Upper Owyhee Watershed Assessment

VII. Rangeland

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VII. Rangeland

The Oregon governor's strategic initiative for ensuring sustainable water resources for Oregon's future, Headwaters 2 Ocean, considers all water resources from the hilltops to the Pacific Ocean. The completion of the assessment of the upper Owyhee subbasin is consistent with the governor's initiative. The upper Owyhee subbasin contains the headwaters of the Owyhee River and two of its principal tributaries.

A. Introduction

1. What is rangeland?

Rangeland is extensive, uncultivated, mostly unforested land that is dominated by native plants. The term range was originally used to describe the wide open lands of the western half of the United States, probably because it was possible to "range" over large expanses.[59,139]

Land that is not towns or cities, farmland, dense forest, barren desert, "badlands", rock or glaciers is termed rangeland. Rangelands include open woodlands, grasslands, and shrublands. Since they exist worldwide, rangelands are known by many names: prairies, plains, grasslands, savannas, steppes, shrublands, deserts, semideserts, swards, tundra and alpines.[58,139,140]

Although rangelands occur on every continent and account for about 45 percent of the earth's land surface, they account for only 36 percent of the land surface of the United States. Most of these rangelands are in the western US where about 80 percent of the lands are rangelands.[59,138]

Rangelands are the dominant type of land in the arid and semiarid regions. In addition to having limited precipitation, they generally have sparse vegetation, sharp climatic extremes, and highly variable and frequent saline soils.[59,138,140] The dominant vegetation of western American rangelands is grasses, shrubs, and forbs (broadleaf plants like wildflowers).[58,138]

The terminology rangelands is generally not applied to lands managed by forestry principles.[139] However, in this assessment of the upper Owyhee subbasin rangelands, the land managed by the U.S Forest Service in the Bull Run and Independence Mountains is sometimes included in the discussion as the use of the land is frequently similar to the use of rangeland.

2. How is rangeland used?

Historically, the primary use of rangeland has been to provide forage for livestock and wildlife. Rangelands also provide wildlife habitat, habitat for a wide array of diverse native plant species, mineral resources, recreation, open space, and areas of natural beauty.[58,59,138,140]

Rangelands provide the varied habitats needed by a wide array of animal species including both game animals and non-game animals. Numerous species of mammals, birds, reptiles, amphibians, fish and insects live in the rangelands. Ruminants, animals such as deer, pronghorn antelope, and big horned sheep, can digest the cellulose in rangeland plants due to their specialized digestive systems. Small rangeland mammals have adapted to the arid environment and the forage provided by rangeland plants.[58,138]

Sheep, cattle, and goats are also ruminants and can utilize the cellulose in rangeland plants. Livestock production on rangeland supplies meat, leather, and wool. In the 19 western states, rangeland and associated pasturelands support 58% of all beef cattle in the United States, 79% of all stock sheep, and 88% of all goats.[58]

Outdoor recreational activities in rangelands include hiking, camping, river rafting, fishing, hunting, and photography.[138] The importance of rangeland for recreation and water production is growing.[58]

B. Rangeland in the upper Owyhee subbasin

Most of the upper Owyhee subbasin is rangeland, however this rangeland is not homogeneous. The different ecoregions (see background section) will support different types of vegetation. The Bull Run and Independence Mountains with their increased elevations will not only have differing vegetation but will also present different problems for ranching.

C. Historical condition of rangeland in the upper Owyhee subbasin

We have little written information on which to base an understanding of the condition of the rangeland before the introduction of livestock. The pioneers on the Oregon and California trails kept to limited routes which skirted the upper Owyhee subbasin. Most of the trappers and early explorers also kept to routes outside the subbasin.

Photo 7.1. Rangeland in the upper Owyhee subbasin

The journals of the trapping expeditions which entered the subbasin give a sketchy idea of the vegetation. These three trapping brigades spent a total of only 44 days within the upper Owyhee subbasin. From the meager entries in the journals of John Work and Peter Skeen Ogden, the vegetation of the Owyhee plateau at the time of Euro-American entry into the region was sagebrush plains and areas with little grass amid large expanses of more barren rocky ground. Some streams banks had willows along them and parts of the swampy areas of the Duck Valley Indian Reservation had more verdant vegetation. The brigade trappers ascended streams into the mountains, and the journals indicate some trees along these streams, but there are no descriptions of any vegetation away from the streams.[77,78,141] (See the at contact section of the history component of this assessment).

1. Prior to significant livestock introduction

The upper Owyhee subbasin was largely unused before miners had discovered gold in the Owyhee Mountains in 1863. Cattle and sheep were introduced on the rangelands of the upper Owyhee soon thereafter. In his memoirs, David Shirk describes the rangeland in 1867.

> "From the west slope of the Rocky mountains to the east slope of the Cascades . . . the valleys along the water courses are covered with a growth of browse, such as greasewood, thorny rabbit brush, salt brush

and white sage. This grows to a height of from fourteen inches to four feet, and is excellent forage for horses, cattle, and sheep. I have driven cattle off the range, where white sage was abundant, in the month of January, as fat as I ever saw in the corn fed stalls of Illinois. On the upland, or mountain ranges, there is little feed save the famous bunch grass, no browse growing worthy of mention. Horses will live indefinitely on the white sage, eating the snow for water. . . Cattle will perish after about six weeks. In the latter, after a period, the browse will become dry in the stomach and will not digest, and hence they will soon die."[110]

"Throughout the great valley of the Snake River, the first vegetation that appears in the spring is Larkspur, a rank poison. While the ground is yet soft, cattle in feeding will pull up some of the roots and if not attended to at once, will die. . . . Consequently, cattle have to be moved into the foothills of the mountains to feed upon bunch grass, and follow up the snow as it melts away."[110]

Photo 7.2. White sage (winterfat)

In 1877, W. J. Hoffman published an article which described in general terms the distribution of vegetation in the Bull Run Mountains.

"The level of the prairie at Bull Run is 5800 feet above the sea . . . At Bull Run the timber-line, at an altitude of 8300 feet, terminates with the upper line of the belt of *Coniferae*, while the lower line rests upon a belt (400 feet of the vertical section) of mountain mahogany (*Cerocarpus ledifolius*), which in turn gives place at 7000 feet to the belt of *Salicaceae*. This group terminates irregularly at the beginning of the foot-hills, at an elevation of about 6200 feet. The foot-hills are chiefly covered with *Phlox*, *Lupinus*, and *Rosaceae*, an the plain with "grease-wood" (*Sarcobatus vermiculatus*) and "sagebrush" (*Artemisia tridentata*), the former being greatly in excess, but is gradually replace by the latter going southward [sic]. The lines of demarcation are frequently indistinct, owing to the mingling of species of one belt with the adjoining ones." [42]

". . . Upon the foot-hills . . . different species of plants occupy distinct patches, but it is apparent that there are changes going on, and that in time some will be destroyed, giving place for hardier varieties." [42]

2. Following livestock introduction

(Further discussion is available in the History component of this assessment dealing with the end of the nineteenth century, early twentieth century).

In the early 1870s, changes in the upper Owyhee subbasin included the introduction of livestock to the rangelands. By 1876 David Shirk says they "began to realize the necessity of preparing food for winter, as the native grasses, mostly bunch grass, were slowly giving way, and prudence required preparations for winter."[110]

When livestock were first introduced, the grass on public lands was "free" and lured livestock growers to turn out herds of sheep, cattle, and, sometimes, horses to roam freely. There was a "winner take all" attitude that encouraged grazing.[33,46] Cattle outfits tended to graze different sections of rangelands so as not to compete with each other. In winter cattle were moved to areas with bunch grass and white sage.[57] The Desert Land Act of 1877 encouraged settlers to settle on arid lands and cattle outfits now faced competition. Competition between cattlemen, sheepmen, and settlers led to overstocking of the range.[46] Prior to 1890 cattle were sold by the head as much for the hide as for the meat. It was more important that cattle survived than the quality of the livestock.[56] After the Desert Land Act, livestock operations acquired lands with water resources to enable them to control the surrounding grazing lands.[34,46]

In 1894 and 1896 the Division of Botany of the Department of Agriculture sent botanists to survey the vegetation of eastern Oregon. The rangeland had been grazed to a greater or lesser extent for 20 years. Frederick Coville, one of those botanists recorded his general impressions for a National Geographic article.

> "The vegetation of the country consists primarily of sage brush, the well-known *Artemisia tridentata* of botanists, a shrub three to six feet high, closely related to the wormwood of Europe, and having in common with that plant a light gray color and a strongly aromatic odor. Away from stream beds and sinks and the shores of lakes, sage brush covers the whole country like a gray mantle and constitutes probably nine-tenths of the total vegetation. It is a plant the herbage of which is eaten by but few animals and by those only in starvation times, one that will grow with little moisture and will stand the widest range of temperature. Sage brush gives to the country its character. A level stretch is known as a sage plain; the grouse which live there are known as sage hens; the fuel of the region is sage brush; the odor upon the atmosphere is that of sage brush."[21]

> "A few other shrubs form an inconsiderable part of the woody vegetation, but these and the sage brush make up by no means all the plant life of the country. As the snow melts away in the spring, the well moistened soil between the Artemisia bushes becomes covered with the seedling of innumerable annuals. For a few weeks the ground is carpeted with these plants, which flower in the greatest profusion, but after about two months they ripen their seeds, dry up, die, and disappear. Growing with these annuals is another type of plants, tuberous-rooted perennials which have stored up during the preceding year's growth a large amount of nourishment. They therefore bloom at the first break of spring, go through a brief period of rapid growth, lasting usually a little longer than that of the annuals, and then the newly formed bulbs, well protected by

impervious coats against the desiccating influences of a long, dry summer, carry over a full supply of plant food for the next spring's blooming."[21]

3. Overgrazing

Already, Coville sees that the rangelands will not support uncontrolled grazing.

> "There is one phase of wastefulness of the natural resources of the United States which a trip across the plains of Oregon particularly impresses upon the traveler, namely, the careless destruction of our great natural wealth of forage . . . Continued over-grazing year after year, if sufficiently excessive, unquestionably kills out the native forage plants, which are then replaced largely by introduced weeds. The original nutritious grasses never regain their former luxuriance and sometimes are almost exterminated. Under moderate grazing the native species produce yearly a good crop, or if even slightly over-grazed will after a few years of rest regain their former abundance."[21]

Probably the first effect of overgrazing was reduced perennial bunch grasses in the spaces between the shrubs. Annuals may have invaded the bare ground, but Russian thistle and cheatgrass had not yet been introduced. The increasing species were probably unpalatable and included big sagebrush and rabbitbrush. In some places the sagebrush thickened and became a monoculture, the predominant plant growing at the site.

In 1902, when Theodore Roosevelt was in the White House, David Griffiths traveled from Winnemucca, Nevada to Ontario, Oregon on horseback. He was invited by the cattle producers who provided him with guides and services. Griffiths, a USDA scientist, wrote that the "public ranges of the region are in many places badly depleted." He reported finding large areas of bare soil and traveling across deteriorated ranges which he says were "directly traceable to overstocking and it does not appear clear how matters will improve in the near future."[31]

As early as the 1860s the cattlemen had been trying to get grazing controls on the public lands. The railroads opposed the establishment of grazing rights that might compromise their plans for settlements. In the early 1900s, both cattlemen and sheepmen in the upper Owyhee subbasin and adjacent areas who had a base property wanted to control the cattle and sheep operators who just used the land with no base property. Local ranchers approached congress and even President Theodore Roosevelt claiming the range was being destroyed by indiscriminate use. Nothing was done by the federal government to manage the use of lower elevation rangelands until the passage of the Taylor Grazing Act in 1934.[34]

Numbers of cattle, sheep and horses increased through the early twentieth century. In addition to causing immediate changes in vegetation, overgrazing by livestock during this period also set in motion long term changes in plant community structure. The reduction of fine fuels in the system interrupted the natural fire cycle. Coupled with the continual consumption of native grass species, which reduced their competitive ability, a reduction in fires resulted in a rapid increase in sagebrush. More insidious, was the increase in juniper seedlings in the wetter sagebrush plant

communities. This increase was only really apparent 40 years later when the juniper became large enough to dominate the landscape. Some members of the livestock industry in the West perceived the destruction going on and championed the Taylor Grazing Act.[121,132]

The number of animals on the range varied, but tended to increase until the Taylor Grazing Act of 1934.[46]

Exotic plant species that were often contaminants of crop seed, found excellent seed beds on the overgrazed ranges and spread rapidly. Russian thistle first began growing on rangeland about 1900, followed by mustard species. The cheatgrass which appeared about 1915 spread over large areas of rangeland during the 1920s. Cheatgrass tended to increase ground cover and although it provided scanty forage, it was more than had been produced by barren lands. Cheatgrass also provided a flash fuel and fires became common.[40]

By the end of the 1940s fire suppression on rangelands had begun to affect the plant communities of rangelands.

D. Vegetation

1. Types of rangeland vegetation

The plants that grow on rangeland can be categorized into grasses, grass-like plants, forbs, shrubs, and trees.

