3. Affected Environment

Fire Management Amendment Environmental Assessment

CHAPTER 3 – AFFECTED ENVIRONMENT

This chapter presents a description of the project study area's environmental conditions that could be affected by general fire management strategies. The focus of this FMA/EA is limited to public lands in the BLM Elko District (District) located in northeastern Nevada. The 7.5 million-acre District consists of vegetation types ranging from desert shrub to mixed conifer. Many of the plant communities evolved under a regime of intermittent fire and are adapted in some way to fire. The present fire regimes are different from the historical regimes due to fuel and successional changes caused by post-settlement activities, biotic succession caused by fire exclusion, invasion of exotic species and fragmented biotic communities. Defining the affected environment is difficult because fire is a natural part of the ecosystem of the area.

The following critical elements of the human environment are not present or are not affected by the proposed action or alternatives in this FMA/EA:

- Environmental Justice
- Farm Lands (prime or unique)
- Floodplains
- Wastes (hazardous or solid)
- Geology/Minerals

The following information is based on a number of resources provided by the consultant and BLM specialists, and information provided through the *Vegetation Treatment by Fire Environmental Assessment*, *2000* and other documents described in Chapter 5.0.

A. Air Quality

Air quality within the interior west was not pristine prior to European settlement in the late 1800's, especially with regards to smoke. Many historical accounts refer to the presence of smoke and burned areas within the Great Basin. Levels of smoke declined as fire was excluded from the land, particularly after the initiation of organized fire suppression.

National Ambient Air Quality Standards (NAAQS) have been established for six criteria pollutants: sulfur dioxide (SO2), particulate matter (PM10 and 2.5), carbon monoxide (CO), ozone (O3), nitrogen oxides (NOx) and lead (Pb). Nitrogen and sulfur oxides can cause adverse effects on visibility, plant life and water quality. The majority of these pollutants are primarily associated with urbanization and industrialization rather than with fire management activities, and are not dealt with further in this analysis.

The criteria pollutants of primary concern with wildfires and wildland fires are ozone, particulate matter (PM10 and PM2.5) and carbon monoxide (CO). Carbon monoxide is a localized "fire line" pollutant with little impact on air resources away from the burn site because of its rapid dilution in the atmosphere. Ozone is a photochemical pollutant, formed on sunny days from the chemical reaction of nitrogen dioxide and hydrocarbon emissions. Ozone chemistry is poorly understood, but it is known to be present in the smoke plumes downwind of large fires. Organic emissions from vegetation are also known to capture ozone, so the rangelands and forestlands are both a source and sink for ozone. Because of generally favorable plume height as well as the generally

reduced size and short duration of prescribed burns, there normally is not a significant human or ecological health concern. The PM10 and PM2.5 do not seriously affect rangeland and forest vegetation types, but can impact the human respiratory system. Since wildland fire historically was a natural occurrence within the range and forest vegetation types described, these ecosystems have some natural adaptation to the effects of fire.

Areas are classified as having either attainment or non-attainment status, or they are unclassified for meeting air quality standards. Unclassified areas are generally treated as attainment areas. The airsheds in Nevada are only classified according to federal standards.

The general conformity provisions of the Clean Air Act (Section 176(c)) prohibit Federal agencies from taking any action within a non-attainment area that causes or contributes to a new violation of NAAQS, increases the frequency or severity of an existing violation, or delays the timely attainment of a standard. They apply only to Federal actions within non-attainment areas. There are no non-attainment areas within the Elko District. Therefore, the conformity regulations do not apply to the management actions proposed in this document.

All of the BLM-administered lands and private lands within the Elko District are classified as PSD (Prevention of Significant Deterioration of Air Quality-Sections 160-169) Class II. The Jarbidge Wilderness Area in northern Elko County is classified as a PSD Class I with little or no degradation allowed.

Wildland fires can impact the air resource by degrading ambient air quality and impairing visibility. The wildland fire regime is currently much different than it was historically because of increased fuel loadings, development of ladder fuels and increases in stand density. The forest vegetation has changed from being primarily a non-lethal or mixed fire regime to lethal (stand replacement) fires (Quigley and Haynes, 1996). The rangeland fuels have also changed with increased fuel loadings of shrubs and invasion of woody species into grass/shrublands. Brown and Bradshaw (1994) found that emissions from modern fires have increased because fuel consumption (fuel per unit area burned) rates have increased. One of the goals of fire prevention is to reduce the amount of fuel present and reduce the potential for future lethal fires. Using prescribed fire in sagebrush/grass vegetation communities could have a similar effect by increasing the percentage of grasses and reducing the heavier sagebrush fuels. While prescribed fire can result in temporary negative impacts on air quality, acute impacts to air quality from wildfire can be reduced in the long term (Schaaf, 1996). Ottmar et al. (1996) estimate that the amount of PM10 emissions from prescribed fire in shrub communities is approximately 71 percent of the emissions from wildfire within the same vegetation type. In forest communities, the estimate is 74 percent (ibid).

B. Native American Consultation/Religious Concerns

In accordance with the National Historic Preservation Act (P.L. 89-665), the National Environmental Policy Act (P.L. 91-190), the Federal Land Policy and Management Act (P.L. 94-579), the American Indian Religious Freedom Act (P.L. 95-341), the Native American Graves Protection and Repatriation Act (P.L. 101-601) and Executive Order 13007, the BLM must provide the affected Tribes and Bands the opportunity to comment and consult on proposed BLM land management actions. The BLM must also make efforts to identify locations having traditional cultural or religious values to Native Americans and insure that land management actions do not unduly or unnecessarily burden the pursuit of traditional religion or life ways by inadvertently damaging important locations or hinder access to them.

The Western Shoshone and possibly other tribes of the Western Great Basin traditionally occupied the lands within the Elko District. Historically, the people hunted and gathered, built temporary shelters and participated in the various social gatherings, activities, and ceremonies that define a culture. The Western Shoshone found and continue to find strength or spirituality in all living things upon the land including the land itself. Therefore, it is believed that the area in question contains locations of religious importance or concern.

However, the release of religious activity and site information within the Elko District is extremely guarded and efforts to solicit information have been moderately successful. Records or past documentation of religious activities and religious areas of concern within the Elko District are quite minimal. Therefore, it is strongly suggested that the BLM maintain an open line of communication and ongoing consultation (for this particular action) with the local tribes and bands in order to acquire an updated and accurate location of culturally important areas.

The Shoshone have had close ties with the land. The earth is believed to be imbued with supernatural power and a major religious goal is the acquisition and use of power. Not only the earth, but all animals, plants and inanimate objects are believed to contain varying degrees of power. This is why traditional Shoshone pray or give an offering when gathering natural resources, and why many view virtually any invasive use of the public domain as being detrimental to their belief system and traditions.

While all objects potentially possess power, concentrations of power are found in certain areas and have special significance to the Shoshone people. Such locations may be used for healing, praying or ceremonies. Other locations, such as those where medicinal plants, basket weaving materials, or food resources are gathered may also be crucial to maintaining Shoshone traditions.

The Elko District encompasses an area that lies within the traditional territory of the Western Shoshone. Eight Native American tribes, bands or organizations are being consulted/notified by the BLM regarding the FMA/EA. Information pertaining to the location and significance of traditional cultural properties and sacred areas is usually considered confidential and not shared with outsiders. Consequently, only limited information is available for analysis. Of the known locations, two appear to be the most significant. One is along the Willow Creek drainage and the other is at Rock Creek. The Willow Creek drainage, including the Midas, Tuscarora and Ivanhoe areas has been identified by the Shoshone as a source of power (Rusco and Raven, 1992). Within the

larger Willow Creek area, three specific localities have been identified. Tosawihi Quarry is the best documented. Tosawihi is considered important because of the presence of two power spots, because it is the source of white chert that is regarded by some to convey power or to aid in doctoring, and because it is a focal point of ethnic identity for the Tosawihi Shoshone. Little is known of the other two localities. Both are power sources. One, consisting of two springs, is located in the Tuscarora Mountains. The other is a located near Midas.

A sacred location along Rock Creek continues to be used for ceremony and healing, drawing Shoshone and others from a wide area (Harney, 1995). Other locations reported to have special meaning to some Shoshone include a locality or localities in the Pequop Mountains, and two former Sun Dance locations along the Humboldt River. The eligibility determinations are being made for the Rock Creek and Tosawihi sites, and are presently at the State Historic Preservation Office (SHPO) for evaluation.

In accordance with Federal legislation and executive orders, Federal agencies must consider the impacts their actions may have on Native American traditions and religious practices. Consequently, the BLM must take steps to identify locations having traditional cultural or religious values to Native Americans, and to ensure that its actions do not unduly or unnecessarily burden the pursuit of traditional religion or traditional lifeways.

