3.9 VEGETATION (FORESTED)

Affected Environment

Area of Influence

The physical area of influence for this resource is the Big Creek watershed as shown in Appendix A, Maps 2 and 3. The primary focus is forested vegetation and it is considered from a past, present and reasonably foreseeable perspective. Much of this area burned in the late 1800's. This will essentially be the starting point for this analyses, though older stands do exist in the area, most of the stands analyzed for treatment are initiated from this era. While possible to model and predict vegetative structure on both the stand and landscape levels for extensive time periods, the possibility of stochastic events and or changes in management direction make consideration for an extended period difficult. This analysis considers a period of 120 years, which is approximately the same as the past time period and can be modeled with some confidence, though unpredicted events are still possible.

Issues Addressed

PFC, or lack thereof as referenced in the Revised Forest Plan (USDA Forest Service 2003, 4-40).
Indicator: Acres moved towards early seral in each forested vegetation type.

Timber supply to local industry.
Indicator: Total Hundred Cubic Feet (CCF) output.

Effects Analysis Methods and Assumptions

The literature cited in this analysis represents the best available science in relation to the proposed action. It is a result of searches conducted through professional contacts, internet search engines, and through the Rocky Mountain Research Station (RMRS) publications site: (http://www.fs.fed.us/rm/publications/titles.shtml), which lists all RMRS publications from 1963 to current.

Data used in this analysis are from several sources. During 2006, the forest fuels inventory crew collected field data. The crew collected information regarding 58, one-tenth acre plots distributed around the watershed. Data is stored in the FIREMON database. More detail on this data is included in Section 3.3, Fire. Stand exam data has been collected periodically in this area and is used also in this analysis. This data is stored in the FSVEG corporate database. Also used is the annual Aerial Detection Survey done by the Rocky Mountain Forest and Range Experiment Center in order to assess insect and disease activity throughout the region.

Vegetation typing, seral stage determination, Vegetation Structural Stage (VSS) and acreage calculations are primarily taken from the work done for the Big Creek Watershed Assessment (USDA Forest Service 2006d). These were further verified during the 2006 field season and some updates were made.

Vegetation modeling is done using the 'Forest Vegetation Simulator' (FVS) model and its extensions. Both fuels inventory and stand exam data are used as a basis for the simulations.

Properly Functioning Condition and assessments are a concept first described by Pritchard et al. (1993) in order to assess riparian conditions. Kaufmann and others further expanded this to upland vegetation in terms of long-term sustainability and biodiversity. Their "guiding premise for sustaining ecosystems and protecting biodiversity now and into the future is to manage ecosystems such that structure, composition, and function of all elements, including their frequency, distribution and natural extinction are conserved" (Kaufmann 1994). The suggested distribution of structural stages is based on the need to have a range of age classes sufficient for recruitment into and replacement of the older classes. Reynolds et al. (1992) developed a sustainable range of structural stages for several major forested vegetation types based on seedling establishment requirements, growth rates, pathological rotation ages, as well as site and climatic factors that Kaufmann used. This then is

also the basis for the PFC assessments, the Revised Forest Plan and hence this proposal's target range for structural stages.

For this analysis the information is based on a conversion of VSS classes to PFC (Properly Functioning Condition) age classes. The reason for this crosswalk is that the landscape assessment, which forms the base for this assessment classifies vegetation in terms of VSS (which has six classes). The Revised Forest Plan, on which the EIS purpose and need are based, sets objectives in terms of PFC (which only uses five classes). The conversion is based on stand exam data and that the diameter ranges that describe the VSS classes are larger than those actually achieved on these sites in the similar age class. In other words, an 8 inch lodgepole pine, which based on diameter would be in a VSS class 3, is in growing conditions on the Wasatch-Cache National Forest a mid aged tree. Sagebrush distribution is based on Fire Regime Condition Class (FRCC) classes from the landscape assessment. Table 3.9.1 shows how these are changed. Table 3.9.2 is the result of the crosswalk and shows the PFC distribution for the landscape based on this conversion.

Table 3.9.1. VSS to PFC conversion.

VSS Class	PFC (Age) Class
1 - Grass/Forb	Grass/Forb & Seed/Sap
2 - Seed/Sap	Young
3 - Young	Mid
4 - Mid aged	Mature
5 - Mature	Old
6 - Old	Old

Existing Conditions

Based on the Big Creek Watershed Assessment there are several major forested vegetation groups within the watershed, all of which are weighted heavily towards the older age classes (USDA Forest Service 2006d). Approximately 50% of the project area (Forest Service portion) is in a forested cover type. The following is a brief discussion / evaluation of these groups. While attempts are made to put dynamic attributes such as vegetative composition and function into discreet classifications or analysis, in reality there is a continuum of stand conditions that range across the landscape in an ever changing balance.

Aspen and Aspen/Conifer Mix

This complex includes conditions ranging from pure aspen to a mix of conifer and aspen with very little aspen remaining in the overstory. Both stable and seral aspen are found within the area; however the majority is in some stage of converting to conifer. There is relatively little pure aspen in the area proposed for treatment.

Seral aspen describes aspen communities that in the absence of disturbance will be replaced by conifers over time. Seral aspen stands tend to occupy higher quality sites. Powell (1988) suggested aspen stands, which can support 20 to 30 conifers per acre within 100 years of aspen's site occupancy, should be considered seral and those with fewer conifers or those that take longer than 100 years for this level of conifer establishment should be managed as stable aspen types. Aspen communities are distributed throughout the watershed area at all elevations. It is estimated in the watershed assessment that more than 80% of the seral aspen in the watershed is in the mature and old age condition with many becoming decadent. Stable aspen stands occur at lower elevations and on drier sites. Their response to fire is similar to seral aspen stands. The risk of loss of these stands is low, but the lack of fire or other disturbance has made the stands mostly mature to old age classes. Without disturbance they may be more susceptible to disease and eventual stand loss.

