4
ENVIRONMENTAL CONSEQUENCES

Changes between Draft and Final EIS

General

- **Removed references to Unit 1 from tables and text.**
- **Corrections of typographical and data errors throughout the chapter.**

4.5 Infrastructure and Improvements

- **Clarified discussion of road maintenance to avoid confusion with reconstruction.**
- **Adjusted miles of roadwork to reflect elimination of Unit 1.**
- **Added keeping Road 80293 open to provide access to Table Top and Lym Lake in Alternatives 2 and 3.**

4.8 Wildlife

- **Minor changes to text to reflect fewer acres of disturbance as a result of eliminating Unit 1.**
- **Additional discussion on management indicator species**
- **Expanded discussion of effects on forest land birds.**

4.9 Fish and Aquatic Resources

- **Table 4.9.1 moved to Chapter 2, mitigation measures.**

4.10 Socioeconomic Setting

- **Expanded discussion of costs that were used in analysis.**
- **Changed Table 4.11.1 to display costs and benefits of current harvest.**
- **Added Table 4.11.2 to display PNV over 60-time period.**

4.12 Air Quality

- **New section.**

4

ENVIRONMENTAL CONSEQUENCES

4.0 Introduction

This chapter forms the scientific and analytic basis for the comparison of alternatives displayed in Chapter 2. It consolidates the discussions of the resource elements that are within the scope of the project and are necessary to support the comparisons. This chapter presents detailed, analytic predictions of the consequences of implementing the alternatives. These predictions include the direct, indirect, cumulative, and other effects of implementing the alternatives. Figure 4.0.1 defines the different types of effects.

Effects

Direct Effects are adverse or beneficial effects that are caused by the action and occur at the same time and place.

Indirect Effects are adverse or beneficial effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.

Cumulative Effects are the impacts that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions.

Other Effects include short term and long-term impacts to productivity, and irreversible or irretrievable commitment of resources. Irreversible commitments are those that result in loss of future options and apply primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time. Irretrievable commitments apply to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

Figure 4.0.1. Types of Effects. *This chapter presents detailed, analytic predictions of the consequences of implementing the alternatives.*

Resource discussions within this chapter are organized in the order that resources are listed within Chapter 3. Environmental consequences are described by alternative under each resource heading.

4.1 Soil and Water Resources

4.1.1 Introduction

This section discusses the impacts of each alternative on soil and water resources within the area of influence of the proposed project. Included within this discussion are a description of 1) potential effects to soil and water resources from post-fire logging and road construction; 2) site-specific direct and indirect effects to soil productivity and water quality, by alternative; 3) cumulative effects, and 4) the irretrievable and irreversible commitment of resources. The soil and water issues are concerned with the effects of the alternatives upon soil productivity and water quality. Effects are discussed in terms of their direct, indirect, and cumulative effects. For direct and indirect effects, the area of influence for both soil and water resources is the immediate area where the proposed activities would take place and includes the area within and below each of the harvest units, temporary roads and landings where erosion or sedimentation potential could affect the soil productivity.

Direct effects are effects caused by the action and occurring at the same time and place. Indirect effects are effects caused by the action but occurring either later in time or further removed in distance. Cumulative effects result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions that are not included in the Proposed Action. A sediment yield model called Disturbed WEPP is used to estimate soil erosion and sediment yield effects for the kinds of disturbances associated with each of the alternatives. The results are used to compare effects between alternatives.

■ Review of Research on the Potential Effects to Soil Resources from Post-Fire Logging, Timber Harvest, and Road Construction.

A description of potential effects from post fire logging is presented in a literature review by US Forest Service research (McIver and Starr 2000). In their publication the following information describes effects to soils and sediment yield, "The activity effects of greatest concern include soil disturbance, erosion, sediment yield, and water yield. Generally, data on activity effects of postfire logging are scanty and uneven, in part because few studies have been done and also because of the inherent difficulties in studying soil, sediment, and hydrological effects in the post fire environment. … Although we could find no studies that looked at the effects of post fire road building and use per se, it is likely that roads would contribute most to sediment production in the postfire environment, just as they do in unburned stand." These authors describe that researchers have found that sediment yield increases to be short-term with yields returning to pre-harvest levels after 3 to 4 years (McIver and Starr 2000, p.11); logging residue can mitigate some of the effects of logging, i.e., one study in eucalyptus by Shakesby and others (1996) showed that soil loss was reduced up to 95 percent (McIver and Starr 2000, p.15). In summary, there are few studies that actually isolate the effect of logging of burned timber to an unlogged control and there are many variables that influence erosion and sediment yield for which a clear cause and effect is difficult to explain (example in McIver and Starr 2000, p.16).

Temporary roads have the potential to modify natural drainage networks and accelerate erosion processes that may result in increased stream sedimentation, degraded aquatic habitats and altered channel morphology. Road impacts increase as they become more hydrologically connected to the natural channel network (Jones et al. 1996). Roads and their drainage systems typically act to intercept surface and subsurface runoff and route excess runoff into the channel system (Hauge et al. 1979, Megahan 1972), resulting in both increased stream flows (Harr et al. 1975) and increased sediment delivery to streams (Wemple et al. 1996). Especially in steep terrain, roads increase the rate of hill slope failures and soil mass wasting (Swanston et. al. 1976, Swanston 1991). Fine sediments can be delivered to natural streams by erosion of road surfaces as well as from non-vegetated road cut and fill surfaces (Reid et al. 1984). Roads impact aquatic habitats by limiting fish passage through culverts at road-stream crossings (Furniss et al. 1991) and increasing fine sediment in spawning gravels which in turn reduces dissolved oxygen levels and sub-surface stream flow and results in reduced spawning success by salmonids (Bjornn et al. 1991, Phillips et al. 1975). Some of the effects of roads can be mitigated by design changes that disperse, rather than concentrate road runoff by gravel surfacing (Burroughs et al. 1989, Furniss et al. 1991), seasonal road closures to protect roads without gravel surfaces from use during adverse weather, or by designating undisturbed protective buffers along streams to allow filtering of fine sediments (Roby et al. 1977). The effectiveness of streamside buffers generally increases with width, but the impacts of large-scale or chronic disturbances can still impact streams, even with relatively wide and intact buffer strips

□ 4.1.2 Soil Resource

This section describes the effects to soil resources from the proposed action and alternatives. Several terms are used in the discussion and their definitions are presented below.

Definitions

Compaction – The densification of soil particles when subjected to wheel or track loading by vehicles, equipment, animals, or humans. Susceptibility to compaction is most common in moist, medium textured soils subjected to loads greater than 7 pounds per square inch (Harris, 1971).

Rutting – The compression and shearing of soil structure under wet soil conditions, resulting in the total deformation of the soil particle arrangement. Susceptibility to rutting is greatest in very wet, very clayey soils and often accompanies the compaction process.

Displacement – The detachment and removal of soil particles by wind or water. Forested soils are usually well protected from erosive forces due to complete and effective ground cover in theses environments. If disturbed, the susceptibility of soil to accelerated erosion will depend upon inherent physical properties such as texture, structure, permeability, organic matter and rock content. Susceptibility is highest in medium textured, impermeable and structure less soils with low organic matter and rock content on steep slopes.

Organic matter displacement and removal occurs when litter, duff, and large woody debris is either destroyed or redistributed as a result of silvicultural treatments. Susceptibility of a soil to litter and duff removals depend upon inherent soil fertility as a function of existing amounts of organic matter.

Figure 4.1.1. Soils Definitions.

■ Method of Analysis

The method of analysis is a description of the likelihood of the direct effects of erosion, compaction, rutting and the indirect effects of loss of soil fertility. Included in the analysis is the a description and results of a model that is used to compare between alternatives the rates of soil erosion; and the effects of mitigation measures that are expected to reduce adverse effects to soil resources.

The Disturbed Water Erosion Prediction Project (WEPP) (Elliot et al. 2002) computer model was used to predict the amount of soil erosion that would be produced by each alternative. The WEPP model, like any model, has assumptions and the output is only an estimate. The model estimates are useful to provide context on the potential magnitude of the effects. This model is currently an accepted method of post-fire erosion prediction in the USFS scientific community and is being applied region-wide for salvage analysis.

The WEPP model has some limitations as described on page 12 of 27on the WEPP website (http://forest.moscowfsl.wsu.edu/4702/wepp0.html). It states that "Any predicted runoff or erosion value—by any model—will be, at best, within plus or minus 50 percent of the true value. Erosion rates are highly variable, and the models predict only a single value. Replicated research has shown that observed erosion values vary widely for identical plots. And for the same plot from year to year (Elliot and others 1994; Elliot and others 1995; Tysal and others 1999)."

The WEPP model predicts very large increases in sediment following moderate to high severity fire. Visual observations and measurement of sediment caught in sediment traps during the year following the fire indicate that large increases in sediment did in fact occur. Table 4.1.1 displays the cubic feet of sediment trapped by structures installed in three small unnamed tributaries of the east side of the East Fork of the Bear River. The drainage basins of these tributaries burned with high severity. The dams were primarily constructed out of straw bales anchored by steel posts during emergency BAER work in the summer of 2002. Tributary 1 drained private land that had previous timber harvest and road construction. Tributaries 2 and 3 were essentially undisturbed by past human activity. These structures were essentially filled with sediment by the fall of 2002.

Table 4.1.1. Sediment Traps (Sediment entrapment measured in 2003)

Unnamed East Fork Bear River Tributaries	Structure	Sediment Trapped (Cubic Feet)
1	Dam	72.5
1	Log	96.1
2	Lower Dam	34.8
2	Middle Dam	23.1
2	Log	12.7
2	Upper Dam	16.5
3	Lower Dam	61.2
3	Dam 2	15.3
3	Dam 3	53.2
3	Upper Dam	229.8
Total		615.3

Figure 4.1.2. Lower Straw Bale Dam in Unnamed Tributary (3June, 2003). *This sediment deposit is about 1.5 feet deep and was seeded with native seed mix. (Rone, 2003)*

Assumptions regarding WEPP Modeling and Soil Productivity and Sediment Yield Assessment are:

1. A buffer representing a 20-year old forest with 100% ground cover is used in the Watershed Erosion Prediction Program (WEPP) model to determine sediment yield from temporary roads where there is at least 130 feet of unburned vegetation in the buffer. No buffer strip is used where vegetation has been burned within the buffer strip.
2. Based on WEPP modeling of soil types in the analysis area, it is assumed that a fully vegetated buffer of about 70 to 200 feet will trap all sediment entering it.
3. For the purposes of this analysis detrimental soil erosion will be considered detrimental where it exceeds the value for allowable erosion losses for soils in the sale area. This value, also known as the "T" factor, has been established at 5 tons/acre for deep, moderately productive, well-drained soils (USDA-Natural Resources Conservation Service 1993) and (Erickson 1973).

☐ 4.1.2.1 Effects on Soils Common to All Alternatives

The activities mentioned under Alternative 1 would continue. In addition, activities proposed under this project would be initiated.

All alternatives would maintain long-term soil productivity within the defined activity units. This would be partially due to a decrease in erosion over the next 1 to 3 years and an increase in coarse woody debris over the next decade for replenishment and development of the soil surface fine organic matter layer within the analysis area. The erosion decrease is attributed to the increase of effective ground cover from the re-growth of the understory vegetation in the burned areas. In addition, implementation of Best Management Practices (BMPs), specific erosion control measures, the BAER rehabilitation work (associated with culvert replacement and fire line rehabilitation), road obliteration (including recontouring), and the soil stabilization measures in the fire area also decreased erosion.

As the burned areas revegetate, re-growth and the coarse woody debris (required as part of the mitigation) would provide a source of material for the development of the surface organic layer of the soils that was lost in the burn. Mitigation measures would also protect or replace the organic layers that may have been lost during ground disturbing activities associated with this proposed project (Rone 2003).

■ **Private Land Harvest**

Regardless of which alternative is chosen, salvage harvest on private lands is expected to occur. Information supplied by the landowner indicates that a maximum of 719 acres will be harvested from West Fork Blacks Fork and Mill Creek (Table 4.1.2 and Appendix A Map 2.6.2). Salvage activities proposed are similar to those proposed on National Forest lands, and will remove fire killed timber beginning in the fall of 2003. Total acres treated from both private and National Forest lands since 1950 are shown in section 4.8, Vegetation and Forest Resources, Table 4.8.3 and Appendix A Map 2.6.11.

Table 4.1.2. Private Land Proposed Harvest Units – All Alternatives. *Private land harvesting is expected regardless of which alternative is chosen..*

Proposed Private Salvage Units		
Watershed	**Unit**	**Acres**
West Fork Blacks	S23-1	46
	S23-2	4
	S23-3	4
	S23-4	12
WFB Total	**4**	**67**
Mill Creek	S27-1	11
	S27-2	15
	S29-1	45
	S29-2	142
	S29-3	40

Proposed Private Salvage Units		
Watershed	**Unit**	**Acres**
	S19-1	48
	S19-2	15
	S19-3	28
	S29-4	151
	S17-1	65
	S31-1	23
	S31-2	9
	S31-3	49
	S31-4	12
Mill Creek Total	**14**	**652**
Total	**18**	**719**

☐ 4.1.2.2 Alternative 1 (No Action)

■ Direct and Indirect Effects

Under Alternative 1, there would be no direct or indirect effects from salvage logging because no salvage logging would occur. There would be continued short-term erosion and sedimentation due to the 2002 East Fork Fire. Accelerated erosion due to the fire is expected to occur for several years and the WEPP model estimates that erosion would revert to pre-fire rates in about 20 years.

■ Cumulative Effects

The analysis area for cumulative effects on soil productivity is the area encompassed by the 2002 East Fork Fire burn perimeter. Past activities that have occurred in the area include previous timber harvest, past wildfire, grazing, and recreation use. Past timber harvest and wildfire, except the East Fork Fire, have very little effect because the ground cover and vegetation have recovered to adequately protect the soil. Effects of past and recent grazing include, but are not limited to narrow (less than 6 inches wide) trails and barren patches in pasture areas where animals, primarily sheep, concentrate during a short period (July through September) in the summer time. These areas are generally at higher elevations (9,000 to 11,000 ft) near timberline or on alpine benches (See Map 2.6.12, Appendix A). The reduction in ground cover due to grazing could cause erosion of topsoil with associated loss of productivity. However, the current impacts are minimal and ground cover potentials are within standards (85% of potential) (R. Zobell, personal communication, March 2003). Within the assessment area, grazing of cattle in the East Fork Bear River and sheep in Mill Creek and the West Fork Blacks Fork are ongoing and have not shown to cause degraded watershed conditions (Zobell 2004).

Motorized recreation is managed through the District Travel Plan and enforcement of the travel plan is expected to continue at current levels.

Of all of the activities that affect the productivity of the soils, the East Fork Fire has had the greatest effect. In the burned area, soil loss is expected to occur at an accelerated rate until vegetation establishes itself. This should occur in 3 to 10 years at which time ground cover would adequately protect the soil. Forest Plan Guideline (G4) for detrimental effects from severe burns is adapted from r4_2509.18-2002-1 Supplement to FSH 2509.18 and applies to prescribed fire and natural fires that are managed for resource benefits.

Under existing conditions, soil erosion has been greatly accelerated by severely burned soil conditions resulting from the 2002 East Fork Fire. For 50-year return period storms (2 percent probability of occurrence) on severely burned soils, loss tolerance values would be exceeded on areas occupied by nearly half of the proposed harvest units without harvest. The amount of erosion predicted for severely burned soils without salvage harvest is within soil loss tolerance values within the perimeters of proposed harvest units 4, 5, 7, 9, 10, 11, 13, 14, 19 and 21. Soil loss tolerances would be exceeded without salvage harvest following a 50 year storm within the perimeters of proposed salvage units 2, 3, 6, 8, 12, 15, 16, 18, 23, and 24.

The cumulative effects on soil resources could include a long-term loss in soil productivity where accelerated soil erosion on severely burned soils from a 50 year storm lead to some unacceptable losses in fertile topsoil. As vegetation re-establishes on severely burned soils over the next decade, soil erosion rates should return to pre-fire levels. Several 50-year type storm events would have to occur during this recovery period for soil productivity to suffer long-term reductions. Because of this, there is a very low probability that soil erosion losses in the interim would result in an unacceptable long-term loss of productivity under the No Action Alternative.

☐ 4.1.2.3 Alternative 2 (Proposed Action)

Within the analysis area, reasonably foreseeable future connected actions are a relocation of an existing ATV trail out of an ephemeral stream channel onto a side slope at least 50 feet away from the channel in Unit 1, and the decommissioning of 1.3 miles of existing road (Road 80299) in the upper end of East Carter Creek (See Map 4.6.1, Appendix A).

Silvicultural practices have the potential to cause short-term reductions in soil productivity by altering the ability of soils to support communities of native plants. Detrimental soil disturbances commonly associated with silvicultural practices are compaction, rutting, movement (erosion) of mineral soil, and displacement or removal of litter, duff, and large woody debris.

Several general effects would be expected under Alternative 2 (See Table 4.1.3 and Appendix A, Map 4.1.1). Some short-term (less than 3 years) impacts to the activity areas include increased effective ground cover in timber salvage units from logging slash, localized areas with decreased water infiltration and areas where the soil food web has been disrupted once ground-disturbing activities have occurred (primarily on main skid trails and temporary roads). Longer-term effects would include the reduction of standing snags that would contribute to future ground cover and woody debris. However, adequate woody debris is being retained to meet Forest Plan Standards and Guidelines.

■ Direct and Indirect Effects

Several factors affect the likelihood of erosion and sedimentation occurring from salvage logging. Based on literature review by McIver and Starr (2000, p.11) road building would be expected to produce the highest erosion rate and this is supported by the WEPP model that shows much greater rates of erosion for temporary roads than for skid trails or existing fire conditions. (See Tables 4.1.10 and 4.1.11 and Appendix A Map 4.1.3) Another main factor is the storm intensity. During small storms of low intensity, runoff and erosion from roads and skid trails is much higher than on undisturbed areas. During large storms of high intensity, runoff is likely to occur over the entire area and runoff and erosion on roads and skid trails created during logging is not much different than the undisturbed area (U.S. Forest Service. 2003; Thomas and Megahan, 1998). Other factors that affect sedimentation are the distance and the ground cover condition of the area between the erosion source and the water feature. The longer the distance and the greater the ground cover, the greater the potential to trap sediment before it reaches a water feature. The effectiveness of mitigation measures for erosion control is also related to storm intensity. Erosion control practices are most effective for low intensity storms and not for large storms that produce a lot of runoff. Observations at Snowbasin Ski Resort of water bars installed every 50 feet on steep, disturbed ski runs that had no vegetative cover showed that the water bars effectively captured runoff during low intensity storms but breached in some places during high intensity storms.

Unconsolidated material of the Tertiary Wasatch formation has created hummocky, unstable terrain due to a landslide within the proposed harvest unit 24 (See Map 4.1.5). Though the area seems to be locally active based on the depth of debris flows on the slope, the overall large scale activity appears to be limited based on two observations. First, the mature forest was able to grow on it. Secondly, a very active earth flow would push the cannel to the opposite side of the valley but the plan form of the channel is still nicely sinuous. Therefore, the slide is big enough that any temporary road construction is unlikely to cause massive reactivation (McKean, 2003). However, road problems can be anticipated in soft wet ground and whenever boundaries of compartments within and across the outside of the slide are encountered.

Mitigation measures were developed to reduce the potential for erosion on the skid trails and sediment movement from the harvest unit. Mitigation measures, such as prohibiting equipment operation on wet soils would reduce the incidence and magnitude of soil compaction and rutting and their indirect effect on soil productivity. Other mitigation measures such as ripping, seeding, slash placement and water barring would slow runoff, increase water infiltration, and enhance revegetation, helping to reduce soil erosion losses and to protect long term soil productivity and water quality. Site-specific mitigation measures include:

1. Temporary roads will avoid crossing wetlands.
2. Water bars will be installed every 200 feet on temporary roads except where noted under the specific units.
3. In units 3, 4, 9, 15, and 16, install cross trail water-bars on skid trails at 50-foot intervals where drainage will not occur naturally.
4. In units 6, 8, 10, 12, and 13, harvest activities will be restricted to the normal dry season or winter.
5. In unit 24, any temporary road on the old slide area will be located to avoid large cuts, drainage paths will require culverts with fill, and the temporary road will be fully recontoured after one season of use.

The direct effects on soil resources include detrimental soil disturbances such as compaction, displacement, and rutting. Proposed harvest unit 24 has less than an acre of compaction prone soils present within its perimeter. Soils susceptible to rutting are present in proposed harvest units 6, 8, 10, 11, 12, 13, and 21. Units 6, 8, 10, 12, and 13 are of most concern because of a greater extent of susceptible soils being present within the perimeter (refer to Table 3.4.2). Physical properties characteristic of soils susceptible to erosion displacement are found within harvest units 3, 4, 8, 9, 12, 15 through 18, and 21. Units 3, 4, 9, 15, and 16 have the greatest soil erosion related concerns, due primarily to the large amount of these units that contain severely burned soil conditions (Table 4.1.4). Unit specific details are outlined in Table 4.1.7.

