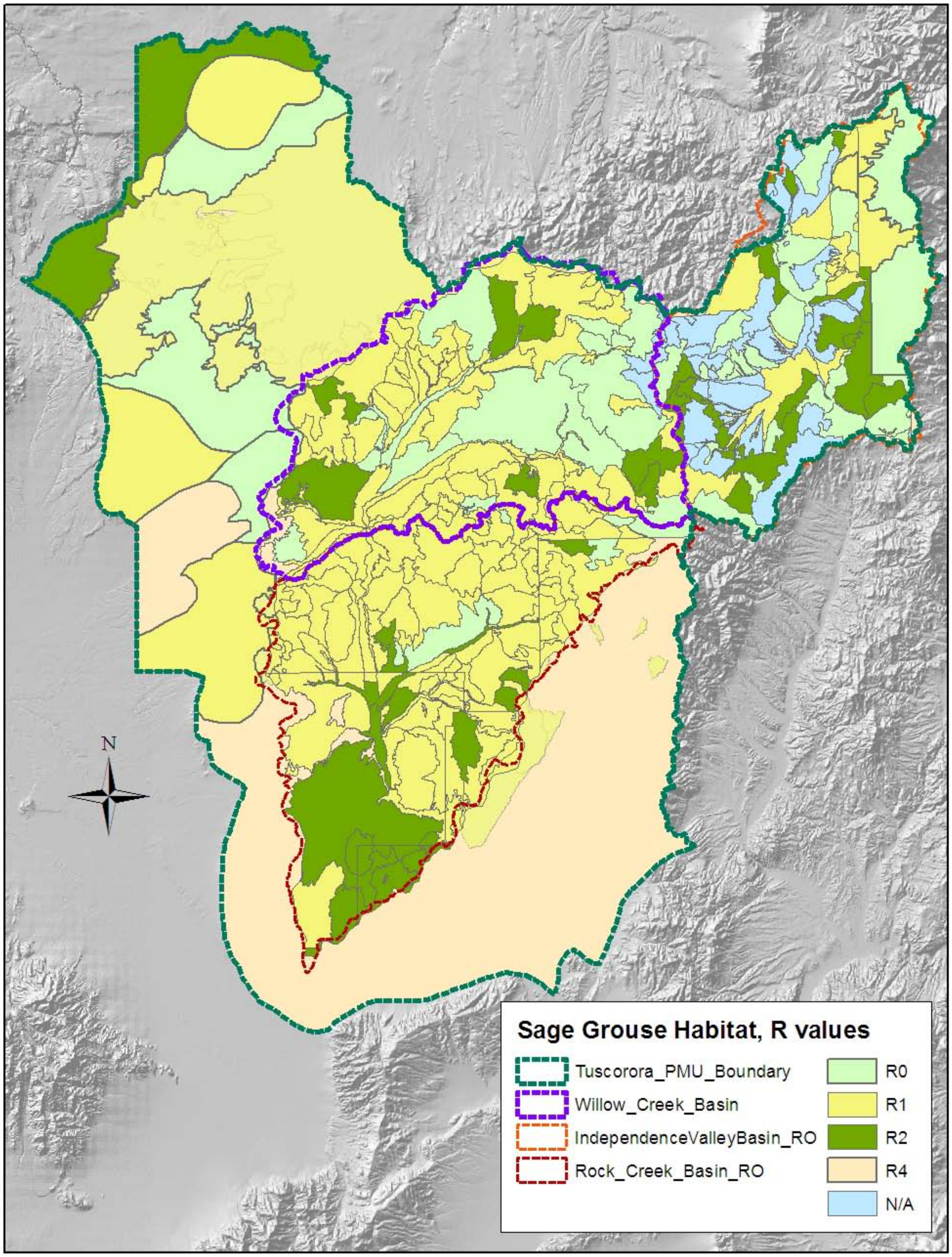


Figure 2 - 1: Tuscarora PMU Sage-Grouse Habitat Assessment

Photo 1: Burned Area Rated as R-1 (Perennial Grass-Dominated)

Photo 2: Sagebrush-Dominated (R-2) Area that Provides Sage-Grouse Winter Habitat

Photo 3: Dense, Decadent Sagebrush (R-2) that Provides Sage-Grouse Winter Habitat

However, portions of Boulder Valley and the southern end of the PMU are occupied by salt desert shrub, which is not considered sage-grouse habitat and also does not meet the description of R-4 habitat. Therefore, the R-4 category is over-represented in Figure 2-1. Conversely, there are many small patches (i.e., less than ten acres) of cheatgrass that occur in the areas identified as R-0, R-1, and R-2 areas of Figure 2-1. These areas were too small to map relative to the scale of the assessment, but they do represent a risk to the native vegetation with respect to repeated fires and expansion of the cheatgrass areas.

While the R-value system of rating habitats has some merit for large scale assessments such as this project, the system is not without flaws. The habitat quality should be rated based on the site potential to provide various seasonal habitats. As shown in Figure 2-2, 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. If one applies the R-value ranking to Figure 2-2, then the R-0 value would occur under conditions represented by the middle one-third of the graph, the R-1 value would occur under conditions represented by the left one-third of the graph, and the R-2 value would occur under conditions represented by the right one-third of the graph. The R-3 and R-4 values are not represented on this graph, as these two values represent crossing the threshold and transitioning to another ecological state. However, the conditions for either of these transitions are represented on the right side of the graph where the plant community is shrub dominated and herbaceous vegetation is sparse. Both P-J and cheatgrass can establish under these conditions. If fire occurs, the site is likely to convert to a cheatgrass-dominated ecological site,

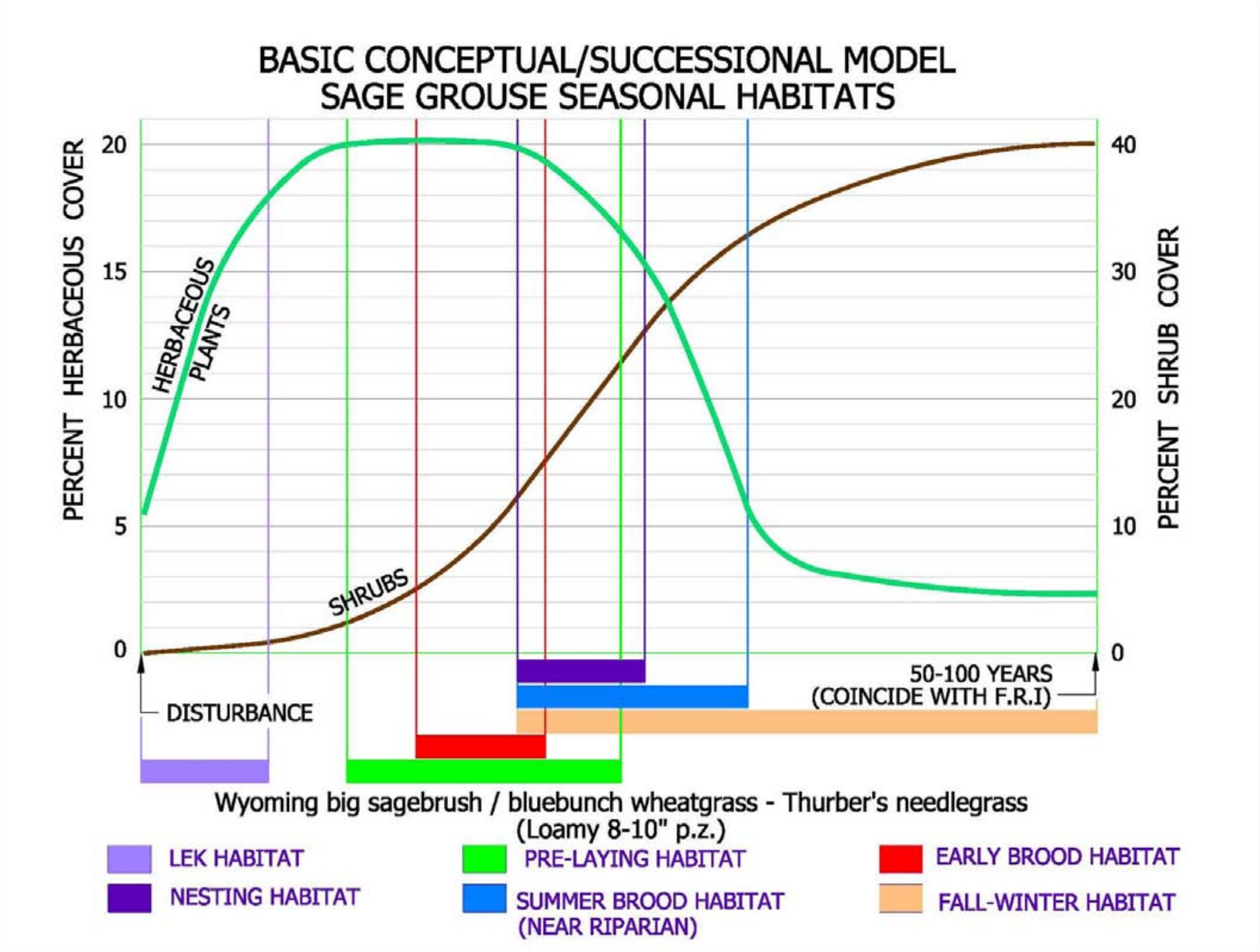


Figure 2 - 2: Basic Conceptual Model with Sage-Grouse Seasonal Habitats

resulting in an increase in fire frequency. If fire does not occur, then P-J has the opportunity to establish and eventually dominate the site.

In contrast, the Shallow Loam 8-10" p.z. ecological site does not produce sufficient grasses and forbs to meet the Western Association of Fish and Wildlife Agencies (WAFA) guidelines for nesting or early brood habitat (Figure 2-3), but could be rated as R-0, R-1, or R-2 using the R-value system. This site is only capable of providing summer habitat and winter habitat.

As a result of the use of the R-value system, much of the R-2 value areas on Figure 2-1 provide winter habitat for sage-grouse, but are identified as non-habitat by the R-value system. Consequently, the R-2 value areas should be considered as sage-grouse habitat, albeit sufficient for only one seasonal use.

Figure 2-1 also depicts areas that were not assessed (i.e., N/A). These areas represent ecological sites for which no observations were made, and therefore, for which no assessment of sage-grouse habitat condition was made. However, these sites were not within any burned areas and the ecological sites for these polygons indicate sagebrush as the major shrub. Many of these are at upper elevations and are likely to have sufficient understory to provide seasonal cover for sage-grouse. Consequently, when considered with the R-0 and R-2 habitats, these areas add a significant amount of habitat within the PMU.

Given the current state of the vegetation in the PMU, the quality of sage-grouse habitat is not very high. While there are still large areas of quality habitat, most of the area has been converted to perennial grasses following wildfire and much of the remaining intact sagebrush is only providing winter habitat.[2] As discussed in the following section, the amount of burned area is extensive, but the silver lining in the cloud is that most of the burned area is currently occupied by perennial grasses and sagebrush is already establishing in many areas. Therefore, sage-grouse populations should increase in this PMU in the future.

[2] This is somewhat of an over-simplification, as the sage-grouse are using this habitat on a year-round basis because quality habitats are not widely available.

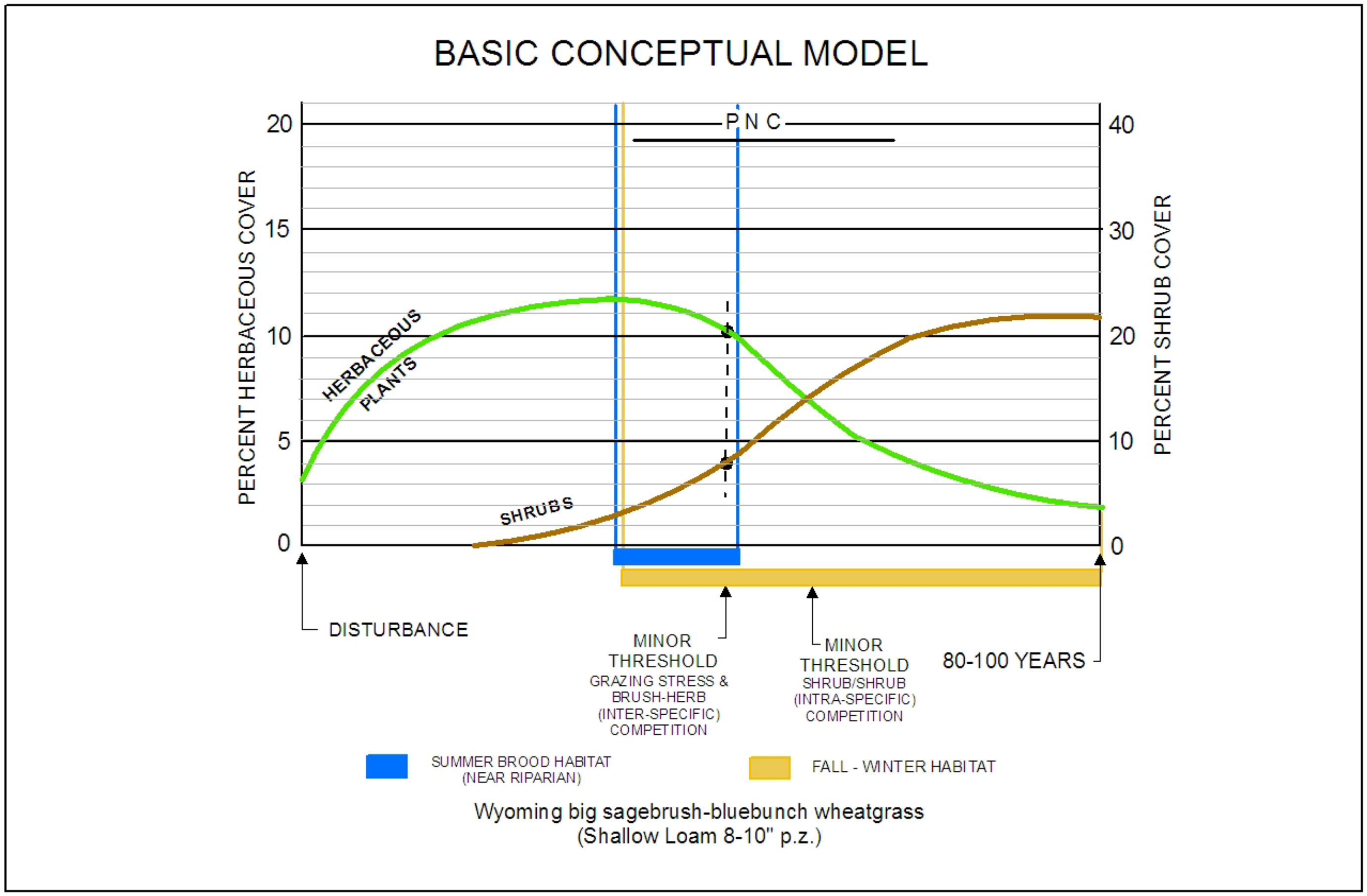


Figure 2 - 3: Shallow Loam 8-10" p.z. Ecological Site with Sage-Grouse Seasonal Habitats

2.2 HABITAT QUANTITY

2.2.1 Upland Habitats

Based on the habitat mapping depicted in Figure 2-1, the quantity of sage-grouse habitat was estimated. Assuming that all of the N/A (i.e., not assessed) habitat was either R-0 or R-2 habitat value, and that the R-2 (intact sagebrush with limited understory) is being used as necessary by sage-grouse, then the total available habitat within the PMU is approximately 531,200 acres. This represents only 36 percent of the PMU area.

The primary reason for the lack of habitat within the PMU is fire. As shown in Figure 2-4, since 1999 approximately 695,000 acres of the PMU have burned at least once, and many areas have burned multiple times in the last 20 years[3]. This map closely matches the R-1 values of Figure 2-1, primarily because the areas burned have either responded well to the fire or have had successful rehabilitation following the fires, resulting in perennial grasslands.

However, the areas along the western, southern, and eastern boundaries of the Rock Creek Sub-basin have converted to cheatgrass and this habitat is lost for the long-term unless expensive rehabilitation is implemented.

When the areas of potential habitat are broken out by seasonal habitats, it is clear that the only sites with an adequate mixture of sagebrush and herbaceous plants to provide suitable nesting, early brood habitat, and pre-laying habitats are very scarce. The higher elevation mountain brush sites appear to provide suitable nesting habitat. However, these sites are often too high in elevation and are snow covered during the nesting season. Therefore, the three seasonal habitats that are involved in population production (i.e., pre-laying, nesting, and early brood habitat) are in short supply.

This is consistent with the data obtained from NDOW through analysis of wings supplied by hunters. The differential feather molt indicates if the wings are from adults or birds of the year, male or females, and if a female has been successful in raising a brood. This data for Elko County has consistently demonstrated that the ratio of birds of the year to adult females has been low; generally just barely high enough to maintain a population or result in a slight decline in population. These "production habitats" are in short supply and the result is very poor yearly production of young sage-grouse.

Relating all of this back to the PMU demonstrates that there is a dire need for changes in management of the landscape. Figure 2-1 shows that less than 40 percent of the PMU has intact sagebrush, and about 50 percent of the sagebrush area consists of decadent sagebrush. Therefore, with respect to Figures 2-2 and 2-3, about one-half of the remaining habitat is represented by the right side of the graphs – sagebrush with very little herbaceous understory, and one-half is represented by the middle third of the graph – habitat that is rapidly losing the herbaceous component and increasing in shrub dominance.

The good news is that about 47 percent of the PMU has burned recently and most of the burned area is currently perennial grasses and forbs – corresponding to the left side of Figures 2-2 and 2-3. Consequently, new sage-grouse seasonal habitats are being developed. The issue now becomes the time required before these sites provide nesting and early brood habitat – will there be more fires that remove the some or all of the remaining intact sagebrush before this new habitat develops?

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[3] Because fire boundaries were not mapped or the accuracy of the mapping prior to GPS technology introduces a wide margin of error, the exact acreage burned cannot be determined. However, based on the BLM data, 1,641,000 acres, or 110 percent of the PMU area has burned. This clearly indicates that many areas have burned multiple times.

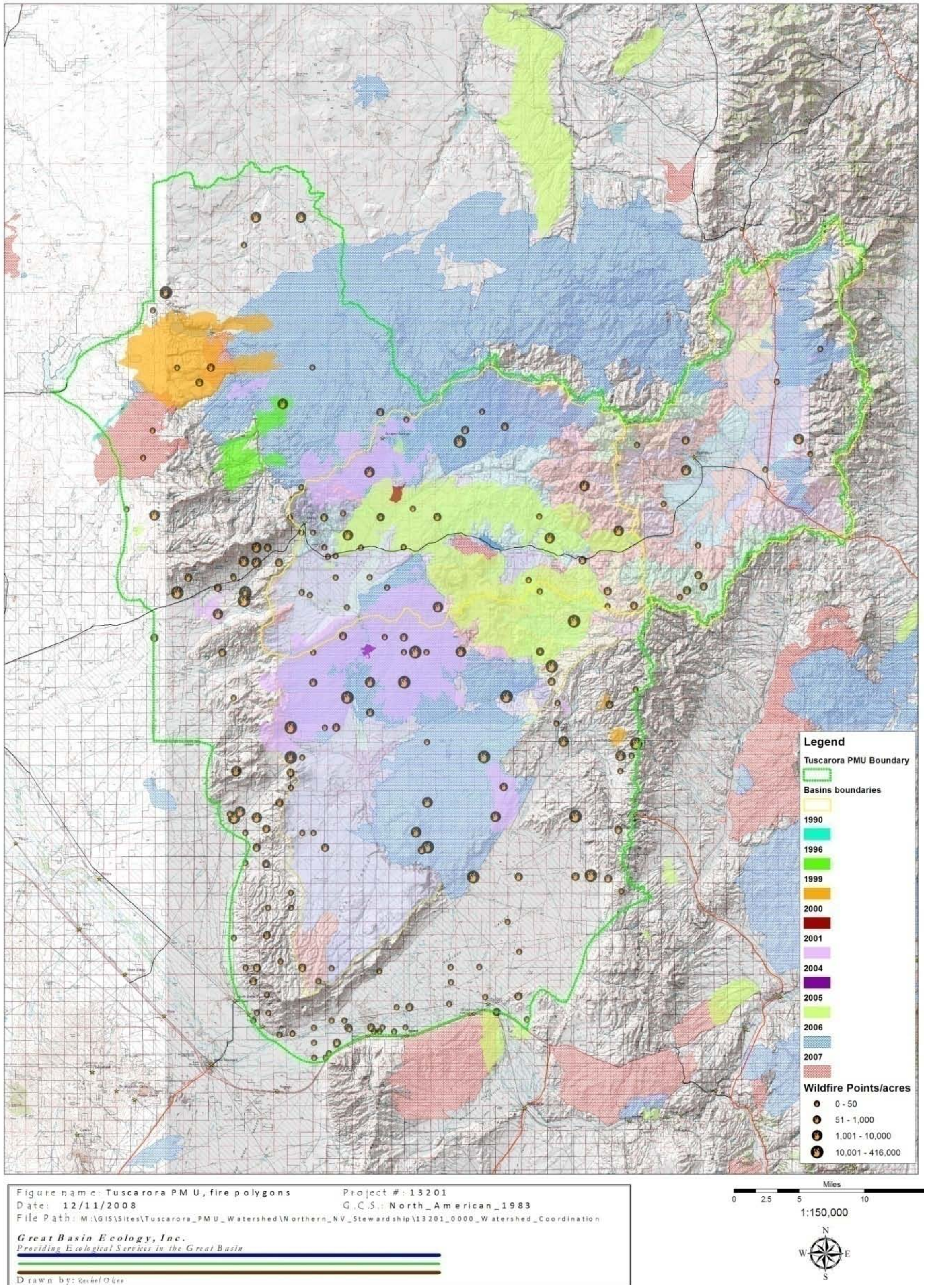


Figure 2 - 4: Fires within the Tuscarora PMU - 1990 to 2007

2.2.2 Riparian Habitat

Although riparian habitats make up only about five percent of the PMU, the forbs and insects associated with springs, seeps, and creek banks provide important habitat for sage-grouse. Sage-grouse obtain most of their daily moisture requirement from the food they eat. For chicks, the succulent forbs and the insects found in these mesic habitats are the mainstay of their first four months of life. Until the end of summer, when sagebrush begins to show up in their diet in quantity, the riparian zones are the primary foraging habitat for sage-grouse.

The succulence that draws sage-grouse to these sites also draws livestock to the riparian zones. Early in the growing season, livestock can meet a sizeable portion of their daily water requirement and their nutritional requirements through the succulent grasses on the uplands. However, by mid-June, the lower to mid-elevation uplands begin to desiccate. At this time, livestock find water, nutrition, and often shade in the riparian areas. Consequently, there is potential for interaction among sage-grouse and livestock at these habitats. The discussion of livestock grazing impacts on these sites is discussed in Section 2.4.

While willows are often an important stabilizing species on streams, they can also destabilize the sites. As willows increase in size and abundance, they can often become barriers to woody material and other debris during high flows. This results in a temporary damming of the flow, allowing the water level to rise. At some point the flow will take another path of less resistance. This built up energy is then released onto the area of lower threshold resistance, resulting in formation of a new channel (Photos 4 and 5). The impact from this type of event is similar to that of livestock grazing – lowering of the water table and loss of associated meadow vegetation.

Photo 4: Willows within Stream Channel in Position to Catch Debris and Divert Flow

Photo 5: Old Channel on Right, New Channel on Left Created by Willow Diversion of the Stream Flow

Roads are another factor that impacts the riparian area. Many roads follow the drainage bottom and either are located adjacent to the creek or cross the creek along the course of the drainage. During periods of high flow, or as discussed above, when the flow is blocked by willows, the flow enters the roadway and begins to erode the road surface (Photos 6 and 7). The new channel is generally less sinuous than the natural channel; therefore, the velocity of the flow is generally greater and the flow can cause more erosion. And as described above, the result is a lowering of the water table and loss of riparian vegetation.

Fire was another factor that impacted riparian habitats within the PMU. However, from the perspective of sage-grouse, some of this was an improvement over previous conditions. The impact from fire on the creeks depended on the severity of the fire on the slopes above the drainages, the condition of the fuel along the riparian zone, and the mortality of riparian plants within the riparian zone. The amount of sediment transported from the upland appeared to be related to the steepness of the slope and the mortality of the upland plants on the slope. Photo 8 shows an area where sediment transport was likely significant for the year or two following the fire, but the riparian grasses and grass-like plants have stabilized the channel banks. Photo 9 shows an area where the vegetation has not returned on the historic flood plain. The area was severely lacking herbaceous plants prior to the fire and either the fire was extremely intense or there was no seed bank prior to the fire.

While these types of impacts were observed within the PMU, there was also evidence that historic damage to riparian areas was in the process of recovering. The removal of old, decadent Basin big sagebrush from many of the areas has opened the stream banks and allowed grasses, sedges, and rushes to establish (Photo 10).

Photo 6: Channel Diverted by Willow Blockage has Captured the Road

Photo 7: Road Captured by Creek with Water Table Lowering

Photo 8: Channel Recovery Following Fire and Sediment Transport from Slopes

Photo 9: Burned Historic Flood Plain Remains a Source of Sediment

Photo 10: Riparian Zone that was Burned and is Recovering

2.3 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. As depicted on Figure 2-1, for sage-grouse large areas of sagebrush habitat were replaced with grasslands. While there are many islands of unburned vegetation within the burned areas, most of this consists of low sagebrush or black sagebrush. These two 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.

While conducting the field work, 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.

Sage-grouse were also observed in the burned areas, sometimes a great distance from the nearest mature sagebrush cover. The forbs (native release and seeded) appear to be at least part of the attraction to these burned areas (Photo 11). But young sagebrush seedlings were also the focus of at least some birds (Photo 12). This is an observation that the author has made in other large burns in Elko County where the grass/forb response following the fire has been favorable.

Photo 11: Yarrow with Fall Greenup Used by Sage-Grouse

Photo 12: Young Sagebrush Plant "Browsed" by Sage-Grouse

Therefore, while these burned areas represent "non-habitat" for sage-grouse, or at least not a primary habitat for sage-grouse, these areas are in the process of following the plant dynamics depicted in Figure 1-4. Because many of the areas had sagebrush seedlings already established, these areas should be providing for sage-grouse nesting in as little as ten years. Consequently, the fragmentation is of relatively short duration and temporary in space and time.

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 2-5, 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 1-4 and 1-5, 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 2-5.

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. Thus the "stress" of the herbivory is 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 it 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 relative to 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.

This has the consequence of continuing the decline of the herbaceous component. While all of this seems quite "negative," examination of Figure 2-5 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 2-6 and 2-7 show that this grazing impact on the vegetation:

- Varies with magnitude based on ecological site capacity; and
- Influences the quality of habitat for sage-grouse.

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.

