3.2 – D. Fire Management Considerations for Specific Fire Management Units

3.2.1 Wilderness FMU Snap Shot

- **FMU Name:** Wilderness
- **Fire Behavior Indicator:** Energy Release Component (ERC)
- **NFDRS Weather Station:**
  - Mt. Adams Wilderness (south)–
    - Trout Creek RAWS - NWSID 451917
  - Mt. Adams Wilderness (north)-
    - Orr Creek RAWS- NWSID 451919
  - Goat Rocks Wilderness
    - Hagar Creek RAWS- NWSID 451115
  - Tatoosh Wilderness
    - Hagar Creek RAWS- NWSID 451115
  - William O. Douglas Wilderness
    - Hagar Creek RAWS- NWSID 451115
  - Indian Heaven Wilderness-
    - Dry Creek RAWS -NWSID 451924
  - Trapper Creek Wilderness
    - Dry Creek RAWS -NWSID 451924
  - Glacier View Wilderness
    - Hagar Creek RAWS- NWSID 451115
- **Acres/Agency:** 180,600 acres USDA Forest Service
  - Mt. Adams Wilderness- 47,270 acres
  - Goat Rocks Wilderness- 71,670 acres Cowlitz Valley Ranger District; 105,600 total acres
  - Tatoosh Wilderness- 15,700 acres
  - William O. Douglas Wilderness- 15,880 acres Cowlitz Valley Ranger District; 166,000 total acres
  - Indian Heaven Wilderness- 20,600 acres
  - Trapper Creek Wilderness-6,050 acres
  - Glacier View Wilderness- 3,000 acres
- **Predominant Vegetation Types and Disturbance Regimes:**

  A crosswalk was developed locally from the regional plant association group map to biophysical settings (BpS's). Similar to potential natural vegetation groups, biophysical settings represent "vegetation that may have been dominant on the landscape prior to Euro-American settlement and is based on both the current biophysical environment and an approximation of the historical disturbance regime" (LANDFIRE). A description of the biophysical settings found in the wildernesses of the Gifford Pinchot National forest in order of decreasing abundance follows.

  - **North Pacific Mountain Hemlock Forest- Wet**

The most frequently occurring BpS in the wildernesses of the Gifford Pinchot National Forest, the wet mountain hemlock BpS occurs sporadically in the high elevation forested zones. The lower elevation limit of the type ranges from about 3,500 feet in the west Cascades to 3,000 feet on the east side of the Cascades. Sites are cold and characterized by deep (10-20 feet) and persistent snowpacks and short growing seasons. The late seral stands are co-dominated by mountain hemlock (*Tsuga mertensiana)* and Pacific silver fir (*Abies amabilis)*. Along the elevation gradient, this mountain hemlock type is above the mesic-wet Pacific silver fir type, and below subalpine parkland. Most fires occur as single tree lightning strikes, particularly on ridgelines, so the frequency of fire tends to be low. Estimates for fire return intervals are over 1000 years, but lack of evidence makes it difficult to determine. In areas of continuous forest, fire sizes can range from tens to hundreds of acres. Avalanches may be a more common disturbance than fire and they tend to repeat at the same locations. Heart-rots and butt-rots occur, but not at a stand scale. Late-successional stands with large individuals (>20 inches in diameter) of mountain hemlock dominate the stands with advanced regeneration of mountain hemlock and other shade tolerant species.

- **North Pacific Mountain Hemlock Forest- Xeric**

  The xeric mountain hemlock BpS occupies some of the highest-elevation forested zones in the Cascade Mountains and can exist as tree clumps in a matrix of parkland. The lower elevation limit is around 4,500-5,000 feet in Washington. Sites are cold and characterized by deep and persistent snowpacks and short growing seasons. The late seral stands are dominated by mountain hemlock, but many other tree species are present throughout the geographic range of this BpS. In some areas, lodgepole pine (*Pinus contorta)* dominates post-disturbance stands. Mature stands may be nearly all mountain hemlock, or may have varying amounts of Pacific silver fir, subalpine fir (*Abies lasiocarpa)* and Douglas-fir (*Pseudotsuga menziesii)* across its range. Common understory species include Alaska huckleberry, big huckleberry, grouse whortleberry, and beargrass. Wildfire is the major disturbance event of this type, but occurs infrequently. Fire is generally stand-replacing because the major tree species are highly susceptible to fire mortality. Estimates of the return interval of wildfire range from 400 to over 1,500 years. The root rot *Phellinus weirii*, bark beetles, and other insects can be locally important disturbance agents. The lodgepole pine component is particularly susceptible to bark beetle infestation in late maturity.

- **North Pacific Mesic Western Hemlock-Silver Fir Forest**

  This Pacific Silver fir type occurs on the western slopes of the Cascades across low- to mid- elevations within the Pacific silver fir zone (3,000-4,500 feet). These forests are cool and moist and typically have high precipitation and moist topographic positions. This area has a moderate snowpack and usually a deep organic layer. Pacific silver fir and western hemlock (*Tsuga heterophylla)* are codominant in the mature canopy. The understory is predominantly composed of a well- developed layer of heath shrubs and lush herbs. It is distinguished from the other Pacific silver fir types by the moisture regime. This BpS is characterized by infrequent fires occurring at approximately 800-1000 year intervals. These events are of high severity and large extent, resetting thousands of acres through stand replacement fire. It is difficult to burn, so fires are wind-

driven when they are present. Even under wind-driven fire conditions, historic fires have gone out at the edge of this type. Although infrequent, avalanches and wind disturbances occur, but these disturbances are more frequent at scales of tens and hundreds of acres.