C. Cultural Resources

The Elko District is rich in cultural resources. Approximately 10 percent of the District has been inventoried, resulting in the recordation of 12,000 archaeological and historic sites. Prehistoric use spanned the last 12,000 years. The people occupying the area were hunter-gatherers who practiced a mobile lifestyle. Camp sites were usually small and inhabited relatively briefly. Winter camps tended to be larger and occupied for longer duration than fair-season camps. The first inhabitants of the region are thought to have arrived at the end of the Pleistocene Epoch. Populations were very low and resource exploitation was centered on the lowlands, particularly the marshes that developed as pluvial lakes dried. As time passed, population increased and uplands as well as the lowlands were fully utilized. Population appears to have peaked in the Late Archaic Period, 700-1300 years ago. The archaeological evidence of prehistoric use range from a location where someone lost a single artifact to places where there are large collections of artifacts, and archaeological features. Among the site types are: isolated artifacts, pot drops, toolstone quarries, rock art sites, camp sites, villages, ritual locations, seed processing locations, game observation posts, tool manufacturing locations, hunting blinds, wild game traps and butchering locations.

The Elko District also contains abundant evidence of the historic era. The Humboldt River served as a primary corridor for the exploration and settlement of the west. Elko County was one of the first parts of Nevada explored by Euro-Americans. The first recorded penetration of the area was by the Hudson Bay Fur Company in 1826 (Patterson et al. 1969:72). Traces of both the main California Emigrant Trail and the infamous Hastings Cutoff (used by the Donner Party) cross the District, as do the first transcontinental railroad, the first transcontinental telephone line and the second transcontinental highway. Innumerable other historic resources are present including the remains of mining camps, railroads, railroad towns, ranches, farms, homesteads, cow and sheep camps, Native American villages, wagon roads, utility lines, aspen art, and horse traps.

D. Paleontology

The types of fossils found in a particular region depend on the age of the rocks that are currently eroding at the surface. Numerous fossil records in various geological formations are found throughout the District. Brachiopod fossils are found from the Upper Permian Gerster Formation and ammonoid fossils from the Lower Triassic Thaynes Formation. Additionally, many well preserved winged seeds and needles from conifer trees, plus fossil insects can be found from the Lower Oligocene Chicken Creek Formation in Elko County. Fossilized leaves can be found in northeastern Nevada where some 42 species of 40-million-year-old plants have been identified from the Upper Eocene Dead Horse Tuff. Paleontological resources in the Humboldt Formation include vertebrate, invertebrate, and plant fossils (Bilbey and Firby, 1997). Tuffaceous sediments interbedded with ignimbrite, vitric ash tuff and lava are mostly found in the Indian Well Formation where reports of early Miocene vertebrates were found in fine gravel lenses.

E. Lands

The Elko District covers the area encompassed by Township 26 North to Township 31 North by Range 48 East to Range 70 East and Township 32 North to Township 47 North by Range 44 East to Range 70 East, Mount Diablo Base and Meridian (Figure 1-1). The Elko District consists of 7.5 million acres of public lands administered by the BLM. Adjacent lands not administered by the District or part of the FMA/EA constitute another 1.3 million acres of public land and 3.5 million acres of private land.

Land Ownership		
Agency	**Acres**	**Percentage**
BLM*	7,508,974	61.02%
BOR	25,957	0.21%
DOD	15,157	0.12%
Native American	158,771	1.29%
USFS	1,070,556	8.70%
USFWS	5,674	0.05%
Other Public Lands	26,288	0.21%
Total Public	**8,811,378**	**71.60%**
Total Private	**3,494,797**	**28.40%**
Total	**12,306,174**	**100.00%**

* Addressed by FMA/EA

Authorized land uses occurring on the public lands consist of ranching (based on allotment guidelines) powerlines, gas pipelines, oil and gas wells with associated pipelines and storage tanks, and mining operations with associated buildings and structures. Additional information about land use activities can be found in Section R. Throughout the Elko District, these uses are located on a mixture of public and private lands.

The following communities are located on private land: Elko, Carlin, Battle Mountain, Wells, Wendover, Jackpot, Tuscarora, Midas, Crescent Valley, Beowawe, South Fork, Contact, Lee and Jiggs. These communities are also located adjacent to public lands where small tracts of public lands are often intermingled with large tracts of private lands. These communities range in size from a few people or dwellings to an urban area of 25,000 people. The FMA/EA primarily addresses public lands, however the alternatives presented in Chapter 2.0 provide guidance aimed at the protection of people and property in these areas.

F. Water Resources

Average annual precipitation for this area ranges from 6 inches in the lower elevations to 30 inches in the mountains, and it falls mostly as winter snows and late spring rains. Very little precipitation falls in the summer months, but thunderstorm events often result in intense, short-duration rainfall. January temperatures range from an average minimum temperature of 13°F to an average maximum temperature of 34°F. July temperatures typically average from 60°F (minimum) to 90°F (maximum). The Elko District is located within four hydrographic basins (Snake River, Humboldt River, Central Region and Great Salt Lake) in the northeastern corner of Nevada. Runoff and infiltration vary with slope, amount of vegetative cover, and soil or rock cover. Fire, whether natural or prescribed, directly affects the vegetative cover, thus affecting runoff and infiltration. Peak runoff typically occurs during April, May and June.

The major rivers of this area include the Humboldt flowing through the southwest portion of the District, the Owyhee and Bruneau in the northwest, and Salmon Falls Creek in the northeast.

Water availability varies greatly in the northeastern part of Nevada. Some mountainous areas have abundant water in springs, streams and ponds, with many man-made reservoirs downstream to store water for various uses. The landscape is mostly characterized by intermittent and ephemeral drainages. Surface water is used for irrigation, stockwater, wildlife, recreation, domestic and municipal use, as well as in-stream flows to support fisheries and riparian habitat. The water supply can be extremely scarce in other areas due to soil impermeability, low precipitation and evapotranspiration from seasonal playas. Water quality on designated rivers and streams normally meets the Nevada State standards within the Elko District. However several rivers and streams are listed in the 2000 EPA 305(b) report (which includes the 1998 EPA 303(d) list) for having impaired water including the Humboldt River, Owyhee River, Shoshone Creek and Salmon Falls Creek. Most of the streams and all of the springs within the District boundaries do not have any numeric water quality standards, and the state does not test these non-classified waters.

Several municipal watersheds, including Carlin, Wendover and Montello, have been identified in the FMA/EA as needing protection from fire. Wellhead protection areas for several small communities such as Jackpot, Midas and Crescent have also been identified as needing preservation. These watersheds include springs that provide drinking water for these communities.

G. Wild and Scenic Rivers

There are two rivers with Wild and Scenic River status in the Elko District. The South Fork Owyhee River designated as wild (23.6 miles) and scenic (1.0 mile), and a segment (2.2 miles) of Fourmile Creek found eligible for wild river status under the Wild and Scenic Rivers Act of 1968 (P.L. 90-542). The eligible river corridor extends for one-half mile on either side of the river. These river segments are within the South Fork Owyhee River and Owyhee Canyon Wilderness Study Areas. Management of this eligible Wild and Scenic River is guided by the Interim Management Policy for Lands Under Wilderness Review.

H. Wilderness

There are ten Wilderness Study Areas (WSA) in the Elko District. These WSA's were identified through an inventory process in the late 1970's. Those lands that were found to contain wilderness values were named as Wilderness Study Areas through the Resource Management Plan (RMP) and EIS processes. WSA management is guided by the 1995 edition of the BLM Manual Handbook H-8550-1, Interim Management Policy for Lands Under Wilderness Review (IMP).

Wilderness Study Areas	Acreage
Bluebell	55,665
Goshute Peak	69,770
South Pequop	41,090
Cedar Ridge	10,009
Red Spring	7,847
South Fork Owyhee River	7,842
Owyhee Canyon	21,875
Little Humboldt River	42,213
Rough Hills	6,685
Bad Lands	9,426
Total for Elko District	**272,422**

I. Areas of Critical Environmental Concern (ACEC)

Public Law 94-579, more commonly known as the Federal Land Policy and Management Act of 1976 (FLPMA) gives the BLM authority for management of areas having special (wildlife) values or to protect against natural hazards (Sections 102(a)(8), 201(a) 202(c)(3)). The Wells Resource Management Plan (RMP) and the resulting Record of Decision (ROD) designated 6,200 acres south of Wendover, NV as the Salt Lake Area of Environmental Concern (ACEC). This area was identified as a historical peregrine falcon use area, which supported a population of nesting falcons as late as 1960. The area is significant because of the history of use and is unique in that it is one of only five historical sites identified in Nevada. The management objective is to preserve the integrity of the Salt Lake ACEC for peregrine falcon reintroduction. The area is characteristic of a desert shrub community which is dominated by winterfat, shadscale, Nuttall's saltbush, together with Indian ricegrass and a variety of other perennial grasses. The topographic relief is characterized by numerous rock abutments and outcroppings that rise 100 to 300 feet to form cliffs. These rock faces generally run

north-south and provide mostly east facing exposures. These exposures overlook a marsh area known as Blue Lake which straddles the Nevada-Utah state line.

