Lake Fuels Project

Vegetation Analysis Report

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FOREST VEGETATION

This section describes the current condition of the vegetation as it relates to the issue of Forest Vegetation and the effects of implementing alternatives.

Vegetation Indicators

- *Spruce-fir stands treated (acres).*
- *Spruce-fir regenerated (acres).*
- *Aspen treated (acres).*
- *Aspen regenerated (acres).*
- *Structural class distribution by forest type (acres of grass/forbs, seedling/sapling, young forest, mid-age forest, mature forest, and old growth).*
- *Forest type change (acres).*

Vegetation Composition and Structure

This section will discuss the effects of the alternatives on stand development, forest composition, and structure. The alternatives were analyzed (Draft Prescriptions and Alternative Comparison, 2008, Diane Cote) by the use of existing stand inventory data (Common Stand Exams, 2002), Geographic mapping (ArcGIS), and the Utah variant of the Forest Vegetation Simulator (FVS). The following indicators are used to compare the alternatives: treated acres; regenerated acres; structural class distribution; and forest type changes.

Vegetation structure for Engelmann spruce stands was determined using the Characteristics of Old-Growth Forest in the Intermountain Region, Hamilton 1993 and the Vegetative Structural Stages, Calculations and Description (VSS), 1992. Figure 1 displays a crosswalk between the descriptions of the stand structural stages in the two documents, the terms, and the parameters used to determine the structural stages.

Figure 1 – Structural Stages Crosswalk for Engelmann Spruce Vegetation Types.

Terms Used In Document	Vegetative Structural Stage	VSS Class	Average DBH Range (Inches)	Canopy Levels
Early	Grass/Shrub	1	0 – 0.9	1
	Seedling/Sapling	2	1.0 – 4.9	
Young	Young Forest	3	5.0 – 11.9	1 or more
Mid-Aged	Mid-Aged Forest	4	12.0 – 17.9	1 or more
Mature	Mature Forest	5	18.0 - 23.9	2 or more
	Old Growth	6	$\geq$ 24.0	

The younger structural classes are usually separated into grass-forb and seedling-sapling. These two classes were combined into the 'Early' structural class.

Old growth or Mature stands of spruce-fir (cold/dry environment) are defined as the following: contain at least two canopy layers (6-inch diameter variation); contain (≥ 15 tree per acre (≥) 15-inches in diameter (150 to 180 years of age); and have from (≥) 2 to 14 trees in a state of decline or decadence (Hamilton, 1993). In this document, stands that met this definition will be referred to as Mature. No spruce-fir stands have been found on the Manti-LaSal with mean stand diameters of 24 inches.

Additional criteria for old growth Engelmann spruce stands are: minimum tree ages range from 150 to 180 years depending on site; two to four standing dead trees at least 10 inches DBH and 15 feet tall; and more than 16 logs (down dead), 8 feet in length with a minimum diameter of 8 inches (Hamilton, 1993).

- **Current Management Situation**

Almost all the proposed units were treated with a commercial harvest approximately 20 years ago. The primary objective of the treatment was to reduce stand density. The average stand basal area was reduced but the basal areas within the stands ranged from 20 to 220 due to the distribution of the trees in clumps. The spruce beetle has killed approximately 90 percent of the Engelmann spruce over 10 inches in diameter. The stands proposed for treatment under this analysis are designated as under Timber (TBR) and Range (RNG) management direction in the Manti-LaSal Forest Plan, 1986, Pages III-64-68.

Figure 2 identifies the broad forest vegetative cover types and acres by structural classes found within the Lake Fuels Project boundary. This data was derived from field inventories (Common Stand Exams, 2002), Forest Stand Simulator Analysis, (Cote, 2007, Vegetative Structure Analysis) and geographic mapping (1960, 2001). The dominant tree species was used to determine the broad vegetation types. The aspen-mixed conifer and spruce-subalpine fir stand have an average Vegetative Structural Stage (VSS) classification but since the stands are uneven aged, portions of the stands have other classifications. Map 1 displays the forested vegetation types.

Figure 2 – Current Vegetation Types and Average Stand Structure (Acres).

Vegetation Type	Not Applicable	Early	Young	Mid - Aged	Mature	Grand Total
Aspen	-	-	-	553	-	553
Aspen–Mixed Conifer	-	-	-	216	-	216
Non- Forest	3,212	-	-	-	-	3,212
Rock	85	-	-	-	-	85
Spruce-Sub-alpine fir	-	242	573	458	-	1,273
Water	145	-	-	-	-	145
Grand Total	**3,438**	**34**	**1,454**	**553**	**-**	**5,479**

The spruce beetle has altered the stand structures within the project boundary within the last 5 years. The changes to the stand structures were based on a field survey of dead and spruce beetle infested spruce complete in 2005 (Cote, 2005, Supplemental Vegetation and Fuels Report Lake Vegetation Project) and Forest Vegetation Simulation runs (Cote, 2008, Forest Vegetation Simulator Reports) based on spruce beetle mortality estimates from monitoring

complete by Forest Health Protection and completed surveys. The spruce beetle (*Dendroctonus rufipennis,* Kirby Engelmann Coleoptera: Scolytidae) is the most important biotic disturbance agent affecting spruce-fir forests in the Intermountain region (Baker and Veblen, 1990, Veblen et all. 1994, Jenkins et al. 1998). Engelmann spruce (*Picea engelmannii* Parry ex. Engelmann) serves as the principle host for the spruce beetle.

The spruce beetle has changed the stand structure of the spruce fir types within the project area and across the entire Wasatch Plateau. Map 2 displays the average stand structural class. These stands are un-even aged and contain a least two structural classes.

Quaking aspen (*Populus Tremuloides* Michx.) is widely distributed throughout the Manti-La Sal National Forest. Root suckering is the predominant mechanism by which aspen regenerates in the central Rocky Mountains of the western United States (Sheppard and Smith, 1993). This form of vegetative propagation gives rise to a stand of genetically identical trees, referred to as a "clone". Disturbances have different effects and responses from clone to clone because of inherent genetic differences (Williams, 2008).

Aspen is adapted to a much broader range of environments than most associated species. Aspen is considered an early seral species on most sites but may become climax on others. Fire has been the most important disturbance factor influencing changes in structural stages, stand composition and minimizing dominance by conifer species. The fire return interval is less frequent today compared to historical averages. Aspen is considered a fire-resistant vegetation type that seldom burns during most fire seasons. Evidence of spring and fall fire scars in historical studies suggests that native burning was likely a key ignition source of many historical fires. In the absence of historical disturbance, much of this type is at risk and is being displaced by other vegetation types (Williams, 2008). Southern Utah contains some of the most productive and extensive aspen forests in the western United States. Generally, aspen tree ages vary from 60 to 150 years.

Historically, it is estimated that 160,400 acres of seral (temporary or intermediate stage in forest succession) aspen existed on the Manti-LaSal National Forest (Draft Manti-LaSal National Forest, Properly Functioning Condition Analysis, July 1998). There is now estimated to be only 104,200 acres of seral aspen on the Forest. The lost acres have converted to Ponderosa pine, Engelmann spruce- sub-alpine fir, Douglas fir, or white fir forest types.