Grasses have long narrow leaves and produce grain-like seeds. They do not have showy colored flowers. The leaves are on two sides of a hollow stem. Grasses are generally the most abundant kind of range plant.[58,61]

Forbs are herbaceous (non-woody), broad-leaved plants which usually have showy flowers. They have solid stems. The above ground growth dies back each year. A few forbs, like wild onion, have leaves with parallel veins. Most forbs have leaves with a network of veins. Most wildflowers are forbs.[58,,61,76,113]

Grass-like plants look like grass but aren't. They have solid stems which are often triangular. Sedges have leaves on three sides. Rushes have leaves on two sides. [61,76,113]

Shrubs and trees are plants with above-ground stems that do not die back from one year to the next. Shrubs grow from several main, solid woody stems that branch from near the base. Their leaves have a network of veins. Shrubs often produce berries.[58,61,76,113]

Trees have a definite main trunk which is woody. Usually trees are bigger than shrubs. Some species of shrubs can form either a tree or shrub depending upon the local conditions, but most shrubs never grow up to be trees.[58,76]

Browse is the part of a woody plant, usually a shrub, that is used for forage by wildlife and livestock. Browse usually includes leaves and young stems.[58,76]

2. Rangeland types

All rangeland is not the same. There are several broad types of rangeland that comprise most of the plateau rangeland in the upper Owyhee subbasin. The type of rangeland may be related to the eco-region (see the background component of this assessment) but a different way of looking at the landscape is by principally examining the vegetation which grows in the area. Like ecoregions, the descriptions of rangeland types can vary. The sagebrush-steppe is an ecosystem encompassing many diverse communities. Sagebrush-steppe is a dry habitat where the vegetation consists primarily of sagebrush and other shrubs and short grasses. Precipitation averages between six and fourteen inches a year and the winters are generally cold and the summers hot and dry. Large portions of the upper Owyhee subbasin can be termed sagebrush-steppe. The natural vegetation consists of a shrub overstory with an understory of perennial grasses and forbs. Great variation exists in soil resources and therefore in the kind, cover, and amount of vegetation present.[44,66,129,132]

a. University of Idaho[106]

The University of Idaho's current descriptions of range regions in Idaho includes pacific bunchgrass, sagebrush grasslands, salt-desert shrub, juniper woodland and coniferous forest and mountain meadow. Like ecoregions these are extremely broad categories. Only three of these are shown as present in the upper Owyhee subbasin: sagebrush grasslands, salt-desert shrub, and juniper woodland.[106]

i. Sagebrush-grasslands

Sagebrush-grasslands are a mix of sagebrush and bunchgrasses.

> "The most wide-spread type of rangeland in Idaho . . . is dominated by sagebrush and bunchgrasses. These rangelands stretch across the plains, plateaus, and valleys . . . Precipitation generally ranges from 10 to 15 inches per year. Big sagebrush is the most common species of sagebrush, but there are actually about a dozen different species of sagebrush in Idaho. Sagegrouse, pronghorn antelope, and black-tailed jackrabbits call sagebrush grasslands home. The shrub-grass mix provides good spring and fall grazing for livestock and wildlife."[60]

ii. Salt-desert shrub

Salt-desert shrublands, also known as salt desert scrub, are located in areas where there is no drainage and therefore salts accumulate in the soil. The desolate looking plant community results from the soil salinity along with cold winter and hot summer temperatures. These shrublands receive very little precipitation each year. Shrubs generally grow better under these conditions than grasses or forbs.[63,130,137]

> "In Southern Idaho, a kind of dry deserts are created by salty soils and cold temperatures. Shrubs . . . are able to live in these salty soils that dominate this "cold desert" (covering 1.5 million acres). These shrublands get very little precipitation each year, usually 10 inches or less. Shrubs are generally more well suited for these harsh conditions than grasses or forbs. Because these shrubs have high nutritive value in winter, cold

deserts are excellent winter range for pronghorn and are considered some of the world's best winter sheep range."[60]

iii. Juniper woodland

"In Southern Idaho, two kinds of small evergreen trees, Western Juniper and Utah Juniper, create a kind of "pigmy forest." The juniper woodlands usually grow on the rougher terrain and can be dense or open depending on soils and topography. These woodlands usually occur in scattered patches rather than solid stands . . . Annual precipitation ranges from 12 to 30 inches per year. The reduced frequency of natural wildfires allows juniper to expand into the adjacent sagebrush-grasslands." [60]

b. Oregon State University Rangeland Department

The Oregon State University Rangeland Department uses an alternative description of rangeland types that includes herbaceous range, shrub and brush rangeland, and mixed rangeland.[56]

i. Herbaceous range

The herbaceous rangeland category is land dominated by naturally occurring grasses and forbs as well as those areas of actual rangeland which have been modified to include grasses and forbs for rangeland purposes.[2]

ii. Shrub and brush rangeland

The brushlands found in arid and semiarid regions are characterized by xerophytic (adapted to life with a limited water supply) vegetation with woody stems such as big sagebrush, shadscale, greasewood, or creosotebush and also by the typical desert succulents such as cactus. Moister areas may have mountain mahogany.[2]

iii. Mixed rangeland

When more than one-third intermixture of either herbaceous or shrub and brush rangeland species occurs in a specific area, it is classified as mixed rangeland. [2]

c. National Vegetation Classification System.

A classification system provides a set of criteria for examining plant communities.[32] Both the Natural Resources Conservation Service (NRCS) and the BLM use the ecological site description, correlated to soil surveys, from the NRCS land classification system to determine vegetation type. Although BLM and NRCS use a different classification system, a National Vegetation Classification System (NVCS) was adopted by the Environmental Protection Agency and the US Geological Survey (USGS) in 1997 [28] and was revised in 2008.[29] It is now used to classify rangeland sites based on plant associations.[57]

"The national vegetation classification system focuses on existing vegetation rather than potential natural vegetation, climax vegetation, or physical habitats . . . The vegetation types covered in the classification range from the short-lived to relatively stable and persistent plant

communities. The classification includes natural, seminatural, modified, and cultural vegetation."[128]

In other words, this classification system is based on the plants that are really growing in an area. This differs from the ecoregion approach as it focuses on the current vegetation. The NVCS also includes different levels. One of the higher levels focuses on the way the area looks and for terrestrial vegetation is divided into forest woodland, sparse woodland, shrubland, sparse shrubland, dwarf shrubland, sparse dwarf shrubland, herbaceous, and sparse vascular/non-vascular. The lowest level is delineated by the association of two or more species.[128]

3. Vegetation in the upper Owyhee subbasin

The vegetation of the upper Owyhee subbasin is extremely varied, including plant species growing above the tree line in the Bull Run and Independence Mountains, evergreen and deciduous shrubs of the sagebrush steppe ecosystems, and riparian species along the streams. Not only does it include species native to the area, but it also includes both invasive and introduced species.

a. Surveys of vegetation

There has been one exhaustive survey of vegetation within the upper Owyhee subbasin which focused on a small section of the subbasin. The Idaho Department of Fish and Game, Conservation Data Center (CDC) contracted the Nature Conservancy to conduct an ecological inventory and assessment of the 45 Ranch. The ranch is bordered by the Little Owyhee, South Fork Owyhee and Owyhee rivers on the west, east, and north respectively. Although exhaustive, the survey only recorded species encountered in the 100 square miles of the ranch. The project occurred in two phases. The inventory of riparian and wetland communities was completed in 1998. The phase focused on terrestrial vegetation was completed during the 1999 field season.[73] All of the species of both riparian and terrestrial vegetation which they encountered on the 45 Ranch are identified within the subbasin plant list, Appendix E.

David Charlet used personal observations and visited fifteen herbarium collections to document the distributions of all conifer species occurring in Nevada. Within the subbasin he identified eight species either currently or historically present in the Bull Run and Independence Mountains of the upper Owyhee subbasin.[18,AppendixE]

b. Plant communities

Surveys of vegetation frequently identify broad rangeland types. However, the plants living in association with each other, the plant communities, are classified more narrowly.

The species in a plant community differ in kind or proportion from the species of a different plant community. Traditionally these communities, or associations, are named for two of the species in them. On rangelands this combination of names tends to be the dominant shrub followed by the most obvious grass. However, the community name may be that of two shrubs or include the name of a forb. The NVCS classification system may include the names of two equally present species or differentiate based on a third prominent species. Although there is a recognized superstructure for identifying

plant communities, different researchers may identify them more broadly or more narrowly.

i. Plant communities on the 45 Ranch

Using the NVCS classification system, the survey of the 45 Ranch described 37 terrestrial plant associations in the upland environments. Table 7.1 lists 25 of these plant communities. Within some of these plant communities, the Nature Conservancy split the community by the inclusion of a third species so that they have more than 37 associations.[73] Three of the plant communities included in the survey were observed by Moseley in the earlier survey of riparian vegetation.[72] They consist of riparian plant associations that occur in intermittent drainage and pool habitats of plateau environments.

Photo 7.3. The 45 Ranch on the South Fork Owyhee River in the upper Owyhee subbasin

Table 7.1. Terrestrial plant communities identified on the 45 Ranch in the upper Owyhee subbasin.

Artemisia arbuscula/Agropyron spicatum		*Salvia dorri/Oryzopsis hymenoides*
Artemisia arbuscula/Festuca idahoensis		*Juniperus occidentalis/Danthonia californica*
Artemisia arbuscula/Poa secunda		*Juniperus occidentalis/Festuca idahoensis*
Artemisia cana/Muhlenbergia richardsonis		*Juniperus occidentalis/Artemisia arbuscula*
Artemisia tridentata tridentata		*Juniperus occidentalis/Artemisia tridentata vaseyana/*
Artemisia tridentata tridentata/Elymus cinereus		*Juniperus occidentalis/Artemisia tridentata wyomingensis*
Artemisia tridentata wyomingensis-Haplopappapus acaulis		*Acer glabrum-Holodiscus dumosus-Ribes* spp
Artemisia tridentata wyomingensis/Agropyron spicatum		*Haplopappus nanus/Poa secunda*.
Artemisia tridentata wyomingensis/Festuca idahoensis		*Sarcobatus vermiculatus*
Artemisia tridentata wyomingensis/Poa secunda		Riparian Working Group
Artemisia tridentata wyomingensis/Sitanion hystrix		Riparian graminoid
Artemisia tridentata wyomingensis/Stipa thurberiana		Riparian Shrubland
Poa secunda/Eriogonum spp.		

On the 45 Ranch, the dominant shrubs tend to be *Artemisia tridentata tridentata (*basin big sagebrush), *Artemisia tridentata wyomingensis,* (Wyoming big sagebrush), and *Juniperus occidentalis* (western juniper). These are the plants that will be most obvious to an observer looking out over the landscape.

ii. Other plant communities

In addition to the sagebrush/steppe terrestrial vegetation, the upper Owyhee subbasin includes rangeland in pinyon-juniper woodland, mountain shrub, subalpine forest, and alpine tundra.[135] No survey similar to that done on the 45 Ranch has been conducted in the more mountainous regions of the subbasin.

Juniper stands occur throughout the higher elevations of the subbasin, generally as part of the sagebrush steppe vegetation. Starting around the 5,500 foot elevation, juniper can be found with stands of aspen and mountain mahogany. Douglas fir and sub-alpine fir occur on the highest slopes.[10,118] Other high elevation vegetation includes juniper, quaking aspen, snowberry, sagebrush and willow (*Salix* spp.).[9,118] Whitebark pine grows in the highest elevation forest and at timberline. In the Bull Run Mountains whitebark pine is usually associated with limber pine.[3]

iii. Recent mapping of vegetation

Recent improvements in the resolution of remotely sensed data and data analysis have produced new vegetation maps. The Landsat satellites take high resolution images of a small section of the earth. The smallest unit which maps to a single pixel within these images is about 30 meters by 30 meters. These images record wavelengths, levels of brightness, and number of gray scale levels. The Gap Analysis Program is designed to map vegetation using the spectral bands. The upper Owyhee subbasin lies within two of the completed projects: the Northwest Regional Gap project and the Southwest Regional Gap Analysis projects completed in 2004 and 2007.[148,149,150]

Figure 7.1 depicts the distribution of land cover within the upper Owyhee subbasin. The Northwest Regional Gap project and the Southwest Regional Gap project sometimes used slightly different classifications for the land cover, resulting in an artifact at the Nevada - Idaho border. Of the plant associations mapped by the Gap Projects in the upper Owyhee subbasin, 45 account for most the of vegetated land (Figure 7.2).