In 1986, the Salt Lake ACEC management plan was approved which outlined management objectives, planned actions, and special management requirements necessary to protect and maintain the existing habitat in its present condition. The plan allows for compatible uses to occur in the area which do not destroy or impair falcon eyries or other suitable habitat or disturb peregrine falcons while they are breeding, nesting, feeding or using the area. All land management actions proposed within the ACEC are carefully evaluated to ensure conformance with the management objectives and special management requirements identified for this area.

J. Recreation

The public lands within the Elko District provide opportunities for a wide variety of dispersed recreational activities, including fishing, sightseeing, hunting, camping, white water rafting, photography, rock-hounding and off-highway vehicle use. The majority of the recreational use (over 95%) that occurs in the District is dispersed. There are six Special Recreation Management Areas, four developed campground/recreation sites and many other undeveloped sites.

K. Visual Resources

The Visual Resource Management (VRM) system guides the inventory and management of visual resources on BLM lands. The inventory process consists of a scenic quality evaluation, a visual sensitivity level analysis and a delineation of distance zones. Based on these factors, BLM-administered lands were placed into four visual resource management classes. Visual resource management objectives are established for each class as described below.

Class I Objective: The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Class II Objective: The VRM class II objective is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Class III Objective: The objective of this VRM class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the landscape.

Class IV Objective: The VRM class IV objective is to provide for management objectives which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management

activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements (BLM, 1986).

The visual contrast rating process is used to analyze potential visual impacts of proposed projects and activities on public land, and thereby assess compliance with the VRM class objectives for that area. Through this process, the form, line, color and texture of the landform, vegetation and structures are compared ("contrasted") with their appearance following the implementation of a proposed project or management action.

The majority of the District has been designated as Class IV. The remaining lands are either Class II or Class III. There are no designated Class I areas in the Elko District; however wilderness study areas may be managed as Class I VRM areas (BLM, 1986).

L. Wildlife

With the tremendous variation of terrestrial habitats in the Elko District, there is a comparable diversity of wildlife species, which include big game, small game and nongame species. There are approximately 70 species of mammals, 273 species of birds, and 28 species of reptiles and amphibians. The complete species list can be found in Appendix 5 and 6).

Several locally representative species of wildlife are used to illustrate the affected environment in relation to an integrated approach to fire management. The integrated approach includes methods such as prescribed burning (to reduce fuel loads in preventing severe fires), fire suppression (use of fire retardants and foams), fire rehabilitation and fire management. The following species were taken from the BLM Vegetation Treatment by Fire EA (2000) as representative species occupying the various habitat types found on the District: pronghorn (*Antilocarpa americana*), elk (*Cervis elaphus*), mule deer (*Odocoileus hemionus*), Great Basin pocket mouse (*Perognathus parvus*) and red tail hawk (*Buteo jamaicensis*). Sage grouse (*Centrocercus urophasianus*) is discussed under Special Status Species (Item No. M) as the representative sensitive species in the Elko District. This section also contains a brief discussion of the listed species that can potentially be affected by fire and the fire management options. Each of these species-affected environments is described below.

Fire activities can improve the habitat for pronghorn. Kindschy et al. (1978), McCarty (1982) and Yoakum (1982) have recommended prescribed burning to improve pronghorn habitat. With a preference for forbs and strong requirements for open cover, pronghorns are favorably influenced by the increase in herbaceous material and the reduction of shrubs after fire (Higgins et al. 1989). Fire has been known to recover long abandoned antelope range in both Nevada and California. Pronghorn require a mosaic of very open spaces and taller, denser shrub areas. As described in the Vegetation Fire Treatment EA, the primary management recommendation is to limit burns in antelope habitat to 1,000 acres, with a mosaic pattern to provide cover for fawning (with 5 to 10 percent shrub cover) (Fire Effects Information System - FEIS). Pronghorn are not likely to be directly affected by fire suppression activities, such as the application of chemical fire retardant. The exception may be in forage availability where fire retardant, like a fertilizer or fire response strategies, may encourage growth of weedy invasive species at the expense of vegetative species preferred by ungulates. Rehabilitation efforts following

a fire would benefit pronghorn browsing if native grass and forb species were not likely to recover on their own.

Prescribed fire is used routinely to create or enhance elk habitat in many Western states (FEIS). Fire can be used to rejuvenate aspen stands, encourage early spring green-up of grasslands by reducing litter, slow or prevent conifer dominance in important foraging areas, increase palatability of foods, reduce the height of browse species, and stimulate regeneration through sprouting or heat scarification of seed (Jourdonnais and Bedunah 1990, Weaver 1987, Leege 1979).

Mule deer habitat can also be improved by the use of fire. Fires that create a mosaic of burned and unburned areas are the most beneficial. Both deer and elk tend to prefer foraging in burned areas compared to unburned areas because of the difference in forage selection. This preference may indicate an increase in plant nutrients, which usually occurs following fire (Asherin 1973, Hobbs and Spowart 1984, Severson, 1987). Mule deer consume leaves, stems and shoots of woody plants most often during summer and fall, while grasses and forbs compose the bulk of spring diets. A mosaic pattern in shrub and pinyon-juniper woodlands creates openings to attract mule deer to the forage, but also provides enough shelter for thermal cover and protection for fawning (FEIS).

The use of fire fighting chemicals and rehabilitation measures following fires would be similar in effect to both mule deer and elk as described above for pronghorn; that is, it would both promote and control introductions of invasive weedy species. Other means of fire prevention, such as mechanical removal of fuels, may benefit these ungulates by providing a mosaic of open foraging areas and cover, provided reseeding efforts are limited to native species.

Despite some of the benefits of fire to ungulates as described above, fire history and past fire management practices has influenced the current condition of mule deer habitat and other big game species. Since 1980, nearly 1.8 million acres of wildlife habitat has been impacted by wildfire. This has significantly affected mule deer habitat in the District, altering large areas of critical winter range from mountain shrub, sagebrush-grasslands, and pinyon-juniper habitats to annual and/or perennial grasslands. Black sagebrush is critical winter deer forage in Nevada. In areas where sagebrush is the only cover, its complete removal can be detrimental to mule deer populations (USDA 1973). Within the Nevada Division of Wildlife's Management Unit 060 over 90 percent of the mule deer winter range supporting 70 percent of the wintering population, has been adversely impacted by wildfires in the last 30 years (Ken Gray, NDOW, personal communication, 2002). Winter range areas that once consisted of shrub-perennial grass mosaics are now dominated by cheatgrass and other annual species. Although mule deer will readily consume cheatgrass when it is available, forage production varies greatly each year, making it an inconsistent and unpredictable food source. In addition, cheatgrass is not available as a food source during extended periods of deep snow cover, at which time browse becomes the only food source. Continuation of sagebrush losses in important winter habitat ranges could impact big game population sizes.

Mule deer are not the only wildlife species affected by this change in vegetation composition in the past few decades. Significant acres of sagebrush habitat important for sage grouse and other sagebrush obligates, have also been lost to wildfire. More than 325,000 acres within the District are currently dominated by annual species such as cheatgrass, Russian thistle, and mustard. Competition from cheatgrass and other annuals has effectively closed the plant community in these areas. Repeated fires have reduced sagebrush overstory to the point where seed dispersal from viable sagebrush stands has become virtually nonexistent. Efforts have been ongoing to reclaim these areas and reestablish shrubs, as well as, perennial grasses and forbs. However, these efforts are very expensive and reestablishment of such communities takes time. Rehabilitation efforts become hampered by the extreme fire potential and shortened fire cycle that continues the extensive shrub loss and cheatgrass invasion. With the increase in large scale fires, the invasion of cheatgrass, and the subsequent increase in fire frequency in these areas, the shrub-perennial habitat important for sagebrush obligates has little opportunity to regenerate. Add on other environmental and human-caused factors (i.e., brush control followed by non-native seeding, invasion of pinyon/juniper woodlands into shrub communities, conversion of sagebrush to agriculture, certain livestock management practices, and habitat fragmentation) and the result is a growing loss of sagebrush habitat and a decline in sage grouse.

Fire has little direct effect on fossorial mammals in their burrows (Hedlund and Rickard, 1981). Since Great Basin pocket mice are mostly active at night and tend to aestivate during the hot, dry periods when wildfire usually occurs, the mouse is probably not directly affected by fire. They do tend to converge on recent burns, probably due to the presence of easily available seed and dead insects. Favorable precipitation after a fire can greatly increase the populations of pocket mice, probably due to the increased seed production of grass and forb species. These increases tend to be short lived, though, with populations returning to normal within a year of the fire (FEIS). Fire fighting chemicals tested on two different rodents did not affect either species survival rate or population size (Vyas and Hill, 1994, Vyas et al. 1996).