Table 4.1.3. Soil Types Within Proposed Harvest Units – Alternative 2. *Several units contain more than one soil type. Acreages are from GIS layers in the project file; mapping units greater than 1 acre are included in the table (See Appendix A Map 4.1.1).*

Unit	Alternative 2 Unit Acres by Soil Type										
	221	**222**	**223**	**225***	**226**	**238**	**354**	**483**	**484****	**520**	**Total**
2					123				50		173
3								3	7		10
4							43		3		46
5							24				24
6			7			7					14
7			11								11
8			37			14					51
9			4			1					5
10				26		36	1				63
11						9					9
12						35					35
13				26		45		7			78
14								6			6
15				50				1			51
16				32				60		7	99
18			6								6
19				4							4
21			8			6					14
23	5	10							5		20
24		59									59
Total	5	69	73	138	123	153	68	77	65	7	778

* The difference between soil types 225 and 226 (Duschesne-Mirror Lake families assoc.) is based on percent slope. The acres shown on the soil type map 3.4.1 in Appendix A as 225 have slope percentages of 30% to 40% and should actually be mapped as soil type 226.

** The difference between soil types 483 and 484 (Embargo family) is based on percent slope. The acres shown on the soil type map as 484 have slope percentages of 10% to 40% and should actually be mapped as soil type 483.

Table 4.1.4. Burn Reflectance Within Proposed Harvest Units – Alternative 2. *All proposed units contain more than one reflectance level.*

Alternative 2 Acres of Burn Reflectance Within Harvest Units				
Unit	**High**	**Moderate**	**Low**	**Unburned**
2	44	52	53	26
3	6	4	0	0
4	2	10	26	8
5	0	7	12	5
6	1	4	7	2
7	2	4	4	1
8	20	24	7	0
9	0	4	0	1
10	9	15	35	4
11	1	3	4	1
12	16	9	8	2
13	6	25	32	14
14	0	0	6	1
15	41	5	5	0
16	85	11	3	0
18	4	2	0	0
19	2	1	0	1
21	7	5	2	0
23	5	9	5	1
24	45	2	12	0
Totals	296	196	221	67

The indirect effects on soil resources include a long-term loss in soil productivity where the additional detrimental soil disturbances from proposed activities lead to an unacceptable loss in fertile topsoil or alteration of soil hydrologic functions. As vegetation re-establishes on severely burned soils over the next 3 to 5 years, soil erosion rates should return to pre-fire levels. For soil productivity to suffer long-term reductions would require that several 50-year type storm events occur during this recovery period. Because of this, there is a very low probability that soil erosion losses in the interim would result in unacceptable amounts of topsoil losses.

Indirect effects on long-term soil productivity are disclosed below. Soil productivity is assessed by comparing 10-year and 50-year return period storm erosion/sediment yield rates, estimated in WEPP modeling for several different kinds of detrimental soil disturbances, to the "T" factor of 5 tons per acre. The results, found in Tables 4.1.10 and 4.1.11 show that:

- In the proposed harvest units, erosion and sediment yield rates would be reduced from the existing post fire condition rates where skid trails are established for timber removal. This is due to the compacting effect of the skidder tires that would make the soils less susceptible to erosion (U.S. Forest Service. 2003).
- For 10-year return period storms on skid trails (10 percent probability of occurrence), the amount of erosion predicted for skid trails is within the soil loss tolerance values in all harvest units.
- For 50-year return period storms on skid trails, soil loss tolerances would be exceeded for 29% of the harvest units. The amount of erosion predicted for skid trails is within the soil loss tolerance values in harvest units 2, 5, 6, 7, 8, 10, 11, 12, 13, 21, 23, and 24. Soil loss tolerances would be exceeded in units 3, 4, 9, 15 and 16. Erosion rates from these units are expected to be below tolerance values by installing cross trail water-bars at 50-foot intervals (Sayedbagheri, 1996, p. 18)

- For 50-year return period storms on temporary roads, sediment yield rate is expected to be higher on the 18 units with temporary roads and on landings that are constructed on all units. The results of the WEPP model indicate that sediment yield rate for temporary roads in individual harvest units range from 0.8 to 7.2 times the existing rates.

For Alternative 2, very little if any additional erosion is expected from skid trails during low intensity storm events for all of the harvest units during the 2 to 3 year period of harvesting. This is because skid trails tend to compact the soil that results in lower erosion rates than those under existing conditions and mitigation measures that require installation of water bars every 50 feet that should be effective in controlling runoff and erosion. The WEPP model reflects this for a 10-year event storm in that it shows a reduction in sediment yield rates from existing rates for skid trails on all units and no sediment yield for 17 of the 24 harvest units. For high intensity storms, some erosion is expected from skid trails and for most of the units the sediment yield rate would still be lower than existing rates because of the compaction of the soil from skidding. Compacted soil particles are less easily dislodged and moved off site (Personal communication between Paul Flood and Bill Eliott on July 10, 2003) (USDA Forest Service 2003d). This is reflected in the WEPP model in that for the 50 year-return period storms all units have lower sediment yield rates than existing conditions except Units 4 and 9 which have steeper slopes, no high severity burn areas, and the existing sediment yield rates are low.

During low intensity storm events, a very small amount of sediment yield may occur from most of the temporary roads because the bare soil on the road surface and shoulders and erosion would be reduced water by properly draining the temporary road through construction of appropriately placed drainage dips or culverts and slash filter strips placed along roads that have small buffer between the road an a stream would capture most of the sediment from the road (Sayedbagheri, 1996, p. 47). During high intensity storms, much high rate of sediment yield is expected from the road surface than the existing ground surface and additional sediment would occur at the drainage points along the road. Also during high intensity storms, sediment is expected to occur throughout the watershed and the added contribution of sediment by temporary roads would be small compared to the sediment produced in the watershed.

■ **Cumulative Effects**

Past activities that have occurred in the area are previous timber harvest, past wildfire, grazing, and recreation use. Past timber harvest and wildfire, except the East Fork Fire, has very little effect on the proposed action because the ground cover and vegetation has recovered to adequately protect the soil. Motorized recreation is managed through the Mountain View and Evanston District Travel Plan (2003b) and enforcement of the travel plan is expected. Several roads and trails are located in the analysis area. The roads have water bars, culverts, and most are properly drained and very little sediment is reaching stream channels. Currently, the only accelerated erosion that is occurring from past timber harvest is from a few small sections of old roads where water runs across or down the road.

The proposed action is expected to reduce soil productivity on temporary roads, landings, and skid trails temporarily for about 3 years. The cumulative effects on soil productivity from the past, present and reasonably foreseeable activities are very small and are not expected to cause detrimental effects to soil resources. The percent of soils affected by detrimental impacts within timber salvage units is 6.3% (Calculated using 45.1 acres of disturbance from Table 4.1.9 and 4.5 acres of temporary roads divided by 781 total salvage acres).

■ **Irretrievable and Irreversible Commitment of Resources**

Temporary roads represent a temporary commitment of the ability of the soil resource to support vegetation communities. This irretrievable loss of the soil resource would occur until the road is restored to productive condition.

☐ 4.1.2.4 Alternative 3

The general effects described in Section 4.1.1.3 under Alternative 2 would also apply to Alternative 3.

■ **Direct and Indirect Effects**

The direct and indirect effects of Alternative 3 would be less than Alternative 2 because no temporary roads would be constructed under this alternative (See Table 4.1.5 and Appendix A, Maps 4.1.2 and 4.1.4). Based on research, roads cause the highest rates of sediment yield. In addition to eliminating temporary roads, some units have been eliminated or reduced in size because access is impractical without temporary roads (See Table 4.1.8). For low intensity storms, very little if any sediment yield would occur from skidding and, based on the WEPP model, would most likely be less than existing conditions because of the same mitigation applied as in Alternative 2. For high intensity storms, some erosion is expected from skid trails and for most of the units the sediment yield rate would still be lower than existing rates because of the compaction of the soil from skidding. Compacted soil particles are less easily dislodged and moved off site (Personal communication between Paul Flood and Bill Eliott, July 10, 2003). The percent of soils affected by detrimental impacts within timber salvage units is estimated at 6.0%. (This estimate is based on skid trails and landings occupying about the same percentage of ground as those under Alternative 2, but without including any temporary road construction).

Table 4.1.5. Soil Types Within Proposed Harvest Units – Alternative 3. *Several units contain more than one soil type. Acreages are from GIS layers in the project file; mapping units greater than 1 acre are included in the table (See Appendix A Map 4.1.2).*

Unit	Unit Alternative 3 Acres by Soil Type										
	221	**222**	**223**	**225***	**226**	**238**	**354**	**483**	**484****	**520**	**Total**
2					115				39		154
3								3	7		10
5							24				24
6			7			7					14
7			11								11
8			37			14					51
9			4			1					5
10				26		36	1				63
11						9					9
12						35					35
13				26		45		7			78
14								6			6
16				32				60		7	99
19				4							4
21			8			6					14
23	5	10							5		20
Total	5	10	67	88	115	153	25	76	51	7	597

* The difference between soil types 225 and 226 (Duchesne-Mirror Lake families assoc.) is based on percent slope. The acres shown on the soil type map 3.4.1 in Appendix A as 225 have slope percentages of 30% to 40% and should actually be mapped as soil type 226.

** The difference between soil types 483 and 484 (Embargo family) is based on percent slope. The acres shown on the soil type map as 484 have slope percentages of 10% to 40% and should actually be mapped as soil type 483.

Table 4.1.6. Burn Reflectance Within Proposed Harvest Units – Alternative 3. *All proposed units contain more than one reflectance level.*

Alternative 3 Acres of Burn Reflectance Within Harvest Units				
Unit	**High**	**Moderate**	**Low**	**Unburned**
2	40	45	46	23
3	6	4	0	0
5	0	6	12	6
6	1	4	7	2
7	2	4	4	1
8	20	24	7	0
9	0	4	1	0
10	9	15	35	4
11	1	3	4	1
12	16	9	8	2
13	6	25	32	15
14	0	0	6	0
16	85	11	3	0
19	2	1	0	1
21	7	5	2	0
23	5	9	5	1
Totals	200	169	172	56

■ **Cumulative Effects**

The proposed action is expected to reduce soil productivity on temporary roads, landings, and skid trails temporarily for about 3 years. The incremental effect of Alternative 3 is similar to that of Alternative 2, but would affect 2.0 acres less than Alternative 2.

□ 4.1.3 Water Resources

This section describes the direct, indirect and cumulative effects to water resources from each of the alternatives. The main issues for water resources are the effects to water quality particularly sedimentation of streams, lakes, and ponds.

■ **Method of Analysis**

The method of analysis is a description and an assessment of the likelihood of the direct and indirect effects of sedimentation on water quality. The analysis includes the a description and results of the WEPP model that is used to compare between alternatives the rates of sedimentation; and the effects of mitigation measures that are expected to reduce sedimentation.

The Disturbed Water Erosion Prediction Project (WEPP) (Elliot et al. 2002) computer model was used to predict the amount of sedimentation that would be produced by each alternative. The assumptions and limitations that are described for the WEPP model under Methods of Analysis under Methods of Analysis for Soil Resources in Section 4.1.2 apply for this analysis.

□ 4.1.3.1 Effects on Water Resources Common to All Alternatives

As described in Section 4.1.2.1 Effects on Soils Resources Common to All Alternatives, activities would continue to occur under the no-action alternative that include a decrease in sedimentation in the next few years of areas affected by the East Fork Fire due to installation of erosion control measures and increased organic matter and ground cover; possible short-term sedimentation from private land harvest units.

As described in 3.4.12, water yield increases due to past timber harvest and fires are negligible. There will be increased water yields from effects of the East Fork Fire over about 15 years with the higher amounts likely in the first few years, depending on precipitation events. This increase is unlikely to be measurable in the larger drainage.

Salvage harvesting under Alternatives 2 or 3 is unlikely to have any measurable cumulative effect on water yields since the salvage is only removing dead or dying trees and the areas affected have already been burned. A review of watershed research on water yield by Troendle and Nankervis (2000) has shown that studies have shown similar responses in stream flow from fire as in timber harvest.

☐ 4.1.3.2 Alternative 1

■ Direct and Indirect Effects

Under Alternative 1, there would be no direct or indirect effects from salvage logging because no salvage logging would occur.

■ Cumulative Effects

Cumulatively, the no-action alternative would have no effect on water quality resources because no salvage logging would occur.

Table 4.1.7. Summary of Water Features Related to Proposed Harvest Units in Alternatives 2 and 3. *Proposed harvest units are evaluated based on their proximity to streams, lay of the land, ground slope, and density of vegetation in buffer areas.*

Harvest Unit		Distance to Stream (feet)	Remarks
No.	Slope (%)		
East Fork Bear River drainage			
2	20 - 40	50’ to a category 4 stream	Most of the lower end of the unit is located just above the main road to the Boy Scout Camp. About 2000’ along the lower end is about 500’ from the East Fork Bear River. The remaining 8,400’ along the along the bottom of the unit is up to 2000’ from the East Fork Bear River. The water from the southern part of this unit would flow into Forest Road 057 drainage ditches and into existing detention ponds located in the Boy Scout Camp.
3	20	1,100’ to a category 4 stream	This unit is located about 200’ above Unit 2, and about 2600’ from the East Fork Bear River. It is situated on a flatter part of the slope below an existing road. The flow path below the unit is same as the southern part of Unit 2.
Mill Creek drainage			
4	18 - 40	100’ to a category 2 stream	Unit is located in the very headwaters of Carter Creek and an unnamed drainage that flows into a marsh area above Deadman Creek about 1.5 miles below the unit. About 800’ along the east edge of the unit is near Carter Creek and about 400’ of the unnamed stream is within the unit. Carter Creek and the unnamed creek are shown as perennial on the topographic map. However, the unnamed creek was dry within the unit all of the summer of 2003. Most of the unit is on the flatter part of the slope but the slope below the unit is steep, up to 80% gradient.
5	24 - 40	500’ to a category 4 stream	Unit is located on the flatter part on the nose of a ridge at the head of Carter Creek.
6	18 - 40	100’ to a category 1 stream	The east side of the unit drains into a meadow area with beaver ponds in it. Lower part is about 560’ from the first beaver pond. Mill Creek flows near the west side of the unit for about 500’ with the main road into Mill Creek located on

Harvest Unit		Distance to Stream (feet)	Remarks
No.	Slope (%)		
			the west side of the stream. The slope to the west of the road and the slope on the very east side is about 40%. Below the east half of the unit is a meadow area on a 7% slope.
7	22	2,500’ to a category 1 stream	This unit is located about 1,700 feet above the beaver pond described in Unit #6. The slope below the unit has about 30% gradient for about 400’ then becomes very flat before entering the drainage in the east half of Unit #6.
8	13 - 32	500’ to a category 1 stream	The distance from the unit to Mill Creek is about 500’ on the southern end and about 1,200’ toward the northern end. There is a no harvest buffer along a category 2 stream between 8A and 8B. Most of the unit has about 27% slope gradient. Between the unit and Mill Creek, small depressions are located in the south part and a flat densely vegetated valley bottom extends 500’ before reaching Mill Creek.
9	36	100’ to a category 2 stream	This unit is located on a 36% slope above a wide flat area. The lower edge of the unit is just above the very uppermost end of an unnamed perennial tributary of Mill Creek.
10	12	1,200’ to a category 2 stream	The lower edge of the unit is about 1,200 to 2,200’ from a perennial stream.
11	20	65’ to a category 2 stream	The very southern end of the unit is near a perennial tributary of Mill Creek. Most of the drainage from the unit is about 1,000’ above the perennial tributary.
12	28	65’ to a category 2 stream	Between the unit and Mill Creek is 600’ of flat densely vegetated valley bottom. The northwest edge of the unit is adjacent to the perennial tributary for about 1,000’, but most of the drainage from the unit is into Mill Creek.
13	6 - 40	160’ to a category 2 stream	Most of the unit is above a flat meadow area. The northeast part of the unit is located on part of this flat area. The shortest distance from the unit to a stream is 160 feet in a low gradient area that has lightly burned or unburned depressions and riparian and wetland areas. The northeast part of the unit is the steepest and drains into the low gradient part.
14	24	200’ to a category 2 stream	The lower point of the unit is about 200’ from Mill Creek.
15	30 - 36	200’ to a category 2 stream	The lower edge of the unit is near Mill Creek for about 700’. There is an intermittent stream channel near the south side of the unit.
16	30 - 46	100’ to a category 4 stream	The lower end of the unit varies from 100’ to 300’ from Mill Creek for about 3,700’. The stream flows only part of the year in this area. There is an intermittent stream channel near the north side of the unit but most of the drainage flows to Mill Creek.
18	23	100’ to a category 2 stream	The lower part of the unit is near a tributary of Mill Creek for about 1,900’. The maximum slope length is about 300’.
19	25	1,200’ to a category 2 stream	Unit is located on the upper slope. The slope percent approaches 40% on the northern end.
West Fork Blacks Fork drainage			
21	9	1,800’ to a	The upper half of unit is located on a low 9% slope. The

Harvest Unit		Distance to Stream (feet)	Remarks
No.	Slope (%)		
		category 1 stream	lowest part of the unit is located about 2,000' west of West Fork Blacks Fork. Lower half of unit is just below the flat part on a 24% slope. This slope extends for about 900' to the densely vegetated valley bottom that extends at a 5% slope for about 1,470' to the West Fork Blacks Fork.
23	7 - 33	1,700' to a category 1 stream	The upper 200-300' of the unit has a 33% slope while most of the unit has a 20% slope. From the lower edge of the unit to the West Fork Blacks Fork channel is a vegetated valley bottom that extends at a 5% slope for about 1,700'. A small portion of the northern part of the unit drains into a flat meadow that has beaver ponds about 500' north of the bottom edge of the unit.
24	11 - 25	500' to a category 1 stream	Most of the unit has a 9% slope while the middle part and along the lower edge of the unit has a 25% slope. Between the lower edge of the unit and the West Fork Blacks Fork channel is 500' of densely vegetated valley bottom meadow. About 2,100' of south edge of the unit is about 100' from a tributary to the West Fork Blacks Fork of which about 200' within the south edge of the unit would drain into this tributary. The tributary drain into the same meadow described in Unit 23 and is about 1700' long before reaching the West Fork Blacks Fork channel. The unit is very hummocky and has many small depressions that create ponds and densely vegetated wet meadow areas that have no flow to very little flow out of them.

Note: Slope gradient was determined bymeasuring contour lines on topographic maps. Unit layout would eliminate slopes over 40%, except for short pitches up to 150 feet.

☐ 4.1.3.3 Alternative 2

■ Direct and Indirect Effects

Within the analysis area, reasonably foreseeable future connected actions are a relocation of an existing ATV trail out of an ephemeral stream channel onto a side slope at least 50 feet away from the channel in Unit 1, and the decommissioning of 1.3 miles of existing road (Road 80299) in the upper end of East Carter Creek. The effect of this would be a small amount of short-term erosion when decommissioning takes place and a long-term reduction of accelerated erosion that could occur from these roads and trails.

The direct effect of harvesting on water resources is the temporary diversion of surface and upper ground water from the compaction of temporary roads, landings and skid trails with roads and landings creating the greatest alteration in flow. The indirect effect of harvesting on water resources is the sedimentation of streams caused by erosion of roads, landings, and disturbed soils on skid trails and the movement of the eroded soil in to streams.

Table 4.1.8 and Map 2.3.2, Appendix A, display the miles of temporary roads and the units they would access.

Table 4.1.8. Summary of Temporary Road Construction Related to Proposed Harvest Units in Alternative 2.

Alternative 2 Temporary Roads		
Watershed	Unit	Miles
	2	0.5
	3	0.2
East Fork Total		**0.7**
Mill Creek	4	0.9
	5	0.0
	6	0.0
	7	0.2
	8	0.0

Alternative 2 Temporary Roads		
Watershed	**Unit**	**Miles**
	9	0.0
	10	0.2
	11	0.0
	12	0.0
	13	0.0
	14	0.0
	15	0.3
	16	0.4
	18	0.3
	19	0.0
Mill Creek Total		**2.4**
West Fork Blacks	21	0.2
	23	0.7
	24	0.5
West Fork Total		**1.5**
Analysis Area Total		**4.6**

Under Alternative 2, skid trails and particularly temporary roads would divert surface flow from the ground surface. For skid trails, surface runoff would be captured by skid trails and water would flow down the skid trails. For temporary roads and landings, surface runoff would be deflected and concentrate the flow along the road and into road drainage structures such as rolling dips or culverts. Runoff from the surface of temporary roads and landings would drain off the side of the road or onto the fill slope. Table 4.1.9 displays the estimated total disturbed acres resulting from skid trails and landings in Alternative 2.