Almost all of the aspen/mixed conifer stands (216 acres) in the Lake Project Area are in a mid-aged condition (some of that acres had been considered mature but the spruce mortality has killed 90 percent of the spruce over 10 inches DBH). Conifers both spruce and sub-alpine fir are succeeding the aspen; the spruce mortality is not a sufficient disturbance to trigger a sprouting response. Stand exams in nearby aspen mixed conifer stands where the spruce have been dead for several years have not found any recent aspen regeneration (CSE Exams, 2005, Millers Flat). Fire exclusion and lack of any alternate regeneration treatment over the past 100 years has caused, in most areas, the decline of these stands and changed the distribution of the structural classes. Figure 3 is a photo of one of the proposed treatment stands, note the overtopping conifers.

Figure 3 – Stand behind Huntington Reservoir, note dead spruce overtopping the aspen.

Aspen forest communities across the forest have declined 34 percent between the timber inventories completed in 1915 and 1965 (Manti-La Sal Forest Plan, page II-12, 1986). A comparison of the acres typed as aspen in the 1993 timber inventory indicates that aspen has declined an additional 15 percent since the 1965 inventory.

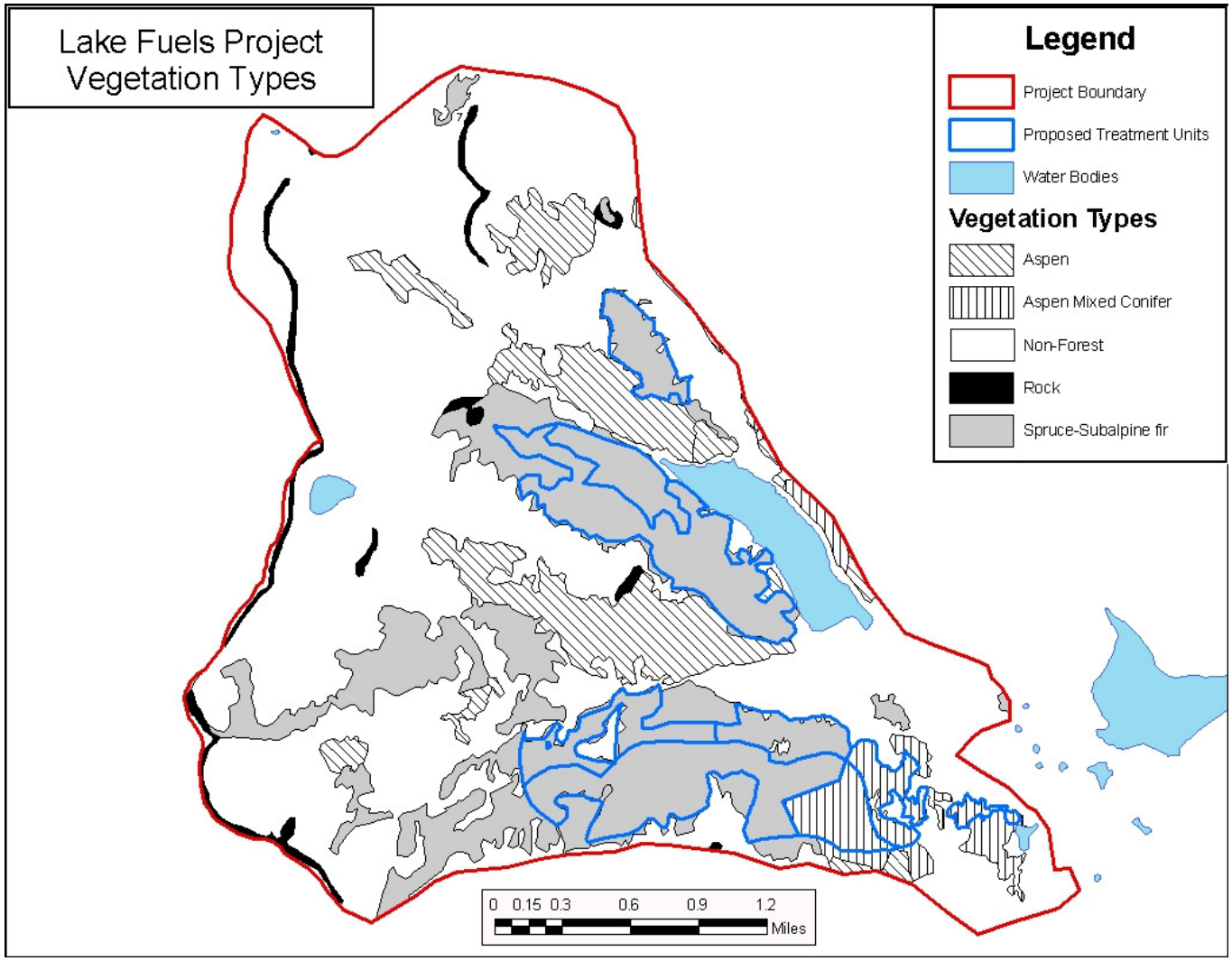
There is a high risk that aspen in the aspen-mixed conifer types will continue to be lost from lack of disturbance. Without disturbance to remove the conifers and stimulate the aspen suckering response in these stands, conifers will gain dominance over the aspen. Many of the seral aspen stands contain too many conifers, which could create heat severe enough to kill root systems and thereby literally killing the aspen clone. In some cases, it will be necessary to physically and mechanically remove conifer trees from within the clone to prevent too much heat from being generated by either prescribed or wildland fire.

> *"Harvesting aspen for commercial products is a viable means of regenerating aspen forests on operable terrain where an aspen wood market is available and a transportation system exists to remove it.* ***Clearcutting, or (more specifically) clearfell-coppice cutting, is the harvest method of choice in most situations. Removing all aspen at once (including understory stems, if present) best meets all three requirements of the aspen regeneration triangle and will stimulate dense suckering (figure 3). Soil compaction (Shepperd 1993; Alban 1991; Navritil 1991) and nutrient recycling may be problems with some harvesting systems that concentrate tops and limbs at centralized landings.***
>
> *Partial cutting may be sufficient to stimulate suckering in some clones, but it often does not work well. It is extremely difficult to avoid damage to residual trees while logging a partial cut. Rot and canker disease organisms may be introduced through even the*