The red-tailed hawk can be negatively affected by fire if the fire burns nest trees that are occupied, or reduces the number of unoccupied nest trees in an area where they are scarce. However, fire can leave behind snag trees that are used as perch sites, thus resulting in improved hunting opportunities for the hawks. Recently burned areas are also frequented by red-tailed hawks due to increased prey visibility. Regular prescribed burning has been noted to increase the habitat and populations of the hawk's prey. Prescribed fire should be in a mosaic pattern to maximize the edge effect and vegetative diversity for increased benefit to hawks (FEIS). Fire retardant use would not likely affect raptor species, such as the red-tailed hawk, unless application occurred during the nesting season. Fire rehabilitation measures could benefit raptor species over time by increasing nesting habitat and habitat for prey species.

Many reptiles and amphibians live in mesic habitats, which are likely to burn less often and less severely than upland sites. A review conducted by Russell et al. (1999) resulted in few reports of fire-caused injury to herpetofauna. In desert and semidesert habitats, patchy fire spread may protect amphibians and reptiles from fire-caused injury or mortality (Smith ed., 2000). Likewise, fire suppression efforts are not likely to affect these species. In rare cases, toxicity from chemical retardant may occur if these species are directly impacted by the treatment, although there are no known studies on toxicological effects of fire chemicals on reptile or amphibian species.

M. Special Status Species

There are 55 state and federal special status plants and animals likely to occur on public lands in the Elko District (Appendix 3). Habitats such as terrestrial, wetland, riparian, streams, lakes and reservoirs can provide important habitat for all of these species. The BLM gives sensitive species special consideration to ensure that their populations do not decline to the point where listing as threatened or endangered becomes necessary.

Riparian habitat provides important landscape features for five listed or candidate species that occur in the Elko District. The District contains 1,138 miles of public perennial streams and 3,900 acres of riparian habitat (52% of the public riparian habitat in Nevada). There are nearly 100 miles of public streams in 19 different grazing allotments in the Elko District which contain populations of Lahontan cutthroat trout (LCT), a Federally listed threatened species. There are nearly 70 known or historic stream or pond sites on public lands in the Elko District which provide habitat for the Columbia spotted frog, a Federally listed Candidate species. The bald eagle, a Federally listed threatened species, is a common winter resident (November-March) throughout the district in forested riparian areas. The Independence Valley speckled dace and Clover Valley speckled dace, two federally endangered species, also occur in riparian/wetland areas within the District. Minimizing the effects of fire within riparian zones through the application of Standard Operating Procedures, will protect important sensitive species habitats.

Sage grouse, a Nevada and BLM sensitive species, found in terrestrial habitats, particularly sagebrush-grasslands and meadows, has been affected by fire over the past two decades. Depending on pre-fire habitat quality and the type of fire, sage grouse can either be positively or negatively affected by fire. Sage grouse use different age classes and stand structures for lekking, brooding, nesting and wintering grounds. Generally, sage grouse prefer relatively open sagebrush communities. Neither extensive stands of dense sagebrush nor extensive open areas are favored by sage grouse. Fire that creates a mosaic of different age class and structure of sagebrush benefits sage grouse. Patches of newly burned areas interspersed with patches of sagebrush provide increased forb production while providing nesting and brood cover. Younger age class sagebrush established after a fire provides more nutritious and palatable browse than older sagebrush. Sage grouse have established lekking areas on new burns in areas where open cover was previously lacking. A fire within a sage grouse area can be beneficial if it does not burn key winter habitat or large tracts of land. A patchy sagebrush habitat, which includes forage and cover areas, should be the management objective. Recommendations have been made to burn or treat sagebrush by other appropriate techniques in sage grouse habitat on a rotational basis to provide the diversity that is needed for the sage grouse populations (FEIS). Fire response plans need to protect critical seasonal habitats. The use of fire fighting chemicals in sage grouse habitat would likely be beneficial in the long run, in order to protect remaining intact suitable sage grouse habitat. Fire rehabilitation can prevent habitat loss and restore open sagebrush habitat for potential sage grouse occupation. Efforts to prevent cheatgrass invasion following fires would be essential to sage grouse habitat rehabilitation. Meeting these objectives with an integrated fire management approach, which includes site-specific analyses, can prevent listing of this species. Management for sage grouse habitat will also preserve other sensitive sagebrush species. A list of Standard Operating Procedures (SOP's) for sage grouse, derived from the *Management Guidelines for Sage Grouse and Sagebrush Ecosystems in Nevada, 2000*, are found in Appendix 2.

Any action that may affect federally-listed species is subject to consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act. The following federally listed or candidate species have been addressed in the Biological Assessment (BA) (BLM, 2003) for the FMA/EA: bald eagle (*Haliaeetus leucocephalus*), Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*), Clover Valley speckled dace (*Rhinichthys osculus oligoporus*), Independence Valley speckled dace (*Rhinichthys osculus lethoporus*) and Columbia spotted frog (*Rana luteiventris*). This BA is available upon request at the Elko Field Office and is incorporated by reference.

N. Migratory Birds

On January 11, 2001 President Clinton signed the Migratory Bird Executive Order . This executive order outlines the responsibilities of Federal agencies to protect migratory birds. The United States has recognized their ecological and economic value to this country and other countries by ratifying international, bilateral conventions for the conservation of migratory birds. These migratory bird conventions impose substantive obligations on the United States for conservation of migratory birds and their habitats. The United States has implemented these migratory bird conventions through the Migratory Bird Treaty Act. President Clinton's Migratory Bird Executive Order directs executive departments and agencies to take certain actions to further implement the Migratory Bird Treaty Act. and promote conservation of migratory bird populations.

A list of the migratory birds affected by the President's executive order is contained in 43 CFR 10.13. References can be found to species in the periodic report "A Migratory Non-game Birds of Management Concern in the United States", priority migratory bird species as documented by established plans (such as Bird Conservation Regions in the North American Bird Conservation Initiative or Partners in Flight physiographic areas), and those species listed in 50 CFR 17.11. A list of migratory bird species that are obligate to the various ecotypes that exist in the Elko Field Office is contained in Appendix 5.

O. Soils

Soils in the Elko District were mapped by the Natural Resource Conservation Service as part of eight different Order III Soil Surveys. Soils are quite variable and are influenced by geology, topography and climate. Specific soil interpretations for qualities such as productivity and potential for revegetation following wildland fire are found by soil map unit in the soil surveys, and are not discussed in this document.

Soils occurring on bolson and semi-bolson floors at lower elevations are deep and young. These soils are poorly drained and are occasionally flooded. They occur on nearly level to gently sloping areas and are characterized by some saline-alkali accumulations. These soils are usually difficult to revegetate because of the high salt content.

Soils occurring in floodplains are deep, have a high organic matter content and may be poorly drained. They are usually young soils with little profile development. They are subject to frequent flooding and generally have a slight wind and water erosion hazard when the vegetation has been removed. These are some of the most productive soils in the District. Sagebrush-perennial grasses and possibly crested wheatgrass seedings would occur on these soils.

Soils that occur on terraces and piedmont slopes are common throughout the District and frequently have sagebrush vegetation. Slopes are quite variable, as well as texture. Soils on tops of fans and terraces tend to be older soils and have silica or lime cemented hardpans, or clay subsoils. These hardpans limit the amount of available moisture, as well as restrict infiltration and root penetration. Wind erosion hazard is slight and water erosion hazard is slight to moderate when the vegetation is removed. Sagebrush-perennial grasses and crested wheatgrass seedings are most likely to occur on these soils.

Soils occurring on mountains and hills may be shallow to deep over bedrock, with or without rock fragments. Textures are variable. Water erosion hazard depends on slope, texture and the amount of rock fragments throughout the soil, and can be moderate to severe. Wind erosion hazard is slight. Mountain soils may have aspen, mixed conifer, mountain brush and pinyon-juniper growing on them.

Soils in the Owyhee Desert are located on the Columbia Plateau. These soils developed over basalt flows in mixed alluvium and are influenced by loess and ash. These soils are generally shallow over a hardpan or bedrock and have a high surface cobble and/or stone content. Lime or silica cemented hardpans are common on these soils. Wind and water erosion hazards are generally slight. Sagebrush-perennial grass and crested wheatgrass seeding vegetation types occur on these soils.

Cryptogamic crusts are commonly found on the soils in the Elko District. They are frequently referred to as microbiotic crusts. Cryptogamic, or biological soil crusts have highest occurrences on shallow and calcareous soils, and are common in several sagebrush communities, including Basin Big Sage, Wyoming sage, mountain sage, black sage , and low sage. They rarely occur in saline or frequently flooded soils (BLM/USGS Technical Reference 1730-2)

They are composed of various living organisms and their byproducts. In the Great Basin, Microcoleus vaginatus, a cyanobacteria (blue-green algae) composes the vast majority of the crust (Johnson, 1997). Lichens of the *Colleria* spp. and moss of the genera *Totula* spp. are also common (ibid.). These crusts serve many functions, including nitrogen fixation, soil stability, changes in infiltration (both increased and decreased) and improved plant health for certain plant species.