Based on the discussion in the soils effects section, during low intensity storms, very little erosion is expected from skid trails, temporary roads, or landings. To ensure that the small amount of sediment that could move from the skid trails, temporary roads, or landings does not reach a stream, the buffer zone between these features and streams were reviewed for their effectiveness in reducing sediment movement. Aerial photos and topographic maps were used to assess the characteristics such as density of vegetation, slope gradient, and burn condition of the pathway between the streams and the skid trails, temporary roads, and landings.

For low intensity storms, very little if any sediment delivery to a stream is expected because many units have a dense well-vegetated buffer that would drop out sediment that enters it. For harvest units that are located adjacent to streams, the mitigation measure of prohibiting skidding operations or other ground disturbing activities at the hydrologic break or within 100 feet of the stream should provide a buffer strip to reduce the likelihood of sediment reaching the stream. Those units that have a small buffer between temporary roads and a stream, the mitigation measure of placing a slash filter strip just below the road fill slope is expected to greatly reduce the likelihood of sediment delivered to the stream channel. Research shows that the slash filter strip reduces sediment by about 80 percent (Foltz and Elliot 2003). During a field trip on October 15, 2003 to review harvest operations on private land within the East Fork Fire area, branches and slash were pushed on the ground by the equipment and small depressions were created that result in greater ground cover and surface roughness. In the undisturbed area very little of the logs and branches were actually resting on the ground surface. For high intensity storms, it is likely that some sediment would reach streams that have temporary roads, landings, or skidding operations close to the streams and that don’t have a dense vegetated buffer

The WEPP model provides an estimate of sediment yield from skidding, temporary roads and landings. The estimate of sediment yield from skidding and the estimate of sediment yield from temporary road building and landings are looked at individually because the process and rates of sedimentation from the two types of activities are very different. The analysis considers the proximity of the harvest unit and roads to streams and the buffering capacity of the area between the harvest units or temporary road and a stream. Mitigation is applied to those units that do not have an adequate unburned buffer between the bottom of the unit and the stream to prevent sediment from being delivered to the stream.

- For temporary roads, many units have sufficient existing buffer strips in place to trap all of the sediment that is predicted by the WEPP model.

- The temporary roads in Units 15, 16, and 18 would either cross streams or would be close to streams. Without mitigation, there is a high probability of sediment reaching the stream channel. There would be an expected

80% reduction in sediment delivery to these streams with installation of slash filter windrows at the toe of the temporary road fill slope (Foltz and Elliot 2003).

- Units 4, 6, 8, 11, 12, 14, and 18 are close to streams. Without mitigation, there is a high probability of sediment from skidding operations reaching the stream channel. Sediment delivery would be reduced by applying mitigation prohibiting skidding operations or other soil disturbing activities within buffer strips along these streams. The width of buffer strips would be as follows:
    - Along fish bearing streams, the buffer strip would be established at 300 feet from the stream or along the natural hydrologic break, whichever is less, but not less than 100 feet.
    - Along non fish bearing perennial streams, the buffer strip would be established at 100 feet from the stream or along the natural hydrologic break, whichever is less.
    - Along ephemeral and intermittent channels, the buffer strip would be established at 50 feet from the stream or along the natural hydrologic break, whichever is less, unless a site specific review by the ID Team determines that lesser or greater distance is required.

The results of the WEPP model for sedimentation rates are shown in Tables 4.1.10 and 4.1.11 for the existing condition and the alternatives. The sediment yield weighted average represents the average rate of sediment yield for each harvest unit from skid trails and landings, temporary roads, and the remainder of the harvest unit. The total at the bottom of each alternative represents the average sediment yield for all of the harvest units for each alternative for these same activities.

There is very little difference between each of the alternatives, especially when one considers that the model prediction of runoff or erosion will be, at best, within plus or minus 50 percent of the true value. He similar values make sense since the amount of area that is within skid tails and landings and in temporary roads is small compared to the entire harvest unit. Because of this, the sediment yield rate of the existing condition represented by Alternative 1 carries the most of the weight of the sediment yield weighted average. Although the sediment yield rate of the temporary roads is higher than the sediment yield rate of the harvest unit, the amount of area is very small and does not contribute very much to the overall sediment yield rate for the entire harvest unit. On the other hand, most of the skid trails and landings have lower sediment yield rates than the harvest unit but would slightly lower the sediment yield of the entire harvest unit because of the small area of the skid trails and landings compared to the entire harvest unit. There area a couple of exceptions to this in harvest units 4 and 9 and this is because these units have a large area of low burn severity where the skid trails and landings would have a higher rate of sediment yield than the existing condition of the harvest unit. Because of the East Fork Fire, most of the harvest units have sediment yield rates that are higher than the skid trails or landings.

The difference in the weighted average sediment yield between the 10-year and 50-year average annual storms is the amount of sediment that would occur from the two storm intensities. The 10-year average annual storm would result in about one-third of the rate of sediment yield of the 50-year average annual storm. Again, similar to the 50-year average annual sediment yield rates, there is little difference in average annual sediment yield rates between alternatives for the 10-year average annual sediment yield rates. The model shows that there is even less difference between alternatives in sediment yield rates in the 10-year than in the 50- year average annual sediment yield rates.

The model shows that sedimentation rates for the existing condition would be higher than Alternatives 2 and 3. The sediment yield rates have been modeled prior to any mitigation measures or best management practices being applied to reduce the amount of sedimentation. A reduction in sedimentation is expected from Alternatives 2 and 3 because the timber harvest activities would break up the bare ground surface and create small depressions and push slash and branches into the ground surface resulting in more ground cover and surface roughness that would be able to catch sediment. Mitigation measures would reduce sediment delivery to streams or ponds by providing buffer strips or slash filter strips that would trap sediment. It is estimated that slash filter strips would reduce sedimentation by 85 percent and since these would be placed below temporary roads that cross slopes horizontally, runoff from skid trails, landings, temporary roads and from the harvest units themselves would be intercepted by slash filter strips and reduce sedimentation form the harvest unit areas.

Table 4.1.9. Acres of Disturbance Related to Proposed Harvest Units in Alternative 2. (See Appendix A, Map 3.4.2)

Alternative 2 Harvest Unit Disturbance						
Watershed	**Proposed Unit**	**Landings (Number)**	**Landings (Acres)**	**Skidtrails (feet)**	**Skidtrails (Acres)**	**Total Dist. (Acres)**
	2	7	3.5	10,900	2.50	6.0
	3	2	1.0	1,100	0.25	1.3
East Fork Total		9	4.5	12,000	2.75	7.3
Carter Creek	4	3	1.5	3,100	0.71	2.2
	5	1	0.5	500	0.11	0.6
Carter Creek Total		4	2.0	3,600	0.83	2.8
Mill Creek	6	3	1.5	1,500	0.34	1.8
	7	3	1.5	1,800	0.41	1.9
	8	5	2.5	4,200	0.96	3.5
	9	1	0.5	800	0.18	0.7
	10	4	2.0	6,400	1.47	3.5
	11	2	1.0	1,000	0.23	1.2
	12	2	1.0	2,600	0.60	1.6
	13	4	2.0	3,900	0.90	2.9
	14	1	0.5	1,600	0.37	0.9
	15	2	1.0	5,000	1.15	2.1
	16	3	1.5	5,700	1.31	2.8
	18	1	0.5	1,000	0.23	0.7
	19	1	0.5	500	0.11	0.6
Mill Creek Total		32	16.0	36,000	8.26	24.3
West Fork Blacks	21	4	2.0	3,600	0.83	2.8
	23	4	2.0	4,700	1.08	3.1
	24	6	3.0	8,000	1.84	4.8
West Fork Total		14	7.0	16,300	3.74	10.7
Total	**20**	**59**	**29.5**	**67,900**	**15.58**	**45.1**

Table 4.1.10. Summary of sediment yield for each alternative for 50-year annual storm.

Unit #	Area (acres)				Sediment Yield (t/ac)						Sediment Yield Weighted Ave (t/ac)		
					Alternative 1	Alternative 2			Alternative 3		Alternative		
	Alt 2 Unit Acres	Alt 3 Unit Acres	Skid Trail and Landing Acres	Temp Road Acres	Unit[1] Tons/Acre	Unit[1] Tons/ Acre	Skid Trail & Landing Tons/ Acre	Temp Roads Tons/ Acre	Unit[1] Tons/ Acre	Skid Trail & Landing Tons/ Acre	1 Tons/ Acre	2 Tons/ Acre	3 Tons/ Acre
2	176	154	6.0	1	7.3	7.3	4.8	16.4	7.5	4.8	7.3	7.3	7.4
3	10	10	1.3	0.4	4.1	4.1	0.6	19.4	4.1	0.6	4.1	4.3	3.6
4	46	----	2.2	1.8	2.7	2.7	5.8	19.4	----	----	2.7	3.5	----
5	24	24	.6	0	3.8	3.8	3.5	0	3.8	3.5	3.8	3.8	3.8
6	14	14	1.8	0	6.0	6.0	4.5	21.5	6.0	4.5	6.0	5.8	3.8
7	11	11	1.9	0.4	5.0	5.0	1.6	22.0	5.0	1.6	5.0	5.0	4.4
8	51	51	3.5	0	7.7	7.7	1.7	22.0	7.7	1.7	7.7	7.3	7.3
9	5	5	0.7	0	4.5	4.5	7.4	0	4.5	7.4	4.5	4.9	4.9
10	63	63	3.5	0.4	3.0	3.0	0	17.3	3.0	0	3.0	2.9	2.8
11	9	9	1.2	0	5.1	5.1	1.1	0	5.1	1.1	5.1	4.6	4.6
12	35	35	1.6	0	12.9	12.9	4.2	0	12.9	4.2	12.9	12.5	12.5
13	78	78	2.9	0	5.2	5.2	4.2	0	5.2	4.2	5.2	5.2	5.2
14	6	6	0.9	0	2.6	2.6	1.6	0	2.6	1.6	2.6	2.5	2.5
15	51	----	2.1	0.6	19.4	19.4	6.6	15.4	----	----	19.4	18.8	----
16	99	99	2.8	0.8	19.2	19.2	5.7	16.7	19.2	5.7	19.2	18.8	18.8
18	6	----	0.7	0.6	10.6	10.6	2.1	22.0	----	----	10.6	10.7	----
19	4	4	0.6	0	4.2	4.2	0.7	15.4	4.2	0.7	4.2	3.7	3.7
21	14	14	2.8	0.4	4.0	4.0	0	21.7	4.0	0	4.0	3.7	3.2
23	20	20	3.1	1.4	5.8	5.8	1.0	22.0	5.8	1.0	5.8	6.2	5.1
24	59	----	4.8	1	9.2	9.2	0.7	22.0	----	----	9.2	8.7	----
Total	**781**	**597**	**45.0**	**8.8**						**Total**	**8.8**	**8.7**	**8.1**

Note: Sediment yield weighted average assumes that all skid trails and landings and temporary roads would be constructed within harvest unit.
[1]Unit Tons/Acre represents the sediment produced from the acres within units not occupied by skid trails, landings, and temporary roads.

Table 4.1.11. Summary of sediment yield for each alternative for 10-year annual storm.

Unit #	Area (acres)				Sediment Yield (t/ac)						Sediment Yield Weighted Ave (t/ac)		
					Alternative 1	Alternative 2			Alternative 3		Alternative		
	Alt 2 Unit Acres	Alt 3 Unit Acres	Skid Trail and Landing Acres	Temp Road Acres	Unit[1] Tons/Acre	Unit[1] Tons/ Acre	Skid Trail & Landing Tons/ Acre	Temp Roads Tons/ Acre	Unit[1] Tons/ Acre	Skid Trail & Landing Tons/ Acre	1 Tons/ Acre	2 Tons/ Acre	3 Tons/ Acre
2	176	154	6.0	1	3.0	3.0	0	16.4	3.1	0	3.0	3.0	3.0
3	10	10	1.3	0.4	3.8	3.8	0	19.4	3.8	0	3.8	3.9	3.3
4	46	----	2.2	1.8	2.0	2.0	1.8	19.4	----	----	2.0	2.6	----
5	24	24	.6	0	2.3	2.3	0.4	0	2.3	0.4	2.3	2.3	2.3
6	14	14	1.8	0	4.4	4.4	0	21.5	3.7	0	4.4	3.8	3.2
7	11	11	1.9	0.4	4.0	4.0	0	22.0	4.0	0	4.0	4.0	3.3
8	51	51	3.5	0	6.8	6.8	0	22.0	6.8	0	6.8	6.3	6.3
9	5	5	0.7	0	3.0	3.0	2.0	0	3.0	2.0	3.0	2.9	2.9
10	63	63	3.5	0.4	1.6	1.6	0	17.3	1.6	0	1.6	1.6	1.5
11	9	9	1.2	0	3.4	3.4	0	0	3.4	0	3.4	2.9	2.9
12	35	35	1.6	0	10.3	10.3	0	0	10.3	0	10.3	9.8	9.8
13	78	78	2.9	0	3.2	3.2	0	0	3.2	0	3.2	3.1	3.1
14	6	6	0.9	0	1.4	1.4	0	0	1.4	0	1.4	1.2	1.2
15	51	----	2.1	0.6	15.5	15.5	0.8	15.4	----	----	15.5	14.9	----
16	99	99	2.8	0.8	17.2	17.2	3.1	16.7	17.2	3.1	17.2	16.8	16.8
18	6	----	0.7	0.6	5.2	5.2	0	22.0	----	----	5.2	6.2	----
19	4	4	0.6	0	1.3	1.3	0	15.4	1.3	0	1.3	1.1	1.1
21	14	14	2.8	0.4	1.4	1.4	0	21.7	1.4	0	1.4	1.7	1.1
23	20	20	3.1	1.4	2.3	2.3	0	22.0	2.3	0	2.3	3.3	1.9
24	59	----	4.8	1	4.4	4.4	0	22.0	----	----	4.4	4.3	----
Total	**781**	**597**		**8.8**						**Total**	**6.1**	**6.0**	**5.7**

Note: Sediment yield weighted average assumes that all skid trails and landings and temporary roads would be constructed within harvest unit.
[1]Unit Tons/Acre represents the sediment produced from the acres within units not occupied by skid trails, landings, and temporary roads.

■ Cumulative Effects

For cumulative effects, the areas of influence for water resources are the watersheds that drain from the harvest areas. Specifically these are the East Fork Bear River drainage to the confluence of the Hayden Fork, the Mill Creek drainage to the confluence of the North Fork Mill Creek, and the West Fork Blacks Fork to the confluence of the East Fork Blacks Fork.

Past activities that have occurred in the area are previous timber harvest, past wildfire, grazing, and recreation use. Past timber harvest and wildfire, except the East Fork Fire, has very little effect on the proposed action because the ground cover and vegetation has recovered to adequately protect the soil. Motorized recreation is managed through the District Travel Plan and enforcement of the travel plan is expected.

Several roads and trails are located in the analysis area. The roads have water bars, culverts, and most are properly drained and very little sediment is reaching stream channels. There are two main fords that cross Mill Creek and cause some sedimentation of the stream. One of the fords that cross Mill Creek would be closed when an access road on private land is built that would bypass the ford. The other ford is across an ephemeral channel in upper Mill Creek and is dry most of the year when access is open to it. The driving surface has been narrowed and culverts have been installed on several road segments in order to reduce road erosion and allow water to pass under the roads.

Currently, the only accelerated erosion that is occurring from past timber harvest is from a few small sections of old roads where water runs across or down the road. There is very little evidence that sediment is reaching a stream channel because sediment is deposited in the vegetation beside the road as it leaves old road surfaces. Most of the old timber roads have good ground cover and no accelerated erosion is occurring.

Livestock grazing has caused soil erosion in the analysis area, primarily in the early 1900s. Currently, small areas of erosion caused by livestock occur on trails and bare areas in meadows where animals concentrate during the summer. Although some erosion does occur from livestock grazing, the amount of area is very small and evidence of sediment reaching stream channels is at the few trails that lead to stream channels.

Wildfire has burned through portions of the analysis area in the 1980s and in the early 1990s and vegetation has grown back. These areas have adequate ground cover and have no evidence of accelerated erosion. The East Fork Fire in 2002 burned a large amount of area of the analysis area leaving bare ground and hydrophobic soil conditions and accelerated erosion has occurred after a few thunderstorm events that have occurred since the fire. These storm events have caused some rills to form on the hillsides and storm-water carried in the ephemeral drainages of the upper watershed have carried some sediment and ash down the channels and deposited this material in the dense vegetation on stream banks and on bars along the creek. During the first couple of storm events, water in the channel has become very turbid from the ash that is carried by the water. One thunderstorm during the summer of 2003 lasted about 0.5 hours and caused water to become very turbid for about 1.5 hours after which the flow dropped to pre-storm levels and the water became clear again. The potential for accelerated erosion due to the East Fork Fire could continue for another 5 to 20 years until vegetation grows back.

Of all the past, present, and reasonably foreseeable future activities in the cumulative effects analysis area, the East Fork Fire of 2002 has the greatest potential for accelerated erosion and sedimentation. Many areas that were burned from the East Fork Fire of 2002 has very little ground cover and logs and branches that remain has very little contact with the ground surface. In the short-term, there is very little ground cover that would reduce sediment movement during storm events. In the burned area, sedimentation is expected to occur at an accelerated rate until vegetation establishes itself. This is should occur in 3 to 10 years at which time ground cover would adequately protect the soil.

As an example of effects that are expected from East Fork Fire a storm event occurred in the upper part of Mill Creek watershed on August 12, 2003. Around noon, rainfall occurred for about 30 minutes dropping about one-half inches of rain. The storm occurred mainly in the upper watershed of two forks that are located above a meadow. The flow in the dry channel of the south fork peaked about 6.0 cubic feet per second (cfs) and the flow in the perennial channel of the east fork increased to a peak of about 3.7 cfs. For the duration of the runoff that lasted about 1.5 hours, the water in both channels turned a dark-brown color due to ash that was carried by the water. The water became clear again after the runoff from the storm passed. In addition to ash, water carried sediment down the channel that was deposited on small, low-gradient floodplains and behind beaver dams that are located about one mile downstream of the meadow. In the near future, it is likely that after rain storms, the amount of turbidity would decrease as less ash is available and becomes assimilated in the soil.

Most of the past activities have little effect on the water quality of the analysis area as indicated by water sampling that shows that water quality standards have been met in these waters since 1993 when water samples have been collected at regular intervals as part of a cooperative program between the USFS and the State of Utah. The East Fork Fire has a great potential for increasing erosion and sedimentation because of the large area that was burned. Within each of the proposed timber harvest units, the potential for accelerated erosion and sedimentation from the East Fork Fire is expected to be equal to or greater than the proposed timber harvest activities, particularly when considering the mitigation measures that would be in place to reduce the effects of the proposed timber harvest. Cumulatively, the proposed timber harvest is not expected to increase erosion and sedimentation in the analysis area.

■ Irretrievable and Irreversible Commitment of Resources

No irretrievable or irreversible commitment of water resources is expected from this alternative because water would be protected from sediment delivery from the creation of skid trails, temporary roads, and landings through installation of erosion and sediment control structures and establishment of buffer zones.

□ 4.1.3.4 Alternative 3

■ Direct and Indirect Effects

The direct and indirect effects of Alternative 3 would be less than Alternative 2 since no temporary roads would be constructed under this alternative. Based on research, roads cause the highest rates of sediment yield. For low intensity storms, very little if any sediment yield would occur because the only ground disturbance would be from skidding and landings. Having water bars located along skid trails and a buffer of 100 feet between skid trails and a stream is expected to result very little if any erosion from reaching the stream. Landings would be located along existing roads and if the landings are close to streams a slash filter strip would be installed to inhibit sediment from reaching a stream and it is expected that very little if any erosion would reach the stream. For high intensity storms, some sediment may reach a stream particularly those units that are located close to a stream without much of a buffer zone. It is expected that slash filter strips would capture most sediment before it would reach a stream or other water body.

■ Cumulative Effects

The cumulative effects for Alternative 3 would be similar to Alternative 2 but without 4.9 miles of temporary roads. No measurable difference in sedimentation is expected between Alternatives 2 and 3 because the mitigation measures that would be in place under Alternative 2 would effectively prevent sedimentation from temporary roads to streams or ponds.

■ Irretrievable and Irreversible Commitment of Resources

No irretrievable or irreversible commitment of water resources is expected from this alternative because water would be protected from sediment delivery from the creation of skid trails, and landings through installation of erosion and sediment control structures and establishment of buffer zones.

■ 4.2 Scenic Resources

□ 4.2.1 Introduction

Direct effects are effects caused by the action and occurring at the same time and place. Indirect effects are effects caused by the action but occurring either later in time or further removed in distance. Cumulative effects result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions that are not included in the Proposed Action.