4. Invasive Species

Invasive species are species which have the potential to expand or invade all or part of their U.S. range and degrade the landscape. Invasive species are commonly called weeds. These weeds are invasive because they grow vigorously and are competitive. Since they out-compete other species for light, water, nutrients, and space, they many rapidly dominate a site. Problems caused by these species include crowding out desirable vegetation, causing crop and forage losses, ruining good wildlife habitat, causing degradation of streams and wetlands, and creating rangeland fire hazards. Although most of these species are nonnative species from outside North America, not all invasive species were introduced to the U.S. Some species are native but have managed to spread and invade habitats such as rangelands or agricultural fields. Other species are native in part of the country but are serious pests in other parts.[64,116,125,126]

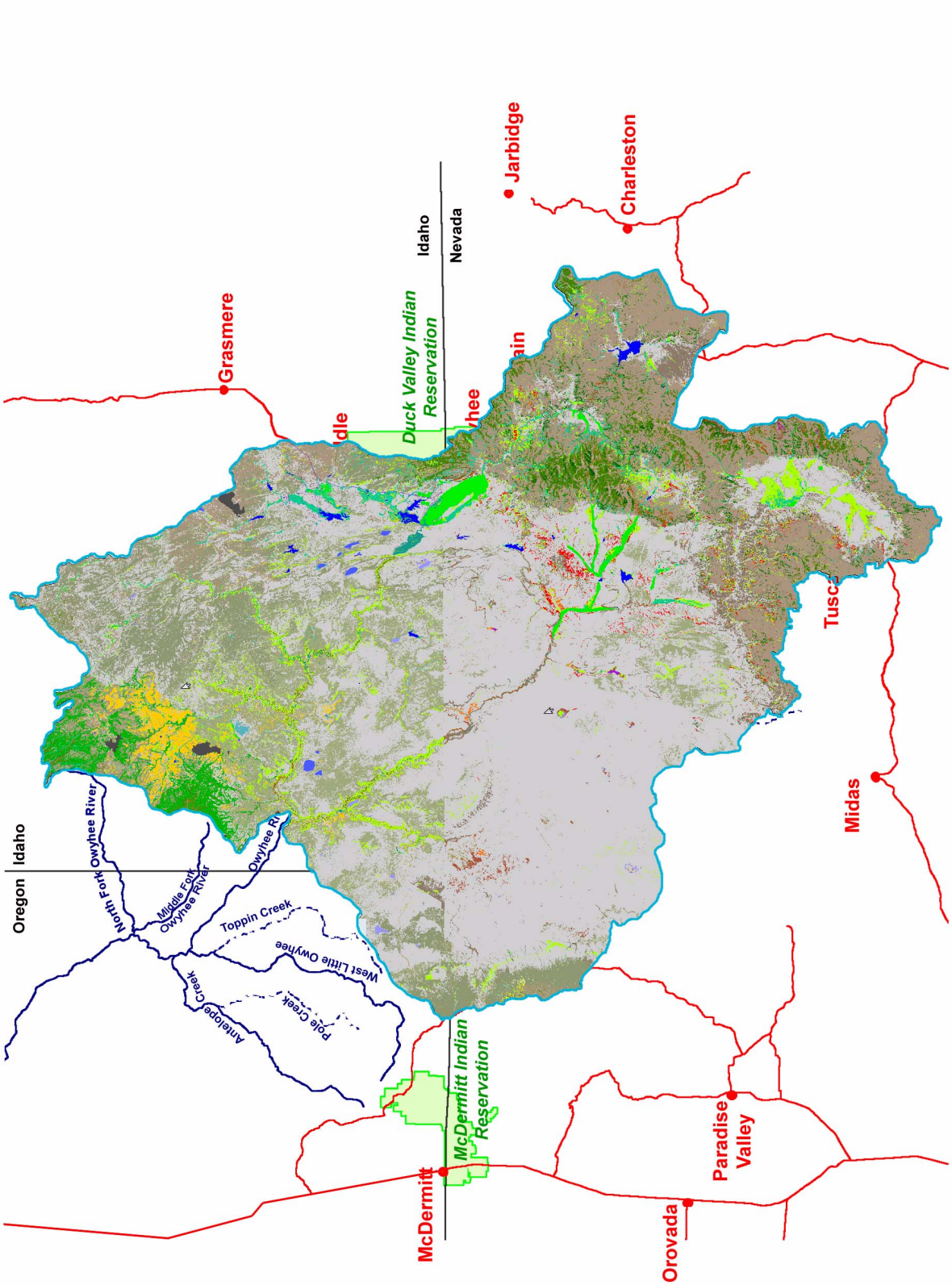

Figure 7.1. Land cover in the upper Owyhee subbasin.

Figure 7.2. Descriptions of the land cover on Figure 7.1.

Species from other countries may have arrived either in the ballast of sailing ships or in shipments of desirable seeds. Some were introduced intentionally as garden plants. The introduction of invasive plants into the US has increased dramatically in the past couple of decades due to the increased ease and speed of national and world travel and the expansion of global commerce. Wind, water, and animals can naturally spread invasive weeds locally, but human activities such as, recreation, vehicle travel, and the movement of contaminated equipment, products, and livestock often greatly increase the distance and rate of dispersal.[83,116]

a. Noxious weeds

A weed is designated noxious when it is considered by a governmental agency to be injurious to public health, agriculture, recreation, wildlife, or property. Noxious weeds are considered to be serious pests because they cause economic loss and harm the environment. Noxious weeds can choke out crops, destroy range and pasture lands, clog waterways, threaten native plant communities or affect human and animal health.[83,116]

Some general characteristics of noxious weeds are their ability to spread rapidly, reproduce in high numbers, and crowd out native plants. Noxious weeds also tend to be very difficult to control. There are many challenges to managing noxious weeds. They are often resistant to mechanical and cultural practices and existing herbicides.

Noxious weeds are generally non-native plants. Noxious weeds appeared and spread with European settlement and new weeds continue to arrive today. A large number of the least desirable weeds are of Mediterranean, European, or Asian origin. Not all weeds are noxious weeds.[116,451]

Invasive plants affect the plant community composition and have profound negative consequences for native biotic diversity. In rangeland, the most significant invasive species affecting the plant community composition are fire-adapted annual grasses, like cheatgrass and medusahead rye. The expansion of these grasses has resulted in annual grass-fire cycles that rapidly replace sagebrush-steppe and salt-desert shrubland systems.[7,17]

b. State designations of noxious weeds

The states of Idaho, Nevada, and Oregon all maintain lists of weeds designated as noxious weeds in that state. Each of the states has a different way of categorizing noxious weeds. Laws governing control of weeds varies from state to state but generally outlines what should be done concerning the identification, reporting, and treatment of noxious weeds. The names of the classifications do not intuitively provide an indication of what the state expects the treatment to be.

Idaho classifies weeds into a statewide EDRR list, a statewide control list, and a statewide containment list.[115] Nevada separates the weeds into categories A, B, and C.[75] Oregon classifies weeds as A or B, either of which can also be classified as T, weeds that represent an economic threat to the state of Oregon.[134]

For Idaho the EDRR list is composed of weeds which must be reported within ten days after identification and "shall be eradicated during the same growing season as identified." Weeds on the control list are considered to already exist in Idaho, but in concentrations where control or eradication may be possible. The control methods should reduce known population within five years. Noxious weeds on the containment list are widespread enough that control efforts are "directed at reducing or eliminating new or expanding weed populations."[117]

Nevada's categories are also based to some extent on the weed distribution. Category A weeds are similar to Idaho's EDRR list in that the weeds are to be "actively eradicated wherever found," and control by the state is required in all infestations. Category B weeds have some established scattered populations and should be "actively excluded where possible." Poorly established populations and populations occurring in locations where they were previously unknown require control by the state. Category C weeds are currently established and generally widespread in many counties of the state and abatement is at the discretion of the state quarantine officer.[75]

In Oregon noxious weeds are "weeds of economic importance" and are classified as either A or B. In addition some weeds in each category are considered to "represent an economic **threat** to the state of Oregon" and should be reported "if you suspect you have found any of these weeds." All A classified weeds should also be reported if found since these weeds "occur in the state in small enough infestations to make eradication/containment possible." Noxious weeds with a B classification are regionally abundant but may have limited distribution in some counties.[98,134]

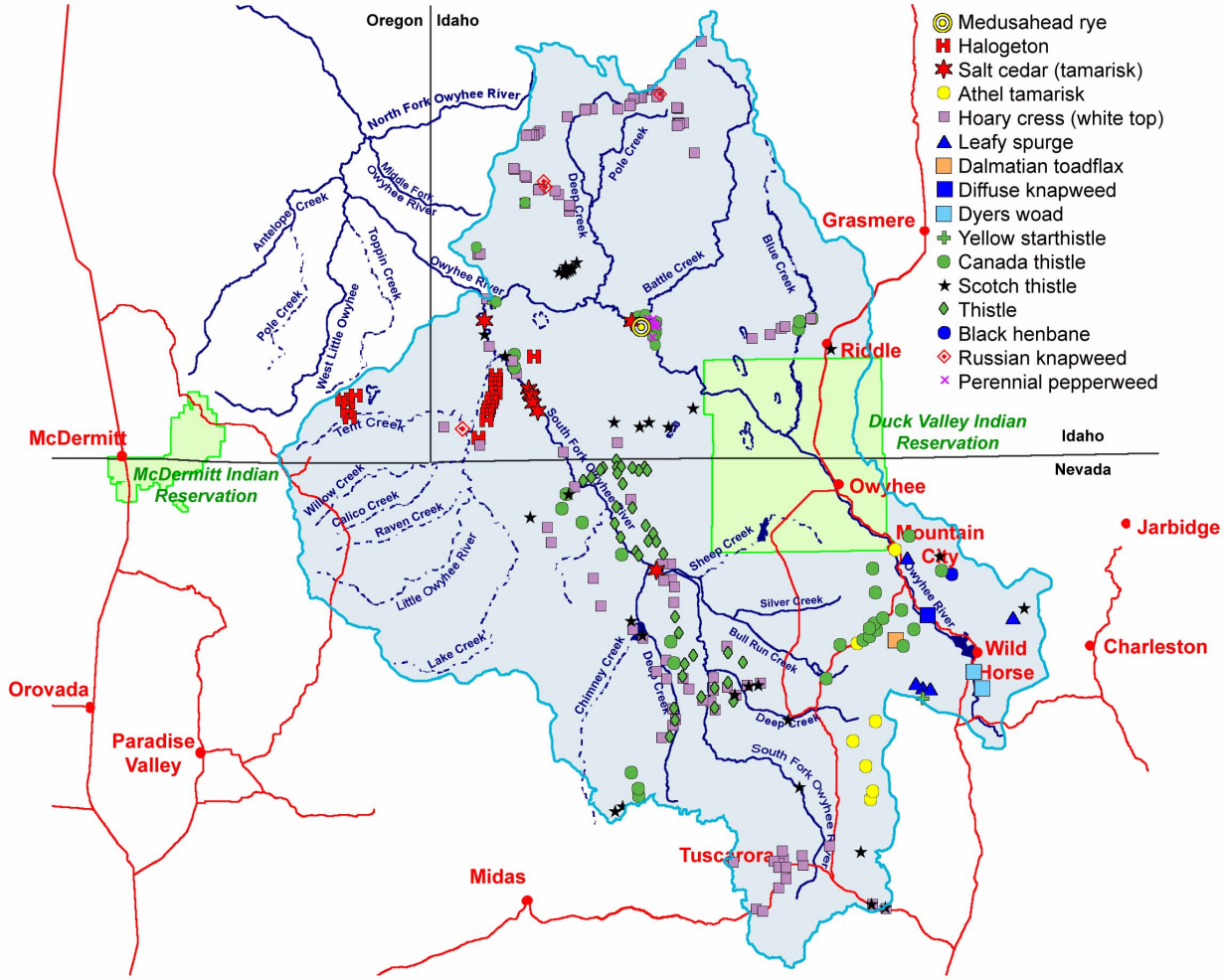

Figure 7.3. Known locations of weeds in the upper Owyhee subbasin.

c. Noxious weed species in the upper Owyhee subbasin

The upper Owyhee subbasin is currently relatively free of noxious weeds compared to some of the surrounding areas. Most of the species identified as within the upper Owyhee subbasin have a very limited range. Individuals, including the authors, familiar with the region and with the species have provided information on the occurrence of a noxious weed species within the upper Owyhee subbasin. Within Elko county, the BLM has identified locations where a specific weed species has been found.[142] The Owyhee field office of the BLM provided a map of the known location of specific weed species. Other mapped occurrences of a species were taken from GPS readings of the locations where they were identified (Figure 7.3).

The potential for a noxious weed to be within the subbasin or to expand into the subbasin has been determined from a number of different sources. The state of Idaho identifies counties in which a noxious weed species occurs. Species identified as noxious weeds by the state of Idaho which are present in Owyhee County have been included in Table 7.2.[115] For species identified as noxious weeds by Nevada, their presence in Elko County as recorded by the USDA plants database has resulted in their inclusion. Within each Oregon county, the state maps where a species has been

reported. Species occurring within the boundaries of the upper Owyhee subbasin in Oregon or very close to the boundary have been included in the list.[133] Table 7.2 includes noxious weeds whether they occur primarily on rangeland, in riparian areas, or in cropland or pastures.

Table 7.2. Noxious weeds known to occur in the upper Owyhee subbasin and candidate species for spread into the upper Owyhee subbasin from adjacent areas.

