APPENDIX D – FIRE EFFECTS FOR VEGETATION TYPES

Information in this appendix has been adapted from, and is consistent with, Phase II of the Fire Plan (Land Stewardship Associates 2002), the Little Snake Field Office and Brown's Park National Wildlife Refuge Environmental Assessment (BLM 2000), and the Fire Effects Information System (USFS 2003). This appendix describes the effects of wildland fire on the vegetation types within the Phase III planning area. The vegetation types discussed include sagebrush, pinyon/juniper, mountain shrub, salt desert shrub, aspen, lodgepole pine, spruce/fir, riparian, and grassland.

SAGEBRUSH

Most species of sagebrush are easily killed by fire. Site productivity affects the propensity for sagebrush to burn. Highly productive sites have greater plant density and more biomass, which in turn provide more fuel to carry a fire. Black and three-tip sagebrush occupy sites with low productivity; therefore, low biomass is available to carry a fire. These latter species occupy sites with very long fire return intervals (100 to 250 years between events).

The fire return interval for big sagebrush, which comprises a majority of the sagebrush association in the Phase III planning area, is shorter than the low sagebrush types. Among the three subspecies, basin big sagebrush is considered intermediate in flammability. Mountain big sagebrush is most flammable, and Wyoming big sagebrush is least flammable. The fire return interval for mountain big sagebrush is 15 to 40 years, for basin big sagebrush is 25 to 70 years, and for Wyoming big sagebrush is 50 to 100 years.

All subspecies of big sagebrush re-invade a burned site by seed stored in the soil or brought from off site. The rate of stand recovery depends on the season of fire, the availability of seed, post-fire precipitation patterns, and the amount of competition with other plant species that regenerate after the fire. If a year of plentiful moisture occurs soon after the fire, reestablishment can be greatly accelerated. Patterns of burning also greatly influence the rate of post-fire reestablishment. Small burned areas are more rapidly re-invaded from adjacent sources of seed, and individual plants that survive within the fire perimeter may provide much of the seed for recolonization. Sagebrush seed does not disperse for great distances; instead, most is shed near the base of the parent plant.

Sagebrush seedlings re-establish readily and grow rapidly on light to moderate intensity burns. Reproductive maturity may occur in 3 to 5 years when competition is removed and growth conditions are optimal. Desirable pre-burn density and cover may be achieved in 15 to 20 years under favorable conditions. Recovery in high-intensity, large burns or where herbaceous competition impedes reestablishment of sagebrush may require 30 years or more before desirable density and coverage of big sagebrush is regained.

Currently, many of the sagebrush stands in the Phase III planning area have reached or are beyond the age, in terms of stand structure and composition, when fire would normally have intervened to move these communities back to an earlier seral stage. Lack of fire may be caused in part by fire suppression efforts, the reduced availability of fine fuels because of livestock grazing, or by other factors that influence the susceptibility of vegetation to fire. Continued exclusion of fire from these communities has facilitated succession of sagebrush stands to a point where fine fuels provided by native grasses and forbs are limited. Many of these sagebrush communities in the pinyon/juniper zone have seen an increased abundance of pinyon and juniper trees, which replace sagebrush and, more importantly, the herbaceous species needed to carry fire. These herbaceous species are critical to maintenance of the natural fire regime for these communities.

Decreased productivity of herbaceous species in the sagebrush community extends the fire return interval outside the norm until extreme conditions are necessary for a fire or other disturbance to occur. At that point, the site is susceptible to invasion by cheatgrass or other non-native plants, and the fire return interval may become much shorter than normal. An undesirable sagebrush community (lacking in or devoid of native herbaceous vegetation) may increase the chance for invasion by cheatgrass after a disturbance, which in turn would be perpetuated by more frequent fire events.

PINYON/JUNIPER

Pinyon and juniper trees and many of the related shrub species in the pinyon/juniper association are vulnerable to high-intensity crown fires. Much of the pinyon/juniper in the Phase III area has been protected from fire for a period long enough to allow the stands to become dense, with a closed canopy and abundant fuels. Under these conditions, fine fuels that grow under the canopy become less abundant. The lack of fine fuels prevents the creeping ground fires that traditionally created natural openings. These natural openings served as fuel breaks. When conditions are favorable for fire to move through the crowns, fires tend to be large, stand-replacing events that convert the woodland community to open grassland. The size of these fires is usually the result of extreme burn conditions, heavy fuel loads, and topography. Hazardous fuel reduction projects would be important in preventing large, stand-replacing fires. These projects would improve the age class distribution of the pinyon/juniper stands and break up large tracts of continuous fuels in the pinyon/juniper association.

MOUNTAIN SHRUB

Many of the plant species common to the mountain shrub association are tolerant of fire. Mountain-mahogany, serviceberry, and snowberry sprout vigorously after fire, and Gambel oak is extremely tolerant of fire. Most shrub species, however, are top-killed by moderate to severe fire. Larger branches may survive low-severity fires. The density of shrubs usually increases, and pre-fire cover is often retained in the ensuing years. Even when there is little change between pre- and post-fire cover, fire usually makes shrubs more accessible to browsing animals by lowering their height. Many of the herbaceous species in the mountain shrub association show increased cover after a burn as shading is reduced.