☐ 4.2.2 Alternative 1

■ Direct and Indirect Effects

As described in Chapter 3, Scenic Resources section, the East Fork Fire and other fires are visible in the foreground, middle ground and background viewing distances from many of the travel ways and high use areas within and adjacent to the project area. The scenic effects of these fires were most obvious directly after the fires took place. The blackened trees and forest floors, red-needled trees, and exposed ground surfaces (from fire suppression efforts) were most noticeable at that time. Since then, however, some of the effects of the fires have already dissipated. For example, the majority of the red-needled trees have dropped their needles, and many blackened ground surfaces have flushed with the new green growth of grasses, forbs and young brush. In many locations, the East Fork wildfire reduced the visual contrasts created between old harvest units and the surrounding uncarpeted forest. The fire created large patch sizes that are more characteristic of naturally occurring vegetation patterns, and over time, these landscape-scale patterns would improve the scenic quality of the area.

In approximately ten to fifteen years, standing dead trees (snags) would rot and fall down, creating a variety of visual effects across the landscape. In locations where the fire burned hottest, killing many trees, large openings would be created. In areas with mixed fire severity, where not all of the trees were killed, a mosaic pattern with patchy openings would be visible.

As time passes, stands of young tree seedlings would reestablish themselves across the landscape. These young trees would likely go unnoticed for the first five years but as they grow in size, they would become a thick, green, mat of trees visible in the foreground, middle ground and background from many viewpoints. In 40 to 50 years, these young stands would become young trees 40 to 50 feet in height and the landscape would begin to take on the appearance of a maturing forest. Several locations within the project area burned very intensely during the East Fork fire. Young trees may reestablish more slowly in these areas because soils were damaged during the fire as seen in part of the Boy Scout fire. In these locations, the scenic recovery of a forested condition would be much longer than 40 to 50 years.

Trees that are weakened by fire, but not killed, are more susceptible to attack by insects and disease. Insects and diseases would create patches of mortality in the surrounding forest that did not burn in the wildfire. These patches would initially appear as clusters of red-needled trees or scattered red-needled individuals. Red needles, visible on dead trees, are often dropped within one to two years after they appear and in the long-term, these dead trees would appear as patches of dead, gray-barked trees.

In the winter, the starkness of the stands of dead timber against the backdrop of white snow will emphasize the openness and extent of the burned area. In the non-winter months the greens, grays and browns of the seasons will reduce the visual contrast of the burned trees and the forest floor. As young stands of trees grow up and replace the burned forest, the scenic effects would lessen over time.

Continued and increased soil erosion and stream sedimentation would also be a result of Alternative 1. Soil erosion creates exposed ground surfaces that take a long time to revegetate. These areas can be obvious on the landscape and are often seen as patches of lightly colored, raveling soils with scattered weeds and other vegetation growing on them. Soil sedimentation problems and poor road drainage and structure also create negative scenic effect in the immediate foreground such as poor road surfaces, ruts, and exposed soils where old culverts may have washed out.

☐ 4.2.3 Alternative 2

This alternative would have short and long-term effects on scenic integrity and the landscape character. Harvest unit design criteria and mitigation measures would be required to reduce short-term negative scenic impacts. The long-term effect would be the same as alternative 1.

Table 4.2.1. Landscape Character Theme and Scenic Integrity Objectives for Alternative 2 Units in the East Fork Fire. *Individual units may have more than one Landscape Character Theme and Scenic Integrity Objective, depending upon the location of the unit.* (See Appendix A, Map 4.3.1)

Unit Number	Landscape Character Theme	Scenic Integrity Objective	Acres by Alternative	
			Alt 2	Alt 3
2,4,6,18,19	Natural appearing	High	172	139
2,3,4,5,6,7,8,9,10,11, 12,13,14,15,16,18,19, 21, 23,24	Natural appearing	Moderate	609	458

■ **Direct and Indirect Effects**

The visual effects of timber harvest activities in Alternative 2, as viewed in the foreground and middle ground from travels ways during the short term would place all units in a scenic integrity of High (see figures 2.3.5 and 2.3.6, Map 4.2.1). The effects to the texture of landscape from the salvage would leave a number of small diameter standing and down dead trees, large snags, and scattered unburned tree to mimic the surrounding wildfire affected forest. Temporary roads and skid trails would be evident during the salvage operation. Their effects will diminish over time as re-contouring and re-vegetation efforts take place.

☐ 4.2.4 Alternative 3

This alternative would have short and long-term effects on scenic integrity and the landscape character. Harvest unit design criteria and mitigation measures would be required to reduce short-term negative scenic impacts. The long-term effect would be the same as alternative 1.

■ **Direct and Indirect Effects**

Alternative 3 would have the same effects as alternative 2 other than the there would be no temporary roads constructed (See Appendix A, Map 4.2.1).

☐ 4.2.5 Cumulative Effects of All Alternatives

Any change to the scenic resource from proposed alternatives would be in addition to past activities and this analysis includes all past and present effects.

■ **Timber Harvest Activities**

Past timber harvest is an obvious part of the viewed forest landscape in the project area, especially, as one moves along the forest travelways within and around the project area. Some of the private timber harvest units appear as large square openings on the landscape while others appear to have a more meandering effect and blend more easily with surrounding unharvested forest areas. Since many of these older openings do not mimic inherent vegetative patterns on the landscape, they have a Low scenic integrity. The East Fork Fire burned across many of these allocated Low scenic integrity areas, greatly reducing the visual contrast between harvested and unharvested areas. As fire-killed trees fall down over time, the visual contrast would become even less evident. Effects of this natural evolution would be seen in Alternative 1. The proposed timber harvest units in Alternatives 2 and 3 would reduce this contrast more quickly by physically removing vegetation rather than waiting for it to fall down. While all alternatives would show an improving trend in scenic integrity in areas of Low Scenic Integrity, these improvements would occur faster because of timber harvest activities in Alternatives 2 and 3.

■ **Road Maintenance**

Open forest roads in the project area would continue to be maintained in the future. These activities include improving road and surface drainage, clearing of roadside vegetation, and repair and maintenance of culverts. Scenic effects of this type of work are short-term and often go unnoticed because they are considered part of the landscape by casual forest visitor.

■ **Burned Area Emergency Rehabilitation (BAER)**

Watershed stabilization techniques proposed by the BAER team were implemented after the wildfire to protect life, property, and resource values in the project area. These stabilization activities had short-term scenic effects noticed primarily as areas of ground disturbance. These disturbances are already recovering and improving the landscape integrity. Soil and watershed stabilization proposals in alternative 2 and 3 would have similar positive effects on scenic integrity.

■ **Roadside and Area Weed Treatments**

The treatment of weeds with herbicide is an ongoing activity on the Wasatch-Cache National Forest. Scenic effects of weed treatment are specific to those areas treated and overall improve the scenery by allowing natural forest vegetation and grasses to re-establish. Herbicide use for site preparation would also be performed in the project area. These treatments aid young seedlings in establishing themselves after planting.

■ **Post Fire Tree Planting**

Where natural regeneration of burned areas is absent or insufficient, tree planting would occur. Immediately following planting, these areas would continue to appear unforested. Within ten years, a thick mat of trees would be noticed and within 40 to 50 years, these young seedlings would grow into thick young forests.

4.3 Heritage Resources

4.3.1 Introduction

Direct effects are effects caused by the action and occurring at the same time and place. Indirect effects are effects caused by the action but occurring either later in time or further removed in distance. Cumulative effects result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions that are not included in the Proposed Action.

4.3.2 Effects Common to All Alternatives

The effects of the East Fork Fire, along with the cumulative effects previous land use and increased recreational use of the Forest have left several historical sites at potential risk for vandalism, theft, and site disturbance. The fire-removed vegetation that once covered artifacts and developments associated with historic land uses.

4.3.3 Alternative 1

Alternative 1 would have no direct or indirect effects on heritage resources.

4.3.4 Alternatives 2 and 3

Both alternatives have the same direct and indirect effects for heritage resources.

■ **Direct and Indirect Effects**

Eleven known heritage sites are located within or directly adjacent to harvest unit boundaries. Five known heritage sites are located within four of the proposed harvest units while six heritage sites are located immediately adjacent to harvest units (Table 4.3.1). One site is a prehistoric lithic scatter while the other ten are historic sites associated with early tie hack activities or later logging of the area. Although not formally evaluated for the National Register of Historic Places (NRHP), all sites will be treated as eligible for the NRHP as under agreement with the State Historic Preservation Office.

Table 4.3.1. Heritage Sites Within or Adjacent to Proposed Harvest Units

Site number	Site type	Location to unit	Site number	Site type	Location to unit
42 SM 1	Lithic scatter	Within unit	42 SM 364	Sawmill	Adjacent
42 SM 106	Sawmill	Within unit	42 SM 370	Sawmill	Within unit
42 SM 107	Sawmill	Within unit	42 SM 371	Tie hack cabins	Adjacent
42 SM 351	Tie hack cabin	Adjacent	42 SM 372	Tie hack cabins	Adjacent
42 SM 353	Tie hack cabin	Adjacent	42 SM 420	Sawmill	Within unit
42 SM 354	Sawmill	Adjacent			

☐ *Mitigation Measures*

These eleven known heritage sites will be protected by a 50-foot no-activity buffer zone. No harvesting, skidding, or yarding would be permitted within the site boundaries. Trees would be directionally felled away from the no activity zone to avoid site disturbance.

In the event that heritage sites are discovered during these surveys, they will be considered eligible to the NRHP and protected and avoided during harvest following the mitigation measure outlined above for the known sites.

Additional mitigation measures would be to ensure that any artifact or structure located during reconnaissance or project implementation would be left undisturbed and reported to the Forest Archaeologist immediately. Timber sale contract provisions require that purchasers shall protect all known and identified sites from destruction, obliteration, removal or damage during purchaser's operations, and that discovery of any objects or areas by either the Forest Service or purchaser shall be promptly reported.

■ Cumulative Effects of All Alternatives

Desired condition for the Western Uintas Management Area in the Revised Forest Plan is to continue inventory efforts to identify and record all American Indian and early European sites, particularly mining locations, in the area. The local and regional history associated with the tie hack sites would be developed and appreciated. Interpretive brochures and/or trails would be developed in coordination with designation of a historic tie hack district.

Several tie hack sites are located immediately adjacent to well-used roads and trails and the impact of visitors is noticeable at these easily accessible sites. The sites are "clean" compared to lesser visited sites in the sense that the majority of the historic artifacts (i.e., bottles, cans, pottery, etc.) are absent from easily accessible sites. The effects of the East Fork Fire may affect the ability to achieve the Desired Future Condition in both beneficial and adverse ways. The fire burned many tie hack buildings and flammable structures. Destruction of these sites occurred before they were thoroughly recorded so any information that we may have collected from the flammable artifacts is lost. In addition, the fire also burned off much of the ground cover that protected the site, both from the weather as well as from human eyes. These previously hidden artifacts are now visible and easily collected by visitors to the site.

Beneficially, the effects of the East Fork Fire increased the monitoring of these sites both by Wasatch-Cache staff and the education of the local public. By recording the burned remains of the tie hack sites, we have gathered information that would be helpful when creating an interpretive plan.

■ 4.4 Roadless Resources

☐ 4.4.1 Introduction

Although no activities are proposed in roadless areas, vegetation management and temporary road development are proposed in areas near roadless in Alternatives 2 and 3. Two issues were identified that expressed concern over the potential effects that the alternatives may have on these resources.

☐ 4.4.2 Effects on Roadless Areas

■ Effects Common to All Alternatives

There are no actions proposed in any of the roadless areas under any Alternative. Routine trail maintenance on existing trails would be the only activity that would be anticipated.

Because of the size, shape, topography and geographic relationship between the roadless areas and adjacent developed areas, all of the alternatives, including Alternative 1 could potentially provide various levels of disturbance to the natural integrity, apparent naturalness, or remoteness of roadless within the project area.

☐ ***Natural Integrity***

The natural integrity of roadless areas could be affected by the potential for increased wildfire severity due to past fire suppression inside and outside of the roadless areas.

The potential for noxious weed spread from adjacent developed areas would also remain common to all alternatives, although this would vary in magnitude by alternative. Despite noxious weed control efforts proposed on land outside of the roadless areas in the action alternatives all roadless areas would remain at some risk to weed spread.

☐ ***Unique and Special Features***

The protection of unique and special features would remain similar through all alternatives. Because no actions would be proposed within the roadless areas, existing cultural and heritage sites, unique vegetation communities and patterns, and geologic formations would be left in their present status. The removal of surface litter in burned roadless may expose heritage sites that were previously not visible.

☐ ***Cumulative Effects***

The effects of past, ongoing, and reasonably foreseeable actions in and adjacent to roadless areas would continue to affect the roadless resource to varying degrees. Previously created harvest units and roads outside of the roadless areas on National Forest System lands and private lands would continue to be seen from vista points from within the roadless areas. The effects of these activities would diminish over time as vegetation within harvest units matured, and the linear appearance of roads was softened with vegetation growth.

Noxious weed spread along established trails, and from adjacent infested areas (via wind, water, wildlife, and human movement) would likely continue to be a risk to natural habitats within roadless areas. Weed treatments proposed under the action alternatives would reduce the potential for spread onto roadless areas from adjacent harvest units and roads.

■ 4.5 Infrastructure and Improvements

☐ 4.5.1 Introduction

Direct effects are effects caused by the action and occurring at the same time and place. Indirect effects are effects caused by the action but occurring either later in time or further removed in distance. Cumulative effects result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions that are not included in the Proposed Action.

☐ 4.5.2 Effects Common to Alternatives 1, 2 and 3

Table 3.8.1 in Chapter 3 displays the existing roads and motorized trails in the analysis area. Transportation related activities associated with Alternatives 2 and 3 generally would include: reconditioning or maintenance of roads to meet Best Management Practices (BMP) and Soil and Water Conservation Practice (SWCP) standards, road scarification and stabilization, road recontouring, road entrance closures (using gates, barriers, and entrance obliteration). Although road development and management activities are proposed at varying degrees and scales to meet the objectives of each alternative, many of these activities are common to all of the alternatives so that the overall effect would provide a transportation system that reflects access needs and responds to resource concerns. Roads proposed to remain open to motorized traffic would have adequate surface drainage and drainage structures such as culverts, drain dips, or outsloped or insloped roadway surface, and gravel surfacing where needed to reduce maintenance costs and provide water quality protection.

The following provides general definitions of the road development and management activities, including BMPs, which would occur in Alternatives 2 and 3 (except Temporary Road Construction which would only occur in Alternative 2). For further information on using BMPs and SWCPs, refer to Appendix II of the Revised Forest Plan. Table 4.6.1 displays proposed road work by Alternative.

Table 4.5.1. Alternative Summary Comparison of Road Work

	Alternative 1 (miles)	Alternative 2 (miles)	Alternative 3 (miles)
Road Pre-Use Maintenance	0	19.8	11.9
Road Yearlong Restrictions (Gated)	6.2	6.2	6.2
Open Roads	92.2	90.9	90.9
Motorized Trail Relocation	0	0.4	0
Temporary Road Construction	0	4.9	0
Road Decommissioning	0	1.3	1.3*

*Dependent on appropriated dollars.

■ Road Maintenance

Maintenance activities would involve drain dip construction and surface drain installation, culvert armoring, minor culvert installation and replacement, catch basin reshaping, road side brushing, surface grading, and road surface seeding. The intention of this treatment is to maintain the existing road features and to bring roads into compliance with BMP standards. Annual road maintenance funds would provide for costs associated with this work.

Under Alternatives 2 and 3, the timber sale purchaser would complete maintenance of roads as identified and appraised for in the Timber Sale Contract. The Forest Service would maintain those roads not used for timber sale activities in Alternatives 2 and 3. Costs associated with performing this work would be provided for by appropriated funds.

Table 4.5.2. Alternative Summary Comparison of Road Maintenance (See Appendix A, Map 3.7.1)

Road Maintenance By Alternative			
Road Name	Road Number	Maintenance (mi)	
		Alt 2	Alt 3
East Carter Cr.	295	2.9	0
Mill Creek	061	5.6	5.6
West Fork	063	4.8	0
North Slope	058	5.8	5.8
Mill Creek	290	0.5	0.5
Total		19.6	11.9

■ Travel Restrictions

The recently approved Mountain View – Evanston Ranger District Travel Plan identified roads that will be restricted or closed to protect resources, while providing public access for dispersed recreation. That document identified 17.2 miles of existing roads that will be closed in

Mill Creek and Blacks Fork watersheds (Travel Plan Table II-1d). Travel will be restricted on one currently open road in the East Fork Analysis Area, the West Fork Blacks Fork Road 80063. Public motorized vehicle travel on the upper 1.7 miles will be prohibited by the installation of a gate (See Map 3.7.1, Appendix A). The road prism will remain accessible year long to administrative motorized vehicle use but not to public use. Gate installation will be completed by the Forest Service, funded by annual Program Maintenance Funds. All district employees report any gate violations they find while in the field. Most gate violations occur during the elk and deer big game hunting seasons. During these hunting seasons, law enforcement and other district personnel do extra gate patrol. During the general season, there is continuous patrol coverage.

A planned timber salvage sale on private land offers an opportunity to eliminate a ford across Mill Creek that introduces sediment into the stream channel. Under Alternatives 2 and 3, ½ mile of Forest Road 80293 (that was closed under the Mountain View and Evanston District Travel Plan (2003b)) would be opened to provide a connection to a private road in Section 29 for public access from Mill Creek to Lym Lake and Elizabeth Ridge (see Map 4.5.1). The private landowner would decommission the private road with a ford across Mill Creek that presently provides that access.

■ Road Decommissioning

There are road closures planned in the East Fork Fire Analysis Area that were identified in the Mountain View / Evanston Districts Travel Plan. Activities associated with road closures would depend on the proposed closure level. Road treatments typically include BMP work as shown in Table 4.5.3. Grass seed and fertilizer would be applied to the road surface, cut slopes and fill slopes at approved rates. The intention of this treatment is to improve water infiltration, and revegetate the road surface, cut slopes, fill slopes and shoulders with grass to improve erosion control and prevent weed spread. This treatment would be performed on these roads because they are not intended to be used immediately, or receive very light use, and because the surfaces of these roads lack vegetation reestablishment (e.g. grass, brush, young trees). Costs associated with performing this work would be provided for by appropriated watershed restoration funds. Where the proposed road treatment is to increase BMP effectiveness on roads with existing closure levels greater than Closure Level 2, nonmotorized traffic use patterns may be disrupted due to scarification and slash strewn across the roadway.

One proposed road closure is associated with this project. Road 80299 (1.3 miles) is proposed to be closed using Closure Level 4 (See Map 4.5.1, Appendix A) under Alternative 2.

Table 4.5.3. Road Closure Level Definitions

Closure Level	Closure Device	Best Management Practice
1	Gate	-Blade, seed, and fertilize. -Normal drainage Best Management Practices. -Treat noxious weed.
3	Recontour intersection or rock/earth barrier	-Waterbar or outslope. -Remove culverts & restore watercourse. -Rip 6-12”, seed, fertilize -Scatter slash on slopes -Treat noxious weeds
4	Recontour intersection or rock/earth barrier	-Waterbar, outslope or selective Recontour. -Remove culverts & restore watercourse. -Rip 12-18”, seed, fertilize. -Scatter slash on slopes. -Treat noxious weeds.
5	Recontour	-Recontour entire prism. -Remove culvert and restore watercourses. -Seed and fertilize.

Closure Level	Closure Device	Best Management Practice
		-Scatter slash on slopes. -Treat noxious weeds.

■ Road Density

The average existing road density on Forest Service lands within the Project Area boundary is 1.06 miles/mile^2 (miles of road per square mile of land). This calculation includes all Arterial, Collector, and Local road systems, regardless of their condition. The road density for all roads within the Analysis Area (private and National Forest) is 1.26 miles/mile^2. Table 3.8.2 displays road densities on National Forest System Lands within the Project Area boundary. Decommissioning of road 80299 would result in a slight decrease in road densities under Alternatives 2 and 3 as displayed in Table 4.5.4.

Table 4.5.4. Road Densities (miles/mile^2 (mi/mi^2)) within the East Fork Salvage Project Area. Road density is calculated by dividing the miles of road in the analysis area by the total square mile area of the Analysis Area.

Ownership	Alternative 1	Alternatives 2 and 3
NF Road Density	1.06	1.05
All Lands Road Density	1.26	1.25
NF Open Road Density	0.99	0.98
All Lands Open Road Density	1.20	1.19

■ Temporary Road Construction (Alternative 2 only)

Roads built for temporary use would be constructed to a minimal standard to provide access for harvesting equipment and log trucks. The lengths of temporary roads and the units they would access are shown in Chapter 2, Figure 2.3.7 and Chapter 4, Table 4.1.8. As part of the initial road clearing, slash removed from the right-of-way would be placed in a windrow below the excavated soil so that it can be replaced over the recontoured surface. The road prism would remain on the ground for less than one season (during timber harvest) and would be fully recontoured immediately following use. Recontouring efforts would include replacing overburden back onto the road prism to return the ground to its natural contour, placing slash and woody debris upon the disturbed area, and grass seeding and fertilizing. The timber sale purchaser would perform construction and recontouring work. Work would be appraised for in the Timber Sale Contract (See Map 2.3.2, Appendix A).