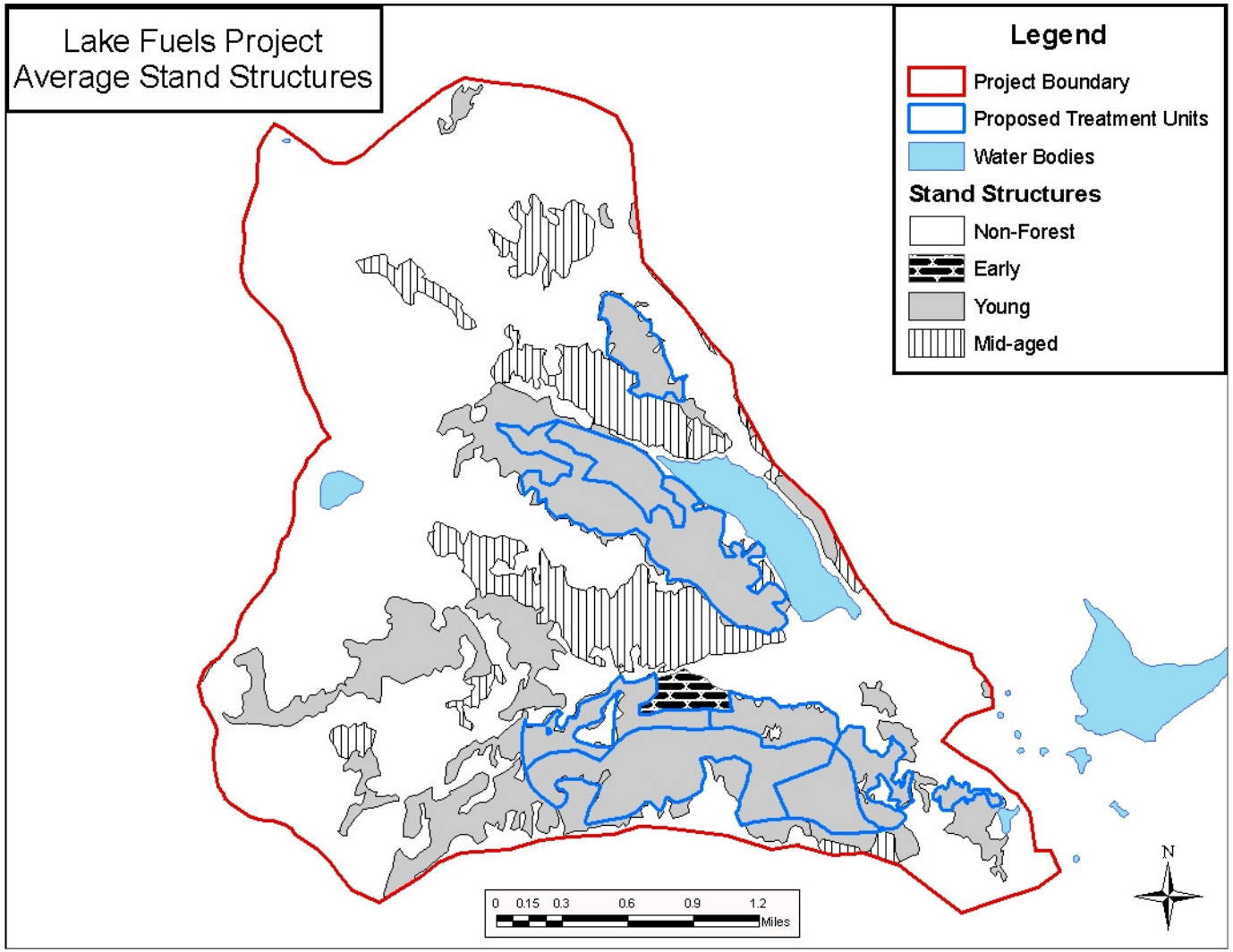
smallest bark wounds and thus, affect the future value of stems that are left. Stems left after a partial cut are also susceptible to breakage, windthrow, and sunscald when exposed to the elements (Jones and Shepperd 1985). Growth of subsequent suckers will be reduced under a partial overstory (Doucet 1989; Perala 1983). Group selection is an uneven-aged option that may be applicable to managing aspen. The suckering response is usually adequate if group openings are sufficiently large to allow full sunlight to reach the ground throughout most of the area.

Harvesting in smaller units partially shades the openings but creates a greater amount of edge between uncut and regenerating aspen than an equivalent area of large harvest units. Smaller openings provide easier access to browsing animals (Timmermann 1991). In one documented case on the Fraser Experimental Forest in central Colorado, cutting small 0.1 ha openings resulted in numerous disease-infected suckers (Jacobi and Shepperd 1991)." (Shepperd, W. D., 2001. Manipulations to Regenerate Aspen Ecosystems).

Map 1 - Existing Vegetation Types.



Map 2 - Existing Average Stand Structures.



- **Insects and Disease**

This section will discuss the status of insect and disease activities in the project area and the history of the current spruce beetle epidemic on the Manti-LaSal. The alternatives were analyzed by the use of existing stand inventory data, Arcview, and the Utah variant of the Forest Vegetation Simulator (FVS) (Cote, 2008).

The spruce beetle (*Dendroctonus rufipennis* Kirby (Engelmann) Coleoptera: Scolytidae) is the most important biotic disturbance agent affecting post-fire, spruce-fir forests in the Intermountain Region (Baker and Veblen 1990, Veblen, 1994, Jenkins et al. 1998). Engelmann spruce (*Picea engelmannii* Parry ex. Engelmann) serves as the principle host for the spruce beetle.

Spruce beetle attack mature Engelmann spruce in the spruce-fir type in the Central Rockies. Since the late 1800's, populations of this bark beetle have periodically reached outbreak proportions and killed thousands of acres of spruce. Outbreaks often originate as a result of stand disturbances such as windthrow, landslides and avalanches when large diameter green spruce, >16" diameter at breast height (DBH) are knocked down. All such activities can create a favorable environment conducive to spruce beetle infestation and brood development (Schmid and Frye 1977). Beetles are more successful at colonizing green down material because trees no longer produce resins that can pitch out attacking beetles. Beetle survival is also increased in downed material when snow acts as an insulator, preventing low temperatures from killing the brood during winter. Snow also protects the brood from predation by woodpeckers (Schmid 1981).

The spruce beetle generally has a two-year life cycle (Furniss and Carolin 1997) but some of the population has a one-year life cycle. In the two-year cycle (most commonly found in Utah), the adults' attack weakened or windthrown trees in late spring to early summer. Most of the adult flight occurs over a five to six week period beginning in June and ending sometime in early-mid August. Adults of this insect have been found flying in early- to mid-September, but peak flight generally occurs sometime in July. Seasonal temperatures play an important role in the timing and length of beetle development and whether beetles will have a one or two-year life cycle. For example, recent research suggests that depending on fall temperatures as much as one third of the beetle population within a given tree could complete their life cycle in one year (Hebertson, 2002).