- **North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest**

  This Pacific silver fir type occurs throughout the west slopes of the Cascades at lower elevations within the Pacific silver fir zone (1,200 to 2,400 feet). It occurs above the western hemlock forests and below moister and cooler plant associations (silver fir-mountain hemlock) at higher elevations. This BpS is distinguished from the high elevation Pacific silver fir type by elevation breaks. Pacific silver fir is the dominant species in the mature canopy, which it shares with a wide variety of conifers depending upon locale. Douglas-fir and western hemlock are codominant throughout the range. Subalpine fir, grand fir (*Abies grandis)*, western white pine (*Pinus monticola)* and Englemann spruce (*Picea engalmannii)* are common around Mount Adams. Noble fir (*Abies procerus)* is an associate. The understory is predominantly composed of a lush to moderate layer (depending upon the amount of moisture) of heath shrubs, forbs, ferns and mosses. This low elevation Pacific silver fir BpS is characterized by infrequent mixed severity fire regimes occurring at intervals greater than 100 years. These fires occur on the scale of thousands of acres and produce variably sized patches throughout the landscape. Landscapes are reset at intervals greater than 200 years through stand-replacing events. Avalanches and wind events are also common disturbances in this type but these disturbances more frequently occur at scales of tens and hundreds of acres.

- **North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest**

  This western hemlock-Douglas-fir BpS occupies low montane elevations of western Washington and Oregon. It occupies mesic to wet microsites on all aspects at elevations up to 4,000 feet. Douglas-fir and western hemlock dominate this type with devil's club, various *Vaccinium* species, vine maple, rhododendron, Oregon oxalis, bear grass, swordfern, salal, Oregon grape and bunchberry dogwood as common understory herbs and shrubs. Fire plays a major, though infrequent, role resetting landscapes within this type, with intervals ranging roughly from 300 to 800 years. Mixed severity fires occur less frequently in this regime than in the Douglas-fir-western hemlock mesic-dry regime. Insects, pathogens and windthrow occur in this type at variable intervals, creating fine scale variability on the landscape. Although fires are often large (100s-1000 acres), fire severity patterns are quite variable, ranging from underburns to high severity patches within single events. Wind, insects and pathogens can create gaps of various sizes. Mature to old-growth forest stands of large individuals of Douglas-fir and western hemlock with advanced regeneration of western hemlock dominate this BpS.

- **North Pacific Maritime Mesic Subalpine Parkland**

  This subalpine BpS occurs on the west side of the Cascade Mountains where deep, late-lying snowpack, steepness of slope and temperature are limiting environmental factors. Communities are typically on ridge crests, shoulders, or upper slopes. Clumps of trees interspersed with low shrublands and meadows characterize this system. Associations include forested and subalpine meadow types. Major tree species are mountain hemlock, subalpine fir, and silver fir.

Tree establishment happens in waves depending on seed years, weather, climate and snowpack. Hundreds of years can pass to reestablish trees. Much regeneration has occurred recently, but past waves of regeneration suggest that survivorship may be limited. There is very little disturbance overall. Fires occur as lightning strikes in tree islands, killing individual trees or clumps. These patches act as a fire break, suppressing fires from lower elevations. Ignitions of this type are probably quite common but typically remain in the one to ten acre size. Snow breakage and avalanches are the most significant medium-term disturbances. Climate change a main factor that determines succession patterns and patch re-initiation. Changes in temperature and precipitation patterns affect tree/meadow dynamics. Meadows dominated by resprouting shrubs and herbs with tree seedlings and saplings present at low cover make up the majority of the landscape.

- **East Cascades Mesic Montane Mixed-Conifer Forest and Woodland**

  This mixed conifer BpS occurs on low- to mid-elevation slopes in the east Cascades on various aspects where sites are strongly influenced by maritime climate. These sites typically occur on the relatively cool, moist end of the mixed conifer environmental gradient. Typically sites receive over 25 inches of precipitation. Vegetative composition will vary widely geographically, but is dominated by western hemlock, grand fir, and Douglas-fir. Western larch (*Larix occidentalis)*, western white pine, western redcedar (*Thuja plicata)*, and Engelmann spruce may be present. Ponderosa pine may be locally important. Lodgepole pine may be present in some post-fire early seral stands. Forests are typically even-aged with scattered residuals (i.e., 1-3 fire-regenerated age classes present in patches) with moderately dense to dense stands including a dense conifer overstory with understories dominated by moist site forbs to tall shrubs. Shade-tolerant conifer species are well represented and dominate the tree understories of late-successional stands. Fires are mostly mixed severity (50-150 year frequency) with the wetter sites experiencing longer fire return intervals and higher severity fires (~200 year frequency). Scales of fires tend to be highly variable—from hundreds to thousands of acres in area. Less productive sites may be susceptible to insects or disease. Douglas-fir bark beetle and spruce budworm will affect Douglas-fir or grand fir. Root rots, butt rots, and stem decay will affect grand fir, western redcedar, and western hemlock while Douglas-fir is less susceptible. Western white pine has been impacted by white pine blister rust and its abundance reduced in affected stands.

