

**Appendix E**  
**Description of Fire Regimes on the GMUG**



## **Summary of Fire Regimes, Fire Effects, and Post-fire Vegetation Response for Vegetation Types on the GMUG**

The following narratives are very generalized summaries of pre-settlement, natural fire regimes and fire effects in several vegetation types found on the GMUG. They are intended to provide a basic overview of the potential impacts of Wildland Fire Use (size, intensity, first order fire effects, post-fire vegetation) which can then be used as a base for more in depth discussion of potential Environmental Consequences (soil, air, water, wildlife, recreation, archeology, etc). In reality each of these vegetation types grades into adjacent vegetation types, resulting in highly complex fire regimes, as well as very complex first, and second order, fire effects. Occasionally a significant post-settlement issue, particularly exotic species or fire exclusion, is mentioned to provide a cautionary note. No literature has been cited; the narratives are based on previously written vegetation descriptions in the Forest Plan revision (draft), Interagency Fire Management Plans, and Fire Regime descriptions as well as knowledge and experience gained while managing fire in these vegetation types.

### **Spruce-fir**

#### **Fire Regime**

Spruce-fir on the GMUG can best be classified as Fire Regime V, which typically consists of fire frequencies of 200+ years resulting in high severity, stand replacement fires. Fire return intervals tend to be longer, (up to 500 years) at the higher elevations and in moist areas and drainages. Only during very dry, droughty years, do fires have a widespread influence on spruce-fir stands; dry conditions result in high surface fire intensity, initiation of crown fire, high rates of crown fire spread and large acres burned. During dry seasons stand replacement fires of several hundred to several thousand acres in size can be anticipated. During most fire seasons higher fuel moisture in spruce-fir precludes any significant fire spread so fires smolder in the litter and duff, stay on the ground, and are typically smaller than 5 acres.

#### **Fire Effects**

During average fire seasons fire effects will be confined to very small areas due to lack of fire spread and will consist of removal of a small percentage of litter and duff and minor mortality of both understory and overstory trees through heating of roots and boles. These fires will have minimal influence on stand structure, perhaps only removing 5-10% of the overstory trees, stimulating some aspen in the understory, and creating openings in which spruce-fir have an opportunity to regenerate.

Most significant fire effects in spruce-fir will occur during severe fire seasons when fuel moistures are lower. Fires will tend to be stand replacing with significant spread, resulting in fires potentially impacting several hundred to several thousand acres. Spruce-fir mortality will probably be 75-90% within the fire perimeter, with the only surviving trees being located in protected moist or rocky areas or on the lee sides of topography. Duff and litter consumption will probably be greater than 80% with significant amounts of soil exposed. Understory shrubs, grasses, and forbs will typically

regenerate over a majority of a spruce-fir burn within 2-5 years. In addition, if aspen were present prior to the fire, even as a very small percentage of the pre-burn vegetation, the residual root structure will rapidly re-sprout at varying densities. Over time fire killed spruce-fir will decay and fall, adding surface debris which could be substantial in some locations. Significant spruce-fir regeneration may not occur on the site for several decades following a fire, resulting in medium to large patches of grass/forb, shrub, and aspen vegetation within the denser spruce-fir vegetation type.

Currently across many areas of the GMUG subalpine fir is experiencing a high rate of mortality due to spruce budworm defoliation. This situation is resulting in an increasing load of dead fuels throughout the spruce-fir stands, which could very well increase the likelihood of stand replacement fires during drier years in the near future.

### Aspen

#### Fire Regime

Aspen on the GMUG is primarily a seral species that, over time, succeeds to spruce-fir, and to a lesser extent, to Douglas-fir and ponderosa pine. Fire plays a minimal role in aspen stands directly but, due to the re-sprouting capability of aspen, fire influences aspen dramatically when it occurs in stands dominated by more flammable species. Occasional aspen dominated stands can be found in which the grass component is adequate to carry a surface fire under some conditions, particularly in the Gunnison Basin, where conifer has largely been removed by these low intensity fires in these stands while the overstory aspen are only impacted to a small degree. Because aspen is mixed with several other vegetation types on the GMUG (spruce-fir, ponderosa pine, mountain shrub, and even sagebrush) and is successional in most locations it is difficult to place it in one or two Fire Regimes.