■ Sign Installation

To ensure that the public is able to navigate through the Forest and discover local destinations, basic route numbering and directional signs have been placed at road intersections as part of implementing the Travel Plan. This is an ongoing activity that will continue for at least another year. Alternatives 2 and 3 will require installation of safety signs to warn motorists of heavy truck traffic.

□ 4.5.3 Alternative 1

■ Direct and Indirect Effects

Under Alternative 1, no road construction, temporary or system, on National Forest lands would occur. Closing of the private land ford across Mill Creek will eliminate access to Elizabeth Ridge and Lym Lake from the west, but access will still be available from the east.

□ 4.5.4 Alternative 2

■ Direct and Indirect Effects

This alternative would include road work applied in locations where maintenance is necessary to protect or restore resources. Road maintenance work would occur on approximately 19.8 miles of road within this alternative. Timber sale activities would complete all of the maintenance. Approximately 4.6 miles of temporary road would be constructed to provide access to proposed timber harvest units. Road 80299 would be decommissioned.

Road maintenance would bring 19.8 miles of road up to standard and would maintain generally good access throughout the area. Closure of Road 80299 would eliminate costly maintenance needs on that road. A very limited amount of motorized recreational access would be lost.

Adding road 80293 to the system would eliminate the ford across Mill Creek and thereby reduce a source of sediment into the stream. Road 80293 would provide the access to Elizabeth Ridge and Lym Lake that is currently provided by the ford, so no access to that recreational area would be lost.

☐ 4.5.5 Alternative 3

■ Direct and Indirect Effects

Alternative 3 is similar to Alternative 2 in that maintenance work would be completed on existing system roads used to access timber. However, eliminating some of the units would preclude timber sale associated maintenance on the West Fork Blacks Road and the East Carter Creek Road. A total of 11.9 miles of reconstruction would be completed with this alternative. No temporary roads would be constructed with this alternative.

Road maintenance would bring of 11.9 miles of road up to standards and would maintain generally good access throughout the area.

Adding road 80293 to the system in place of the ford would have the same effects as with Alternative 2.

☐ 4.5.6 Cumulative Effects Common to All Alternatives

None of the alternatives would have much long-term effect on the infrastructure of the Analysis Area. In the short term, temporary roads would increase the road density during the time they are open. However, they would be obliterated and covered with slash upon completion of harvesting and would not affect the road density for more than one or two years.

Maintenance and culvert replacement on Forest Road 80290 under Alternatives 2 and 3, and the accompanying bypassing and eliminating the Mill Creek ford will reduce sediment delivery into Mill Creek. This will therefore reduce existing impacts from motorized traffic and improve motorized access from Mill Creek to Elizabeth Ridge.

The Mountain View / Evanston District Travel Plan Decision (2003b) has reduced road density within this analysis area to an acceptable level while maintaining and improving the opportunities for loop routes for recreational access. Closure of Road 80299 under Alternatives 2 and 3 would provide a slight further reduction in road density with very little effect on recreational access.

■ 4.6 Vegetation and Forest Resources

☐ 4.6.1 Introduction

The environmental consequences are arranged by issue groups where public issues have been combined with similar internal issues. Tables 4.6.1 and 4.6.2, and Maps 2.3.2 and 2.3.3 in Appendix A which provide a summary of the harvest activities under Alternative 2 and Alternative 3, help illustrate the effects of the alternatives discussed in the remainder of this section. The "salvage" harvest activities are those salvage harvests that would resemble, visually and structurally, even aged silvicultural systems such as clearcuts with reserve trees, seed tree seed cuts with reserve trees, and shelterwood seed cuts with reserve trees. Silvicultural prescriptions are located in the East Fork Fire Salvage EIS project file.

Cumulative effects analysis assesses the impact of the proposed activities combined with anticipated impacts from past and reasonably foreseeable future activities. Past harvest activities are presented by decade in Table 4.6.3, and the reasonably foreseeable future harvest activities are presented in Table 4.6.4. Data in Tables 4.6.3 and 4.6.4 have been summarized in

Chapter 3, but are presented here in more detailed form.

Table 4.6.1. Alternative 2 Harvest Activities *(See Map 2.3.2, Appendix A)*

Salvage Units – Alternative 2				
Watershed	**Unit Number**	**Acres**	**Estimated Volume Per Acre (CCF)**	**Estimated Unit Volume (CCF)**
	2	176	11	1,903
	3	10	14	140
East Fork Total		**186**		**2,043**
Carter Creek	4	46	4	184
	5	24	4	96
Carter Creek Total		**70**		**280**
Mill Creek	6	14	16	224
	7	11	4	44
	8	51	4	204
	9	5	4	20
	10	63	8	504
	11	9	6	54
	12	35	6	210
	13	78	4	312
	14	6	12	72
	15	51	34	1,734
	16	99	16	1,584
	18	6	20	120
	19	4	12	48
Mill Creek Total		**432**		**5,130**
West Fork Blacks	21	14	10	137
	23	20	18	360
	24	59	22	1,298
West Fork Total		**93**		**1,795**
Alternative Total		**781**		**9,248**

Table 4.6.2. Alternative 3 Harvest Activities *(See Map 2.3.3, Appendix A)*

Salvage Units – Alternative 3				
Watershed	**Unit Number**	**Acres**	**Estimated Volume Per Acre (CCF)**	**Estimated Unit Volume (CCF)**
	2	154	11	1694
	3	10	14	140
East Fork Total		**164**		**1,834**
Carter Creek	5	24	4	96
Carter Creek Total		**24**		**96**
Mill Creek	6	14	16	224
	7	11	4	44
	8	51	4	204

Salvage Units – Alternative 3				
Watershed	**Unit Number**	**Acres**	**Estimated Volume Per Acre (CCF)**	**Estimated Unit Volume (CCF)**
	9	5	4	20
	10	63	8	504
	11	9	6	54
	12	35	6	210
	13	78	4	312
	14	6	12	72
	16	99	16	1,584
	19	4	12	48
Mill Creek Total		**375**		**3,276**
West Fork Blacks	21	14	10	140
	23	20	18	360
West Fork Total		**34**		**500**
Alternative Total		**597**		**5,706**

Table 4.6.3. Past Harvest Activities (acres) *Recent harvest activity dates back to the 1950s. The greatest number of acres treated was a result of the Lily Lake Fire in 1980. Very little activity has taken place in the Analysis area since 1990. (See Map 2.6.11, Appendix A)*

Past Vegetation Treatments Within the East Fork Fire Analysis Area									
Watershed	**Section**	**Activity**	**Acres Treated by Decade**						
			1951-1960	**1961-1970**	**1971-1980**	**1981-1990**	**1991-2000**	**2001+**	**Total**
East Fork Bear									
	23, et. al.	Fire Salvage				3400	100		3500
Total			**0**	**0**	**0**	**3400**	**100**	**0**	**3500**
Mill Creek									
N F Lands	24	OSR			42				42
	24	Fire Salvage				300			300
	10	CC	93	102					195
	16	CC			233				233
	20	CC		118	77				195
	27	OSR			280				280
	30	CC		65	104				169
Pvt Lands	15	OSR	28	20					48
	17	OSR		57	136				193
	19	OSR		26	54	221			301
	21	OSR		92					92
	29	OSR	96		59				155
	31	OSR			400				400
Total			**217**	**480**	**1385**	**521**	**0**	**0**	**2603**
W.Fork Blacks									

Past Vegetation Treatments Within the East Fork Fire Analysis Area									
Watershed	**Section**	**Activity**	**Acres Treated by Decade**						
			1951-1960	**1961-1970**	**1971-1980**	**1981-1990**	**1991-2000**	**2001+**	**Total**
N F Lands	14	CC				92			92
	14	OSR				13			13
	22	CC				46			46
	22	OSR				29			29
	24	CC				47			47
Pvt Lands	13	PC						50	50
	19	OSR			150				150
	23	OSR		18	7				25
	25	OSR		80					80
	27	OSR			280				280
Total			**0**	**98**	**437**	**227**	**0**	**50**	**812**
Total Acres			**217**	**578**	**1822**	**4148**	**100**	**50**	**6915**

OSR - overstory removal; CC - clearcut; PC - partial cut

Table 4.6.4. Future Harvest Activities (acres) *Reasonably foreseeable future harvest would affect approximately 719 acres of private land. There are no expected entries into National Forest lands in the foreseeable future. (See Map 2.6.2, Appendix A)*

Proposed Salvage on Private Land			
Watershed	**Section**	**Activity**	**Acres**
Mill Creek	17	Salvage	65
	19	Salvage	90
	29	Salvage	378
	31	Salvage	93
Subtotal			**626**
West Fork Blacks	23	Salvage	67
	27	Salvage	26
Subtotal			**93**
Total Acres Proposed			**719**

☐ 4.6.2 Insect Predation (Mountain Pine and Spruce Beetles)

■ Effects Common to All Alternatives

Salvage of an estimated 719 acres of fire killed timber from private lands is expected to proceed under all alternatives. Most of those (652 acres) are located within the Mill Creek drainage, with an additional 67 acres in West Fork Blacks.

The effects on beetle predation would be minimal under any alternative because of the extensive acreages that in are in roadless or management prescription categories that preclude management, and the mixed species condition of surrounding stands. Also, no harvest would occur until the second year after the fire, further limiting the effects of any alternative on insect predation.

■ Alternative 1

☐ ***Direct and Indirect Effects***

Alternative 1 would provide no direct reduction of bark beetle (mountain pine beetle and spruce beetle) infestation or risk of future infestation of host trees. There could be some loss of mature and old trees (particularly Englemann spruce) from endemic bark beetle predation in unburned stands within the analysis area.

A beneficial effect of Alternative 1 would be the role bark beetle predation plays in forest succession described in Chapter 3. Early seral species, such as lodgepole pine and aspen would benefit from this successional effect of spruce beetle, although lodgepole would be impaired by the effects of mountain pine beetle.

☐ ***Cumulative Effects***

Although the fire is not expected to cause widespread beetle outbreaks, the pre-wildfire bark beetle populations and observed predation of host trees could result in an eventual outbreak. The cumulative effects of the eventual outbreak would chiefly relate to the significant mortality of large diameter host trees and the environmental conditions associated with standing dead trees that ultimately fall to the ground, e.g. increased fuel loading and potential for increased wildfire intensity. Whether beetle populations actually increase would depend upon the number of insect brood emerging next year from fire-weakened, infested spruce trees and continued successful host infestation over ensuing years.

Continued unaltered high-risk conditions would predispose stands containing large sized host trees to significant mortality from bark beetles. There have been no recent or planned projects in proximity to the analysis area that would have a noticeable effect on this high-risk condition.

■ **Alternatives 2 and 3**

☐ ***Direct and Indirect Effects***

The direct, indirect and cumulative effects would be similar to Alternative 1 except that Alternative 2 would treat 435 acres of low and moderate burn reflectance stands that would provide suitable host for beetle populations (refer to Table 4.1.4). This would reduce the risk on adjacent stands. The timing of the treatment would be too late for beetles that have already attacked standing trees, but may be useful in preventing future attacks within the treated acres.

The direct, indirect and cumulative effects of Alternative 3 would be similar to Alternative 2 except that Alternative 3 would treat fewer acres. Approximately 349 acres of low and moderate burn reflectance burn stands would be treated.

☐ ***Cumulative Effects***

The combined of National Forest and private land harvesting would reduce bark beetle predation and risk on approximately 10 percent of the area within the wildfire perimeters (Alternative 2) and less than 10 percent (Alternative 3). In the untreated areas, cumulative effects would be the same as Alternative 1.

☐ 4.6.3 Mature and Old Structure

■ **Effects Common to All Alternatives**

The Wasatch-Cache National Forest Revised Forest Plan Goal 3e calls for maintaining 40% of total conifer cover types in mature and old classes across the landscape. Prior to the fire, approximately 38,660 acres of mixed conifer, lodgepole pine, and spruce-fir stands within the analysis area were occupied by forests in the mature and old classes. Approximately 10,300 of those acres are within the burn perimeter. Areas that possessed mature and old structures prior to the burn ceased to have those structures after they burned. Burned areas would require at least 80 years of regrowth without major disturbance before they again achieved mature structures, and 150 years before they reach the old class. Therefore, the determination of effects of the alternatives on such structures is limited to the remaining unburned areas within the analysis area. All alternatives provide for more than 40% in mature and old classes.

■ **Alternative 1**

☐ ***Direct and Indirect Effects***

All existing mature and old structural classes would remain intact, until affected by a future large scale event, such as wildfire. Approximately 73% of the existing mature and old conifer stands are outside the burn perimeter.

□ ***Cumulative Effects***

The increasing age of mature old forests and individual trees under the present age distribution would predispose the whole landscape to further affects from insects, disease and major fire disturbances.

■ **Alternative 2**

□ ***Direct and Indirect Effects***

Direct and indirect effects for Alternative 2 would be the same as Alternative 1.

□ ***Cumulative Effects***

Salvage harvest would occur on 781 National Forest acres. Where reforestation is not adequately established within 5 years of harvest, seedlings would be planted. This would insure reforestation of the treated acres and provide for future mature and old classes in the long term.

The removal of fire-killed trees would reduce the future down woody material within harvest units. Future large down woody material would be limited to those dead trees left on site during the harvest, which would be approximately 30 snags/100 acres. Most of the future down material would be small diameter on the 856 acres harvested.

■ **Alternative 3**

The direct, indirect and cumulative effects of this alternative would be similar to Alternative 2 except that this alternative would treat fewer acres (refer to Table 4.6.4).

4.6.4 Threatened, Endangered and Sensitive Species

Effects were analyzed by assessing the activities proposed in each alternative and the potential effects to the species that are known or have potential habitat in the project area (refer to Threatened, Endangered and Sensitive Plant section in Chapter 3). There would be no effects to any Federally Listed (Threatened or Endangered), Proposed, or Candidate species. Because no sensitive species are within the harvest units or the burn perimeter, there would be no effects to sensitive species under any alternative (Duncan 2003).

4.6.5 Noxious Weeds

Transportation of weed seeds on vehicles, clothing or animals presents the potential for increased populations of noxious weeds. This is particularly a concern for vehicles that come onto the forest and are operated off-road for recreational or timber harvesting purposes.

■ **Alternative 1**

□ ***Direct and Indirect Effects***

This alternative would have no direct effects on noxious weed species. However, weeds could increase in areas that are currently infested, and that are not covered by other ongoing weed management actions.

□ ***Cumulative Effects***

Harvest of private lands will occur regardless of what alternative is chosen. The private land harvest provides a potential source for noxious weed spread should populations become established on those lands. Noxious weed survey and control work on National Forest lands will be ongoing, funded through appropriated dollars.

■ **Alternatives 2 and 3**

□ ***Direct and Indirect Effects***

The ground disturbing activities proposed in these alternatives would have a high risk of weed spread in (1) habitats that have high susceptibility to weed invasion or (2) areas that are already disturbed. However, washing and inspection of logging equipment that will be operated off roads (skidders, dozers, loaders) will be required prior to bringing the equipment onto the Forest. Knutson-Vandenburg (KV) funds will be collected from the timber revenues to fund noxious weed spraying, which would reduce or eradicate noxious weeds and improve the vigor of native vegetation, thereby increasing resistance to further weed invasion. Where KV funds are not available, appropriated funds will be requested. Weed control, both direct herbicide use and non-herbicide prevention measures, would be included as design criteria.

Musk thistle and Canada thistle have been recorded near, but not within, proposed harvest units. Both of these species disperse seed primarily by wind. Due to their presence in the fire perimeter and the primary mode of seed dispersal, the movement of harvesting equipment and vehicles in and around the harvest units and between units will have minimal effect on the introduction of these weeds to new sites.

☐ ***Proposed Direct Methods of Weed Control***

Under Alternative 2, herbicide treatment of noxious weeds would occur on approximately 4.9 miles of temporary road constructed for accessing the timber, and closed obliterated following use. Treatments would be commensurate with the location of existing populations and with weed risk. Monitoring would take place to determine effectiveness of treatment.

All noxious weed treatments would follow the procedures and mitigation measures outlined in the Revised Forest Plan, Appendix III.

☐ ***Proposed Indirect Methods of Weed Control***

Seeding: This would take place in conjunction with temporary road and log landing rehabilitation

Equipment washing: Any equipment used for restoration activities and timber harvest (Alternatives 2 and 3) would be washed to prevent dispersing weed seeds.

☐ ***Cumulative Effects***

The potential area of ground disturbance from both private and National Forest harvest activities would be 1,573 and 1,358 acres for alternatives 2 and 3, respectively (refer to Table 4.6.4). Monitoring for the presence of noxious weeds would be necessary under either alternative.

☐ ***Monitoring***

Monitoring would be conducted in accordance with guidance in the Revised Forest Plan, Appendix III. Monitoring of environmental conditions would occur during direct weed treatment. Monitoring of non-target resources, including wildlife, plant and animal abundance, and aquatic resources would also occur. Effectiveness monitoring would be implemented during the next growing season following treatment.

Inventories for new infestations as a result of the proposed activities would be conducted every growing season. The monitoring and inventories would be conducted by qualified Weed, Range, and/or Botany personnel on the Wasatch-Cache National Forest.

■ 4.7 Fire and Fuels

☐ 4.7.1 Potential for High Intensity Reburn and Resistance to Control

The greatest potential for damage to resources from a reburn and the greatest potential resistance to control in the future is within the high and moderate burn reflectance areas, where the mortality of standing trees was the greatest. The low burn reflectance would be less of a risk because the number of surviving trees is greater, thereby limiting the future down woody material that would fuel a reburn. Table 4.7.1 compares the National Forest acres treated by alternative. In addition to the acres shown in Table 4.7.1, 719 acres of private land will be treated under all alternatives.

Fuel loading due to logging comes primarily from tops, limbs, and unmerchantable portions of the boles of trees. All landing slash would be treated. Much of the smaller diameter material would remain on site, but the amount of fine fuels remaining would be lighter than that following harvest of green trees since needles, twigs, small branches, and duff layers were substantially reduced by the fire in moderate to high reflectance areas. Only fire-killed trees will be removed in those areas mapped as low intensity burn or unburned. Fine fuels would also be fairly light in these areas since generally a small percentage or small patches of the trees would be removed. Fine fuels were substantially reduced by the fire in most of these small patches as well. Natural fuel loading following a fire occurs as trees tip over, usually over a period of 5 to 10 years, although some dead trees may remain standing for decades. The lodgepole pine, subalpine fir, and Engelmann spruce found in the analysis area have shallow root systems and most of them fall over within 5 to 20 years. Fuel loading from logging happens at the time of the logging or very soon after. However, since the merchantable boles are removed, the total tons/acre of fuel on the ground are less than the amount that accumulates naturally over 5 to 10 years following a fire.

Table 4.7.1. Acres Treated to Reduce Fuel Loadings by Alternative

Ownership	Alternative 1	Alternative 2	Alternative 3
National Forest (acres)	0	781	597
Private Lands	719	719	719
Total	719	1,500	1,316

■ Alternative 1

□ *Direct and Indirect Effects*

Alternative 1 would provide no direct reduction of large fuels that pose a risk of potential soil damage on National Forest lands (refer to Table 4.7.1). A nominal amount of removal may occur from personal use firewood gathering along open roads. The relevance of any adverse effects would be proportional to the extent of heat duration causing soil damage during a reburn, which is unknown at this time.

Beneficial and adverse effects of Alternative 1 would be the role these atypically high levels of large woody debris play in the forest environment.

□ *Cumulative Effects*

High levels of large woody debris in severely burned sites would facilitate spruce regeneration on high elevation and high reflectance burn areas by ameliorating the harsh post-fire environment, providing a seed source is available. Adversely, this same woody debris loading would increase the degree of tree mortality in the event of a future wildfire. A total of 7,244 acres of high and moderate burn reflectance stands would remain untreated and provide potential fuel for future wildfires (Table 4.7.2). The removal of future fuel from private lands would reduce the ability of fire to spread through the private lands to adjacent National Forest lands, and may therefore limit the extent of a future fire within the lower elevation, "checkerboard" ownership.

■ Alternative 2

□ *Direct and Indirect Effects*

Alternative 2 would provide direct reduction of large fuels on 781 National Forest acres through salvage of fire-killed timber (See Table 4.71 and Appendix A, Map 4.7.1). Of those acres treated, 296 are high and 196 are moderate reflectance. Timber harvest would remove boles of fire-killed trees, which would eventually become large down woody fuel. The effectiveness of salvage is limited to the merchantable portion of the fire-killed trees and does not include large boles that are non-salvable from decay or severe checking. Alternative 2 would directly reduce uncharacteristic risk conditions on treated sites. The potential for uncharacteristic soil damage to occur in the event of a reburn would be reduced. Continuity of heavy fuel loading would be interrupted and resistance to control in the event of a future reburn would be low where treatments occurred.

□ *Cumulative Effects*

Alternative 2 would reduce fuels on 781 National Forest acres through timber harvest and an additional 719 acres of intermixed private lands. Approximately 13,406 acres within the burn would receive no treatment, with 6,622 of those in high and moderate burn reflectance (Table 4.7.2). The remaining untreated acres would become predisposed to the same insect, disease and fire disturbances as discussed under Alternative 1. Continuity of heavy fuel loading would be interrupted and resistance to control in the event of a future reburn would be low where treatments occurred.