- **North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest**

  Very little of this type occurs in the wildernesses. It occupies low montane elevations of the western Cascades typically on well-drained soils. This type is most common on warm, southerly aspects up to 4000 ft in elevation. Douglas-fir is the most common tree species found in this type. Western hemlock, western redcedar, grand fir, white pine, lodgepole pine, and are seral associates. Common understory herbs and shrubs include salal, dwarf Oregon grape, rhododendron, twinflower, vanilla leaf, and swordfern. Fire is the major disturbance process. Mixed severity fires are more common than stand replacing events, occurring at 50-150 year frequencies. Stand replacement fires reset large landscapes at 250-500 year frequencies. Although fires are often large (hundreds to thousands of acres), fire severity patterns are quite variable, ranging from underburns to high severity patches within single events. This fire

regime is largely responsible for the dominance of Douglas-fir in these landscapes. Insects, pathogens and windthrow also occur in this type at variable intervals, often interacting with drought and other extreme weather conditions and create gaps of various sizes.

- **Unforested**

  Unforested areas occur primarily at the highest elevations as bare rock. Scattered areas of bare rock occur along ridges and outcroppings as well. Meadows and waterbodies are included in the unforested classification and serve as natural fuel breaks.

- Mt. Adams Wilderness:
  - North Pacific Mountain Hemlock Forest- Xeric- 45%
  - North Pacific Mountain Hemlock Forest- Wet- 27%
  - Unforested- 24%
  - North Pacific Mesic Western Hemlock-Silver Fir Forest- 3.0%
  - North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest- 2%
  - North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest- 0.5%

- Goat Rocks Wilderness:
  - North Pacific Mountain Hemlock Forest- Wet- 32%
  - North Pacific Mountain Hemlock Forest- Xeric- 29%
  - North Pacific Mesic Western Hemlock-Silver fir Forest- 17%
  - North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest- 17%
  - North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest- 2%
  - Unforested- 0.5%

- Tatoosh Wilderness:
  - North Pacific Mountain Hemlock Forest- Wet- 37%
  - North Pacific Mesic Western Hemlock-Silver Fir Forest- 24%
  - North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest- 19%
  - North Pacific Mountain Hemlock Forest- Xeric- 11%
  - North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest- 8%

- William O. Douglas Wilderness:
  - North Pacific Mountain Hemlock Forest- Wet- 60%
  - North Pacific Maritime Mesic Subalpine Parkland- 15%
  - North Pacific Mesic Western Hemlock-Silver Fir Forest- <10%
  - North Pacific Mountain Hemlock Forest- Xeric- <10%
  - North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest- <10%

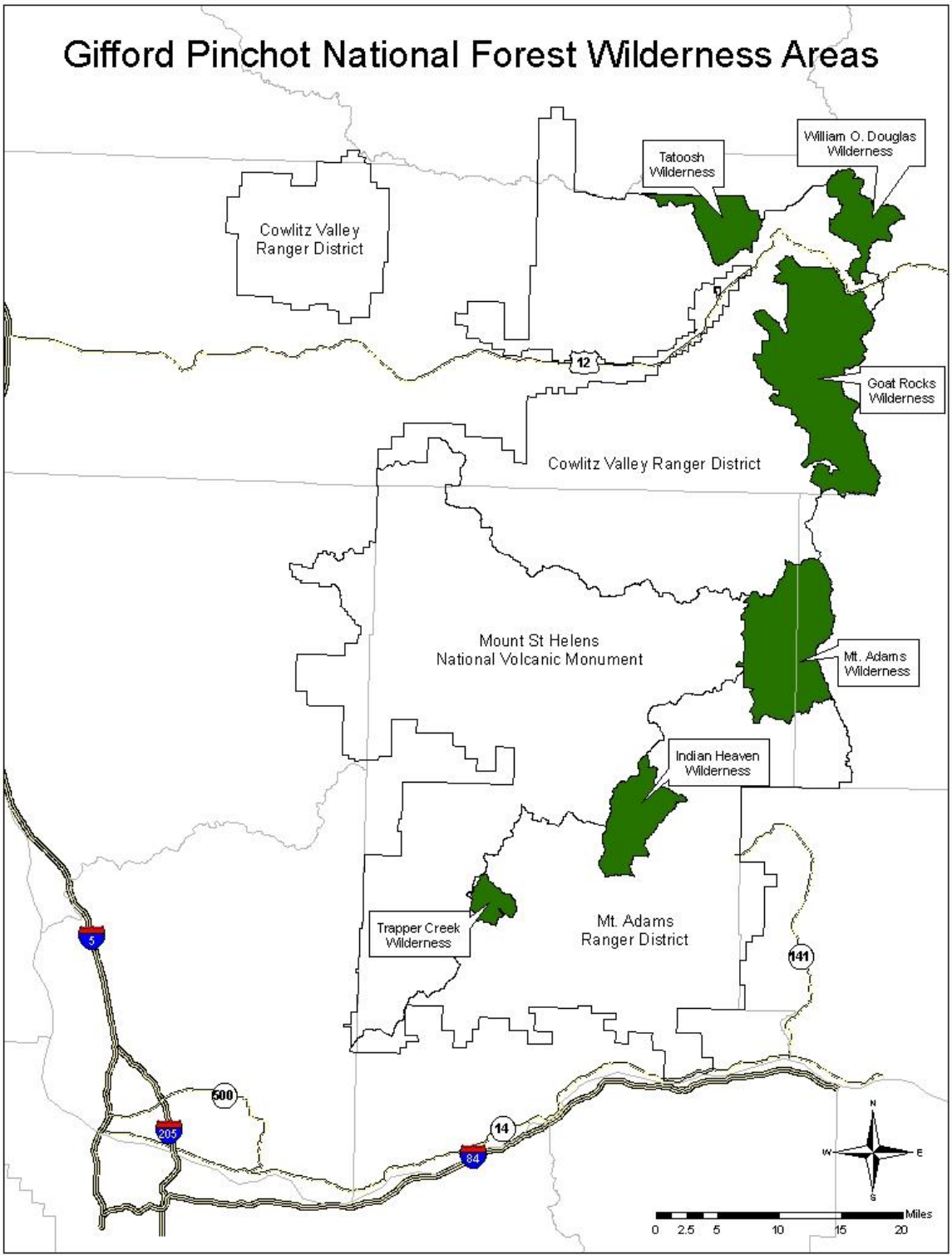
- Indian Heaven Wilderness:
  - North Pacific Mountain Hemlock Forest- Wet- 40%
  - North Pacific Mountain Hemlock Forest- Xeric- 40%
  - North Pacific Mesic Western Hemlock-Silver Fir Forest- 15%
  - North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest- 5%