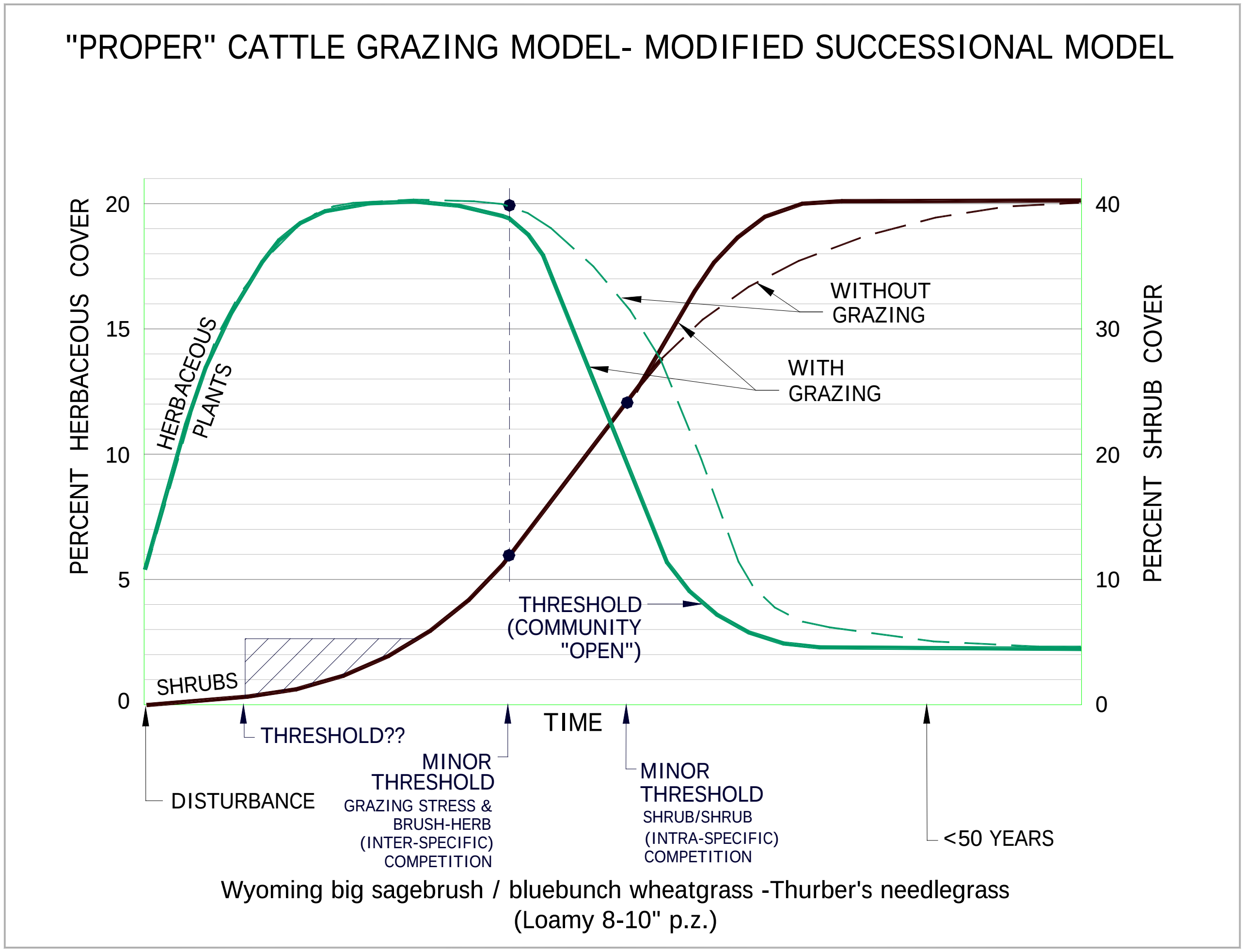


Figure 2 - 5: Basic Successional Model with Grazing - Loamy 8-10" p.z. Ecological Site

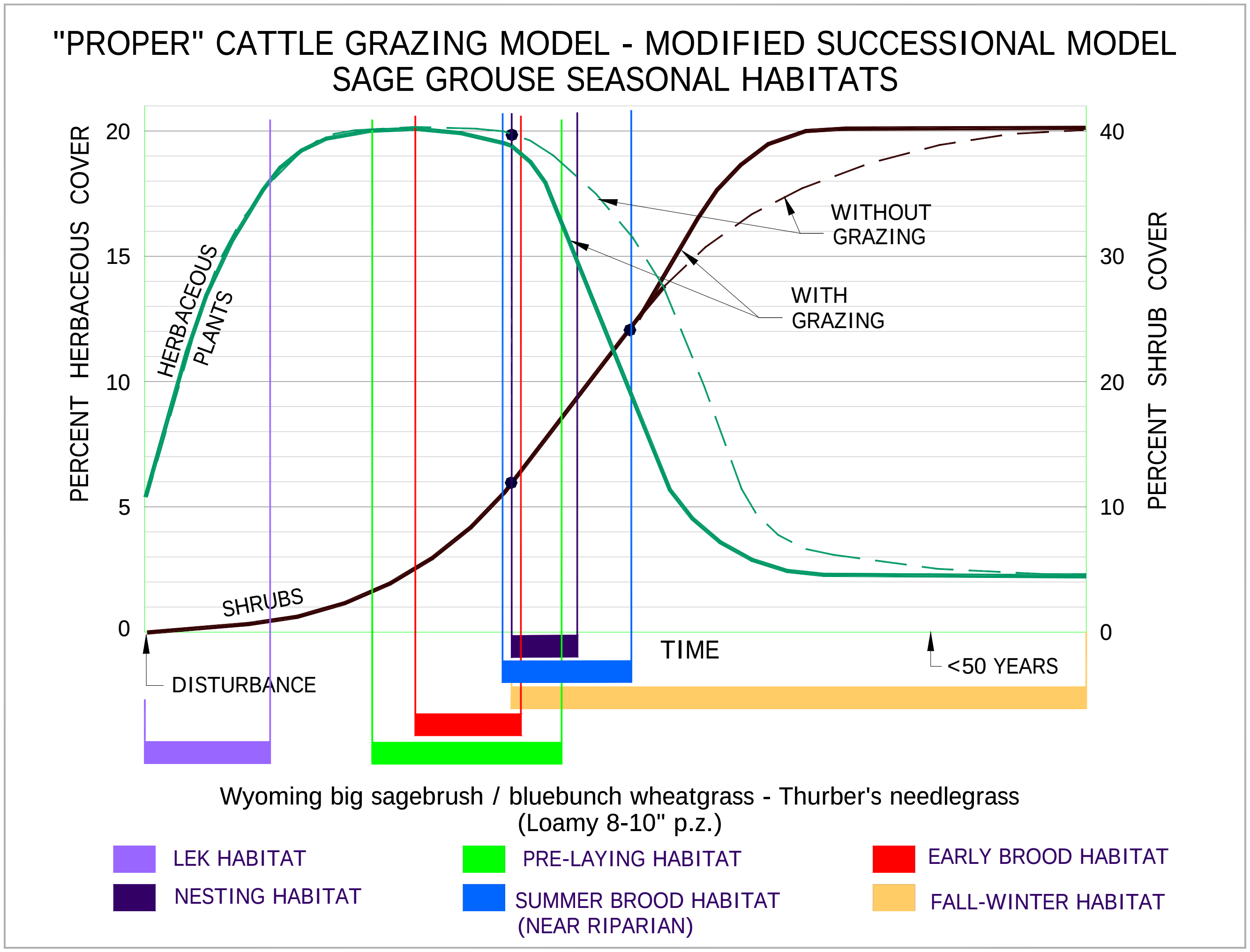


Figure 2 - 6: Grazing Impact to Sage-Grouse Seasonal Habitats - Loamy 8-10" p.z. Ecological Site

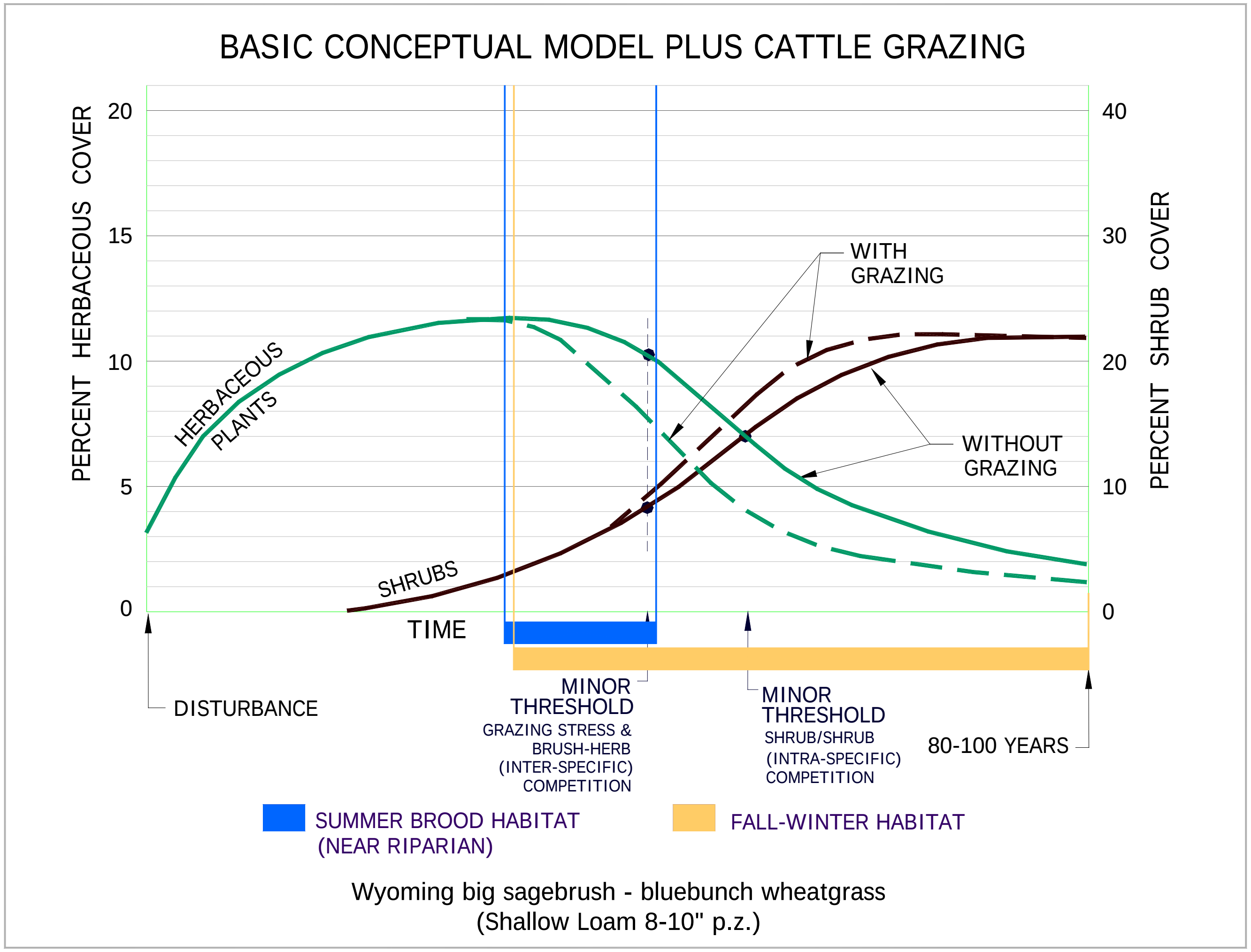


Figure 2 - 7: Grazing Impact to Sage-Grouse Seasonal Habitats – Shallow Loam 8-10" p.z. Ecological Site

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 2-6 and 2-7, the impact of grazing is minimal on upland sites when the vegetation is dominated by grasses – R-1 in terms of habitat restoration values for sage-grouse. Therefore, the creation of areas with abundant grass 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 these areas are the only places they can meet their water and nutritional requirements in a timeframe that allows them to maintain or gain weight. This was evident during the field work. Almost every spring that had been impacted by livestock was located in dense, decadent sagebrush with very little understory (Photos 13, 14, and 15).

Photo 13: Riparian Area Surrounded by Dense Sagebrush on the Upland

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

Photo 14: Spring Enclosure in Disrepair - Area Surrounded by Dense Sagebrush

Photo 15: Spring Area Surrounded by Dense Sagebrush

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.

2.5 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 Tuscarora PMU.

Figure 2-8 depicts the fire ecology for the Loamy 8-10" p.z. ecological site. While 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 2-8, "move" 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, 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.

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. 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 spreads 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 loadings. 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.

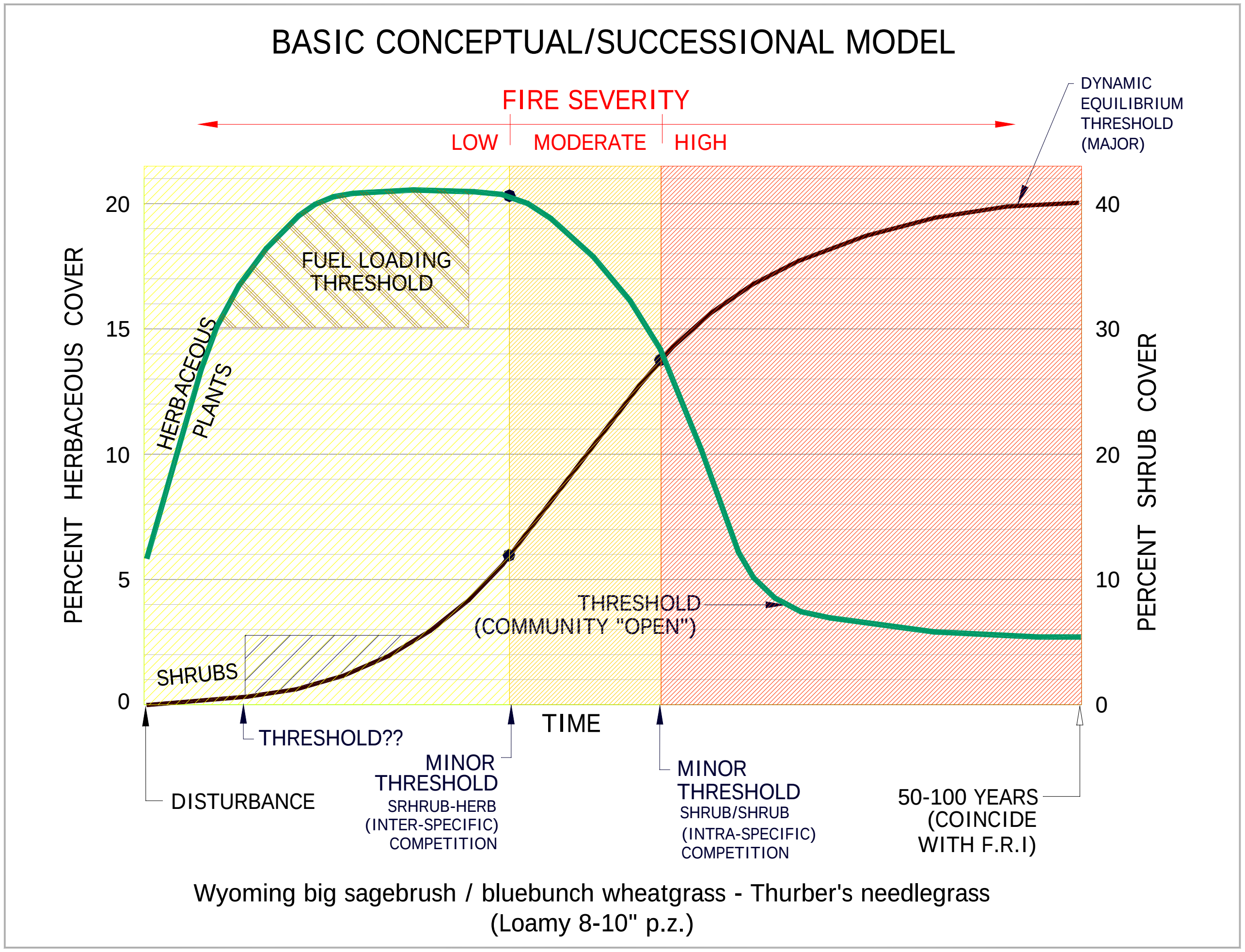


Figure 2 - 8: Loamy 8-10" p.z. Ecological Site - Fire Ecology

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 2-9).

Even though the shrubs would have increased the fuel loading and increased the ration 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 2-9).

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. The Boulder Valley/Dunphy Hills area at the southern end of the PMU burned during this time period.

This is also the time that cheatgrass began to appear in Elko County in large patches. Consequently, Boulder Valley and Dunphy Hills crossed a threshold and changed states from a sagebrush-bunchgrass ecological site to an annual grass/annual weed ecological state. Thus in approximately 100 years, grazing was able to cause a shift in the landscape from a mosaic of grass, grass-shrub, and shrub-grass patches to predominantly a contiguous shrub-grass landscape, except where fires resulted in conversion to cheatgrass.[4]

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 spread to plant communities once believed to be relatively invulnerable to fire (e.g., salt desert shrub communities).

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. Once we understand how livestock influence fire ecology of the various ecological sites, we can adjust vegetation management to reflect that understanding.

The fires in the Tuscarora PMU over the last 15 years are much larger on average than the 15 years previous to 1994. Fires are going to continue to occur, putting the remaining intact sagebrush at risk.

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;
- Off-road vehicle abuse; and

[4] During this time period, changes were also occurring that resulted in a shift from sagebrush communities to P-J communities, but not in the Tuscarora PMU.

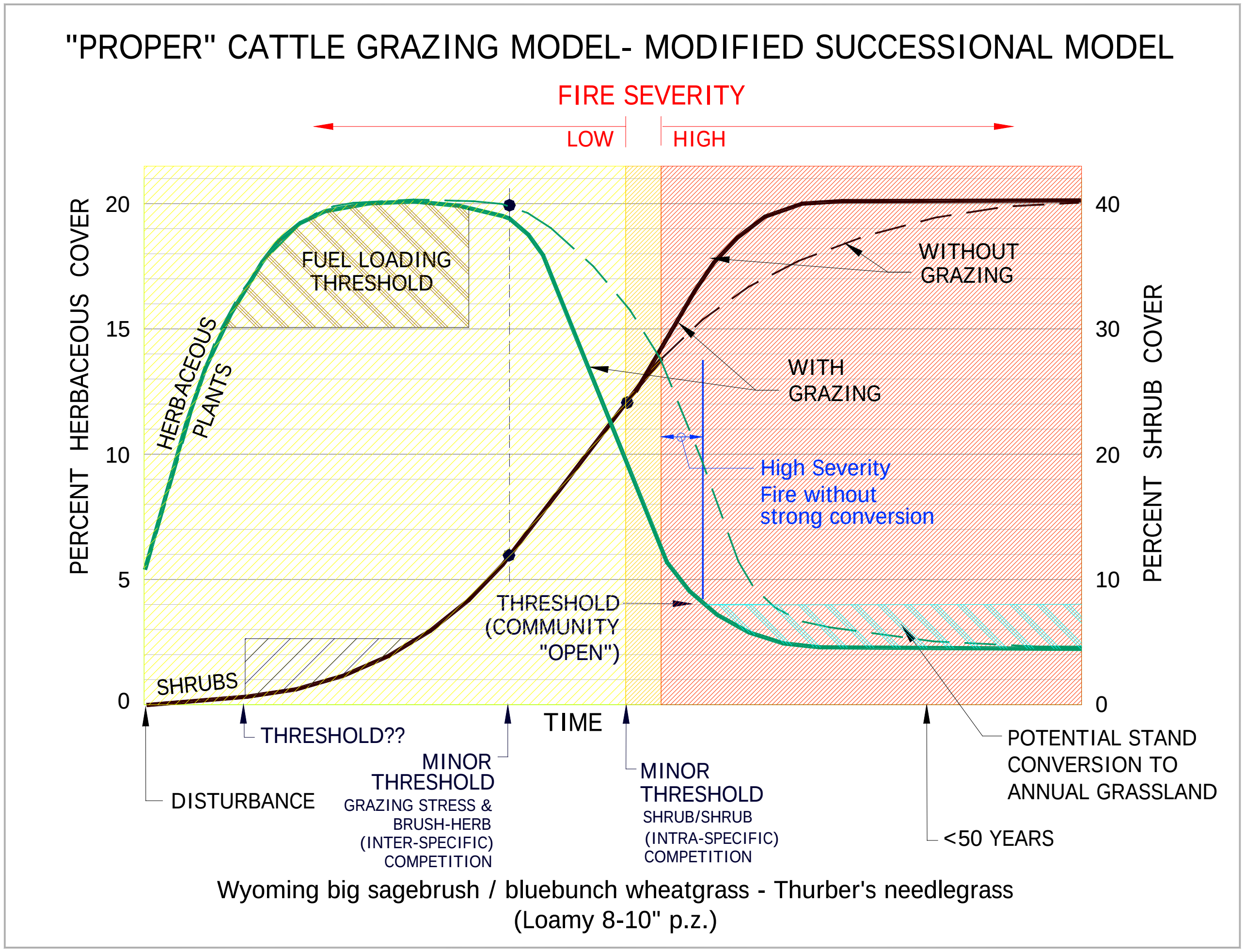


Figure 2 - 9: Grazing Influence on Fire Ecology of the Loamy 8-10" p.z. Ecological Site

- Sheep trailing.

Mining and exploration within the PMU are somewhat 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 (Independence Sub-basin) 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 months.

The Midas Mine is an underground mine with surface exploration activities associated with the mining (Willow Creek Sub-basin). This site is located near Midas and is limited in size. The Hollister Mine is within the Rock Creek Sub-basin, but the major access is through the Willow Creek Sub-basin. Activity associated with these mines is primarily via county roads, with final access to the sites via newly constructed roads. None of the roads cross through any leks.

Exploration activities continue to occur within the PMU at localized sites.

Power lines traverse the PMU with a major line crossing the Sheep Creek Range to the Tuscarora Mountains. Many smaller lines convey power to the mines, communities (e.g., Midas and Tuscarora), 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.

Currently, subdividing and development of ranchettes has not been a major disturbance in the Tuscarora PMU. Because of the amount of private land within the PMU there is potential for this to occur, but currently, this is not viewed as a major impact.

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), 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.

Historically, sheep trailing has occurred through the PMU. While the numbers of sheep and sheep operators has declined in the past 40 years, the activity continues. During the field work there were several bands of sheep in the upper portion of Rock Creek. These animals were primarily using the burned areas and there did not seem to be any issue with the amount of forage consumed or left as stubble. However, the area was closed to cattle grazing during this period in the Willow Creek Sub-basin and the fires released tremendous amounts of herbaceous vegetation. Therefore, it is not clear that sheep trailing is still an issue. However, during the spring when the sheep move north, there may be interference breeding activities if the sheep pass through leks.

2.7 SUMMARY

The PMU has undergone changes since the 1860s. Historic grazing combined with plant dynamics on each of the ecological sites have created conditions suitable for large, intense fires. These have occurred with some regularity over the past 40 years. With respect to sage-grouse, the current condition of the PMU may contain less habitat than at any other time in the last 150 years. However, the amount of burned area that has recovered with perennial grasses and forbs indicates that the PMU will have abundant habitat in the future, if fire and other factors can be controlled.

Of the six highest risks discussed above, Habitat Quality, Habitat Quantity, and Habitat Fragmentation remain the three largest concerns for sage-grouse and they are integrally related and associated with Fire Ecology. Because of the amount of grassland that now covers the majority of the PMU, Livestock Grazing will be a major influence on the PMU Habitat Quality from this point forward.

In the last 40 years we have seen the PMU transition from a shrub-dominated condition to a grass-dominated condition, with islands of shrub-dominated habitat scattered throughout. While this has not been beneficial to sage-grouse in the short-term, there is now an opportunity to build a mosaic of habitats from the "ground up."

2.8 RECOMMENDATIONS

Even though the fires have been causing the transition from shrub-dominated to grass-dominated vegetation over more than 50 years, the recent fires have been sufficiently large that many areas that were recovering have burned a second or third time. Consequently, the landscape now has approximately 47 percent of the surface covered with grasses. The remaining 53 percent is either riparian habitat (about five percent), non-sagebrush types (salt desert shrub, aspen, conifer, cheatgrass, or agricultural fields, etc.) which may occupy as much as 20 percent of the PMU. This leaves about 28 percent in intact sagebrush.

The soil association polygons are an indication of the scale of the natural mosaic that is possible on the landscape. The mosaic will occur at even a finer scale, as the soil association polygons are themselves made up of up to three soils and five inclusions. Each can be an individual ecological site or some of the soils may be similar enough that an ecological site spans more than one soil. Within the three sub-basins there are 392 soil association polygons, totaling 711,900 acres. The average size of the polygons is approximately 1,800 acres, although the individual polygons range in size from less than one acre to approximately 30,000 acres. This average is a suitable "management unit" size, as it allows for a variety of size treatments within an area.

2.8.1 Vegetation Management

The information depicted on Figure 2-2 is sufficiently relevant to the following discussion that the figure is provided again as Figure 2-10 for easy reference. While this model only represents this one ecological site, the concept is similar for more mesic sites and for more xeric sagebrush sites (see Figure 1-5). More mesic sites have shorter timeframes for which the plant dynamics occur and also have higher maximum and minimum values for the herbaceous and shrub cover. The change in Figure 2-10 to represent a more mesic site is essentially raising the two curves and shortening the time interval on the X-axis. Conversely, for a more xeric sagebrush site, the change would be to lower the two curves and extend the time over which the changes occur. The more xeric the site, the higher the potential for cheatgrass to be present at the site; however, cheatgrass is capable of establishing on any of the ecological sites within the sub-basins.

Because the change brought about in the plant community proceeds from left to right on Figure 2-10, the means to provide for sustainable sage-grouse populations is to have different locations on the landscape representing each one-quarter of the graph. Thus the graph represents the progression of plant communities at one site over time, but by creating different phases of the progression at multiple sites at one time, all the seasonal habitats required by sage-grouse would be present on the landscape. To maintain sustainability would require to always treat vegetation in the final phase (i.e., the right side of the graph) before a catastrophic burn occurs. The timeframe over which this would need to be managed would depend on the specific ecological site.

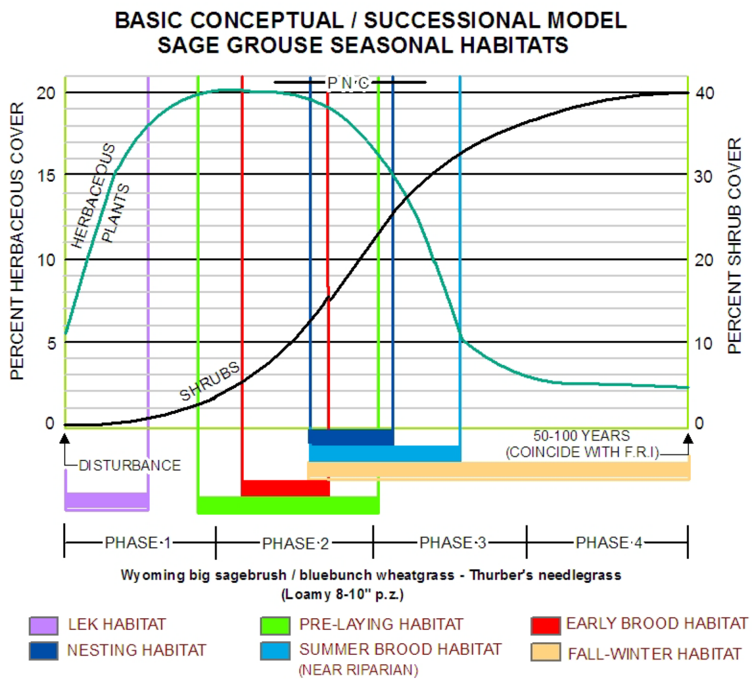


Figure 2 - 10: Basic Conceptual Model with Sage-Grouse Seasonal Habitats

Under this management "rotation", about 25 percent of the habitat should be in grasses/forbs with shrubs establishing, 25 percent should be in a mixture of grasses/forbs with mature shrubs, 25 percent should be in a mixture of mature shrubs with grasses/forbs, and 25 percent in the shrub-dominated phase. The WAFWA guidelines (Connelly et al. 2000) recommend against having specific percentages of the landscape in any particular successional stage; however, the sustainability of the system depends on the development of the various stages over time.

As stated above, almost half of the PMU has been converted to perennial grasses with sagebrush already establishing on some of this area. Approximately 28 percent of the PMU is in a sagebrush-dominated condition. Very little of the PMU is in the condition represented by a mixture of grasses/forbs and mature sagebrush. Therefore, there currently exists a lot of Phase 1, no Phase 2 or Phase 3, and about the right total amount of Phase 4.

The key to managing for more Phase 2 and 3 is to facilitate the establishment of sagebrush on portions of the landscape that now have Phase 1 vegetation, and thin some sagebrush in the existing Phase 4 vegetation. This requires scheduling sagebrush seeding in coordination with the grazing system. Wyoming big sagebrush seed requires a period of soil moisture and minimal frost during the time of germination. Capturing some of the winter snow with standing grass litter is a way to ensure moisture is present during germination. Therefore, seeding pastures that have been rested or that received only early season use provide the best chance of getting sagebrush established.

The entire burned area does not need to be seeded. The areas to be seeded should be planned relative to ecological site and water sources. There is no reason to seed big sagebrush on claypan sites and ridges with shallow soils that only support low sagebrush, or on limestone derived soils that support black sagebrush. Therefore, the soil association polygons provide a reasonable guide to where the seeding should take place. The seeding should occur in patches that vary in size from 100 acres to 600 acres[5], and only two-thirds of the existing burned area should be seeded at this time. This will set the stage for Phase 1 to continue to develop (not seeded with sagebrush) slowly, with facilitated seeding for Phase 2.

Seeding at a rate of no more than 0.1 pound pure live seed (PLS) per acre is recommended. That is the equivalent of approximately six sagebrush seeds per square foot. Allowing for a high percentage of mortality, this rate of seeding should produce enough sagebrush seedlings to restock the seeded area.

Once the sagebrush is established, monitoring of the sites would be conducted at five to ten year intervals. As the sagebrush approaches about 22 percent cover (i.e., begins to transition to Phase 3), about one-half of the seeded area should be burned with prescribed fire to create more Phase 1. By this time, the original Phase 1 areas will have transitioned into Phase 2. At the end of this treatment period, there should be newly created Phase 1, Phase 2 on the original burned area that was not seeded, and Phase 3 on the areas seeded with sagebrush. At this time, the mosaic of age classes on the burned areas is in place. Over the next 25 years, the three phases will transition into Phase 2, Phase 3, and Phase 4. At which time the acreages of the three phases can be adjusted by treating some of each phase to create a new Phase 1 on about 25 percent of the area. After this, the Phase 4 will be the primary source of Phase 1 by treating the Phase 4 before the vegetation crosses a threshold that will not allow treatment.