During the late 1990's surveys were made of aspen stands on the Ogden Ranger District (USDA 2001), which includes the Big Creek Watershed and mapped for future management opportunities. O'Brien and Pope (USDA 1997) estimated that across the Wasatch-Cache National Forest only 34% of the historical aspen acreage still remains dominated by aspen, the remainder having been lost to conifer replacement. This condition is assumed to be true for this area as well because both plot data and field observations show remnant aspen, and / or old aspen stems on the ground within many of the conifer dominated stands indicating

the presence or dominance of aspen in the recent past. Aspen has been recognized for many years as being very intolerant of shade (Jones and Debyle 1985) and thus is lost once conifer gains dominance and shade.

Aspen is a fire adapted species that suckers profusely after fire or other disturbance (Debyle and Winokur 1985). Stands that succeed from aspen to aspen/conifer and later to conifer/aspen will eventually lose the aspen component and become less likely to return to early seral aspen with stand treatments be they prescribed fire or mechanical treatments. Campbell and Bartos (2000) suggest that a minimum of 20 mature live stems per acre need to be remaining in the stand in order to assure regeneration to aspen. Historically, fires began in mountain brush environments and burned up into the aspen stands where more moisture and cooler temperature under aspen canopies would stop the fire's advancement. During those times of drier, warmer, and cured fuel conditions, top kill of aspen was more likely followed by profuse suckering. These fires occurred frequently enough to remove the seed source for conifer species' encroachment.

Historical livestock grazing has contributed to changes in species composition and dominance, including an obvious increase in western coneflower. The historical fire regime in northern Utah aspen stands was stand-replacing events every 70 to 200 years. Aspen is also demonstrating an increase in mortality, primarily as a result of stand aging.

Diseases in aspen stands are common. Most of these do not cause immediate mortality, but reduce the growth and vigor of infected trees – especially in older stands. Diseases and lack of fire induced regeneration result in decadent stands at risk of loss.

Figure 3.9.1 shows an aspen stand proposed for treatment in the advanced stages of conifer encroachment.

Figure 3.9.1. Conifer replacing aspen.

Lodgepole Pine

Within much of the analysis area, lodgepole pine can be considered long-persistent. While under a long-term successional process (and in the absence of disturbance), these stands usually convert to more shade tolerant fir species, lodgepole pine remains dominant because of the interplay of fire history, site, and climatic factors that have kept the later seral spruce and fir from dominating these sites. Composition, structure, and fire history studies indicate that these stand types naturally included stand replacing disturbances at intervals of 100 to 200 years followed by rapid regeneration of trees. Evidence of historic fire is common across the lodgepole pine type indicating widespread stand replacing events in the late 1800's.

Subalpine fir, which is shade tolerant, develops in the understory of the lodgepole pine over time and can eventually replace the shade intolerant pine as it dies out of the overstory and is unable to regenerate due to the shade now provided by the subalpine fir. Figure 3.9.2 shows a typical lodgepole stand with fir in the understory.

Figure 3.9.2. Lodgepole pine stand with subalpine fir.

Pure lodgepole pine stands are limited in their distribution on the landscape. Many stands have developed an understory of subalpine fir, and occasionally spruce regeneration. Most of the stands are located on north facing slopes with sage/grass or aspen communities on the opposite south facing slope. They are

also found only on the central and northern portion of the watershed area. These stands are in the older and mature age classes.

Where more recent fires have occurred, or there has been timber harvest, lodgepole pine is generally found as even-aged, single-storied stands, usually without an understory of subalpine fir since the younger stands have not yet developed this later seral condition. Figure 3.9.3 is of a typical young even-aged stand in the Otter Creek area that was harvested in 1983.

Figure 3.9.3. Young even aged lodgepole pine stand.

Lodgepole pine is a pioneer species which regenerates prolifically after stand-replacing fires (or harvest). As stands age, become denser and begin reaching a diameter threshold they become susceptible to mountain pine beetles (MPB). In larger, continuous stands, beetle outbreaks can result in high levels of mortality. The susceptibility to this level of mortality increases with stand conditions that include stand average diameter greater than 8 inches, and stand age greater than 80 years. Elevation and latitude are also important as indicators of climatic conditions favorable to brood development (Amman et al. 1977). Much of the lodgepole pine in this analysis area meets these criteria due to the lack of disturbance since the late 1800's. These stands fall within the high risk range for elevation and latitude.

The 2006 Aerial Detection Survey shows a rapid increase in MPB populations over 2005 levels, particularly in the New Canyon and Otter Creek areas, where no active pockets were mapped in 2005 (USDA Forest Service 2006a; Meyerson 2006 Email). In this northern portion of the watershed the

lodgepole pine is more prevalent and contiguous stands cover more of the landscape. With the building presence of MPB and the high stand densities there is potential for a large scale outbreak in this area.

Dwarf-mistletoe, a major pathogen in lodgepole pine stands causing growth loss and increasing susceptibility to other diseases, is found in some of these stands. Because the lodgepole pine in this community type occurs primarily as even-aged stands, the spread of the disease is mainly lateral. Lateral spread is slow due to the trajectory of the mistletoe seeds, whereas the spread to an understory of lodgepole pine can be more rapid.

Engelmann Spruce – Subalpine Fir

Spruce/fir communities occur as smaller group stands rather than large continuous forest. It most often occurs as a mixed species forest, with aspen as an important seral species on many sites. Lodgepole pine and occasionally a few Douglas-fir are often associated with this type in mixed mid to late seral stands. The majority of the type is mature to old. Stands are generally uneven-aged and/multistoried, with much of the regeneration as subalpine fir.