- Trapper Creek Wilderness:
  - North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest- 45%
  - North Pacific Mesic Western Hemlock-Silver Fir Forest- 35%
  - North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest- 15%
  - North Pacific Mountain Hemlock Forest- Wet- 5%

- Glacier View Wilderness:
  - North Pacific Mesic Western Hemlock-Silver Fir Forest- 55%
  - North Pacific Mountain Hemlock Forest- Wet- 35%
  - North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest- 10%

- **IA assets assigned to this FMU:**
  - Mt. Adams Wilderness—See Mt. Adams FMU
  - Goat Rocks Wilderness— Shared response between Cowlitz Valley Ranger District and Wenatchee National Forest
  - Tatoosh Wilderness—See Cowlitz Valley FMU
  - William O. Douglas Wilderness—Shared response between Cowlitz Valley Ranger District and Wenatchee National Forest
  - Indian Heaven Wilderness—See Mt. Adams FMU
  - Trapper Creek Wilderness—See Mt. Adams FMU
  - Glacier View Wilderness—See Cowlitz Valley FMU
- **IA Dispatch Office:** Columbia Cascade Communication Center
- **LRMP options available for management response:** Fire suppression strategies depend upon specific Management Area standards and guidelines, alternative suppression strategies to consider include confine, contain and control. Section 3.1.1. Gifford Pinchot Land and Resource Management Plan *and FMU* Guidance, Table 1.1. Management Response Strategies for LRMP Designated and Management Areas, of this document, summarizes management response suppression strategies for specific Management Areas.

FMU Map


Gifford Pinchot National Forest Wilderness Areas
Tatoosh Wilderness
William O. Douglas Wilderness
Cowlitz Valley Ranger District
12
Goat Rocks Wilderness
Cowlitz Valley Ranger District
Mount St Helens National Volcanic Monument
Mt. Adams Wilderness
Indian Heaven Wilderness
Trapper Creek Wilderness
Mt. Adams Ranger District
141
5
500
205
14
84
N
W
E
S
Miles
0 2.5 5 10 15 20

3.2.2 FMU Guidance

- **Desired Conditions, Objectives, Guidelines, Goals and Standards:** Section 3.1.1. Gifford Pinchot Land and Resource Management Plan *and FMU* Guidance, Table 1.1. Management Response Strategies for LRMP Designated and Management Areas provides a summary of guidance for this FMU.

3.2.3 FMU Characteristics

3.2.3.1 Safety

Firefighter and public safety is the primary concern. Limited accessibility, steep terrain, and areas of heavy timber can challenge the efficacy and safety of suppression efforts. Where these concerns arise, suppression tactics that minimize threats to firefighter and safety will be employed, including using aerial support and confine strategies. Recreation and land use closures will be ordered as needed to maximize public safety.

- Fire fighter safety remains the utmost priority. Terrain, accessibility, and potential fire behavior in the wildernesses will influence fire management decisions.
- Public safety: maximum visitor safety will be accounted for through a specific public safety plan incorporated into the communication plan including contact with local media, information and signing at the forest headquarters, ranger stations, trailheads, campgrounds, and locally as needs determine. Coordination will be maintained as necessary with tribes, Washington DNR, county leaders, and other interested and/or affected parties.
- Communities most likely to be affected by smoke are Trout Lake from the Mt. Adams Wilderness and Packwood and Randle from the Goat Rocks and Tatoosh Wildernesses. Smoke impacts will be considered during daily incident evaluations.
- Mountain weather is unpredictable. Thunderstorms and instability in the atmosphere contribute to fire ignition as well as fire spread.
- Large amount of fuels has accumulated in some of the wildernesses below treeline. Down woody debris makes travel difficult and contributes to fire severity and spread.
- Whenever possibly, flights over wildernesses should be avoided. Should air support be needed, a map of known aviation hazards will be provided.