Fire can cause a decline in cryptogamic crusts. This impact can be severe in high intensity fires, such as those associated with mountain shrub communities. Low intensity fires, such as found in grass/sagebrush communities, would not remove all the crust structure. The cyanobacteria recovers from disturbance most rapidly, attaining undisturbed densities within 1 to 5 years, because the higher pH favors its establishment (Debano, et al., 1998). Algal cells of many species can survive the most severe disturbances (ibid.) Where bacterial populations are reduced immediately post-fire, they typically increase dramatically after the first post-fire rainfall (Clark,1994). There is little research on the lichens that form the cryptogramic crusts. Lichens are one of the slowest crust components to recover and may take decades to reestablish significant cover. The time for full crust recovery after a fire depends on fire intensity levels. The response time can be improved by limiting the size of the fire and increasing the mosaic pattern of the burn, so that there is a nearby source of inoculum.

The amount of duff consumed by fire is highly dependent on duff moisture content. Duff with moisture content of 120 percent or greater basically will not burn. At moisture contents of 30 to 120 percent, the amount of duff consumed depends on the consumption rate of the associated surface fuels. Duff with a moisture content of less than 30 percent will burn spontaneously. (Peterson, 1999)

Approximately 8 percent of the heat generated by fire is transferred to the mineral soil. The amount of heat transfer relates directly to the duration of all phases of combustion. The temperatures reached by the soils are also dependent on the amount of duff and organic matter insulating the soil, and on the size and length of burn time of the surface fuels that contact the soil (Peterson, 1999). In grass-dominated vegetation types, the usual maximum heating of the soil is 125°C in 15 minutes. In brush vegetation, the maximum temperature is 200°C in 30 minutes. In timber duff, the highest temperature of 400°C is reached after 16 hours during the smoldering and glowing phase of the fire. Most of this temperature heating is within the top 2 centimeters of the soil.

The temperature-induced fire effects on soil include chemical and physical changes occurring in organic matter and soil nutrients. At 150°C, rapid pyrolysis occurs. At 300-390°C, the loss of up to 75 percent of soil nitrogen can occur and the soil pH increases. Long duration heating of 400-500°C causes ashing of organic matter. At still higher temperatures, structural changes in the soil occur (Hartford and Frandsen, 1992).

Hydrophobicity is the result of the distillation of organic compounds that causes soils to develop resistance to wetting. Hydrophobicity also occurs naturally in the absence of fire. The danger of hydrophobicity is greatest for fires occurring in chaparral shrub communities and forested areas. Hydrophobicity may also occur in sagebrush communities. This is generally extremely limited in scope and only occurs where shrubs and basal litter are consumed in a long duration fire. This effect causes increased runoff. Hydrophobicity primarily occurs in coarse-textured granitic soils most frequently following fires that heat the soil to 176-204°C. Granitic soils are very limited within the District. The two main areas are approximately 46,000 acres in the Granite Range and approximately 6,000 acres in the Dolly Varden Mountains (Coates, 1987). Fine-textured soils with a moderate amount of soil moisture are not susceptible to this phenomenon when the soil temperature remains below 176°C. When the soil is heated above 288° C, these hydrophobic compounds are destroyed (Clark, 1994).

The removal of vegetative cover subjects the soil to direct raindrop impact, which increases runoff and water erosion. The amount of water erosion will be highly dependent on slope steepness as well as soil texture and severity of the storm event. Avoiding steep slopes can minimize water erosion impact, especially where erodible soils are present. Timing a prescribed fire when large storm events are not likely to occur will also help. In the long term, this impact should be positive if post-fire vegetation has denser soil surface and subsoil root masses.

P. Wetland and Riparian Zones

There are approximately 30,000 acres of wetlands and riparian zones within the Elko District. These zones are at times inundated by water, and normally have saturated or seasonably saturated soil conditions within 10 feet of surface water. The width of the areas vary from a few feet along small streams, ponds and within spring meadows, to several hundred feet along major rivers, lake shores and within large meadow basins.

Many of the riparian areas do not have a surface flow, but are maintained by the high soil moisture. The presence of moisture and abundant nutrients makes the wetlands and riparian areas the most vegetatively diverse communities within the Elko District. Stream bank stability and cover are important for stream shading, which contributes to lower (below 70°F.) water temperatures that are critical for fisheries. These zones are valuable for wildlife and aquatic habitat. Wildland fire has and does occur in riparian zones. Riparian zones may act as fire breaks or green strips due to the high soil moisture content and the mesic vegetation. When fire does burn in the riparian zone, the impacts are less severe due to the available soil moisture.

Typical wetland and riparian vegetation species includes cottonwood (*Populus spp*.), Pacific willow (*Salix lasiandra*), sandbar willow (*Salix exigua*), chokecherry (*Prunus virginiana*), Wood's rose (*Rosa woodsii*), sedge (*Carex spp*.), American threesquare (*Scirpus americanus*), Baltic rush (*Juncus balticus*), bent grass (*Agrostis stolonifera*) and Kentucky bluegrass (*Poa pratensis*). All of these species are at least moderately fire tolerant.

Some cottonwood species respond more vigorously to fire then other cottonwood species. A study conducted in southern Alberta, Canada found that when fire occurred prior to bud flushing cottonwoods responded by vigorous sprouting particularly in the first summer and by fall 75% of the burned trees had produced coppice sprouts, new shoots from remnant stumps (Gom and Brood 1999). *Populus angustifolia* and *P. balsamifera* produced more sprouts than *P. deltoides* and *P. fremontii* (Gom and Brood 1999).

Willows in all stages of vigor resprout from the root crown or stem base following fire. Their numerous wind dispersed seeds are also important in revegetating areas post-fire. Severe fires that burn off most of the organic layer of the soil and leave roots and stem bases exposed eliminate basal sprouting by killing dormant buds.

Chokecherry is well adapted to disturbance by fire. It is easily top-killed but resprouts vigorously from buds on root crowns and rhizomes. Seed dispersed by mammals and birds, and pre-existing buried seed on-site can be significant sources of post-fire vegetative regeneration. Post-fire recovery is relatively rapid, with plant numbers and cover densities enhanced for several years. Most rhizomes are buried at least one inch below the surface, suggesting that it can tolerate a severe fire with significant soil heating in the upper inch of soil. If the plant is phenologically active, significant damage can occur, although fire rarely occurs at this time of the growing season. Studies in Utah show that twice as many shoots were found on a fire site than on a nearby unburned site, and that the increased densities were maintained for approximately 18 years until the plants regained pre-fire densities.

Wood's rose is typically top-killed by a fire. The plant regenerates by sprouting from the root crowns and underground rhizomes and survives low to moderate intensity fires. In some studies, Wood's rose doubled in abundance by the second post-fire year. After high intensity fires, the plant recovered to near pre-burn densities by the second post-fire year.

Sedges reproduce by both rhizomes and seed. Most sedges show a good resistance to low to moderate intensity fires as long as the organic layer of the soil is left mostly intact. Residual seeds often exist in areas that have become dominated by other plants and readily sprout after the vegetation is burned. Fire does not change sedge composition

when it is the dominant or co-dominant species. Seasonality of fire does not appear to matter as long as sufficient moisture is in the organic soil layer to reduce its burning.

American threesquare's rhizomes are buried up to six inches in the soil; thus, they are well protected from the soil heating caused by the fire. Field studies have shown that seeds that have been subject to fire on the moist soil surface or buried up to one inch have slightly higher germination rates than seeds not subjected to fire. Generally only the above-ground parts of the plant are removed by fire.

Baltic rush survives fire by sprouting from its extensive rhizome system. Fires in riparian/wetland areas often only top-kill the plants, leaving the rhizomes in moist soil unharmed.

Bent grass has a moderate tolerance to fire, however, there is no specific information available in the literature on the fire ecology of this species. A similar species, ticklegrass (*Agrostis scabra*), has been shown to colonize bare mineral soil after a fire. This species is considered to be an increaser species with stolons that are probably killed after a moderately severe fire. The seeds of this species are stored in the soils for short durations.

Kentucky bluegrass's response to fire depends on the season of the burn, fire frequency and post-fire precipitation and soil moisture. This grass is a cool season perennial and burning in the spring when it is actively growing damages it. Repeated spring burns can greatly reduce its density and biomass production. Kentucky bluegrass growing on more mesic sites is more affected than the grass growing in moist swales and riparian areas. Burning when the grass is dormant does not affect it. In the west, Kentucky bluegrass is often more abundant on recently burned sites than on similar unburned sites, especially in the sagebrush/grassland communities (FEIS).

Q. Vegetation

The affected vegetative communities include the following:

Annual Grassland Communities - There are few native grasses in Nevada that are annuals. Most of Nevada's grasses live for many years (perennial) developing bunched or clumped growth forms. Most annual grasslands in Nevada are dominated by cheatgrass (*Bromus tectorum*), and other non-native weeds.