Figures 2-11 through 2-14 demonstrate how this process works on a small watershed in the Willow Creek Sub-basin. Trout Creek was selected as the demonstration watershed because it is entirely within a Loamy 8-10" p.z. ecological site. If other ecological sites are present in the watershed, then some adjustments in laying out the phases would be necessary. Once the four phases are established, the management becomes very straight forward. This provides a system for sustaining the watershed health, fuel loading, sage-grouse seasonal habitats, livestock forage, and habitat for many other species.

For the areas that are currently occupied by mature and decadent sagebrush, the process is similar, but involves creating new Phase 1, Phase 2, and Phase 3 by the intensity of the vegetation treatments. Where the understory of herbaceous plants is limited, seeding either prior to the treatment or immediately following the treatment with native grasses suited to the site must be part of the treatment. If the seeding is not conducted, there is a high probability that cheatgrass will become a major component of the herbaceous vegetation.

Because sagebrush already exists on these sites, treatment consists of thinning the sagebrush to provide opportunity for grasses and forbs to establish. Treatments can include prescribed fire, mechanical treatment with an aerator, or herbicide. There may also be opportunity to use livestock grazing as a thinning treatment based on studies currently being conducted by Chuck Petersen (personal communication).

Because sagebrush suffers high mortality by fire, the prescribed burn treatment should only be used when attempting to create Phase 1 and Phase 2 conditions (i.e., the higher intensity treatments, but

[5] This is a guideline only. There may be circumstances where large patches are appropriate. However, patches in excess of 2,000 acres should only be considered in the context of a very large area that can be monitored.

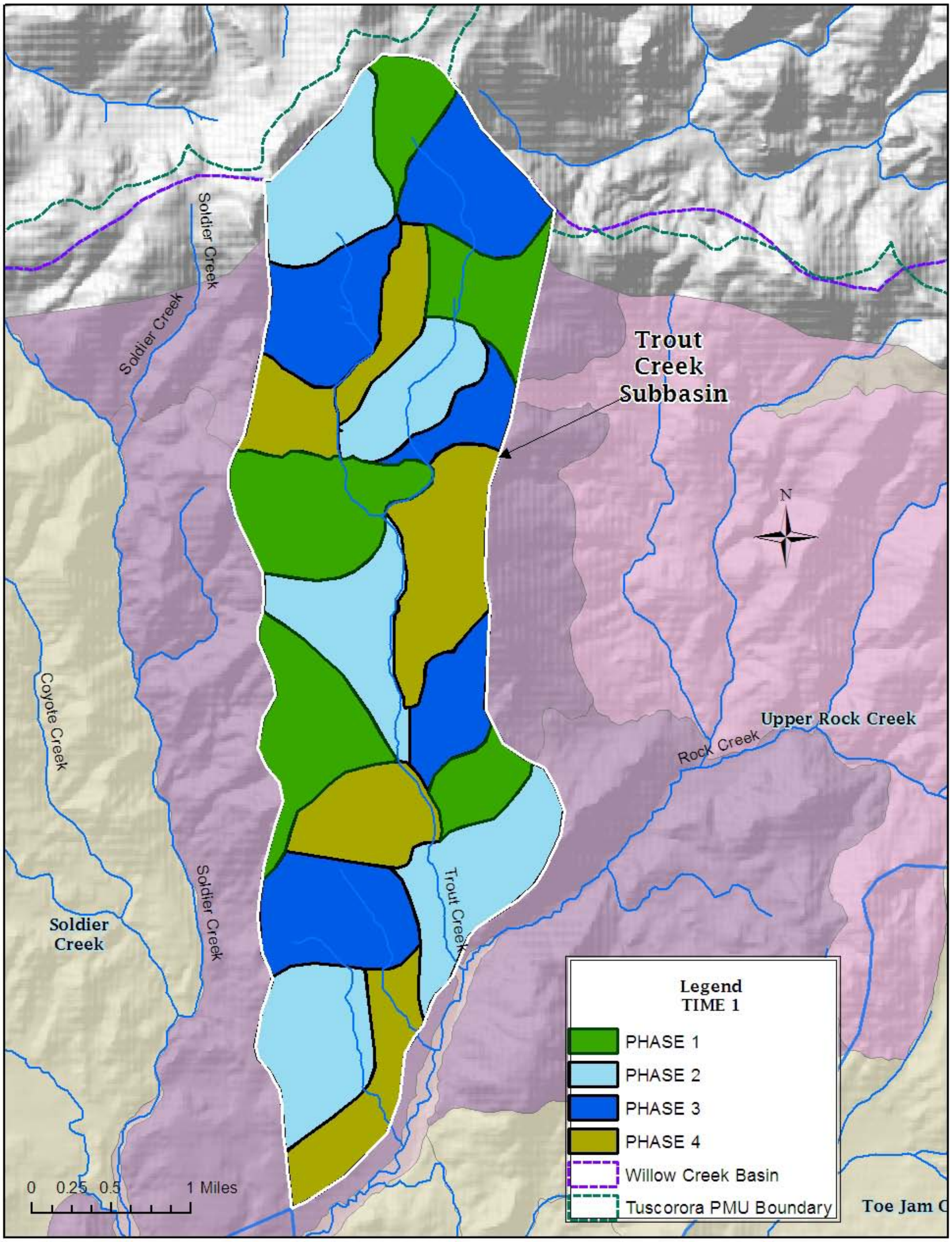


Figure 2 - 11: Example of Establishing Multiple Age Classes of Vegetation - Time 1

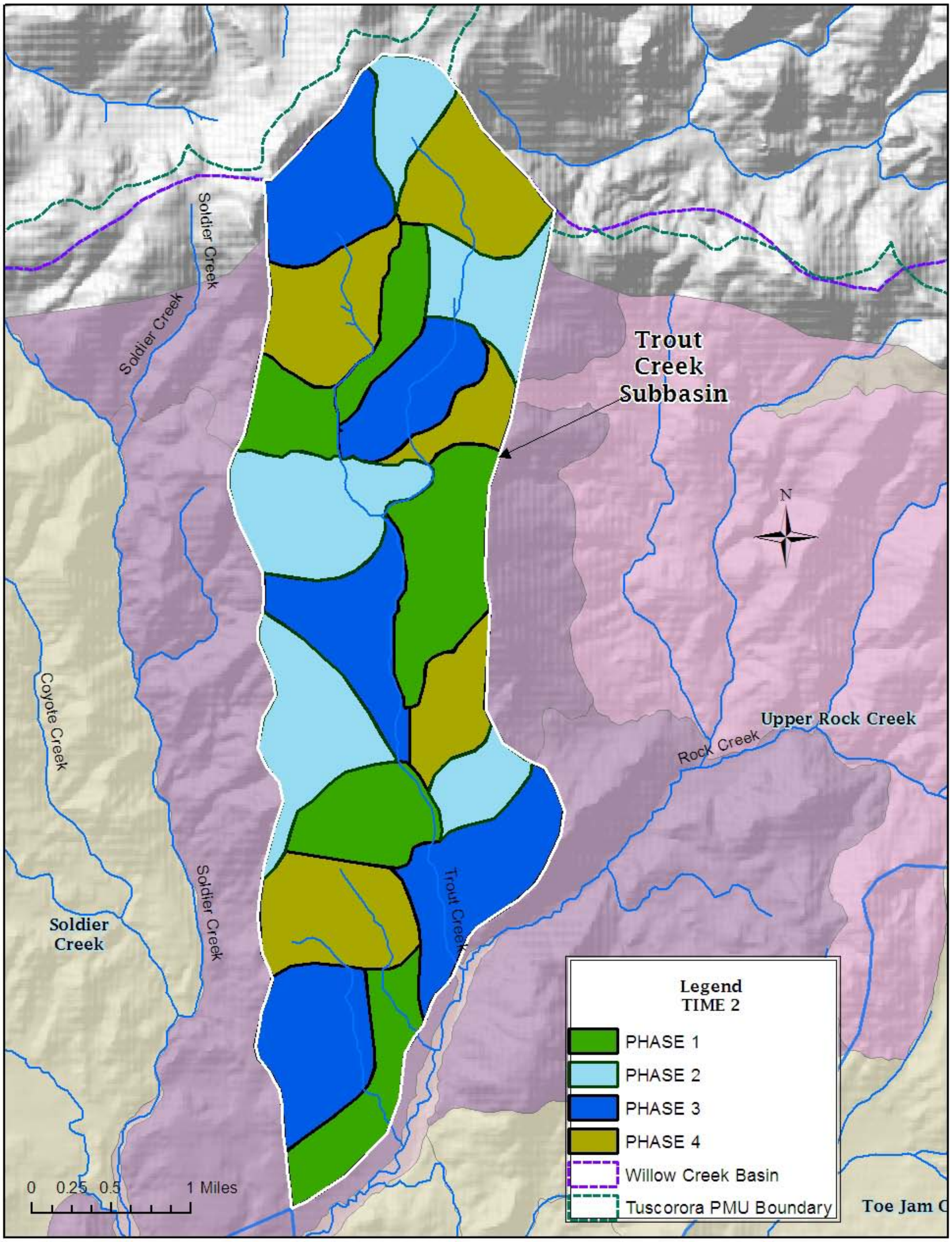


Figure 2 - 12: Example of Establishing Multiple Age Classes of Vegetation - Time 2

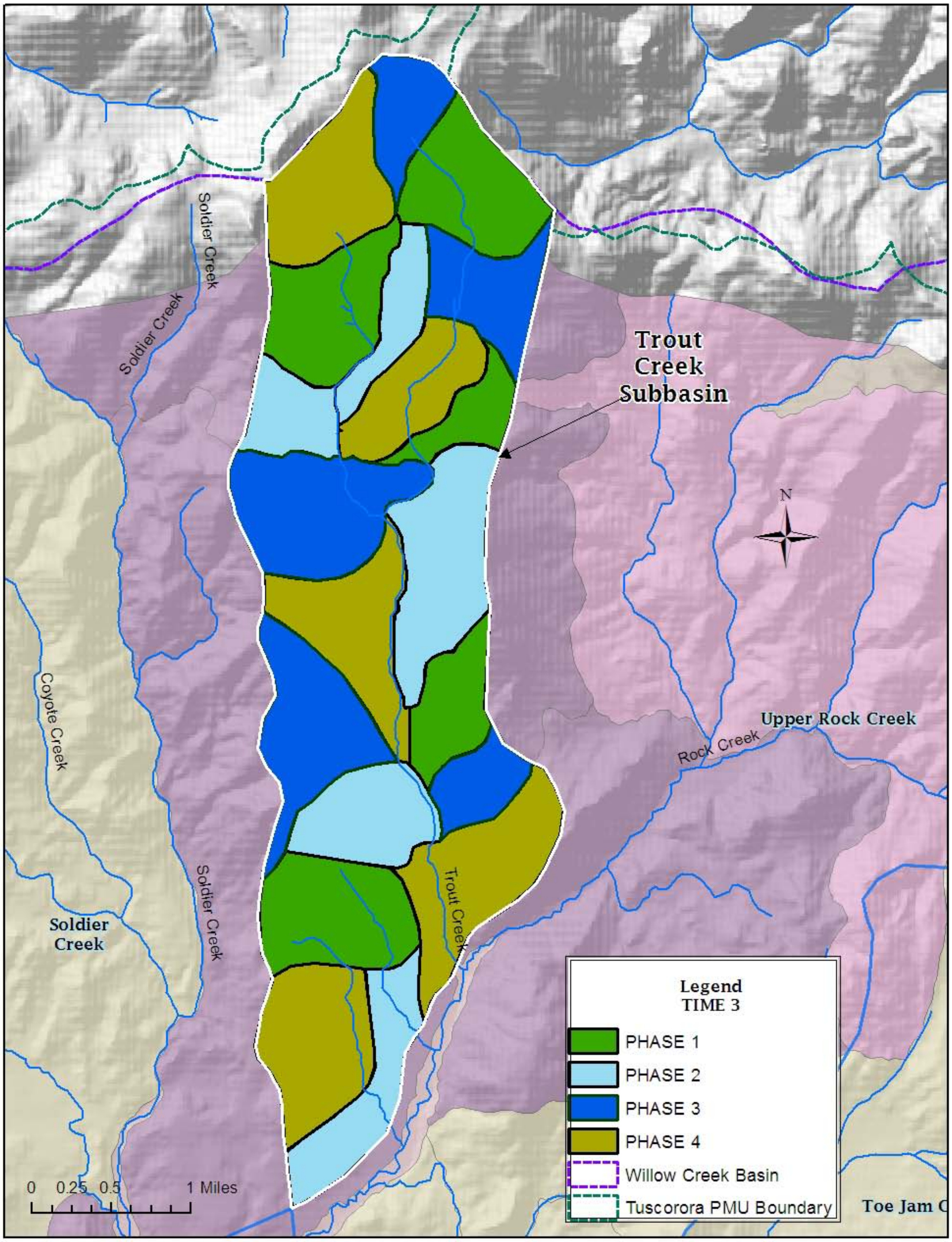


Figure 2 - 13: Example of Establishing Multiple Age Classes of Vegetation - Time 3

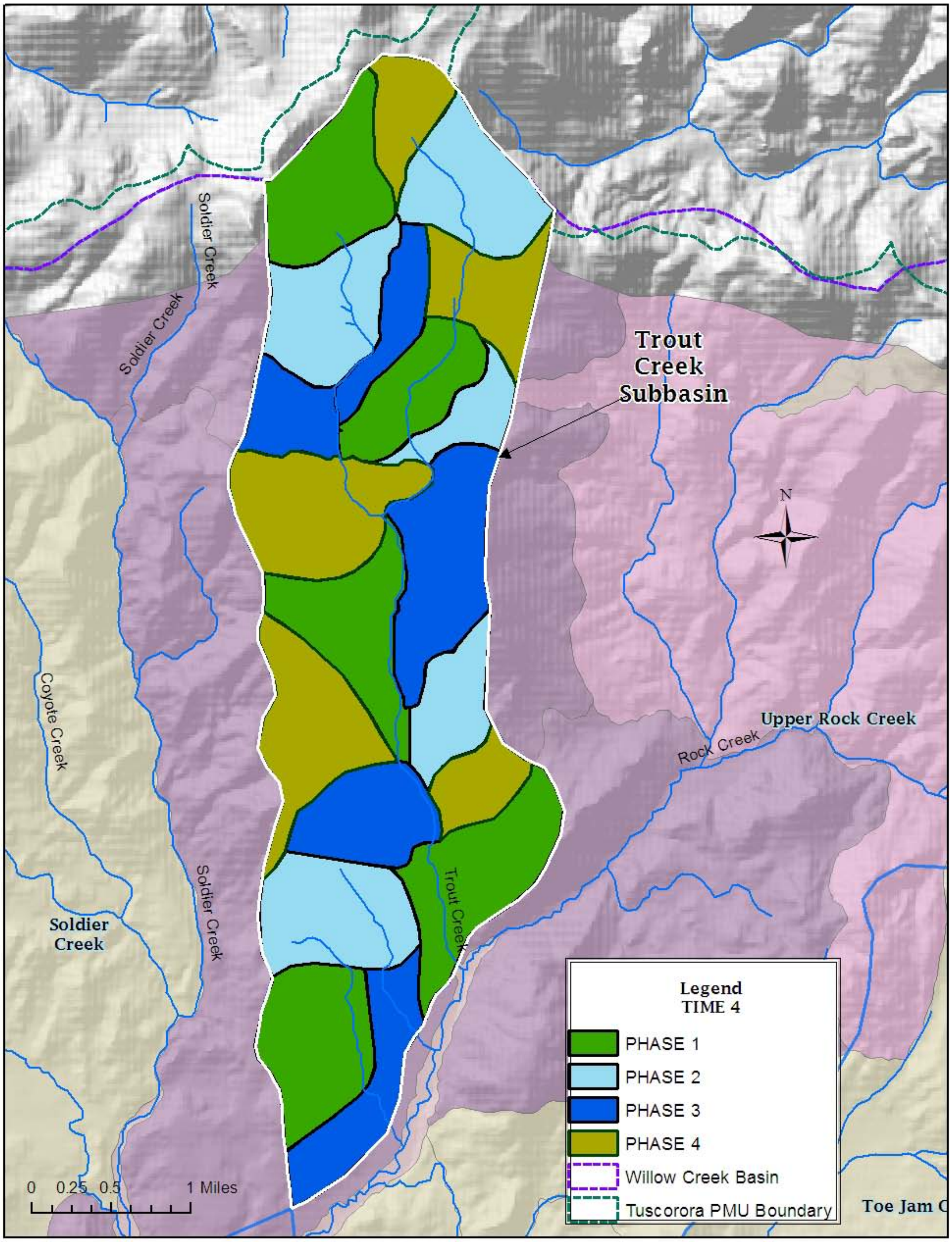


Figure 2 - 14: Example of Establishing Multiple Age Classes of Vegetation - Time 4

this does not imply a high intensity burn[6]). The burn prescription can be used to control the intensity of the burn, thereby controlling the amount of sagebrush removed. The condition created will not be a Phase 2 immediately following the fire, but should transition to this phase in a few years as sagebrush re-establishes in the burned area.

An aerator can also be used to change the intensity of the treatments among areas, and a broadcast seeder can be mounted on the aerator to thin and seed at the same time. Intensity of the treatment is managed by changing the weight and offset of the drums. The intensity of the treatment can also be managed by the number of swaths treated before leaving a swath or two untreated.

Another alternative for treatment is herbicide. Teubthiron has been shown to be effective at thinning sagebrush and allowing native grasses to be released. This is applied in a clay pellet by aircraft and is water activated.

Each of these treatments have their limitations, but each is appropriate for the objective of thinning sagebrush. Prescribed burning is not likely to be permitted near structures or valuable habitats that are not to be treated (i.e., aspen, riparian zones, etc.). Aerators cannot be used where the soils are very rocky or on steep slopes. Herbicides have restrictions for use around live waters. Therefore, the treatment needs to be suited to the objective as well as the site.

All treated areas need to be examined on the ground prior to treatment to conduct reconnaissance for cheatgrass, noxious weeds, and to determine if seeding native grasses and forbs is necessary prior to or following the treatment.

Planning of the treatments in time and space must consider livestock grazing. Creating Phase 1 next to a riparian area is likely to result in impacts to the riparian area, and possibly to the upland vegetation. Therefore, the treatments should be planned to facilitate riparian health. The sagebrush thinning treatments should consider the contiguous nature of the existing sagebrush stands. These thinning treatments can be used to create fuel breaks. The NNSG Strategy developed the concept of “brown strips” – areas where herbaceous vegetation is created between areas of sagebrush dominance. The herbaceous areas are grazed to reduce the fine fuels, creating a fuel break between the sagebrush areas.

2.8.2 Livestock Management

Livestock grazing and management are discussed in the context of the vegetation management described above. Currently, the amount of grass and forbs on the PMU is unprecedented in the last 150 years. To maintain the sustainability of the grazing and the wildlife habitats (as well as fuel loading, watershed values, etc.) grazing needs to be managed more intensively than in the past.

As stated above, the objective of the vegetation management is to maintain a landscape where Phase 1, Phase 2, Phase 3, and Phase 4 conditions exist in patches of 100 to 600 acres. These patches should occur on the landscape in a mixed mosaic, and not necessarily in some sequence (i.e., Phase 1 next to Phase 2, etc.). As each patch will eventually support the vegetation of each phase, it is important that the phases are somewhat clustered to provide all the seasonal habitats in an area of 5,000 acres or less.

Figures 2-5 and 2-6 show the impacts of “proper” grazing on sage-grouse habitats. Proper is defined as a grazing system that manages the time, intensity, and duration of grazing and incorporates the following guidelines:

[6] All of the treatments described are basically low to moderate intensity. The goal is to change the vegetation without modifying soil organic conditions or to impact the existing seedbank. Therefore, “high intensity” when used in this context is the high end of moderate.

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

These guidelines are based on plant physiological responses to grazing and 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 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 was 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 in the PMU. The vegetation on the burned areas 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 depicted in Figure 2-9, and increase the likelihood that cheatgrass or other non-native invasive species will eventually dominate the site.

As discussed below, grazing that follows these guidelines is compatible with sage-grouse habitat requirements. It is also the key to sustainable forage of high quality forage species.

Because cattle are primarily grazers, they are expected to focus on the areas where Phase 1 and Phase 2 occur – where grasses are the most abundant. This would not create much impact to sage-grouse, which are primarily using Phase 3 and Phase 4. Phase 2 provides pre-laying habitat and early brood habitat (Figure 2-10). The pre-laying habitat is used by sage-grouse in April and early May, prior to laying the clutch of eggs. The sage-grouse are primarily interested in forbs, not grasses. Therefore, livestock grazing in this habitat is not likely to affect hen use of the area. Early brood habitat is used by sage-grouse from late May to the end of June or early July. The chicks are primarily seeking insects and forbs in these habitats. Grazing in areas containing this phase is likely to reduce cover, but may not have much impact on insect and forb abundance.

Phase 2 and Phase 3 provide nesting habitat during mid-April through May. Grazing is likely to remove nesting cover in Phase 2 areas, but the level of grazing in Phase 3 areas is anticipated to be very light. There is likely to be very little grazing impact where these areas are at distance from water.

Livestock use of Phase 4 is likely to be minimal as long as areas of Phase 1 and Phase 2 are available.

Because of the extent of the fires in the PMU, it is not clear how the burned areas adjacent to the riparian zones are going to impact the riparian vegetation. There are two opposite scenarios possible. The first is that there is so much new grass that the livestock will not focus on the riparian zones until mid-July. The uplands have more grass that should be highly nutritious and palatable. Therefore, livestock are likely to spread out in the pasture and go to the riparian areas to drink, at least while upland grasses are succulent. If this is the case, then rotation systems that move the livestock from pasture to pasture will minimize the time that riparian areas are exposed to grazing.

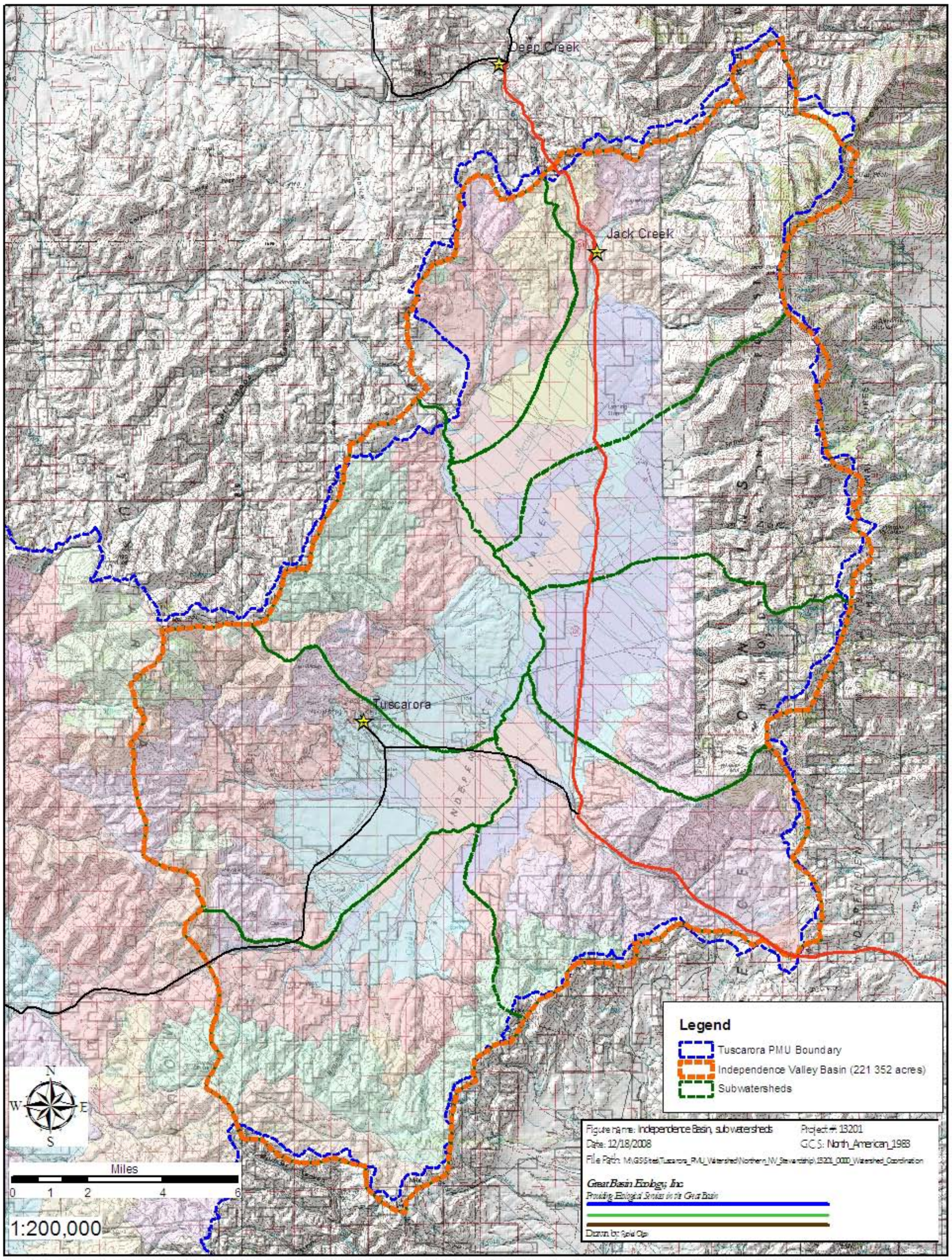
The second scenario is that because the Basin big sagebrush was removed during the fires, the old historic flood plains now have abundant grass and there is no reason for livestock to move away from the riparian areas. In this case, utilization will be heavy to severe on the area within one-quarter mile of the riparian area.

In actuality, both scenarios are likely to occur. Cows have individual preferences for grazing certain species and locations. These preferences are modified by age and condition. There are some cows that have been "riparian grazers" for years and the change in forage availability following the fires is not like to change their behavior. The older the cow, the more likely she will not change her behavior. These riparian grazers should be culled from the herd, along with their calves. Because the calves learn from the parent cow, the calves are the next generation of riparian grazers. Other cows prefer the uplands and will use the riparian areas in the dry season. The calves from these cows should be the replacement calves. In contrast, steers are more likely to travel some distance from water and use steeper slopes. So steer operations should not present the same degree of riparian grazing as cow-calf pairs.

However, the grazing guidelines discussed above will also help maintain riparian areas.

Sheep trailing impacts will depend on the amount of forage removed by cows during the grazing season. The level of utilization observed in 2008 by the fall trailing sheep bands was well within acceptable levels. However, the areas were still closed to cattle grazing, so the full impact of the sheep grazing could not be determined. However, if the sheep can be herded to some of the higher country where the cows are less likely to concentrate, then there should be minimal impact from the sheep grazing. In the spring, sheep focus on forbs and grasses, but in the fall they are more of a browsing species. Therefore, potential impacts to young sagebrush seedlings could occur. This should be monitored to ensure that sagebrush survival is not threatened.

CHAPTER 3 – INDEPENDENCE SUB-BASIN ASSESSMENT



1. INTRODUCTION

The Independence Sub-basin is located in northwestern Elko County (Figure 1-2) and is part of the South Fork Owyhee Basin. The waters from this sub-basin are part of the South Fork Owyhee River drainage system, which flows north to the Snake River Drainage. This is one of five Sub-basins in Elko County that flow to the Snake River Drainage.

The Sub-basin is bounded on the east and south by the Independence Mountains and on the west and north by the Tuscarora Mountains. The mountains of both ranges have abundant aspen stands and high elevation basins. The Tuscarora Mountains range to about 8,500 feet amsl and the Independence Mountains range to about 10,000 feet amsl. The Independence Valley is about 5,600 feet amsl. The Sub-basin is approximately 221,000 acres in size.

For the purposes of the assessment, the Sub-basin was divided into eight smaller watersheds (Figure 3-1). The drainage from the Sub-basin flows northwest to the Owyhee Desert.

The east side of the Sub-basin is public land administered by the U.S. Forest Service (USFS). This portion of the Sub-basin was not included in the NRCS soil survey; therefore, the ecological sites were not determined prior to conducting the field work. The rest of the Sub-basin is public land administered by the BLM, and private land.

The community of Tuscarora is the primary community within the Sub-basin. Livestock grazing, hay production, and horse breeding are the primary agricultural activities. Both the Tuscarora Mountains and Independence Mountain have historic mining works and some active exploration and mining. The area is also popular for outdoor recreation.

2. WATERSHED ASSESSMENT

2.1 FIRE AND FUELS

Up until 2006, this Sub-basin was characterized by few, small fires. In 2006 three large fires occurred, bringing the total acreage to approximately 40,000 acres burned, or 19 percent of the Sub-basin. Approximately 30,000 acres have burned since 1999, or about 15 percent of the Sub-basin (Figure 3-2).