Subalpine fir will commonly dominate spruce/fir stands in this watershed. This is due to a dynamic cycle between spruce and subalpine fir dominance depending on stand conditions and insect activities. Subalpine fir will often dominate during the first phase of development and then decline with age, insect and disease activity, and decadence. During the successional period in the absence of fire, Engelmann spruce will assume dominance because of its longevity. As the stand continues to age, overstory mortality usually caused by spruce beetle mortality will result in the release of understory regeneration usually dominated by subalpine fir. At this stage, with heavy fuels buildup and ladder fuel development, stand replacing fires can occur. Every 250 to 300 years conditions were ideal for spruce beetle epidemics. Epidemics kill much of the overstory, which would have been dominated by spruce. Lightning strikes that create small pockets of mortality contribute to uneven-aged conditions, and less frequent (300 to 400 year intervals) stand replacing fires set the situation back to earlier seral stages. After long periods of fire suppression, catastrophic fire can occur resulting in long periods in the grass/forb seral stage. Fire suppression has resulted in denser spruce/fir forests with higher accumulations of large woody debris and ladder fuels creating conditions conducive to large more intense fires outside the historical range.

The historical fire regime was a mixed one, consisting of lightning strikes that created small pockets of mortality that contributed to the uneven-aged conditions, and less frequent stand replacing fires. Fire history is probably within the historical range for large stand-replacing fires, but has removed the effect of small, frequent lightning strikes.

Most stands are in a multi-canopy, structural condition. Subalpine fir is experiencing mortality from a combination of insects, disease and old age. The majority of the stands are mature.

Spruce/fir stands, which normally have a much longer interval between stand replacement, are often mixed with aspen in this area. Aspen would dominate for a period following fire, but would be moved into a secondary position as the shade tolerant spruce and fir develop once again in the understory.

Mixed Conifer

This cover type is abundant on the landscape, occupying 13% of the total acres, and contains a variable mix of subalpine fir, Engelmann spruce, lodgepole pine and occasional Douglas-fir. Limber pine is found in the combination at higher elevations and usually on rocky sites. Aspen is commonly an associated species whose presence is diminishing as the stands age. Spruce and fir amounts will vary from stand to stand while lodgepole pine is mostly always present. Typically these stands are multistoried and uneven-aged. Following fire, lodgepole pine and/or aspen typically replace these communities.

The mixed conifer type generally represents stands that are in a mid-seral successional stage, containing both seral species (aspen and lodgepole pine) and climax species (spruce and fir). Uninterrupted by disturbance, these stands would succeed to the more tolerant climax species.

Interior Douglas-fir

Douglas-fir stands are usually small and widely scattered. They occur primarily on north and east facing slopes with limestone based soils. White fir that commonly occurs with Douglas-fir in most other locations in Utah does not occur in these stands. Stands on dryer sites are usually open canopied, short and often have forked tops or contorted bole structure. However, stands on better, more mesic sites are tall and of good form. In these cases, stands are dense, closed-canopy and even-aged with high amounts of duff understory. Aspen is a component of many stands. Douglas-fir also occurs in mixed conifer stands in combination with Engelmann spruce, subalpine fir and lodgepole pine. Most of the Douglas-fir in the watershed are mature and older age-class stands. The lack of lethal fires during the past century have allowed for the increase in tolerant species in the understory and overstory, as well as an increase in dead and down and ladder fuels. With continued lack of fire or silvicultural treatment, the stands on better sites will become mixed species and more climax species dominated. The drier sites with more calcareous soils will most likely remain Douglas-fir with limber pine, aspen, and occasionally rocky mountain juniper as common cohorts.

In the stands of Douglas-fir, fire occurrence can result in mortality to thinner barked species and retain the heavier barked Douglas-fir. However, fire can attract Douglas-fir beetles that can result in heavy mortality to Douglas-fir – usually in patches. As a result of fire suppression, lack of density management, and build up of heavy fuels, Douglas-fir stands on better sites are vulnerable to insect damage and stand replacing fire.

As already discussed, and as discussed in Section 3.3, Fire, all of the major forested types in the area are out of balance with respect to properly functioning condition (PFC), primarily in terms of an overabundance of the mature structural classes and under representation by early, mid seral or old classes. Table 3.9.2 shows the current distribution of these classes for the forested types as well as the desired PFC distribution.

Table 3.9.2. Acres of Structural stage distributions of forested types in the Big Creek Watershed.

Cover Type (Acres)	Distribution	Grass/Forb (Acres)	Seed/Sap (Acres)	Young (Acres)	Mid (Acres)	Mature (Acres)	Old (Acres)
Spruce/Fir (1,345)	**Current**	**0**	**0**	**0**	**348**	**872**	**133**
	Desired	*135*	*135*	*271*	*271*	*271*	*271*
Mixed Conifer (1,144)	**Current**	**0**	**0**	**27**	**43**	**1,061**	**13**
	Desired	*114*	*114*	*229*	*229*	*229*	*229*
Lodgepole Pine (2,421)	**Current**	**0**	**0**	**295**	**825**	**1,301**	**0**
	Desired	*242*	*242*	*485*	*484*	*484*	*484*
Douglas-fir (482)	**Current**	**0**	**0**	**0**	**137**	**345**	**0**
	Desired	*49*	*49*	*96*	*96*	*96*	*96*
Aspen - Aspen/Conifer (2,834)	**Current**	**17**		**2,817**			**0**
	Desired	*1,133*		*851*			*850*

Not only are the early age classes deficient, but the old forest as well. This is due primarily to the timber harvesting and wildfires in the late 1800's that initiated many of the stands in this area. However, there is an overabundance of mature forest that will develop into the old age class in a short period of years. Forestwide subgoal for Biodiversity and Viability 3e (USDA Forest Service 2003, 4-19), which requires

that 40% of the total conifer be mature and/or old at the landscape level is exceeded with 60% of this watershed's conifer currently in mature or old classes and 56% following treatment under the more proactive Alternative 1.