Cheatgrass is a detrimental non-native invasive species in the District, particularly in relation to fire, wildlife habitat, and grazing. It was brought from Eurasia to North America in the 1890s and it quickly spread through arid areas. When cheatgrass invades an area, the amount of nitrogen in the soil available to plants decreases dramatically, with potential to choke native desert plants (Evans 1999). The nitrogen tied up in plant litter becomes a volatile fuel. Cheatgrass not only changes the fire frequency of a site, but also the fire volatility, intensity and the extent that an area is likely to burn in the future. It invades areas where native plants are weakened. Such weakening can occur under the effects of sustained overgrazing by livestock, especially sheep, or from episodic drought, or because of a broad change of land use regimen. Species that are commonly displaced by cheatgrass include big sagebrush (*Artemisia tridentata*), antelope bitterbrush (*Purshia tridentata*), bluebunch wheatgrass (*Agropyron spicatum* = *Pseudorogneria spicata*), crested wheatgrass (*Agropyron cristatum*), western

wheatgrass (*Agropyron smithii* = *Pascopyrum smithii*), Sandberg bluegrass (*Poa sandbergii* = *Poa secunda*), needle-and-thread grass (*Stipa comata* = *Hesperostipa comata*), and Thurber's needlegrass (*Stipa thurberiana*). Although fire is a natural part of the sagebrush grassland ecosystem, those fires usually occurred at intervals between 60-100 years (Whisenant 1989). Cheatgrass infested areas burn at a much greater frequency, every 3-5 years (Whisenant 1989). At this frequency, native shrubs and perennial grasses cannot recover and after a few wildfire cycles a cheatgrass monoculture develops. This monoculture further increases the frequency of fires and its ability to return and expand in dominance in the area. There are approximately 325,000 acres of cheatgrass dominated sites within the District.

Cheatgrass is also considered especially detrimental, because, despite its early growth and virulent color, it cannot be used as feed for livestock because it dries out quickly, with its surface annual-grass roots. When the sharp-pointed bearded florets mature, they can cause injury to animals that graze on them.

Perennial Grassland Communities - Most native grasses in Nevada are bunch grasses. Some non-native species are also bunch grasses, such as crested wheatgrass. Some perennial grasslands have been created by livestock forage projects which were designed to remove the shrub component of the sagebrush-grassland community and establish introduced perennial wheatgrass species. In addition, fire occurrences in the last 10 years have resulted in many acres of shrub-grasslands being converted to a vegetative community currently dominated by perennial grasses and forbs. There are nearly 1.3 million acres in the Elko District that are currently dominated by perennial grasses with less than 15 percent shrub composition. Over time, shrubs will naturally re-establish and begin to dominate the vegetative composition of these areas.

Sagebrush Communities – The sagebrush/perennial grassland is the most extensive community in the area, covering approximately 4,500,000 acres. This type occurs from clay pan valley bottoms, to well drained deep soils in valley bottoms, to alluvial fans, and up to ridgetops on all exposures. Slopes range from 2 to 75 percent, but 4 to 25 percent is the most typical. Elevations range from 4,000 to 9,000 feet. The accepted ranges of fire occurrence within the sagebrush vegetation types (Miller, 1998) are as follows:

Wyoming big sagebrush (*Artemisia tridentata spp. wyomingensis*) - From 25 to 100 years. Where shrubs were small in stature and grass sparse due to low site productivity and precipitation, the frequency was closer to 100 years. This sagebrush type occupies approximately 40 percent (1.8 million acres) of the sagebrush-dominated areas.

Basin big sagebrush (*Artemisia tridentata spp. tridentata*) - From 30 to 70 years during the pre-settlement period, with dry sites burning at greater than 50 year intervals. This sagebrush type occupies approximately 20 percent (900,000 acres) of the sagebrush-dominated areas.

Mountain big sagebrush (*Artemisia tridentata spp. vaseyana*) - From 11 to 40 years, the sites closest to Nevada (in southwest Idaho) with western juniper ecotones had an estimated fire return interval of 11 years. This sagebrush type occupies approximately 25 percent (1.1 million acres) of the sagebrush-dominated areas.

Black sagebrush (*Artemisia nova*) - Estimated fire return intervals of 100 to 200 years. This sagebrush type occurs on approximately 15 percent (700,000 acres) of the sagebrush-dominated areas.

Associated with the sagebrush communities are various perennial grass species. Among the most important are: Thurber needlegrass (*Stipa thurberiana*), Idaho Fescue (Festuca Idahoensis) bluebunch wheatgrass (*Pseudorogneria spicata*), Indian ricegrass (*Oryzopsis hymenoides*), Great Basin wildrye (*Elymus cinereus*), bottlebrush squirreltail (*Elymus elymoides*), Sandberg bluegrass (*Poa secunda*) and pine bluegrass (*Poa scrabrella*). Important forb species include arrowleaf balsamroot (*Balsamorhiza sagittata*) and taper hawksbeard (*Crepis acuminata*). Potential vegetative composition is about 50 percent grasses, 15 percent forbs and 35 percent shrubs.
Site productivity affects the burning patterns of the big sagebrush species. Highly productive sites have greater plant density and more biomass, which provides the fuels to carry the fire. Among the three subspecies of sagebrush, mountain sagebrush is the most flammable, Wyoming big sagebrush is the least flammable, and basin big sagebrush is of intermediate flammability. All three species are easily killed by fire and reestablish themselves through on-site seed caches and off-site seed sources (FEIS).

The black sagebrush communities extend from low arid foothills and ranges to high mountain ridges. The perennial grasses associated with these communities are Idaho fescue (*Festuca idahoensis*), Webber ricegrass (*Oryzopsis webberi*), bottlebrush squirreltail, Cusick bluegrass (*Poa cusickii*), Sandberg bluegrass and pine bluegrass. Potential vegetative composition is about 50 percent grasses, 15 percent forbs, and 35 percent shrubs.

Typically, the sparse vegetation of most black sagebrush communities normally precludes the occurrence of fire, except in exceptional years. Black sagebrush stands, where they form a major part of the community, are a valuable wildlife winter forage species and should not be burned on a large scale basis.

The grasses associated with these communities are generally fire resistant. Bluebunch wheatgrass is a coarse-leafed plant without a lot of fuel buildup around the base, so there are no prolonged high temperatures during fire events and most basal buds survive. Following fire, tiller production usually increases and biomass increases. Regrowth after a burn shows increased mineral content and lower fiber concentrations than untreated foliage. Great Basin wildrye is generally favored by disturbance and has shown increased foliage production and higher densities after fires in the Elko District. The plant resprouts from buds at the root crown and from new seedlings established from residual plants. This grass is a poor competitor and is suppressed by other species. Bottlebrush squirreltail is one of the most resistant bunchgrasses. It often increases in abundance after a fire. Shoot biomass and density and the number of reproductive shoots may increase dramatically after a fire. Bluegrass species are normally unharmed by fire. Their rapid maturation in the spring reduces fire damage because they are dormant during most of the burning season. Bluegrass cover generally increases after a fire. Indian ricegrass normally is only slightly damaged by fire. Early spring burning generally increases the canopy cover and density of this grass with it easily reseeding from adjacent plants. Idaho fescue can survive low to moderate intensity fires if the basal buds are not damaged. Spring burning has the least effect on this grass. In some areas with more favorable growing conditions, it resembles bluebunch wheatgrass in its ability to withstand fire. In poor sites it is easily damaged.

Idaho fescue that burned in the Lone Mountain fire of 1994 on the Elko District recovered to its pre-fire density and biomass within two years following the fire. The needle-and-thread and needle grasses are the grasses that are most easily damaged by fire. This is due in large part to the dense fine fuels and culms around the bases of the plants. Large plants are the most susceptible due to the greater buildup of fuels. Midsummer fires are the most damaging. For all of the grasses, it appears that post-growing season fires have the most beneficial effects (FEIS).

The forbs found within this community are generally unaffected by fire or are favored by fire. This is due in part to their growth forms and because most forbs are colonizing species.

Pinyon-Juniper – This type occurs in mountainous regions. Closed and open stands of pinyon-juniper cover approximately 1,100,000 acres within the District. Slopes range from 30 to 50 percent, but slope gradients of 30 percent are most typical. Elevations are 5,500 to 9,000 feet. The pinyon, juniper and mahogany types may be roughly divided into three altitudinal belts. On low, dry fans, juniper occurs in nearly pure stands. Pinyon and mahogany occur at the higher elevations where the annual precipitation is greater, while in between is a transition zone where the three species mix. The pinyon pine, Utah juniper and inclusions of curlleaf mountain mahogany (*Cercocarpus ledifolius*) forest types are distinct ecosystems that are managed and perpetuated for the production of multiple resource values. These values include wildlife habitat (numerous species attracted to pine nuts), recreation, and watershed protection. Harvest of wood products produced in pinyon/juniper woodlands for personal use and for use in numerous small business operations is another value. Important forest products include firewood, Christmas trees, posts, pine nuts and wildings.