The two large fires burned the west mid-slopes of the Independence Range and west across the valley to State Route 226. A third large fire burned the Tuscarora Mountains north of Tuscarora.

The portions of these fires that burned the higher elevation county removed most of the sagebrush and mountain brush, some aspen, several riparian areas consisting of aspen, alder, and/or willow, and the associated understory grasses and forbs. During the 2007 field assessment of this area, the sprouting shrubs, such as snowberry, were already returning to the landscape, as were the grasses and many forbs. Aspen stands were reestablishing and the willows along most of the creeks were several feet tall. Perennial grasses were present, but their abundance varied across the landscape. Forbs were plentiful, but limited to a few species. Cheatgrass occurred mixed with perennial grasses, especially on some of the south slopes and the benches. Where deeper soils and greater soil moisture occurred, the perennial grasses dominated. Some of the south slopes also had abundant perennial grasses. Overall, the fire was likely to result an improvement over pre-fire conditions – for livestock in the short-term and for other wildlife species in the long-term.

The lower elevations had mixed response to the fires. Some areas had very sparse perennial grass cover, with little or no cheatgrass. These areas are likely to continue to improve with more perennial grass each year. Other areas had cheatgrass as the dominant or co-dominant species and these areas are prone to repeated fires, possibly followed by conversion to monocultures of cheatgrass.

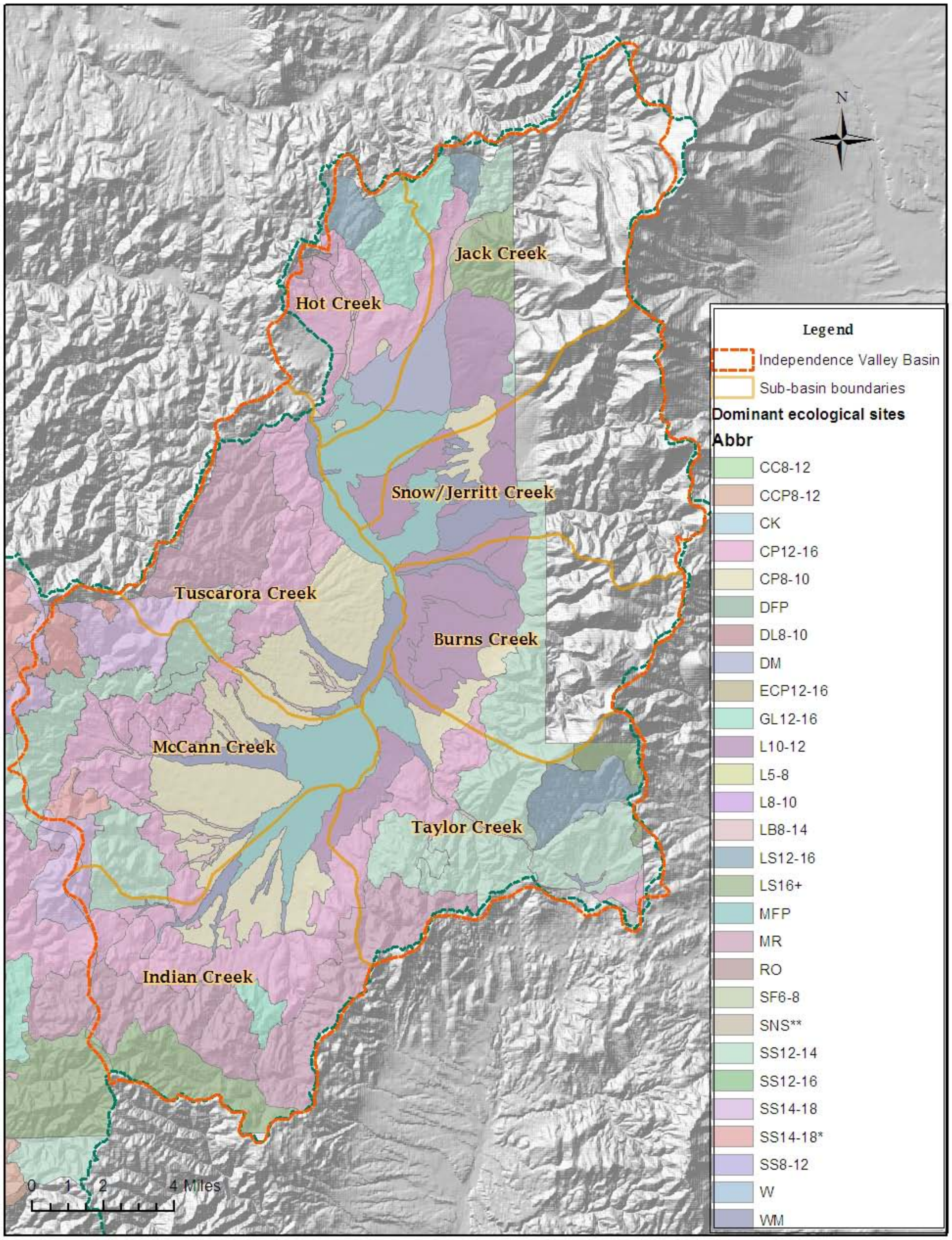


Figure 3 - 1: Sub-basins or Watersheds within the Independence Valley Sub-Basin

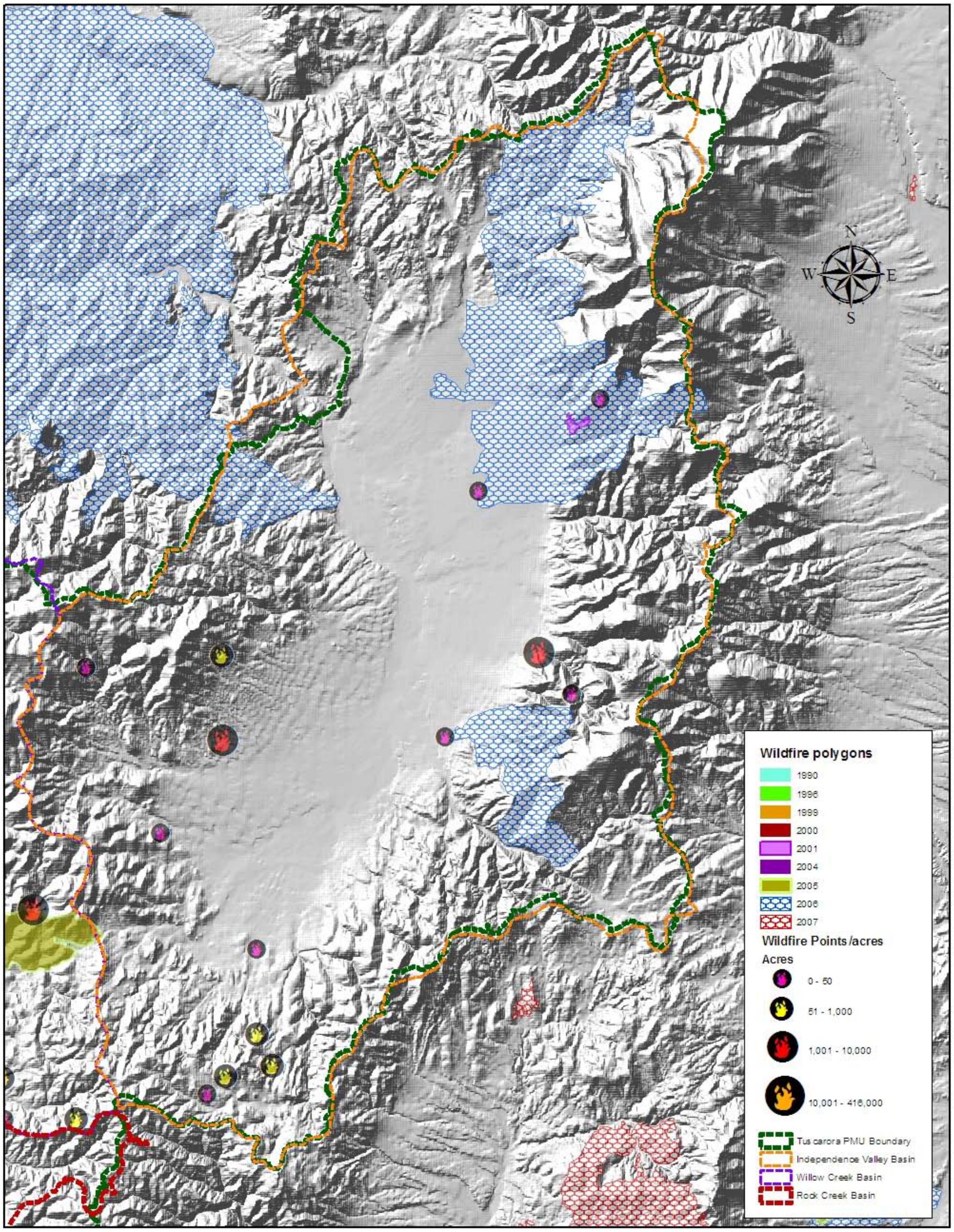


Figure 3 - 2: Recent Fire History of the Independence Valley Sub-Basin

Other noxious weeds, such as Scotch thistle, bull thistle, and hoary cress, were found in small patches in the burned areas. These were expected to spread in 2008 and 2009 as the ground was still very open in many places where grasses had not yet filled in all the areas once occupied by shrubs. The areas under the shrubs often burn so hot that the organic matter is vaporized and some grass species do not germinate well in this bare mineral soil. However, many weedy species readily establish in these "hot spots."

Examination of many of the smaller fires that had occurred in the past showed excellent recovery of the burned areas. Most were in the higher elevations and the grasses were abundant and robust. Sagebrush had returned to many of these older burns. Using the phases depicted in Figure 2-10, most of these burned areas were either in Phase 2 or Phase 1. Because of the high elevation, it was not clear if sage-grouse were using these sites for pre-laying foraging, nesting, or early brood habitat. In most years, these high elevation sites may be snow covered during nesting season.

After several days of collecting field data the observation was made that it was apparent that the most recent burns were a result of high fuel loading and that just about every area that had not burned was prime for a fire. Fuel loadings in the high elevations were extreme due to the amount of fine fuels (grasses) and long-term fuels (shrub and trees). While the fuels were broken up to some degree by different soil types and ecological sites, such as Claypan 8-10" p.z. sites, even these sites burn under extreme conditions. Therefore, much of this Sub-basin has a high probability of burning with relatively high intensity in normal fire years. Figure 3-3 shows the ecological sites and other areas where fuel loading was assessed as excessive. Many of the sites where data was not collected also would have been rated as having excessive fuels based on our ocular estimates. Figure 3-4 shows the areas where decadent shrubs were abundant; these are areas where fire is likely to be extreme.

As this Sub-basin has more intact sagebrush than the other two that were assessed, addressing fuel loading is a fairly high priority in this Sub-basin. Given the response of the vegetation to the three large fires, many areas should respond well to fuels treatments.

2.2 RANGELAND HEALTH AND EROSION

Assessment of rangeland health using the 17 indicators of rangeland health (Appendix A) resulted in most of the ecological sites visited as having minor or no deviation from the ecological site description (Figure 3-5). However, in most of the situations where there was some deviation, the amount of brush was excessive relative to the ecological site description. For those areas where there was a high deviation from the ecological site description, the primary factors which deviated were:

- Plant community composition and distribution relative to infiltration;
- Functional/structural groups;
- Plant mortality/decadence;
- Annual production;
- Invasive plants; and
- Reproductive capability of perennial plants.

All of these factors indicate the plant community is in Phase 4 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.

With respect to infiltration of precipitation, the areas on the east side of the Sub-basin and northern end of the Independence Range were areas that had been subject to periods of glacial occupancy. The high elevation sites had deep layers of glacial till at the base of the peaks (Photo 16) and the glacial till extended down the drainages to the valley floor. The soils associated derived from the glacial till were quite coarse and water rapidly infiltrated this material (Photo 17). Consequently, even following the fires there was little evidence of surface erosion of these soils.

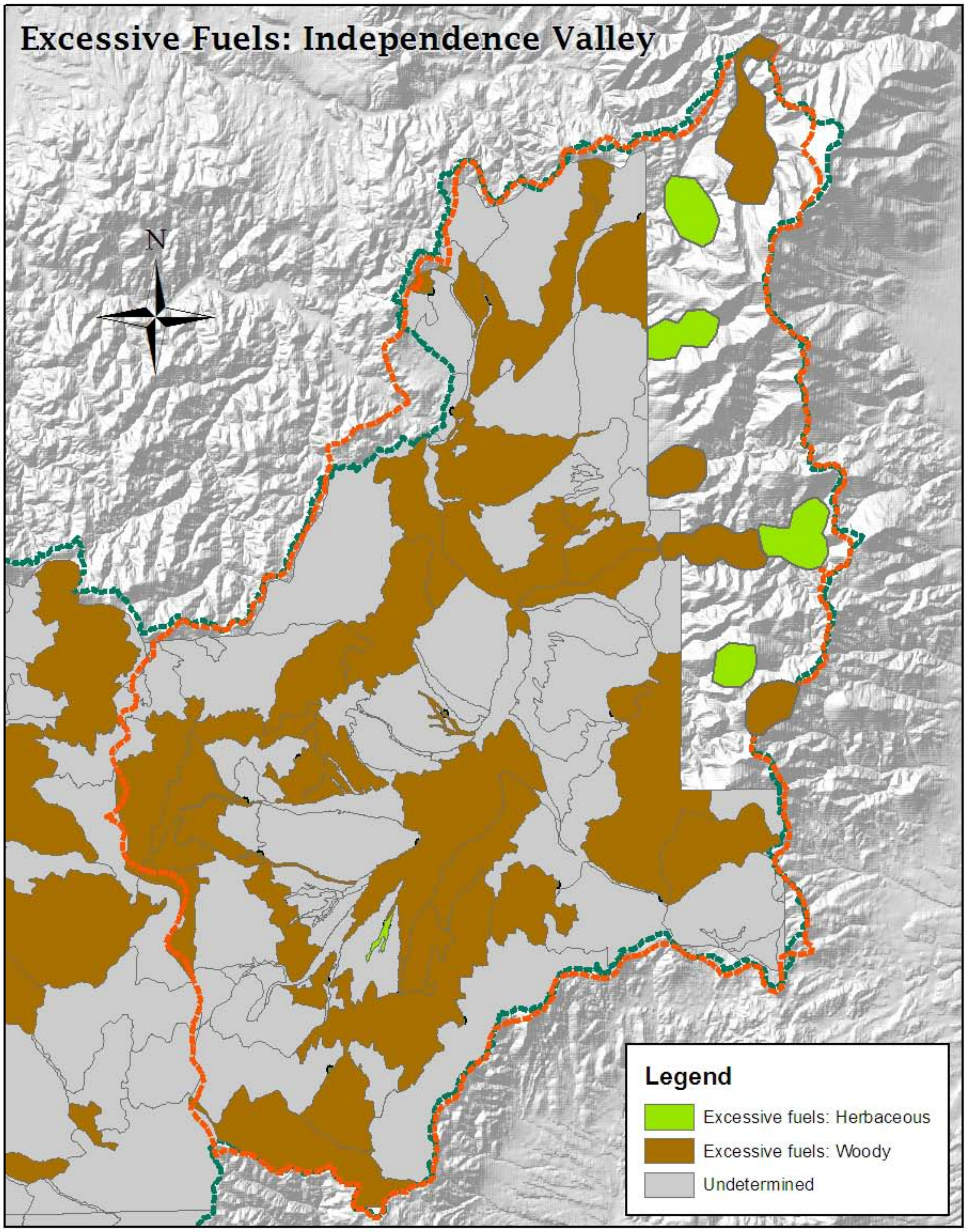


Figure 3 - 3: Ecological Sites where Fuels Were Rated as Excessive – Independence Valley Sub-basin

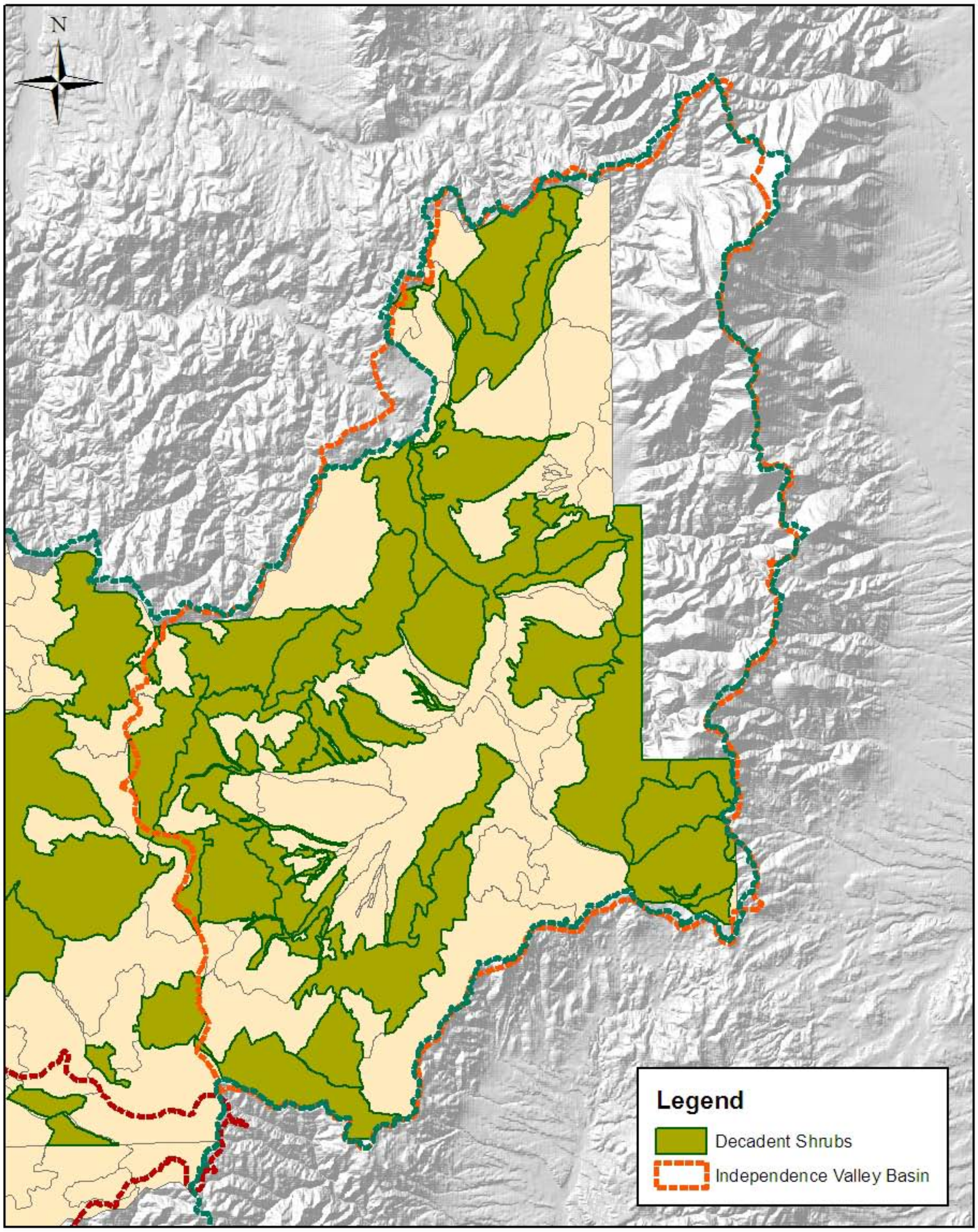


Figure 3 - 4: Ecological Sites with Decadent Shrubs in the Independence Valley Sub-Basin

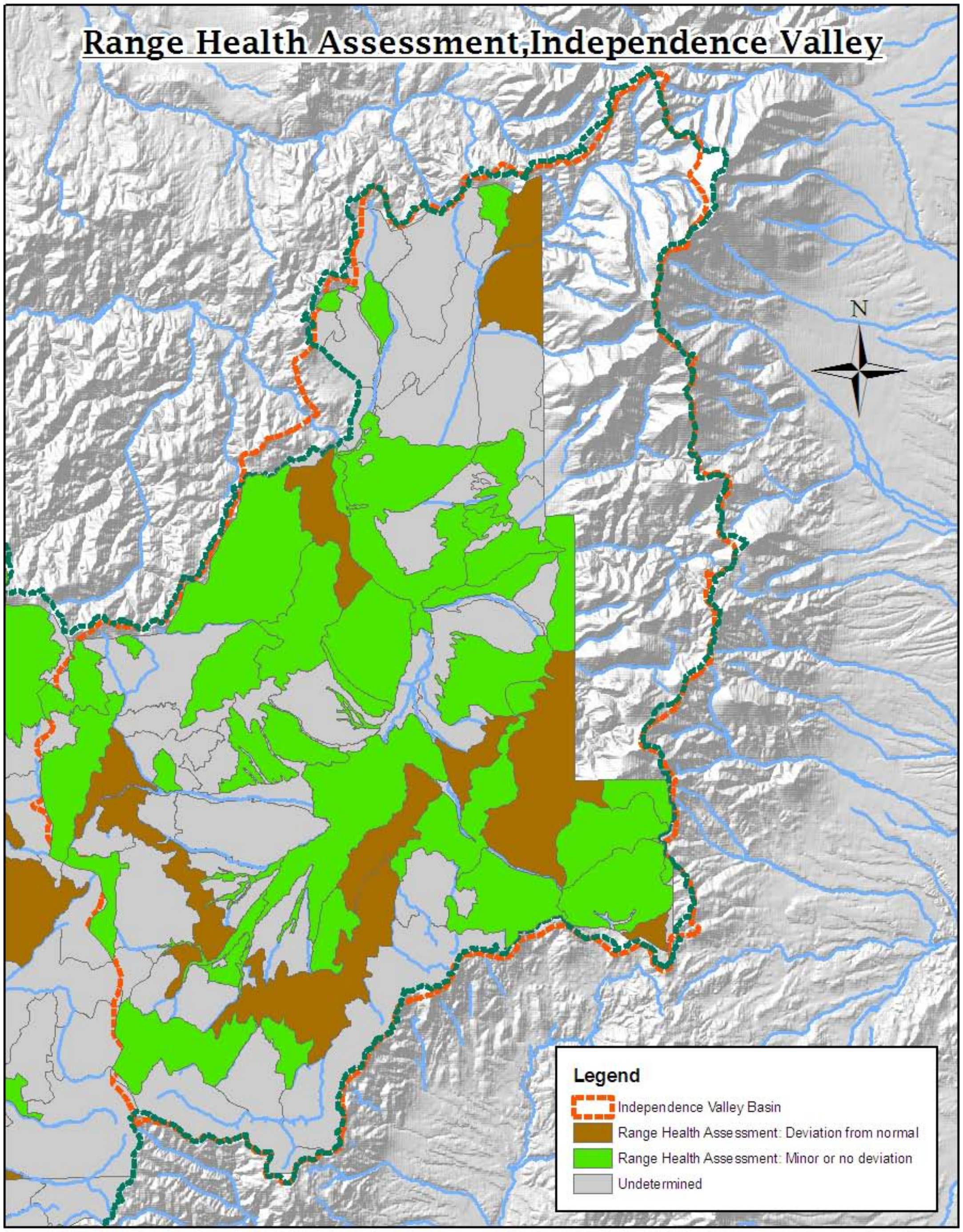


Figure 3 - 5: Results of the Rangeland Health Assessment in Independence Valley Sub-Basin

Photo 16: Area Subjected to Glacial Activity with a Thick Layer of Glacial Till

Photo 17: Typical Soil Surface in Areas Subject to Glaciation

Even in locations where washing of the gravels removed the finer materials, the creeks remained very stable (Photos 18 and 19).

Photo 18: Cobble and Boulders Remain to Armor the Channel After the Fine Sediments have been Washed

Photo 19: Stable Streambank within the Glacial Till

The streambanks of the streams in the glacial till did not have much evidence of livestock use[7] prior to the fire. This may have been due to the rocky nature of the terrain near the creeks and there were few places for livestock to congregate or lie down (Photo 20). Consequently, the riparian vegetation responded quite well after the fire.

Photo 20: Rocky and Vegetated Nature of the Streams in Glacial Till

The creeks in this portion of the watershed appeared very stable, even though some erosion was noted at the higher elevations. The combination of large rocks and abundant woody vegetation along the stream banks, and the large recharge zone for these creeks provide a combination of factors that give these streams stability following fire and season-long flows.

In contrast, the southern portion of the Independence Mountains and the Tuscarora Mountains had surface soils derived from volcanic rocks. The soils had high clay content and were very susceptible to erosion (Photos 21, 22, and 23). These creek banks are much more vulnerable to livestock impacts as the livestock can cause compaction of these clay soils, which dries them out over time, and create “nick points” in the vegetation where erosion processes can get started. These soils were very susceptible to other disturbances as well (Photo 24). Roads were often found to be causes of erosion. Runoff reaching the roads follows the rut and the ruts are often not protected with vegetation. Once the root zone is penetrated by the erosion, the soil is very susceptible to erosion.

[7] Note that the burned area was closed to grazing during the time the assessment was conducted, but the condition of the vegetation indicated that there was very little bank use prior to the fire.

Photo 21: Erosion of Clay Soils in Riparian Zone

Photo 22: Erosion of Surface Soils Following Compaction by Livestock

Photo 23: Erosion of Soils Derived from Volcanic Rocks

Photo 24: Erosion Created by Poorly Placed and Constructed Road

Erosion was not just related to streams and riparian zones. The claypan sites also had considerable evidence of pedestalling. The shrinking and swelling of the clay soils leaves them susceptible to surface erosion. The grasses and shrubs hold the soil in place, but the interspaces between the plants are subject to mud flows in the spring during the freezing and thawing season. The result is plants that have elevated root collars (Photo 25).

Photo 25: Claypan Ecological Site with Pedestalling of the Plants

The overall result is that there is a lot of sediment movement in these clay soils to the drainages, and the drainages are susceptible to minor as well as major events. This is illustrated in Figure 3-6 which shows the locations where active or recent erosion was occurring in the Sub-basin and where historical erosion was observed. Many of the erosion points in the Independence Range were either where the glacial till had been washed of fines during extreme events or where roads created erosion concerns when crossing creeks.

Evidence of erosion was less observable in the loamy ecological sites as the soils had less clay and rills, gullies, and overland flow patterns were not commonly observed. Pedestalling was not common in these sites, as would be expected from the lower clay content of the soil. However, many of the lower elevation loamy sites did not have much understory vegetation (i.e., Phase 4 condition) and the potential for erosion on these sites was high. In the higher elevation sites, the loamy soils had sufficient vegetation cover (except on some south slopes) to promote infiltration.

2.3 NON-NATIVE INVASIVE SPECIES

This is the number one issue in the IndependenceValley Sub-basin. Several noxious weeds are widespread and increasing in abundance. During the assessment in the fall of 2007 the burned areas had some noxious weeds and other non-native invasive species, but due to the amount of bare

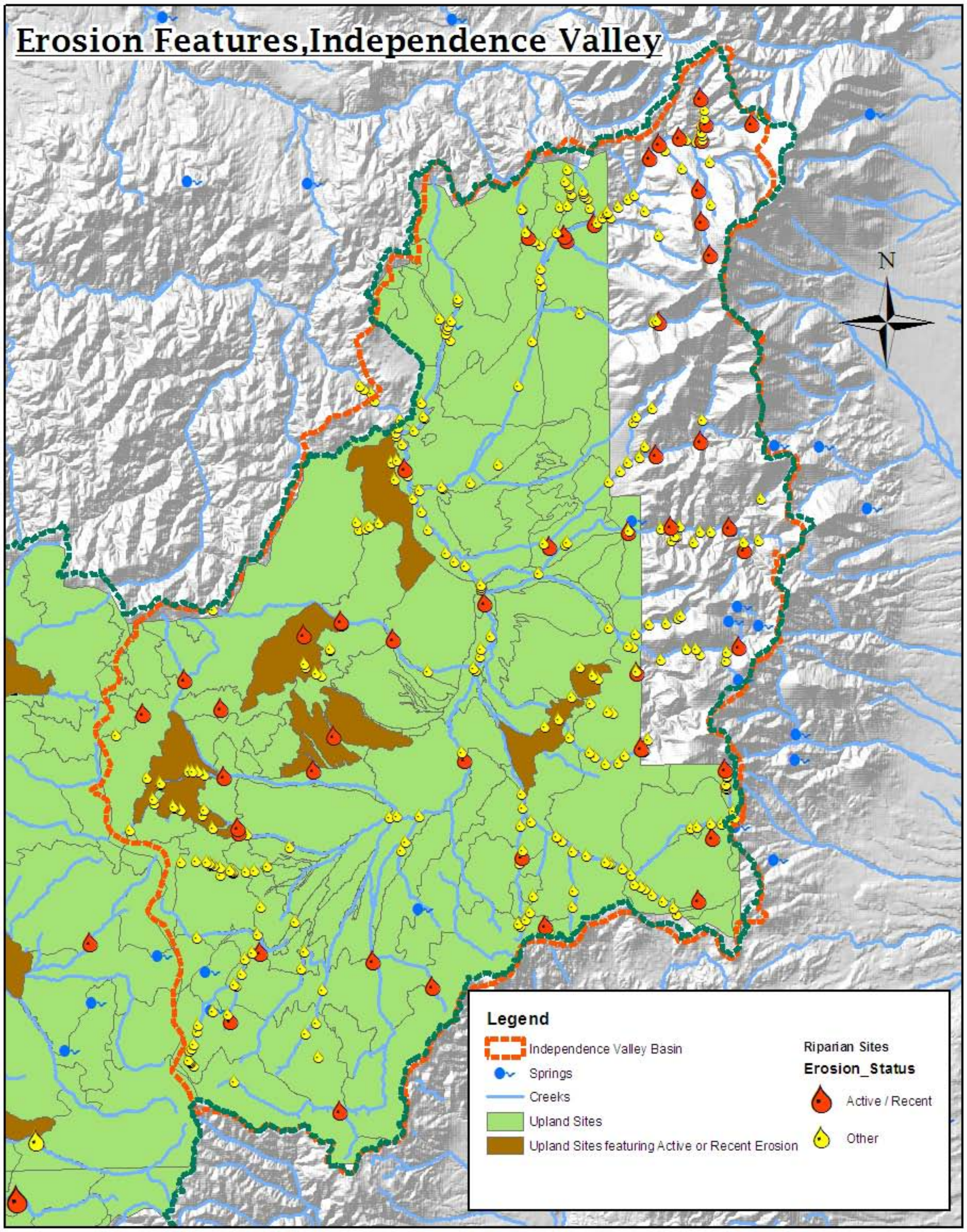


Figure 3 - 6: Erosion Status in the Independence Sub-Basin

ground observed, it was anticipated that these species would increase in abundance in 2008 and in the future.