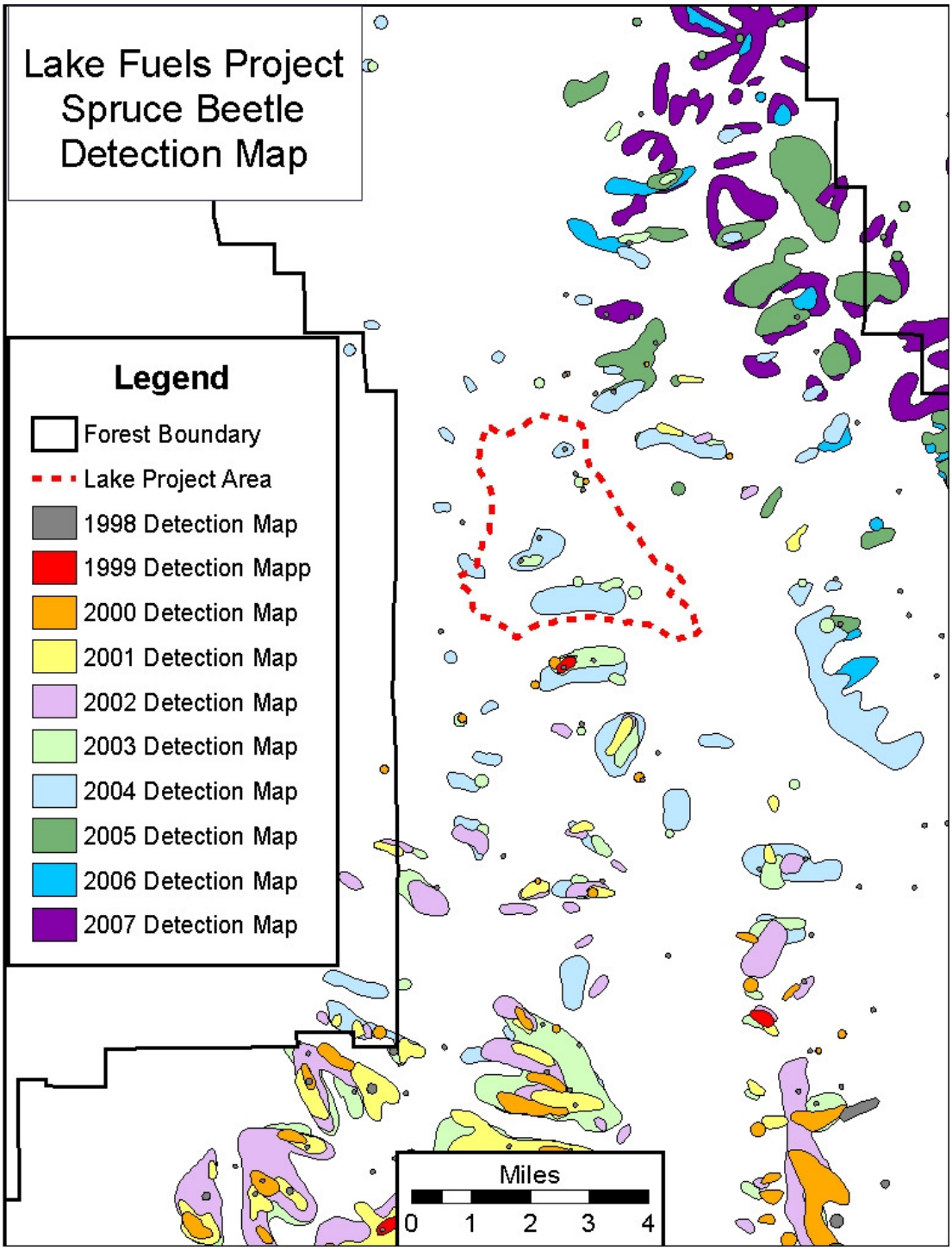
Once the eggs are laid, larvae hatch in 10-14 days and begin feeding within the phloem layer of the host tree. The larval stage is the most abundant over wintering stage during the first year of development, although some eggs and parent adults can be present. In the two-year life cycle, larvae pupate approximately one year following initial adult attack. During the second winter of the two-year life cycle, callow adults (sexually immature) over winter in their pupal sites or in the base of the infested tree. Sexually mature adults emerge the following spring, attacking recently downed or otherwise susceptible spruce with phloem layers capable of supporting larval development. Standing green spruce may also be attacked as beetle population levels increase.

During the early 1980's a small outbreak of spruce beetle was observed in the spruce-fir stands on the southern portion of the Sanpete Ranger District, approximately 50 miles to the south of the project area. A sanitation/thinning project was proposed and analyzed. Just prior to implementation an approximately 1000-acre landslide occurred within 2 to 3 miles of the spruce beetle infested stands. This slide caused extensive damage to the Engelmann spruce in the affected area and eliminated the main road access to the proposed treatment area. During the time it took to relocate the access road the spruce beetle population infested the damaged and down trees in the slide area. The population grew and expanded to the surrounding spruce stands and has achieved epidemic status.

The spruce beetle has killed an average of 90 percent of the Engelmann spruce from the original infestation to the northern extent of the spruce fir type on the Wasatch Plateau.

Map 3 displays the last seven years of the aerial insect surveys for spruce beetle on the Northern Portion of the Manti-La Sal (1998 thru 2007, GIS Forest Health Protection Aerial Surveys).

Map 3 – 1998 thru 2007 Spruce Beetle Detection Map.



- **Direct/Indirect Effects**

This section discusses the short (5 years) and long term (100 Years) effects of the alternatives on the spruce-fir, aspen and aspen-mixed conifer stands within the project area.

Alternative 1

This alternative would not alter the current vegetation types or structural class distribution within the watershed in the short term. Aspen-mixed conifer, aspen, and spruce-fir stands would not be treated or regenerated, see Figure 2. Vegetation type distributions would remain the same in the short-term.

In stands where aspen is associated with conifers, fire has been the most important disturbance factor influencing changes in structural stages and composition, and minimizing dominance by conifer species.

Historically, fire prevented conifers from dominating aspen stands. Fire maintained a mosaic of age classes in aspen across the landscape. Fire also maintained the clones in a healthy, vigorous condition. Non-lethal fires (7 to 10 years) at lower elevations, and stand-replacing fires (30 to 100 years) at higher elevations, historically regenerated this species forming even-aged stands and maintained a mosaic of structural stages across the landscape (Fire Plan Amendment, 2001). The fire return interval is less frequent today compared to historical averages (Bartos and Campbell 1998).

Under this alternative, conifers will eventually replace many aspen stands or clones. Conifers are longer lived and can, by their shade, prevent aspen from regenerating. This can and has led to the permanent replacement of aspen stands by conifers. The absence of fire or disturbance, coupled with excessive browsing of young aspen trees by livestock and wildlife, has led to rapid replacement of aspen communities by conifer forests (Fire Plan Amendment, 2001). The decline of aspen results in loss of forage and biodiversity (Bartos and Campbell 1998).

Figure 4 displays the vegetation types and structures that are currently present (Short-term) in the project area and the anticipated changes over time from both alternatives (Long-term). The Rocky Mountain Vegetative Structural report was used to determine the stand classifications and the acre distribution of VSS classes. Stand Density Index for each class was used to determine the percent of the stands in a given class.