3.2.3.2 Physical Characteristics

- Mt. Adams Wilderness— The Mt. Adams Wilderness is located on the west slope of Mt. Adams, featuring the 12,276 foot peak, the second highest in the northwest. Over 60% of lands in this wilderness are forested with the remainder being rock, lakes, and streams. A diverse vegetative landscape results from the mixture of dry eastside and moist westside weather conditions with evident patterns in relation to elevation bands.
- Goat Rocks Wilderness— The Goat Rocks Wilderness is situated between Mt. Adams and Mt. Rainier along the Cascade Mountains. It features rugged, mountainous terrain dissected by numerous waterways and ridges with peaks

eroded from an ancient volcano and elevations between 3,000 and 8,201 feet. A good portion of the wilderness lies in an area featuring alpine conditions above timberline, while lower elevations feature heavy to moderate amounts of timber.

- Tatoosh Wilderness— The Tatoosh Wilderness is directly south of Mt. Rainier National Park. It is a diverse physical environment with steep and rugged subalpine and alpine areas along the ridgeline to densely forested river bottoms. This wilderness is relatively wet and low in elevation compared to Mt. Adams and Goat Rocks.
- William O. Douglas Wilderness— The Gifford Pinchot National Forest administers 15,880 acres of the William O. Douglas Wilderness, which covers 166,000 acres between the White Pass and Chinook Pass highways. The remainder of the wilderness is administered by the Okanogan-Wenatchee National Forest. The western boundary borders Mt. Rainier National Park. Minerals, fish, and other wildlife are abundant throughout the area's hundreds of small lakes, scattered peaks, and steep slopes. The Pacific Crest National Scenic Trail goes through this wilderness as well.
- Indian Heaven Wilderness— The Indian Heaven Wilderness straddles the Cascade Crest between Mt. Adams and the Columbia River Gorge. It is a relatively recent addition to the wilderness system (1984) comprised of rolling landscapes with open meadows, forests, and 175 lakes. The highest point is Lemei Rock at 5,927 feet. Though there are rock outcroppings, none of the area extends above treeline.
- Trapper Creek Wilderness— Trapper Creek Wilderness is located in the Wind River watershed on the west side of the Mt. Adams Ranger District. Streams and waterfalls are plentiful throughout the steep slopes at the lower elevations, while huckleberry fields occur in the higher elevations near Observation Peak. A small lake in the southern portion of the Wilderness adds to the diversity of habitats in the area.
- Glacier View Wilderness— The Glacier View Wilderness is located on the west boundary of Mt. Rainer National Park. The topography allows a high degree of isolation with popular peaks Mt. Belijica (5,476 feet) and Glacier View Point (5,507 feet).

3.2.3.3 Biological Characteristics

- Wildlife habitat: Where habitat exists, northern spotted owls may inhabit the wildernesses as well as barred owls, pileated woodpeckers, goshawks, and bald eagles. Other wildlife include blacktail deer, Roosevelt elk, and black bear, cougar, bobcat, and pine marten. Mountain goats are found at higher elevations.
- Headwaters to major rivers throughout the forest and Columbia River Basin are located in the wildernesses.
- Several rare and culturally important botanical resources are found in the wildernesses. Most of the subalpine meadow habitat on the Gifford Pinchot National Forest is located in the wilderness.

3.2.3.4 Resources

Specific resource concerns will be addressed for each fire and resource advisors will provide guidance in management direction and prioritization. Cumulative

effects will become a concern if significant acres are affected over a short period of time. Resource specialists will work with the line officer as decisions are made.

- Soil: Potential effects of fire to soil include the combustion of surface litter and duff layers, changes in color and chemical composition through the release of carbon, nitrogen and phosphorous in the consumption of live and dead biomass, hydrophobicity, erosion, and debris slides. Low and moderate intensity fires are unlikely to result in effects that significantly influence ecosystem composition and productivity. High severity fires increase the probability for erosion and landslide, but the predominant fire regime over most of the area is one that primarily experiences high severity fire, making these disturbance events within the natural range of variability.
- Wildlife: Direct and indirect effects of fire to wildlife vary by species and the timing and intensity of the burn. They can include reduction or loss of habitat, harassment, displacement, or death from fire, smoke, and disturbance from suppression activities. The potential for sedimentation and loss of fish habitat will be address for all fires occurring near major waterways, particularly where the fuel loadings are outside of their natural range of variability.
- Botanicals: Threatened and endangered botanical species will be handled in the same way as wildlife. The adaptability or susceptibility of a particular species to fire will be specifically considered along with potential fire intensity and extent.
- Clean air and water: Fires should be managed to limit adverse affects to these resources.
- Recreation: Fires may inconvenience recreational users either by displacement or visual impacts.