Several sources were used to record the presence of a weed within the upper Owyhee subbasin

45 - Present on the 45 Ranch[72,73]
O - Presence in Owyhee County noted by mapping from the Idaho's noxious weeds list.[115]
N - Presence in Elko County from USDA plants database[85]
M - Presence in Malheur County from weedmapper[95]
P - Presence noted by individuals

		Present	State classification		
Common name	Scientific name		OR	ID*	NV
Black Henbane	*Hyoscyamus niger*	O, N		c	A
Buffalobur	*Solanum rostratum*		B	c	
Bull thistle	*Cirsium vulgare*	45, P	B		
Canada thistle	*Cirsium arvense*	45, O, N, P	B	d	C
Cheatgrass	*Bromus tectorum*	45, P			
Dalmatian toadflax	*Linaria dalmatica*	O,N, P	B,T	d	A
Diffuse knapweed	*Centaurea diffusa*	O, M, P	B	d	B
Dyers Woad	*Isatis tinctoria*	O	B	c	A
Eurasian Watermilfoil	*Myriophyllum spicatum*	O	B	c	A
Field Bindweed	*Convolvulous arvensis*	O	B	d	
Field sow thistle	*Sonchus arvensis*	N		c	A
Halogeton	*Halogeton glomeratus*	O, P	B		
Houndstongue, gypsyflower	*Cynoglossum officinale*	N	B	d	A
Leafy spurge	*Euphorbia esula*	O, N, P	B,T	d	B
Mediterranean sage	*Salvia aethiopis*		B	c	A
Medusahead rye	*Elymus caput-medusae*	M, P	B		B
Musk thistle	*Carduus nutans*	O	B	c	B
Perennial pepperweed	*Lepidium latifolium*	O, N, P	B	d	C
Poison hemlock	*Conium maculatum*	O, N, P	B	d	C
Puncturevine	*Tribulus terrestris*	O, N	B	d	C
Purple loosestrife	*Lythrum salicaria*	O, M, P	B	d	A
Rush skeletonweed	*Chondrilla juncea*	O	B,T	d	A
Russian knapweed	*Acroptilon repens*	O, M, P	B	c	
Saltcedar, tamarisk	*Tamarix ramosissima*	O, N	B,T	d	C
Scotch thistle	*Onopordum acanthium*	45, O, M, P	B	d	B
Spotted knapweed	*Centaurea stoebe* or *C. masculosa*	O, N, P	B,T	d	A
Spotted water hemlock	*Cicuta maculata*	N			C
White top, Hoary cress	*Cardaria draba*	O, N, M	B	d	C
Yellow starthistle	*Centaurea solstitialis*	N, P	B,T	d	A
Yellow toadflax	*Linaria vulgaris*	N	B	d	A

* b. Idaho EDRR c. Idaho statewide control lists d. Idaho statewide containment list

d. Rangeland noxious weeds

Although there may not be observations of specific occurrences in the upper Owyhee subbasin of the noxious weeds which are described below, all of these weeds have the potential to exist within the subbasin or to expand into the subbasin.

i. Leafy spurge (Euphorbia esula)

Leafy spurge is one of the west's worst weed species because it reduces cattle carrying capacity of infested rangelands by 50 to 75%. Once established, control of even modest-sized infestations is difficult. This weed is most common under dry conditions where competition from native plants is reduced. It is capable of invading disturbed sites, including abandoned cropland, pastures, rangeland, woodland, roadsides and waste areas. A milky latex exists in all broken parts of the plant that can cause skin irritations in humans, cattle, and horses and may cause permanent blindness if rubbed into the eye.[53,86,111]

ii. Medusahead rye (Taeniatherum caput-medusae)

Medusahead rye has the ability to outcompete other annual grasses and generally crowd out perennial grass seedlings by extracting the majority of moisture well before perennial grasses have begun to grow. Medusahead is almost worthless as forage for cattle, sheep or wildlife as it becomes unpalatable in late spring. The stiff awns and hard florets can injure eyes and mouths of grazing animals. Once land is invaded by medusahead, it becomes almost worthless, no longer supporting domestic livestock or native plants, animals, and birds. Medusahead rye changes the temperature and moisture dynamics of the soil, greatly reducing seed germination of other species and creating fuel for wildfires The propensity of medusahead to support frequent fire cycles makes range restoration even more difficult.[76,87,100]

Medusahead rye has invaded and completely dominated large tracts of land in the mid-Snake River region. It can invade stands of bluebunch wheatgrass. Expansion of medusahead rye places economically viable livestock production in peril with far reaching consequences. Medusahead has already had a serious impact on sage grouse habitat. It may also affect the movements of big game.[100,111]

iii. Rush skeletonweed (Chondrilla juncea)

Rush skeletonweed is an aggressive plant in both rangeland and cropland. A deep-rooted, creeping perennial, it also reproduces by seed. Rush skeletonweed has the capability to reduce or choke out native range species, decreasing range productivity and diversity. [51,92,111]

Rush skeletonweed has been found at sites contiguous to and intermingled with Malheur forget-me-not (*Hackelia cronquistii*), Mulford's milkvetch (*Astragalus mulfordae*), Owyhee clover (a*Trifolium owyheense*), and Malheur valley fiddleneck (*Amisinckia crinata*), all of which have been identified by the BLM as threatened or endangered.[100] Despite efforts to eradicate or contain outbreaks, new sites are being found each year.[92]

Rush skeletonweed reaches new sites mainly by wind borne seed. However, increased occurrences at recreation sites indicate that those seeds also arrive with recreationists and their vehicles.[100] It is hard to control because of the deep taproots, and tilling it under can spread the rootstock. Rush skeletonweed does well on road sides, rangelands, grain fields, grasslands, open forest, and pastures.[111]

iv. ***Halogeton (Halogeton glomeratus)***

Halogeton is poisonous to cattle and sheep. The toxic substance is found in both fresh and dry plants. Halogeton is not highly competitive in vigorous range conditions, but thrives in disturbed sites or sites limited by alkaline soils. It produces two types of seeds: one has wings to blow in the wind and can germinate within one year and the other type can lie dormant for several years. Late in its growth stage it can break off and tumble across the landscape, spreading seeds as it rolls.[84,111]

Halogeton has gained a foothold along some of the roads in the upper Owyhee subbasin. From these sites it is expanding into neighboring rangelands since much of the upper Owyhee subbasin has alkaline soils.

v. ***Spotted knapweed (Centaurea maculosa)***

Spotted knapweed is one of the most dominant weed species in the western United States. It has seriously degraded millions of acres of prime range and native habitat throughout the northern Rocky Mountain states. It will form dense stands on any open ground, excluding more desirable forage species and native plants. On heavily infested range, the necessary control measures to recover the land are often more expensive than the income potential derived from grazing. It establishes on disturbed soil and is competitive for soil moisture and nutrients. A spotted knapweed plant can produce up to 1,000 seeds. Control success is hampered by seed longevity.[95,100,111]

vi. ***Yellow starthistle (Centaurea solstitialis)***

Yellow starthistle is an aggressive, adaptable weed that inhibits the growth of desirable plants in pasture, rangeland, and wasteland. It will grow wherever cheatgrass grows as well as growing in canyon grasslands, rangelands, pastures, edges of cropland, roadsides, and disturbed areas. This plant may become a problem in ground where the grass stand is weak. Many large rangeland sites in the western US have become dominated by yellow starthistle. It will grow in any type of soil and intermountain environment. Yellow starthistle is toxic to horses causing “chewing disease”, equine spongiform encephalopathy, if they eat it.[97,111]

vii. ***White top, hoary cress (Cardaria draba)***

Whitetop is a deep-rooted perennial that spreads by seed and vegetative root growth. It forms dense patches that can completely dominate sites, restricting the growth of other species and degrading pastures. The species is not toxic to livestock but is only grazed in the absence of more desirable species. White top had been mainly confined to riparian or seasonally wet areas for much of the time since its arrival in the area around 1930. However, white top has spread and is continuing to advance into many of the rangelands including the upper Owyhee subbasin. Whitetop spreads by

seed and vegetatively under the soil and is very competitive with native vegetation on disturbed or alkaline sites. [49,96,100,111]

viii. ***Dalmatian toadflax (Linaria dalmatica) and Yellow toadflax (Linaria vulgaris)***

Both Dalmatian toadflax and yellow toadflax can invade rangeland, overgrazed pastures, and roadsides. Both species are unpalatable, and although yellow toadflax may contain a poisonous glucoside, reports of livestock poisoning are rare. They reproduce by seed and horizontal rootsocks. A mature Dalmatian toadflax plant my produce as many as 500,000 seeds per year. The seeds can remain dormant in the soil for up to 10 years.[16]

ix. ***Scotch thistle (Onopordum acanthium)***

Scotch thistle is a wasteland weed that generally inhabits moist sites or drainages in dry locations. Scotch thistle can be found along roadsides, waste land areas, and lower range slopes, where there is more moisture than in surrounding range. Scotch thistle also invades grasslands and sagebrush communities, especially where there is disturbed soil. If not controlled, it presses into farmland or forms dense canopies in any area overgrazed or not under intense cultivation. It is a major issue in rangeland management.[8 ,54,94,111]

x. ***Diffuse knapweed (Centaurea diffusa)***

Diffuse knapweed will form dense stands on any open ground, excluding more desirable forage species. It is very competitive with native range plants, growing from taproots. It is very aggressive, and invades roadsides, waste lands, grass lands, and dry rangelands. It spreads rapidly and can quickly forms stands. Once established, the necessary extensive control measures are often more expensive than the income potential of the land. Diffuse knapweed grows under a wide range of conditions, such as those of riparian areas, sandy river shores, gravel banks, rock outcrops, rangelands, and roadsides.[82,111]

xi. ***Musk thistle (Carduus nutans)***

Musk thistle is unpalatable to wildlife and livestock. Wildlife and livestock selective graze on native plants and leave musk thistle alone, giving musk thistle a competitive edge. The musk thistle spines can harm animals and hinder their movement through infested areas. Musk thistle may produce chemicals that handicap the growth of other plants. Musk thistle invades fields and pastures, especially under conditions of heavy grazing. It spreads by seeds, taking advantage of human disturbance and is also found on ditch banks, stream banks, roadsides, waste lands, and in grain fields.[88,111]

xii. ***Houndstongue (Cynoglossum officinale)***

Houndstongue can be a serious problem in rangeland and pasture. The weed is highly invasive and can significantly reduce forage. The plant produces barbed seeds, or burrs, which allow the plant to readily adhere to hair, wool, and fur and can in turn reduce the value of sheep wool. In addition houndstongue contains large quantities of alkaloids which can cause liver problems in cattle and horses. Animals may survive six months or longer after they have consumed a lethal amount.[50,85,111]

xiii. ***Russian knapweed (Acroptilon repens)***

Russian knapweed can grow aggressively, eliminating most native plants. After invading rangelands or fields, it forms dense stands, spreading by rhizomes, horizontal plant stems with shoots above and roots below the ground, or by seed. Once established, it can overrun native grasslands as well as irrigated crops. It is bitter and not palatable to livestock. Its aggressive and deep spreading root system make it very difficult to control and it is drought tolerant. [52,93,111]

xiv. ***Buffalobur (Solanum rostratum)***

Buffalobur is not very competitive and survives in disturbed, dry areas. A native of the Great Plains, buffalobur is drought tolerant and grows most frequently on disturbed, sandy soils. The burs may cause damage and considerable loss in wool and fiber value for sheep and goats.[79,111]

xv. ***Bull thistle (Cirsium vulgare)***

Bull thistle is a biennial found in waste lands, along road sides, in fields and pastures, and many other places where there is disturbed soil. It takes the place of forbs and grasses and if not controlled, presses into farmland. The seeds develop on top of the flowers, with fluffy white tops which can be picked up by the wind and spread all over, infesting more places with this noxious weed. Horses consider the flowers to be a delicacy because the heads are filled with sugary nectar.[80,111]

xvi. ***Canada thistle (Cirsium arvense)***

Canada thistle invades crop fields, pastures, rangeland, riparian areas, roadsides, and waste lands. Individual plants easily grow into dense, persistent thistle patches. A lack of control will result in dramatic reductions in crop production in heavily infested ground. This strong, aggressive perennial is difficult to control. New infestations can be spread from seeds, but are more often caused by redistribution of roots by tillage practices.[81,111]

e. Riparian noxious weeds

Although a number of the noxious weeds grow primarily in riparian areas, they can affect the health of the rangeland. A variety of range animals, both wild and domestic, may rely on the riparian area as part of their habitat.

i. ***Poison hemlock (Cicuta douglasii)***

Poison hemlock is a highly toxic plant and commonly infests riparian areas. It is considered to be one of the most poisonous plants in North America. It has accidentally poisoned many who have mistaken it for water-parsnip or other edible plants of the same family such as celery, parsley, and sweet anise. Several deaths of livestock and humans are attributed each year to poison hemlock. Poison hemlock can be found in marshes, wet meadows and pastures, along stream banks, and on roadsides.[90,100,111]

ii. ***Saltcedar, tamarisk (Tamarix ramosissima)***

Tamarisk or saltcedar is a strong perennial shrub to small tree species that is invading riparian areas in the mid Snake River region, and the upper Owyhee subbasin.