#### Fire Effects

Aspen dominated stands, as mentioned previously, may occasionally carry fire through the grass/forb understory during extreme drought conditions. These stands are the exception rather than the rule and fire effects in them would result in mortality to scattered areas of the stand through cambial kill, with subsequent regeneration in the fire impacted areas as the root system re-sprouts. A small patchwork of different aged aspen patches could be expected in this situation.

A more typical situation on the GMUG would be when an aspen stand has largely succeeded to spruce-fir, or become dominated by Douglas-fir and/or ponderosa pine. In this situation a fire would burn with higher intensity due to the conifer component, and some, or most of the overstory could be killed by the fire. The aspen root structure, protected beneath the soil surface, could be expected to rapidly re-sprout following the fire, resulting in a young, dense aspen stand with individual unburned conifers, or pockets of unburned conifer, scattered about.

For a better understanding of the multiple fire regimes in which aspen may be found, as well as additional fire effects, refer to the narratives on Spruce-fir, ponderosa pine, and sagebrush.

## **Lodgepole pine**

### **Fire Regime**

Lodgepole pine on the GMUG can be in both Fire Regime III (35-100 year frequency and mixed severity) IV (35-100 year frequency and high severity, stand replacement) and V (200+ year frequency and high severity, stand replacement). Fire Regimes IV and V are typically found above 10,000 feet. Stands above 10,000 feet less than 100 years old tend to be very dense and may have significant fuel on the ground consisting of both needle litter and leftover woody material from a previous disturbance event; these conditions provide an opportunity for an intense fire to occur at a young age. Fires under these conditions could burn several hundred acres, depending primarily on the size of the stand exhibiting the fire prone conditions. As high elevation lodgepole becomes middle aged it grows taller and begins to self prune, losing much of the branches and needles needed by a fire to move up into the canopy, and much of the surface material from the previous disturbance event has decomposed to the point that it does not contribute substantially to intense surface fire behavior. During this period fires on the surface become less intense due to the reduction in woody debris, and fires cannot move into the canopy due to a lack of ladder fuels. Fires typically remain smaller and do not burn in a stand replacing fashion during this period. As high elevation lodgepole pine becomes older trees begin to die and woody material again accumulates on the ground, potentially increasing surface fire intensity. In addition some shade tolerant species may move into the understory, once again providing a ladder for surface fires to reach the canopy. Fires under these conditions could burn several hundred to several thousand acres with a stand replacement fire. The Fire Regime III type stands are most typically found below 10,000 feet in the Gunnison Basin and appear to support significant amounts of low intensity surface fire with occasional high severity where mistletoe is present.

### **Fire Effects**

During average fire seasons fires in lodgepole pine can be expected to remain relatively small (less than 100 acres) and burn with mixed severity, torching a few trees or small portions of the stand while burning as a cooler understory burn throughout much of the area. With this fire scenario possibly up to 30% of trees in a burn area could be killed either through torching or cambial kill from the surface fire. Surface litter could be reduced by 50-70%, leaving patches of bare soil throughout the burn area. Depending on pre-burn vegetation composition this type of fire could result in a mosaic of vegetation in the future, possibly containing patches of older lodgepole, younger, regenerating lodgepole, and even patches of aspen and grass/shrub.

During more severe fire seasons, and depending on stand age and structure, fires could be expected to move into the overstory and grow substantially (several hundred to a few thousand acres). The majority of a burned area would be stand replacement (70-80%) with some small protected areas, or small areas which burned under less severe conditions (at night) resulting in less severe impacts. Overall the litter and duff could be reduced by 80-90% across the burn area, resulting in significant amounts of bare ground. Post-burn vegetation would probably be composed primarily of dense, young lodgepole

pine with smaller patches of old, unburned lodgepole, regenerating aspen, aspen/shrub, or shrub/grass present, again, depending on pre-burn vegetation composition.