3.2.4 FMU Fire Environment

Historical fire maps indicate several large fires in the wilderness areas during the mid- to late- 1800s and early-1900s. Determination of the exact historic size and number of fires before settlers came to the area is difficult, yet evidence suggests that nearly all these fires were stand-replacing. Many were lightning caused, but anthropological evidence suggests that local fire regimes were highly influenced by Native Americans and sheep herders who set fires in early fall to improve the production of huckleberries and forage. The introduction of fire suppression and federal protection of lands greatly decreased the size and frequency of fires in the area. The majority of fires in wilderness areas since 1970 have occurred in summer months and been lightning caused and low intensity with some passive crowning. Fire suppression efforts and associated precipitation that often accompanies summer thunderstorms have kept recent fires relatively small. Climatic variations dictate the average frequency of lightning storms and ignitions by influencing the potential for storms and fuel flammability. When an ignition occurs, topography, wind, fuel type, and fuel loading play an important role in the impacts of fire on the landscape. Uncontrolled fires before the era of fire suppression occurred in various landscapes, fuel loading, stages of succession, and under different weather and topographic conditions to create a mosaic on the landscape. According to Habeck and Mutch (1973) "…past, uncontrolled fires did not, at any point in time, create a completely burned over and denuded landscape, because many stages of successional development can usually be found in each forest zone."

Fuel Models

The 13 standard fire behavior fuel models (FBFMs) were developed to serve as inputs to Rothermel's mathematical surface fire behavior and spread model (Rothermel 1972). They represent distinct distributions of fuel loading found among surface fuel components (live and dead), size classes, and fuel types. The FBFMs are separated into grass, brush, timber litter, or slash groups and then broken down further by loading by size class, fuelbed depth, and moisture of extinction.

A majority of the wilderness areas of the Gifford Pinchot National Forest are classified as FBFM 10 according to LANDFIRE data. FBFM 10 has the heaviest fuel loading of the timber litter group. Anderson (1982) describes it as follows:

> The fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead-down fuels include greater quantities of 3-inch or larger limbwood resulting from overmaturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in the fuel situation, leading to potential fire control difficulties…examples are insect- or disease-ridden stands, wind-thrown stands, overmature situations with deadfall, and aged light thinning or partial-cut slash.

In general, lower elevation forested areas up to around 5,000 feet can be described as FBFM 10. Particularly high fuel loadings are found in the Trapper Creek Wilderness and in areas on the south slopes of the Mt. Adams and Goat Rocks Wildernesses that have been affected by insects and disease.

FBFM 8 is the next most common type, occurring generally above 5,000 feet and up to timberline:

> Slow-burning surface fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. (Anderson 1982)

FBFM 9 is found along some of the riparian areas. It is characterized by long-needle conifers and hardwoods. Overall, fires run through the surface litter faster than FBFM 8 and have longer flame height but with less intensity than FBFM 10 (Anderson 1982).

Less than 5% of the land is grassy meadows (FBFM 1) and shrub-dominated lands (FBFM 5). The grass models have potential for high rates of spread but that fire behavior is extremely unlikely with the amount of annual moisture received in the study areas. These meadows and marshlands typically stay green and are considered fuel breaks. In FBFM 5, areas where fires are carried by shrubs and other surface fuels, "The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material" (Anderson 1982).

Fire Regimes

Fire regimes are broken down based on the historical role of fire across a certain landscape without the influence of modern human intervention but including the influence of aboriginal fire use (Agee 1993; Brown 1995). The LANDFIRE models for

biophysical settings used in this analysis classify fire regimes into five groups based on average fire frequency and severity indicated by percent overstory replacement. The following fire regime definitions use 25 and 75 percent as severity thresholds between low, mixed, and replacement regimes (FRCC Guidebook Version 1.3.0).

Group	Frequency	Severity	Severity Description
I	0-35 years	Low/mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory
II	0-35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation
III	35-200 years	Mixed/low	Generally mixed-severity; can also include low-severity fires
IV	35-200 years	Replacement	High-severity fires
V	200+ years	Replacement/ any severity	Generally replacement-severity; can include any severity type in this frequency range

The majority of the wilderness areas in this plan are comprised of high elevation, wet BpS's that fall into fire regime group V. However, there a few lower, drier sites characterized as fire regime group III.

- Mt. Adams Wilderness—

  Nearly all lands fall into fire regime group V with average fire return intervals ranging from 300-1500 years. The North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest covers <2% of the land primarily in lower elevation areas on the south end of the forest and is in fire regime group III. Lightning-caused fires are common both within and adjacent to the wilderness. Fuels are categorized as FBFM 10 primarily at lower elevations and FBFM 8 at higher elevations though this can vary.

  Fires occurring in or near the southern portion of the wilderness are of particular concern due to the close proximity to the Gotchen Late Successional Reserve. Spruce budworm outbreaks over the past 30 years have left large tracts of standing dead timber and fire suppression has contributed abundant ladder fuels in the form of grand fir regeneration.

  Records indicate that the 316 acre Salt Creek Fire in September of 2001 was the last large fire within the wilderness boundary. Other notable large fires include the 150 acre Lava Fire in 1987. The 8,000 acre Cold Springs Fire burned just south of the wilderness in 2008. In all, there have been approximately 50 lightning-caused fires since 1970.