Tamarisk is known to use prolific amounts of water and dry out riparian areas. It has a habit of mining salts from the soil profile and exuding them on the surrounding soil, rendering those areas unable to support plant species that cannot tolerate saline conditions.[100,111]

Salt cedar is at or near the top of the list of noxious invasive weeds for all agencies. There is a high probability that established salt cedar will limit the ground flow of water to an extent that it may affect fish and wildlife. Tamarisk has very prolific seed production and can out compete native riparian trees and shrubs. [65,100,111]

iii. Perennial pepperweed (Lepidium latifolium)

Perennial pepperweed establishes and colonizes rapidly. It degrades riparian areas and nesting habitat for wildlife. It can completely displace desirable species in natural riparian areas and hay meadows. It lowers the digestibility and protein content of hay and inhibits grazing. It can grow in a large variety of habitats but grows best along streams and in other wet areas such as ditches, roadsides, and marshes. Perennial pepperweed had been mainly confined to riparian or seasonally wet areas since its arrival about 1930. However, perennial pepperweed is appearing in some very remote seasonal streams and springs. Perennial pepperweed spreads through root fragmentation and seed.[89,100,111]

iv. Purple loosestrife (Lythrum salicaria)

Purple loosestrife is a vigorous noxious weed that crowds out marsh vegetation required by wildlife for food and shelter. It can eventually destroy marshes and choke waterways. Decreased waterfowl and songbird production has been well documented in heavily infested marshes. Purple loosestrife is an escaped former ornamental species and can be found along wetlands, stream banks, or farm ponds. One plant can produce 300,000 seeds a year, as well as being able to reproduce by offshoots and cuttings.[91,111]

f. Other invasive range weeds

There are other weeds which have not been classified as noxious by the state of Oregon, Nevada, or Idaho, but which may affect the rangeland of the upper Owyhee subbasin.

i. Bur buttercup (Ranunculus testiculatus)

Bur buttercup has rapidly colonized broad expanses of rangeland. Since bur buttercup begins growing early in the spring and has a short growing season, it can use most of the available moisture before many of the annual native species have emerged. It spreads into bare, denuded sites subject to erosion. Because it is comparatively shallow rooted, produces scant biomass, and has a relatively short life span, the potential for soil erosion in areas where it is dominant continues to be very high. It is toxic to sheep and can be competitive with small grain crops. Bur buttercup seed heads are irritating to hands, knees, or bare feet. The seed and seed heads also have the annoying habit of sticking to shoe laces, pants cuffs, etc. with tiny Velcro-like spines. [48,100,111]

ii. Moth mullein (Verbasum blattaria)

Moth mullein is a sun-loving plant usually found on bare hillsides, in worn out fields, in closely grazed pastures, along fence rows that are not overgrown, and in other waste places. Livestock will not eat the hairy, felt-covered leaves. It cannot stand much competition, even by grass, but prospers on dry poor upland soils. Moth mullein can be invasive in pastures and rangelands affecting forage quality and quantity. It has the potential to displace native species.[19,30,111]

5. Cheatgrass, downy brome (*Bromus tectorum*)

Cheatgrass is considered as a desirable forage grass in many places and a valuable forage resource. It provides a substantial amount of forage for many livestock operations and some of the earliest green feed available to deer on some winter ranges.[101,122] Other rangeland scientists and ranchers consider it an undesirable exotic or noxious weed.[17,26,67]

Cheatgrass is vigorous, short lived, and widely distributed. Cheatgrass does provide forage but can form dominate stands following repeated fire events. It grows rapidly and competes with and replaces native grasses. It is a widely adapted plant and has spread throughout the upper Owyhee subbasin.[100,111]

a. Why it spread

As early as 1900 uncontrolled livestock grazing had depleted and permanently altered vegetative composition of rangelands. Although an exotic species, cheatgrass was well adapted to the climate and soils in much of Idaho, Nevada, and Oregon. Cheatgrass filled the void left vacant by the reduction of native herbaceous vegetation by legacy livestock grazing.[67,101,120]

b. Competitive advantage

Cheatgrass competes strongly with native grasses and planted crested wheatgrass. It not only is a prolific seed producer, but the seed is highly viable. The seed is capable of germinating in either the spring or autumn, giving it a competitive advantage over native plants. Viable cheatgrass

Photo 7.4. Rangeland dominated by cheatgrass above Red Basin in the upper Owyhee subbasin

seeds can survive in the soil for up to five years, enabling cheatgrass to survive periodic drought.[67,101]

Cheatgrass germinates early in the season or in the fall and overwinters. It grows rapidly following emergence. It has rapid and extensive root penetration into the soil and extensive root development. Cheatgrass has been shown to reduce the growth of seedlings of bluebunch wheatgrass and crested wheatgrass. By extending its roots during the winter, it gains control of a site before bluebunch wheatgrass seedlings become established. Cheatgrass is capable of producing twice as many roots as bluebunch wheatgrass seedlings during the first 45 days of growth. Its roots also move down into the soil faster than those of bluebunch wheatgrass. [35 ,36,37,67,101]

Cheatgrass has a short growth period relative to native plants. It can out compete native plants for water and nutrients in the early spring since it is actively growing when many natives are initiating growth. It matures four to six weeks earlier than bluebunch wheatgrass and utilizes the limited moisture supply prior to use by bluebunch. Cheatgrass is tolerant of grazing and increases with frequent fire.[67,101]

c. Fire danger

Cheatgrass ranges burn frequently. Wildfire return intervals are now less than five years on some rangelands heavily infested with cheatgrass. The short growth period of cheatgrass relative to native plants increases the likelihood that wildfires will start and spread. Cheatgrass becomes flammable four to six weeks earlier and remains highly flammable for one to two months later than native perennials. Cheatgrass is usually dry by mid-July when perennial plants may contain 65% moisture. Standing dead cheatgrass and litter are extremely flammable resulting in shorter wildfire return intervals. As cheatgrass ranges burn frequently, the population of native plants is limited so that natural reseeding of the site doesn't occur.[17,67,101]

As fire cycles increase, cheatgrass abundance increases until the rangeland is essentially a cheatgrass range. Some federal land managers call this a "locked in" range. The name "locked in" refers to the never ending cycle of fire with more cheatgrass filling in the interspaces until perennial plants such as Wyoming sagebrush and bluebunch wheatgrass become replaced.[67] In these rangelands, each fire further reduces the native plant population with the accompanying loss of native plant seed production.

d. Removal of livestock

Some cheatgrass communities have maintained a steady state that would not return to native vegetation after livestock removal. Some researchers have speculated that the removal of livestock from rangeland could increase the rate of conversion of the range to cheatgrass because of the increased fuel accumulations which would result in more frequent wildfires.[101] Livestock will eat cheatgrass, limiting fuel accumulation.

e. Other considerations

Cheatgrass normally provides adequate soil cover for watershed protection. Cheatgrass litter effectively reduces raindrop energy and promotes infiltration. However

in drought years and after a wildfire, this protection is reduced and the potential for erosion is increased.[101]

Forage quality and digestibility also affect cheatgrass use by livestock. The period that cheatgrass is palatable and nutritious for herbivore consumption is considerably shorter than for most native herbaceous plants. Forage quality declines as cheatgrass matures, therefore early spring to early summer grazing provides the greatest nutritional benefits to livestock.[101]

f. Research, solutions, and unknowns

i. Greenstrips to reduce fire danger

Strips of fire resistant vegetation, greenstrips, can be used to manage the fuels on rangeland. These strips are designed to slow or stop wildfires. As early as 1946, Platt and Jackman proposed planting fire resistant species in strips in cheatgrass areas.[102,104]

Wildland fires burn differently depending on the type of vegetation, the amount of fuel, the proximity of fuel sources to each other, the water content, and the fuel volatility. Greenstrips slow fires by separating volatile fuels and disrupting fuel continuity, reducing the amount of accumulated burnable material, and increasing the proportion of plants with a higher moisture content. Fine fuels that readily ignite and carry fire are replaced with perennial, less flammable vegetation.[39,102]

Reports suggest that forage kochia (*Bassia prostrata*) is a very effective greenstrip species to decrease fire frequency by successfully competing with and decreasing cheatgrass density. Forage kochia has four times the moisture content of crested wheatgrass and ten times the moisture content of cheatgrass. Fires have burned up to a forage kochia greenstrip and stopped because of the green biomass and sparsity of contiguous fine fuels. When fires burn in forage kochia the flame length and intensity are both reduced, aiding fire fighting.[39,102]

There have only been a few burning trials of forage kochia and there is a lack of published data on its fire suppressant qualities. The most efficient greenstrip width, best establishment practices, and potential combinations with other greenstrip species are unknown.[39]

ii. Competitive native vegetation

There have been promising initial studies that show that squirreltail can invade both cheatgrass and medusahead stands. Is it a more promising native plant to seed in cheatgrass infested areas?[67]

iii. Management to increase native vegetation

A five-year research project is being conducted that will explore ways to improve the health of sagebrush rangelands across the Great Basin in the western United States. The purpose of the SageSTEP project is to conduct research to be able to provide land managers with improved information about sustaining and restoring sagebrush rangelands. The project is a collaboration among the USGS, Oregon State University, University of Idaho, University of Reno-Nevada, Brigham Young University,

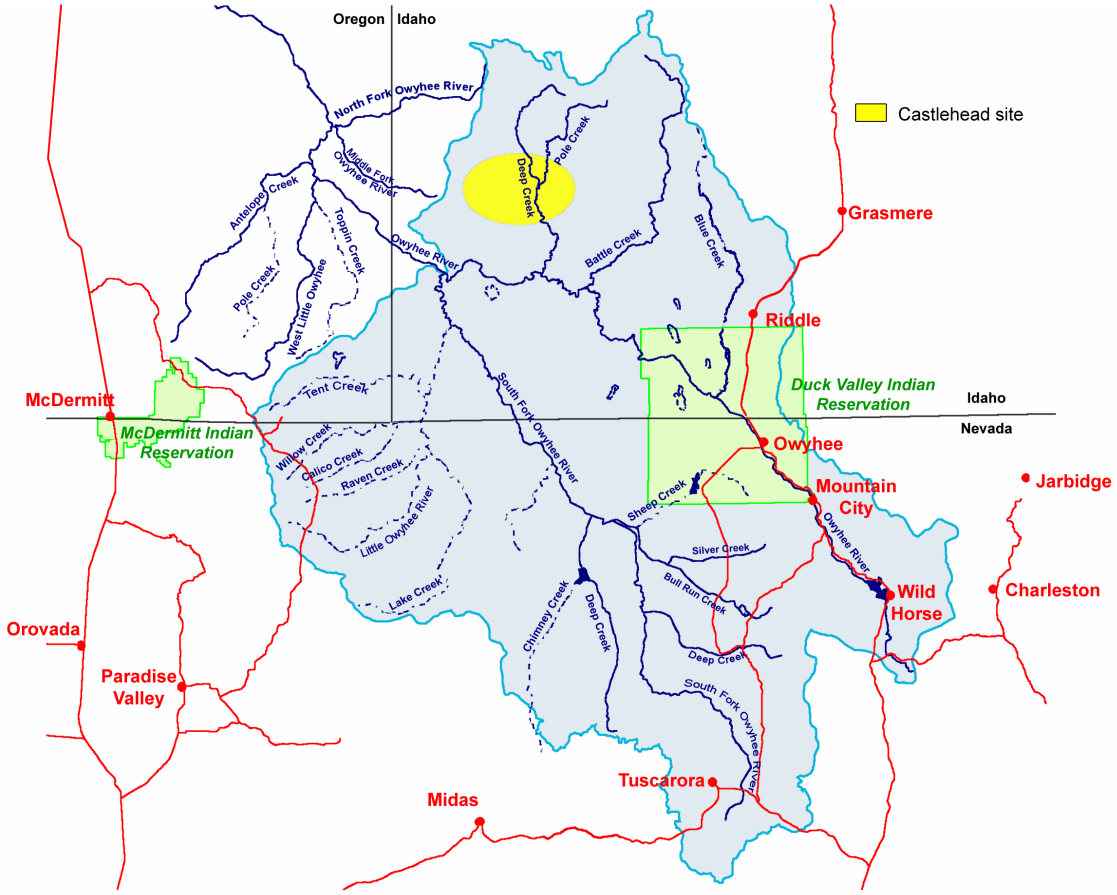

Figure 7.4. Location of the Castlehead site of the SageSTEP project in the upper Owyhee subbasin.[107]

US Department of Agriculture (USDA) Forest Service, USDA Agriculture Research Service, and BLM.[1,114,127]

One of the two experiments of this project is focused on sagebrush communities threatened by cheatgrass invasion. Four primary land-management treatment options will be studied including prescribed fire, mechanical thinning of shrubs and trees by mowing, herbicide applications, and a control with no management action. Some sections within the treated areas will have an additional herbicide application applied to control cheatgrass. One objective is to discover how much native perennial bunchgrass needs to be present to create a community that will be more resistant and resilient to fire and weed invasion without having to conduct expensive restoration.[1,127] One of the cooperating sites, the Castlehead Site, is within the upper Owyhee subbasin. Three 35 to 60-acre core plots will include a control and be treated mechanically and by burning. Burning will also be done on a 3200 acre plot with a 2545 acre control plot (Figure 7.4).[107]

In cheatgrass infested rangelands, could livestock grazing management practices be used strategically to improve the vigor and quantity of native perennial vegetation by reducing the competition from cheatgrass?[101]

iv. Understanding conditions favoring and retarding cheatgrass dominance

Dominance by cheatgrass varies depending on the elevation. At higher elevations cheatgrass performance is closely related to temperature. At lower elevations it is related to soil water.[123] Can we use these relationships to anticipate which areas are most subject to cheatgrass dominance?