Appendix A, Maps 6 and 7 show the current distribution of the species within the watershed as well as the PFC class represented in each.

Sagebrush

Sagebrush is discussed in Section 3.3, Fire.

Environmental Consequences

There are three parts to the purpose and need for this proposal: 1) Properly Functioning Condition – i.e., create early seral; 2) Fire Regimes (see Section 3.3); and 3) Timber Supply. Each of the alternatives would have a differing level of consequence on each of these three parts. Creating early seral is an indicator both for moving towards PFC and for moving the fire regime to a more historical interval in terms of both frequency and severity. Using the established indicators, Table 3.9.3 displays the differences between the alternatives.

Table 3.9.3. Environmental consequences (forested vegetation only).

Alternative	Approximate Early Seral Acres Created	Estimated Timber Supply in CCF
1	1,193	21,300
2	0	0
3	844	13,700

Table 3.9.4 shows the estimated PFC distribution following treatment for each action alternative. While the old class is still deficient there is sufficient mature to develop into the old class over time since the mature class is still over represented.

Table 3.9.4. Approximate post-treatment PFC distribution.

Cover Type (Acres)	Distribution	Grass/ Forb	Seed/ Sap	Young	Mid	Mature	Old
Spruce/Fir (1,354)	**Alt. 1**	**38**	**0**	**0**	**349**	**834**	**133**
	Alt. 2	**0**	**0**	**0**	**348**	**872**	**133**
	Alt. 3	**30**	**0**	**0**	**349**	**842**	**133**
	Desired	*135*	*136*	*271*	*271*	*271*	*271*
Mixed Conifer (1,144)	**Alt. 1**	**66**	**0**	**27**	**43**	**995**	**13**
	Alt. 2	**0**	**0**	**27**	**43**	**1,061**	**13**
	Alt. 3	**26**	**0**	**27**	**43**	**1,035**	**13**
	Desired	*114*	*114*	*229*	*229*	*229*	*229*
Lodgepole Pine (2,421)	**Alt. 1**	**343**	**0**	**295**	**825**	**958**	**0**
	Alt. 2	**0**	**0**	**295**	**825**	**1,301**	**0**
	Alt. 3	**299**	**0**	**295**	**825**	**1,002**	**0**
	Desired	*243*	*243*	*485*	*484*	*484*	*484*
Douglas-fir (482)	**Alt. 1**	**14**	**0**	**0**	**137**	**331**	**0**
	Alt. 2	**0**	**0**	**0**	**137**	**345**	**0**
	Alt. 3	**0**	**0**	**0**	**137**	**345**	**0**
	Desired	*49*	*49*	*96*	*96*	*96*	*96*
Aspen -	**Alt. 1**	**732**		**2,102**			**0**

Aspen/Conifer (2,834)	**Alt. 2**	**17**	**2,817**	**0**
	Alt. 3	**489**	**2,345**	**0**
	Desired	*1,134*	*851*	*850*

Note: Acres created in early seral are put into the grass/forb stage, however it will be a relatively short time before these acres become seedling/sapling. For aspen this should only be one or two years.

Old Forest

The Revised Forest Plan requires that at least 20% of each forest type is maintained, by ecosection in stands with old forest characteristics (USDA Forest Service 2003, 4-39). This is evidenced by having more than 10 trees per acre that are at least 150 years old. Stands with these ages represented typically have other old forest attributes valuable for ecosystem function such as large diameter trees, snags and dead and down woody material.

Prior to the Forest Plan revision, a Properly Functioning Condition (PFC) assessment was completed for the Wasatch-Cache (USDA Forest Service 2003, 3-90) Table 3.9.5 shows the summary by forest type for the Overthrust Mountains Ecosection from that assessment. This ecosection encompasses the Bear River, Wasatch, Wellsville and Stansbury Mountain ranges. This project area is within the Bear River portion of the Ecosection.

Table 3.9.5. Old forest by forest type.

Cover Type	Old	Mature
Douglas-fir	<1%	99%
Lodgepole Pine	<1%	94%
Mixed Conifer	<1%	94%
Spruce/Fir	98%	1%
Conifer/Aspen Mix	*	99%

**Old forest was not estimated for aspen.*

In most of the cover types the 20% minimum in old forest is not currently being met, and was not at the time the plan was revised and the standard established. This is due to the widespread fire and timber harvesting that occurred across the northern portions of the forest in the late 1800's, creating these stands, and the condition where so much of that type is now in mature age classes. The Forest Plan revision team used the Vegetation Dynamics Development Tool (VDDT) to display the changes in structural stage distributions, over time, for each of the alternatives. The modeling showed (USDA Forest Service 2003, 3-123) that under Alternative 7, which was developed into the Revised Forest Plan, 20% of the ecosection acres in old forest would be developed and maintained over time, even though it is currently at lesser acreages. This proposal fits within the treatment projections estimated for the Revised Forest Plan (USDA Forest Service 2003, p. 5-3).

An analysis of the Forest Inventory and Analysis (FIA) data (USDA Forest Service 2006b) was recently completed for the Overthrust Mountains Ecosection to determine the age classes of the forested cover types. This analysis estimated that 22% of the conifer is currently in an old age class. Since all of the treatments, except for 8 acres of mixed conifer, are planned in the mature structural stage as mapped in our GIS, and not the old class, this proposal will not affect this 22% of the ecosection in old forest.

The 2006 FIA analysis was also done for each type in the Overthrust Ecosection to show the proportions in the 120, 130 and 140 year old classes. This shows that there is an overabundance of acres in the mature classes poised to grow into the old forest age class, and supports the VDDT modeling for the Forest Plan Revision that showed the 20% will be met and maintained over time while implementing the treatment acreage prescribed in the Revised Forest Plan. The following Table 3.9.6 shows these proportions. Stands in the 140 year old class will grow into the old class within the next decade.