Figure 3-7 shows the locations of non-native invasive species observed during the assessment. However, it should be noted that the assessment was conducted in the fall and many weeds are less visible at that time of the year and not every ecological site polygon was visited. So Figure 3-7 should be considered the minimum observation of non-native invasive species. In particular, the area in the

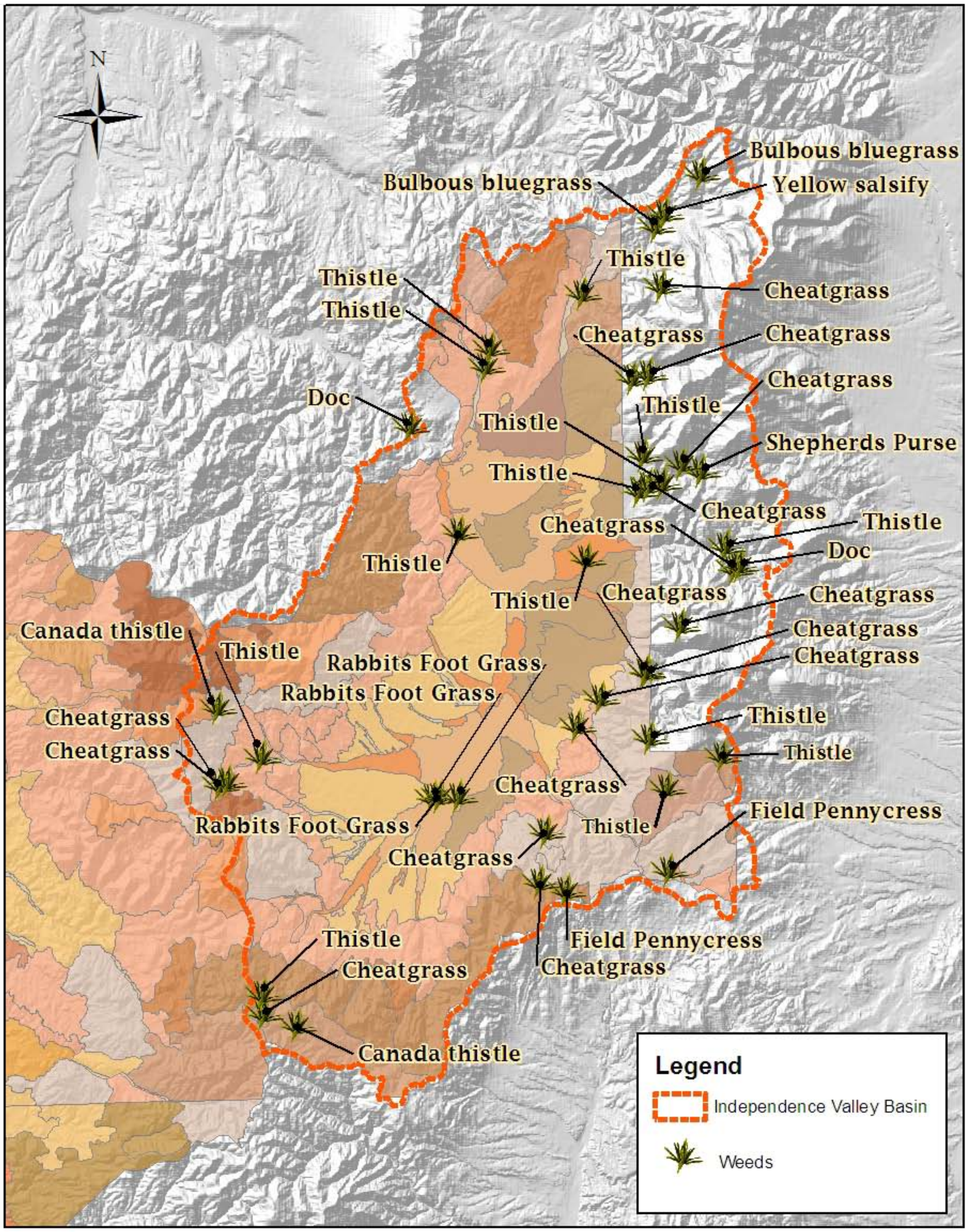


Figure 3 - 7: Non-Native Invasive Species Observations in the IndependenceValley Sub-Basin

vicinity of the community of Tuscarora was heavily infested with hoary cress. The Owyhee Conservation District has been conducting weed control efforts along the major roadways within the Sub-basin and many of the individual ranches have been actively controlling weeds. However, noxious weeds cannot be controlled just by some of the ranches or property owners. This is a region-wide issue and the solution has to include all stakeholders. The risk increases with each fire, as these weed species will easily colonize burned areas.

2.4 OTHER CONCERNS

At the end of the data sheets there was a place to enter "Primary Concern" by circling one or more categories. In the Independence Valley Sub-basin, the four major Primary Concerns were Vegetation (composition and structure), Fuels, Weeds, and Cheatgrass. The ecological sites where these concerns were expressed are shown on Figure 3-8. Based on the discussion above, these concerns are appropriate and are supported by the field observations. The lack of concerns on the east side of Figure 3-8 is not because the conditions were so much better, but because there were no ecological site polygons identified on the USFS-administered lands (i.e., lack of soil survey data).

On Figure 3-8 the "Other Concerns" include Excessive Erosion, Excessive Sedimentation, Drainage Integrity, Flooding, Terrestrial Ecology, Soil Productivity, and Aquatic Ecology. These are all important concerns, but they usually represented localized concerns rather than the broader ecological site concerns.

2.5 RIPARIAN CONDITION

As discussed above, the riparian assessment was conducted using the checklists for PFC. Because individuals were making the assessment, rather than an interdisciplinary team, the determination of PFC or function at risk, or not functioning was not made. However, the items checked on the list as identifying issues were tallied and those assessment sites that had only a few items checked as issues are indicated in blue on Figure 3-9 and those with multiple issues are depicted in orange. The approximate reach of stream associated with each assessment point is also indicated.

From Figure 3-9 it is clear that there are some riparian issues that need to be addressed. Many of these sites had poor channel morphology, excess sediment entering the system, poor age-class structure of riparian vegetation, etc. Those sites on the east side of the Sub-basin that are identified as having issues were primarily in the burned areas and vegetation had not yet recovered to the point where all riparian functions had been restored. Whereas those on the west side of the Sub-basin were primarily related to excessive erosion, bank instability, or loss of riparian vegetation.

As discussed in the PMU assessment (Chapter 2) the riparian habitat condition in some ways reflects the condition of the upland vegetation. When the uplands are dominated by shrubs, the livestock spend more time, and create more impacts, on the riparian vegetation. Given the rangeland health assessment and the amount of areas with excessive woody vegetation and decadent shrubs, the riparian issues are not surprising.

The noxious weed issue is also a riparian issue, as riparian areas are often the first places for noxious weeds to establish. Therefore, any changes in management intended to improve the riparian areas need to be combined with noxious weed control. Treating one without the other is wasted effort.

There are also many structures that were put in for irrigation, channel protection, flow control, etc. that are currently not in use or are in disrepair. These should be either restored to functioning condition or removed. These structures tend to divert energy and cause erosion when not functioning. In addition, there are many low water crossings that are not constructed crossings. Many have eroded to the point that the bank is sheer and people are not moving up or down stream to create additional crossings.

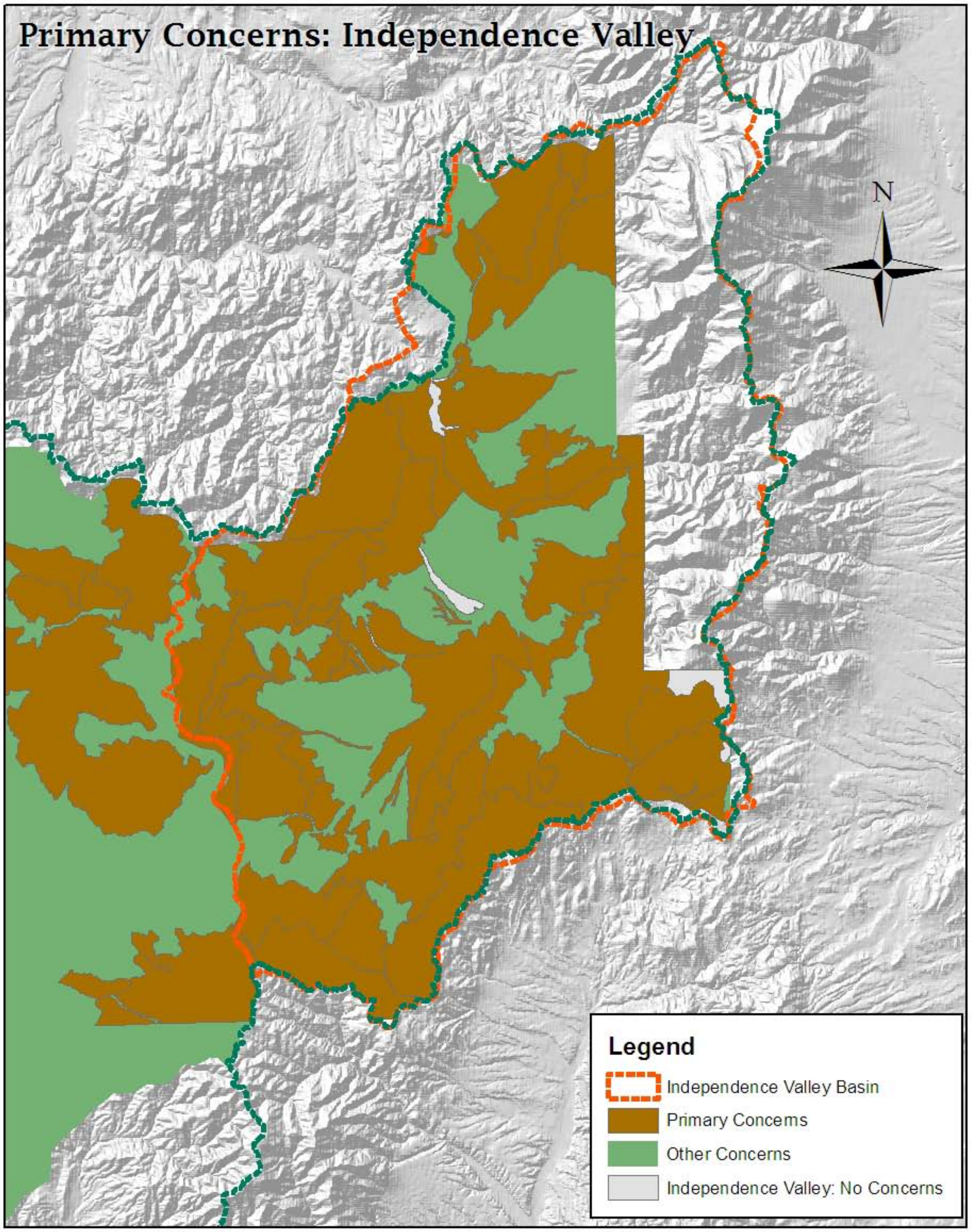


Figure 3 - 8: Areas with Resource Concerns in the Independence Valley Sub-Basin

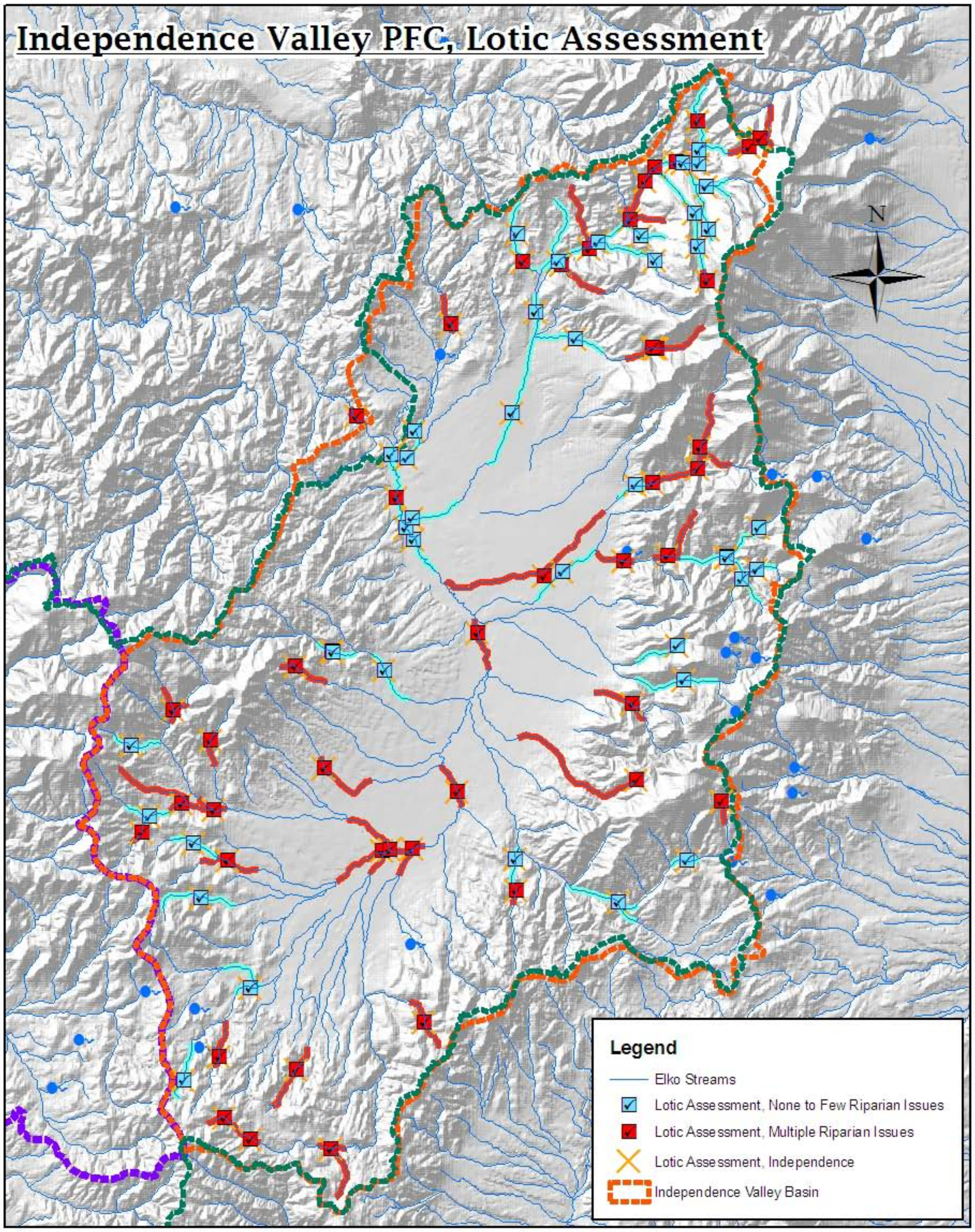


Figure 3 - 9: Riparian Assessment Locations and Concerns

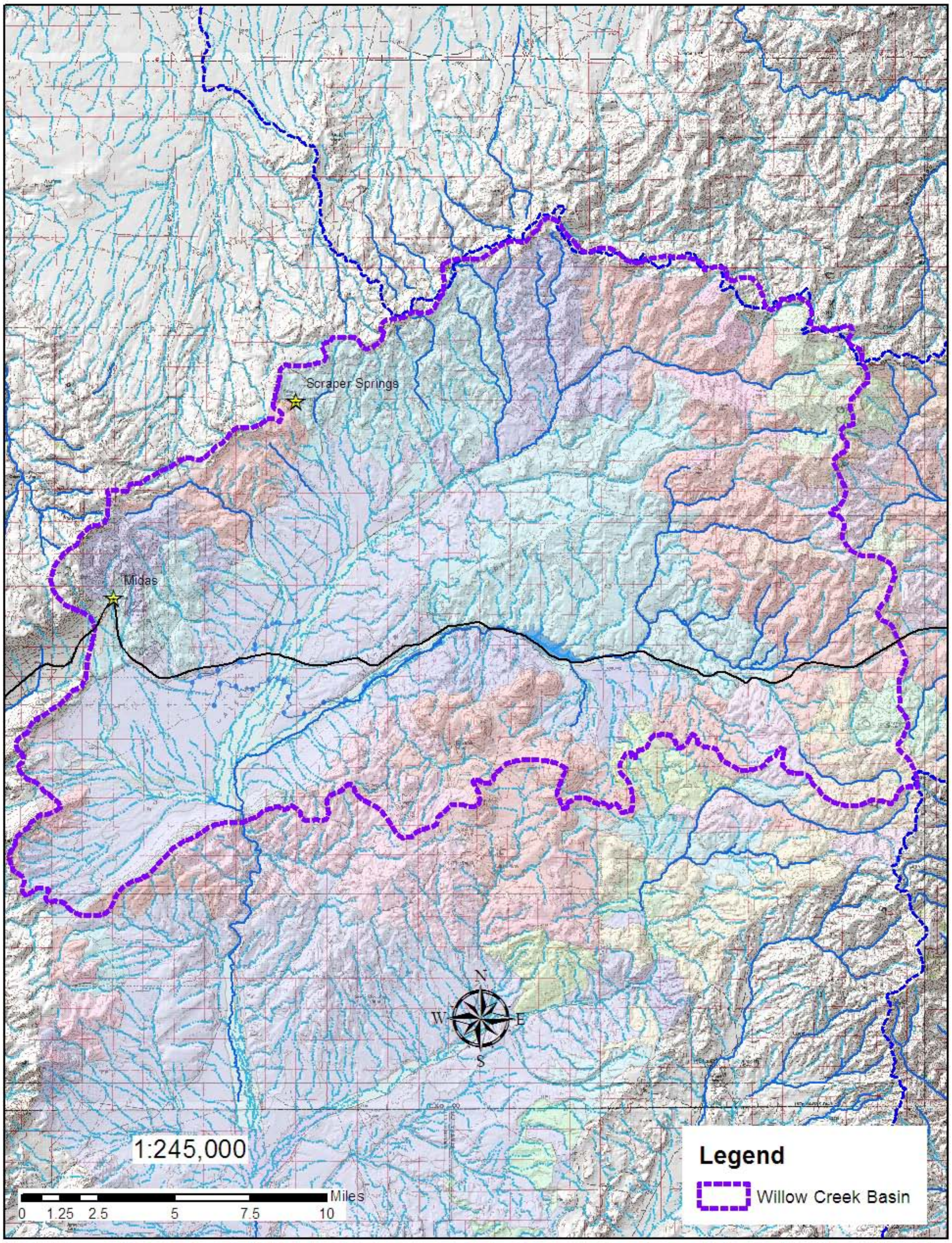
3. RECOMMENDATIONS

None of the other issues in the Tuscarora Sub-basin are of any consequence if the noxious weed issue cannot be solved. Any vegetation treatments to improve watershed conditions are only likely to encourage the spread of noxious weeds. Erosion on the west side of the Sub-basin also creates opportunities for noxious weeds to establish. Therefore, the first priority, and only priority for the near future is to organize all the stakeholders and combat the noxious weed problem.

If that can be accomplished, then addressing the fuels, decadent sagebrush, and watershed health will help to control some of the erosion problems. However, the clay soils are abundant in this Sub-basin and it is foolish to expect that these problems will not be resolved without changes in road locations, changes in vegetation and associated changes in livestock management.

All of the recommendations included for the PMU discussion in Chapter 2 are appropriate to this Sub-basin, except the emphasis should be on modifying the existing brush sites, rather than creating a new mosaic on the burned areas (although this should not be ignored).

CHAPTER 4 – WILLOW CREEK SUB-BASIN ASSESSMENT



1. INTRODUCTION

Willow Creek Sub-basin is located in Elko County (Figure 1-2) and is part of the Rock Creek Basin. The waters from this sub-basin are part of the Humboldt River drainage system which flows south to the Humboldt River. This is one of six Sub-basins in Elko County that flow to, or form, the Humboldt River Drainage.

The Sub-basin is bounded on the north and east by the Tuscarora Mountains, on the west by the Snowstorm Mountains, and on the south by the Santa Renia Mountains. The Owyhee Desert is also to the northwest of the Sub-basin. The mountain ranges have abundant aspen stands and high elevation basins. The mountains range to about 8,500 feet amsl. Squaw Valley is at about 5,100 feet amsl. The Sub-basin is approximately 260,500 acres in size.

For the purposes of the assessment, the Sub-basin was divided into 13 smaller watersheds (Figure 4-1). The drainage from the Sub-basin flows southwest to the Hot Lake area at the confluence of Willow Creek and Rock Creek before turning south to flow through the canyon to the Rock Creek Sub-basin.

All lands within the Sub-basin are either private lands or public land administered by the BLM. The only community within the Sub-basin is the community of Midas, on the west side of the Sub-basin. Livestock grazing is the primary agricultural activity. Mining is currently conducted at the Midas Underground Mine and exploration is ongoing throughout the Sub-basin. Willow Creek Reservoir is located along the Midas-Tuscarora Road and is used for storing water for irrigation. This is also a popular recreation site.

2. WATERSHED ASSESSMENT

2.1 FIRE AND FUELS

This Sub-basin has a long history of fire, but in 2001, 2005, 2006, and 2007 major fires swept through this area. Of the 260,500 acres in the Sub-basin, 174,500 acres burned from 1999 to 2007. This represents 67 percent of the Sub-basin. Fires burned an additional 74,000 acres that were not mapped as polygons since 1980. Most of the acreage burned since 1999 had burned at least once before. Three large areas of intact sagebrush remain (Figure 4-2) and many small islands of sagebrush exist within the burned areas.

Most of the areas burned were sagebrush habitats: Basin big sagebrush on the floodplains, Wyoming big sagebrush below 6,500 feet amsl, mountain big sagebrush above 6,500 feet amsl, and low sagebrush on claypan sites and ridges with shallow soils. Riparian vegetation, aspen stands, and agricultural fields (crested wheatgrass) also burned.

Various fire rehabilitation efforts have been conducted and most were successful. Between native release (Photo 26) and rehabilitation seedings (Photo 27), the area is predominantly perennial grasses with abundant forbs. Some areas of cheatgrass occur, but most are about an acre in size, but some south slopes have areas exceeding 20 acres that are dominated by cheatgrass.

The portions of these fires that burned the higher elevation county removed most of the sagebrush and mountain brush, some aspen, several riparian areas consisting of aspen and/or willow, and the associated understory grasses and forbs. During the 2008 field assessment of this area, aspen sprouts and serviceberry sprouts were apparent. Willows along most of the creeks were several feet tall. Much of the willow growth had been initiated by several years of voluntary non-use by the permittee

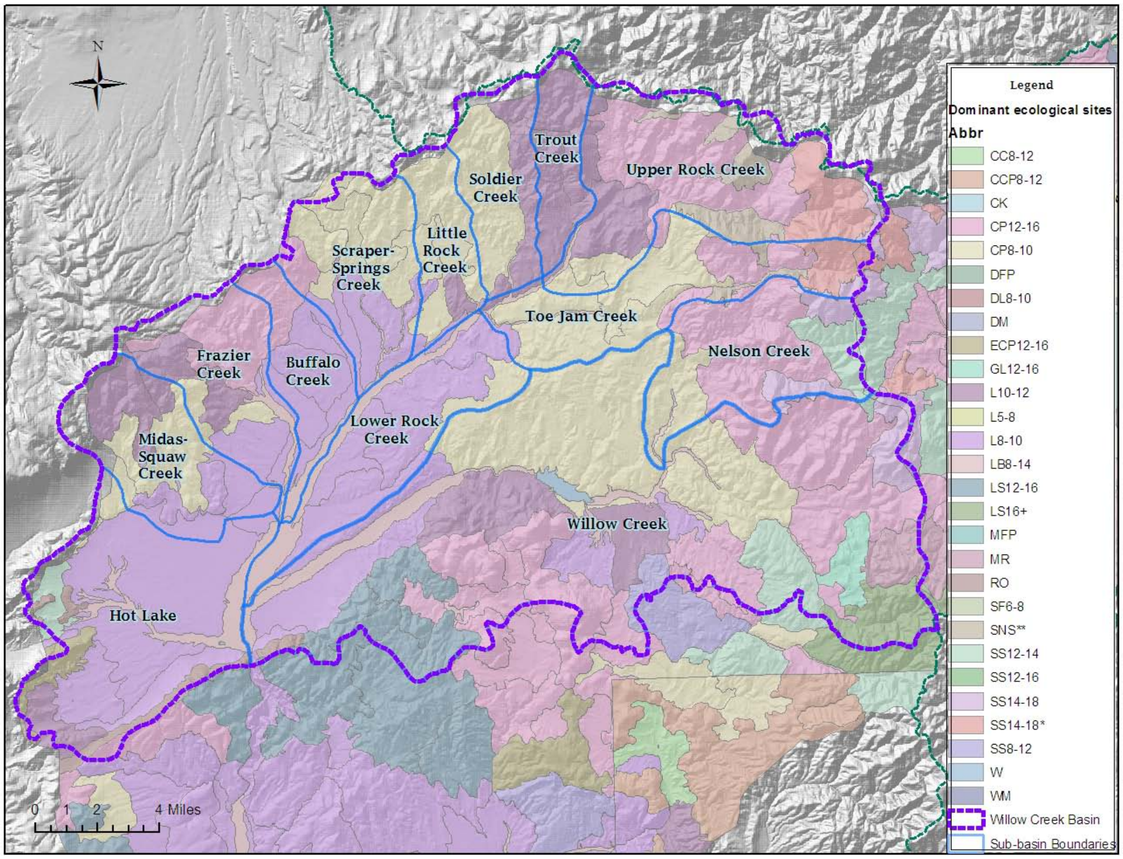


Figure 4 - 1: Sub-basins or Watersheds within the Willow Creek Sub-Basin

and this non-use influenced the fuel loading and the vegetative response. Cheatgrass occurred mixed with perennial grasses, especially on some of the south slopes and the benches. Where deeper soils and greater soil moisture occurred, the perennial grasses dominated. Some of the south slopes also had abundant perennial grasses. Overall, the fire is likely to be an improvement over pre-fire conditions – for livestock in the short-term and for other wildlife species in the long-term.

The low sage sites also had a good response to the fire, although the response was tempered by the species present before the fire. Photo 28 shows an area that had mostly Sandberg bluegrass prior to the fire and the site is dominated by this species following the fire. Photo 29 shows an unburned low sage site in the foreground with a mixture of grasses and the grass response adjacent to the non-burned area in the background. A variety of species responded to the fire.

Noxious weeds were present in the burned areas, but no large patches (i.e., none greater than one acre) were observed. Isolated patches of hoary cress were observed (Photo 30) and these seemed to be related to wild horse "stud piles." Often the stud piles were on roads or at mineral supplement sites and the stallions would use these sites to mark their territory. Weeds from the noxious weed species would pass through the digestive system and be deposited at these sites.

The three large areas of intact sagebrush include crested wheatgrass seedings, irrigated meadows, and a good mixture of low sagebrush and big sagebrush sites. So there still remains habitat for sage-grouse, but the quantity has been greatly reduced (Figure 4-2).