These plant communities are characterized by Pinyon pine (*Pinus monophylla*) and/or Utah juniper (*Juniperus osteosperma*). On the Elko District most of the woodland sites are dominated by Utah juniper. The understory consists primarily of bluebunch wheatgrass and black sagebrush. Other important species associated with these sites include Thurber needlegrass, Sandberg bluegrass, Great Basin wildrye and needle-and-thread grass (*Stipa comata*). Juniper and pinyon trees are prevalent enough to dominate these areas, however antelope bitterbrush (*Purshia tridentata*) and curleaf mountain mahogany can be located within the understory. Potential vegetative composition is about 40 percent grasses, 15 percent forbs, and 45 percent shrubs.

The fire frequency in the pre-settlement period on pinyon-juniper and mahogany varied considerably. Highly productive sites with continuous grass cover probably had a fire frequency of approximately 10 years, and limited pinyon-juniper to rocky outcrops and sites without grass. Fire maintained a savanna plant community of grass with occasional trees. On moderately productive sites, it is estimated that there were frequent surface fires ranging from 10 to 30 years, with crown fires occurring every 200-300 years. Fires on low productivity sites with discontinuous grass cover probably were small, patchy and infrequent (Miller, 1998). In the Great Basin woodlands, the best candidate locations for prescribed fire are areas where juniper is invading the sagebrush-grassland communities. Communities in early to middle stages of succession typically can be treated to control their expansion by various methods, including fire (Miller and Tausch 2001). These sites usually have a shrub and tree cover ranging from 45 to 60 percent. These sites can be burned with low intensity spring burns to eliminate the encroaching small (up to 4 feet high) tree overstory.

Aspen – Many areas in the mountains have small stands of aspen (*Populus tremuloides*), and it is estimated that approximately 17,000 acres of aspen are found on the District. The understory consists of forbs such as aster (*Aster spp*.), lupine (*Lupinus spp*.), fireweed (*Epolobium spp*.) and geranium (*Geranium spp*.), but is often dominated by snowberry (*Symphocarpus spp*.). Some common grasses that may be present are smooth brome (*Bromus marginatus*), slender wheatgrass (*Agropyron trachycaulum*) and blue wildrye (*Elymus glaucu*).

Aspen is usually top-killed by fire and regenerates by root suckers. Fire frequency is determined by aging the stand to see when it originated. In the intermountain west, aspens mature and start declining at 80 to 100 years. As the aspens mature, they become susceptible to insects and disease. Stands may be lost when conifers invade and shade out the aspen. In sagebrush areas, the stands may break up and convert to shrub-dominated vegetation (Miller, 1998). Aspen can thrive after fire by suckering (FEIS) and rejuvenate the stand and eliminate encroaching vegetation. When grazing is reduced or eliminated by construction of exclosures, Aspen rejuvenation by suckering is enhanced (Kay and Bartos 2000). Aspen is highly competitive on burned sites. Even when there is little detectable aspen on a site, it may dominate after a fire. Given adequate rest from grazing following fire, the recovery is good and the potential exists for increasing the total acreage of aspen within an area.

The primary grasses in the aspen community easily regenerate after a fire, either through their rhizomes or through seeds. Smooth brome is negatively affected by early spring burns. The seed bed after a fire is particularly conducive to the establishment of blue wildrye. After approximately four growing seasons, blue wildrye is suppressed by smooth brome, which outcompetes it (FEIS).

The forbs within this community are all fire resistant, with fireweed and lupine being aggressive colonizers after a fire, either though sprouting or seeds. Asters are moderately resistant due to their rhizomes, and the population increases rapidly after a fire due to mass flowering and seed production in the first two post-fire years (FEIS).

Mixed Conifer – The mixed conifer community occupies approximately 47,000 acres on the District. Tree species include limber (*Pinus flexilis*) and whitebark (*Pinus albicaulis*) pines, white fir (*Abies concolor*), subalpine fir (*Abies lasiocarpa*), Englemann spruce (*Picea englemannii*) and, at the highest elevations, bristlecone pine (*Pinus longaeva*).

All age classes of the various conifer species are represented within the District, with the majority being mature (100 to 300 years old). These forests are found from 5,000 to over 10,000 feet in elevation, where precipitation is the greatest. However, they will extend downslope to lower elevations (in areas such as drainages or north slopes) when moisture is adequate. Quigley and Haynes (1996) show that the type of fire regime within this vegetation type in the Jarbidge area of Northeast Nevada (the closest area with similar forested types to the Elko District) has changed from non-lethal to lethal over the past 50 years. This is probably due to the buildup of fuels and the conversion of parts of this forest from pine-dominated open stands to a closed-stand forest with a higher concentration of fir and spruce trees with more stems per acre. Of concern is that the "islands in the sky" areas of mixed conifer in the Elko District are remnant stands of a previously larger vegetation type. A stand replacement fire occurring in these remnant

stands may totally change the vegetative community, losing a potentially valuable resource.

Limber pine is susceptible to fire when it is young. The older trees have bark up to 2 inches thick, which acts as insulation and protects the trees from stem scorch. The terminal buds are somewhat protected from heat associated with crown scorch by tight needle clusters. The vulnerability of limber pine to fire is somewhat mitigated by the open structure of the stand and the sparse understory. The fuel loadings are generally light, leading to low intensity understory fires. Studies in Montana show a fire frequency of 50 to 200 years. It is suggested that limber pine growing in open stands may be maintained by periodic surface fires, which reduce the undergrowth (FEIS).

Whitebark pine is a moderately fire resistant species, and is benefited by both creeping ground or surface fires and severe stand replacement fires. Its susceptibility to fire is offset by the open structure of its stands and the sparse understory within this habitat type. Whitebark pine is favored by severe stand-replacing fires, especially in moist sites where succession to more shade tolerant species (such as white fir) is apt to occur. Fire scar studies have shown a relatively infrequent 50 to 300-year fire frequency. With the lengthening of the fire return intervals, older stands are more susceptible to bark beetle infestations, which aid to advance succession to shade tolerant species. The regeneration of whitebark pine in small openings is probably due to surface fires. Whitebark pine's perpetuation in moist sites, where succession to shade tolerant species is rapid, is probably due to severe fires. The occurrence of whitebark pine in association with Englemann spruce in subalpine basins and north slopes is probably the result of fire (FEIS).

White fir (in the Elko area often genetically mixed with subalpine fir) is a shade tolerant species that thrives with the lack of fire. It rapidly invades pine sites in the absence of fire. Sapling and pole-sized trees are very fire-sensitive because of their thin bark and low hanging branches, which easily ignite from surface fires. As the bark thickens they achieve more fire resistance. Small patches of mature white fir survive fire and provide a seed source to recolonize the site. In the Sierra Nevada Mountains (the closest studied site with similar environmental conditions), the fire frequency was from 6 to 20 years. This fire frequency kept the fire intensity low, as there was little fuel build-up. This regime kept the forests in open pine and Douglas fir-dominated stands. Today's heavy fuel accumulations and thick "dog hair" stands greatly increase the chances for high intensity stand replacement fires.

Englemann spruce is very sensitive to fire and is generally killed by even a low intensity fire. Post-fire establishment of seedlings is through seed dispersal from remaining mature trees. Pockets of Englemann spruce stands that escape burning are generally in moist sites where fire spread is limited. In subalpine sites, the spruce escape fire because of the discontinuous fuels, moist environment, and the broken and rocky terrain. Englemann spruce probably has a fire frequency of 150 years or more. Many of the Englemann spruce stands are even aged, suggesting that they developed after a fire (FEIS). In the Cherry Creek Mountains on the Elko District, Englemann spruce trees were observed to have healed fire scars on healthy mature trees from low intensity surface fires. This suggests that low intensity surface fires have occurred in this forest type, as well as the usual stand replacement fires.

Subalpine fir (in the Elko area often genetically mixed with white fir) is very sensitive to fire and generally has a high mortality from even low intensity fires. Subalpine sites are moist, with the lower, warmer sites experiencing shorter fire return interval with a lower intensity. Areas with fire return frequencies of 20 years or less keep the areas dominated by seral conifers. Sites at higher and cooler elevations are subject to stand replacement fires occurring from 90 to 350 years (FEIS).

Bristlecone pine generally occurs in habitats where fire-carrying fuels are basically non-existent. Fires with enough intensity to result in crown fires rarely occur in the grass dominated understory. Surface fires in these areas are low intensity, slow burning and very infrequent (FEIS).

A species that may have been present but now is probably missing from this community is the inland Douglas fir (*Pseudotsuga menziesii var. glauca*). The lack of inland Douglas fir may be due to successional change to more shade tolerant species. Also, its highly desirable wood characteristics may have led to it being overharvested. The last known stands of Douglas fir were harvested in the 1970's from the Ruby Mountains. Douglas fir has existed in this area and still may be found in an occasional isolated area. Douglas fir is among the most fire tolerant tree species in the Great Basin, with the larger trees having thick bark that serves as insulation. Low intensity surface fires tend to reduce fuel levels and keep Douglas fir stands open. On sites where Douglas fir is a seral species (such as subalpine sites and/or north facing slopes), seedling establishment tends to be better after a fire. Large, high intensity fires tend to reduce seedling establishment and favor Englemann spruce and subalpine fir (FEIS).