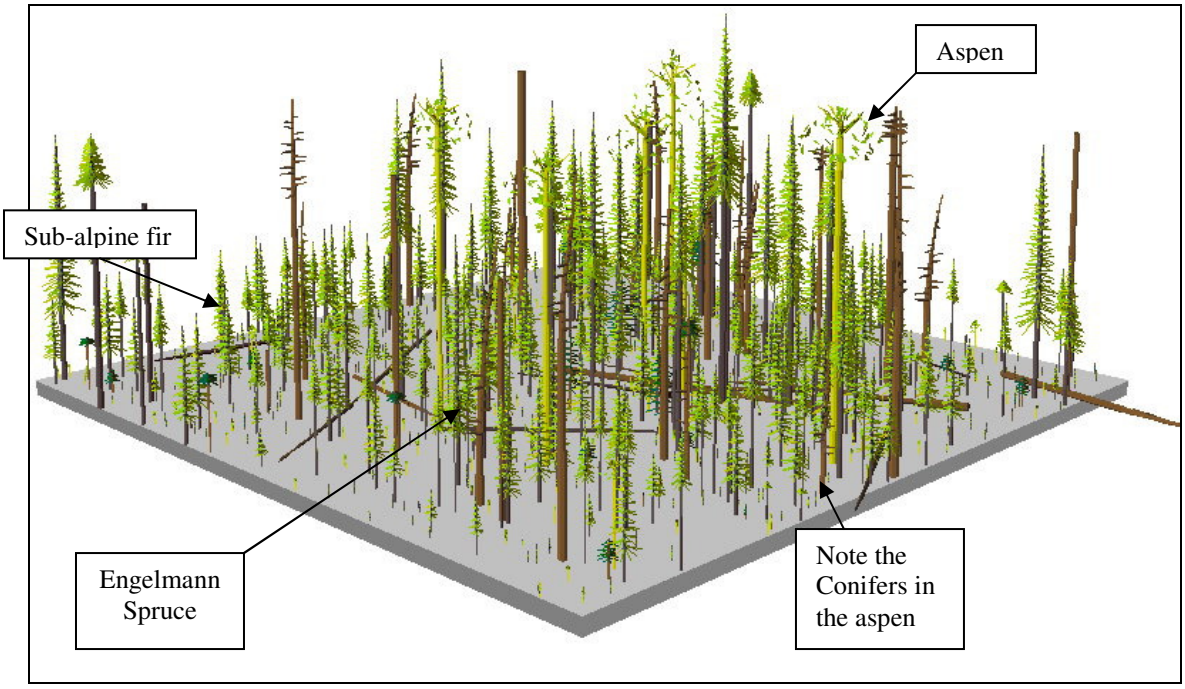
Figure 4 – Direct Effects of the Alternatives on Stand Composition and Structure (Acres).

Vegetation Type	Structure	VSS	Alt. 1 Short Term	Alt. 2 Short Term		Alt. 1 Long Term	Alt. 2 Long Term
Spruce-Sub-alpine fir	Early	1, 2	242	181		229	230
	Young	3	560	539		611	392
	Mid-Aged	4	458	447		165	199
	Mature	5	-	-		267	347
Total Acres			1,273	1,168		1,273	1,168
Aspen-Mixed Conifer	Early	1, 2	-	145		-	-
	Young	3	-	-		-	-
	Mid-Aged	4	216	176		216[1]	313
	Mature	5	-	-		-	-
Total Acres			208	321		208	313
Aspen	Early	1, 2	-	-		-	-
	Young	3	-	-		-	-
	Mid-Aged	4	553	553		553	553
	Mature	5	0	0		0	0
Total Acres			553	553		553	553

Figure 5 is a graphic representation (SVS) of a typical spruce-fir conifer stands in the project area following a spruce beetle epidemic (Cote 2008, FVS Simulations). Most of the Engelmann spruce has died from the spruce beetle. Conifers still dominate the aspen patch. Monitoring of the spruce beetle epidemic on the Lake Fuels Project has indicated that 100 percent of the spruce greater than 16 inches DBH, 90 percent of the trees between 10 and 16 inches DBH, and 85 percent of the 5 to 10 inches DBH classes has died (Cote, Stephen J., 1999). This stand is now has an average stand structure of mid-aged, has 31 percent canopy closure and two canopy levels.

[1] This acreage can be expected to decrease as these stands convert to a spruce-fir cover type in the absence of disturbance.

Figure 5 – Existing Condition and Alternative 1. (Short term).



Alternative 2

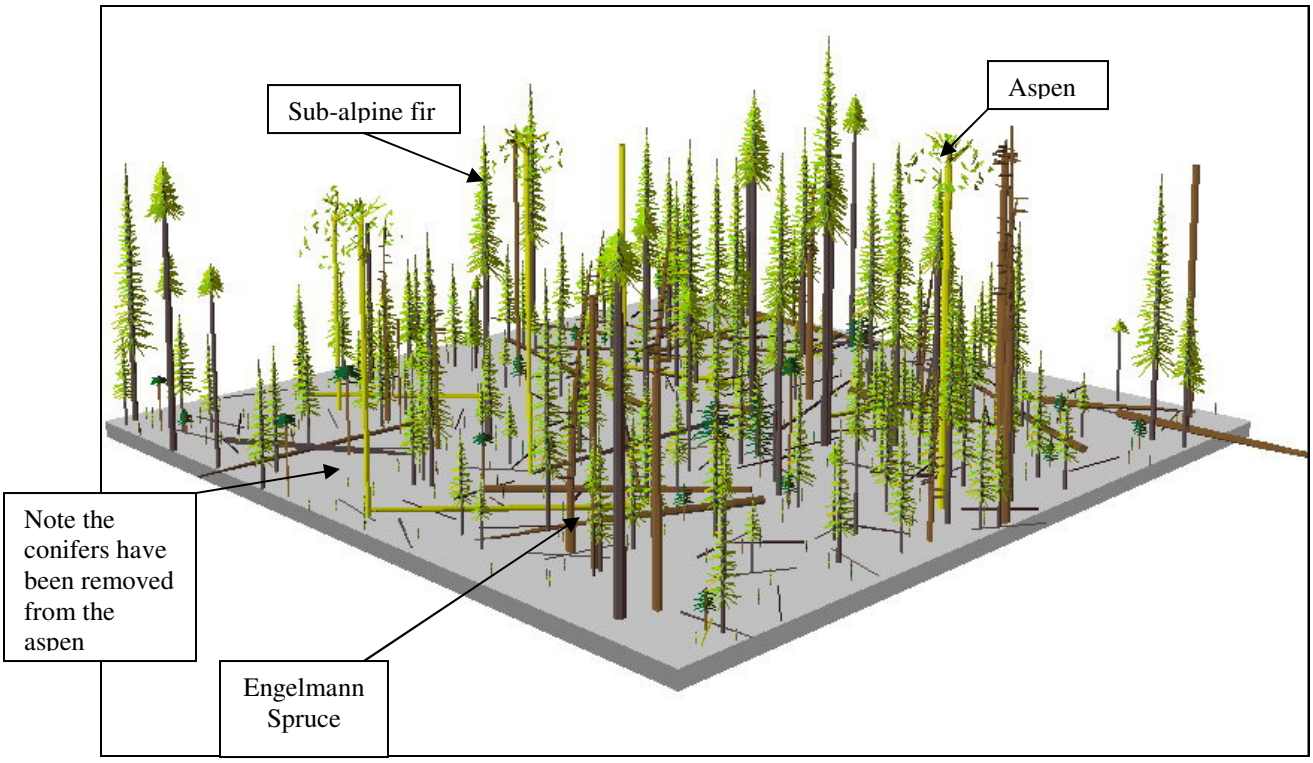
Alternative 2 proposes to remove most of the dead or infested Engelmann spruce. Openings sizes may be greater than 5 acres and could affect up to 30 percent of the stand. The stands classified, as aspen-mixed conifer would have all of the conifers removed from the aspen and would be uneven-aged. Figure 7 illustrates the application of this prescription on an average spruce-fir stand with scattered aspen pockets. The Stand Vegetation Simulator (SVS) was used to develop this graphic representation. Approximately 40 acres (4 units) would be treated with even-aged (clearcut) management. The sizes of these treatments would range from 5 to 10 acres.

