II. FOREST VEGETATION

Introduction

The following analysis documents the existing conditions and effects of the proposed action and its alternatives on the forest vegetation resource. The issues addressed in this section are: (1) the effects of the proposed actions on forest composition, structure, age/size classes (which includes snags and downed wood), both at the stand and landscape level; (2) the effect of the proposed actions on insect, disease and other mortality factors; and (3) the effects of the proposed actions on old growth/late successional forests. Effects to other aspects of the vegetation resource, specifically threatened, endangered and sensitive plants and noxious weeds, are covered in separate sections of this document.

Information Sources

Vegetation data utilized at the stand level includes information from field exams conducted in the past, as well as those conducted specifically for this project by the silviculturist in 2005 and 2006. Summaries and write-up from these exams are found in Appendix B of the Silvicultural Diagnosis Report (see section F, project file). Additional information was acquired for both the site specific and landscape level analyses through the use of aerial photo interpretation, from flights conducted in 2004 and 2005. For the cumulative effects/landscape level analysis of existing vegetation, satellite-based remote sensing data was used, as provided by the Northern Region Vegetation Mapping Project (R1-VMP). This is a geospatial database of vegetation and landcover produced following consistent analytical logic and methods, and mapped continuously across all ownerships. It is suited to broad and mid scale levels of analysis. Refer to metadata documentation found in the Flathead National Forest GIS Library (*J: /fsfiles/ref/library/gis/metadata/fnf/r1vmp).*

Analysis Area Description

Analysis of direct and indirect effects to vegetation occurs primarily at the stand (treatment unit) level. A list of the specific stands associated with each unit is found in Table 1 of the Silvicultural Diagnosis Report (see section F, project file).

Analysis of cumulative effects on forest vegetation occurs at the broader watershed level. This is because the ecosystem processes that most affect the vegetation resource (primarily fire in this area) often operate at large scales, with fires many thousands or tens of thousands of acres not at all uncommon historically. Watersheds provide a well-defined land area over which meaningful evaluation of the condition and functioning of the ecosystem, and specifically the forest vegetation, can occur.

The cumulative effects analysis for forest vegetation considers effects that may occur over many decades, or even centuries, into the future. Trees can live for centuries, and the forest resource is very dynamic, as are the factors that influence that resource. For example, large, stand replacing

fires, a primary disturbance factor in this ecosystem, are unpredictable, infrequent and may not occur for 200 years or more in some portions of the analysis area.

The cumulative effects vegetation analysis area (VegAA) for the Red Whale Project incorporates all the watersheds that are affected by proposed mechanized and prescribed burn treatments (often refered to as 6th code watersheds, or "HUC6"). Refer to Table 3-3 below and Map 1, found in Appendix A of the Silvicultural Diagnosis Report (see section F, project file). A map of this VegAA area can also be found in the Hydrology section of Chapter 3 (Map 3-9). All of Tepee, the lower half of Whale, and all of Moose, Hawk, Red Meadow, Spruce, Spring, Hay and Moran Creeks are included within the VegAA for evaluation of cumulative effects. All private and state lands within these watersheds are also included. There are about 7738 acres of private lands and 4583 acres of State lands within the VegAA.

Table 3-3. Cumulative Effects Vegetation Analysis Area: Watersheds and Acres

HUC6 Number	Watershed Name	Total Acres
170102060203	Tepee Creek	9513
170102060206	Whale Creek	18833
170102060207	Moose Creek	11817
170102060208	Red Meadow Creek	19270
170102060211	Hawk Creek, Spruce Creek, Spring Creek and intermittent streams flowing into the North Fork Flathead River (excludes Glacier National Park)	14454
170102060301	Hay and Moran Creeks	27374
Total Acres in VegAA		**101261**

Affected Environment/Existing Condition

Site Description

The VegAA includes the relatively gently sloped lands in the lower reaches of the drainages and the wide valley bottom of the North Fork Flathead River, as well as the steep slopes and deeply incised drainages at the mid to upper reaches of the watersheds. The wide North Fork Flathead River valley bottom region ranges from about 3500 foot elevation in the southern end of the VegAA (lower reaches of Hay Creek) to about 4800 feet in the northern end (lower reaches of Tepee Creek). Elevations within the VegAA reach 7600 feet at their highest point in the upper reaches of the watersheds.

The mechanical treatments are concentrated in the lower reaches of the watersheds, within the wide valley bottom region where the private lands are located. In this area, slopes are mostly gentle (less than 40%). The proposed wildlife burns are located on the much steeper (60%+) and drier southerly aspects in the middle reaches of the Moose, Red Meadow, Hay and Moran Creek watersheds.

Landtypes are mapping units that incorporate landforms, geomorphic processes, soils and vegetation to help describe landscape and site conditions (USDA Flathead National Forest 1983). Most of the lower valley bottom area is Landtype 26 – glacial moraine and mountain slopes sporting sandy, silty or loamy glacial till soils with volcanic ash influences. These sites are well drained and generally quite productive for vegetation growth. Water deposited soils (LT 10 – alluvial floodplain and LT14 – lacustrine) lie adjacent to the North Fork Flathead River and in some portions of lower Red Meadow, Hawk and Tepee Creek drainages. Stream terraces, kames and kettles (LT 27) occur in the bottom and lower reaches of Moose, Whale and Tepee Creek. These soils have low water holding capacity and can become droughty, which can limit vegetation growth. Steep, glaciated mountain slopes, ridges, troughwalls and breaklands with ash influenced soils occupy the mid and upper reaches of the watersheds (LT57, LT72, LT73, LT76 and LT77). Vegetative productivity is variable, from low to moderate, depending upon elevation, slope, aspect, and soil type.Refer to Map 2 in Appendix A of the Silvicultural Diagnosis Report (see section F, project file) for identification and location of all the landtypes in the analysis area.

Habitat types are a classification of a forest or grassland site based upon its potential natural vegetation, as opposed to whatever existing vegetation condition may occur at any one point in time (Pfister et al. 1977). A habitat type therefore reflects the presence of certain site conditions (such as soil type, aspect, precipitation, etc) that influence the diversity, growth and abundance of grass, forb and tree species. The majority (over 60%) of the VegAA is within Habitat Group 7, characterized by cool, moist habitat types noted for their moderate to high productivity for tree growth and diverse vegetative cover. Within this habitat group, subalpine fir/clintonia (ABLA/CLUN) is the dominant habitat type with subalpine fir/twinflower (ABLA/LIBO) a close second (Pfister et al. 1977). All of the mechanical treatment units are classified into one or both of these habitat types. Some of the units also contain portions in a subalpine fir/dwarf huckleberry habitat type, which is within Habitat Group 9 and indicative of sites that are somewhat cooler and drier than the ABLA/CLUN sites. These sites are often frost pocket areas and found most commonly in the lowest reaches of the watersheds, where cold air accumulation occurs.

The steep slopes in the mid to upper reaches of the watersheds follow the typical pattern of habitat type distribution that occurs in all of the deeply incised drainages of the North Fork Flathead River basin. The cool, moist habitat types within Habitat Group 7 occur on the lower slopes, often with the heavy shrub cover indicative of habitat types ABLA/MEFE and ABLA/ALSI (menziesia and alder shrubs). Above about 6000 foot elevation subalpine fir/luzula (ABLA/LUHI) becomes most common, with whitebark pine/subalpine fir habitat types at the highest elevations. These habitat types reflect cold sites with short growing seasons. At the mid-elevations on the southerly aspects, subalpine fir/beargrass is a common habitat type, which is within the cool and moderately dry Habitat Type Group 9. On the driest sites of these aspects, Douglas-fir habitat types within Habitat Type Group 2 can be found, mostly Douglas-fir/snowberry (PSME/SYAL) and Douglas-fir/huckleberry (PSME/VAGL). The wildlife burn units, located on these southerly aspects, are dominated by the ABLA/XETE and the dry Douglas-fir habitat types. Often these sites are utilized as transitory or winter range by ungulates due to the relatively more open condition of the forest and prevalence of desirable shrub species.

Refer to Map 3 in Appendix A of the Silvicultural Diagnosis Report (see section F, project file) for identification and location of habitat type groups. Refer also to Table 1 in the Silvicultural Diagnosis Report for a description of the specific site conditions for each proposed treatment unit.

Disturbances

Fire, timber harvest, private land development and insects/disease are the primary factors that have influenced vegetative conditions within the VegAA over the past century.

Fire

Fire is known to be one of the primary disturbance factors influencing vegetation in the Northern Rocky Mountain ecosystem. However, prior to 1910, accurate fire history records are few or nonexistent. Mapping conducted in about 1889 by H.B.Ayres (Ayres, 1898) suggest that at that time, the lower reaches of the watersheds within the VegAA and along the major streams were covered by older forest stands that had probably not experienced a major, stand replacing fire for one or two centuries (refer to Map 5 in Appendix A of the Silvicultural Diagnosis Report, project file, section F). These are some of the more moist and productive lands in the VegAA. Ayres mapping indicated that smaller trees occupied the steep mountain slopes and ridgetops in the mid to upper elevations of the watersheds. Though this could indicate regions where fire had occurred within the last 50 years or so, it probably just as likely reflected older stands but poorer growing conditions. A “recent fire” classification (probably forests of seedling or sapling size trees at the time) was mapped in part of the Moran creek drainage. A band of smaller trees was also mapped along the North Fork Flathead River, and may have reflected frosty, poorer growing conditions or perhaps recent flooding of the river.

Reliable records show that fire has burned across about 52% of the VegAA since 1900. Major fires occurred between 1910 and 1929, when nearly one quarter (about 24,400 acres) of the VegAA burned (mostly in the 1926 fire). The majority of these acres were in the lower reaches of the watersheds, with fires that spread across the North Fork Flathead River and into Glacier National Park. If observations recorded by Ayres are to be believed, these fires burned largely through what at that time were probably quite old forests of large trees that hadn’t seen severe fire for 150 to 200+ years. The fires between 1910 and 1926 were largely stand replacement fires, killing nearly all trees, though small patches of less severely burned or unburned forest existed within the fire boundaries, and in some portions of the fire individual large diameter larch or Douglas-fir trees survived. These fires have been a primary influence in the shaping the forest we see in the Red Whale Project area today, particularly the areas proposed for treatment. A large portion of the areas proposed for treatment occur in forests that regenerated after these fires. These forests are currently in a mid-successional stage of development, where relatively dense closed canopy stand conditions predominate. Trees are typically 50 to 80 feet tall, and range from a skinny 5” dbh (in the most dense stands) up to 12 or 14” dbh in some of the less dense stands where trees have had more room to grow. Lodgepole is usually present and often dominant in these stands. Larch and to a lesser degree Douglas-fir are also very common. Spruce and subalpine fir may occur in the overstory on some of the cooler, more moist sites but is mostly an understory species due to its slower growth rates and high tolerance for shade.