- Goat Rocks Wilderness—

  A majority of the lands fall into fire regime group V with average fire return intervals ranging from 300-1500 years with the exception of the North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest type, which covers approximately 17% of the wilderness. This BpS is found in lower elevation areas and is in fire regime

group III. Although lightning strikes fairly frequently, large fires are rare. Where large fire potential does exist, fire suppression has nearly eliminated them from the landscape. Most fires are single tree or small stand lightning strikes that do not significantly alter the landscape. The LANDFIRE data used to analyze this landscape estimates 75% of the area as a FBFM 10, 12% in FBFM 8, scattered brush areas (FBFM 5), FBFM 9 in the drainages, and unforested ridges. Local knowledge suggests FBFM 10 covers closer to 60% of the area and FBFM 8 covers approximately 30%.

The last large fire in the Goat Rocks was the Lost Lake Fire (321 acres) in 2003. Also notable was the Two Lakes Fire that burned several thousand acres on the south end of the wilderness in the first half of the 20th century. In all, there have been 69 lightning-caused fires in the Goat Rocks Wilderness since 1970.

- Tatoosh Wilderness—

  Approximately 10% of the area in the Tatoosh Wilderness falls into a Fire Regime group III while the rest is in V. Approximately 80% of the area is a FBFM 10; 10% is FBFM 8; less than 5% is grass and brush models; FBFM 9 occupies the drainages, and rocky ridges are unforested. There have been nine fires in the Tatoosh Wilderness since 1970 and no historic large fires are recorded for the past 100 years.

- William O. Douglas Wilderness—

  Over 85% of the area is a FBFM 10 with some FBFM 9 in wet areas and FBFM 8 at higher elevations. Local knowledge suggests the portion of FBFM 10 is slightly lower and FBFM 8 is higher. There have been 38 lightning caused fires since 1970, the largest of which was the 100-acre White Pass Fire of 1998. Also important to note is that adjacent lands to the east, administered by the Wenatchee National Forest, are drier fuel types with greater fire potential. The portion administered by the Gifford Pinchot is a wetter, west slope area.

- Indian Heaven Wilderness—

  With the exception of the small area occupied by North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest, all BpS's in this wilderness are part of fire regime group V, experiencing very long fire return intervals. The area just north of the wilderness, comprising much of the Sawtooth Berry Fields was burned in the late 1890's and again in 1902 in the Lewis River Fire; however, most of the wilderness was unaffected. The berry fields were maintained by Native Americans with subsequent fires and other reburns of the Lewis River Fire. Since 1970, there have been 19 recorded fires within the wilderness boundary but no recent large fires. There are several wet areas, particularly around the numerous lakes and wet meadows that fall into a FBFM 9. There is a scattering of brush fuel types, FBFM 8 in some of the higher upper elevations, and the remainder of the land is FBFM 10 (approximately 80%).

- Trapper Creek Wilderness—

All but approximately 15% of the Trapper Creek Wilderness falls into fire regime group V. The remaining 15% is in fire regime group III. Large amounts of large woody debris are present under a dense canopy cover, resulting in a FBFM 10 over most of the area. The relatively higher sites are FBFM 8. The Trapper Creek Wilderness is relatively low in elevation, wet, and heavily timbered. There are no recent large fires on record for the Trapper Creek Wilderness.

- Glacier View Wilderness—

  Ten percent of the land is in fire regime group III with the remainder in group V. It is primarily FBFM 10 with FBFM 8 and high elevations.

3.2.4.1 **Fire Behavior**

Potential fire behavior was estimated based on simulations using the FARSITE Fire Model-Simulator. Fuels, weather, and topography dictate the intensity and rate of spread under the various scenarios. The Rare Event Risk Assessment Program (RERAP) determines the probability of some undesired fire movement by considering probable fire behavior based on weather and terrain influences as well as the probability of a fire stopping or season ending event.

- Mt. Adams Wilderness— Fires occurring in this wilderness can be either cross slope wind driven or backing/flanking fires. Uphill runs do not generally pose control problems as the ridge tops are barren rock with intermittent glaciers. One area of concern is the south and southwest facing slopes where steep terrain, heavy dead and down, and scattered mortality contribute to higher fire intensity levels and rates of spread. Winds of concern are from the west, northwest. The mountain provides a shield from the east winds that historically have not had any effect on fire behavior characteristics.
- Goat Rocks Wilderness— Rates of spread in the Goat Rocks Wilderness rarely exceed two feet per minute. The higher rates of spread occur as fires burn uphill. The rugged topography limits the length of uphill runs, alternating spread patterns with backing and flanking. Aspect does not appear to have had a major influence on rate of spread. Those fires starting at slope bottoms have higher initial rates of spread. Some ignitions become trapped in enclaves along ridges and cease growth beyond that point. The RERAP results indicate that fires ignited before September have high probabilities of escaping the wilderness boundary if no management actions are taken. Those ignited during or after September have progressively lower chances based on shorter burn periods and greater likelihood of a season ending event.
- Tatoosh Wilderness— The topography of the Tatoosh Wilderness contributes to the greatest projected rates of spread in any of the wilderness areas. It has the largest continuous opportunities for uphill runs. However, the north-south ridge through the center of the wilderness creates a topographic pull for most fires started to run towards the center of the wilderness rather than at the boundary. Though these fires experience high rates of spread toward the ridge, they then slow down as the behavior changes to a backing fire. RERAP indicates low probabilities for escape with the exception of fires starting in the northwest arm of the wilderness.