■ Alternative 3

The direct, indirect and cumulative effects would be the similar to Alternative 2, except that Alternative 3 would treat fewer acres (597 acres), and leaves more acres untreated (6,827).

Table 4.7.2. Acres of Untreated Fuel Loadings by Alternative *Untreated dead and down material may provide fuels for future wildfires. The highest fuel loadings result from the high and moderate burn reflectance stands, where a majority of the standing trees were killed and will fall in the near future.*

Burn Reflectance	Alternative 1	Alternative 2	Alternative 3
High	4,134	3,791	3,898
Moderate	3,110	2,828	2,933
Subtotal	7,244	6,622	6,827

■ 4.8 Wildlife

□ 4.8.1 Introduction

Direct effects are effects caused by the action and occurring at the same time and place. Indirect effects are effects caused by the action but occurring either later in time or further removed in distance. Cumulative effects result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions that are not included in the Proposed Action.

□ 4.8.2 Threatened and Endangered Species

Bald Eagle

Because the project does not include any suitable wintering habitat or nesting habitat for bald eagles, all alternatives would have no effect on bald eagles. None of the alternatives would render any of the project area unsuitable for future use by foraging bald eagles. All alternatives would have no direct, indirect or cumulative effects on bald eagles (Hollingshead 2003a, USDI F&WS 2004).

■ **Lynx**

Foraging habitat, denning habitat, unsuitable habitat, and open road density are used to assess effects to lynx habitat

□ ***Effects Common to All Alternatives***

No salvage is proposed in any lynx foraging habitat (lodgepole pine stands 15-30 years old) under any alternative; therefore, all alternatives would have no effect on foraging habitat. Gains in foraging habitat would only occur as young, unsuitable stands mature. A Biological Assessment (Hollingshead 2003a) determined that the East Fork Fire Salvage "may affect, but is not likely to adversely affect" Canada lynx. The U.S. Fish and Wildlife (USDI, Fish and Wildlife Service 2004) concurred with this determination in a Biological Opinion issued on February 25, 2004 after requesting and receiving an addendum (Jaureguie 2004) to the Biological Assessment.

□ ***Cumulative Effects Common to All Alternatives***

Trapping, increased road access, fire suppression and timber harvesting all are believed to have had impacts on lynx populations across the West. Expanding networks of logging roads made access for trapping easier. Fire suppression may have reduced areas that have high populations of snowshoe hares, because hares tend to favor younger stands of lodgepole pine that would grow following a stand replacement fire.

Extensive clearcuts that left no foraging or denning habitat also reduced lynx habitat. Now, thirty plus years later, those same clearcuts that removed habitat have become foraging habitat. If young forest stands are not created by natural or planned activities, then lynx foraging habitat would continue to decline.

The Utah Division of Wildlife Resources regulates trapping in the state. There is no trapping season for lynx in Utah. Even though this removes the direct trapping pressure, there is still the potential for lynx being caught in traps set for other species.

Foreseeable Future Actions: The activity that could impact foraging habitat would be precommercial thinning or road construction in lynx habitat. There is no precommercial thinning planned. There are no proposals for new permanent road construction in the area so there will not be an increase in open road density.

Table 4.8.1. Open Road Density Within LAUs by Alternative (miles/square mile)

LAU	Alternative 1	Alternative 2	Alternative 3
Bear River #35	0.94	0.93*	0.93*
Black's Fork #34	0.93	0.93	0.93

*Reduced due to closure of .8 miles of existing road in East Carter Creek.

Table 4.8.2. Percent of Unsuitable Lynx Denning Habitat after the Fire

LAU	Total Acres	Total Acres Suitable Habitat	Total Pre-Fire Acres Unsuitable Habitat	Pre-Fire Percent Unsuitable	Acres of LAU within High/Mod Burn Severity	Post-Fire Percent Unsuitable
Bear River #35	62,390	47,289	249	0.5%	5,871 (12.4%)	12.9%
Black's Fork #34	42,433	27,817	444	1.6%	1,066 (3.8%)	5.4%

Table 4.8.3. Acres and Percent of Unsuitable Lynx Denning Habitat Within the LAUs by Alternative

LAU	Alternative 1 Unsuitable Habitat (acres and percent)	Alternative 2 Unsuitable Habitat (acres and percent)	Alternative 3 Unsuitable Habitat (acres and percent)
Bear River #35	6120 (12.9%)	6392 (13.5%)	6342 (13.4%)
Black's Fork #34	1510 (5.4%)	1519 (5.5%)	1517 (5.5%)

These LAUs had from .5 to 1.6 percent unsuitable habitat before the fire. Refer to Table 4.8.2. The fire burned at a variety of severities, and areas that burned at high and moderate severity are considered unsuitable habitat. Areas that burned at low severity may still provide suitable lynx denning habitat. Table 4.8.3 shows the acres of unsuitable potential denning habitat by alternative. Acres of low intensity burn that would be salvaged have reduced the amount of suitable habitat available to lynx.

☐ ***Alternative 1***

Direct and Indirect Effects: This alternative would have no effect on lynx because there would be no change in existing lynx habitat (refer to Tables 4.8.1, 4.8.2 and 4.8.3, above, and Map 3.11.1 in Appendix A).

Cumulative Effects: This alternative would have no cumulative effects because vegetation and open road density would not change.

☐ ***Alternative 2***

Direct and Indirect Effects: Under this alternative, there would be 4.6 miles of temporary road construction and proposes to salvage 781 acres within Lynx Analysis Units. The acres of unsuitable foraging habitat would remain the same. Some potential (future) denning habitat would be treated. Salvage of 288 acres of low intensity burn is proposed, reducing potential denning habitat by an estimated 150 acres. Potential denning habitat is abundant in both of the LAUs and the LAU with the least denning habitat still has well over the amount recommended in the Lynx Conservation Assessment and Strategy (LCAS). This alternative would salvage some potential denning habitat; therefore, this alternative may affect, but would not likely to adversely affect lynx denning habitat.

The high to moderate severity portions of the fires created many acres of unsuitable habitat because there is not enough vegetation to support snowshoe hares. If a stand is unsuitable because of having been severely burned, harvesting some of the material while leaving sufficient snags (standing dead trees) and woody debris would not increase the acres of unsuitable habitat. No existing foraging habitat would be treated; thus, no foraging habitat would be converted to unsuitable habitat. The potential denning habitat (salvage acres of low intensity burn) that would be treated would be considered unsuitable habitat.

Cumulative Effects: This alternative would have no cumulative effects because there would be no change in the vegetation types. The open road density would be slightly reduced. Only temporary road construction is included and those roads would be reclaimed once salvage operations are completed. The fire may improve habitat for prey species. This alternative would produce some unsuitable habitat, which would become foraging habitat in about 15 years.

□ ***Alternative 3***

Direct and Indirect Effects: Under this alternative, there would be no temporary road construction and therefore, less acres of salvage is proposed. The acres of unsuitable foraging habitat would remain the same. Some potential denning habitat would be treated. Salvage of 228 acres of low intensity burn is proposed, reducing potential (future) denning habitat by an estimated 125 acres. Potential denning habitat is abundant in all of the LAUs and the LAU with the least denning habitat still has well over the amount recommended in the Lynx Conservation Assessment and Strategy (LCAS). This alternative would salvage some potential denning habitat; therefore, this alternative may affect, but would not likely to adversely affect lynx denning habitat. The high to moderate severity portions of the fire created many acres of unsuitable habitat because there is not enough vegetation to support snowshoe hares. If a stand is unsuitable because of having been severely burned, harvesting some of the material while leaving sufficient snags (standing dead trees) and woody debris would not increase the acres of unsuitable habitat. No existing foraging habitat would be treated; thus, no foraging habitat would be converted to unsuitable habitat. The potential denning habitat (salvage acres of low intensity burn) that would be treated would be considered unsuitable habitat. Because both of the LAUs would meet the recommendations for unsuitable habitat, this alternative may affect but would not likely to adversely affect lynx habitat.

Cumulative Effects: This alternative would have no cumulative effects and may slightly improve lynx habitat because denning habitat would exceed the recommended amount. The fire may improve habitat for prey species. This alternative would also produce some unsuitable habitat, which would become foraging habitat in about 15 years.

■ **Black-footed ferret**

□ ***Effects Common to All Alternatives***

Because the project area does not include any black-footed ferret habitat, all alternatives would have no effect on black-footed ferrets. All alternative would have no direct, indirect or cumulative effects on black-footed ferrets.

■ **Western yellow-billed cuckoo**

□ ***Effects Common to All Alternatives***

Because the project area does not include any yellow-billed cuckoo habitat, all alternatives would have no effect on yellow-billed cuckoo. All alternative would have no direct, indirect or cumulative effects on yellow-billed cuckoo.

□ 4.8.3 Sensitive Species

■ **Peregrine falcon**

□ ***Effects Common to All Alternatives***

Because no activities would take place near potential nesting habitat in cliffs, all alternatives would have no impact on peregrine falcons. All alternative would have no direct, indirect or cumulative effects on peregrine falcons (Hollingshead 2003).

■ **Northern goshawk**

□ ***Cumulative Effects Common to All Alternatives***

Past to Present: Throughout North America, extensive clearcutting, removal of large trees and conversion of forested habitats to agriculture and developments have impacted goshawk populations. Fire suppression may have also reduced the number of stands with an open understory (Graham et al. 1999). These birds do not appear to forage effectively in large, cleared areas during nesting season, and large trees are important nest sites (Reynolds et al. 1992).

The East Fork Fire fire burned 6,925 acres at high to moderate severity, which moved these stands back to newly developing stands of trees. The severely burned stands will take several decades to return to suitable goshawk habitat.

Foreseeable Future Actions: The main activity that could affect goshawk habitat would be timber harvest. No other large-scale timber harvests are proposed on Forest Service lands in this area.

□ ***Alternative 1***

Direct and Indirect Effects: Because this alternative would not alter the vegetation, it would have no impact on goshawk habitat.

Cumulative Effects: This alternative would have no cumulative effects on goshawk habitat because the vegetation would not be altered.

□ ***Alternative 2***

Direct and Indirect Effects: This alternative would salvage timber from approximately 288 acres typed as low intensity or unburned stands that could provide potential goshawk habitat. Because the salvage operations would involve only about 4% of the total acres of low intensity burned area, this alternative may impact individual goshawks, but is not likely to cause a trend toward federal listing or a loss of viability to the potential goshawk population (Hollingshead 2003).

Cumulative Effects: This alternative in combination with salvage logging on private land would have a cumulative effect of removing dead trees from about one percent of the potential habitat in the analysis area.

□ ***Alternative 3***

This alternative would salvage timber from approximately 228 acres typed as low intensity or unburned stands that could provide potential goshawk habitat. Because the salvage operations would involve only about 3% of the total acres of low intensity burned area, this alternative may impact individual goshawks, but is not likely to cause a trend toward federal listing or a loss of viability to the potential goshawk population (Hollingshead 2003).

Cumulative Effects: This alternative in combination with salvage logging on private land would have a cumulative effect of removing dead trees from less than one percent of the potential habitat in the analysis area.

■ **Boreal owl**

□ ***Effects Common to All Alternatives***

Boreal owls are not likely to find suitable habitat in acres burned at high or moderate fire intensities, therefore none of the proposed salvage activities in these burned acres would negatively impact boreal owls. Suitable habitat may exist within areas burned at low intensities.

□ ***Cumulative Effects Common to All Alternatives***

Foreseeable Future Actions: The main activity that could reduce boreal owl habitat would be timber harvest within the spruce-fir forest types. No other large-scale timber harvests are proposed on Forest Service lands in this area.

□ ***Alternative 1***

Direct and Indirect Effects: This alternative would not have an impact on boreal owl habitat because there would be no change in vegetation.

Cumulative Effects: This alternative would have no cumulative effects on boreal owl habitat because the vegetation would not change.

□ ***Alternative 2***

Direct and Indirect Effects: Only the portion of proposed salvage harvest in low intensity burned areas would potentially impact boreal owls. This alternative would harvest less than 150 acres of boreal owl habitat out of about 14,698 acres of the potential habitat. Because the salvage operations would involve only about 1% of the total acres of potential habitat in the analysis area, this alternative may impact individual boreal owls, but is not likely to cause a trend toward federal listing or a loss of viability to the potential boreal owl population (Hollingshead 2003).

Cumulative Effects: This alternative in combination with salvage logging on private land would have a cumulative effect of removing dead trees from about two percent of the potential habitat in the analysis area.

☐ ***Alternative 3***

Direct and Indirect Effects: Only the portion of proposed salvage harvest in low intensity burned areas would potentially impact boreal owls. This alternative would harvest less than 100 acres of boreal owl habitat out of about 14,698 acres of the potential habitat. Because the salvage operations would involve less than 1% of the total acres of potential habitat in the analysis area, this alternative may impact individual boreal owls, but is not likely to cause a trend toward federal listing or a loss of viability to the potential boreal owl population (Hollingshead 2003).

Cumulative Effects: This alternative in combination with salvage logging on private land would have a cumulative effect of removing dead trees from less than two percent of the potential habitat in the analysis area.

■ **Flammulated Owl**

☐ ***Effects Common to All Alternatives***

There is no suitable flammulated owl habitat wihin the East Fork Fire area, therefore all alternatives would have no impact on flammulated owls. All alternatives would have no direct, indirect or cumulative effects on flammulated owls.

■ **Great Gray Owl**

☐ ***Effects Common to All Alternatives***

Great gray owls are not likely to find suitable habitat in acres burned at high or moderate fire intensities, therefore none of the proposed salvage activities in these burned acres would negatively impact great gray owls. Suitable habitat may exist within areas burned at low intensities.

☐ ***Cumulative Effects Common to All Alternatives***

Foreseeable Future Actions: The main activity that could reduce great gray owl habitat would be timber harvest within the spruce-fir forest types. No other large-scale timber harvests are proposed on Forest Service lands in this area.

☐ ***Alternative 1***

Direct and Indirect Effects: Because there would be no change in vegetation, this alternative would have no impact on great gray owl habitat.

Cumulative Effects: This alternative would have no cumulative effects on great gray owl habitat because the vegetation would not change.

☐ ***Alternative 2***

Direct and Indirect Effects: Only the portion of proposed salvage harvest in low intensity burned areas would potentially impact great gray owls. This alternative would harvest less than 150 acres of great gray owl habitat out of about 14,698 acres of the potential habitat. Because the salvage operations would involve only about 1% of the total acres of potential habitat in the analysis area, this alternative may impact individual great gray owls, but is not likely to cause a trend toward federal listing or a loss of viability to the potential great gray owl population (Hollingshead 2003).

Cumulative Effects: This alternative in combination with salvage logging on private land would have a cumulative effect of removing dead trees from about two percent of the potential habitat in the analysis area.

☐ ***Alternative 3***

Direct and Indirect Effects: Only the portion of proposed salvage harvest in low intensity burned areas would potentially impact great gray owls. This alternative would harvest less than 100 acres of great gray owl habitat out of about 14,698 acres of the potential habitat. Because the salvage operations would involve less than 1% of the total acres of potential habitat in the analysis area, this alternative may impact individual great gray owls, but is not likely to cause a trend toward federal listing or a loss of viability to the potential great gray owl population (Hollingshead 2003).

Cumulative Effects: This alternative in combination with salvage logging on private land would have a cumulative effect of removing dead trees from less than two percent of the potential habitat in the analysis area.

■ **Townsend's big-eared bat**

☐ ***Effects Common to All Alternatives***

Because the project area does not contain any caves, mines or abandoned buildings, all alternatives would have no impact on Townsend's big-eared bats. All alternatives would have no direct, indirect or cumulative effects on Townsend's big-eared bats (Hollingshead 2003).

■ **Three-toed Woodpecker**

Acres of potential three-toed habitat treated are used to analyze the effects on three-toed woodpeckers and other snag-dependant wildlife species (See Table 4.8.4. and Maps 4.8.2 and 4.8.2 in Appendix A).

☐ ***Effects Common to All Alternatives***

All proposed salvage units would have dead trees marked as reserve trees in order to provide habitat for woodpeckers and other snag-dependent wildlife habitat. The Wasatch-Cache Forest Plan Guideline 16 includes leaving approximately 30 snags per 10 acres of salvage proposed. In many cases the trees would be left in clumps or patches and these would be spread across the landscape or in corridors along riparian areas.

☐ ***Cumulative Effects Common to All Alternatives***

Past to Present: For many forest types in the West, stand replacement fires were the common fire regime. Three-toed woodpecker numbers are often highest in stands that have burned within the last five years, and numbers decline rapidly after that, as insect activity declines. Active fire suppression has greatly reduced the number of acres that burn with stand replacing fires.

Foreseeable Future Actions: The main activity that could change three-toed woodpecker habitat is salvage of burned timber. Much of the fire-killed timber on private lands will be salvaged also. No other large-scale timber harvests are proposed on Forest Service lands in this area. Firewood cutting will also reduce three-toed woodpecker habitat.

Table 4.8.4. Snag Density Remaining on National Forest and Private Land Within the Fire Perimeter Following Timber Salvage

Snag Density	Forest Condition	Alt 1 Acres	Alt 2 Acres	Alt 3 Acres
high, 100+ snags/acre	burned forest	5,622	5,045	5,203
mod, 50+ snags/acre	low intensity burned forest	2,056	1,839	1,872
variable, 10-60 snags/acre	unburned forest	2,648	2,586	2,595
variable, 0-10 snags/acre	past harvest units*	1,935	1,935	1,935
0 snags/acre	non-forest	1,934	1,934	1,934
3+ snags/acre	new harvest units	0	856	648

* Includes 719 acres of planned salvage harvest on private land.

☐ ***Alternative 1***

Direct and Indirect Effects: This alternative would have no impact on three-toed woodpecker habitat because there would be no change in potential three-toed woodpecker habitat (See Map 3.11.2 in Appendix A).

Cumulative Effects: Cumulative effects of timber salvage on private land on three-toed woodpecker habitat would be the removal of merchantable dead trees from 719 acres, leaving 7,678 acres of high snag density (50+ snags per acre) burned timber.

☐ ***Alternative 2***

Direct and Indirect Effects: This alternative would salvage approximately 781 acres of potential three-toed woodpecker habitat from the 9,634 acres of National Forest within the East Fork Fire. All stands proposed to be salvaged would have some value as foraging habitat for these woodpeckers because of the reserve trees remaining across the landscape.

Considering the number of acres burned and the small percentage (9%) of the National Forest land within the East Fork Fire proposed for salvage harvest, this alternative may impact individuals or habitat, but will not likely result in a trend toward federal listing of three-toed woodpeckers (Hollingshead 2003).

Cumulative Effects: About 719 acres of salvage is planned on private land in combination with 781 acres of salvage on National Forest (resulting in removal of merchantable dead trees from a total of 13% of the 12,261 forested acres within the fire perimeter). This would contribute to the long-term decline of post-fire habitat. Because 87% of the potential habitat would remain, the overall impact to potential three-toed woodpecker habitat would be slight. Connectivity of large remaining patches of snags would remain good (See Map 4.8.1).

☐ ***Alternative 3***

Direct and Indirect Effects: This alternative would salvage approximately 597 acres of potential three-toed woodpecker habitat from the 9,634 acres of National Forest within the East Fork Fire. All stands proposed to be salvaged would have some value as foraging habitat for these woodpeckers because of the reserve trees remaining across the landscape (See Map 4.8.2).

Considering the number of acres burned and the small percentage (7%) of the National Forest land within the East Fork Fire proposed for salvage harvest, this alternative may impact individuals or habitat, but will not likely result in a trend toward federal listing of three-toed woodpeckers (Hollingshead 2003).

Cumulative Effects: About 719 acres of salvage is planned on private land in combination with 597 acres of salvage on National Forest (resulting in removal of merchantable dead trees from a total of 11% of the 12,261 forested acres within the fire perimeter). This would contribute to the long-term decline of post-fire habitat. Because 89% of the potential habitat would remain, the overall impact to potential three-toed woodpecker habitat would be slight. Connectivity of large remaining patches of snags would remain good (See Map 4.8.2).

■ **Wolverine**

Effects Common to All Alternatives

Because all proposed salvage activities are located in previously roaded areas with regular human activity providing little suitable wolverine habitat, all alternatives would have **no impact** on wolverine (Hollingshead 2003).

☐ 4.8.4 Other Species at Risk

Habitat for species-at-risk is addressed in the discussion on properly functioning condition of the vegetation type at the Forest scale and effects on these species are projected through the effects of the alternatives on the forest habitat and PFC.