A period of relative quiet in fire activity followed the 1929 fire (initiating an era of effective fire suppression) until 1988, when over 10,000 acres of National Forest, state and private lands burned in the Red Bench fire. All of these acres lie within the Red Whale VegAA and are concentrated in the mid to lower reaches of Red Meadow Creek, and within Spruce and Spring Creek. Prior to this 1988 fire, much of this area was covered by relatively young forests (<65 years old), that originated after the 1926 fire. They were densely stocked with small trees (<8" dbh) and burned at high severity, killing all or nearly all trees. Abundant natural regeneration of mostly lodgepole pine and larch trees occurred after the Red Bench fire, and today the area is covered with young sapling forests, with trees from 5 to about 10 feet tall. However, many of these stands have extremely high tree densities, with tens of thousands of trees per acre. This has resulted in severe competition between trees for light (and in some cases for moisture as well), leading to poor tree crown development, vigor and growth. Many of the proposed treatment areas are located in this stand type.

In 2003 the Wedge Canyon Fire burned a total of about 24,000 acres of National Forest, state and private lands. About 15,200 acres of the Wedge fire is within the Red Whale VegAA, located in the Tepee and Whale Creek drainages. This fire burned primarily at high and moderate severity, killing most or all of the trees. Currently the sites are in the very early stages of tree regeneration, dominated by young conifer seedlings, grasses, forbs and shrubs. No treatment units are proposed within this area.

Refer to Map 4 found in Appendix A of the Silvicultural Diagnosis Report (see section F, project file) for fire history information in this area. Refer also to the "Fire and Fuels" section of this report for additional information on fire history.

Timber Harvest

About 26,470 acres, or about one quarter of the VegAA, has been affected by timber harvest over the last 50 years. Refer to Map 6 in Appendix A of the Silvicultural Diagnosis Report (see section F, project file) for location of harvest areas and Table 3-4 below for harvest acres by years. About 60% of the past harvesting was regeneration cuts (clearcut, seedtree or shelterwood) which removed most or all of the existing tree cover. This harvesting was concentrated in the north half of the VegAA, from Red Meadow Creek to Whale Creek, and in the areas along the major streams. That is because these areas had not experienced any major fire for 150+ years and mature/old stands were common. Some type of intermediate cut occurred over the rest of the harvested areas (about 40% of past harvesting), which removed varying portions of tree cover, but left a fully stocked, manageable stand on the site. These were most commonly one of two harvest types: the removal of older, larger overstory trees from younger stands (often occurred in those stands that had experienced fire in 1910 or 1926); or salvage of scattered dead, dying, or damaged trees from older stands, such as spruce or Douglas-fir that were at risk or had been killed by insect or disease.

Table 3-4. Past Harvesting by Years Within the VegAA

Harvest Type	Harvest Description	Year Of Harvest				
		1952-1960	1961-1970	1971-1988[1]	1989-2006[2]	Total Acres
Regeneration Harvest (clearcut, seedtree or shelterwood)	All or nearly all of the trees removed, resulting in a very open area which regenerates to a new stand of conifers. Areas harvested over 20 years ago are now occupied by sapling trees >5 ft tall.	2586	6891	5453	1300	**16230**
Intermediate Harvest (salvage, improvement cut, overstory removal)	A light to moderate partial cutting, involving removal of a portion of the stand for a variety of reasons (usually to improve growth/vigor of remaining trees or salvage value of dead or dying trees). A fully stocked residual stand remains, and may range from 50 to >200 trees per acre, sapling to mature/large trees.	459	2175	5392	2214	**10240**
Total Acres		**3045**	**9066**	**10845**	**3514**	**26470**

[1] 1988 is the year of Red Bench Fire. Acres include stands harvested in the years prior to 1988 but that burned in the fire. This was about 1964 total acres.

[2] 2003 is the year of the Wedge Canyon Fire. Acres include stands harvested in the years prior to 2003 but that burned in the fire. This was about 5894 total acres. Acres also include areas salvaged after the fire.

The majority of harvesting was accomplished using ground based mechanized equipment, typically dozers and skidders, with use of line machines on the steeper slopes. Logging slash was normally dozer piled and burned, or broadcast burned on the steeper slopes. Reforestation of areas that were clearcut, seedtree or shelterwood harvested occurred through either planting or natural regeneration. All these harvest areas are currently fully stocked with young trees (see section F, project file). Many of these reforested areas were subsequently thinned when they reached sapling size (usually around 15-25 years after harvesting). About 14,000 acres have been thinned in the VegAA since 1965. Some of the treatment units in the Red Whale Project propose additional thinning within these previously harvested areas.

The most obvious way that past harvesting (and in particular regeneration harvesting) has affected the current vegetation condition is by altering the forest age, size and structure, and in some cases the species composition. In most harvested stands, older and larger trees were removed and replaced with a new, young age class of trees. A more multi-canopy/multi-aged stand structure was often replaced with a more single canopy/single aged stand. Species composition frequently shifted to more early successional species, such as larch and lodgepole pine, and less late successional species, such as spruce and subalpine fir. In short, older mid and late successional forest stands were converted to young, early successional conditions. These

changes often resulted in overall improved health, vigor and growth of the stand, especially with the subsequent thinning that occurred in many of the young sapling stands. These early successional stands tended to have more abundant cover of shrubs, grass and forbs as well. However, some of the forest structural diversity and complexity often found in older forests was lost in those stands that had regeneration harvests (and some of the intermediate harvests as well). Most or all of the large, old trees and snags were removed and slash piling and burning dramatically reduced the amount of downed wood in the stand. Though another common disturbance process – fire – also results in dramatic changes in forest age, size and structure, effects are not fully equal to that of timber harvesting. A primary difference is in the large number of snags and dead/downed wood that would result with fire as opposed to harvesting.

Private Land Development

About 7738 acres of the VegAA (18%) is private lands. An additional 4583 acres are State Lands. Refer to Map 1 in Appendix A of the Silvicultural Diagnosis Report (section F in project file) for location of private and state lands. The town of Polebridge lies near the southern end of the Veg AA. Development on the private lands, including timber harvest, clearing and home construction, has been steadily increasing over the past 25 years, causing dramatic changes to the vegetation. Harvest of larger trees and thinning of smaller trees has occurred across much of the private lands. Some of these changes in forest structure and species would be more or less permanent, with landowners maintaining a non-forest, open condition over time. In other areas, conifers would seed back in and forested areas would again develop. However, it is likely that these forests would be heavily influenced and conditions substantially manipulated by the landowners into the future.

Insect and Disease; Other Tree Mortality Factors

Insects and diseases can exert major influence on forest conditions over time, though they are usually less spectacular or noticeable compared to fire or timber harvesting. Their influence on a year by year accounting can appear deceptively inconsequential, but over time they can cause major shifts in species composition, stand structure and other characteristics by causing mortality to selective stand components. Sometimes their effects can be quick and dramatic, such as during an insect epidemic.

Though insects and disease are a natural component of the ecosystem and accepted as such, their effects (particularly at epidemic levels) may not be a desired condition in some areas from a management or social perspective. In the wildland urban interface, for example, where the Red Whale treatment units are located, large and/or contiguous areas of dead and down trees that might result from high levels of insects or disease are not considered desirable. In the event of a fire, this amount of fuel would increase fire intensities and reduce our ability to safely attack and control fire.

The following is a discussion of the major insects or diseases that have been influencing vegetation in the Red Whale Project area for at least the past 50 years of so. Annual insect and disease flight surveys are conducted by the Forest Service nearly every year, which provide a good data base on insect/disease levels and trends since the 1960s.

Mountain Pine Beetle (MPB). Mountain Pine Beetle has been one of the major players affecting existing stand conditions within Red Whale VegAA. Lodgepole pine and whitebark pine are the host species for MPB in the VegAA. In recent times, MPB populations reached epidemic proportions in the latter half of the 1970s, with populations peaking about 1980 (refer to Maps 7 and 8 in Appendix A of the Silvicultural Diagnosis Report, project file, section F). Vast areas were affected and large numbers of lodgepole pine and whitebark pine were killed during this time, particularly the most susceptible trees and stands, i.e. those that were of larger diameter (>8" dbh), older age classes (>70 yrs old) and at mid to low elevations. Salvage of some of the dead lodgepole pine occurred in succeeding years. In some affected stands, larch or Douglas-fir were present (or subalpine fir and spruce in the upper elevation whitebark pine stands), both of which often responded well to the reduced competition resulting from the lodgepole or whitebark pine mortality. Where open conditions were created by the loss of these overstory trees, new tree regeneration often occurred, creating a young understory layer of lodgepole and sometimes larch or Douglas-fir trees. Over time much of the dead lodgepole and whitebark pine eventually fell to the ground and is now contributing to the downed woody fuel loadings.

Currently, there are two main age classes of lodgepole pine forest in the VegAA – the 70-90 year old forests that originated after fires in the early 1900s, and the <40 year old forests that originated after timber harvesting since 1960 or the large fires of 1988 and 2003. Around 8%, or about 7800 acres, of the VegAA is covered by older (i.e. 70-90 year) lodgepole pine dominated forest (refer to Map11a in Appendix A of the Silvicultural Diagnosis Report, project file, section F). These are the stands that are at highest hazard to MPB due to their age, size and location. An additional 13% of the VegAA, or about 13,400 acres, are mixed conifer forests, many of which contain mature lodgepole pine as a major or minor component. These stands are also vulnerable to MPB infestation, though the presence of non-susceptible species would reduce the resulting impact on some stand conditions such as tree density and dead wood quantities.

Epidemic population levels of MPB can develop where there are large areas or acreage of high hazard forest. Much of the higher hazard older lodgepole pine dominated forest in the VegAA occurs as smaller discontinuous patches, though there are large patches concentrated in the lower reaches of Whale and Moran/Hay Creek watersheds. Whitebark pine stands were severely affected by the MPB epidemic in the 1980s, killing most of the mature trees, and there are few beetle susceptible whitebark pine trees left.

Douglas-fir Beetle and Armillaria/Laminated Root Rot Diseases. These components have been prominent factors influencing forest conditions in the Red Whale Project area where Douglas-fir is a dominant stand component. These types of stands are concentrated on the warmer and drier southerly aspects within the Red Whale Project area (the Project areas that are proposed for prescribed burning). Douglas-fir beetle and root disease often work together, and it is sometimes difficult to ascertain just which organism is the primary reason for a trees weakening or death. For example, root disease can weaken the tree considerably, which makes it far more vulnerable to attack and death by the beetle – and vice versa.

Root diseases are caused by parasitic fungi that spread from the roots of diseased trees to those of healthy ones. They are natural components of the forest and infect both weakened and healthy,

vigorous trees of all ages and sizes. The fungus can persist in the soil for many decades, even centuries, with levels varying through time depending upon the abundance of food source (i.e. their host tree species). In the forests of our area, Douglas-fir is a primary host species and trees of all sizes and ages are highly susceptible to these particular root diseases. It is a subtle disease, but can cause persistant mortality year after year within a stand, which cumulatively can result in the loss of high proportions of susceptible trees over time. About the only thing that can reduce root disease in a stand is reducing its food source (i.e. lowering the proportion of Douglas-fir and increasing the proportion of more disease resistant species).