This alternative would require monitoring of pocket gopher activity within proposed plantations. This species can be a serious threat to successful establishment of newly reforested areas if not managed properly. Planted areas may require gopher (underground strychnine baiting) treatments to ensure establishment and continued growth. Perimeter treatments would be included around planted areas. Information on the northern pocket gopher, treatment methods, and effects is available in the project file (Bonar, Ronald E., 1997, The Northern Pocket Gopher Most of What You Thought You Might Want to Know, but Hesitated to Look Up).

The design features listed in Appendix B under the Forest Vegetation issue details the activities to be implemented following the harvest in Alternative 2.

The guidelines listed for down woody debris and snags listed in Design Criteria will be followed in this alternative.

Figure 6 - Example of an average Spruce-fir stand following Harvest, Alternative 2 (Short-term).



The 40 acres of treatment listed for even-age and the 105 (spruce-fir) acres of uneven-aged management would be converted to aspen because of the harvest, these acres are expected to regenerate naturally to aspen. The 241 acres of treatment listed as even-aged in the spruce-fir typed stands are not fully stocked as a result of the spruce beetle and will need natural or artificial reforestation.

The aspen stands are expected to regenerate naturally to aspen by coppice method. Experience with clearcuts in other portions of the forest has shown that clearcutting will result in full stocking over 95 percent of the time (Cote, 2008, Validation Case Study).

Planting will be necessary in the spruce-fir type to ensure an even mixture of spruce and sub-alpine fir. Experience in the harvested units under the South Manti Environmental Assessment has shown that there is insufficient spruce in the beetle killed stands to provide enough seed source to reforest the stands in the short term. The proposed treatment stands in the Lake Fuels project can be adequately reforested within 5 years by the use of planting.

Figure 6 compares the acres treated by treatment system for each alternative and vegetation type.

Figure 7 – Treatment Acres by Alternative.[2]

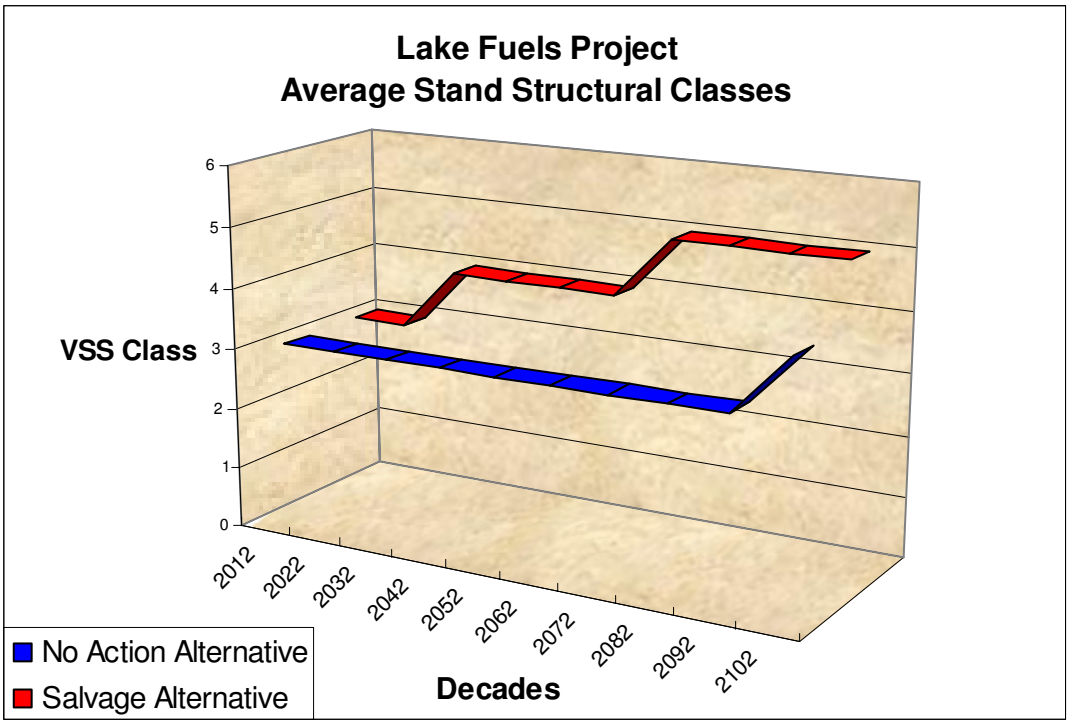
Vegetation Types	Proposed Treatment	Alt. 1	Alt. 2
Spruce-Sub-alpine fir	Even-aged	-	241
	Uneven-Aged	-	434
	Spruce Type Regenerated	-	675
	Total Treatments	-	**675**
	Total Untreated Stands	1,250	591
Aspen-Mixed Conifer	Even-aged	-	40
	Uneven-Aged	-	105
	Total Treatments	-	**145**
	Total Untreated Stands	208	168
Total Acres Treated		-	**820**

Even-aged treatment acres are converted to an early structural class. Thirty percent of the acres treated with uneven-aged management would be converted to Early in Alternative 2. The rest of the uneven-aged treated acres would be stocked with trees with varying size classes.

The stand characteristics to meet old growth or mature stands are described in Hamilton, 1993 for cold, dry Engelmann spruce are: a minimum of 15 trees per acre greater than 15 inches DBH; and two distinct diameter classes and canopy layers (Hamilton, 1993). Figure 8 displays the effects of the Alternatives on the vegetative structure over time. Portions of the stands under alternative 2 would be meet mature forest or VSS 5 criteria approximately 70 years after treatment (Vegetative Structure Analysis, 2007, D. Cote) The stands do not currently meet old growth definition due to the spruce beetle mortality. Figure 8 details the average stand structure characteristics by alternative for both short and long term. The spruce fir stands in the project area are currently considered uneven-age. FVS does not address the variability in stand structure within the stand at this time.

[2] Approximately 105 acres of the spruce-fir type contain patches of aspen that will be converted from this type to aspen-mixed conifer by the removal of all the conifers within and for 66 feet around the aspen patch.

Figure 8 – Vegetative structure changes (Short and Long Term).



The clearcut aspen mixed-conifer stands remained in the aspen-mixed conifer vegetation type and were placed in the early structural stage. The changes to structure on the managed acres were based on the modeling of the treatments in FVS (D. Cote, 2008).

- **Cumulative Effects**

The cumulative effect analysis boundary used to analyze the cumulative effects to the vegetative types is the same as in the wildlife section. Changes in vegetation structure, density and composition have a direct effect on wildlife and the effects need to be discussed within the same boundaries.

Alternative 1

In the absence of disturbance, aspen would continue to be lost from the in-growth and overtopping of conifers. Diversity of stand composition and structure would continue to be reduced as the stands evolve toward a high composition of conifers. Average tree size and age would increase since conifers are generally a longer-lived species.

If current trends continue, it is likely that aspen will continue to convert to dominance by coniferous species (Bartos and Campbell, 1998; Fire Plan Amendment, 2001). The ability of aspen to re-colonize these sites may be limited or lost by long-term site dominance by conifers. This could affect the resiliency of these areas to disturbance because aspen clones may continue to lose their ability to sprout or are unable to produce enough sprouts to sustain the clone following fire.