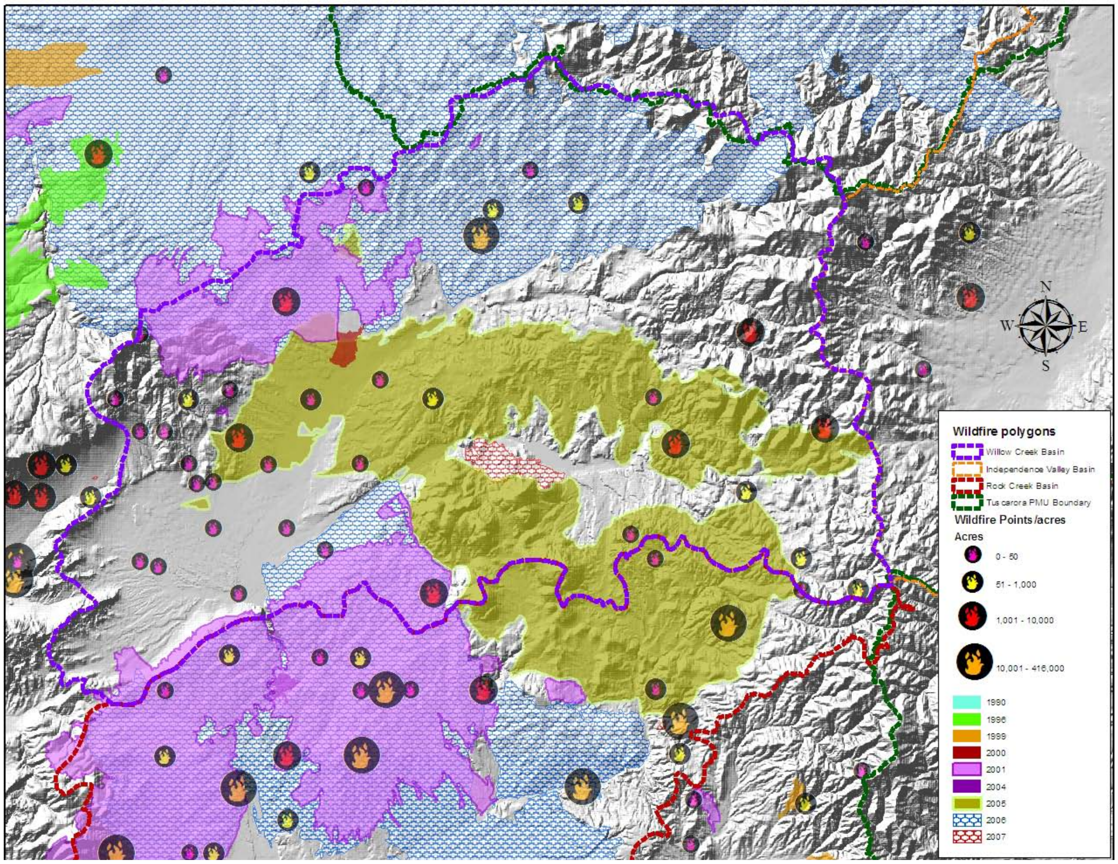


Figure 4 - 2: Recent Fire History of the Willow Creek Sub-Basin

Photo 26: Native Release of Perennial Grasses Following Fire in Willow Creek Sub-Basin

Photo 27: Post-fire Seeding Response in Willow Creek Sub-Basin

Photo 28: Bluegrass Response on a Burned Low Sage Site

Photo 29: Unburned Low Sage in Foreground and Burned Area in Background

Photo 30: Hoary Cress Infestation along a Two Track Road - Willow Creek Sub-Basin

Figure 4-3 shows the ecological sites and other areas where fuel loading was assessed as excessive. This generally coincides with the unburned areas in the Willow Creek Sub-basin. These areas were representative of the pre-burn fuel loading and there is no reason to believe that these areas will not burn in the future. Figure 4-4 shows the areas where decadent shrubs were abundant; these are areas where fire is likely to be extreme. The area at the northern edge of the Sub-basin over-estimates the amount of shrub cover as the values for these polygons were based on data collected in unburned islands.

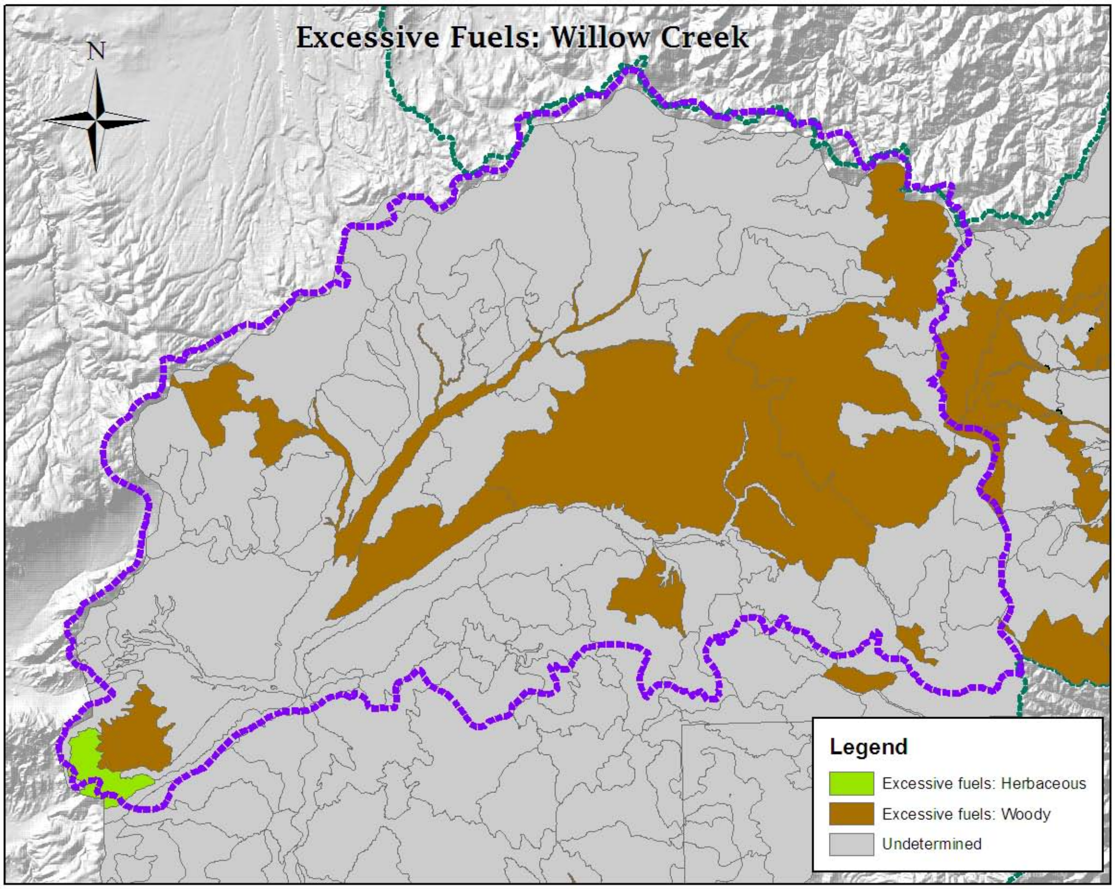


Figure 4 - 3 : Ecological Sites where Fuels Were Rated as Excessive - Willow Creek Sub-Basin

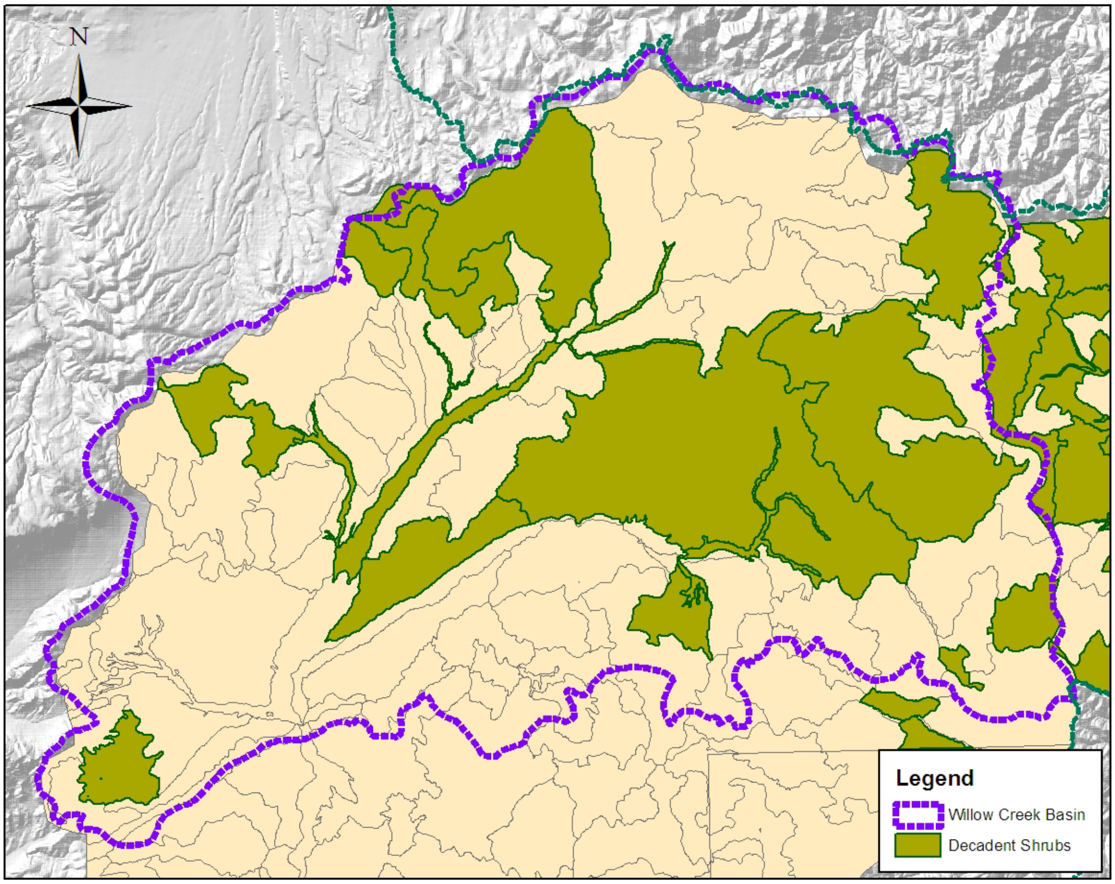


Figure 4 - 4: Ecological Sites with Decadent Shrubs in the Willow Creek Sub-Basin

2.2 RANGELAND HEALTH AND EROSION

Assessment of rangeland health using the 17 indicators of rangeland health (Appendix A) resulted in most of the ecological sites visited as having deviations from the ecological site description (Figure 4-5). However, in most of the situations where there was some deviation, the amount of brush was excessive relative to the ecological site description. For those areas where there was a high deviation from the ecological site description, the primary factors which deviated were:

- Plant community composition and distribution relative to infiltration;
- Functional/structural groups;
- Plant mortality/decadence;
- Annual production;
- Invasive plants; and
- Reproductive capability of perennial plants.

All of these factors indicate the plant community is in Phase 4 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 so as to not cause the community to cross the threshold. These sites were found at high elevations as well as low elevations.

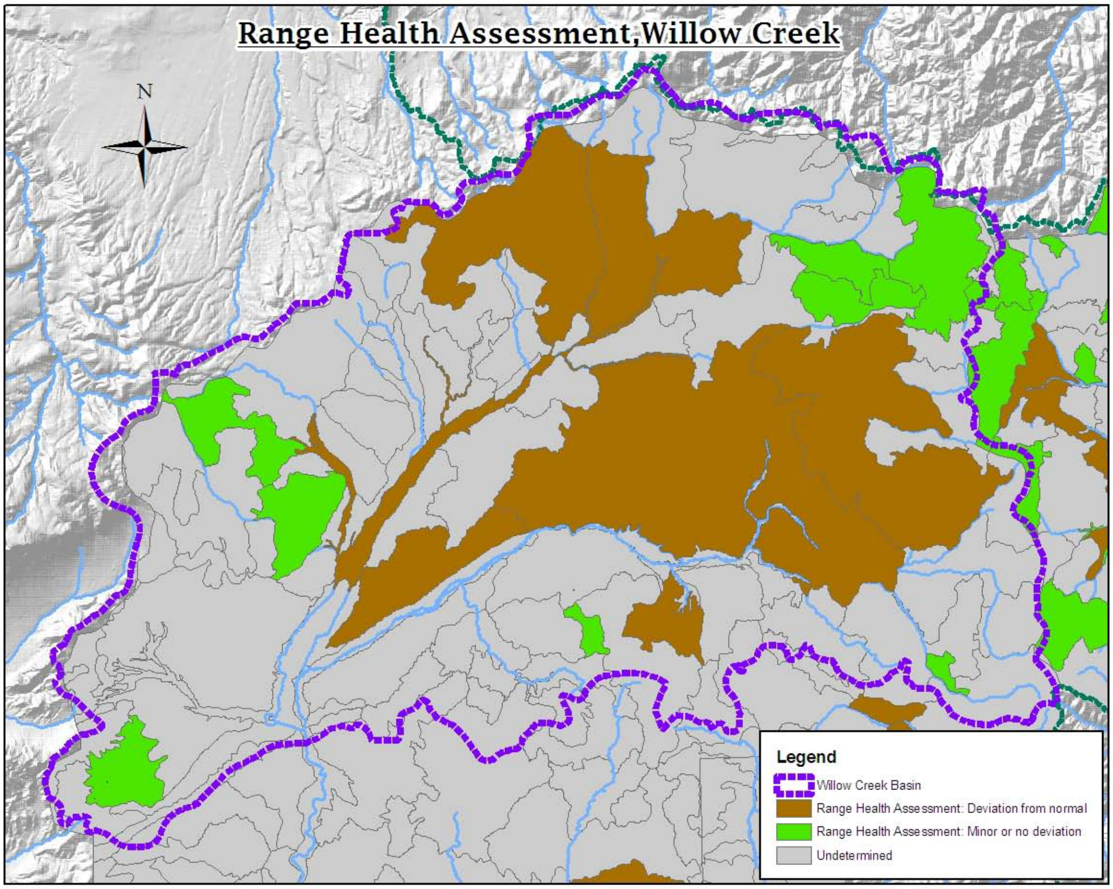


Figure 4 - 5: Results of the Rangeland Health Assessment in the Willow Creek Sub-Basin

Most of the burned areas were not evaluated with respect to rangeland health as they had been recently burned and deviated from their respective ecological site descriptions due to the lack of shrubs and/or forbs. Therefore, Figure 4-5 underestimates the sites that deviate from the normal.

However, with respect to infiltration of meteoric water, many of the grass-dominated sites had adequate ground cover and litter to promote infiltration (Photos 31 and 32). Some of the more recent burns are still recovering from the fire, and some areas burned with higher intensity than others, but overall, infiltration appeared to be occurring based on the lack of flow indicators, rills, or other evidence of surface runoff.

The soils in Willow Creek were intermediate to their erodability to the glacial till soils of the Independence Range and the heavy clay soils of the Tuscarora Range. While it was apparent that most of the creeks had undergone some past erosion, many were recovering following the fires (Photo 33).

Evidence of severe erosion was not observed on most of the Willow Creek Sub-basin, except for historic erosion on Willow, Rock, and Rattlesnake creeks (Photo 34). Most of the creeks have some areas of historic erosion where downcutting occurred through deep sediments that had been deposited at a much earlier time.

Photo 31: Ground Cover in Burned Area - Litter and Grasses

Photo 32: Burned Area Shown in Photo 31

Photo 33: Burned Area with Recovery of Riparian Banks

Photo 34: Historic Erosion on Rattlesnake Creek - Willow Creek Sub-Basin

Pedestalling of the claypan sites was also observed in the Willow Creek Sub-basin (Photo 35). This removal of the surface soil decreases the depth of the clay layer that is characteristic of these sites and reduces the productivity of these sites. The clay holds the soil moisture near the surface in the spring, but these sites dry out early in the season. Thus, the shallower the site, the quicker the site will dry out and the less productive the site will be. As these sites are important to sage-grouse, stabilizing these sites is relatively important.

Photo 35: Pedestalling of the Vegetation on Claypan Sites in the Willow Creek Sub-Basin

2.3 NON-NATIVE INVASIVE SPECIES

Non-native invasive species were present, but not dominant in the Willow Creek Sub-basin. Figure 4-6 displays the locations of non-native invasive species observed during the field assessment. The primary sites where weeds were located were irrigation ditches (Photo 36), watering troughs (Photo 37), and other disturbance sites. Cheatgrass was prevalent throughout the burned areas, but only dominant in small patches (Photo 38).

As the photos demonstrate, most of the infestations are small; less than one-quarter acre. However, the potential for seed to spread from troughs and mineral supplement sites through transport by livestock and along the irrigation ditch by water flow are concerns that need to be addressed.

2.4 OTHER CONCERNS

At the end of the data sheets there was a place to enter "Primary Concern" by circling one or more categories. In the Willow Creek Sub-basin, the four major Primary Concerns were Vegetation (composition and structure), Fuels, Weeds, and Cheatgrass. The ecological sites where these concerns

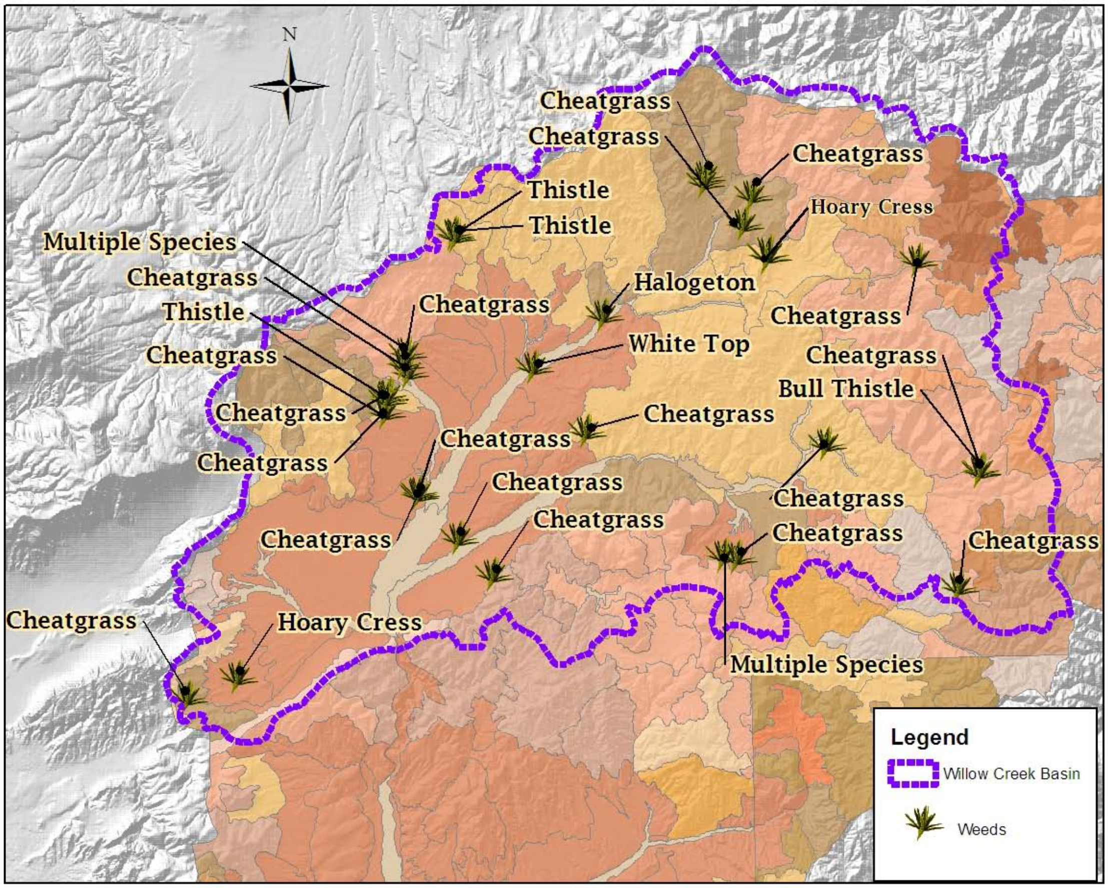


Figure 4 - 6: Non-Native Invasive Species in the Willow Creek Sub-Basin

Photo 36: Hoary Cress and Scotch Thistle Along an Irrigation Ditch

Photo 37: Hoary Cress at a Watering Trough

Photo 38: Cheatgrass at a Mineral Supplement Site

were expressed are shown on Figure 4-7. Based on the discussion above, these concerns are appropriate and are supported by the field observations. The burned areas lacked shrubs over wide areas, although sagebrush seedlings were observed in many areas. Forbs are still not abundant or diverse in most of the burned areas and in many of the unburned areas.

Currently, many of the areas that are ungrazed have excessive herbaceous fuel. While some of the grass-dominated areas have wide interspaces between the plants, others have very contiguous fuels. These areas are susceptible to lightning strikes and re-burning. This would increase the chance for cheatgrass to increase in abundance on many sites. Weeds and cheatgrass are concerns because they are both present and could easily spread when livestock grazing is resumed.

On Figure 4-7 the “Other Concerns” include Excessive Erosion, Excessive Sedimentation, Drainage Integrity, Flooding, Terrestrial Ecology, Soil Productivity, and Aquatic Ecology. They are all important concerns, but they usually represented localized concerns rather than the broader ecological site concerns.

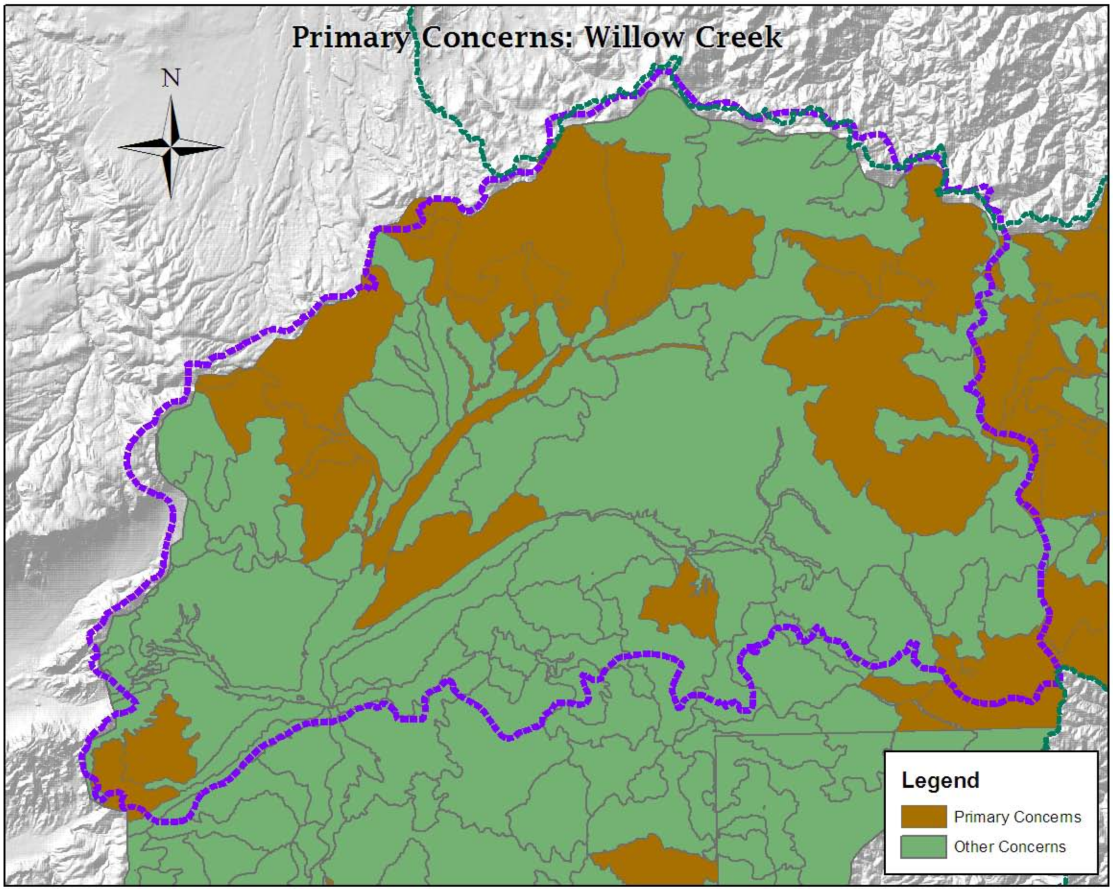


Figure 4 - 7: Areas of Resource Concern - Willow Creek Sub-Basin

2.5 RIPARIAN CONDITION

Because the ranch has taken voluntary non-use for several years on most of the allotment in this Sub-basin, the riparian areas have been recovering (Photo 39). While the fires resulted in some increased sediment to the creeks before the plants re-established on the site, there did not appear to be any new areas where streams were actively eroding.

As discussed above, the historic downcutting of the streams has left many of the creeks in incised channels. However, many have developed a new floodplain within the incised channel and are stabilizing the new channel.

The sites where the PFC indicators were used to identify problems are depicted on Figure 4-8. Many of these sites would likely be rated as functioning at risk with an upward trend as they are still recovering. Depending on the grazing system that is implemented, many of these will continue to recover.

Photo 39: Riparian Area Showing Recovery After Several Seasons of Voluntary Non-Use

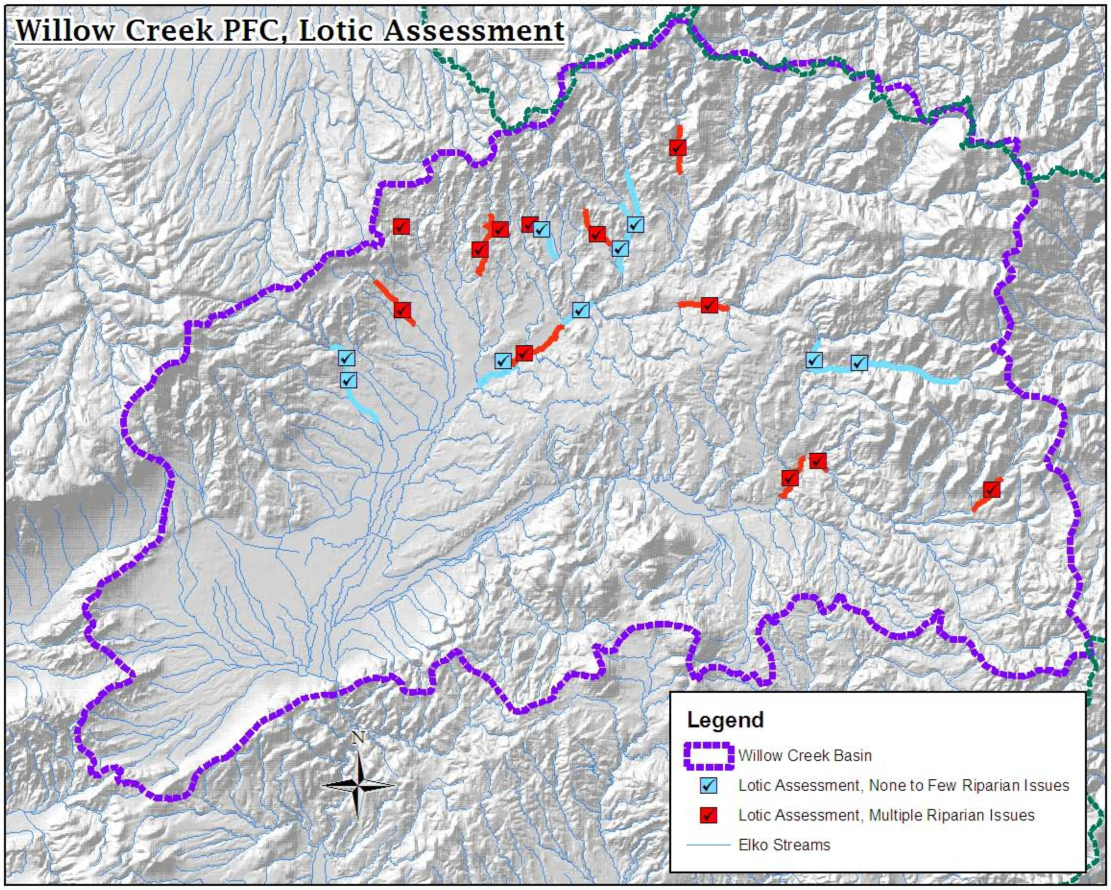


Figure 4 - 8: Riparian Assessment Locations and Concerns

3. RECOMMENDATIONS

First and foremost, a noxious weed control plan needs to be developed and implemented. Most of the noxious weed infestations are:

- Small;
- At easily identifiable locations (troughs, fence corners, irrigation ditches, roads, etc.); and
- Consist of species that are readily controllable.