Douglas-fir beetles are aggressive and opportunistic organisms. They feed and breed under the bark of trees, so unlike root disease, they require older, larger trees with adequate stem circumference to sustain themselves. Douglas-fir trees >16” dbh and older than 120 years are the most susceptible, though younger, smaller trees down to 7” dbh or so would be attacked when beetle populations are high. Stand characteristics linked with increased susceptibility are (1) higher density; (2) higher proportions of larger, older Douglas-fir; (3) drier habitat types where trees may more likely be water-stressed; (4) higher numbers of trees already diseased and/or injured (such as by root disease or fire). At lower, endemic beetle population levels, individuals and small groups of trees may be attacked and are sometimes killed each year, which, as with root disease, can cause substantial losses over a period of time. At high, epidemic beetle population levels, individual trees are often overwhelmed by the sheer numbers of beetles attacking and large numbers of trees may be killed. Warm, dry weather conditions favor beetle survival, as well as increase stress on susceptible trees, which can lead to large population buildups. A sudden increase in food and breeding habitat can also cause large populations of beetles to build. Fire, especially that which burns at lower severity and wounds but doesn’t kill the trees, can create just such abundant food/breeding habitat in the form of thousands of stressed Douglas-fir trees. If other factors, such as weather, are also favorable, a fire event in Douglas-fir stands can lead to large buildups of beetle populations. Drought conditions in western Montana, in combination with large fires in some areas, led to epidemic beetle population levels in the late 1990s through about 2003. Large numbers of Douglas-fir trees were killed during this period across this region. More moist and favorable weather conditions over the last few years, along with a lack of large areas of recently fire-damaged Douglas-fir, have caused a reduction of beetle populations and mortality in our local area.

Currently, Douglas-fir beetle and root disease both exist within the older Douglas-fir dominated stands in the Red Whale Project area. These stands are concentrated in the prescribed burn Units 4, 5 and 6. Infestation and infection appears to be “chronic”, with individuals and small groups of trees dying every year, but not in excessive numbers at the present time. Beetle populations are apparently at endemic population levels. Douglas-fir beetle hazard is moderate to high in prescribed burn Units 4, 5 and 6, but very low in burn units 1, 2, 3, 7, 8 and 9, due to stand conditions (younger stands, low proportion of beetle susceptible Douglas-fir, low stand densities). Hazard is a measure of a stand’s ability to support a population of Douglas-fir beetles. If the stand experiences disturbance, such as windthrow or fire scorch, it may provide beetles with abundant breeding material and experience high levels of mortality. Refer to Map 15 in the Silviculture Diagnosis Report, section F of the project file for a map of the Douglas-fir beetle hazard.

Spruce Beetle and Western Balsam Bark Beetle. These beetles have affected stands where spruce and subalpine fir (the host species respectively) exist. These bark beetles can also be fairly aggressive and cause high levels of mortality in their hosts. Results from aerial surveys and field reconnaisance suggest that these beetles are present but at low population levels and mortality has been sporadic and light in the spruce and subalpine fir over the last few decades. Mortality has varied from year to year, and has been mostly localized rather than widespread. The cumulative loss over time of the larger, older trees within a stand (which are the most susceptible to these beetles) has undoubtedly caused some changes in stand structure and perhaps species composition as well at the site specific scale.

There are a whole host of minor insects, diseases, or other biotic and abiotic factors that have also affected individual tree or stand conditions within the Red Whale Project area, such as larch needle diseases, western gall rust, root diseases, severe climatic changes (i.e. red belt), windthrow and dwarf mistletoe. Tree mortality from these factors appears to have been fairly localized and quite limited in the VegAA, with no apparent widespread, large areas of mortality due to these factors for at least the past 40 years.

Forest Composition, Size, Age and Structure

Stand Level

Vegetation composition, structure, age/size classes, density and condition are described in detail in the Silvicultural Diagnosis Report table 1 (see section F, project file) for each proposed treatment unit. Refer to Maps 9a, 9b and 9c in Appendix A of the Silvicultural Diagnosis Report for location of proposed units respective to the stand numbers identified in the table. Table 3-5 below provides an abbreviated summary of the units grouped by similarities in forest conditions.

Table 3-5. Summary of Current Forest Conditions by Unit Groups for All Action Alternatives

Treatment Unit	Current Forest Condition
Mechanized Treatments (Thinning, Patch Seedtree)	
Group 1: B, C, D, Q, R, CC, FF, HH, 4A	Lodgepole Pine, single age/single story stands, 70-90 years old (originating after 1910 to 1926 fires). Densely stocked and small diameter (3 to 8” DBH). Sparse understory trees in most stands; low shrubs/forbs in undergrowth. Dead woody material (standing and down) amounts variable, from light to heavy concentrations in areas where mortality and blowdown have occurred.
Group 2: E, F, H, L, M, N, P, DD, GG, 4B, 4M, 4N, 4P, 4Q, 4R	Mixed species, mostly single aged stands: Primarily larch and lodgepole pine, with some Douglas-fir, spruce and subalpine fir; 70-90 years old (originating after 1910 to 1926 fires). Well stocked, trees 6-12+” DBH. Understory tree density varies, from sparse to moderately dense spruce/subalpine fir. Dead woody material amounts variable, mostly light to moderate, with isolated concentrations of heavy fuels.

Treatment Unit	Current Forest Condition
Group 3: A, I, EE	Mixed species and multi-aged stands; with spruce, larch, Douglas-fir, subalpine fir and lodgepole pine all present in various amounts. Main canopy trees from 70 to 120+ years old. Understory is moderate to densely stocked spruce, subalpine fir with Douglas-fir in some stands. Dead woody material amounts are moderate.
Group 4: G, J, K, O, BB, 4C, 4D, 4E, 4F	Young forest (20 to 50 years old), mostly originating from past regeneration harvests (clearcut/seedtree) in 1960s through early 1980s. Well stocked stands of small trees (mostly <6" DBH) with all species represented. Some areas dominated by lodgepole pine; some areas larch, spruce, Douglas-fir and subalpine fir are common. Dead woody material very light due to previous post harvest slash treatment.
Group 5: S, T, U, V, W, X, Y, Z, 4G, 4H, 4I, 4J, 4K, 4L	Young forest (18 years old) originating from the 1988 Red Bench Fire. Very dense stands of small trees (mostly <15 feet tall). Nearly 100% lodgepole pine, with larch present in some areas and dominant in Units S4, 4H, 4I and 4J. Dead/down woody material sparse in some units (where previous harvest or salvage/removal of the fire killed trees occurred) and heavy in others (where downfall of snags from 1988 fire have accumulated).
Prescribed Burn Treatments	
Group 6: 1 through 9	Units are located on southerly aspects, where a mix of open, semi-open and more densely forested areas exist in variable amounts. Forests are mostly young, 70-90 years old, originating after fires in the early part of the 20th century. Units 4 and 5 contain more multi-aged forest with some trees over 150 years old and up to 24" dbh. In all burn areas, Douglas-fir is the predominant species, with lodgepole pine common in portions of some units. Western larch is present in some units although it is a minor component. Subalpine fir and spruce are present in some of the moister sites, draws and creeks, usually in the mid and understory tree layers. Whitebark pine occurs at elevations above 6000 feet, along with spruce and subalpine fir. These high elevation areas occur within Units 1, 2 and 8.

Landscape (Watershed) Level

Tree Composition. Shade intolerant mixed conifer forests (mostly a larch/lodgepole pine mix) and lodgepole pine-dominated forests are the primary cover type in the VegAA, particularly on the more gently sloped lands in the lower reaches of the watersheds where the mechanized treatments are located. These tend to be forests of younger age classes (i.e. <100 years old), originating after the fires of this last century. Though spruce and subalpine fir are often in the understory (and sometimes overstory) of these younger stands, these species tend to become dominant only in the older stands (i.e. >150 years); in riparian areas or sites with poor drainage; and at upper elevations (i.e. >5800 feet). Spruce/subalpine fir forests are also most common on the northerly aspects at the mid to upper elevations, where the colder, more moist conditions favor its regeneration and growth. Douglas-fir is a species that is present to varying amounts in many stands, but it is the major species in stands only on the drier sites; primarily the steeper, southerly aspects in the mid to upper reaches of the drainages. On these sites Douglas-fir is more able to out-compete other species due to its greater tolerance for droughty conditions. Open grass

or shrub dominated areas are common on the shallow, poorer soils along the high elevation ridgetops, often with subalpine fir, spruce and a few whitebark pine growing as well. Conditions in the VegAA are not suitable for the regeneration and growth of grand fir, western red cedar, western hemlock, western white pine or ponderosa pine, though they do occur incidentally in some areas. Refer to Map 10 in Appendix A of the Silvicultural Diagnosis Report (section F, project file) and Table 3-6 below for a summary of cover types in the VegAA.

Table 3-6. Vegetation Cover Types in the VegAA

Cover Type (dominant species)	Acres in VegAA	Percent of VegAA
Shade-Iintolerant Mixed Conifer (mainly lodgepole pine and western larch mix)	26,159	26%
Lodgepole Pine	15,078	15%
Douglas-fir	6511	6%
Subalpine Fir	13386	14%
Engelmann Spruce	9292	9%
Shade-Tolerant Mixed Conifer (spruce/subalpine fir)	18,374	18%
Grass/Forb/Shrub/Sparsely Vegetated	12,463	12%
Total	**101,263**	**100%**

Forest Age, Size Class and Structure. There are three main forest age classes, roughly corresponding to three main forest size classes, within the VegAA. Refer to Maps 11 and 12 in Appendix A of the Silvicultural Diagnosis Report (see section F, project file), and Table 3-7 below.

Very young seedling/sapling forest currently occupies the largest percentage of the VegAA (about 39%). These forests are generally less than 40 years old, originating from recent fires (in 1988 and 2003) and past timber harvest (since about the 1960s). They often form large, continguous patches on the landscape, particularly those stands that originated from fire. Shade-intolerant, early successional species (primarily larch and lodgepole pine), are most common in these stands. Density of these young stands varies, but they are fully stocked with trees or expected to be (as in the case of the most recent 2003 Wedge Fire) (see section F, project file). In the area of the 1988 Red Bench fire, very high density sapling stands are common (i.e. >10,000 tpa). In the more recent Wedge fire, stands are in the very early stages of regeneration.

An additional 20% of the VegAA is in a small tree category (5-9.9” dbh), typically correlating with the young forest that originated after the fires of 1910, 1926 and 1929. These young forests are most often dominated by the early successional species; lodgepole pine and larch are most common, with Douglas-fir a major stand component on the steep southerly aspects. Stands are usually single-storied, though some have moderate to densely stocked understories of spruce and subalpine fir. Stand density is usually fairly high, often over 500 trees per acre, reflecting the relatively good sites for vegetation growth and abundant conifer regeneration that occurred after the wildfires.