### **Douglas-fir**

#### **Fire Regime**

Douglas-fir, though limited primarily to the Gunnison Basin area of the GMUG, can be classified best as a Fire Regime III (35-100 year frequency and mixed severity) under natural conditions. Most fires occurring in Douglas-fir were low intensity understory fires with only occasional torching of pockets of small to medium sized groups of trees (possibly ¼ to 5 acres in size). Due to fire exclusion over the past 120 years these stands have become much more dense with shade tolerant species encroaching into the understory, allowing the potential for stand replacement fires to occur over much more of the Douglas-fir type. In addition bark beetle-caused mortality over the past 20-30 years has increased the amount of understory fuel, adding surface intensity to any fires that occur.

### **Ponderosa Pine**

#### **Fire Regime**

Ponderosa pine on the GMUG falls into two distinct fire regimes; the first is limited primarily to the southwestern portions of the Uncompahgre Plateau and is classified as Fire Regime I (0-35 year frequency and low to mixed severity (surface fires most common), while the second is located on the north and east side of the Uncompahgre Plateau and in the Gunnison Basin area and is classified as Fire Regime III (35-100 year frequency and mixed severity). There is some gradation of these regimes on the southern end of the Uncompahgre Plateau. The primary difference in the two regimes is the type of understory fuel that drives the regime. In the southwestern portions of the GMUG (Naturita Division, Sanborn Park area) needles and grass tend to be the carriers of fire, resulting in a less intense fire that occurs more frequently. Elsewhere on the GMUG the shrub component (primarily Gambel's oak, antelope bitterbrush and sagebrush) tend to carry the fire, resulting in a more intense fire that occurs less frequently. Natural fires in ponderosa pine in the southwestern GMUG would tend to be less severe while natural fires in ponderosa pine stands on the remainder of the GMUG would tend to result in mixed severity, with the overstory being burned in some areas, while in other areas only the understory being consumed. There is some legitimate speculation that more of the ponderosa pine on the GMUG should be in the low severity regime, dominated by grasses and surface fire, than is currently the case, and that the reason for the significant shrub component is fire exclusion during post-European settlement.

#### **Fire Effects**

During average fire seasons in ponderosa pine on the GMUG fires typically burn with low to moderate intensity, resulting in primarily understory burns of ten to a few hundred acres in size. These fires would have little impact on the overstory trees, instead consuming litter and duff, branchwood, logs, some shrubs in the understory, and occasionally torching a single tree or small group of trees. Overstory mortality would probably be under 5%, understory shrub mortality might range from 10-60%, and litter and duff consumption might be 50-60%. Patches of bare ground would be created, typically not over more than 50% of the burn area. Post-burn vegetation would consist of

an overstory of ponderosa pine (potentially 'fire-thinned'), resprouting shrubs, grasses and forbs, and in the bare mineral soils, ponderosa seedlings. (In addition, if aspen were present in portions of the stand the root system could be expected to resprout.) This type of fire effect would result in generally open, uneven aged ponderosa pine stands with minimal understory fuel and a mix of shrubs, grasses, and forbs in the understory.

During more severe fire seasons fire intensity in ponderosa pine is higher, resulting in mixed severity fires, and in some cases, high severity fires, that range in size from several hundred to several thousand acres, in size. (As more fuels treatments occur in the ponderosa pine type in the future fire intensity can be expected to decrease with most fires occurring as low to mixed severity, even under more severe fire conditions.) Currently, mixed to high severity fires in ponderosa pine may kill 20-70% of the overstory trees in some areas, with lower mortality occurring in protected areas and during less severe burning conditions (at night). Litter and duff could be reduced by 70-90%, resulting in a significant amount of exposed soils. Post-burn vegetation would consist of a matrix of older ponderosa pine, with resprouting shrubs, grasses and forbs, and in areas with bare mineral soil, some ponderosa pine seedlings. (In addition, if aspen were present in portions of the stand the root system could be expected to resprout.) This type of fire is on the severe side of the natural range of variability for ponderosa pine; as such additional fuels treatments prior to designating fires as wildland fire use, as well as caution when designating fires as wildland fire use, will be needed.