■ **Williamson's sapsucker**

Williamson's sapsuckers nest in both live trees and dead trees with a preference for live aspen in mixed conifer and aspen stands or snags with soft wood (Sousa 1983). Effects for this species are associated to those of the three-toed woodpecker. Unlike the three-toed woodpecker this species has not been reported associated with burns in the Rocky Mountain area. However, overall effects on Williamson's sapsucker will be very similar to those on three-toed woodpeckers. Studies have found sapsuckers' nesting in snags in post fire areas, while foraging in adjacent live stands. (See Direct, Indirect, and Cumulative effects on Three-toed woodpecker).

■ **Pine Marten**

Effects Common to All Alternatives

The loss of vegetative cover in areas burned will cause some level of habitat fragmentation. This level of fragmentation has likely occurred repeatedly through time with the fire regimes of this vegetative type. In areas of high to moderate burning where canopy was decreased to less than 30%, a negative short-term effect is associated with the marten. However martens benefit where fires were less intense and small openings of diverse habitat were created (Koehler and Hornocker, 1977, Koehler et.al. 1975; Viereck and Schandelmeier, 1980).

Cumulative Effects Common to All Alternatives

Past to Present: For many forest types in the West, stand replacement fires were common fire regime. Pine marten numbers are often lowered after this type of event when ground cover is eliminated and forest openings are created. Over time marten numbers increase as vegetation and food sources become available.

Foreseeable Future Actions: The main activity that could change marten habitat is salvage of burned timber. Short-term effects from the removal of individual or small pockets of fire-killed trees in “unburned” units where habitat is available may occur. These short-term effects are removing potential future downed woody debris, which can be used as den and foraging sites. Much of the fire-killed timber on private lands will also be salvaged. No other large-scale timber harvests are proposed on Forest Service lands in the area.

☐ ***Alternative 1***

Direct and Indirect Effects: There would be no effect to the pine marten under this alternative because there would be no change within post fire stands.

Cumulative Effects: Cumulative effects of timber salvage on private land on pine marten would be the removal of merchantable dead trees and potential future den and foraging sites on a total of 1,500 acres, or approximately 13% of the forested burned area.

☐ ***Alternative 2***

Direct and Indirect Effects: This alternative is proposed to salvage 781 acres that could become downed woody debris and potential future den and foraging sites for martens. Snags will be retained at a level to meet Forest Plan Standards. Large quantities of snags and down woody material created by the fire will be retained outside of harvest units. Marten population numbers tend to return to burn areas several decades’ later when adequate food and cover return. Temporary roads may affect movement, but there should not be any increase of habitat fragmentation in the long term. Connectivity of snag habitat and down woody material is displayed on Map 4.8.1, Appendix A.

Cumulative Effects: Salvage of timber on private lands in combination with adjacent salvage on National Forest would increase fragmentation in the short term. Removal of merchantable timber will decrease potential future downed woody materials and increasing size of openings. Roads constructed on private land could increase unauthorized access to motorized vehicles in non-motorized areas, although the private landowner has stated they will decommission any new roads they build.

☐ ***Alternative 3***

Direct and Indirect Effects: Except for a smaller amount of acreage (597), effects to the marten would be the same as alternative 2. Connectivity of snag habitat and down woody material is displayed on Map 4.8.2, Appendix A.

Cumulative Effects: In this alternative cumulative effects would be the same as in Alternative 2.

☐ 4.8.5 Management Indicator Species

■ **Northern goshawk**

Effects on potential northern goshawk habitat are previously described as this species is also a Forest Service Sensitive species. Refer to Section 4.8.2.

Table 3.11.12 indicates that the percentage of monitored territories that were active between 1999 and 2003 remained relatively constant, except in 2000 when the percentage was low for some unknown reason. This data is a representation of the population across the planning unit. Except for the low intensity burn areas where some harvest will take place (279 acres out of 781 acres) the rest of the proposed sale area was essentially rendered unsuitable for goshawk habitat by the fire. The nesting areas of the two pairs of goshawks were not burned and post-fledging areas are still adequate despite the fire. These two pairs have been active since the fire and are expected to continue to use their nest territories.

The project will not affect the viability or distribution of the goshawk across the planning unit.

■ **Snowshoe hare**

☐ **Effects Common to All Alternatives**

Salvage units contain no snowshoe hare habitat because the fire destroyed that habitat. Stands of sapling size aspen and conifer are not included for salvage in any alternative, therefore the salvage activities would have no effects on snowshoe hare habitat. These fire-killed stands would regenerate in 15-20 years to a size class of trees that can provide for snowshoe hare foraging and would in turn provide an increase in foraging opportunities for predators that feed on snowshoe hare. The salvage sale would not have any adverse effect on the reestablishment of that habitat throughout the fire area. All alternatives would have no direct, indirect or cumulative effects on snowshoe hare.

■ **Beaver**

☐ *Effects Common to All Alternatives*

Direct and Indirect Effects: There will be no harvesting in riparian areas. RHCA's have been identified on all streams adjacent to harvest units and the appropriate buffers established by stream as identified in the mitigation measures. There will be no cutting within these identified buffers. Approximately 24,000 acres of riparian area would remain available for beaver habitat across the Forest. There will be no green conifer or aspen cut unless incidental to temporary road construction. Because of the measures in place there will be no effect on beaver habitat.

Cumulative Effects: There may be some cumulative effects from private land salvage logging. Some sedimentation from these activities may be deposited into the stream. The effects are expected to minor, similar to those from salvage operations on National Forest land.

☐ *Alternative 1*

Direct and Indirect Effects: Large landscape fires affect wildlife species in different ways. Beavers benefit both positively and negatively from large fires. The successional change of vegetation is beneficial to beavers providing forage and materials for dam construction. Negative effects from fire are from the loss of vegetative cover for exploring or dispersing individuals. The loss of cover increases the possibility of predation while away from the pond and/or water. Spring run off from burned areas may potentially increase the likelihood of dam failure (breach) and filling of ponds by sediment.

☐ *Alternative 2*

Direct and Indirect Effects: Alternative 2 would harvest 781 acres and have 4.6 miles of temporary road constructed. There is a potential to increase sedimentation in ponds but these effects would be mitigated with measures established for amphibians. Temporary road crossing of stream channels would be restored following salvage operations. Salvage of dead trees from areas that burned at low intensity leaving some trees alive, is widely distributed and covers only a small percentage of the analysis area. Effects of this salvage on vegetation cover for individual beavers exploring or dispersing are not likely to result in any change in beaver population. There would be no substantial direct or indirect effect on beaver habitat because there are no salvage activities proposed within riparian areas.

☐ ***Alternative 3***

Direct and Indirect Effects: Alternative 3 would harvest 597 acres with no temporary roads constructed. Some of the proposed units would be reduced in size while others would be eliminated. Mitigation measures in Alternative 3 would reduce the risk of sediment in streams. There would be no direct or indirect effect because there are no salvage activities proposed within riparian areas.

☐ 4.8.6 Big Game Habitat

Effects on big game habitat are measured by changes in security cover for elk.

☐ *Effects Common to All Alternatives*

There are short-term adverse effects of the East Fork fire on security cover for all big game species. Long term effects of the fire are generally positive due to increased forage. Elk are the most affected by loss of security cover and travel corridors. All alternatives would have no adverse impacts on summer big game habitat. There are no critical calving areas or elk or deer winter range within the fire perimeter.

After 15 to 30 years, both the severely burned areas as well as old clearcuts would again provide hiding cover and elk security cover would increase in the herd unit.

Foreseeable Future Actions: Activities that could change elk security include green timber harvest and road construction. No other large-scale timber harvests are proposed on Forest Service lands in this area. There are no proposals for new permanent road construction in the area, so open road density would not increase. About 719 acres are planned for salvage on private land.

☐ ***Alternative 1***

Direct and Indirect Effects: Under this alternative, there would be no change in elk security and no opportunity to immediately increase elk security. Because there are no changes in existing conditions, this alternative would have no impact on big game habitat.

Cumulative Effects: About 719 acres are planned for salvage on private land. The cumulative effects would be generally positive. The private landowner plans to decommission one road and close any new temporary roads following their use.

☐ ***Alternative 2***

Direct and Indirect Effects: Salvage harvesting would have little effect on big game habitat or elk security. There is likely to be short term displacement of big game animals during summer and fall harvesting operations. Decommissioning of Forest Road 80299 would increase security cover in the large mature forest strip remaining between the East Fork Fire and the 1980 Lily Lake Fire. This alternative would provide an overall slight improvement in elk habitat and therefore would have no impact on elk habitat.

Cumulative Effects: Timber salvage on private land would have similar effects to those on National Forest Land. The cumulative effects would be generally positive. The private landowner plans to eliminate a ford across Mill Creek and the approaches, and close any new temporary roads following their use.

☐ ***Alternative 3***

Direct and Indirect Effects: Salvage harvesting would have little effect on big game habitat or elk security. There is likely to be short term displacement of big game animals during summer and fall harvesting operations. Decommissioning of Forest Road 80299 would increase security cover in the large mature forest strip remaining between the East Fork Fire and the 1980 Lily Lake Fire. This alternative would provide an overall slight improvement in elk habitat and therefore would have no impact on elk habitat.

Cumulative Effects: Same as Alternative 2.

☐ 4.8.7 Snag Habitat

Removal of snags during harvesting, fire suppression, and extensive salvage programs have impacted snag habitat, a component of old growth forest. Harvesting can remove snags, and fire suppression reduces the number of snags created in a landscape.

All alternatives would meet Forest Plan Guideline 16 for snag retention.

Foreseeable Future Actions: The main activity that could change snag habitat would be salvage timber harvest. No other large-scale timber harvests are planned on Forest Service lands in the area. Firewood cutting will also reduce the number of snags adjacent to open roads in the area.

☐ ***Alternative 1***

Direct and Indirect Effects: This alternative would have no impact on snag habitat because there would be no changes in the vegetation.

Cumulative Effects: Timber salvage on private land would remove merchantable dead trees, thus reducing snag density on 719 acres.

☐ ***Alternative 2***

Direct and Indirect Effects: This alternative would treat about 288 acres that were typed as unburned or low intensity burn. Removal of fire killed trees from those acres would affect the potential of those stands to provide the snag component of old growth habitat within the fire perimeter. This salvage affects approximately 0.6% of the 48,000 forested acres in the analysis area. Older dead trees would be retained and minimum Forest Plan snag densities would be maintained.

Cumulative Effects: This alternative in combination with approximately 200 acres of private harvest in low burn intensity stands would have the potential to adversely affect less than one percent of the old growth in the analysis area. Past harvesting and fires (including the East Fork Fire) have reduced the snag component of potential old growth in the analysis area by about 14,000 acres or 29% of the 48,000 forested acres in the analysis area (Map 4.8.1). That leaves about 70% of the forest in the analysis area in a condition that could provide snags for potential old growth habitat. All alternatives provide for more than 40% in mature and old classes (See 4.6.2).

☐ ***Alternative 3***

Direct and Indirect Effects: This alternative would treat about 228 acres that were typed as unburned or low intensity burn. Removal of fire killed trees from those acres would affect the potential of those stands to provide the snag component of old growth habitat within the fire perimeter. This salvage affects approximately 0.5% of the 48,000 forested acres in the analysis area (Map 4.8.2). Older dead trees would be retained and minimum Forest Plan snag densities would be maintained.

Cumulative Effects: Same as Alternative 2.

☐ 4.8.8 Forest Land Birds

■ Effects Common to All Alternatives

There is wide adaptability of native bird species. Almost any change in vegetation benefits some species at the expense of others. Post-fire habitat attracts a high concentration of woodpeckers. The effects of any action, from timber harvest to fire suppression, would be an improvement for some species and detrimental for others. Selected bird species with restricted habitat needs (including snag dependent species) are discussed in separate sections in this Wildlife section.

The Wasatch-Cache Revised Forest Plan states that a "course filter" approach will be made to address species viability, which is directed by NFMA. The approach is based on changes in ecological characteristics of the landscape (e.g. ecosystem composition, structure and pattern) rather than on demographic characteristics of individual species. Kaufmann et al. (1994) states "The concept assumes that a representative array of communities will contain the majority of species and that an array of cover types in an ecoregion will include appropriate vegetation mosaic"

The Wasatch-Cache N.F. Revised Forest Plan outlined sub-goals for biodiversity and viability (3d, 3e, and 3g) (4-19 FEIS) and established guideline 14 "Manage vegetation for properly functioning condition at the landscape scale. Percentages of cover types can be found in Table G14 Desired Structure and Pattern for Cover Types (4-39 FEIS). Sub-goals and guidelines are established efforts to maintain or enhance the necessary vegetative component and structure for a number of wildlife species including migratory birds that utilize the Wasatch-Cache landscape.

All alternatives would likely have little effect on these birds, considering the small extent of the habitat treatments compared with the fire effects. Table 4.8.5 displays the acres of the various cover types affected by the fire and proposed treatments. Alternative 2 proposes to salvage 781 acres and alternative 3 a total of 597. The number of acres for a particular tree species is not known, but it is assumed that a majority of the trees removed would be of a mixed conifer component. When comparing the overall available habitat remaining on the forest and the amount of salvaged acres under both alternatives the habitat would not be impacted from the removal.

Table 4.8.5. Acres of habitat cover type within the fire perimeter and on the Forest.

Habitat	Aspen/Conifer	Spruce-fir	Lodgepole pine	Mixed Conifer
Acres on Forest	205,600	153,400	61,300	151,700
Acres within fire perimeter	7,016	14,698	5,384	19,510
Affected acres*	621	1,759	2,568	4,614
% acres within fire affected	8	11	48	24
Remaining	198,584	138,702	55,916	132,190

available habitat on Forest				

*totals include high, moderate, and low burned acres (definitions can be found in Chapter 3 following Table 3.9.1)

4.8.9 Fragmentation

Effects Common to All Alternatives

The loss of vegetative cover in areas burned at high and moderate fire intensities will cause some level of fragmentation across the landscape. This level of fragmentation has likely occurred repeatedly through time with the fire regimes of this vegetative type.

Foreseeable Future Actions: Activities that could alter elk security include timber harvest and road construction. No other large-scale timber harvests are planned on Forest Service lands in the area. There are no proposals for new road construction in the area so open road density would not increase.

Alternative 1

Direct and Indirect Effects

Under Alternative 1, there would be no change in cover provided by low intensity burned vegetation or open road density. There would be no opportunity to decrease the open road density. Because cover and open roads would not change, this alternative would have little effect on fragmentation, corridors or linkages.

Cumulative Effects

This alternative would have no cumulative effects because vegetation and open road density would not change. Salvage of timber on 719 acres of private land is planned in areas that have been extensively harvested and roaded in the past.

Alternative 2

Direct and Indirect Effects

Under this alternative, 288 acres of unburned and low intensity burned area are proposed for salvaging. The open road density would be slightly reduced. This alternative would provide a slight decrease in cover and open road density, which may make it easier for some species to move across the landscape. Because there would be only a temporary change in vegetative cover and the open road density would decrease, this alternative would have little effect on fragmentation.

Cumulative Effects

This alternative would have no cumulative effects because vegetative cover would only temporarily decrease and open road density would decrease in all elk herd units. Salvage of timber on 719 acres of private land is planned in areas that have been extensively harvested and roaded in the past. The private landowner plans to decommission one road and close any new temporary roads following their use.

Alternative 3

Direct and Indirect Effects

Under this alternative, 228 acres of unburned and low intensity burned area are proposed for salvaging. The open road density would be slightly reduced. This alternative would provide a slight decrease in cover and open road density, which may make it easier for some species to move across the landscape. Because there would be only a temporary change in vegetative cover and the open road density would decrease, this alternative would have little effect on fragmentation.

Cumulative Effects

This alternative would have no cumulative effects because vegetative cover would only temporarily decrease and open road density would decrease in all elk herd units. Salvage of timber on 719 acres of private land is planned in areas that have been extensively harvested and roaded in the past. The private landowner plans to decommission one road and close any new temporary roads following their use.

4.9 Fish and Aquatic Resources

4.9.1 Introduction

This section discusses the impacts of each alternative on aquatic and semi-aquatic species within the area of influence of the proposed project. Included within this discussion are descriptions of (1) potential effects to aquatic and semi-aquatic species from post-fire logging, timber harvest, and road construction; (2) site-specific direct and indirect effects to aquatic and semi-aquatic species by alternative; (3) cumulative effects, and (irretrievable and irreversible commitment of resources. The aquatic and semi-aquatic issues are concerned with the effects of the alternative on fish and amphibians. Effects are discussed in terms of their direct, indirect and cumulative effects. For direct and indirect effects the area of analysis is the immediate area where the proposed activity would take place and includes the area of stream downslope of the harvest units, temporary roads and lands where sediment could move from the activity area into a water feature.

Direct effects are effects caused by the action and occurring at the same time and place. Indirect effects are effects caused by the action but occurring either later in time or further removed in distance. Cumulative effects result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions that are not included in the Proposed Action. A sediment yield model called Disturbed WEPP is used to estimate soil erosion and sediment yield effects for the kinds of disturbances associated with each of the alternatives. The results are used to compare effects between alternatives.

In the Soil and Water Resources section (4.1) there is a review of the research on the potential effects to soil and water resources from post-fire logging, timber harvest, and road construction. Soil, which migrates from the slopes and road surfaces into the stream, can directly affect fish through smothering eggs that are in the spawning beds (redds). It can also indirectly affect fish as habitat for aquatic insect communities shift from sediment intolerant communities to sediment tolerant communities.

4.9.2 Effects Common to all Alternatives

East Fork Fire Effects

Under existing conditions, soil erosion has been greatly accelerated by severely burned soil conditions resulting from the 2002 East Fork Fire. Much of this increased sediment runoff however did not make it into fish bearing streams because of the large amounts of unburned vegetation which exists in the riparian zones. The exceptions to this include the lower end of Boundary Creek where the fire originated and the west fork of upper Mill Creek where runoff from the burned slopes entered the channel. Runoff from unit 2 did enter the streams but these tributaries fan out prior to reaching the East Fork of the Bear River.

The indirect effects on aquatic and semi-aquatic species from the East Fork Fire include a loss of shading along some streams and the potential for increased water temperature. Sediment runoff may have also affected some of the macroinvertebrate communities causing a shift to sediment tolerant species. The increased runoff in the drainage has caused what appears to be an increase in spawning habitat in upper Mill Creek as fine sediment has been washed out of the gravel and more gravel appears to be present. Amphibian habitat may have been reduced where large woody debris burned in riparian areas.

4.9.3 Alternative 1

Direct and Indirect Effects

Under Alternative 1, there would be no direct or indirect effects from salvage logging because no salvage logging would occur. There would be continued short-term erosion and sedimentation due to the 2002 East Fork Fire. Accelerated erosion due to the fire is expected to occur for several years and the WEPP model estimates that erosion would revert to pre-fire rates in about 20 years

Cumulative Effects on Bonneville cutthroat trout

Existing cumulative impacts for Bonneville cutthroat trout were taken from the Wasatch-Cache National Forest Plan and the EIS for that Plan (Wasatch-Cache National Forest 2003). Current ongoing impacts to aquatic resources include sediment from existing roads. These typically are maintained at a low standard. In the project area private land management activities have also impacted Bonneville cutthroat trout. Timber harvest, the removal of potential recruitable large wood has had a lasting impact in these areas. Past activities that have occurred in the area is previous timber harvest, past wildfire, grazing, and recreation use. Past timber harvest and wildfire, except the East Fork Fire, has very little effect on the proposed action because the ground cover and vegetation has recovered to adequately protect the soil. Roads and trails continue to cause impacts to the East Fork of the Bear and the Mill Creek. There are limited developed and special uses in the area. Cattle and sheep grazing can also cause impacts to fish and amphibians. Cattle and sheep both cross streams and may crush eggs as they cross over the spawning beds during the period of 15 May through 15 August when eggs remain in the gravel. Non-native fish in the East Fork of the Bear River can also impact native species as they compete for food and space in the East Fork Bear River and its tributaries. A potential threat to these populations is the continued expansion of summer home development just north of the Forest and the expanding populations using the North Slope of the Uinta Mountains. Fishing is likely to increase over time.

■ Cumulative effects on Colorado River cutthroat trout

The primary concern in the West Fork Blacks Fork drainage is the same as for the other drainages, the upstream movement of non-native fish. There is potential for grazing impacts to Colorado River cutthroat trout. The risks and threats are expected to remain constant. Affects on other fish in the drainage are believed to be similar to those of the Colorado River cutthroat trout.

■ Cumulative effects on amphibians

Cumulative effects on amphibians are similar to those on fish. Past timber harvest has removed trees adjacent to riparian areas in some cases which may have reduced large woody debris recruitment into riparian areas. Road construction across riparian areas has removed riparian habitat. These activities have occurred on a small percentage of the total riparian habitat available in the analysis area. Historic grazing removed riparian vegetation. More recent grazing management has resulted in recovery of riparian areas to a properly functioning condition in this analysis area.

☐ 4.9.4 Alternative 2

■ Direct and Indirect Effects

Alternative 2 would harvest 781 acres. A total of 4.6 miles of temporary road would be constructed. Two units (11 and 12) have buffer strips less than 100 feet that, during major storm event, may contribute sediment to the fish bearing streams. During average storm events the below mitigation should reduce the risk of sediment to the streams.