Observations have been made of multiple, small, low-intensity surface fires ranging from 10 to 60 years ago in mixed conifer areas within the Elko District (Goshutes, Pequops, Cherry Creek and Spruce mountains). This is in addition to larger block fire scars (up to 40-60 acres) that were of the stand replacement category.

Mountain Brush – This type occurs on upland terraces and in mountain valleys and slopes of all aspects. Areas of this community occur throughout the District, often in association with mountain big sagebrush. Slopes range from 4 to 50 percent, but are mostly about 30 percent. Elevations are 6,000 to 9,000 feet. The primary species present are serviceberry (*Almelanchier utahensis*), antelope bitterbrush, curlleaf mountain mahogany, oceanspray (*Holodiscus discolor*) and snowberry (*Symphoricarpos spp.*).

Serviceberry is damaged by wildland fire, but is a vigorous resprouter after a wildland fire. It can also remain in a suppressed state in a closed stand of conifers for a long time, and canopy removal by fire will stimulate sprouting (FEIS).

Bitterbrush is often killed by fire. It either regenerates by sprouting after a fire, or from on-site rodent seed caches and off-site seed sources. The erect form found in this part of the Great Basin is less likely to sprout than low lying forms found in other areas. Spring fires are less damaging to bitterbrush than either summer or fall burning. Even though bitterbrush is often killed by fire, it occurs in communities with a high fire frequency. Fire may be necessary to maintain populations of bitterbrush by providing bare mineral soil and reducing vegetative competition. Bitterbrush stands in juniper are sensitive to fire, but the long-term survival appears to depend on fire-generated seral

conditions (FEIS). Bitterbrush in a prescribed fire in the Stormy area of Elko District has been observed to sprout after a September prescribed fire.

Curlleaf mountain mahogany is usually killed by fire. Seedlings do establish after a fire, primarily from off-site seed and sometimes by resprouting. Studies in western and central Nevada on the Shoshone Range (the closest studied area to the Elko District) indicate that fire was infrequent in old growth stands, probably due to the lack of surface fuels and also growing on extremely rocky "fire proof" sites. Burning is generally only recommended in sites that have been invaded by conifers, so that competition is reduced and mineral soil is made available for seedling establishment (FEIS).

Oceanspray is well adapted to fire. It is a vigorous resprouter and is generally resistant to fire mortality. Post-burn recovery is usually rapid, depending on the amount of mineral soil exposed. Fall burning appears to have a more positive effect on this plant than burning at other times of the year (FEIS).

Snowberry is moderately resistant to fire and resprouting has been documented in Nevada. Spring burning in Idaho, in mountain big sagebrush and Idaho fescue on sites similar to those found within the Elko District, has shown increased coverage of snowberry. Studies within pinyon-juniper woodlands show a significantly higher occurrence of snowberry than on adjacent mature woodlands (FEIS).

The grasses in this plant community are characterized by Idaho fescue, bluebunch wheatgrass and mountain brome (*Bromus marainatus*), with mountain big sagebrush being an important species associated with this site. Brush species dominate the area. Potential vegetative composition is about 55 percent grasses, 15 percent forbs and 30 percent shrubs.

Crested Wheatgrass Seedings – Crested wheatgrass was introduced into the United States from native cold, dry plains of Siberia and Russia in an attempt to obtain a pasture and hay grass well suited to the severe growing conditions of the semiarid Great Plains and the foothill and lower elevations of mountain ranges in the West. Approximately 390,000 acres within the District have been seeded to crested wheatgrass (*Agropyron cristatum* and *Agropyron desertorum*), a non-native species used in post-fire rehabilitation. Fire on these sites removes the encroaching sagebrush vegetation and maintains the seedings as intact grassland, with excellent recovery potential following the fire. Crested wheatgrass is resistant to fire because it maintains high moisture content through most of the summer wildland fire season. Recovery after fire is usually rapid. Crested wheatgrass is a long-lived perennial bunchgrass that is tolerant of fire when dormant. The plant has coarse stems and leaves that burn quickly with little heat transfer to the basal buds. This grass has the capacity for rapid new tiller formation, preventing the depletion of stored nutrients. It also allocates plant resources to new tiller development and curtailing root system growth. Post fire response is considered to be rapid. Some studies have indicated that late summer burning favors this grass (FEIS).

R. Noxious Weeds

A noxious weed inventory has been completed on approximately 5 million acres of public lands within the Elko District as of August, 1998. Preliminary findings from this inventory suggest that most noxious weeds occur on disturbed areas frequently used by livestock,

wildlife and humans. Examples of disturbed areas include roadsides and rights-of-way along primary and secondary roads, gravel pits, salt licks, recreation sites, spring sources, water sources and trails. The 38 species of Nevada Noxious Weeds are listed in the Programmatic Environmental Assessment of Integrated Weed Management on Bureau of Land Management Lands. If a disturbed area that is infested and dominated with noxious weeds is burned, the noxious weeds will rapidly reestablish, out-competing the remnant native vegetation. If the area has a good seed source of native desirable species, chances are the native desirable species will return and out-compete the noxious weeds.

S. Wild Horses

Wild horses and burros are protected under the Wild Free Roaming Horse and Burro Act of 1971. The objectives of FLPMA and the RMPs are to keep populations at a level that would achieve and maintain a thriving natural ecological balance on the public lands.

Wild horses are protected in 8 herd management areas (HMA) and/or herd areas (HA) in the Elko District. The HA/HMA's encompass approximately 22 different grazing allotments and are dispersed throughout the entire District. Wild horses typically inhabit the mountains during the summer months, and can be found on the valley floors during the winter. Their habitat ranges from the pinyon-juniper woodlands to the desert shrub/salt brush vegetation communities. The Wells RMP was amended for wild horses in 1993 and a proposed amendment for the Elko RMP was issued in July 2003.

Wild Horse Herd Management Areas

Wild Horse Herd	Acres
Antelope Valley	463,540
Goshute	250,800
Spruce-Pequop	138,000
Maverick-Medicine	285,960
Rock Creek (proposed)	126,753
Little Humboldt (proposed)	17,151
Owyhee	339,104
Diamond Hills North	70,479

T. Rangeland / Grazing Management

Livestock grazing (cattle, sheep and horses) is a primary use of BLM lands in the area. Livestock use levels are administered through the issuance of leases and permits. Nevada BLM achieves desired objectives for livestock grazing management through allotment evaluation and a multiple use decision process. They prescribe the manner and extent to which livestock grazing is conducted and managed to meet multiple use, sustained yield, economic, and other goals and objectives. Seasonal use from March to October is generally permitted whereby cattle use the valley bottoms and fans, and eventually move to the tops of the mountain ranges where they stay until fall. During winter, they are confined to the valleys and bench lands. This pattern varies with the availability of water, the need to implement grazing systems to meet objectives for riparian and stream habitats, the steepness of slope, weather, and forage supply and distribution. The majority of cattle use is from April to October. Sheep use is made both in trailing through the area and on seasonal ranges within the area. The Utah livestock

operators make the majority of sheep use on the Utah border between November and March. Domestic horses are licensed in a few allotments through the area.

Within the Elko BLM Field Office, the total permitted use in Animal Unit Months (AUMs) allocated to domestic livestock is currently 737,983. The total permitted use is allocated between 235 grazing allotments grazed by 181 livestock permittees. The average AUM for sagebrush-perennial grass communities is approximately 0.12 per acre. The AUM for pinyon-juniper and mixed conifer forests is approximately 0.06 per acre.

U. Socioeconomic Conditions

The Elko BLM District consists of all of Elko County and a small portion of Lander and Eureka Counties in Nevada. Elko County is by far the largest of the three counties in terms of population size. In 2000, Elko County had 45,291 residents, while Lander and Eureka Counties had just 5,794 and 1,651 residents, respectively (2000 U.S. Census).

An examination of employment trends in Elko County reveals that the County's employment base is heavily concentrated in the services sector. In 2000, the service sector represented 49 percent of the County's total employment base and 40 percent of all of the County's wages ($190,875,000, Bureau of Labor Statistics). Although smaller, the retail trade sector was also an important contributor to the County's employment base. The sector represented 17 percent of the County's employment in 2000 and 10 percent of the County's wages ($49,111,000, Bureau of Labor Statistics). The smallest sectors in Elko County's employment base included the finance, insurance and real estate (FIRE) sector; agriculture, forestry, and fishing sector; and the manufacturing sector. Each of these sectors represented less than 3 percent of the County's employment base, and in total, the three sectors accounted for just 5 percent of the County's total wages ($24,781,000, Bureau of Labor Statistics).