Table 3.9.6. Proportion of acres in mature age classes.

Cover Type	140 years	130 years	120 years
Conifers	35%	35%	70%

a. Alternative 1 – Proposed Action

1. Direct and Indirect Effects

Under Alternative 1, management would change from the current regime to one of more timber harvest and prescribed fire in order to create early seral vegetation in all vegetation types and move the watershed overall towards PFC as described in the Revised Forest Plan.

Of the approximately 1,811 acres treated, 1,193 would be moved directly to an early seral structural stage.

Timber supply to local industry would be increased through the offering of an estimated 21,300 CCF of timber product volume including post, poles, sawtimber and other products.

Table 3.9.7 shows the treatments in forested types for Alternative 1.

Table 3.9.7. Approximate acres treated in forested vegetation.

Prescription	Alt. 1 Acres
Clearcut	206
Conifer Removal with Patch	27
Conifer Removal followed by Fire	556
Group Selection	256
Groups and Patches	150
Irregular Shelterwood (IRSW)	71
IRSW with Groups / Patches	140
Overstory Removals	130
Shelterwood Prep	32
Thin with Groups	38
Mosaic Prescribed Fire	205
Total Forested Treated	1,811

Aspen/Conifer

The objective of treatments in the aspen/conifer type is to remove the conifer component of the stand and return the stand to both an early seral structural stage as well as a relatively conifer free composition. Treatments are essentially focused on removal of all conifer and aspen stems through timber harvest, other mechanical treatment such as pushing and piling, fire, or various combinations depending on stand size, amount of conifer present, and ability to safely and effectively burn the stand based on fire control, private land issues, or other resource concerns. Due to the growth characteristics of aspen, treatments are designed to be as large as feasible and typically all, or nearly all of the vegetation is removed within the treatment. Large areas of treatment also disperse the browsing by ungulates, and ensure regeneration. Prolific suckering responses to such treatments are expected. (Debyle and Winokur 1985, p. 31).

Approximately 732 acres of aspen/conifer mix would be returned to an early seral stage in this alternative.

Lodgepole Pine

The objectives in the lodgepole pine type are to create stands of early seral lodgepole pine, provide timber products, and also to congeal some of the older clearcuts into sizes and shapes more typical of what

would occur under a natural fire regime where fires were typically of variable size and intensity – not restricted to patches under 40 acres as are the older harvest units. Treatments in this type are typically clearcut patches, which remove essentially all of the vegetation in a patch due to the shade intolerant nature of lodgepole pine, which requires full sunlight to establish regeneration. Natural regeneration (seedlings from existing seed on the ground as opposed to planting nursery grown stock) is expected to be abundant in these as evidenced by the successful regeneration of other similar treatments in this area. Figure 3.9.4 shows a naturally regenerated harvest in Otter Creek typical of those in the analysis area.

Figure 3.9.4. Naturally regenerated harvest in Otter Creek typical of those in the analysis area.

In some cases, primarily due to the presence of active nesting sites for the Northern Goshawk, it is desirable to maintain a mature forested character to the site. In these cases, a partial removal is planned that would initiate a shelterwood sequence to regenerate the stand over time. The first entry thins the stand to establish wind firmness in the residual trees, and begin to select phenotypically superior trees within the stand for future seed trees as well as eliminate inferior trees from the gene pool.

Approximately 343 acres of early seral lodgepole pine would be created in this alternative.

Spruce/Fir

The objective in the spruce/fir type is to create patches of early seral spruce within the overall matrix of existing uneven aged stands by using small group selection. There is currently very little regeneration within this matrix and no early seral spruce/fir. Spruce needs partial sunlight to regenerate and grow, but not too much. Small groups of about ¼ to 1 acre or so will be used to simulate natural openings in the

canopy that would have occurred from either small spot fires or pockets of spruce bark beetle. Approximately 20% of the acreage in a stand will be treated in these groups. This will create early seral spruce pockets within the larger mature forested matrix. Some thinning will also occur in the matrix to remove inferior trees and reduce basal area where it is high enough that susceptibility to spruce beetle is likely.

Approximately 38 acres of early seral spruce/fir would be created in this alternative.

Mixed Conifer

The mixed conifer type includes a variety of tree species on most sites. All of the species found in the analysis area can be found in these stands in varying sizes and proportions. Treatments focus on establishing openings for regeneration. Opening size will vary with the species expected to regenerate in that spot. Smaller groups (¼ to 1 acre) will be used where spruce or Douglas-fir dominate and are the desired regeneration. In areas with more aspen or lodgepole pine, patches of up to several acres will be created to favor regeneration of the more shade intolerant species. Irregular shelterwood sequences will also be used in this type to initiate the regeneration / replacement process while providing for mature forest cover in the short term.

Approximately 66 acres of early seral mixed conifer would be created in this alternative.

Douglas-fir

The Douglas-fir type is relatively infrequent in pure stands within the analysis area. Group selection with a thinning in the matrix between groups will be used to create openings for regeneration and thin the stand from below to enhance VSS class and promote growth in the residual stand.

Approximately 14 acres of early seral Douglas-fir would be created in this alternative.

2. Cumulative Effects

The cumulative effects constraints for the forested vegetation include: Spatial – the Big Creek Watershed and Analysis Area. Temporal: The time period of approximately the late 1800's (last period of large scale disturbance in the area) and approximately 120 years from the present (typical modeling time frame and "rotation" age for most forested vegetation). Evidence on the ground and stand ages demonstrates there was both timber harvest and fire historically, however, records of activities such as timber harvest or historic fire are essentially absent prior to 1965.