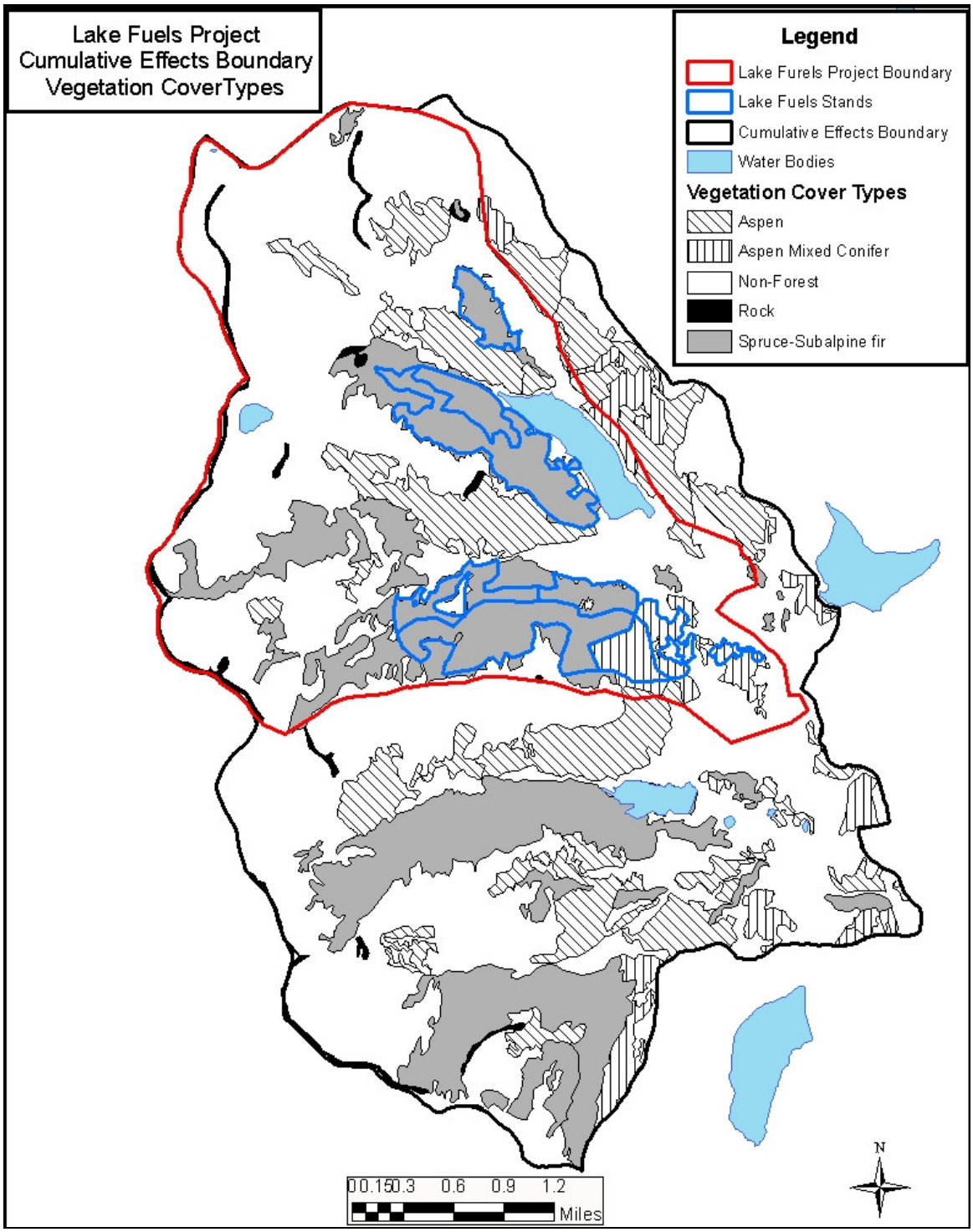
The structure of the stands is expected to change as displayed in Figure 8. These changes were based on the data collected from the spruce beetle epidemic on the Wasatch Plateau on the north portion of the forest (Dymerski, 2001, S. Cote, 1999).

There are approximately 1,186 acres of spruce fir type immediately adjacent to the project area. These acres have similar characteristics (species composition and stand structure) to the stands found in the project area (Cote, 2008). The Rocky Mountain Vegetative Structural report was used to determine the stand classifications and the acre distribution of VSS classes. Stand Density Index for each class was used to determine the percent of the stands in a given class.

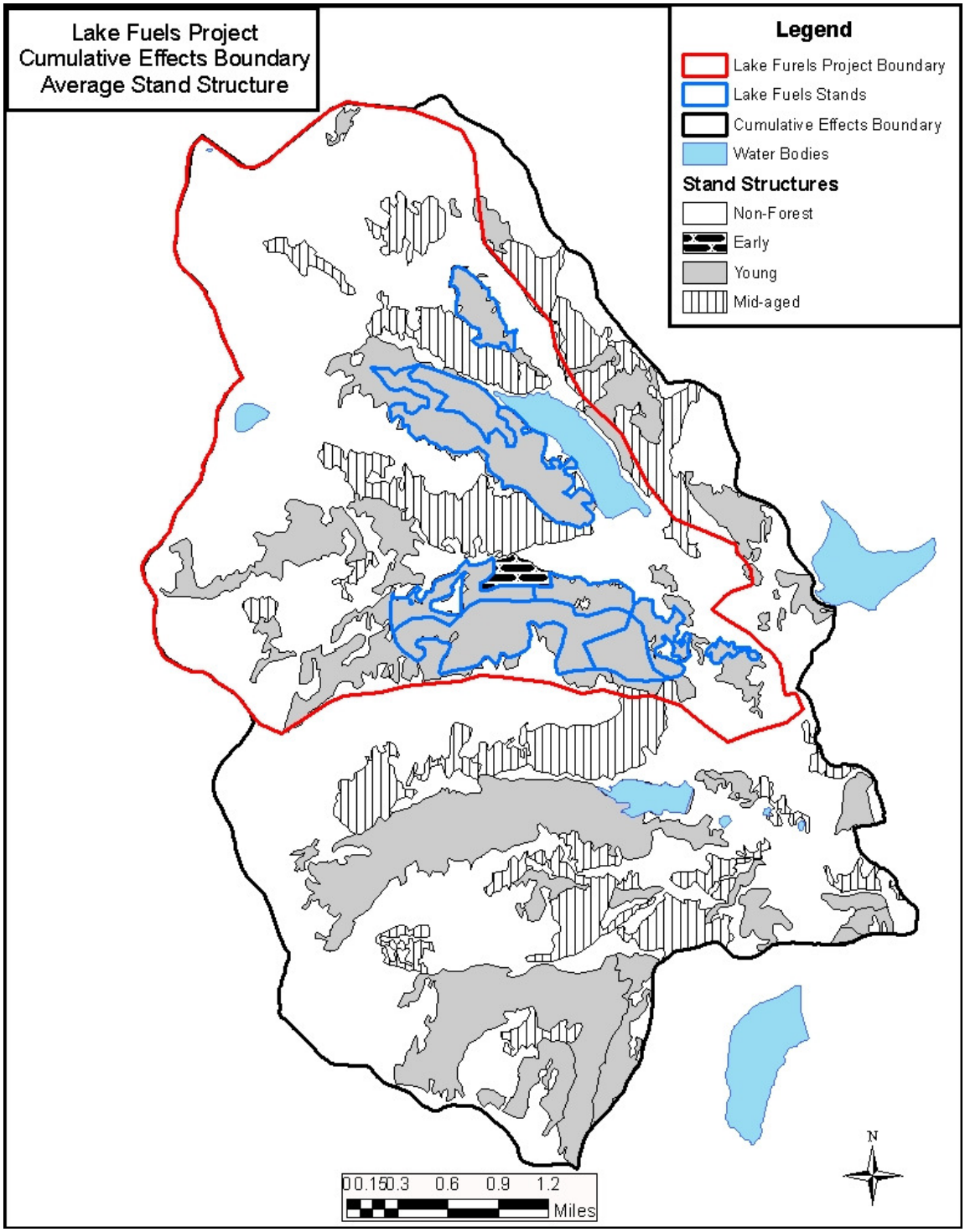
Figure 9 – Cumulative Effects of the Alternatives on Stand Composition and Structure (Acres) if all stands are treated.