## **Mountain Shrub**

### **Fire Regime**

The mountain shrub community on the GMUG consists primarily of Gambel's oak and serviceberry, with lesser amounts of snowberry, mountain mahogany, and other shrub species mixed in at some locations. It can best be classified as Fire Regime III (35-100+ year frequency and mixed severity). Fires typically range in size from a few acres to several hundred acres in this vegetation type with both size and severity influenced primarily by fuel moisture and weather conditions. Typically when these shrub communities are young they have not produced enough litter and dry woody material to support a fire, only when they become 30 or 40 years old will they have produced enough litter and dead woody debris for fires to spread, at which time the entire overstory can be consumed by fire during high winds events. As winds moderate or humidities rise, such as at night, fires typically drop into the understory.

### **Fire Effects**

As mentioned previously, fire severity, and fire effects, can be quite variable in the mountain shrub community. Under dry, windy conditions fire will rapidly move into the canopy and consume most of the above ground portions of stands. However, as winds moderate or humidity increases fire will drop back to the surface and may burn with low to moderate intensity, consuming litter and debris in the understory and only occasionally killing the overstory through torching or cambial kill. Most of the shrub species in the mountain shrub community regenerate through sprouting from the root crown and most fire serves only to rejuvenate a stand, resetting the vegetation to an earlier seral stage which consists of many of the same shrub species that were present prior to the fire.

During this process, however, any non-sprouting species that may have been in the stand, such as pinyon, juniper, ponderosa pine, or sagebrush, will be removed, and may take decades to become reestablished in the burn area. What results from fire in the mountain shrub community is often tens to hundreds of acres of more homogeneous shrub stands with fewer non-sprouting species present.

### **Pinyon-juniper**

#### **Fire Regime**

Pinyon-juniper on the GMUG can best be classified as Fire Regime V (200+ year frequency and high severity, stand replacement fires). During average fire seasons fuel moisture and weather conditions preclude significant fire spread; resulting fires typically burn only a single tree or small group of trees, having little impact on stand structure. However, during dry, droughty conditions, and under the influence of winds, fires in pinyon-juniper rapidly move into the canopy and can become very large, burning hundreds to several thousand acres in one or two burn periods. These types of fires are stand replacing, usually killing all above ground vegetation within the crown fire area. When winds subside fires drop to the surface and exhibit very little understory spread; usually 2-3 days without winds on a pinyon-juniper fire results in the fire going out.

#### **Fire Effects**

During average fire seasons most fires in pinyon-juniper remain small, perhaps burning only a single tree or small group of trees, winds may increase the fire size to a few tens of acres, but, due to higher fuel moisture, crown fire spread is limited. Surface fire spread is limited by a lack of continuous litter and grasses. Fire effects during average fire seasons in pinyon juniper are negligible; fires are typically small, a tenth acre to a few acres in size, with only a few trees killed, allowing for a few shrubs to re-sprout and a small patch of grasses and forbs to become established.

During severe fire seasons fire effects in pinyon-juniper are substantial, and can cover hundreds and even thousands of acres. Usually more than 90% of the area burned in a wind driven pinyon-juniper fire is burned as a stand replacement fire, with no, or very little, live vegetation remaining. Often times, particularly at lower elevations, pre-fire grasses and forbs are very limited in the understory, subsequently post-fire response is very limited, requiring the area to be seeded with native species. Exotic plants, primarily cheatgrass, can also be a significant post-fire issue in the pinyon-juniper vegetation type. At higher elevations more grasses and forbs are typically present so post-fire response is adequate as long as exotic species are not present. Also at higher elevations there are often more sprouting shrubs, such as Gambel's oak and serviceberry, which rapidly recolonize a burned area. Post-burn vegetation in the pinyon-juniper vegetation type following a large, severe fire usually consists of large open areas dominated by resprouting native grasses, and early successional forbs, or seeded grasses and forbs. In addition patches of re-sprouting shrubs, primarily Gambel's oak and serviceberry can be expected. Pinyon-juniper may not begin to re-colonize a burned area for several decades following a stand replacement fire.