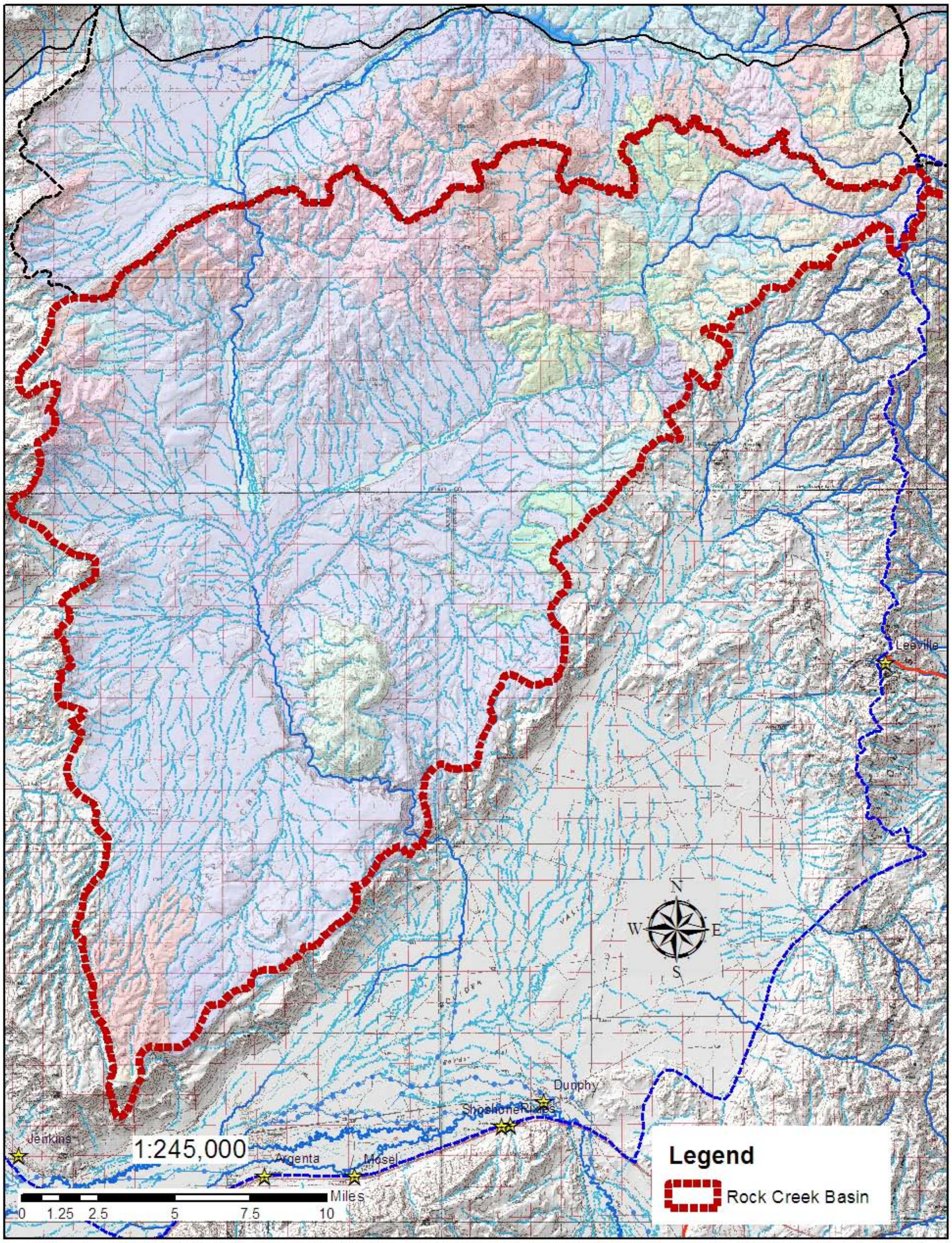
Therefore, this issue can be addressed immediately. The earlier this is addressed, the sooner other beneficial treatments can be implemented.

The resumption of grazing is the second most important issue. The non-use that has taken place has provided a boost to the riparian areas, but the accumulation of grasses now creates a risk of for the remaining sagebrush areas. Therefore, grazing should be resumed when the fire rehabilitation objectives have been met, and should be focused around the remaining sagebrush. The grazing principles outlined in Chapter 2 should be incorporated into whatever grazing plan is developed for the allotment.

Improper grazing will encourage the spread of cheatgrass and the establishment of noxious weeds. Both of these factors will eventually result in the ecological sites transitioning to another ecological state. This should be avoided.

The steps outlined in Chapter 2 to restore sagebrush in a mosaic of age classes should be implemented on the burned areas. As the sagebrush begins to establish, the decadent stands of sagebrush that have not yet burned should be considered for treatment.

CHAPTER 5 – ROCK CREEK SUB-BASIN ASSESSMENT



1. INTRODUCTION

Rock Creek Sub-basin is located in Elko County (Figure 1-2) and is part of the Rock Creek Basin. The waters from this sub-basin are part of the Humboldt River drainage system which flows south to the Humboldt River. This is one of six Sub-basins in Elko County that flow to, or form, the Humboldt River Drainage.

The Sub-basin is bounded on the north by the Santa Renia Mountains, on the west by Izzenhood Mountain and valley, on the south by Humboldt River, and on the east by Boulder Valley and the Tuscarora Mountains. The Sheep Creek Range separates this large basin from Boulder Valley. The mountains form a rim around this elevated basin and have elevations ranging from about 6,500 feet amsl to almost 7,500 feet amsl. The basin is at about 5,200 feet amsl. The Sub-basin is approximately 283,000 acres in size.

For the purposes of the assessment, the Sub-basin was divided into four smaller watersheds (Figure 5-1). The drainage from the Sub-basin flows south and then east through the Rock Creek Canyon and empties into Boulder Valley where it turns south and flows to the Humboldt River.

All lands within the Sub-basin are either private lands or public land administered by the BLM. There is no community within the Sub-basin. Livestock grazing is the primary agricultural activity. Mining is currently conducted at the Hollister Underground Mine and exploration is ongoing throughout the Sub-basin. This area is a popular recreation site, especially for chukar hunting for nearby Battle Mountain residents.

2. WATERSHED ASSESSMENT

2.1 FIRE AND FUELS

This Sub-basin has been subject to numerous fires over the past 40 years. The elevated basin surrounded by mountains is subject to many lightning strikes as storms pass over the Sub-basin. Approximately 77 percent (218,600 acres) of the Sub-basin has burned since 1999 (Figure 5-2). However, the total acreage that has burned within the Sub-basin since 1980 is 1,060,000 acres, or 375 percent of the area. Because there are still some large areas of unburned sagebrush, these figures indicate that large areas have burned multiple times.

Most of this Sub-basin has been covered by sagebrush in the past, with few areas of aspen. The three subspecies of big sagebrush: Basin big sagebrush, Wyoming big sagebrush, and mountain big sagebrush, occur on the floodplains, lower elevation basin, and mountains, respectively. Riparian areas are a combination of willows, sedges, rushes, and meadow grasses, with woods rose and currant also common in these areas.

Much of the Sub-basin has been the focus of fire rehabilitation efforts over the years including seedings with crested wheatgrass, or mixtures of crested wheatgrass (Photo 40) and native perennial grasses (Photo 41), and supplemental seeding with sagebrush. These efforts have created large areas of perennial grasses, some with a mixture of cheatgrass. Cheatgrass is common on the burned floodplains, as these areas contained a combination of cheatgrass understory and Basin big sagebrush overstory prior to the fires (Photo 42). These areas had very little perennial grass prior to the fires and even less after the fire, unless seeded as part of the fire rehabilitation effort.

Even within the large burns, there are islands of sagebrush (Photo 43). However, overall these islands are too few to maintain a large population of sage-grouse. Because of the multiple fires over the same areas, islands remaining after the first fire have been burned in subsequent fires. Consequently, the

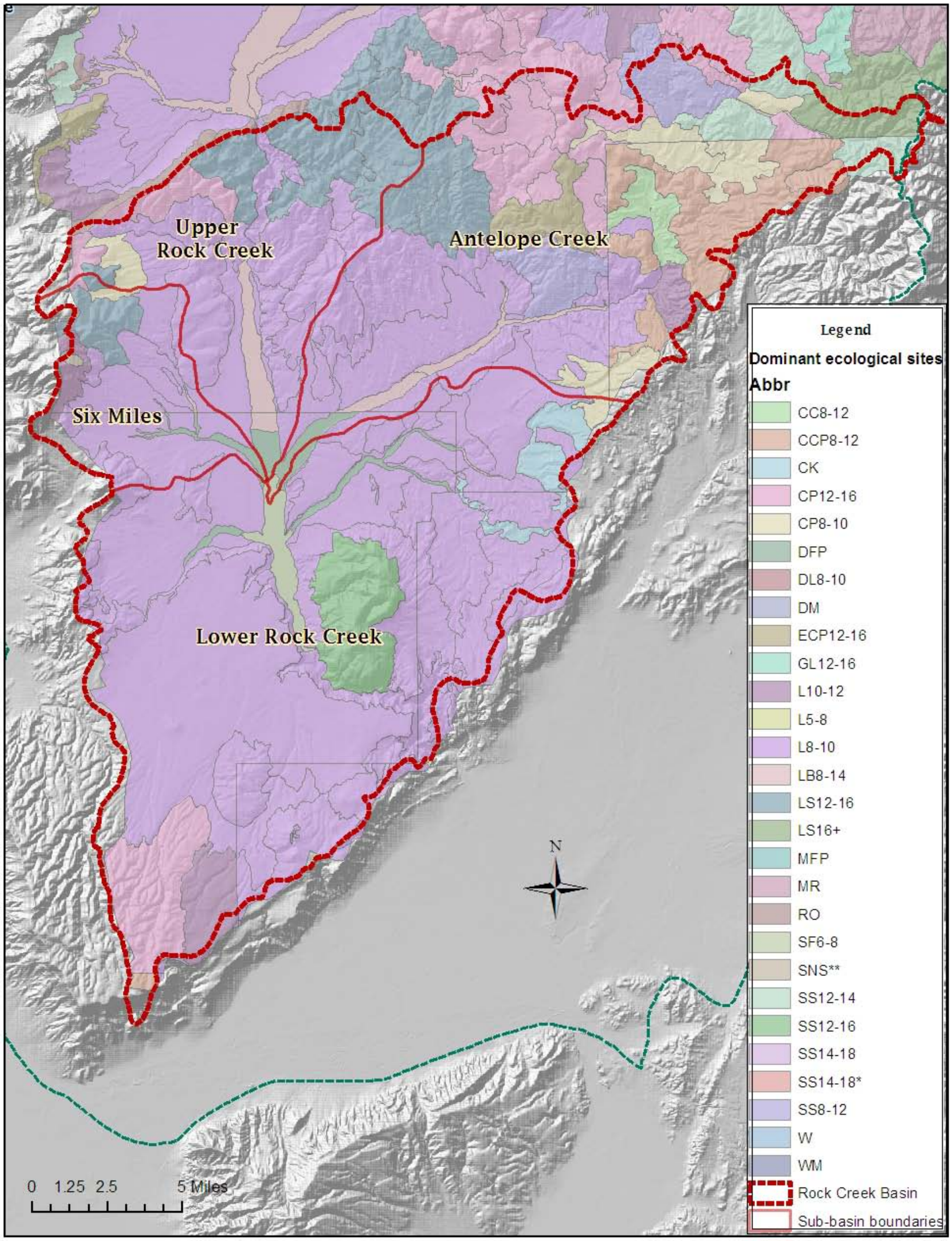


Figure 5 - 1: Sub-basins or Watersheds within the Rock Creek Sub-Basin

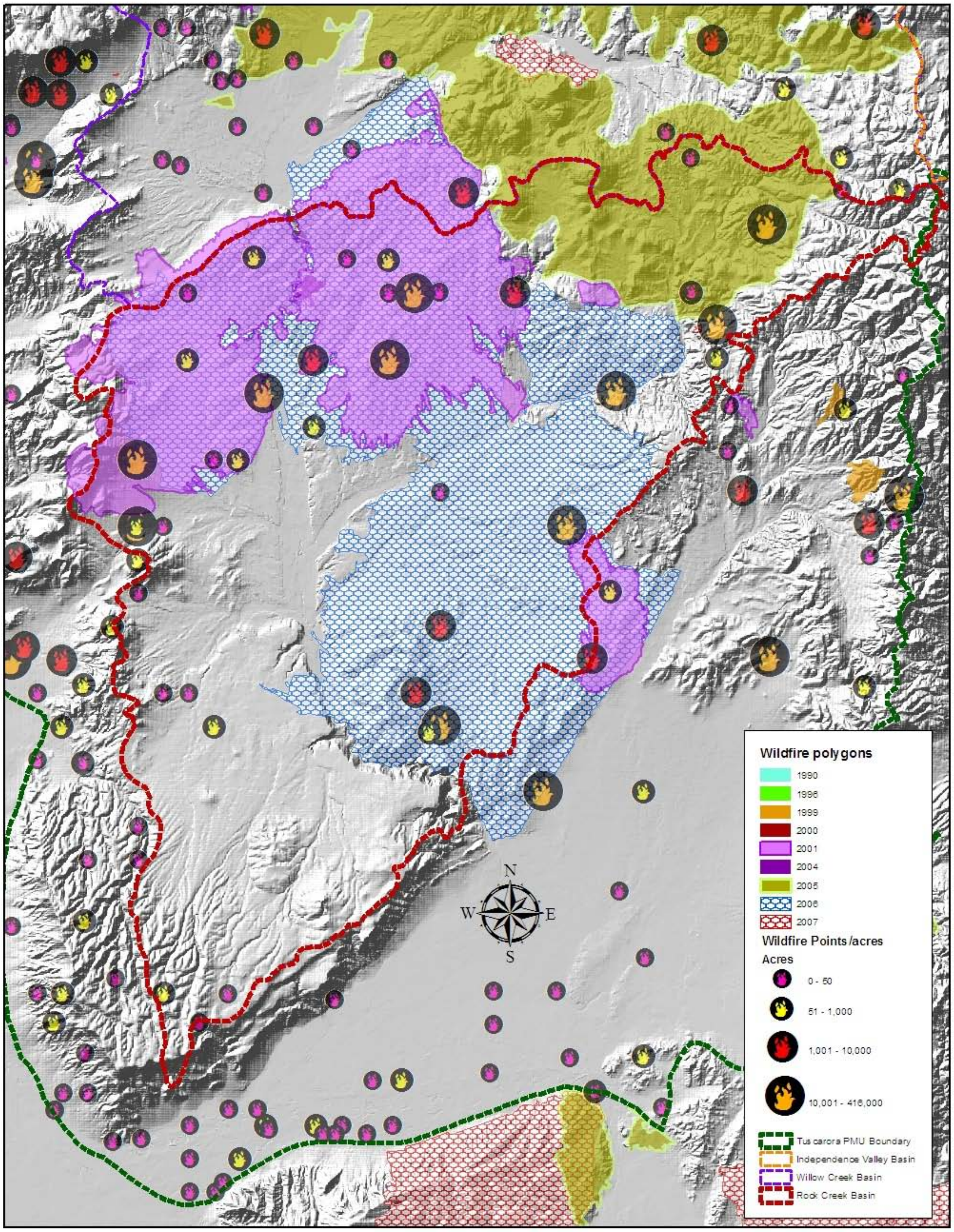


Figure 5 - 2: Recent Fire History in the Rock Creek Sub-Basin

Photo 40: Mixed Species Seeding in the Rock Creek Sub-Basin

Photo 41: Native Release of Perennial Grasses Following Fire in the Rock Creek Sub-Basin

Photo 42: Pre-fire Combination of Basin Big Sagebrush and Cheatgrass on Floodplains

Photo 43: Unburned Islands of Sagebrush within the Larger Burned Area - Rock Creek Sub-Basin

acreage of burned to unburned is not sufficient for sage-grouse to obtain all of their seasonal habitat requirements throughout most of the Sub-basin. The only large area of intact sagebrush is located at the southern portion of the Sub-basin (Photo 44 and Figure 5-2). This large block of sagebrush and the unburned floodplain associated with Rock Creek and portions of Antelope Creek were identified as having excessive woody fuels (Figure 5-3).

Photo 44: Large Block of Sagebrush Habitat in Rock Creek Sub-Basin

These unburned areas were representative of the pre-burn fuel loading and there is no reason to believe that these areas will not burn in the future. Figure 5-4 shows the areas where decadent shrubs were abundant; these are areas where fire is likely to be extreme. These are the same areas identified on Figure 5-3 as having excessive woody fuels. These areas generally have reduced perennial understory and many have cheatgrass present in varying amounts.

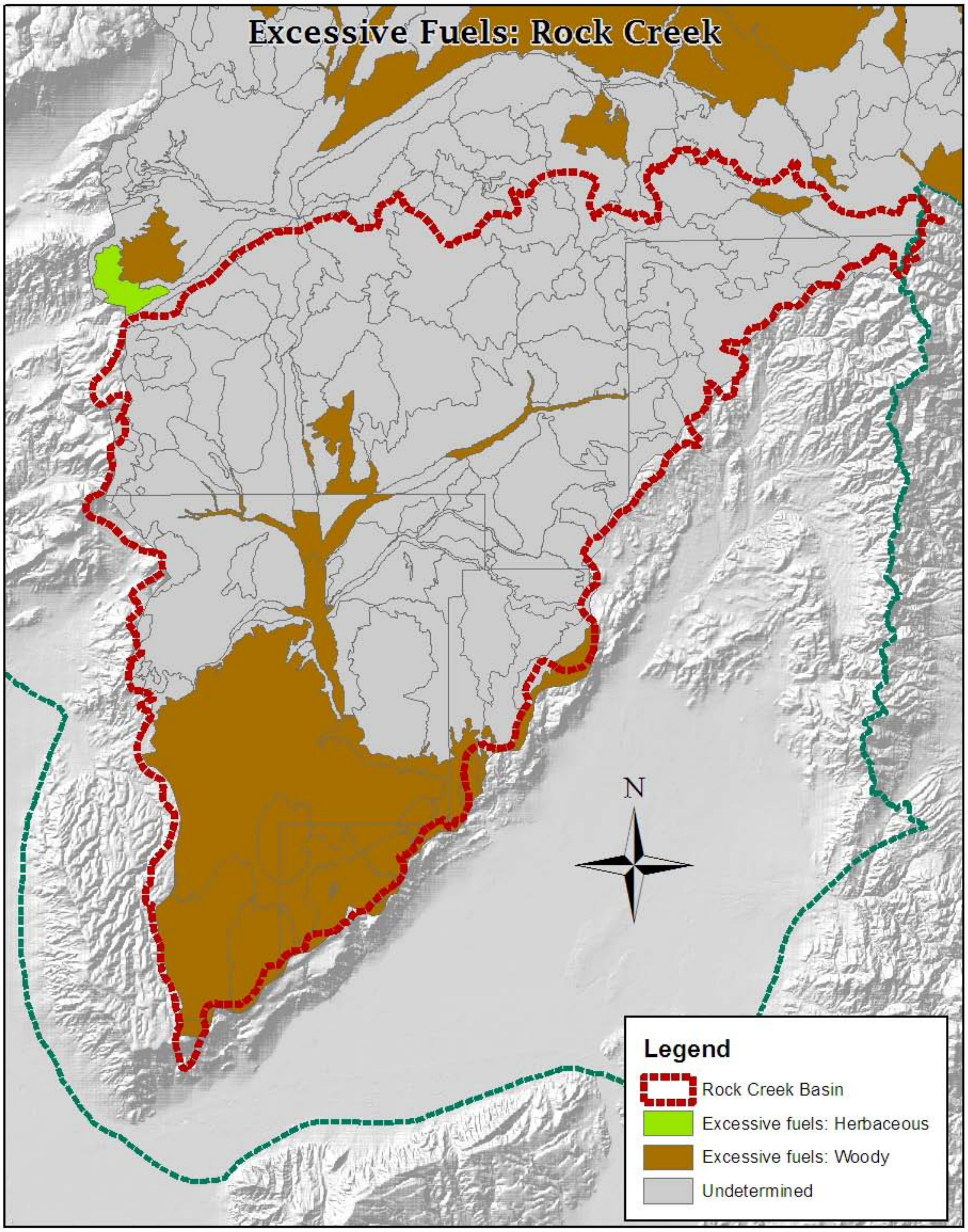


Figure 5 - 3: Ecological Sites where Fuels Were Rated as Excessive - Rock Creek Sub-Basin

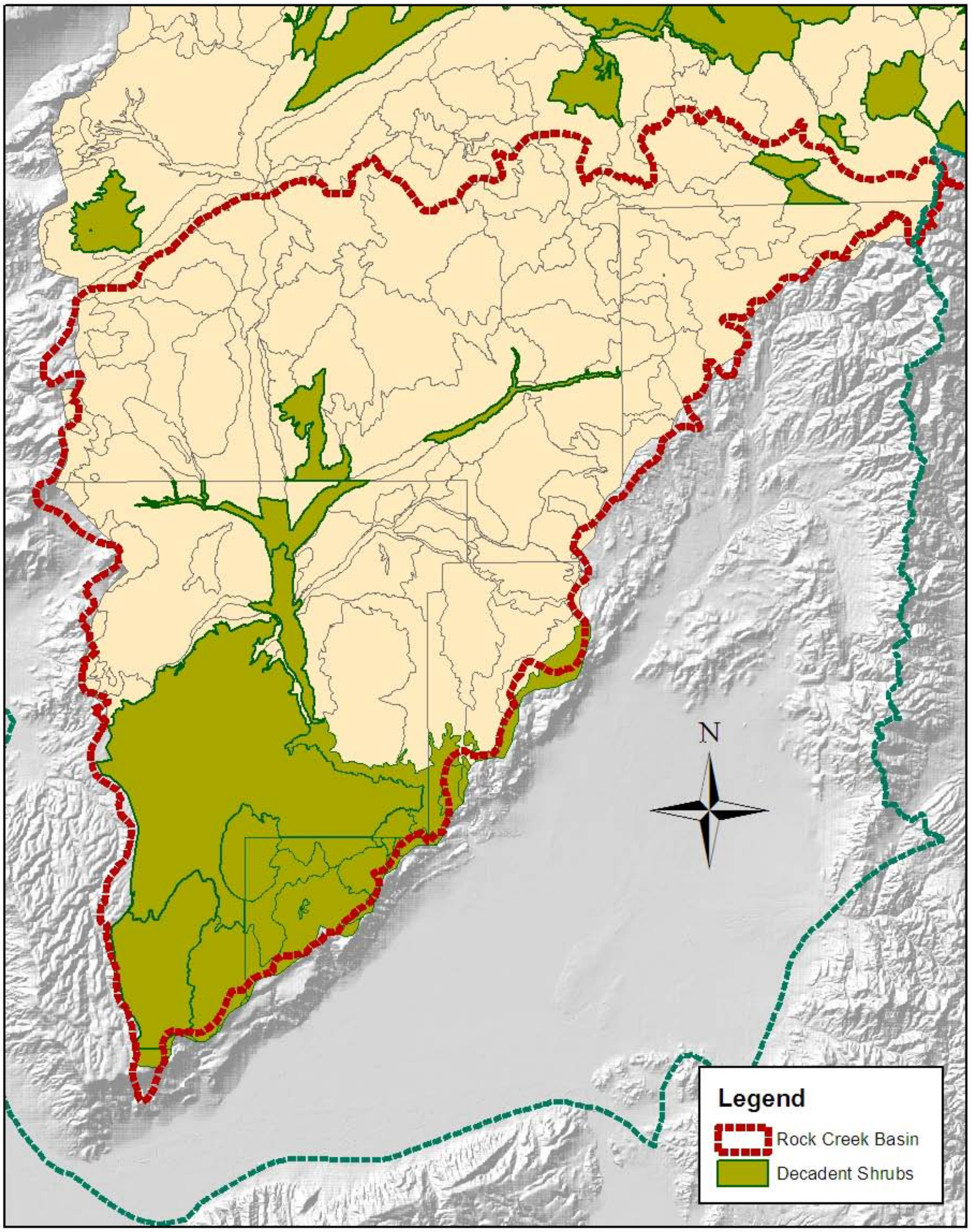


Figure 5 - 4: Ecological Sites with Decadent Shrubs in the Rock Creek Sub-Basin

2.2 RANGELAND HEALTH AND EROSION

An assessment of rangeland health using the 17 indicators of rangeland health (Appendix A) resulted in most of the ecological sites visited as having deviations from the ecological site description (Figure 5-5). However, in most of the situations where there was some deviation, the amount of brush was excessive relative to the ecological site description. For those areas where there was a high deviation from the ecological site description, the primary factors which deviated were:

- Plant community composition and distribution relative to infiltration;
- Functional/structural groups;
- Plant mortality/decadence;
- Annual production;
- Invasive plants; and
- Reproductive capability of perennial plants.

All of these factors indicate the plant community is in Phase 4 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 so as to not cause the community to cross the threshold. These sites do not promote infiltration of meteoric water due to the lack of herbaceous vegetation (Photo 45).

The areas dominated by perennial grasses, most shown on Figure 5-5 as "Undetermined" also deviated from the norm for the ecological site descriptions because of the lack of shrubs. These sites are in the Phase 1 condition. Therefore, Figure 5-5 underestimates the sites that deviate from the normal.

However, with respect to infiltration of meteoric water, many of the grass-dominated sites had adequate ground cover and litter to promote infiltration (Photo 46). Some of the more recent burns are still recovering from the fire, and some areas burned with higher intensity than others, but overall, infiltration appeared to be occurring based on the lack of flow indicators, rills, or other evidence of surface runoff.

Antelope Creek and Rock Creek have experienced significant downcutting of the floodplain. This has resulted in both creeks reestablishing new flood plains in the incised channels, but much sediment remains to be transported out of these drainages (Photo 47). These areas will continue to be active during extreme events.

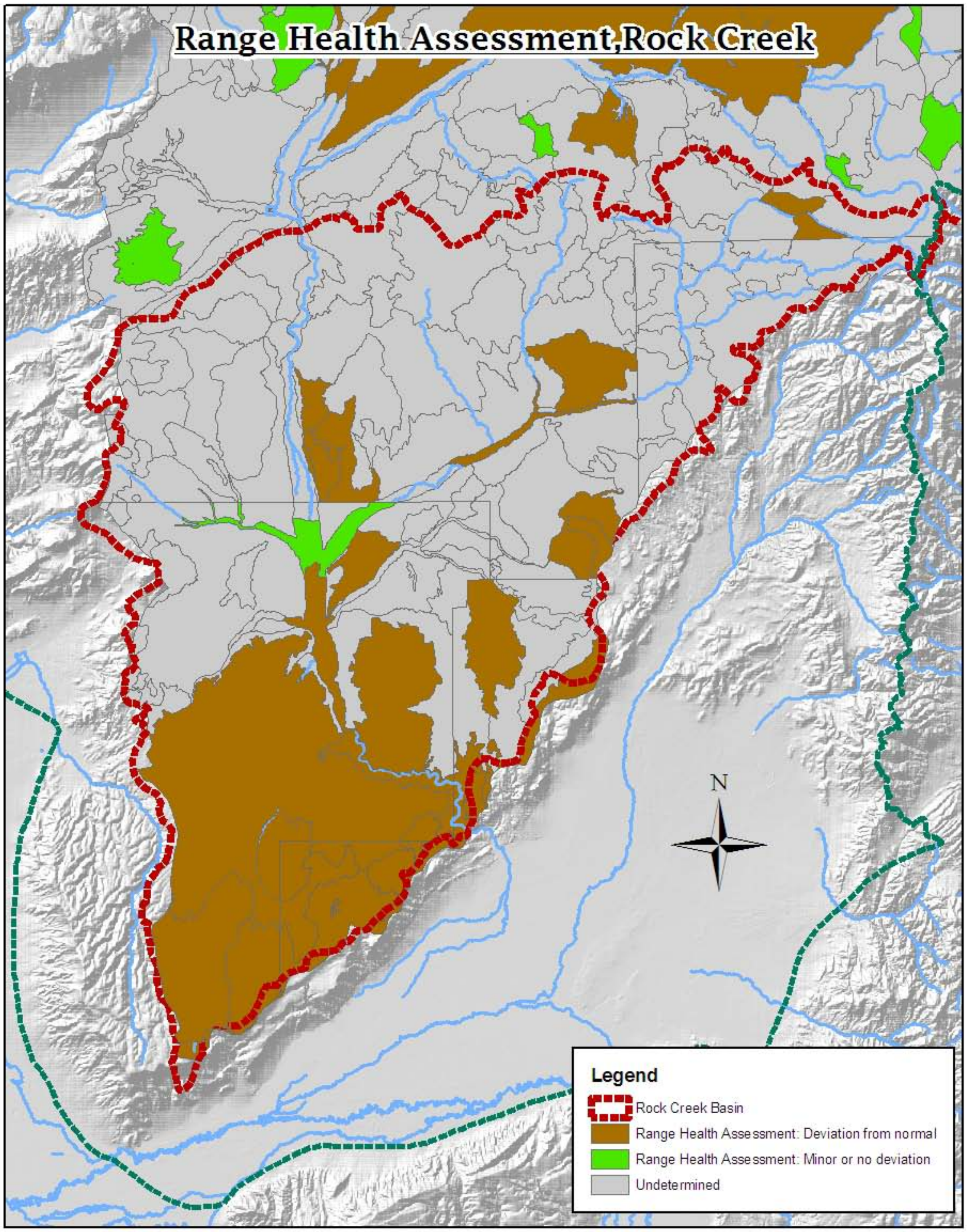


Figure 5 - 5: Results of the Rangeland Health Assessment in the Rock Creek Sub-Basin

Photo 45: Poor Infiltration Conditions in the Unburned Sagebrush Areas

Photo 46: Infiltration Conditions in Burned Area - Rock Creek Sub-Basin

Photo 47: Channel Formation within the Large Incised Floodplain

2.3 Non-Native Invasive Species

Non-native invasive species were present, but not dominant in the Rock Creek Sub-basin. Figure 5-6 displays the locations of non-native invasive species observed during the field assessment. The primary sites where weeds were located were drainages, watering troughs, and other disturbance sites. Cheatgrass was prevalent throughout the burned areas, but only dominant in small patches.