The remaining forests in the VegAA are mostly in a medium tree size category (10-14.9” dbh),

with a few reaching the large tree category (>15” dbh). These forests occupy about 30% of the VegAA. Though some of these stands are in the younger 70-100 year old age class, they typically represent the older forests (100-150 years or greater in age) in a mid to late successional stage of development. Stands at the lower end of this age range tend to be fairly dense single story stands, whereas the stands of 150 to 200 or more years old are often in a more multi-canopy condition. This occurs because as a stand ages, mortality of the overstory trees increases due to disease, windthrow and other causes. This opens up the dense forest canopy and allows light to reach the forest floor, often stimulating growth of the understory trees and vegetation. The more shade tolerant spruce and subalpine fir are the most common tree species in the mid and understory tree layers. Large, old larch and spruce are also common in the overstory of the older stands, with Douglas-fir a common overstory and understory component on the drier sites.

Higher elevation sparsely forested areas or grass/forb/shrub-dominated nonforest areas occupy the remaining lands in the VegAA, covering about 11% of the area. Most of these vegetation types are located in the upper eleations areas and on the driest, southerly aspects. In these areas shallow soils and harsher site conditions limit tree growth. However, a sizable portion of the grass/forb type also occurs on the private lands in the North Fork Flathead River valley bottom. These are areas cleared or logged by private land owners.

Table 3-7 below summarizes the forest age/size classes in the VegAA.

Table 3-7. Forest Age/Size Classes in VegAA

Age/Size Class	Acres in VegAA	Percent of VegAA
Grass/Forb/Shrub - Sparsely Vegetated (mostly non-forest sites)	11320	11%
Grass/Forb/Seedling - 2003 Wedge Fire Area	15273	15%
Seedling/Sapling Trees - <5” dbh	24157	24%
Small Tree - 5-9.9” dbh (typically younger forest, <100 years old)	20690	20%
Medium Tree - 10-14.9” dbh (typically 70-150 years old)	22981	23%
Large Tree - >15” dbh (usually older forest >150 years old)	6972	7%
Total	**101,393**	**100%**

Snags and Downed Wood. The quantity of dead wood varies across the VegAA, dependent primarily on the stand history and site condition. An assessment of snags and downed wood at the landscape scale can utilize knowledge of the successional stage of the forest and the change that typically occurs in these components through the natural aging of the stand.

In the fire-dependent ecosystems characteristic of this area, peaks in quantities of dead wood within stands typically occur during the early and late successional stages of the forest – those time periods right after a fire has occurred, and again when the forest has aged to the point where mortality rates have increased due to a variety of natural factors (such as disease and windthrow). The lowest quantity of dead standing and down wood occurs in the “middle-aged” stands, about 70-140 years old. These stands are at the point in their successional development where much of

the dead wood that was created from the last fire event (i.e. 1910 to 1929 in the Red Whale VegAA) has fallen and largely decomposed. These stands are still relatively young and vigorous, with smaller tree sizes, and have not experienced the higher levels of tree mortality that create many new dead trees and snags. The exception to this is in stands that are (or were) dominated by lodgepole pine. Many of these stands did experience high mortality during the mountain pine beetle epidemic in the 1970s and 1980s, and as a result, contain spotty but heavy concentrations of dead and down trees.

In the Red Whale VegAA, the highest densities of both standing dead (snags) and downed wood occur in the areas that were burned in the 1988 and 2003 wildfires, and substantial quantities of both components exist across a large portions of the landscape. These recently burned areas are at the early successional stage of development and cover about 25% of the VegAA (about 25,000 acres) . Most of the dead trees in the 2003 Wedge Fire are still standing, but most in the 1988 Red Bench fire area have already fallen to the ground and are adding to the downed wood component. Past harvesting (previous to the 1988 and 2003 fires) reduced the number of large diameter trees across portions of these fire areas, and thus the potential for large diameter snags that would exist after the fire. Therefore, though small diameter snags are abundant, the larger snags – particularly larch, which is of high wildlife value – are more scarce and less than what would have occurred had the area been unharvested. In addition, some of these fire-killed trees were removed during post-fire salvage sales, especially on private lands. In the most recent Wedge Fire salvage harvesting, large diameter larch and Douglas-fir snags were left at varying densities, where they existed, on the National Forest lands.

The lowest amount of snags and downed wood in the Red Whale VegAA occurs in areas with past regeneration harvesting. The dead wood and slash was typically removed by piling and/or burning. The larger diameter snags were also removed from these stands. These past regeneration harvests cover about 16%, or 16,000 acres, of the VegAA, concentrated in the lower elevations and gently sloped regions of the analysis area.

The remaining 60% of the VegAA, or about 60,000 acres, is mostly a mix of “middle-aged” mid successional forest stands and late successional forest, with some (estimated 12,000 acres) naturally open grass/forb/shrub or sparsely vegetated areas on the more southerly aspects and at higher elevations. Mid-successional stands are typically those that have been affected by fire within the last 150 years or so, and are at the stage of development where downed wood and snag components are most likely at a low level. The late successional stands and old growth forests are likely to have higher amounts of snags (especially the larger diameter trees) and downed wood. However, much variability can occur within stands at these stages of development, depending upon many factors; species composition is one such factor. For example, in lodgepole pine stands where their shorter life spans, and/or beetle mortality, may provide more abundant levels of snags and downed wood in relatively young (i.e. <100 year old) stands; in Douglas-fir stands, the presence of root disease could create a similar increase in dead wood amounts; in other stands, large diameter larch snags may still persist from fires that occurred nearly a century ago; and in higher elevation forests where whitebark pine was a component, the high mortality of whitebark pine in the 1980s has resulted in large numbers of snags and downed wood in some areas. These whitebark pine snags tend to be very long-lasting, due to the nature of the wood and the cold climatic conditions. Moist, spruce dominated forests

may also have especially abundant downed wood. Larger spruce are particularly susceptible to spruce beetle and to wind throw. Dead spruce would stand only a few years at most, and then add to the downed wood component.

Most of the long-lasting, large diameter snags that are especially valuable to wildlife species (e.g. older larch killed by the fires) have largely been removed from areas adjacent to open roads, both through timber harvesting and by firewood cutters. The lower elevation and valley bottom areas within the VegAA have historically had high densities of roads to access areas for timber harvest and private land holdings. Though most of these roads have been decommissioned, bermed or gated yearlong, in years past many roads were accessible to firewood cutters. In stands away from road access, large diameter larch snags still occur.

Private Land. About 4700 acres, or 60%, of the private land within the VegAA is in an early successional stage of development, dominated by conifer seedlings/saplings or grass/forb vegetation types. Most of these areas are in this condition due to the effects of recent fire (Red Bench in 1988 and Wedge Fire in 2003). However, clearing of land for buildings and the logging of mature forests has also contributed. The remaining 40% of private land is primarily forested with trees >70 years old, and in some areas >150 years old. Lodgepole pine, larch, spruce and subalpine fir are the most common species on these lands.

State Land. About 1615 acres, or 35%, of state land within the VegAA is occupied by early successional forests, primarily seedling/sapling size trees. These forests originated from the 1988 and 2003 fires. Most of the remaining forests on state land are in a mid-successional stage of development, dominated by small to medium sized trees approximately 70-90 years old. These stands originated after fires in 1919 and 1926. Lodgepole pine, larch and spruce are the most common species.

Old Growth/Late Successional Forest

Stand Level

Most forest types on sites in the western Montana area are considered mature when about 100-120 years old (somewhat younger for lodgepole pine stands). Late successional and old growth conditions typically begin to develop when a stand nears 150 years old and beyond. Though all stands age through time, not all stands have the capability of developing into what we would consider “old growth”. Obviously many factors influence stand development, starting at the very point the stand is initiated; e.g. after a fire or other disturbance. Site conditions, climatic factors, availability of conifer seed sources, density of trees and resulting effects on growth, species composition, insect or disease activity, are just some of the factors that can affect forest conditions over time. Some stands would never reach maturity or old age, such as those visited by fire at a young age and returned to a seedling stage of development. Other stands may continue to age, but because of high tree densities or species compositions, they may never develop the larger diameter trees that are associated with the old growth condition.

Old growth and late successional forests are resources of interest for a variety of reasons, ranging from their value and utilization by wildlife species of concern, to their more abstract, aesthetic

values to many people. The evaluation of these components in this document is limited to their identification and description as a vegetative condition, and the effects of the proposed actions on the various vegetative components of old growth or late successional forests. Their interaction or effect to other resources, such as the habitat requirements of old growth related wildlife species or their social values, are not evaluated in this section. Additional interpretation is needed to address the effects to these resources, which are found in their respective sections of this document.

Old growth could be simply defined as a forest in which a sizable proportion of the trees are relatively old (i.e. 150 years or greater) and of larger diameter (diameter varying depending on site capabilities), where larger sized downed woody material is usually present, and a fair amount of decay and breakage usually exists in the overstory trees. The old growth condition results from the natural development (or succession) of a forest stand through time. The old growth definition at the project, or stand, level currently in use across western Montana and the Flathead National Forest is outlined in the document *"Old Growth Forest Types of the Northern Region"* (USDA Forest Service 4/92). These are local definitions for old growth based on ecological attributes such as number of large diameter trees, minimum ages, percent downed woody material, snags, and other variables. They utilize attributes that are determined at the site specific level through field examination of the stand. The definitions vary depending upon the old growth cover type/habitat type group you are in, e.g. Douglas-fir/larch type, spruce/subalpine fir type, etc. Table 3-8 below displays old growth characteristics necessary to be defined as old growth for the old growth/habitat type groups represented in the Red Whale VegAA.

Late successional forests, like old growth, are in a more advanced age class and contain some of the components of old growth forest, such as a sizable number of old, large trees and/or downed wood. Although they provide some of the values specific to old growth forest, such as habitat for certain wildlife species, they do not meet all the criteria necessary to be classified as old growth. Often the lack of an adequate number of large, old trees is their shortcoming. However, they are of interest because of their similarities to old growth forest, and in some cases because of their potential to develop into old growth in the near future.

Table 3-8. Western Montana Zone Old Growth Type Characteristics

Old Growth Type	Habitat Type Group [4]	Min. Age Of Large Trees	Number TPA/ DBH	DBH Vari-ation [2]	% Dead/ Broken Top [1]	Proba-bility Of Down Wood [2]	% Decay [1] (range)	# Canopy Layer [3]	Snags/ Acre [1] (range)
3 Lodgepole Pine	Highly variable Habitat Group C,D,E, F,G,H	140	10 > 13"	L	11 / 5-22	H	6 (2-15)	Single	19 (0-92)

Old Growth Type	Habitat Type Group [4]	Min. Age Of Large Trees	Number TPA/ DBH	DBH Vari-ation [2]	% Dead/ Broken Top [1]	Proba-bility Of Down Wood [2]	% Decay [1] (range)	# Canopy Layer [3]	Snags/ Acre [1] (range)
4 Subalpine Fir, Douglas-Fir, Larch	Cool/ moist & wet Habitat Group D,E,F	180	10 > 21”	H	9 / 0-19	H 2-43	9 (0-19)	Mult.	15 (2-43)
5 Subalpine Fir, Douglas-Fir, Larch	Mod. cool/ moist & Cool/ mod. dry Habitat Group G,H	180	10 > 17”	M	9 / 1-18	H	6 (0-12)	Mult.	12 (3-36)
6 Subalpine Fir, Whitebark Pine	Cold/ mod. dry Habitat Group I	180	10 > 13”	M	11 / 2-31	M	10 (2-17)	Mult.	25 (5-38)
7 Lodgepole Pine	Cold/ mod. dry Habitat Group I	140	30 > 9”	L	8 / 3-14	H	5 (0-11) (9-22)	Mult.	17
8 Subalpine Fir, Whitebark Pine	Cold Habitat Group I	180	20 > 13”	M	12 / 10-14	M	5 (0-8)	Single	37 (33 - 44)

[1] These values are not minimum criteria. They are the range of means across plots within forests, forest types or habitat type groups.
[2] These are not minimum criteria. They are Low, Moderate, and High probabilities of abundant large down woody material or variation in diameters based on stand condition expected to occur most frequently.
[3] Number of canopy layers can vary within an old growth type with age, relative abundance of different species and successional stages.
[4] Habitat Groups: refer to section F in project file.