The USGS has begun an investigation of factors related to cheatgrass performance including climate, sources and forms of soil nutrients, soil characteristics, underlying geology, and topologic location.[7]

6. Western juniper (*Juniperus occidentalis*)

a. Juniper expansion

Since the settlement of Euro-Americans, juniper has been spreading throughout the Great Basin including the Owyhee uplands and the upper Owyhee subbasin (Figure 7.5). Although the data on expansion are not specific to the upper Owyhee subbasin, anecdotal information indicates that the trends documented in adjacent areas apply to the subbasin. In southwestern Owyhee County of Idaho, the area occupied by western juniper has more than doubled from what was occupied in 1860.[69] "Analysts estimate the annual encroachment rate in Owyhee County to be as high as 2500 acres/year."[145]

The invasion of juniper into sagebrush steppe communities over the last 120 years has been documented by various methods including determining the age of trees, studies of juniper pollen increases, and comparisons of aerial photographs. The expansion of juniper in southeastern Oregon began in the late 1860s and accelerated in the 1880s. In the state of Oregon the estimated area of juniper forest and savanna is over four times the acreage of 1930.[5,38,68,69,123,136]

b. Problems of juniper expansion

Juniper expansion into sagebrush communities results in many negative consequences. These changes result primarily from the fact that juniper hogs water.

i. Changes in plant community

Juniper invasion results in major changes in the plant community composition. Increasingly abundant juniper outcompetes other native vegetation for water. Biomass production is significantly affected and there can be a serious loss of forage. The diversity of plants in the community is reduced and desirable understory vegetation can disappear. The amount of ground covered by herbaceous (non-woody) plants is diminished. The grass clumps are smaller and more widely spaced so there is an increase in bare ground. As juniper utilizes more of the water and nutrients at a site, other plants lose vigor and die.[5,69,70,136]

ii. Wildlife

A change in the plants growing in an area alters the wildlife habitat and impacts the wildlife species. Increasing dominance by juniper results in a decline in wildlife abundance and diversity. Much of the food for large herbivores like mule deer, pronghorn antelope, and elk disappears. Fawning habitat for deer is reduced by

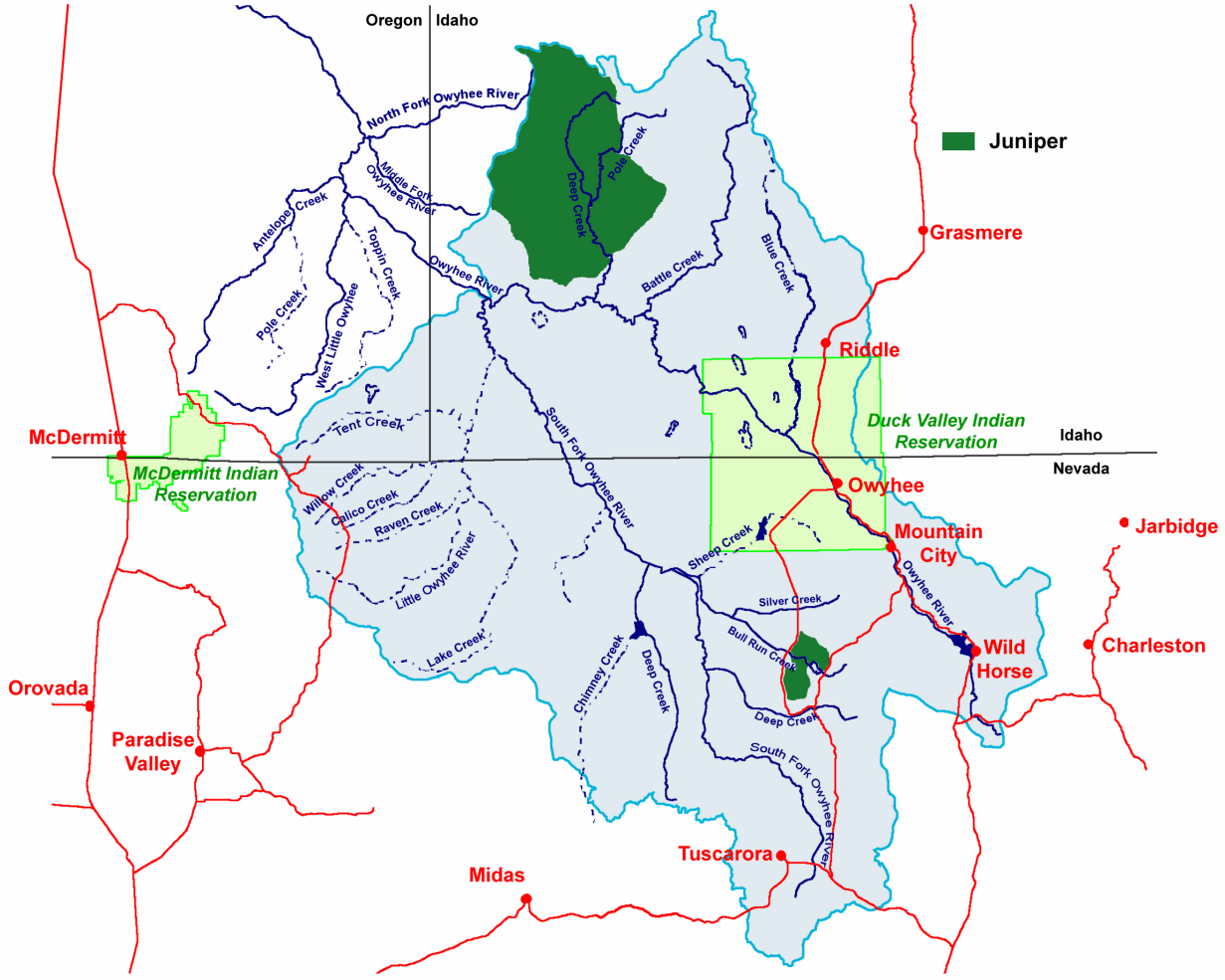

Figure 7.5. Locations of juniper in the upper Owyhee subbasin.[70]

replacement of big sagebrush with juniper. Some of the shrub-steppe communities which pronghorn antelope prefer in winter and spring disappear. The small mammal population is affected by both decreases in food and cover.[5,68,70,136]

With juniper encroachment, there are fewer shrub-steppe birds. How much the population of a species decreases with increasing western juniper varies. Species which require sagebrush, including the sage grouse, are very sensitive to juniper invasion into sagebrush communities. Nesting habitats for birds such as the sage grouse disappear.[5,68,70,136]

c. Changed hydrology

"Juniper encroachment into shrub-grassland communities modified historical patterns on the land, and the new resident truncates the hydrologic cycle in the watershed. Juniper is a voracious water consumer, leaving less for sagebrush, grasses and forbs."[145]

Juniper roots extend over a wide area and deep into the soil, depleting water from the soil. In addition, the juniper canopy intercepts a large amount of precipitation, reducing the amount of moisture actually reaching the soil. Measurements below

Photo 7.5. Juniper expansion into the rangeland of the upper Owyhee subbasin near Juniper Mountain

juniper show a reduction in precipitation of 20% near the canopy edge to 75% under the canopy by the trunk.[5,68,70,136]

The structure of the changed plant community can affect infiltration rates and overland flow of water. Where plant cover has changed from more evenly dispersed to clumped plants, there is increased soil erosion. Hillsides with juniper had runoff in a thunderstorm with an intensity that occurs about every two years. Similar hillsides with no juniper only had runoff from the type of thunderstorm that occurs every 50 years. With a 50-year thunderstorm, the hillside without juniper lost no sediment, but the hillside with juniper lost 275 lb/acre of sediment. The loss of nutrients off site in sediment will ultimately change soil fertility and cause a reduction in plant community productivity.[68,69,70,103]

Juniper expansion may lead to the loss of sustained stream flow. There is ample anecdotal evidence that streams, springs, and meadows have dried due to increased juniper. Where juniper has been removed the flows have returned. Juniper expansion may be a substantial factor in the loss of stream function.[6,24,41,70,119]

An indication of the amount that juniper expansion may result in diminished stream flows is the result of changes in hydrology following juniper removal. In Eastern Oregon, two watersheds were paired and monitored for twelve years. Following this monitoring, in 2005 all juniper trees less than 140 years of age on one of the watersheds were cut. After two years, in the watershed where juniper were cut, the spring flow, groundwater, and soil moisture had all increased when compared to pre-treatment levels. There was no clear trend in the flows in ephemeral channels. The results suggested that juniper removal in the uplands can create a herbaceous groundcover across hillslopes. The resulting reduction in bare ground should decrease soil erosion.[23]

d. Previous range

A characteristic of the location of older western juniper stands is that the sites where they are growing are mostly naturally shielded from fire. Old-growth juniper typically occupy rock outcrops, rocky ridges, or rimrock. Junipers grow in fractured bedrock in these spots .[15,14,69,70,121,136]

A small minority of juniper stands are ancient with trees that are 1,000 years old or older. One juniper tree growing east of Bend has been determined to be 1600 years old. Old juniper growth is a relative term. Younger juniper trees are between 80 and 130 years old and typically are an inverted cone shape. Older trees have a round-topped crown and become unsymmetrical in appearance with spreading canopies that may be sparse.[69,70,136]

About 10 percent of the existing western junipers were established before the 1870s. Stands of these older trees have long achieved a steady state. The other 90 percent of areas occupied by juniper are still in transition.[70,136]

e. Reasons for juniper expansion

i. Previous fire intervals

Fire has been an important natural factor in the environment of southwestern Idaho and southeastern Oregon for "at least several centuries preceding white settlement."[15] Native Americans deliberately set fires to improve forage for game, maintain or increase the yield of certain wild edible plants, or increase seed production. In the 1820s Peter Skene Ogden noted abundant evidence of fires caused by Native Americans. These fires had probably been set throughout the 1700s, if not earlier, to add to the number of fires started naturally. Following a fire ignited naturally or by man, there would be a new flush of grasses and wildflowers. Young juniper would be killed.[68,136]

Young juniper is much more severely affected by fire than older trees. Just scorching of the crown and stem can kill young juniper, especially seedlings and saplings. In some recent burns nearly all the juniper less than 50 years old was killed. Prehistoric fire frequency was probably less than every 50 years. The plant species comprising sagebrush communities are a product of an environment which included relatively frequent fires and are adapted to survive periodic burning. Although big sagebrush is readily killed by fire, the stands generally regenerate quickly from

Photo 7.6. Juniper trees on Juniper Mountain burnt by fire in 2007

surviving plants and seed. Juniper, especially young juniper, is not adapted to survive burning. Juniper became established in areas which fires would not completely burn.[15,14,131]

In big sagebrush plant communities with Idaho fescue the fire return intervals typically ranged between 10 and 25 years. Large fires occurred about every 40 years. However, in the more arid areas with big sagebrush, fire return intervals could range up to 50 to 100 years. In Eastern Oregon large fires in sagebrush-steppe communities were preceded by at least one year with above-average precipitation. A series of wet years would allow greater quantities of fuels to accumulate that could carry fire. When fire return intervals become greater than 70 years, the probability that juniper will establish and successfully mature greatly increases.[15,69,70]

ii. Juniper encroachment

Invasion of juniper and its phenomenal expansion is attributed to the reduced occurrence of fire. Fire return intervals now exceed 100 years and there has been a reduced role of fire since the 1870s with a large decline in the occurrence of fires since 1910.[15,69]

Livestock have grazed on the Owyhee Plateau since the late 1860s. When Griffiths crossed from Nevada to Ontario, Oregon in 1902, he commented that "no open-range lowland was seen on the whole trip which had much feed upon it excepting that consisting of the tough and persistent salt grass."[31] Overgrazing by domestic livestock reduced not only the supply of feed but also the supply of fine fuel available to carry fire. Fire was less effective and did not spread far. Fire suppression did not become a major factor in range management until after World War II.[5,15,68,69,70]

Overgrazing at the close of the 19th and beginning of the 20th centuries and fire suppression by state and federal agencies during the last 60 years have reduced the occurrence of fires that would have killed smaller juniper. Juniper expansion in eastern Oregon occurred at the same time fire return intervals increased.[5,15,17,24,68,69] Most of the upper Owyhee subbasin is part of the Owyhee Plateau where "A cause and effect relationship between the decline in periodic fires and the initiation and rate of juniper invasion on the Owyhee Plateau is suggested by the data."[15]

f. Progression of invasion

Overgrazing is not the direct cause of juniper invasion, but indirectly affects juniper expansion through decreasing fire frequency and intensity. Most older trees grew on ridges or rimrocks and juniper seedlings establish downslope from the old juniper. Most juniper seed is spread close to the parent plant, about 4½ feet downhill and two feet uphill. Seeds are apparently spread by small mammals as the seeds are found in the droppings of cottontail rabbits and ground squirrels. Although mule deer will eat juniper when other food is not available, this is generally after most juniper seeds have dropped to the ground. Birds also spread juniper seed. Seed buried in the soil can germinate a number of years later.[15,69,136]

Juniper seedlings establish in the protected areas under the crown of shrubs, usually big sagebrush, possibly because this is a bird perch. The density of seedlings is

negatively related to bare ground and positively related to the presence of shrubs and trees. In an unusually dry year in the Owyhee uplands, 1967, 71% of seedlings survived the first year and 60% survived for two years.[5,15,56]

When juniper is first established the trees are widely scattered and the community is dominated by sagebrush and grasses. The understory of grasses and shrubs begins to decline when the trees reach 45 to 50 years old. Juniper begins to exclude other species through moisture competition and halting juniper expansion becomes more difficult. Eventually juniper outcompetes other native vegetation including smaller junipers, sagebrush, and grasses. By the time the trees are around 100 years old the juniper has become so dominant that it is unlikely that there is enough native understory community left to reestablish itself even if the trees are removed.[5,70,136]

Much of the sagebrush-steppe in the Owyhee uplands with juniper trees already growing on it is still developing into juniper stands. Juniper seedlings on these lands indicate that juniper is still in an establishment stage, and that the probability juniper on these lands will continue to increase in density is greater than for areas with a single old juniper.[5]

g. What to do

Without treatment, areas of range that have been invaded will continue to decline in forage productivity due to the effect of young trees already present. The problems created by juniper invasion can not be solved by grazing manipulation alone. There is no reason to believe that competition from other vegetation will either crowd out existing juniper or prevent the establishment of new juniper plants. In the early and middle stages of development, juniper invasion can be successfully treated by various methods, particularly fire. Where native grasses, forbs, and shrubs were present in southeastern Oregon, they increased following juniper removal and there was a good chance they would regain dominance.[15,69,70,136]

The ability to predict the outcome of western juniper removal decreases when juniper becomes more dominant. Several reburns might be required to destroy all the residual seed in the soil in established juniper stands. The composition of the understory prior to juniper removal affects the chance of reestablishment of desirable species. Instead of reverting to native grasses and shrubs, the range can achieve a new steady state with invasive species such as cheatgrass or medusahead and leave the site in poorer shape than before.[17,68,69,70,136]

Chemical treatments to control western juniper have had limited success. Sites where chemical control is appropriate are limited. Prescribed fire and mechanical treatment have both been effective reducing juniper dominance of an area. The Sagebrush Steppe Treatment Evaluation Project has produced a field guide to selecting the appropriate management actions for different juniper woodlands.[71] (Available on-line at http://pubs.usgs.gov/circ/1321/). Appropriate management actions are determined by the composition of the vegetation layers, economic feasibility, and social acceptability. Where the understory vegetation is more sparse, fire will not necessarily carry well. Where fire will carry, preparation of the land for burning and predicting the

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Photo 7.7. Adjacent plots in the upper Owyhee subbasin in the spring. The photo on the left shows the untreated area. The picture on the right shows the regrowth following juniper mastication the previous fall.

esponse to fire are difficult. Mechanical treatments have been used successfully in many areas, frequently leaving cut trees or slash on the site.[71]

To remove encroaching junipers, the Owyhee County Sagegrouse Local Working Group partnered with the Jordan Valley Cooperative Weed Management Area and the Nature Conservancy on a mastication project on private land near Juniper Mountain within the upper Owyhee subbasin. Hayden-based Environmental Forestry used masticators to destroy juniper trees in the mud flat section of the subbasin in the fall of 2009. There was "minimal impact to the soil, sagebrush and bunchgrasses."[144] The principal goal for the local sagegrouse working group was to improve sagegrouse habitat by controlling juniper encroachment on ranch land. The site will also be monitored for forb and grass populations so that this conservation practice can be weighed against other juniper control methods.[47,143,144] The authors visited the site of the mastication project in early July, 2010. The treated area appeared to have more bunchgrasses and native forbs than the nearby untreated areas.