As Photo 48 demonstrates, most of the infestations are small; less than one-quarter acre. However, the potential for seed to spread from troughs and mineral supplement sites through transport by livestock are concerns that need to be addressed.

2.4 Other Concerns

At the end of the data sheets there was a place to enter "Primary Concern" by circling one or more categories. In the Rock Creek Sub-basin, the four major Primary Concerns were Vegetation (composition and structure), Fuels, Weeds, and Cheatgrass. The ecological sites where these concerns were expressed are shown on Figure 5-7. Based on the discussion above, these concerns are appropriate and are supported by the field observations. The burned areas lacked shrubs over wide areas, although sagebrush seedlings were observed in many areas. Forbs are still not abundant or diverse in most of the burned areas and in many of the unburned areas.

Currently, many of the areas that are ungrazed have excessive herbaceous fuel. While some of the grass-dominated areas have wide interspaces between the plants, others have very contiguous fuels. These areas are susceptible to lightning strikes and re-burning (as has happened in the past). This would increase the chance for cheatgrass to increase in abundance on many sites. Weeds and

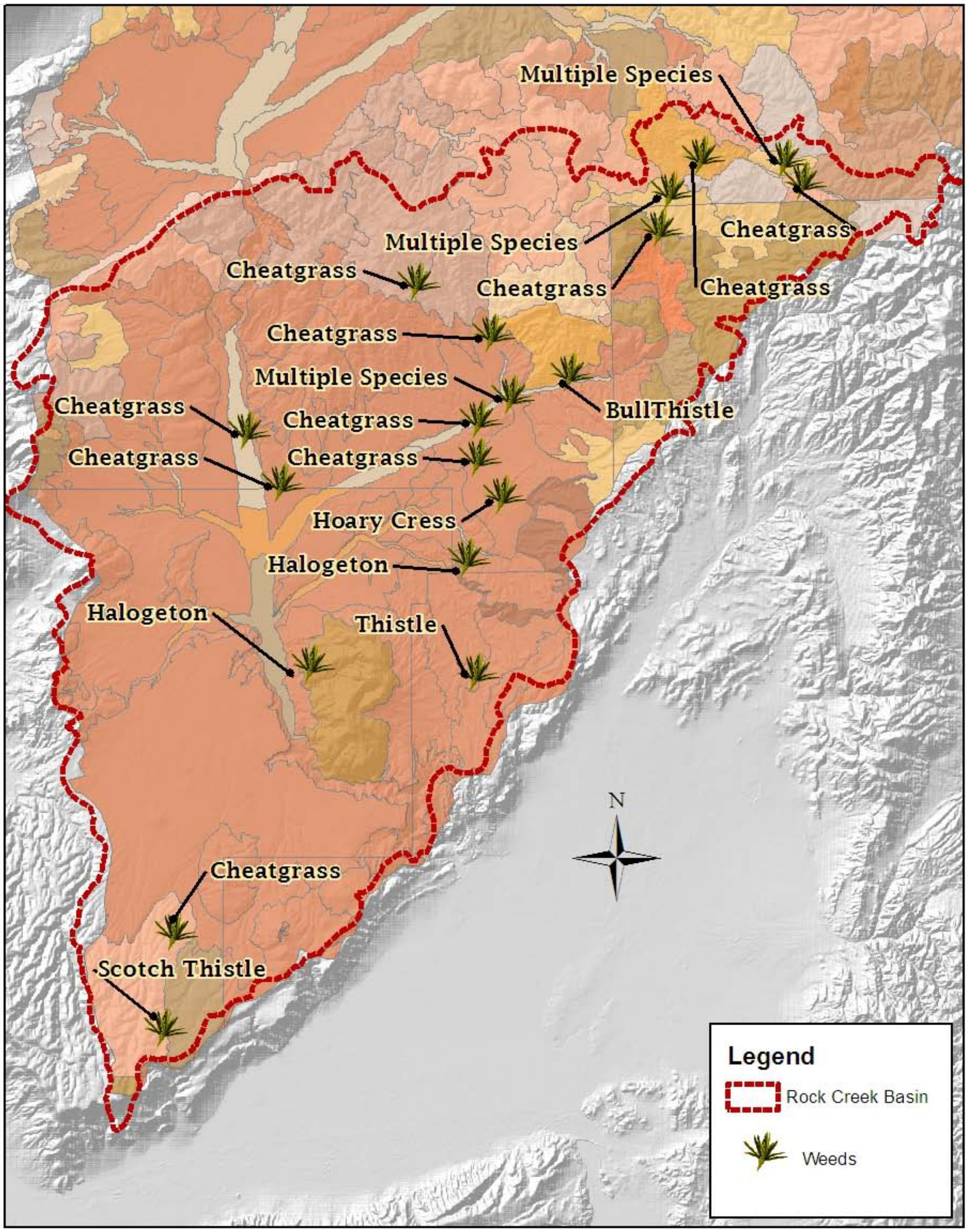


Figure 5 - 6: Non-Native Invasive Species Observations - Rock Creek Sub-Basin

Photo 48: Hoary Cress Infestation Mixed with Cheatgrass - Rock Creek Sub-Basin

cheatgrass are concerns because they are both present and could easily spread when livestock grazing is resumed.

On Figure 5-7 the "Other Concerns" include Excessive Erosion, Excessive Sedimentation, Drainage Integrity, Flooding, Terrestrial Ecology, Soil Productivity, and Aquatic Ecology. They are all important concerns, but they usually represented localized concerns rather than the broader ecological site concerns.

2.5 Riparian Conditions

Riparian conditions were only assessed at two locations within the Sub-basin. However, the issues appeared to pertain to most of the drainages observed. Most of the drainages had experienced downcutting of the historic floodplain. However, examination of the incised banks indicated that the material that had been incised were fine sediments (Photo 49). This indicates that some large event exceeded the ability of the floodplain vegetation to hold the system together, and once this threshold was exceeded, the fine sediments were easily eroded.

Without knowing the time period involved with this event, it cannot be determine if livestock grazing was involved in lowering the threshold of resistance for these floodplains, but regardless of the "cause," there is excess sediment in the drainage and during large events, this sediment can be expected to be transported.

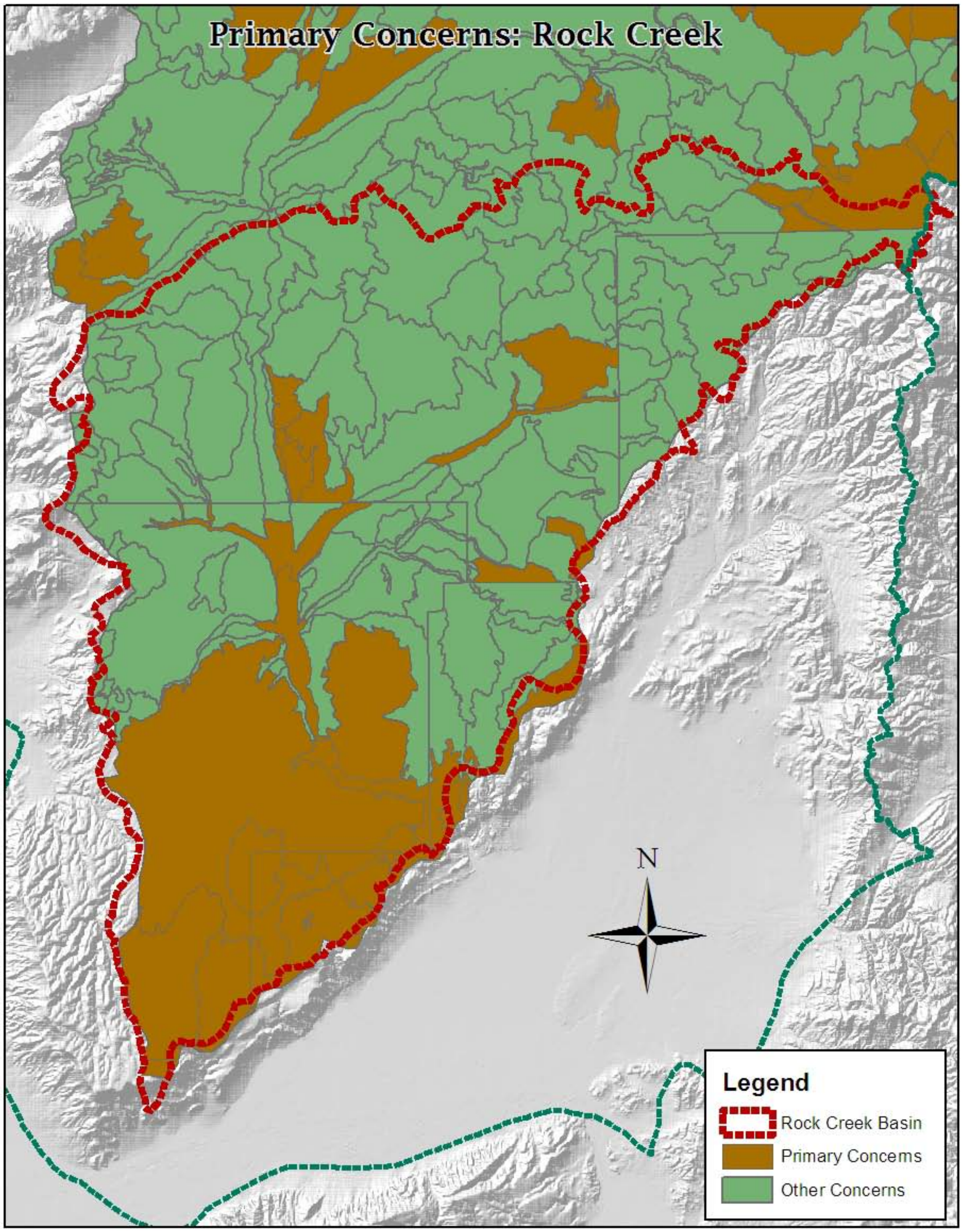


Figure 5 - 7: Areas of Resource Concern - Rock Creek Sub-Basin

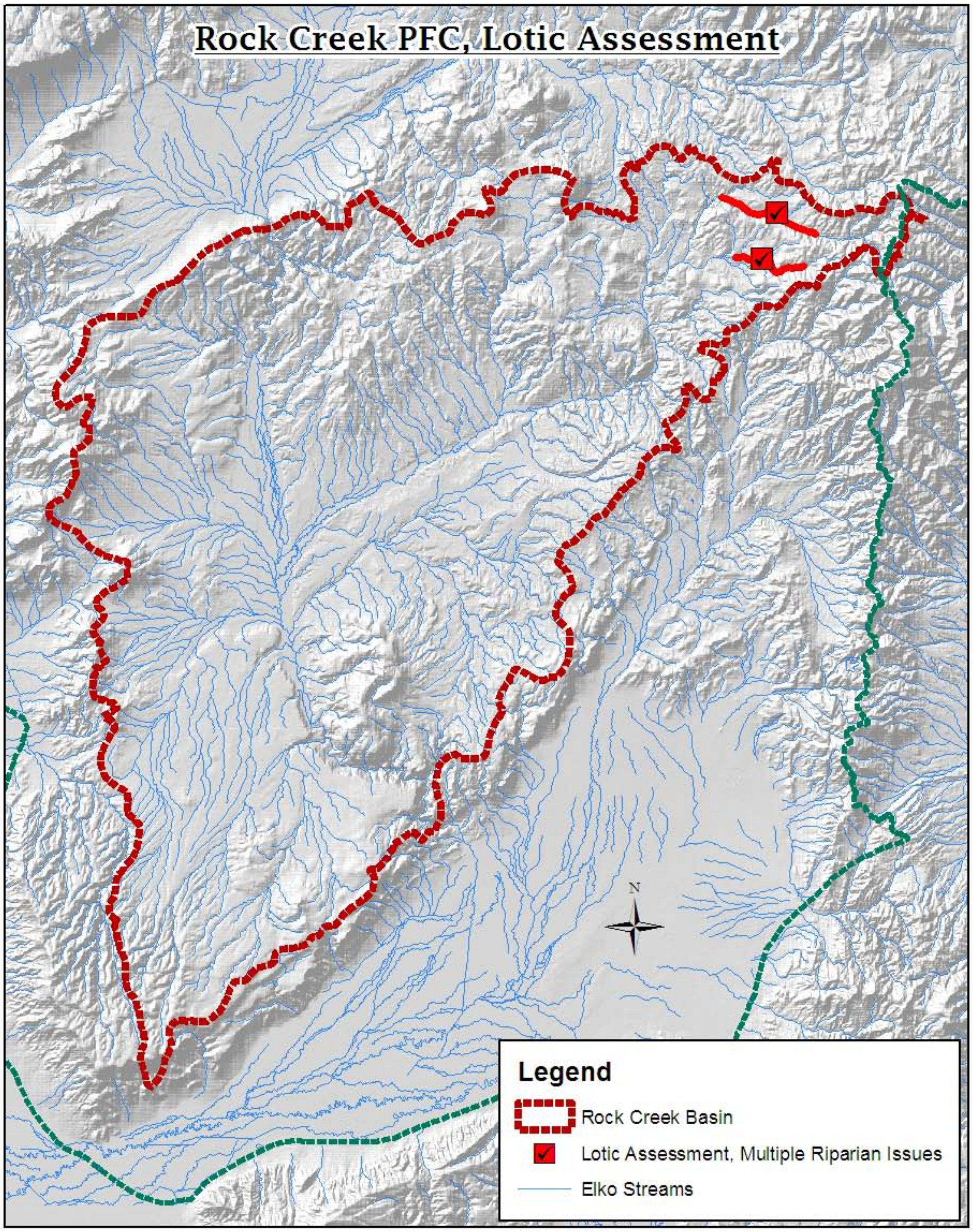


Figure 5 - 8: Riparian Assessment Locations and Concerns

Photo 49: Incised Channel with Fine Sediments in the Upper Five Feet of Bank

3. RECOMMENDATIONS

As indicated for the Willow Creek Sub-basin, the small patches of noxious weeds should be considered a priority for this Sub-basin. Ignoring these relatively small patches, which are for the most part in predictable locations, will allow these noxious weeds to expand into the rest of the ecological sites. Given the fire history of this Sub-basin, fires can be expected in the future and these weed species are likely to spread following fire.

Grazing is currently taking place on portions of the Sub-basin where fire closures have been lifted or on private lands. There were signs that current grazing is not in conformance with the guidelines provided in Chapter 2 (Photo 50). Because of fire closures, this level of grazing may be a short-term issue as the grazing utilization would be reduced when the fire closures are removed and the grazing can be distributed over large areas. However, if this is not a short-term issue related to fire closure, then the grazing system needs to be revised.

Utilization levels were not excessive throughout the allotment. Photos 51 and 52 show the levels of utilization that are well in conformance with the grazing guidelines in Chapter 2. Photo 52 shows selective utilization of the fall green up on Sandberg bluegrass, with little if any use of crested wheatgrass, Thurber's needlegrass, bluebunch wheatgrass, bottlebrush squirreltail, and Basin wildrye. The abundant residual grass in these photos will trap winter moisture (e.g., snow) that will promote additional forbs to colonize the site, as well as sagebrush.

Creating the multiple age-classes of the sagebrush plant community as outlined in Chapter 2 should be implemented on the burned areas. Once this has been initiated on a large portion of the burned area, the unburned areas should be considered for treatment to sustain the sagebrush ecosystem on these sites before the areas are burned by wildfires and convert to cheatgrass.

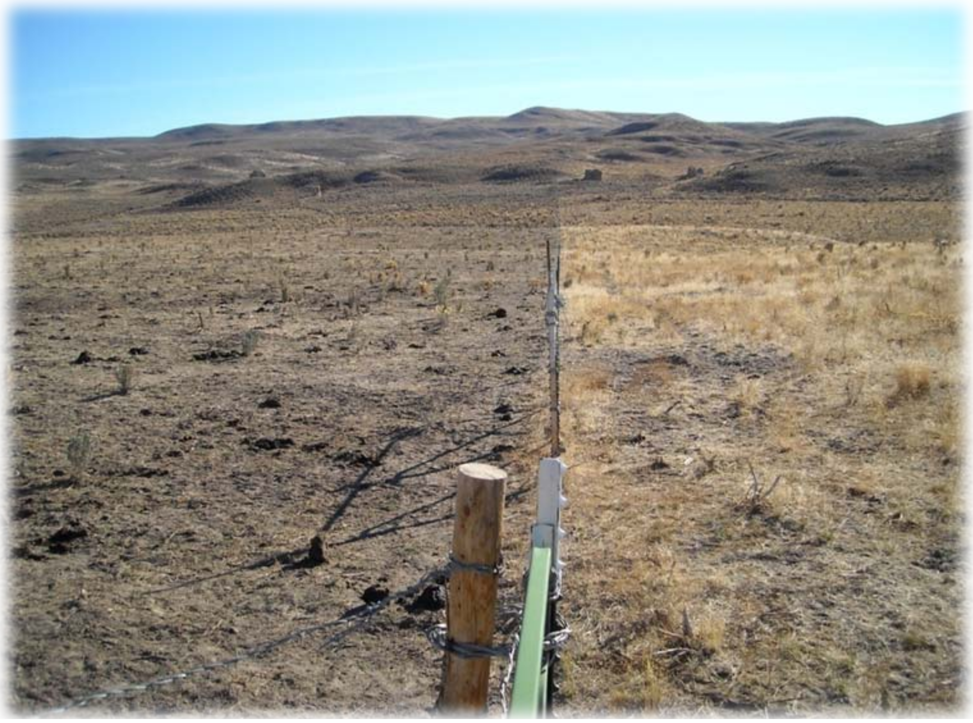


Photo 50: Example on Left of Grazing that Does Not Conform to Grazing Guidelines in Chapter 2

Photo 51: Acceptable Grazing Utilization Levels - Rock Creek Sub-Basin

Photo 52: Selective Fall Grazing Utilization on Sandberg Bluegrass

CHAPTER 6 – REFERENCES AND LIST OF ACRONYMS

1. REFERENCES

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2. LIST OF ACRONYMS

amsl	Above mean sea level
BLM	Bureau of Land Management
ESA	Endangered Species Act
F.R.I.	Fire Return Interval
GIS	Geographic Information Systems
NEPA	National Environmental Policy Act
NRCS	Natural Resource Conservation Service
NDOW	Nevada Department of Wildlife
NNSG	Northeastern Nevada Stewardship Group, Inc.
P-J	Pinyon-Juniper
PMU	Population Management Unit
PNC	Potential Natural Community
p.z.	Precipitation Zone
PFC	Proper Functioning Condition
PLS	Pure live seed
R-values	Restoration Values
USFS	United States Forest Service
WAFA	Western Association of Fish and Wildlife Agencies

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Ecologist

Reviewed by

Gary N. Back
President

Stefanie T. Adams
Technical Editor

APPENDICES

NNSG Watershed Assessment

-e ____________ GPS (UTM NAD 83) Point ________ E ______________ N ______________

O. .rver(s) ________________ Photo Number(s) ______________________ Camera ________

(Vertical & Landscape)

Watershed ________________________ Sub-Watershed ______________________

Site Type: *Upland* or *Riparian* Site (*e.g. creek, spring, ridge, etc*) ______________________

Ecological Site: ______________________ Current Veg. Community: ______________

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____

Composition: *diverse or monotypic* **Structure:** *single-layered or multi-layered* **Spatial Arrangement:** *mosaic or continuous*

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

Shrub Condition: *Seedlings/Sprouters* *Mature* *Decadent*

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

Forage Conditions: *Grazed* or *Not Apparent*

Grazing Species: *Horses* *Cattle* *Deer* *Rabbit* *Other:* ______________________

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____

Weeds *Yes* or *No* **Species:** ______________________ **Patch size/type:** ______________

Fire History: *Unburned* or *Burned* *Year* ______ **Plant Mortality:** *None* *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: ______________

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Erosion Features: *None* *Sheet* *Rill* *Gully* *Incised-channel* *Wind* *Slumping* *Bank-Scour* *Headcut* *other:* ______________

Erosion Status: *Active* *Recent* *Historic* *Stable* **Pollutants:** *N/A* *Potential* *Existing* **Water Quality:** *N/A* *Turbid* *Clear* *Warm* *Cool*

Assessment Performed: *No* or *Yes* **Method:** *PFC-L* *PFC-S* *Range Health* **Results:** *PFC* *FARU* *FARD* *NF*

Key Species Use Method: *Browse* or *Key Species* **Stubble Height:** *No* or *Yes*

Primary Land Use ______________________________ **Other Use** ______________________________

Potential Impacts to: *N/A* *Water Supply* *Water Quality* *Roads* *Agriculture* *Homes* *Air Quality* *Soil Stability* *Vegetation Productivity*

Sage Grouse Habitat R-Value:

	Ideal Habitat	Grass Dominated	Shrub Dominated	P-J Dominated	Conversion Types
N/A	*R0*	*R1*	*R2a* *R2b* *R2c* *R2d*	*R3a* *R3b*	*R4*

Site Needs further investigation *No* or *Yes* **Reason:** ______________________________

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

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Potential Recommendations/Alternatives: ______________________________

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Evaluation Sheet (Back)

Departure from Expected	Code
None to Slight	N-S
Slight to Moderate	S-M
Moderate	M
Moderate to Extreme	M-E
Extreme to Total	E-T

Instructions for Evaluation Sheet, Page 2

(1) Assign 17 indicator ratings. If indicator not present, rate None to Slight.
(2) In the three grids below, write the indicator number in the appropriate column for each indicator that is applicable to the attribute.
(3) Assign overall rating for each attribute based on preponderance of evidence.
(4) Justify each attribute rating in writing.

Indicator	Rating			Comments
1. Rills	S	H		
2. Water-flow Patterns	S	H		
3. Pedestals and/or terracettes	S	H		
4. Bare ground ________%	S	H		
5. Gullies	S	H		
6. Wind-scoured, blowouts, and/or deposition areas	S			
7. Litter movement	S			
8. Soil surface resistance to erosion	S	H	B	
9. Soil surface loss or degradation	S	H	B	
10. Plant community composition and distribution relative to infiltration		H		
11. Compaction layer	S	H	B	
12. Functional/structional groups			B	
13. Plant mortality/decadence			B	
14. Litter amount		H	B	
15. Annual production			B	
16. Invasive plants			B	
17. Reproductive capability of perennial plants			B	

E-T	M-E	M	S-M	N-S

S (10 indicators):
Soil & Site Stability
Rating: ____________

Attribute Rating Justification
Soil & Site Stability:

E-T	M-E	M	S-M	N-S

H (10 indicators):
Hydrologic Function
Rating: ____________

Attribute Rating Justification
Hydrologic Function:

E-T	M-E	M	S-M	N-S

B (9 indicators):
Biotic Integrity
Rating: ____________

Attribute Rating Justification
Biotic Integrity:

Quantitative Measures for the 17 Indicators

Potential quantitative measurements and indicators that we believe specifically relate to the 17 rangeland health qualitative indicators. For each quantitative indicator, we provide a potential explanation (interpretation) of the relationship between the qualitative and quantitative indicators (from Pyke et al., 2002). Also see table relating quantitative indicators to attributes in the Concepts section. References: 1 - USDA NRCS, 1997, 2 - Elzinga et al., 2001, 3 - Herrick et al., 2002.

Qualitative Indicator	Quantitative Indicator	Measurement (References)	Interpretation
1. Rills	None		
2. Water flow patterns	Percent basal cover	Line-point intercept (2,3)	Basal cover is *negatively* correlated with water flow patterns because plant bases slow water movement.
	Proportion of basal gaps > 25, 50, 100, 200 cm	Basal gap intercept (3)	Basal gaps are *positively* correlated with water flow patterns because water gains energy as it moves unobstructed across larger gaps.
3. Pedestals and/or terracettes	Standard deviation of pin heights	Erosion bridge (microtopography) (3)	Pedestals and terracettes *can be positively* correlated with pin height standard deviation because increased microtopography is *sometimes* due to pedestals and terracettes.
4. Bare ground	Percent bare ground	Line-point intercept (2,3)	Bare ground is *positively* correlated with runoff and erosion.
	Proportion of line in canopy gaps > 25, 50, 100, 200 cm	Canopy gap intercept (3)	The bare ground qualitative indicator is also *positively* correlated with canopy gaps because bare ground in large gaps usually has a larger effect on many functions than bare ground in small gaps.
5. Gullies	Width-to-depth ratio and side slope angle	Channel profiles (3)	Lower width-to-depth ratios and higher side slope angles both reflect more severe or active gully erosion.
	Headcut movement	Headcut location (3)	Higher rates of headcut movement reflect greater gully erosion.
6. Wind-scoured, blowout, and/or depositional areas	None		
7. Litter movement	Proportion of litter cover in interspaces vs. under canopies	Line-point intercept (2,3)	Higher proportions of litter in the interspaces can be *positively* related to litter movement.
	Proportion of basal gaps > 25, 50, 100, 200 cm	Basal gap intercept (3)	Basal gaps can be *positively* related to redistribution or loss of litter.
8. Soil surface resistance to erosion	Average soil surface stability	Soil stability kit (surface)(3)	Surface aggregate stability is *positively* related to soil's resistance to wind and water erosion.
9. Soil surface loss or degradation	Average soil sub-surface stability	Soil stability kit (sub-surface)(3)	Sub-surface soil structure degrades and organic matter declines as surface soil is lost, thus sub-surface aggregate stability is negatively related to soil surface loss or degradation.
10. Plant community composition and distribution relative to infiltration and runoff.	Percent composition	Line-point intercept (2,3) or production (1,2)	Changes in species composition can be related to changes in infiltration. For example, root and shoot morphology of tussock vs. stoloniferous plants.
	Proportion of basal gaps > 25, 50, 100, 200 cm	Basal gap intercept (3)	Changes in basal gaps can be related to changes plant distributions that relate to infiltration and runoff.
11. Compaction layer	Ratio of penetration resistance in the upper 15 cm (6 inches) between the evaluation and reference area	Impact penetrometer (3)	Ratios of penetration resistance or bulk density above 1 can indicate the presence of a compaction layer.
	Ratio of mass-per-volume of soil in the upper 15 cm between the evaluation and reference area	Bulk density	
12. Functional/structural groups	Percent composition by functional or structural group and group richness	Line-point intercept (2,3) Production (1,2)	Composition and richness of functional or structural groups are *positively* related to plant functional or structural groups qualitative indicator
13. Plant mortality/decadence	Proportion of live-to-dead canopy	Line-point intercept (2,3)	The live-to-dead proportion is *positively* related to the plant mortality or decadence qualitative indicator
14. Litter amount	Litter mass	Litter mass	The amount of litter mass and cover per unit area is related to litter amount
	Litter cover	Line-point intercept (2,3)	
15. Annual production	Total annual production	Production (1,2)	Productions relates directly with the qualitative indicator of annual production
16. Invasive plants	Density of invasive species	Belt transect (1,2,3)	Number of species and their densities or cover will directly relate to the qualitative indicator
	Percent foliar cover of invasive species	Line-point intercept (2,3), Production (1,2), or quadrat cover (1,2)	
17. Reproductive capability of perennial plants	None		

Standard Checklist

Name of Riparian-Wetland Area:____________________

Date:__________ Segment/Reach ID: ________________

Miles:__________ Acres:__________

ID Team Observers: ____________________

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)

Remarks

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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 ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)________________________________

Lentic Standard Checklist

Name of Riparian-Wetland Area:______________________________________
Date:___________ Area/Segment ID: ________________ Acres:__________
ID Team Observers: ______________________________________

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

(Revised 1999)

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