Fire return intervals in mountain shrub are probably longer than in sagebrush. Mountain shrub occurs on more mesic sites in the Phase III planning area, where fire typically occurs during infrequent dry periods. Fires are probably larger, higher in intensity, and consume most of a stand when conditions are right. Currently, most of the mountain shrub stands in the Phase III planning area are older and have high fuel loads. Normal fire return intervals were probably spaced sufficient to hold encroachment by trees at a level much below the level that occurring at present.

SALT DESERT SHRUB

Natural fire events are usually not common in this association because of the sparse fuels. Many of the native species within this association are able to survive occasional fire events either by re-sprouting or by reestablishing from on-site seed. Native species may be slow to recover from any disturbance event, including fire, because non-native species such as cheat grass and halogeton out-compete native species for scarce water and other resources.

ASPEN

Aspen stands tend to be located at higher elevations where conditions are wetter. Consequently, fire is infrequent in this plant community. When fire does occur, it tends to burn with low intensity through the understory. Even these low-intensity fires are usually enough to cause significant mortality of young to middle-aged trees. However, aspen re-sprouts aggressively after fire and depends on fire or other disturbances for establishment. After a fire, many forest sites that were previously occupied by coniferous trees will be converted to aspen, which will dominate for 50 to 100 years. Many aspen stands in the Phase III planning area are being invaded by conifers because fires that would have regenerated these stands have been suppressed. In addition, livestock grazing, although it reduces fuels in the understory, can also decrease recruitment of young aspen.

LODGEPOLE PINE

Lodgepole pine tends to form dense, even-aged stands that are prone to infrequent, high-intensity, stand replacement crown fires. The fire interval for lodgepole pine is between 75 and 200 years. Lodgepole pine is a fire-dependent species that needs the heat of fire to open its cones and release the seeds. Many of the stands of lodgepole pine in the Phase III planning area are reaching an age where the likelihood of a stand-replacing fire is increasing.

SPRUCE/FIR

Subalpine fir and Engelmann spruce are two of the least fire-resistant western conifers. They tend to be susceptible to fire because their thin bark provides little insulation for the cambium; the bark ignites readily; the shallow roots are susceptible to soil heating; their low-growing branches are readily ignited; they exhibit a tendency to grow in dense stands; they bear highly flammable foliage, and lichen growth is moderate to heavy in these stands. Spruce/fir forests are normally subject to high-intensity, stand-replacing crown fires that occur at intervals of 100 years or longer. These fires kill most or all of the trees in the stand. These species are also susceptible to surface fires because fine fuels, which are often concentrated under mature trees, burn slowly and girdle the thin-barked bole. Some large trees may survive light surface fires, but often die later from infection caused by wood-rotting fungi that enter through fire scars.

RIPARIAN

Live fuels in riparian communities usually contain more moisture and do not readily burn. Nevertheless, accumulations of dead fuels can burn under some conditions. Mature cottonwood trees and willows are top-killed by moderate and severe fire. The cambium layer is damaged by even low-severity surface fire. Severe wildland fire can consume the understory vegetation of a riparian community. Most cottonwoods and willows readily sprout after an injury such as fire; sprouting occurs primarily from the root crown and bole but also from lateral roots. Riparian communities that have been invaded by saltcedar accumulate fuels more rapidly than do communities dominated by cottonwood and willow, and consequently burn about every 10 to 20 years. Native vegetation, including cottonwoods and willows, is often absent from these burned areas despite pre-fire presence. The native vegetation is usually replaced by the fire-adapted saltcedar. Herbaceous riparian areas rarely burn because of high moisture content in the fuel. Some areas, such as cattail marshes, can burn in the fall after the leaves are killed by frost. These fires can be intense, but do not affect re-growth the following spring.

GRASSLAND

The effects of fire depend on the growth habit and phenology of affected plants, as well as the season of burn, intensity of the fire, and severity of the burn. Fires usually top-kill and consume vegetation to ground level. Rhizomatous grass and forbs are frequently favored by fire; growth of new shoots is stimulated. Rhizomatous species usually have coarse stems and lesser amounts of leafy material, so that combustion is rapid and downward transfer of heat to belowground plant parts is limited. Heat transferred downward may adversely affect meristematic growth tissues and injure the affected plant. Bunchgrass crowns characterized by coarse stems and leaves are generally considered less prone to prolonged burning than are fine-leaved bunchgrasses.

Burns that occur in the spring (an unlikely scenario given the rare incidence of natural ignitions at that time of the year) after new growth is initiated can severely injure most grass and forb species. Likewise, burns when grasses and forbs are in the fruiting stage (generally in early- to mid-summer) when carbohydrate reserves in the roots are low can result in significant damage. Fires that would be allowed to burn for benefit in early summer in C and D areas could adversely affect plant species before fruiting. However, fires would likely remain small because of higher moisture in most plants at this stage of growth.

Grasses and forbs spread rapidly via surviving rhizomes after a burn. Nonrhizomatous plants establish relatively rapidly from seed banks in the soil or from off-site sources of seed. Composition and production of most grass and forb species usually exceed (under optimal conditions) pre-burn levels within two growing seasons after a burn. Establishment of cheatgrass or other invasive annual grasses after fire can decrease the productivity of native grasses. Cheatgrass can also abbreviate the fire return interval, reducing the amount of time available for native grasses and forbs to recover after a fire.