Every Red Whale mechanized treatment unit was field surveyed to confirm forest conditions and the presence or absence of old growth or late successional forest. A small area (about 15 acres) on the west side of Unit J was the only area likely to qualify as old growth forest as per the definitions described above. Units A and I, and portions of Unit H (about 19 acres) and Unit EE (17 acres) contain older late successional forest, with old trees (>200 years) and in some cases multi-aged/multi-canopy forest conditions (refer to Table 1, Site and Vegetation Conditions by Each Unit, in the Silvicultural Diagnosis Report, project file, section F). They do not fully meet old growth forest definitions, but do exhibit some of the values and characteristics of old growth. Units A, I and part of Unit H contain multi-canopy forest conditions, as well as some larger, older overstory trees; but at inadequate numbers and size to qualify as old growth (with <10 trees per acre 18” dbh or larger). Part of Unit EE contains adequate numbers and sizes of old overstory

trees, but has been harvested in the past and has minimal understory tree development, snags or larger diameter downed wood.

Old growth/late successional forest likely exists within the wildlife burn Units 4 and 5, based on review of past surveys and photo interpretation. No field review has yet occurred to validate this, but the assumption would be made for this analysis that they are at the least in a late successional stage of development. Field validation would occur if these units are included in the final decision.

It is worth noting that the intent of the Red Whale project is to avoid treatment in old growth forest, as this forest type is limited in the area due to past fire history and harvest activities. The areas identified as old growth in this analysis would be dropped when developing the final decision.

Landscape (Watershed) Level

Defining and identifying old growth at the landscape scale of analysis is necessarily less detailed than at the stand level, due to the broader scale and availability of vegetation data. Data appropriate for use at this scale of analysis is typically derived from photo interpretation or remote sensing, with limited incorporation of site specific field data. Tree sizes, stand structure, composition and density are able to be determined at this broad scale of analysis, though other old growth components such as tree age, snag presence or defect/breakage are not. However, by assessing the available vegetation data along with stand disturbance data (e.g. fire history), stands can be identified that are the *most likely* to be old growth habitat. This information can be compared with similar data on historical, or natural, ranges of variability in old forest conditions. Further ground verification of these stands can also occur if necessary for the accurate project level identification of old growth habitat.

The analysis conducted for Amendment 21 of the Flathead Forest Plan provides some preliminary mapping at the landscape level of stands likely to be old growth, based on past field surveys and queries of available tree data. Map 13 in Appendix A of the Silvicultural Diagnosis Report (see section F, project file) displays these areas of probable old growth from the Amendment 21 analysis, which totals an estimated 5375 acres within the VegAA (or about 5% of the total area). Most of these mapped polygons were not field verified for this project, however, all areas that are proposed for mechanized or burning treatments have been (or would be) field reviewed to verify presence or absence of old growth.

The current amount of old growth forest has been influenced primarily by three factors: (1) stand replacing fires over this past century; (2) past timber harvesting; and (3) clearing, harvesting and development on private lands.

<u>(1) Past Fires.</u> Over 50% of the VegAA has been affected by stand replacing fires this past century. Some of what burned was undoubtedly old growth forest (see discussion earlier under fire), though it is not possible to determined precisely how many acres.

(2) Past Timber Harvesting. Harvesting on National Forest lands since the 1950s has affected about 25% of the VegAA, with over half of this harvesting (about 16,000 acres) removing all or nearly all of the trees and regenerating to a new stand (refer to Table 3-4). It can be assumed that most of this regeneration harvesting occurred in the older stands within the project area; those stands that were at least over 100 years old and in a mid to late successional or old growth stage of development. These actions undoubtedly lowered the proportion of old growth forest in the project area, though the exact amount can not be determined. Fires in 1988 (Red Bench) and 2003 (Wedge Canyon) burned over some of these past harvested acres (a total of about 7900 acres), and it could be argued that these particular stands of older forest would have been eliminated anyway, whether harvest had taken place or not.

(3) Clearing, Harvesting and Development on Private Lands. Private lands cover about 18%, or 7738 acres, within the VegAA. About 60% of these lands are in a grass/forb/shrub or seedling/sapling stage of development; some of which is due to fires in 1988 and 2003 and some of which is due to logging or clearing for development. It is likely that there have been some older forests, and perhaps old growth forest, that was burned, logged, and/or cleared on these private lands, although the exact amount cannot be accurately determined.

Historical Range of Variability (HRV)

HRV is a term used to describe the natural fluctuation of ecosystems over time. It refers to the range of conditions and processes likely to have occurred prior to settlement of the region by Euro-Americans (about the mid 1800s). HRV serves only as a reference point to establish a baseline set of ecological conditions, for which sufficient scientific or historical information is available, to enable comparison to current conditions. It does not necessarily equate to a "natural" range of variability, meaning one with no human influence. Nor does it necessarily equate to a condition we desire to attain, or can even feasibly attain. However, it is valuable for understanding how ecological processes and functions operated with human use, but prior to high human population and contemporary technology. This can provide clues for designing management strategies that maintain ecological integrity. Healthy ecological systems are essential to maintain or create current and future social and economic opportunities.

HRV is best discussed and analyzed at a broad scale, with watershed delineations providing a well-defined, ecologically based and suitable sized analysis unit. Ecological Subregions (ESRs) are groupings of watersheds based on similarities in biophysical features, such as potential vegetation groups and precipitation/temperature regimes (Hessburg et al. 1999). Watersheds on the Flathead National Forest have been mapped into several ESRs. The watersheds affected by the Red Whale Project are almost all within ESR 19, which is a common ESR in the North Fork Flathead River sub basin. It is characterized by a relatively high proportion of cool/moist and higher elevation habitat groups. Only Spring Creek and Spruce Creek drainages, in the southeast corner of the VegAA, are within ESR 20, which is characterized by lower elevation, drier conditions. However, since this area constitutes such a minor portion of the VegAA (about 7%) and is not dramatically different in character to the rest of the analysis area, it will not be analyzed separately.

HRV analyses have already been completed by the district Silviculturist for several ESRs on the Flathead National Forest as part of previous land management proposals. The HRV for vegetation composition, structure and patterns in ESR 19 was evaluated within both the Big Creek Ecosystem Analysis Project (1999) and the Teakettle Ecosystem Analysis Project (2003). These analyses can be adapted for use in evaluating the current conditions in the Red Whale Project area as well, although direct comparisons must be tempered due to the different methodology and sources of information used for classifying vegetative conditions. Relevant excerpts from the more recent Teakettle analysis can be found in section F of the project file, including a discussion of the data sets and analysis process used for the HRV analysis. The following summarizes the more pertinent aspects of these analyses as they relate to the Red Whale Project.

Cover Type

The spruce/subalpine fir cover type was historically the most prevalent in ESR 19, and could occupy up to about 63% of the watershed area (see project file, section F). Lodgepole pine, larch and Douglas-fir were also common cover types historically, individually occupying up to 25 to 40% of the landscape. They probably were at their most dominant the first 100 years or so after the stand replacing fires that are characteristic of this landscape. Whitebark pine cover type is also represented although at low proportions, as is open shrub or forb dominated areas.

Currently, there is about an equal mix of the spruce/subalpine fir and lodgepole pine/larch cover types in the Red Whale VegAA, with each group covering about 41% of the area (refer to Table 3-6). The Grass/Forb/Shrub and Douglas-fir cover types cover the remaining 18% of the area. This blend appears to be soundly within the expected HRV, reflecting the unique history of stand altering disturbances in the past (primarily fire and harvest) and the abundant regeneration of early successional species after these disturbances.

Structure Class

The structural classes evaluated in the previous HRV analyses for ESR 19 were derived from a rigorous photo interpretation process of the specific project area (see section F, project file), which was not done for this Red Whale Project analysis. Therefore, comparison between current and historical conditions for the less discernable structural classes (specifically the mid successional types “stem exclusion”, “understory reinitiation” and “young-forest/multi-story” classes) will not be attempted. However, the readily detectable “stand initiation” structural stage can be evaluated, as this represents the early successional seedling/sapling dominated forest.

Historically, fire was a common occurrence in ESR 19, and the historical distribution and relative abundance of the different forest structural stages within these watersheds reflect this disturbance factor. This is evident in both the periodic dominance and high proportion of the early successional stand initiation stage and the variability among the other structural classes (see section F, project file). All structure classes are represented within these watersheds, with the potential for wide variability in proportions, depending upon the unique history and characteristics of a particular watershed. The stand initiation stage (seedling/sapling forest) has the highest range of historical variability, ranging from a low of about 2% up to a maximum of

about 53% of the area. This data reflects the historical pattern of infrequent fires (i.e. every 150 to 300 years) that are typically large and of lethal or mixed severity. These fires would convert large areas of older, mature or nearly mature forest back to an early successional stage of development. The median value in the stand initiation stage is 10%, indicating that most of the time the proportion of the watershed in this stage was at the lower end of the potential range, also reflecting the infrequency of fires in this regime.

Currently the proportion of stand initiation structural stage – the early successional seedling/sapling forest – is estimated at around 24% of the Red Whale VegAA (see Table 3-7). A large portion of this was created by the 1988 Red Bench Fire; past timber harvest directly created additional acres. Another 26% of the VegAA is in a grass/forb/shrub stage of development. Perhaps half of this represents areas that would ultimately support full forest cover, but are currently in the very early stages of tree regeneration; primarily areas burned in the 2003 Wedge Fire. Overall, the proportion of early successional forest structural type is firmly within the HRV. The value is well above the historical median of 10% of the area, which reflects the widespread recent fire activity in the VegAA.

Old Growth/Late Successional Forest

As mentioned earlier in the section on old growth forests, at the broader landscape scale of analysis less specificity in vegetation data is available, and old growth analyses focus on identifying stands with a sufficient density of large trees, i.e. those that are *most likely* to be old growth. The analysis for ESR 19 suggests the HRV for these “Large Tree” or “Old Forest” structural classes (correlating to those stands most likely to be old growth forest) is quite wide, from essentially zero percent of the landscape up to 40 or 50% of the area (see section F, project file). This wide range is entirely logical, considering the preponderance of lethal and mixed severity fires across these areas and the expected long fire intervals. It would not be uncommon for 200 or more years to pass between stand replacement fires, allowing the potential development of old forest over large portions of the landscape. However, in a geological instant, most or even all of this old forest could be eliminated with one large, severe fire event, such as occurred in 1910.