There are approximately 1,375 acres of past harvesting mapped (see Gibson 2008) within the watershed, including 124 acres on private land, dating back to 1965, with the most recent being 145 acres in 1997. Table 3.9.8 shows these sales, as well as the Alternative 1 proposed sales. Currently these stands are at varied stages of development (based mostly on time since the harvest) and contribute to nearly all of the mid seral forested vegetation within the watershed. The effects of past veg treatments were incorporated into the assessment of existing condition. Not all sales created early seral vegetation however, as some of them were thinning. Under this alternative, approximately 1,811 more acres would be treated to varying degrees by the proposed harvest and burning activities, some of these overlapping past treatments.

Table 3.9.8. Mapped past harvest.

Year	Sale	Acres
1976	Bug Lake Sale	161
1986	Campground Springs Sale	201
1980	Greenfork Sale	252
1970	Old Canyon Sale	118
1997	Pole Canyon Sale	145

Year	Sale	Acres
19??	Private Sale	124
1983	Roundup I Sale?	112
1980	Six Bit Sale	179
1965	Spencer Basin Sale	83
Total Past		1,375

b. Alternative 2 – No Action

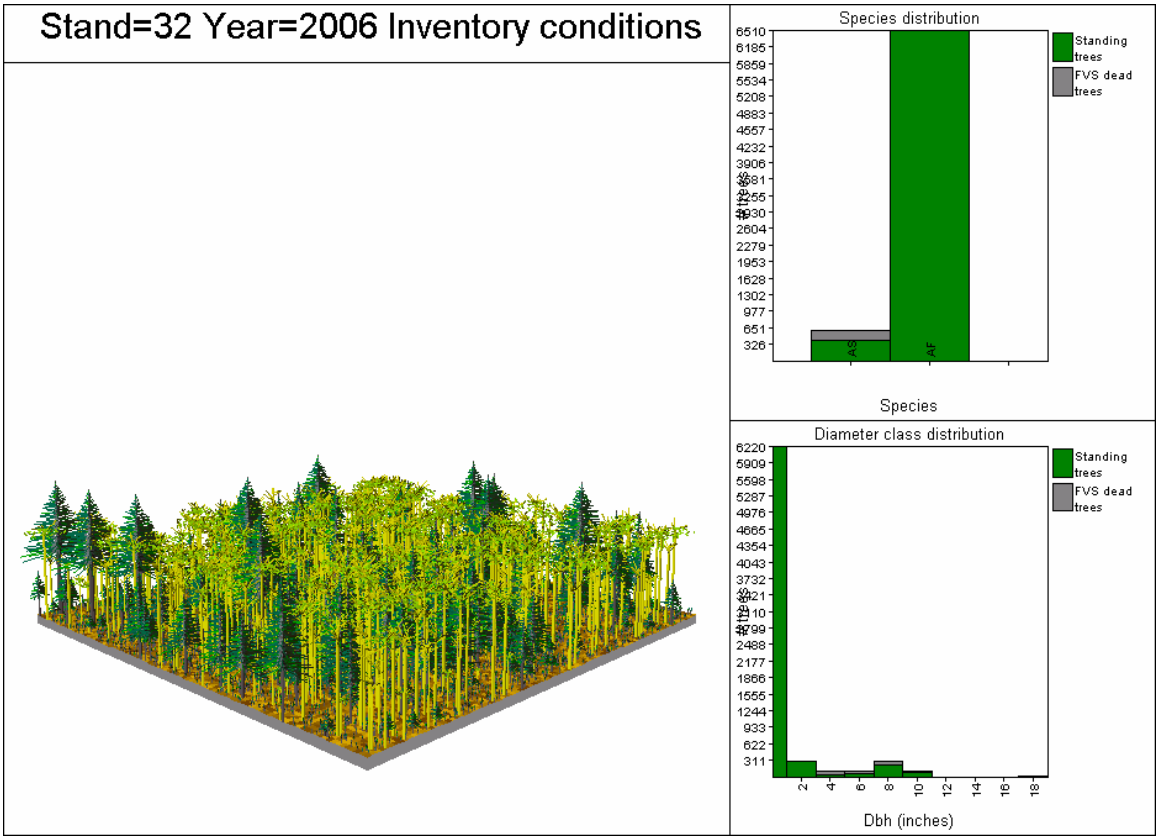
1. Direct and Indirect Effects

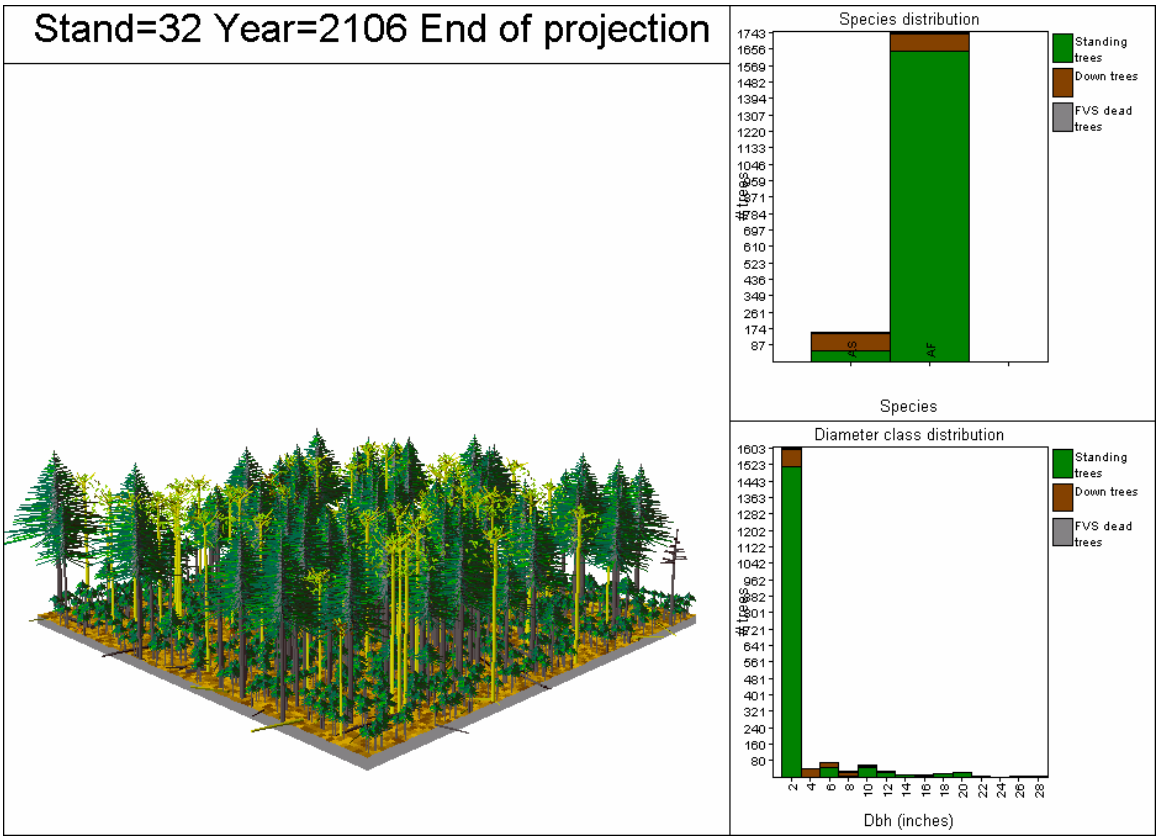
Under the No Action Alternative, management would not change from the current practice. Fire would continue to be suppressed as it has been and no new timber harvest would occur. All vegetation types would continue to move towards later seral phases of development, and in general the watershed vegetation would move farther away from PFC becoming even more heavily skewed towards the older age classes. No timber supply to local industry would be generated from this area for the foreseeable future.

Aspen/Conifer

The aspen/conifer type would be put further at risk. Campbell and Bartos (USDA 2000) suggest that these stands, where conifer is encroaching or is rapidly replacing the aspen are the stands at greatest risk of loss and therefore the highest priority for treatment. Continued fire suppression would further exacerbate this situation in this watershed where essentially all of the potential aspen acres are currently moving towards conifer dominance. None of the fuels inventory plots (USDA 2006) showed a stand of pure aspen with no fir present in the understory, however field observations by the Forest Silviculturist (Gibson 2007) did show some small stands without any conifer. The FVS Figure 3.9.5 shows this change in a typical aspen stand in Big Creek over a 100 year period. Note that aspen has dropped from about 400 stems per acre to less than 50 stems per acre by the end of the simulation.

Figure 3.9.5. FVS figures demonstrating the change in a typical aspen stand in Big Creek over a 100 year period.


Stand=32 Year=2006 Inventory conditions
Species distribution
Standing trees
FVS dead trees
#trees
AS
AF
Species
Diameter class distribution
Standing trees
FVS dead trees
#trees
Dbh (inches)


Stand=32 Year=2106 End of projection
Species distribution
Standing trees
Down trees
FVS dead trees
#trees
AS
AF
Species