### **Sagebrush-grass**

### Fire Regime

Sagebrush species on the GMUG primarily include Black sagebrush, Wyoming big sagebrush, Basin big sagebrush, and Mountain big sagebrush, among others. These species are found at numerous elevation zones and mix with numerous other species, subsequently it is difficult to place sagebrush in any one Fire Regime, rather different species at different elevations in different vegetation communities probably fall into Fire Regimes II, III, and IV, consisting of 20-100+ year fire frequencies with mixed to high severity fires. Most sagebrush fire frequencies on the GMUG are probably on the longer end of the frequency due to the influence of grazing on understory fuels. Fires burn either through the grass understory, if present) within a sagebrush stand, or, under the influence of wind and in denser stands, may burn through the sagebrush plants as a crown fire. Natural fires are typically tens to hundreds acres in size and consume 90%+ of the understory grasses and forbs and 80-100% of the overstory sagebrush.

### Fire Effects

During average fire seasons fires in sagebrush vegetation types typically stay small and have limited structural impact on the stand. Typically less than an acre is burned in which 30-70% of the overstory sagebrush is killed. Grasses and forbs regenerate in the small opening. Lower elevation sagebrush types, when disturbed, are prone to invasion by cheatgrass so care must be taken when considering Wildland Fire Use and seeding with native species may be required following some Wildland Fire Use events.

During more severe fire seasons fires occurring in sagebrush types can grow to tens to several hundred acres in size. Fire intensity is typically significant, with 80-90% of the overstory sagebrush killed and 90-100% of the understory consumed. Small, isolated pockets of sagebrush may remain within the burned area in topographically protected areas, in areas where fuels were discontinuous, or where winds temporarily subsided. Post-fire vegetation across these areas typically consists of large areas of native grasses and forbs with a few residual unburned sagebrush plants or pockets of sagebrush, surrounded by older, unburned sagebrush. As mentioned previously, if exotic species, such as cheatgrass, are present in the area, care should be taken when considering Wildland Fire Use, and any burn area may require seeding with native grasses and forbs following the fire. Higher elevation sagebrush may contain some overstory aspen stands on their peripheries; these aspen stands may be impacted by a sagebrush driven fire and, depending on moisture availability, the aspen may re-sprout and dominate a grass/forb understory. However, many of these periphery aspen stands are located on very dry sites and response may be limited.

### Grass

#### Fire Regime

Grass areas on the GMUG typically fall into Fire Regime 1 (0-35 year frequency and low to mixed severity surface fires). The return interval on the GMUG may be greater than 35 years at the higher elevations where it is cooler and more moist, and in areas which have heavy grazing pressure. Fires are typically a few acres to a few hundred acres in size, depending largely on the size of the grass stand.

### Fire Effects

During average fire seasons grass fires on the GMUG are uncommon due to the ability of the grasses to remain green throughout most of the May-July fire season. With the onset of a normal monsoon, moisture in the late summer and early fall is often present to minimize any fire occurrence and fire spread in grass fuel types.

During more severe, droughty fire seasons grasses on the GMUG may cure well before the onset of the monsoon, allowing for significant spread. Grass fires may become several hundred acres in size during these types of seasons. Typically grass fires are of short duration unless other fuel types, such as mountain shrub, and ponderosa pine, are present to carry the fire for multiple days. Post-fire vegetation consists of resprouting grass and forb species that were present prior to the fire. Any non-sprouting woody species that may have been present in the grassland prior to the fire, such as sagebrush, pinyon, and juniper will be largely removed from the area. Re-sprouting woody species, such as Gambel's oak, that may have been present prior to the fire will quickly re-sprout.