Vegetation Type	Structure	VSS	Short Term			Long Term	
			Alt. 1	Alt. 2		Alt. 1	Alt. 2
Spruce-Sub-alpine fir	Early	1, 2	467	407		443	444
	Young	3	1,107	1,073		1,180	961
	Mid-Aged	4	885	874		320	353
	Mature	5	-	-		516	596
		Total Acres	2,459	2,354		2,459	2,354
Aspen-Mixed Conifer	Early	1, 2	-	145		-	-
	Young	3	-	-		-	-
	Mid-Aged	4	533	493		533	638
	Mature	5	-	-		-	-
		Total Acres	533	638		533	638
Aspen	Early	1, 2	-	-		-	-
	Young	3	40	40		40	40
	Mid-Aged	4	1,592	1,592		1,592	1,592
	Mature	5	-	-		-	-
		Total Acres	1,632	1,632		1,632	1,632

Map 4 - Map of Vegetation Cover Types.



Map 5 - Map of Stand Structures.



Alternative 2

There are approximately 1,186 acres of spruce fir type immediately adjacent to the project area. These acres have similar characteristics (species composition and stand structure) to the stands found in the project area (Cote, 2008). The untreated stands outside and inside the project area were assumed to be the same as described in Alternative 1.

The untreated stands in Alternative 2 are the same as Alternative 1 since the there are no planned treatments in the stands adjacent to the Lake Fuels Project. The resulting anticipated changes to forest composition and structure are displayed in Figure 8. There are no cumulative impacts relative to spruce-fir and aspen stands being treated and regenerated.

- **Relationship between Short-Term Use and Long-Term Productivity**

Alternative 1

In the short-term, the change in relationship between short-term uses and long-term productivity would be manifested by changes in stand and landscape stocking, structure, and species composition described in direct, indirect, and cumulative effects above.

The recovery period to reach fully stocked stands following the spruce beetle epidemic would be approximately 70 years in spruce-fir stands. The recovery period is based on the age gaps found in the naturally occurring stands in the area that probably evolved after a spruce beetle epidemic 300 to 400 years ago. The aspen/spruce and the aspen/mixed conifer stands would be similar but without disturbance aspen composition would be reduced.

In the absence of site disturbance or planting, spruce would regenerate slowly and composition would shift to predominantly subalpine fir. The structural stage of the affected stands would shift to either young or mid-aged. The recovery of the mature spruce structural component may take over 150 years.

Alternative 2

Managed stands grow faster over time than unmanaged stands. Planting trees, stocking control to reduce competition and improve growth of individual trees, and intermediate treatments to maintain health and vigor of stands would maintain the long-term productivity of forest stands. Reforestation would shorten the time to attain a fully stocked stand (five years or less). The shortened recovery time is due to a combination of natural and planted regeneration. The proposed treatments should minimize loss of mature spruce from the spruce beetle; retaining the mature structural component now and into the future.

- **Irreversible/Irretrievable Commitment of Resources**

Alternative 1

Irreversible commitments are those that cannot be reversed (extinction of a species or removal of mined ore), except perhaps in the extreme long term (restoration of an old growth-forest). Loss of mature and old forest structures from the spruce beetle epidemic or catastrophic wildland fire occur within the project area may be an irreversible commitment of the vegetation resource under Alternative 1 (No Action); 150 to 300 years could be required to restore these structures.

Loss of aspen clones would be an irreversible commitment of resources as clones continue to decline due to age and fail to regenerate or are lost to conifer competition.

Irretrievable commitments are those that are lost for a period of time. The loss of salvageable material and its associated economic value would be irretrievable.

Alternative 2

There should be no irreversible or irretrievable commitments of vegetation resources as a result of either of the action alternatives. Timber harvest would change plant succession, stand development, and species composition but the stands would eventually recover.

- **Forest Plan Consistency**

Alternative 1

Alternative 1 may not be consistent with Forest-wide direction to manage suitable timberlands for harvest; provide for timber stand improvement, reforestation, and wildlife habitat improvement; and provide for multiple uses (FP p. III-25).

Alternative 1 is not consistent with Forest-wide direction to manage the aspen type in a condition of high productivity through commercial or noncommercial treatments, with the goal of maintaining or increasing the aspen communities toward historic conditions (FP p. III-2 and III-8).

Alternative 1 would not be consistent with Forest-wide direction to: 1) Maintain a healthy forest by applying appropriate silvicultural treatments (FP p. III-3); 2) Reduce accumulated fuels to a tolerable risk (FP p. III-5); 3) Provides a level of protection from wildfire that is cost efficient, meets objectives of the management unit, considers the values of the resources threatened, considers the probability of occurrence, fuels, and environmental and social concerns of the area among other factors (FP p. III-42); and 4) Maintain fuel conditions which permit fire suppression forces to meet protection objectives for the management unit (FP p. III-43) (D.Cote, 2008, Forest Plan Consistency Checklist for Vegetation Projects).

Alternative 2

Alternatives 2 would be consistent with Forest Plan direction to manage suitable timberlands for harvest, provide for timber stand improvement, reforestation, and wildlife habitat improvement, and provide for multiple uses.

This alternative is also consistent with Forest-wide direction to manage the aspen type in a condition of high productivity through commercial or noncommercial treatments with the goal of maintaining or increasing the aspen communities toward historic conditions.

Alternatives 2 would be consistent with Forest-wide direction to: 1) Maintain a healthy forest by applying appropriate silvicultural treatments (FP p. III-3); 2) Reduce accumulated fuels to a tolerable risk (FP p. III-5); 3) Provides a level of protection from wildfire that is cost efficient, meets objectives of the management unit, considers the values of the resources threatened, considers the probability of occurrence, fuels, and environmental and social concerns of the area among other factors (FP p. III-42); and 4) Maintain fuel conditions which permit fire suppression forces to meet protection objectives for the management unit (FP p. III-43).

Alternative 2 would promote aspen, and treat harvest related fuels to reduce the potential for large wildland fires (D.Cote, 2008, Forest Plan Consistency Checklist for Vegetation Projects).

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