Diameter class distribution
Standing trees
Down trees
FVS dead trees
#trees
Dbh (inches)

Under Alternative 2, the aspen communities within the watershed would continue to move towards conifer dominance, and in the absence of disturbance, is lost as the clones die without any overstory support to the root systems. As the conifer creates a shady environment, the aspen (which requires sunlight to regenerate) dies out and is not replaced. Research suggests that a minimum of 20 stems per acre in the mature stems are needed to maintain the live root system and obtain regeneration following treatment (Campbell and Bartos 2000). At lower numbers the stand may not regenerate following treatment. There are many stands in this treatment proposal that are at or near that threshold (USDA 2006) and if these are not treated, or otherwise changed, they will be lost because this threshold will be crossed and there will not be enough above ground live aspen to maintain the clone's root system. Conversion to conifer is the main threat to the aspen in this area, not the lack of aspen regeneration. Elk do not browse on subalpine fir seedlings.

Pure aspen can act as a fire break under the right conditions and its regeneration is not entirely dependant on fire. It does burn and the stand is top killed and sprouting follows, thus creating an even aged young stand. Aspen trees are thin barked and extremely sensitive to fire, thus even a light surface fire can regenerate the clone (Jones and Debyle 1985). However, aspen with a significant fir component is highly flammable. Historically in these sites the fir develops and provides the fuel to carry a stand replacing fire (Margolis 2007) after which the aspen clone re-sprouts profusely, later to be again invaded by sub alpine fir. Thus with continued fire suppression the stands continue to move towards conifer dominance.

The few aspen stands without conifer would likely persist, and the present ramets develop into full size stems over time. Observations (Gibson 2007) show that there is successful regeneration within these and it is likely that this would continue because of the low ungulate use. Browsing is evident on some of the suckers, however it is light and not to the point that the suckers fail to grow. Grazing pressure in this area is relatively low. Livestock is herded regularly and the area does not support high elk numbers, nor do they congregate in this transitional area between summer and winter ranges as is the case in the Yellowstone National Park area. There are recent scientific observations and publications (Ripple et al. 2001; Ripple and Larsen 2000) showing that the changes in elk grazing patterns as a result of the re-introduction of wolves has eliminated the detrimental browsing that was preventing the aspen from regenerating successfully in that area. However in this area aspen regeneration is not being suppressed by elk browsing as is evidenced by successfully regenerating stable aspen stands at lower elevations near the forest boundary and by the good regeneration in the aspen stands on adjacent private land burned during the 1994 Dry Canyon 2 wildfire.