- William O. Douglas Wilderness— The William O. Douglas Wilderness experiences some higher rates of spread but rarely above four feet per minute. The highest rates of spread occur on the steepest slopes, which tend to be found on the north end and in the east-west drainages. The central-eastern portion of the wilderness becomes flatter where the boundary meets the section of the wilderness administered by the Wenatchee National Forest. Fires occurring in that area appear to pose very little threat to the boundary of the portion administered by the Gifford Pinchot National Forest. Again, the RERAP results show probability of escaping the wilderness boundary as proportional to the amount of time an ignition is allowed to burn entirely unmanaged. Fires ignited in June-August pose the greatest risk of escape, while those in September experience lower probabilities.
- Indian Heaven Wilderness—Although Indian Heaven has several mountain peaks, there are no large changes in elevation or steep slope gradients. Therefore, Indian Heaven Wilderness experiences relatively low rates of spread, rarely exceeding two feet per minute. A wind-dominated fire spread event would likely exceed the projected rates of spread. RERAP analysis shows similar results to the other wildernesses in that fire starting before September have a high probability of escaping the wilderness boundary.
- Trapper Creek Wilderness— A drainage splits the Trapper Creek Wilderness in half from northwest to southeast. The topography associated with the various small peaks and ridges within the wilderness will influence direction and rate of spread of fires. Trapper Creek Wilderness is typically quite wet, but, under dry fuel moisture conditions, the quantity and density of fuels may result in high fire intensities and rates of spread. There are no recent large fires on record for Trapper Creek.
- Glacier View Wilderness— There are a couple small peaks along the ridge on the western boundary of the Glacier View Wilderness. The Glacier View Wilderness is typically wet, but under dry conditions could experience high fire intensities and rates of spread in the heavy fuels. Accessibility may be an issue. There are no recent large fires on record for Glacier View.

3.2.4.2 Weather

The majority of the wildernesses discussed in this document can be described as cool and moist with significant winter snowpack. Areas west of the Cascade Crest receive more precipitation than those wildernesses located on the Crest, specifically the south and east portions of the Goat Rocks, Mt. Adams, and William O. Douglass Wildernesses.

Temperatures vary considerably each day and throughout the year. Weather data from the Western Regional Climate Center from 1971-2000 at the Mt. Adams Ranger Station shows average maximum temperatures of around 74 degrees Fahrenheit for June and September and 82 degrees for July and August. Average minimums were around 24 degrees in December and January. Average mean annual precipitation is 43.4 inches with less than an inch in each July and August and 1.0-1.5 inches in each June and September.

Weather data records for Packwood, WA show average maximum temperatures of 78 degrees for July and August and 71-73 degrees for June and September. Average minimums were around 29 degrees in December and January. Average

mean annual precipitation is 57.8 inches with just over an inch falling in each July and August and 2-2.4 inches in each June and September. The majority of precipitation falls from November through February in both of the aforementioned areas.

Precipitation becomes increasingly higher as you move toward the west. The Trapper Creek Wilderness may experience up to 120 inches of annual precipitation.

Wind speeds and direction vary, but typical prevailing winds are from the southwest for the Mt. Adams, Trapper Creek and Indian Heaven Wildernesses and from the northwest for the Goat Rocks, Tatoosh, William O. Douglass, and Glacier View Wildernesses. The topography in the wildernesses is such that while one area may be exposed to high winds, there are others that are sheltered and are influenced very little by wind. Historically, fall east wind events have been known to cause drying and significantly influence fire behavior and spread.

Trends indicate that energy release components (ERCs) rise continually from the onset of the fire season until mid-August when there is a dip caused by a late-summer precipitation event. August precipitation event is rarely season-ending, and the ERCs often increase to or surpass the point at which they were before the precipitation event. A season-ending event typically occurs some time between late-September and mid-October. RERAP shows the following probabilities of season ending events by certain dates according to weather data from 1999-2008. The Hagar remote area weather station (RAWS) was used to represent the Goat Rocks, Tatoosh, Glacier View, and William O. Douglass Wildernesses; Trout Creek RAWS represents the Mt. Adams Wilderness, and Dry Creek RAWS represents Indian Heaven and Trapper Creek Wildernesses.

RAWS Weather Station	October 1	October 7	October 15
Hagar	49%	76%	98%
Trout Creek	51%	68%	86%
Dry Creek	54%	82%	99%

In the absence of other concerns, weather is the key factor in management decision making around late season fires. The length of time until a season-ending event, current ERCs, and the likelihood of east wind events influence management strategies. East wind events have contributed to large fire growth in the majority of historical large fires on the Gifford Pinchot National forest. East winds are a factor in the Indian Heaven Wilderness, Trapper Creek, on the south side of the Mt. Adams Wilderness, in the east-west drainages of the William O. Douglas, and the east side of the Tatoosh, but do not play much of a role on the west slopes of Mt. Adams, Goat Rocks, or Tatoosh, which are sheltered by the peaks.