Currently, using the best available information, it is estimated that about 5% of the Red Whale VegAA is likely in an “old growth” condition (see discussion earlier under the section on Old Growth). This proportion is considered to be within, but at the low end, of the HRV for this forest condition. For discussion on the character of this old growth and the influencing factors on this current amount of old growth, see the section earlier on *Old Growth/Llate Successional Forest.*

Environmental Consequences

Introduction

This section describes the direct, indirect and cumulative effects of the proposed treatments on the forest resource. Effects to other resources, especially wildlife, due to these changes in the

forest conditions and understory vegetation are discussed in their respective sections of this document.

Reference information for this analysis includes: (1) descriptions of the proposed treatments for each unit by alternative (found in Chapter 2 or in section F of the project file), and (2) detailed descriptions of the existing and desired stand conditions for all treatment units (found in the Silvicultural Diagnosis Report, project file, section F). Effects in this section are sometimes described by "Unit Groups", which are collection of units of like forest conditions. Table 3-5 earlier in this report describes these unit groups and identifies the units within each group; an abbreviated description of these groups is provided below:

- Group 1 = Dense lodgepole pine stands, small diameter (4-7" dbh), 70-90 years old.
- Group 2 = Mixed species stands (mostly lodgepole pine and larch), 6-12"+ dbh, 70-90 years old.
- Group 3 = Mixed species stands (spruce, larch, subalpine fir, lodgepole pine, Douglas-fir), multi-size, multi-age (70-120+ years).
- Group 4 = Mixed species stands (lodgepole pine, larch, spruce, subalpine fir, Douglas-fir), young sapling age (20-50 years), up to 40 feet tall; previously harvested areas.
- Group 5 = Dense lodgepole pine and larch saplings, 18 years old, mostly <15 feet tall; 1988 Red Bench Fire origin.
- Group 6 = Variable forest conditions (these are the prescribed burning units): multi-canopy and multi-aged stands, a mix of open/semi-open and dense forest, with Douglas-fir and lodgepole pine dominant.

To focus the forest vegetation analysis and describe relevant effects, the following effects indicators are used:

- Total acres treated within each unit group and resulting effects to forest conditions at the stand and landscape level (stand/tree vigor, growth, structure, species composition, understory vegetation, snags and downed wood). Focus in particular on Unit Groups 1 and 5, where current conditions are poorest.
- Acres treated with moderate to high hazard of Douglas-fir beetle.
- Acres of old growth/late successional forest affected.

Direct, Indirect and Cumulative Effects of Alternative 1 – No Action

Effects to Forest Conditions

No treatment of forest stands would occur under this alternative, and thus no change to the existing forest conditions, as described under the "Affected Environment" section of this report, would occur. Forests would continue to develop along their natural trajectory. In all stands, increasing tree densities would lead to continued competition among individual trees for light and moisture, causing reduced growth rates and vigor over time both at the individual tree and stand level.

Group 1 Stands. These very dense, older lodgepole pine forests have been, and are currently,

experiencing mortality due to tree competition and insect or disease occurances (usually mountain pine beetle). Lodgepole pine is a relatively short lived species, reaching its growth peak around 70 years old, with relatively rapid decline in growth and vigor in succeeding decades, and an increasing susceptibility to insect and disease. Mortality in Group 1 stands would continue under the no action alternative, resulting in decreasing overstory tree density and a corresponding increase in the amount of dead and down wood. In some stands, this opening up of the dense forest canopy would stimulate the growth of other species in the overstory, the understory (if there are any) and the ground vegetation. These changes would have corresponding effects to other resources, such as wildlife, and may increase fire risk. Incidentally, these stands looked very similar to stands in Group 5 about 50 years ago and provide us with a good illustration of what Group 5 stands would look like in several decades.

Group 2 Stands. These stands are similar in age and structure to Group 1 stands, however they are mixed species with less lodgepole pine and tend to be less densely stocked with trees. Consequently, there would be less deterioration of stand conditions in this Group under the no action alternative. Larch, Douglas-fir and spruce are long-lived species, and larch in particular is resistant to most insects or disease. These stands would be expected to maintain a more stable condition into the near future, with less mortality of trees and less increase in dead standing or downed wood. Though tree growth would decline due to stand density, in most stands the growth reduction would not be dramatic.

Group 3 Stands. Group 3 stands would also remain relatively stable into the near future under the no action alternative; due to their mixed species composition and mixed ages.

Group 4 Stands. These are young forests, less than 50 years old, and thus in a stage of development where growth rates are typically high and tree health and vigor at their best. However, tree density affects these factors, and in some of the Group 4 units high tree densities are reducing potential growth and development of the stand. In these areas growth would continue to decline under the no action alternative, with resulting effects on individual tree sizes and health.

Group 5 Stands. Current tree densities in these stands approach or exceed 30,000 trees per acre. Competition among individual trees for light and moisture is and has been very high through most of their 18 years of life, and tree growth and crown development in these stands have already suffered considerably as a result. This has reduced growth rates and vigor at both the individual tree and stand level. High densities and severe inter-tree competition would continue into the future given no disturbance, such as fire. Small tree sizes, sparse understory vegetation, and increasing concentrations of dead and downed trees would be expected into the future. This is not an uncommon or unnatural condition, and it often develops under natural disturbance regimes on sites where lodgepole pine regenerates particularly abundantly. However, these stand conditions may produce undesirable effects to other resources, such as wildlife habitat, and may increase fire risk.

Group 6 Stands. These are the stands proposed for prescribed fire treatments, which would not occur in Alternative 1. Stands would continue to develop along their natural trajectory, with tree cover becoming more dense, and open areas gradually filling in with conifers.

Effects to Insect and Disease, Other Mortality Factors

Little change in current insect and disease conditions would occur in the near future under the no action alternative. Lodgepole stands would become increasingly susceptible to mountain pine beetle attack and mortality as they age. The Douglas-fir dominated forests within the proposed prescribe burn units would also become increasingly susceptible to Douglas-fir beetle as stand age, size and densities increase. Rates of mortality attributed to these factors are expected to remain fairly steady, unless a stand disturbing event occurs (e.g. windthrow or fire), which causes a dramatic increase in tree stress and/or beetle population levels.

Effects to Late Successional/Old Growth Forest

No effect to old growth forest would occur under Alternative 1. Over time, some stands in the project area that are of desirable species composition and lower tree densities would have the potential to develop into an old growth condition, barring any major disturbance such as fire. Of the Unit Groups, only some of the stands in Group 2, 3, 4 and 6 would have that potential; stands in Groups 1 and 5 are of such high density and/or dominated by lodgepole pine that old growth conditions would very likely never develop.

Direct and Indirect Effects Common to Alternatives 2, 3 and 4

Effects to Forest Conditions

The following discussion describes general effects that the treatments of thinning, regeneration and burning have on a forest, which would be the same among all action alternatives. Each alternative would implement different acreages of these kinds of treatments, influencing the magnitude of these effects on the stand or area. These differences in magnitude between alternatives are described in the next section “Direct and Indirect Effects by Alternative”.

Thinning Treatments (Groups 2, 3, 4, 5). Thinning would reduce tree density in all size and age classes, widening the distance between tree crowns and removing understory trees that act as ladder fuels. Spacing of trees would vary considerably in the thinned stands, depending upon tree sizes, species, age, and condition, but would generally range from about 10 to 30 feet. This leaves about 50 to 430 trees per acre. This number is an average across the stand, which takes into account the natural variability in the unit and allows for the selection and grouping of desirable leave trees. Spacing would be closest in the sapling stands, where trees are still quite small, and widest in the older, mixed species stands, where crowns are fullest and widest.

A predominantly single story stand structure would be maintained or created by thinning treatment, with removal of most of the understory tree layers to achieve the fuel reduction objectives. No change in the current age class of the stand would occur, because no new tree regeneration is intended to be initiated by the thinning treatment.

Thinning would focus on removing the smaller and less vigorous trees first, leaving the larger,

healthier trees with best form. Western larch and Douglas-fir would be favored for leave trees, because they tend to be the most disease resistant and windfirm, are long-lived and most fire resistant. However, other species, such as lodgepole pine and spruce, would also be left where needed or desired, to achieve target tree density and species diversity. Because of the favored status of larch and Douglas-fir as leave trees, and the focus on removal of the mature lodgepole pine, stand composition within some of the treated areas would shift towards greater proportions of larch and Douglas-fir and less of lodgepole, spruce and subalpine fir.

Thinning reduces inter-tree competition, increasing availability of light and moisture to remaining trees. This would maintain or improve the vigor and growth of the leave trees, now and into the future. It would promote the development of larger and healthier trees that are more resistant to the effects of insects, disease, fire, windthrow, and other factors that may damage or kill. These effects would also influence the current and future value of these stands for other social and natural resource values, such as wildlife habitat, development of large trees for aesthetic or wildlife use, and production of wood products (see analysis under respective resource sections in this document). These effects would be most pronounced in Group 4 and 5 units, where young trees dominate (<50 years old) and thus are most capable of responding to improved growing conditions. The most dramatic improvement in potential tree vigor and growth, crown condition, overall health, and ultimately tree size is expected in Group 5 units, where current tree density is highest. This improvement may require several years to be realized, however, due to the already severely suppressed condition and poor crowns of many of the trees and the time it would take them to expand their crowns and respond to the increased light and growing conditions. Planting of Douglas-fir and larch, along with natural regeneration of lodgepole pine, would occur within some of these Group 5 treatment areas. This would more quickly establish a new, vigorous age class of trees on these sites and diversify both the present and future stand structure and species composition.

For stands in Group 2, the 70-90 year old mixed species forests with larch or Douglas-fir, the improved growing conditions created by thinning also have the potential to result in substantial increase in size of individual trees over time. This is because the larch and Douglas-fir are still immature, and have fuller, larger crowns and greater capacity to respond to the improved conditions, as compared to lodgepole pine.

<u>Patch Seedtree Harvests (Group 1).</u> Openings would be created within the dense, mature lodgepole pine stands, leaving 20 or more trees per acre within the openings to provide some diversity in forest structure and future downed wood. Openings would be fairly small and irregularly shaped, typically less than 6 acres in size and no more than about 150 feet to the untreated edge of the opening. Up to 80% of the unit area may be converted to openings, with the rest remaining untreated. This proportion, size and pattern of openings would maintain some wildlife cover values and be less abrupt of a change in appearance while still effectively reducing fuels and potential fire intensity, and providing for the establishment of a new, more diverse and vigorous stand. Openings are necessary to allow the establishment, growth and development of more desirable tree species, specifically larch, Douglas-fir, and on some sites, western white pine or ponderosa pine. These species need full or nearly full sunlight to grow well and would be planted, due to the lack of sufficient natural seed source. This treatment would dramatically improve the species diversity, growth, vigor and potential size class of the future stand, and

promote conditions more resilient to factors such as disease, insects, windthrow and fire.