Lodgepole Pine

Lodgepole pine within the watershed is characterized by even aged stands, most of which are currently in the mature class. Without treatment the stands would continue to age. Where subalpine fir is present, these stands would develop a thick cohort of this species and these stands would be very susceptible to intense and stand replacing fire once these ladder fuels get established. In the absence of any disturbance, some of these types would succeed to the later seral spruce/fir cover type, as the lodgepole pine dies out either from age or mountain pine beetle (MPB).

Higher densities and increasing diameters in the lodgepole pine would continue to contribute to a landscape highly susceptible to MPB infestation. These natural events would return the affected stands to an early seral condition, however there may be side effects that are not desired from either a social or environmental standpoint such as soil damage and erosion following a fire or product value loss in the event of either fire or MPB mortality.

Spruce/Fir

Spruce/fir stands currently have no early seral representation and very little regeneration of spruce overall. This situation would continue to deteriorate under the No Action Alternative. Spruce and fir

typically trade dominance on a site over time with the subalpine fir being able to regenerate in the shade, but the spruce being a longer lived tree. These stands would continue to age, with spruce regenerating in small openings created by insects, pathogens or other small scale disturbances.

Mixed Conifer

Mixed conifer stands, which are mid-seral and still currently have a proportion of the shade intolerant species such as lodgepole pine or aspen, would move towards dominance of the more shade tolerant subalpine fir, Douglas-fir or spruce. Potential aspen within these would be lost over time as the root systems die out. Douglas-fir and spruce would regenerate in small openings created by either blowdown or insect and disease agents.

Douglas-fir

Douglas-fir, in pure stands, occurs only in small proportion in this project area. In all cases there is a strong cohort of shade tolerant species. Without treatment these stands would continue to age and in many cases be replaced by the subalpine fir until natural disturbance such as fire or insects would open up the stand, or portions of it, and provide conditions for seedling establishment, which include at least partial sunlight and adequate moisture. Established seedlings require full or nearly full sunlight. As small openings are created in the canopy by spot fires or insects, these will regenerate to Douglas-fir.

2. Cumulative Effects

There would be no harvest acres added to 1,375 acres which are the current total of past harvesting in the watershed on Forest Service administered lands. It is reasonable to expect that there would be some harvest on state and/or private land.

No new acres of early seral would be created in any of the vegetation types without some kind of disturbance. Therefore the position in respect to PFC would deteriorate further as stands continue to age. Based on the recent analysis of the FIA data (USDA Forest Service 2006b), within approximately 30 years 70% of the conifer cover type would be in the old forest age class. The conifer dominated stands are not in an area where wildland fire use is a consideration, so it is unlikely that new early seral stands would be created by fire in these areas because any fire starts would be fully suppressed. In some of the southern units where there is aspen and aspen/conifer mix, wildland fire use is a tool that may be considered so there is a possibility that some early seral could be created in these areas. Other natural conditions include the possibility of mountain pine beetle outbreak in the more contiguous, older stands of lodgepole pine that may create some early seral. Other insect and disease agents could cause areas of mortality in other species as well.

c. Alternative 3 – Reduced Treatment and Wildlife Emphasis

1. Direct and Indirect Effects

Under Alternative 3, management would change from the current regime to one of more timber harvest and prescribed fire in order to create early seral vegetation in all vegetation types and move the watershed overall towards PFC as described in the Revised Forest Plan. However, this would be at a slower rate than in Alternative 1 due to less acreage being treated. There are three main differences between the action alternatives: (1) Units with higher road needs were dropped, (2) Treatments within goshawk PFA boundaries were reduced in number and in type, and (3) Less openings are created in this alternative and irregular shelterwood thinning designed to increase VSS in the short term, while maintaining mature forest cover yet initiating a regeneration sequence to eventually move the stands into an early seral class.

Of the approximately 1,240 acres treated, about 844 would be moved directly to an early seral structural stage.

Timber supply to local industry would be ensured through the offering of an estimated 13,700 CCF of timber product volume including post, poles, sawtimber and other products.

Table 3.9.9 shows the treatments in forested types for Alternative 3.

Table 3.9.9. Approximate acres treated in forested vegetation.

Prescription	Alt. 3 Acres
Clearcut	137
Conifer Removal w/patch	27
Conifer Removal followed by Fire	343
Group Selection	183
Groups and Patches	0
Irregular Shelterwood	211
IRSW with groups / patches	0
Overstory Removals	130
Shelterwood Prep	9
Thin with Groups	0
Mosaic Rx Fire	200
Timber Harvest Acres Subtotal	1,240

Aspen/Conifer

See narrative for Alternative 1 – same discussion, lower number of acres.

Approximately 489 acres of aspen/conifer mix would be returned to an early seral stage in this alternative.

Lodgepole Pine

See narrative for Alternative 1 – same discussion, lower number of acres.

Approximately 299 acres of early seral lodgepole pine would be created in this alternative.

Spruce/Fir

See narrative for Alternative 1 – same discussion, lower number of acres.

Approximately 30 acres of early seral spruce/fir would be created in this alternative.

Mixed Conifer

See narrative for Alternative 1 – same discussion, lower number of acres.

Approximately 26 acres of early seral mixed conifer would be created in this alternative.

Douglas-fir

See narrative for Alternative 1 – same discussion, no acres.

No early seral Douglas-fir would be created in this alternative.

2. Cumulative Effects

There would be approximately 1,240 treated and forested acres added to the 1,375 acres which is the current total of past harvesting in the watershed on Forest Service administered lands. It is reasonable to expect that there would be some harvest on state and/or private land. Table 3.9.8 in the previous Alternative 1 discussion displays the past sale acres. These do not change between alternatives.