The current increase in juniper is aided considerably by human activity. Continued increase can affect the ecological functioning of the natural communities of juniper, sage, and bunchgrass. It's important to maintain functioning hydrological and nutrient cycles and healthy understory communities to provide habitat for sage grouse and food and shelter to a rich diversity of wildlife.

7. Invasive weed control

a. Fire

Periodic fire has been mentioned above as a means to keep juniper from invading rangelands. However in some areas fires have become more frequent and severe. Historic overgrazing followed by vigorous fire suppression reduced the number of fires. Reduction in fires meant that sagebrush and juniper cover increased. With removal of overgrazing, fine fuels, especially cheatgrass, filled the interspaces between the shrubs allowing fires to spread. Increases in the continuous proximity of fuels allows rapid spread of fires. These fires can be very destructive to existing perennial

vegetation and extremely difficult to control. Cheatgrass may become the dominate species following fire in some areas. Dominance by cheatgrass then promotes frequent burns to the detriment of existing or reestablishing shrubs and perennial grasses.[22,43,131]

Fire is an important tool in range management. Another grass which is invading areas of the upper Owyhee subbasin is medusahead rye. Although medusahead rye supports frequent fire cycles, prescribed burning has shown great success in the management of medusahead. Timing is critical. Medusahead seed maturity needs to be in the milk or soft dough stage. The fire is best set when the relative humidity is about 30% to 50% and it will burn slowly into a light breeze. A complete burn is necessary. There is no germination of medusahead seeds which are completely burnt. Uncharred seeds may still have 87% germination. Under wildfire conditions only 50% of the seed is usually destroyed.[25,100]

Controlled burns are also effective on yellow starthistle. Unfortunately the proper timing, early to mid-summer, is when the risk of escaped fires is very high. Also the seeds can survive three or more years in the soil and three consecutive years of burning are needed.[25]

Studies show that few non-target plants respond negatively to prescribed summer burning. Those that do respond negatively are generally non-native species. The most important positive impact of prescribed burning for invasive weed control is the potential increase in native perennial grasses. In general controlled burns increase the plant diversity, particularly of native plants. Most studies show that this is due to an increase in forbs. The amount of land covered by summer native legumes can increase. Although most species benefiting from burns are desirable, in some cases invasive perennials can increase following a prescribed fire.[25]

Controlled fires or wildfires have some effect on diffuse knapweed if the seeds are exposed to the direct heat from the flames of the burn. Prescribed burns don't control spotted knapweed, leafy spurge, or dalmatian toadflax regardless of the timing. Saltcedar is favored by fire. It readily resprouts from the base following fire or mechanical damage. In most cases, successful control of invasive perennial forbs involves integration of other control options.[25]

b. Integrated management

Noxious rangeland weeds are highly competitive and persistent and control requires an integrated approach. Since invasive weeds know no boundaries, they can infect both public and private lands. Weed control efforts will be more successful if local public and private property managers develop coordinated management strategies. Fire, herbicides, and grazing management plans can all be part of weed control. An integral part of any control program is mapping where weeds exist.[22,25,64]

The most effective method for managing noxious weeds is to prevent their invasion into new areas. Possible methods to limit noxious weed encroachment include early detection and eradication of new weed introductions, limiting weed seed dispersal, containing neighboring weed infestations, minimizing soil disturbances, and establishing competitive species.[108,109]

Successful weed species have seed adapted to spread. Wildlife and livestock can ingest seeds which pass through unaffected and are introduced to new areas. Timing of livestock grazing on weed infested areas can minimize both the amount of seed which matures and the amount of mature seed which is carried to other areas. A vehicle driven through spotted knapweed can pick up 2000 seeds and still be carrying 10% of them 10 miles from the infestation. Flowers picked by hikers, campers, and recreationists can produce viable seed after they are discarded. Seed can stick to the coats of wildlife or livestock and to the clothing of people. [108,109]

Weed infestation can be contained to existing areas to protect neighboring uninfested rangeland. Spraying borders of infested areas may contain the weeds although it doesn't eliminate the infestation and is a long-term commitment to weed control. It also enhances the future success of eradication efforts. [108,109]

Eradication of existing weed species depends on using control techniques appropriate for the site and weed species. This includes the effectiveness of the technique, the availability of control agents including labeled uses of herbicides, the presence of grazing animals, and environmental considerations. Some control measures may need to be repeatedly applied until the weed seed bank and root reserves are exhausted. [25,109]

Herbicides with short half-lives need to be available for use whenever herbicides are part of the management program.

Reestablishment of native species can prevent reinfestation with noxious weeds. Replanting in the upper Owyhee subbasin needs to be with species that are competitive with cheatgrass and medusahead.

c. Weed control efforts

Part of the upper Owyhee subbasin is within the Jordan Valley Cooperative Weed Management Area (CWMA). The Jordan Valley CWMA has brought together everyone with responsibility for weed management within the CWMA including, but not limited to, landowners, cattlemen, Owyhee and Malheur Counties and their weed departments, the Oregon and Idaho departments of agriculture, the Nature Conservancy, the local sage grouse working group, Oregon and Idaho BLMs, and the Oregon Watershed Enhancement Board. The Jordan Valley CWMA "developed common management objectives, set realistic management priorities, facilitated effective treatment methods, and coordinated efforts along logical geographic boundaries with similar land types, use patterns, and problem species. The CWMA has also provided educational opportunities to the general public as well as to local landowners raising their awareness of the problems associated with noxious and invasive weeds."[12,99]

In addition to involvement in cooperative spray projects for selected weeds, the Jordan Valley CWMA has been involved with the release of biocontrol agents. Educational efforts have not only included monthly meetings but also the publication of information sheets on specific weeds and their control. Annual weed seminars have provided education about the problems associated with noxious and invasive weeds

and treatment options for different weed species. Funding continues to be a hurdle to accomplishing the goals of the CWMA. [12,47]

Although the Elko County CWMA in Nevada focuses primarily on the Ruby Mountains to the south of the upper Owyhee subbasin, they have held an annual Elko Weed Summit to supply information to all residents of Elko County about noxious and invasive weeds, particularly on public lands. Ranchers have also been introduced to the idea of using ruminants to control weeds.[74]

The Elko County CWMA also was a sponsor of an extension manual for weed control in NE Nevada that contains guidelines for 24 invasive weeds and seven "nuisance" weeds. For each species, the weed is pictured and identified with distinguishing characteristics. Methods to control the weed are listed, along with the rates of chemicals to use when chemical control is indicated. In May of 2011, the guide was available on the Internet at http://www.unce.unr.edu/publications/files/ho/2005/eb0502.pdf.[64]

d. Special considerations

Rush skeletonweed is hard to control with herbicides because of the deep taproots and spreading roots, and tilling it under can spread the rootstock.

Whitetop spreads by seed and vegetatively under the soil and is very competitive with native vegetation on disturbed or alkaline sites. It has also been found that one time tilling of the soil will spread this noxious weed, and that it takes 3 consecutive years of tilling to destroy the root system.

Russian knapweed can be successfully controlled with combinations of grazing and herbicides but control programs must persist for several years.[93]

Special species of fruit fly (*Urophora affinis* and *U. quadrimaculatus*) have been introduced as a partial biological control of spotted and diffuse knapweed. Larvae within galls on knapweed seedheads eat the developing seeds, leaving only 5-20 seeds instead of 30.[27]

The leafy spurge flea beetles (*Aphona czwalinae*, *A. lacertosa*, and *A. nigriscutis*) are a promising biocontrol for leafy spurge. Trials have shown that the flea beetles dramatically reduced the cover and expansion of leafy spurge. However, there is some indication that species richness of treated areas declined.[20,55]

Expanded biological weed control efforts are warranted.

E. Fire suppression

Prescribed burns in the spring when the vegetation is still moist may be part of the management system of an area. However, wildfires when the vegetation in tinder dry are a different matter.

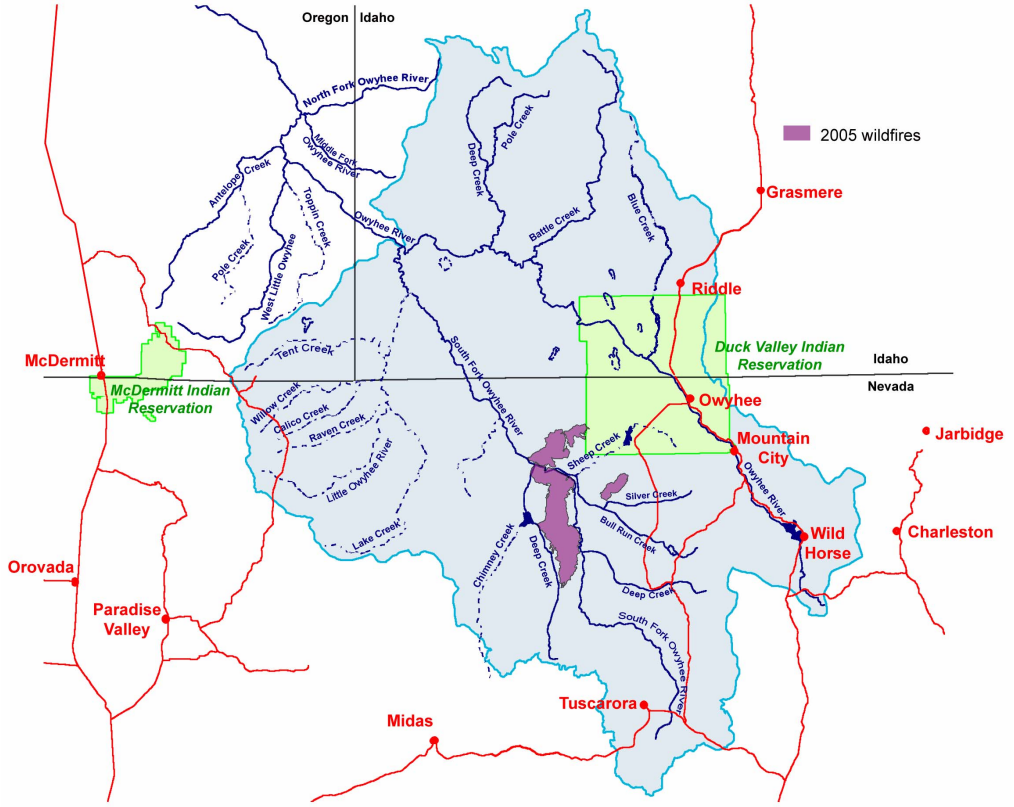
Fire is a natural component of many ecosystems. However, the invasion of cheatgrass has been fueling larger, more frequent fires. The more dense and continuous source of fuel extends the fire season and increases the frequency of fires. These fires may diminish or eliminate many of the native plant species. Cheatgrass

also out-competes many of the native forb and grass species that are part of the ecosystems. The BLM actively fights most wildfires on BLM land.[105]

In 2005 and 2006, wildfires burnt significant areas of rangeland in the Nevada section of the upper Owyhee subbasin (Figures 7.6 and 7.7). In 2007, a wildfire on Juniper Mountain burnt an area in the Idaho section of the subbasin (Figure 7.8) . Figure 7.9 shows the areas of the upper Owyhee subbasin burnt by wildfires between 2001 and 2007. There were no significant fires in the subbasin in 2008 or 2009.

Following a fire on BLM land, cattle are removed from that section of range for at least two grazing seasons to allow the area to recuperate.[11] The primary goal of rehabilitation for a burned area is to protect the burned area from erosion and halt the spread of invasive species by developing a stable plant community. If a burned area will recover naturally, no reseeding is done. If it will not naturally recover, the burned area may be reseeded. Reseeding may be done with either native or non-native plants. An executive order of President Clinton directed that native forbs and grasses be used wherever possible. [45,105]

Restoration differs from rehabilitation. Restoration is the use of a mixture of only native species to obtain a plant community that is similar in appearance and function to the vegetation prior to European settlement. Restoration is designed to develop ecosystems such that they are self-sustaining. One challenge is to figure out whether these area were naturally dominated by sagebrush, grasslands, or both. Total



Appendix A

Figure 7.6. 2005 wildfires in the upper Owyhee subbasin.