Understory Vegetation and Snags/Downed Wood in both Thinning and Patch Seedtree Treatments. Abundance and diversity of understory vegetation would increase in all thinned areas (Groups 2, 3, 4 and 5) and in the openings created in the Group 1 units, due to the increased light reaching the forest floor. Currently, understory vegetation is very sparse in some of the more dense stands, particularly those in Groups 1 and 5. The increase in vegetation would have effects on other resources, particularly the value of the area for wildlife habitat (see analysis under wildlife section of this document).

Some of the treatment areas contain hardwood trees or tall shrubs, such as birch, cottonwood and maple. These hardwood and shrub species are not targeted for removal because they are not considered a significant fire hazard in this region, due mainly to the high moisture content and low flamability of their foliage. They would be left, except perhaps in such cases where hardwood trees impede the implementation of the treatments, or where they are seriously competing against the other coniferous leave trees. Their retention would improve the wildlife habitat value of the treated area, as well as providing a more diverse and pleasing appearance.

Thinning and patch seedtree treatments include the removal of concentrations of existing downed wood, as well as slash created by the treatments. Piling and burning, or chipping/mulching would be used to accomplish removal. Overall, downed surface fuel loadings would be reduced (on average) to less than or equal to 12 tons per acre to meet fuel reduction objectives. Emphasis would be placed on leaving the larger (>12” diameter) wood where available, which provides for longer term soil productivity needs and is beneficial for many wildlife species. In the thinning treatments, a substantial number of standing live trees would be left to provide for future snags and downed wood. In addition, this future dead woody material is likely to be larger in size than what would have existed had the stands not been thinned, due to the increased growth and size expected on the leave trees. In the patch seedtree openings (Group 1 units), retention of 20+ overstory trees per acre also provides for the needs of future downed woody material. All large diameter live or dead larch and Douglas-fir trees (i.e. >=18” DBH) would be left within all treatment areas to preserve what remnant trees and snags exist on the site and to provide this important wildlife habitat component. A few of these larger snags may need to be felled during implementation of the treatment if, for example, they occur within a landing area. However, this would be minimized to the greatest extent possible.

Prescribed Burns (Unit Group 6). It is not as easy to predict the stand conditions that would result from the prescribed burning activities, because fire is a less precise tool than mechanized treatment. The low to moderate intensity burn that is prescribed is expected to cause mortality mostly in the smaller size classes of trees (<14” dbh), and in the species most susceptible to fire, particularly lodgepole pine, spruce and subalpine fir. Fire would not necessarily be applied to every acre within the burn unit boundary. Stand conditions targeted for applying fire are the more open areas within the unit, in order to reduce conifer encroachment and maintain/enlarge the shrub dominated areas. Some of the more densely forested portions of the burn units may also experience some fire, which would create new openings. It is estimated that between 30-60% of the burn unit area would be in an open or semi-open forest condition after implementation.

The burning would result in reduced stand densities due to mortality of individuals and patches of trees, though the density is likely to be quite irregular across the stand. Openings of various sizes would occur across the unit, interspersed with semi-open and dense patches of forest. As a result of the overall decreased tree density, increased vigor and growth is expected on the remaining live trees in the unit, particularly those in the younger age classes (<100 years old). Regeneration of a new age class of trees is expected in the areas that burn more intensively, with Douglas-fir and lodgepole pine most common, and larch in the more moist areas. Whitebark pine would have an opportunity to regenerate in the burned openings created in the higher elevations, generally above 6000 feet. There are an estimated 100-150 acres at these higher elevations that may benefit from whitebark pine regeneration within Units 1, 2 and 8.

The burn treatments would scorch or consume above ground plant parts of the understory vegetation; however few if any plants would be permanently removed from the site. This includes plants within riparian or wetland areas. Fire is the dominant disturbance factor in this ecosystem, and all plants have adaptations of one kind or another to survive, and in many cases thrive, under the influence of fire. These adaptations include sprouting from below ground plant parts and new germination from seeds that have lain dormant in the soil for many years. In the years immediately after the burn, a flush of shrub sprouting or new plant species (such as fireweed) are expected to appear in the understory in response to the changed conditions. This abundance of new growth is expected to persist for many years, providing the desired wildlife forage values.

The prescribed burn treatments have the potential to both reduce any existing down and dead woody debris, and increase the amount of new dead woody material through the effects of the burning. These areas of new mortality and increased snag densities would be in variable sized patches spread across a large landscape area, interspersed with large areas of green, forested stands.

Effects to Insect and Disease, Other Mortality Factors

Thinning Treatments (Groups 2, 3, 4, 5). Because of the reduced tree competition and improved tree growth and vigor that is generally achieved and maintained through thinning in younger stands, it is expected that these forests would be less susceptible to various insects and diseases that can weaken or kill individual trees. However, some of the most aggressive organisms, such as mountain pine beetle and armillaria root disease, may still be able to overcome the healthy tree's natural defenses.

Windthrow may increase within thinned stands in Group 2, especially of the more shallow rooted, species such as lodgepole pine and spruce. Trees that have developed and grown in conditions of high stand density tend to be less windfirm than those that grew in more open conditions. When the stand is opened up, the support and wind shielding provided by adjacent trees is reduced and trees are more susceptible to windthrow. This effect is most pronounced in stands that are of high density prior to thinning and where lodgepole pine is dominant. Because heavy winds with resulting evidence of multiple downed trees have not been observed to be

widespread in the area, it is expected that windthrow would not be excessive within any of the Group 2 units.

Patch Seedtree Harvests (Group 1). The removal of stagnated lodgepole pine currently experiencing high mortality due to inter-tree competition, and the establishment of a new, young and vigorous stand through planting, would improve the overall health and insect/disease condition of the treated stands.

Because there would still be portions of these stands remaining untreated, windthrow is likely to increase along the edges of the openings where dense, small diameter lodgepole exists, and in the residual trees that are left within the openings. Since lodgepole pine is a relatively shallow rooted species, and due to the long history of crowded forest conditions in these stands, trees have become accustomed to a high degree of support and shielding from their neighbors. Consequently, the increased exposure to wind that would occur along the opening edges would increase their vulnerability to windthrow. Exactly how severe this may be is dependent upon location, orientation, exposure of stands to prevailing winds, and the localized weather conditions, much of which is unpredictable or unknown.

Prescribed Burns (Unit Group 6). The application of a low to moderate intensity burn would cause direct mortality primarily in smaller trees (<14" dbh), younger age classes, and in species most susceptible to fire (lodgepole pine, spruce and subalpine fir). Many of the larger and older Douglas-fir and larch trees would survive, though they may experience some fire injury. Larch is fairly resistant to most insects and disease, so fire damage is not expected to cause an increase in mortality due to these secondary factors; in addition, larch is scarce within the proposed burn units. Douglas-fir damaged by fire is far more vulnerable to successful attack by Douglas-fir beetle and/or root disease due to its weakened condition. It is expected that mortality due to these factors would increase to some degree within Burn Units 4, 5 and 6 in the years following implementation, with an associated localized increase in Douglas-fir beetle population. The other burn units probably do not contain enough of the older, larger Douglas-fir to provide any noticable increase in breeding habitat and beetle populations following the burn. Though favorable feeding and breeding habitat would be provided to Douglas-fir beetle by burning in Units 4, 5 and 6, these are not large areas (total of about 250 acres) and only an estimated 80-150 acres would actually be targeted to burn. Therefore, beetle population buildup, if it occurs, would not be very large. Potential spread outside the burn areas may occur, but is not expected to be very appreciable.

Direct and Indirect Effects by Alternative

Effects to Forest Conditions

The following table shows the number of acres within each Unit Group to be treated under each action alternative. Refer to Table 3-5, or the description in the "Introduction" section of this vegetation analysis, for forest characteristics of each Unit Group.

Table 3-9. Acres Treated by Unit Group by Alternative

Alternative	Group 1 (Patch Seedtree in Lodge-pole)	Group 2 (Thin 70 to 90 Yr Old Forest)	Group 3 (Thin Under-story Trees)	Group 4 (Thin Saplings)	Group 5 (Thin Saplings -Red Bench)	Total Acres (Mechan-ized)	Group 6 (Prescribed Burns)
2	274	734	128	574	368	**2078**	650
3	224	259	44	354	46	**927**	560
4	323	1305	128	897	930	**3583**	700

There are a total of about 5140 acres of lodgepole dominated 70-90 year old stands on National Forest lands within the Red Whale Project area (refer to Map 17, Silvicultural Diagnosis Report, section F of the project file). About 2600 acres of this lodgepole pine lies in the gently sloped lands of the North Fork Flathead River valley bottom, below about 4600 foot elevation, in the region where all the mechanized treatment units are proposed. The lodgepole pine in all these stands are mature and declining in growth and vigor, and susceptible to losses to mountain pine beetle. Treatment and eventual replacement with other species is desirable to meet objectives related to long term fuel reduction and stable stand condition. Units in Group 1 and 2 contain the most acres of these lodgepole stands, but there are also small areas of lodgepole stand type within Group 3 units and in the older harvested areas within Group 4.

There is a total of about 3200 acres of very high density saplings (>5000 trees per acre) on National Forest lands within the Red Bench Fire area (Group 5 units) (refer to Map 16, Silvicultural Diagnosis Report, section F of the project file). These acres are of poorest condition currently and would experience substantial improvement with treatment, as discussed in the section above.

Alternative 2. Alternative 2 would mechanically treat about 574 acres of 70-90 year old lodgepole pine dominated stands. This equates to about 22% of this lodgepole pine type on National Forest lands in the valley bottom area. About half of these lodgepole stands treated (274 acres) are within the stands of highest density and poor condition (Group 1). These stands would undergo the greatest change and show the greatest improvement in stand condition with treatment.

Alternative 2 would treat 368 acres of high density Red Bench sapling stands, or about 12% of the total acres in this density class. This would provide some improvement in the condition of the sapling stands within this area, but at a moderately low level. An additional 574 acres of sapling stands from past harvesting would be treated under this alternative as well. These are stands of a young age and therefore capable of substantial long term improvement in conditions with the reduction of competition that would be achieved through the thinning.

Alternative 3. Alternative 3 treats the least amount of acres within all unit groups, providing some benefits that are associated with the thinning and planting treatments, but at fairly low levels.

There would be 332 acres of 70-90 year old lodgepole pine dominated stands mechanically treated in Alternative 3. This equates to about 12% of this lodgepole pine type on National Forest lands in the valley bottom area. Nearly 70% (224 acres) are within Group 1 stands, the stands of highest density and poorest condition.

Very few acres (only 46 acres) of the high density Group 1 Red Bench sapling stands would be treated under this alternative. There would be little change or improvement of the dense sapling stand conditions in this area, with the resulting short and long term effects similar to Alternative 1, the No Action alternative. About 354 acres of past harvested sapling stands would be treated under Alternative 3, which would substantially improve growth in these stands.

Alternative 4. Alternative 4 would treat the greatest acreage of forest within all Unit Groups. This alternative would therefore result in the greatest changes to vegetation and highest benefits related to stand conditions described earlier in this effects section. The most improvement would be realized in tree growth and potential size class of individual trees, stand vigor, species composition and long term resilience to insects and disease.