Several factors affect the likelihood of sedimentation occurring from salvage logging. Based on literature review by McIver and Starr (2000, p.11) road building would be expected to produce the highest increase in sedimentation. The location, planning and construction of these temporary roads and skid trails can alter the sediment expected to enter the stream channels causing direct and indirect effects to fish and amphibians. Other factors that affect sedimentation are the distance and the ground cover condition of the area between the erosion source and the water feature. The longer the distance and the denser the ground cover, the potential to trap sediment before it reaches a water feature increases.

Mitigation measures were developed to reduce the potential for sediment from reaching fish bearing streams or ponds where amphibians may be impacted. The primary mitigation measure used to protect aquatic and semi-aquatics species was prohibiting logging operations adjacent to water bodies. This is supported by Minshall (2003) and provides for recruitment of large woody material into the stream channel and prevents disturbance of the flood plain and riparian vegetation. Large wood provides shade, instream cover and resting areas for fish. Many of these stream channels lack large wood because of the historic tie hacking that took place in the 1920s. Other mitigation measures such as limiting skidding operations near the edge of the units; ripping, seeding, slash placement and water barring would slow runoff, increase water infiltration, and enhance revegetation, helping to reduce runoff into the streams and small ponds.

General mitigation measures include:

1. Temporary roads will avoid crossing wetlands.
2. Water bars will be installed every 200 feet on temporary roads except where noted under the specific units.
3. In units 3, 4, 9, 15, 16, and 20, install cross trail water-bars on skid trails at 50-foot intervals.
4. In units 6, 8, 10, 12, and 13, harvest activities will be restricted to the normal dry season or winter.

See Table 2.4.2 for site specific mitigating measures.

The primary direct effect on fish and amphibians, from sediment coming from the harvest areas or roads used for harvest, is the smothering eggs and swim-up fry in the spawning areas. The ability of fish and amphibians' to uptake oxygen through their gills is also impacted as sediment is suspended in the water column. Harvest of trees in riparian zones can also reduce overhead, instream and riparian cover for fish and amphibians. The potential for large trees to be recruited into the channel and riparian areas was also considered in setting no harvest areas adjacent to streams and wetlands.

Indirect affects include the loss of habitat and aquatic insects that provide part of the food base for the fish and amphibians.

■ **Cumulative Effects on Bonneville Cutthroat Trout**

Cumulative effects for Alternative 2 are similar to the effects for Alternative 1. The proposed timber harvest would employ site specific mitigation measures that would reduce or eliminate the impacts of the harvest.

■ **Cumulative Effects on Colorado River Cutthroat Trout**

The primary concern in the drainage is the same as for the other drainages, the upstream movement of non-native fish. The harvest of the units in the West Fork Blacks Fork should not change potential for grazing impacts to Colorado River cutthroat trout. It is anticipated that the Colorado River cutthroat trout would persist over the next 100 years also. Again the risks and threats are expected to remain constant. Affects on other fish in the drainage are believed to be similar to those of the Colorado River cutthroat trout.

■ **Cumulative Effects on amphibians**

Cumulative effects for Alternative 2 are similar to the effects for Alternative 1. The proposed timber harvest would employ site specific mitigation measures that would reduce or eliminate the impacts of the harvest.

■ **Sensitive Species**

A Biological Evaluation (Chase 2004) determined that the proposed fire salvage "**may impact individuals**, but is not likely to cause a trend toward federal listing or a loss of viability" to the Bonneville cutthroat trout population on the Forest and that the proposed fire salvage activities will have "**no impact**" on Colorado cutthroat trout due to distance between cutting units and the streams.

■ **Irretrievable and Irreversible Commitment of Resources**

There are no irretrievable losses of the aquatic or semi-aquatic resources from this Alternative. Best management practices (BMPs) are the primary mechanism to enable achievement of water quality goals and soil retention. BMPs include, but are not limited to, structural and non-structural controls and operations and maintenance procedures to reduce or eliminate introduction of pollutants into receiving waters. Project specific BMPs are in the project file and incorporated by reference.

■ **Management Indicator Species**

Table 4.9.1 displays the adjacency of timber salvage units to stream channels that have Bonneville and Colorado River cutthroat trout populations.

Table 4.9.1. Acres of habitat cover type within the fire perimeter and on the Forest.

Drainage	Stream Miles in 3.1a (Aquatic Emphasis) Management Prescription	3.1a Stream Miles Within 300' of Salvage Units	Percentage of 3.1a Stream Length Within 300' of Salvage Units
East Fork Bear River	5.2	0	0
Mill Creek	15.0	0.8	5.3 %
West Fk. Blacks Fk.	6.6	0	0

☐ 4.9.5 Alternative 3

■ Direct and Indirect Effects

Alternative 3 would harvest 597 acres. No temporary roads would be constructed. Units 4, 15, 18, and 24 would be eliminated from harvest. Unit 2 would be reduced in size. Units 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 19, 21, and 23 would remain the same. During average storm events the mitigation listed under Alternative 2, for the harvest units, should reduce the risk of sediment to the streams.

The direct and indirect effects of Alternative 3 would be the same as Alternative 2 except for the effects of temporary road construction since temporary roads would not be constructed under this alternative. Based on research, roads cause the highest rates of sediment yield. For low intensity storms, very little if any sediment yield would occur from skidding and, based on the WEPP model, would most likely be less than existing conditions because of the same mitigation applied as in Alternative 2. For high intensity storms, some erosion is expected from skid trails and for most of the units the sediment yield rate would still be lower than existing rates because of the compaction of the soil from skidding.

■ Cumulative Effects

Cumulative effects for this alternative are similar to those for Alternative 2. With the elimination of unit 24, there would be no effect in the Blacks Fork drainage. The elimination of units and associated road construction would also reduce the impacts in the Mill Creek drainage

■ Sensitive Species

A Biological Evaluation (Chase 2004) determined that the proposed fire salvage "**may impact individuals**, but is not likely to cause a trend toward federal listing or a loss of viability" to the Bonneville cutthroat trout population on the Forest and that the proposed fire salvage activities will have "**no impact**" on Colorado cutthroat trout due to distance between cutting units and the streams.

■ Irretrievable and Irreversible Commitment of Resources

There are no irretrievable losses of the aquatic or semi-aquatic resources from this Alternative. Soil and Water Conservation practices (SWCPs) are the primary mechanism to enable achievement of water quality goals and soil retention. SWCPs include, but are not limited to, structural and non-structural controls and operations and maintenance procedures to reduce or eliminate introduction of pollutants into receiving waters. Project specific SWCPs are in the project file and incorporated by reference.

■ Management Indicator Species

Bonneville and Colorado River cutthroat are management indicator species under the Wasatch Cache Forest Plan. Based on post fire monitoring and expected effects on the habitat of these species from Alternative 3, it is believed that the Bear River and Mill Creek populations of Bonneville cutthroat trout and the West Fork Blacks Fork population of Colorado River cutthroat trout will persist over the next 15 years, for the same reasons as those stated under Alternative 2.

Table 4.9.2 displays the adjacency of timber salvage units to stream channels that have Bonneville and Colorado River cutthroat trout populations.

Table 4.9.2. Acres of habitat cover type within the fire perimeter and on the Forest.

Drainage	Stream Miles in 3.1a (Aquatic Emphasis) Management Prescription	3.1a Stream Miles Within 300' of Salvage Units	Percentage of 3.1a Stream Length Within 300' of Salvage Units
East Fork Bear River	5.2	0	0
Mill Creek	15.0	0.2	1.0 %
West Fk. Blacks Fk.	6.6	0	0

4.10 Recreation

4.10.1 Introduction

Direct effects are effects caused by the action and occurring at the same time and place. Indirect effects are effects caused by the action but occurring either later in time or further removed in distance. Cumulative effects result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions that are not included in the Proposed Action.

4.10.2 Effects Common to All Alternatives

Recreation Use Patterns

The broader scale patterns and types of recreation uses would not change appreciably under any of the alternatives. Relatively low density recreation uses such as driving for pleasure, undeveloped primitive car camping, camping, firewood gathering, hunting, cross country skiing, snow shoeing, hiking and horseback riding would continue to occur across all of the project area. There would be no change to the designated Recreation Opportunities Spectrum (ROS) for any of the affected areas. On the Wasatch-Cache National Forest, off highway vehicle (OHV) travel is allowed only on designated routes and areas for winter and summer recreation.

Recreation Safety

Standing fire-killed trees would present a safety concern for recreationists and a continuing maintenance problem along travelways within the project area.

Firewood Gathering

The popularity of firewood gathering is likely to increase under all alternatives. So long as fire-killed trees remain near open roads, there are likely to be increased levels of firewood collection. This is expected to diminish after several years, when the supply is depleted near roads.

Hunting

Increased forage production may increase deer and elk numbers in the burned areas somewhat in coming years. It is likely that this and the more open nature of the stands may increase big game hunting opportunities.

Forest Plan

Though no Forest Plan standards specifically apply to recreational uses for this project, implementation of any of the alternatives would be consistent with guidelines, broad goals and objectives of the revised Wasatch-Cache National Forest Land and Resource Management Plan.

4.10.3 Alternative 1

Direct and Indirect Effects

Under Alternative 1, the current system of open, closed, and seasonally restricted roads would remain in place. Undeveloped primitive camping and other recreation activities would remain the same. Choices to camp in certain camps may change because of user preference for camping in shaded areas. Snowmobile use would continue to be allowed or restricted as it currently is. Because of the opening up of the stands, more snowmobilers may choose to spend time in burnt stem stands. This would be a short term effect as the forest re-growth makes travel difficult as time passes.

4.10.4 Alternative 2

Direct and Indirect Effects

In this alternative, roads would be maintained to better accommodate logging traffic. As a by-product of this work, recreationists could find roads less rutted with less challenging driving conditions than they now sometimes are. During the salvage operation recreationists would be affected by the truck traffic creating dust and noise but this would be a short-term effect (See Map 4.10.1, Appendix A). Winter recreation would be the same as Alternative 1.

4.10.5 Alternative 3

This alternative would have the same effects as Alternative 2 (See Map 4.10.2, Appendix A).

4.10.6 Cumulative Effects of All Alternatives

The major past effect that continues to affect the recreation opportunities in the analysis area is the relatively extensive network of roads. Consequently, recreation opportunities are and would continue to be of a more developed nature (semi-primitive, motorized and roaded natural ROS) around the harvest units.

4.11 Socioeconomic Setting

4.11.1 Introduction

This section displays the economic information for each alternative. Present Net Value (PNV) is used as an indicator of economic efficiency. Present Net Value combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to all economic activity occurring in a single year. Other economic indicators are: timber volume harvested, sale value of the timber stumpage and costs of implementing the timber sale.

Financial Efficiency

Financial efficiency considers the estimated direct expenditures with estimated financial revenues. This analysis displays market costs and benefits, although there are many non-market benefits and costs that are not be assigned dollar values. Examples of non-market benefits that are not included in this analysis are watershed and wildlife habitat restoration, application of Best Management Practices (BMPs) to project area roads, and activities to reduce the spread of noxious weeds. Examples of non-market costs are erosion, scenic integrity degradation, and invasion of weeds onto National Forest land. This section focuses on the market costs and benefits of implementing the alternatives and relies on the various other resource sections of this chapter to identify the non-market benefits and costs that implementation would produce. Table 4.11.1 displays the Present Net Value (PNV) of each category of activities included in each alternative, and the Total PNV for each alternative. The cost of environmental document preparation is not shown, because those costs are incurred regardless of the final alternative chosen in the Record of Decision. Present Net Value calculations are contained in the East Fork Fire Salvage EIS project file.

Management of the forest is expected to yield positive benefits, but not necessarily financial benefits. Economic effects are assessed within the managerial context of the Wasatch-Cache National Forest Revised Forest Plan, as a part of an integrated approach to multiple-use management.

Economic Impacts

Economic impacts for the timber program have been addressed at the forest level in the revised Forest Plan. That analysis estimated employment and employee compensation estimated to result from the implementation of each alternative. Estimates of job and income impacts were made with IMPLAN Input-Output models. IMPLAN estimates combine direct, indirect and induced effects into the total impact. The measure for “jobs” includes both full and part-time jobs. The measure for “income” is employee compensation. Impact areas (the counties affected by implementation) were based on U.S. Department of Commerce, Regional Economic Information System, 2000. These areas are defined as functioning economies based on commuting patterns. Each economic area includes, as far as possible, both the place of work and the place of residence of the labor force. The Forest plan analysis determined that the timber program on the Wasatch-Cache provides an annual average of 37 wood products related jobs, and $800,000 annually in labor income (Wasatch-Cache National Forest Revised Forest Plan FEIS, Tables SE-10 and SE-11, pages 3-472 and 3-473).

☐ 4.11.2 Analysis Methods

The analysis displays the project-level financial attributes (predicted costs and revenues) of each alternative. Alternatives 2 and 3 would include timber harvest. The appraisal system estimates the predicted stumpage value of timber sales as if the sales were sold in September 2003. The actual appraised value of forest products will change between now and the time any projects are actually advertised for bids because of constant changes in stumpage market prices. For example, the value of dead wood is generally less than the value of live timber. However, one of the most valuable products within the Region at this time is large diameter dead spruce trees suitable for houselogs. The stumpage values used in the analysis represent a slightly higher value than for dead timber, but significantly less that what would be expected for houselog material.

Costs for various vegetation and road management activities are based on experienced costs and professional judgment, and represent the estimated costs to implement the alternative. Costs include sale preparation (marking/cruising, appraisal, contract preparation, advertising, etc.), sale administration, road maintenance, temporary road construction and obliteration, and post-sale activities (slash treatment, planting, and regeneration surveys). Road maintenance, temporary road construction and obliteration and slash treatments are all appraisal costs and are subtracted from the value of the timber to derive the stumpage value. The other costs are determined outside the appraisal process and are shown as separate costs. The financial efficiency analysis was calculated out 50 years to the first commercial entry.

Non-commodity values were not included in this analysis because these resources are evaluated under each specific resource section. Title 40, Code of Federal Regulations for NEPA (40 CFR 1502.23) states “For the purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are qualitative considerations”. Effects on resources are documented in individual resource sections in this chapter.

Additional information on unit costs and sale revenues used to develop PNV estimates are in the project file. Spreadsheets used to summarize IMPLAN employment and income impacts are included in the Forest Plan planning records, and the FEIS.

☐ 4.11.3 Effects Common to All Alternatives

The estimated cost of environmental document preparation has not been included in the analysis, because the cost is the same for all alternatives. By comparing the cost of each management activity with the level of outcomes and the description of effects in each resource section of this chapter, the reader can get a sense of any tradeoffs associated with the activity. Timber harvest is the only proposed activity that has a revenue component as well as costs. Proposed reforestation, road work and other activities only have a cost component.

State and local economies would be directly and indirectly affected by the monetary inputs this project represents. Timber products provided to the raw material markets through direct timber sales would contribute to the continuing operation of lumber mills. This would add directly and indirectly to the local and state economies through employment and tax revenues. This project represents opportunity for input to local and regional economies because of the proposed harvest activities. Employment opportunities in the wood products industries would be available. Employment would also be available in the reforestation and road projects. Table 4.11.1 compares the economic efficiency of the alternatives, and reflects the costs and benefits associated with the current harvest. The Total Discounted Costs, Total Discounted Benefits and PNV reflect the value over a 50 year period and are displayed in Table 4.11.2.

Table 4.11.1. Economic Efficiency Comparison of Alternatives. *Table displays the costs and benefits of the current proposed entries – those that are directly connected to the salvage sale.*

Timber Sales	Alternative 1	Alternative 2	Alternative 3
Acres	0	781	597
Volume (CCF)	0	9,248	5,706
Estimated Value ($/CCF)	0	$35.00	$35.00
Total Timber Value ($1000)	0	$323.7	$199.7
Road Construction Cost ($1000)*	0	92.9	41.3
Mark/Cruise Cost ($1000)	0	99.0	61.6
Sale Admin. Cost ($1000)	0	138.6	85.5
Contract Prep Cost ($1000)	0	21.4	21.4
Planting Cost ($1000)	0	43.7	43.7

*Estimated timber value is determined from the value of the timber, minus the road maintenance, temporary road construction and obliteration, and slash costs. Construction costs are shown here for comparison purposes only.

Table 4.11.2. PNV Comparison of Alternatives. *PNV is determined by projecting benefits and costs for a 60 year period and discounting them to current value. The PNV reflects this 60 year timeframe and includes costs and benefits for activities beyond the current proposal.*

Timber Sales	Alternative 1	Alternative 2	Alternative 3
Total Discounted Costs ($1000)	0	-$324.5	-$231.6
Total Discounted Benefits ($1000)	0	$335	$210.2
Overall PNV for Alternative ($1000)	0	$10.5	-$21.4

☐ 4.11.4 Alternative 1

Alternative 1 would produce no economic outputs. There would be no return on the cost of environmental study. No timber volume is harvested in this alternative. Present Net Value of the project is 0 (refer to Table 4.11.1)

☐ 4.11.5 Alternative 2

Alternative 2 would provide an estimated 9,248 CCF (4.4 MMBF) of timber volume offered for sale, the greatest amount of any alternative. This is approximately 50% of the annual volume needed to supply local mills. It would also maintain a total of 19.8 miles of existing system roads during the period of use. Road maintenance expenditures with this alternative are estimated to be about $93,000. Planting would be accomplished the same as Alternative 1. The total PNV for this alternative over 50 years is estimated at $10,500 (refer to Tables 4.11.1, 4.11.2 and 4.11.3).

☐ 4.11.6 Alternative 3

Alternative 3 would provide an estimated 5,706 CCF (2.7 MMBF) of timber volume offered for sale. If all the timber volume were sold and harvested, this alternative would provide approximately 30% of the annual volume needed to supply local mills. This alternative would also maintain roads, but because of the lower level of harvest, some roads would not be used and therefore not maintained. Maintenance would not be performed on two roads within the East Fork

Bear drainage, because the sales would be small offerings, and prospective purchasers are unlikely to have the equipment or expertise to complete such work. The sale in the West Fork of the Blacks also would not maintain any roads in that drainage. However, maintenance deposits would be collected into the road maintenance pool for future use. Mill Creek roads would receive the same maintenance as Alternative 2. Road maintenance work and deposits would be approximately $41,300. Planting would occur as with the other alternatives. The Present Net Value of the alternative over 50 years is -$21,400 (refer to Tables 4.11.1, 4.11.2 and 4.11.4).

Table 4.11.3. Alternative 2 – Sale Detail. *Total road maintenance column reflects the cost of maintenance, and/or the deposits paid for deferred maintenance.*

Sale Name	Acres Harvested	Total CCF Vol.	Total MBF Vol.	Total Road Mtce $
East Bear	256	2,323	1,115	$15,300
Mill Creek	432	5,130	2,513	$34,200
West Blacks	93	1,795	881	$43,400
Total	781	9,248	4,509	$92,900

Table 4.11.4. Alternative 3 – Sale Detail. *Total road maintenance column reflects the cost of maintenance, and/or the deposits paid for deferred maintenance.*

Sale Name	Acres Harvested	Total CCF Vol.	Total MBF Vol.	Total Road Mtce $
East Bear	164	1,834	862	$3,173
Carter Creek	24	96	46	$411
Mill Creek	375	3,276	1,572	$34,200
West Blacks	34	500	240	$3,557
Total	597	5,706	2,720	$41,341

4.12 Air Quality

Direct and Indirect Effects

The primary effect to air quality results from burning of harvest created slash piles in log landings.

4.12.1 Alternative 1

No burning would occur with this alternative; therefore Alternative 1 would have no effects on air quality.

4.12.2 Alternative 2

Under Alternative 2, slash would be piled in landings for disposal by burning. During the burning period, piles would produce smoke that would be visible within the project area and could drift into surrounding communities. Burning can be expected to take place over two or three days. Burning will be done in accordance with State of Utah Air Quality guidelines and smoke management plans, and under conditions that will disperse smoke and minimize drift into nearby communities. Considering the short time of burning, the limited volume of slash, and burning only under appropriate conditions, the effects on air quality are expected to be minimal.

4.12.3 Alternative 3

Effects of Alternative 3 are expected to be similar to Alternative 2, except the amount of slash and number of days required for burning will be less. The effects of air quality are expected to be minimal.

☐ 4.12.4 Cumulative Effects

Alternative 1

Alternative 1 would not add any additional smoke or particulate matter to the existing levels resulting from campfires or other sources within the project area. Burning of slash on private land would increase smoke and particulate matter during the few days that piles are burned. Compliance with Utah Air Quality guidelines will mitigate the effects on air quality.

Alternatives 2 and 3

Alternatives 2 and 3 would be expected to slightly increase smoke and particulate matter during the time slash piles are actually burned. These effects will be minimized through the use of air quality guidelines and timing of burning to coincide with conditions that will maximize dispersal and insure that smoke doesn't concentrate in the project area or adjacent communities. Because of compliance with Utah Air Quality guidelines, there will be no effect on air quality.