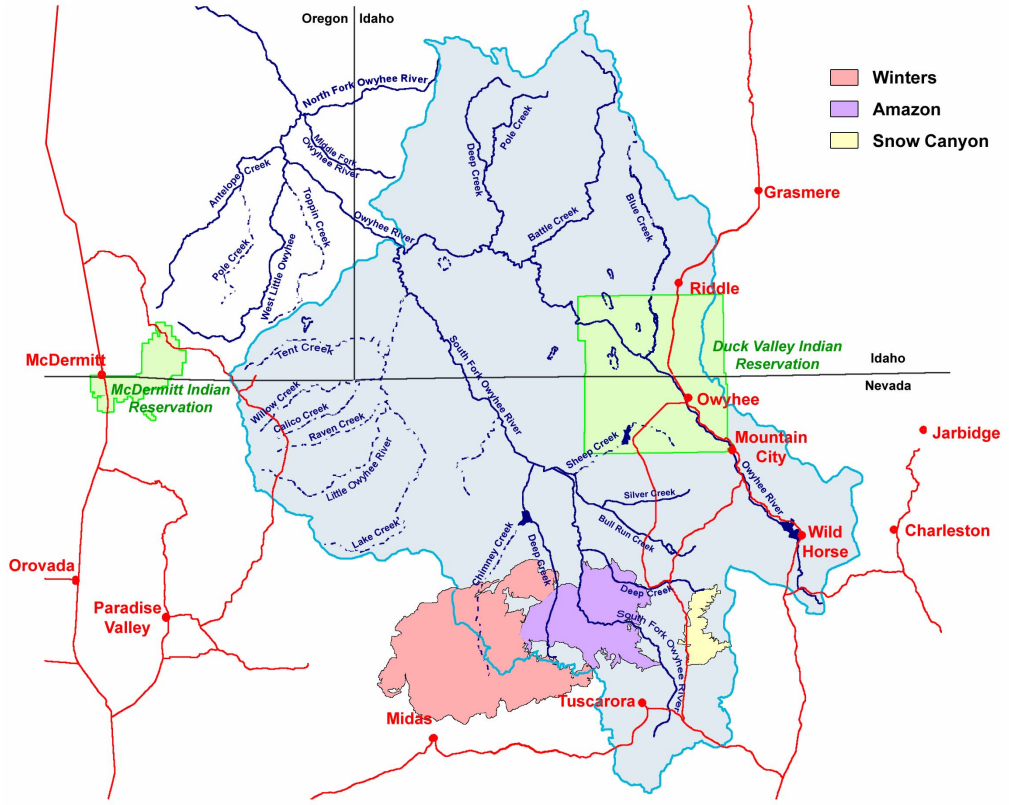


Figure 7.7. 2006 wildfires in the upper Owyhee subbasin. Appendix A

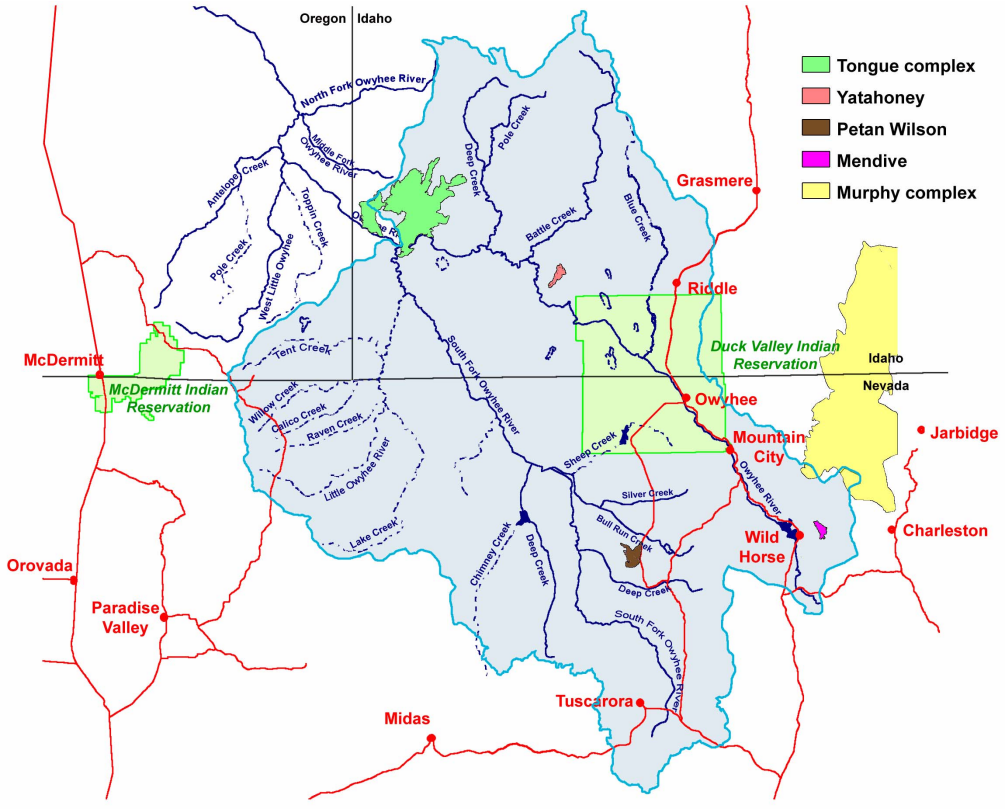


Figure 7.8. 2007 wild fires in the upper Owyhee subbasin. Appendix A

of a burned area is outside the scope of most fire rehabilitation programs.[45,105]

Following fire, non-native species tend to invade many burned areas. In the past many burned areas have been reseeded largely with grass species. Although native forbs are components of most native communities, their use in revegetation has been limited, largely due to inadequate seed supplies. The availability of native forb and grass species is developing. The Great Basin Native Plant Selection and Increase Project is a multi-state, multi-agency collaborative research project. The goal is not only to increase the availability of native plant materials for restoring Great Basin rangelands, but to both develop the seed technology and cultural practices to produce native seed and the practices necessary to improve the establishment of native seedings. [112,124]

F. Wilderness study areas

Within BLM managed land, there are a number of wilderness study areas (WSAs). No new WSAs are being designated, but existing WSAs remain WSAs until Congress makes a decision to designate the area as wilderness or to release the area for non-wilderness uses. Wilderness study areas in the upper Owyhee subbasin are shown on Figure 2.9 in the background section of this assessment.

According to the BLM web site, management of wilderness study areas is less restrictive than management of wilderness areas. "For example off-highway vehicles may drive on designated routes in WSAs and WSAs are open to location of new mining claims. Both activities are prohibited in wilderness."[13] Similar to wilderness areas, in WSAs outdoor recreation is allowed, including hunting, fishing, hiking, horseback riding,

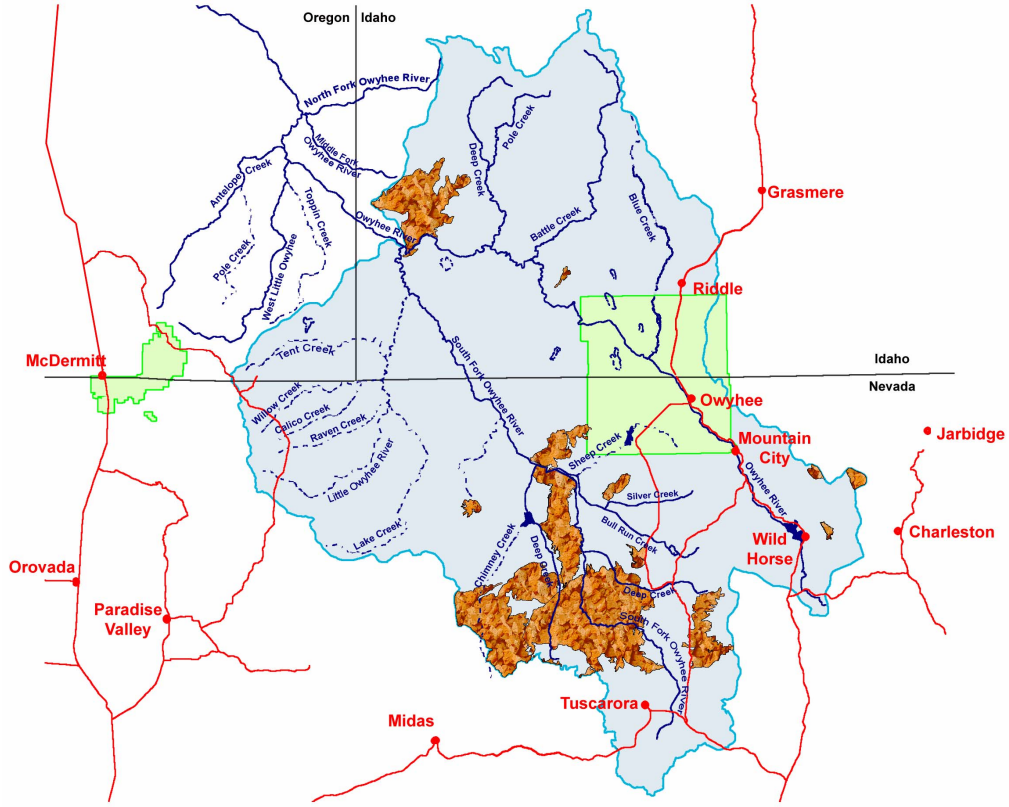


Figure 7.9. Areas of the upper Owyhee subbasin burnt by wildfires between 2001 and 2007. Appendix A

and camping. Although livestock grazing is permitted by law, some BLM districts interpret their mandate to manage WSAs to retain their wilderness character by restricting livestock grazing. If an area has previously been grazed and becomes wilderness, then the grazing may continue. There is no similar mandate that grazing continue to be permitted in a WSA.[13,4] However, the "majority of WSAs are grazed by domestic livestock. Livestock grazing may continue in the same manner and degree as it took place in 1976. Developments such as fences, wells, and pipelines may be maintained. New livestock facilities may be constructed if they are temporary, or they benefit overall management of wilderness values. Vehicles may be used on designated routes to support grazing management."[13]

G. Use of the upper Owyhee subbasin rangeland

The majority of the rangeland in the upper Owyhee subbasin is used for grazing.

> "Ranchers in the Owyhee Uplands effectively manage their land, adeptly handling the arid landscape that hosts their family business. Operating a ranch requires financial capital, and the economic values depend on the composition of the range vegetation rooted in soil - the underlying natural capital. Driving from Jordan Valley, Oregon towards Juniper Mountain in Idaho, the visitor can view a mix of vegetation that survives on a meager 13 inches of annual precipitation. Every good manager recognizes constraints on production. The soil moisture limits productivity, and is a production cap faced by the range manager. . . The changing vegetation and soil moisture [from juniper expansion] further constrain range production for the rancher."[145]

BLM lands (Figure 2.8) are managed by the Elko field office of the BLM in Nevada, the Owyhee and Bruneau field offices of the BLM in Idaho, and the Vale field office of the BLM in Oregon. The agency has regulations, revised in 1995, for administering livestock grazing. Ranchers may "lease" portions of the public rangeland for grazing. These leased areas, called allotments, are grazed under a management plan which may include the season, the amount of time the grazing may occur, the number and kind of livestock permitted, and the distribution of the livestock over the landscape achieved by herding, water development, salting, fencing, or other methods. A management plan is developed for each allotment in coordination with the permittee.[146,147]

Permittees pay a fee based on the number and type of livestock they graze. "Grazing permittees purchase Animal Unit Months (AUMs) of livestock forage. An AUM is the amount of forage needed to sustain one cow and calf, five sheep, two burros, or one horse for one month."[147]

H. Discussion

The native vegetation of the upper Owyhee subbasin was greatly changed at the end of the 19th and beginning of the 20th centuries. We have descriptions of what the area was like at the time of Euro-American settlement, but we don't really know the composition of the native species. Following the abusive livestock grazing which ended

between the passage of the Taylor Grazing Act of 1934 and World War II, the rangeland has improved. Vegetation cover of the landscape has increased. The ecoregion is recovering. However the plant communities undoubtedly remain altered. There has been a public shift in the perception of the role of range. The idea of maintaining a sustainable long-term output of livestock products has been replaced by one of continuing to produce livestock products while maintaining ecological functions and multiple uses.

Wildlife, as well as livestock, is endangered by a perception that water which is currently stored in stock ponds could instead increase the flows into the river.

Current knowledge should provide for continued improvement in ecological conditions. Throughout the Great Basin ecoregion, the reintroduction of fire as a management tool is having a very positive effect in reducing the amount of late successional sagebrush and invasive juniper dominance that has occurred with past fire suppression practices. Livestock management for riparian zone enhancement is in its infancy, but where practiced significant positive results are occurring. However, any management activities on public land require an extensive paper trail and public scrutiny before implementation.[121]

I. Conclusions

The use of the important resources of the rangelands of the upper Owyhee subbasin affects all of us. Therefore, proper use and management is vitally important.

> "Thou shalt inherit the holy earth as a faithful steward, conserving its resources and productivity from generation to generation. Thou shalt safeguard thy fields from soil erosion, thy living waters from drying up, thy forests from desolation, and protect thy hills from overgrazing by thy herds, that thy descendants may have abundance forever. If any shall fail in this stewardship of the land thy fruitful fields shall become sterile stony ground and wasting gullies, and thy descendants shall decrease and live in poverty or perish from off the face of the earth". - W.C. Lowdermilk [62]

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