Alternative 4 would mechanically treat about 876 acres of 70-90 year old lodgepole pine dominated stands. This equates to about 34% of this lodgepole pine type on National Forest lands in the valley bottom area. About a third of these lodgepole stands treated (323 acres) are within the stands of highest density and poorest condition (Group 1).

About 930 acres of high density Red Bench sapling stands, or almost 30% of the total acres in this density class would be treated under this alternative. This is substantially greater than the other alternatives and would result in significant improvement in both short and long term stand conditions within this area, while retaining areas of dense sapling cover to provide wildlife cover values and lynx foraging habitat. An additional 897 acres of sapling stands from past harvesting would be treated under this alternative as well; areas of less dense forest that would also experience considerable short and long term improvement of stand growth due to thinning.

Effects to Insect and Disease, Other Mortality Factors

The primary effect of the action alternatives associated with mortality factors are connected with the prescribed burns and potential impacts on Douglas-fir beetle. There are no serious insect or disease consequences of the mechanized treatments, except to improve tree vigor such that remaining trees are more resistant to insect or disease effects. The alternatives with the greatest acres treated would provide the greatest benefits in this regard.

Alternatives 2 and 4. Both of these alternatives include the prescribed burn Units 4, 5 and 6 (total of 250 acres), which are the units with the highest hazard of Douglas-fir beetle. Upon burning, it is likely that some of the beetle susceptible larger Douglas-fir trees would be injured or killed, which would create favorable beetle breeding habitat. Some increase in beetle population may occur, with subsequent increase in tree mortality. However, a relatively small area is targeted for burning, and substantial increases in beetle mortality would not be expected. Refer to discussion earlier in this section on effects to insect and disease.

Alternative 3. This alternative does not include prescribed burn Units 4 or 5. These units are high hazard to Douglas-fir beetle, so with the dropping of these units there would be less potential for beetle population buildup and increased mortality after burning. Unit 6 also has a moderate to high hazard, but this unit is only about 78 acres and only part of it would actually experience fire. Burning this small acreage is not likely to cause any notable change in the current Douglas-fir beetle population levels.

Effects to Late Successional/Old Growth Forest

Alternatives 2 and 4. A small area (approximately 15 acres) on the west end of Unit J is the only area that is likely to be old growth forest that would be treated with mechanized treatment (i.e. thinning or patch seedtree). This area would be thinned under both Alternatives 2 and 4, which would remove most understory trees as well as a few of the overstory trees. Though all of the larger overstory trees would be left on the site (i.e. >18" dbh), as would much of the larger diameter downed wood, the treatment would alter the stand sufficiently so it would no longer meet old growth definitions. It would still qualify as a late successional stand and retain some of the characteristics of old growth, namely many large, old overstory trees. However, the multi-canopy conditions would no longer exist, and snags/downed wood components would be reduced. Existing old growth forest would be reduced across the project area by 15 acres under Alternatives 2 and 4.

Thinning treatments are proposed for a total of about 128 acres of late successional forest under Alternatives 2 and 4. This includes acres within Units A (5 acres), H (19 acres), I (87 acres) and EE (17 acres). Treatments are a light understory thin, leaving nearly all the larger, old, live overstory trees and removing most mid and understory trees, particularly those that extend into the crowns of the overstory. Though these stands would still be considered in a late successional condition, with many large, old overstory trees, some of the elements characteristic of older forest would be reduced or eliminated. Specifically, stands would be maintained in a single story rather than a multi-story condition. Dead standing and downed woody material would be minimized, though large diameter downed logs and snags would be retained. With the maintenance of this condition into the future, there would be little potential for the stand to develop fully into an old growth forest condition characteristic as defined earlier.

Old growth or late successional forest is likely to exist within the proposed prescribed burn Units 4 and 5 (total of 171 acres). Low to moderate intensity burns are proposed, with mortality mostly in the smaller diameter understory and midstory tree component. The larger diameter, old overstory Douglas-fir (the primary species on these sites) may be scorched by the burns, but most are expected to survive. However, resulting vegetation condition after prescribed fire treatments is less predictable or certain than with mechanized treatments. It is likely that some of the older overstory trees would be killed by the burn, either directly due to the heat of the fire or indirectly due to delayed mortality factors (i.e. increased tree stress from fire damage leading to greater susceptibility to insect or diseases). This would alter the character of the late successional/old growth forest, though it would probably still retain, or have the potential to develop, many of the qualities associated with those stand structures; specifically large diameter overstory trees both dead and alive, multi-canopy forest conditions, and large diameter dead/downed wood.

Alternative 3. In this alternative the 15 acres of likely old growth within Unit J and the prescribed burn Units 4 and 5, which are also likely to contain old growth, have been dropped. Thus no old growth forest would be mechanically treated or prescribed burned under this alternative, and there would be no direct or indirect effect on old growth forest.

About 31 acres of late successional forest is proposed for light understory thinning under Alternative 3 (6 acres in Unit H, 8 acres in Unit I and 17 acres in Unit EE). Though most or all of the large, old overstory trees would be left in these treatments, understory canopy layers would be largely removed, as would most of the small to mid sized downed wood and snag components. The stands would still be considered to be in a late successional stage of development, but there would be little potential for development into an old growth condition, as defined ealier in this section.

Cumulative Effects of Alternatives 2, 3 and 4

Forest Conditions

Our overall desired condition over time is to maintain or create forest conditions within the Red Whale Project area that might occur under natural disturbance and succession regimes. By managing within this range of historical variability we can be better assured that the ecosystem remains healthier and more sustainable, and thus more resilient in the face of inevitable change, providing greater flexibility and management choices in the future. All alternatives (including the no action alternative) maintain or create conditions that are within the range of historical variability. Individual stand treatments are designed to create a condition that does not conflict with these ecosystem objectives. Natural succession would continue within all treated areas, causing gradual but predictable changes in forest stucture, size and age classes over time. The intention within the treatment units is to maintain a forest condition over time that would meet the objective of reducing potential fire intensity in the future. This means that periodic treatments would need to be applied to the units in the future to maintain the more open stand conditions and prevent a densely stocked understory from developing. Analysis and decisions to implement any future treatment beyond what is proposed in this Red Whale Project would occur at that future time.

Not all portions of the project area would be managed in a condition that maintains lower fuel loadings and more open forest canopy. Many stands would remain untreated, including riparian areas, old growth forest, stands providing important wildlife cover, stands with poor access, etc. In these areas, a variety of forest conditions could occur, with heavier down wood amounts, greater numbers of snags, and more multi-canopy forest conditions. This would provide the desired diversity of forest conditions, downed wood and snags across the landscape as a whole, adequately providing for small mammal and other wildlife habitat needs and long term soil productivity, while meeting project objectives of reducing risk of high intensity fire.

Timber Management

All action alternatives propose changes to the current road conditions and travel management

within the project area. Alternative descriptions in Chapter 2 of this Environmental Assessment describe and display the proposed changes by alternative. These changes include berming of roads that are currently gated, yearlong closures of roads that are currently open or seasonally closed, removal of culverts, and increasing the proportion of lands within Grizzly Bear Security Core (which limits all management activities to the denning season, i.e. winter). These changes would substantially impact future forest management, impacting such activities as thinning (both in young sapling and older stands), salvage of diseased, dead or windthrown trees, regeneration harvesting to establish a new stand of young trees, etc. With restrictions in road access, options for management would be greatly reduced, methods of treatment are limited, and treatments could become economically or technically infeasible. In addition, experience has shown that the complexities and difficulties of planning and implementing projects that propose use of closed or temporary road access is very high, leading to greatly increased costs of the project at all stages of development.

Though all action alternatives decrease access options and feasibility of future forest management due to changes in road conditions, Alternative 3 causes the greatest effects with the yearlong closure of about 20 miles of road that is currently open seasonally or yearlong. Grizzly bear security core increases by about 11,000 acres over the current approximately 40,000 acres in core across all three of the affected grizzly bear subunits. Alternative 2 proposes yearlong closure by berm of an additional 7.4 miles of road over current conditions – road that is currently closed yearlong with a gate. Security core is increased by about 6000 acres in this alternative. Alternative 4 proposes yearlong closure by berm of about 11.4 miles of road over existing situation, some of which is currently closed yearlong with a gate, and some of which is currently open yearlong. Security core is increased by about 5300 acres with this alternative.

Most units would be accessed for treatment using existing county or National Forest System (NFS) roads. Some of the NFS roads that would be used are currently closed yearlong to motorized use to provide grizzly bear and other wildlife security. Some units would also require construction of short temporary roads. If temporary roads or closed NFS roads are used to access units, mitigation for the temporary loss of grizzly bear security would occur. This mitigation may include treating the unit only during the bear denning period (i.e. the winter) or temporarily closing other open roads in the project area while the temporary road or closed road is being used. These mitigation measures are described under the alternative descriptions. These measures increase project complexity, reduce management flexibility and increase restrictions at the implementation stage. All this increases costs of planning and implementing the project.

Some specific previous road management decisions that have directly impacted options and costs for treatments of some of the units in the Red Whale proposed action are summarized below.

<u>Unit J (included in all action alternatives).</u> This unit is mostly in Grizzly bear security core, which precludes any treatment during the non-denning season (April to Dec). This would be difficult, as this is a thinning in a sapling stand, followed by slash removal (i.e. chipping or piling). Both activities are difficult, if not infeasible, under winter snow conditions.

<u>Units 4B and 4E (included only in Alternative 4).</u> All or portions of these units are in Grizzly bear security core, limiting any activity to the winter time. Removal of trees can be done in the

winter without difficulty, but treatment of the slash (chipping or piling) may be infeasible under winter snow conditions.

Unit F. This unit is not in security core habitat, but the access via national forest land (temporary road on an old road template) is through core habitat. This temp road can only be used during denning season, thus limiting any treatment in Unit F to the winter only. There is a possibility in this unit for access through private land, but this access cannot be guaranteed.

Regulatory Framework and Consistency

The National Forest Management Act of 1976 (NFMA) has provisions that pertain to vegetation management on National Forest lands. These requirements relate to the consideration and protection of other resources, such as soil, water and wildlife, when conducting vegetation management; to the appropriateness of even-aged management and the adequate restocking of the site after such harvest; and to the proper consideration of the economic aspects of the Red Whale Project. They are described in the Forest Service Manual at 1921.12. The proposed project activities have been determined to fully comply with these requirements. Full evaluation and documentation of this compliance can be found in the project file, section F.

Forest Plan goals include maintaining a diversity of vegetation and habitats across the forest to meet the needs of a variety of wildlife species, and to provide for a sustained yield of timber products (Forest Plan, p. II-5). Amendment 21 to the Forest Plan has updated and modified some of the goals, objectives, standards and guidelines regarding vegetation management on the Flathead National Forest, particularly regarding old growth. The Forest Plan further defines timber management goals of providing a sustained yield of timber products that is cost effective, responsive to the needs of the local economy and is consistent with other Forest management goals (Forest Plan, p. II-5). These goals are discussed in Forest-wide timber management objectives described on pages II-7 to II-9 of the Forest Plan.

All alternatives meet these goals, objectives and standards of the Forest Plan for the Management Areas affected. Refer to section F of the project file for full documentation of compliance.