SUMMARY

Background

In a March 5, 2007 Record of Decision (ROD) former Forest Supervisor Faye Krueger approved Alternative 2 for the West Bear Vegetation Management Project. Two appeals were received on the project; one of the appellants identified an error in the FEIS. Additionally, Forest Supervisor Krueger saw an opportunity to clarify the scientific methodology employed in the West Bear Vegetation Management Project FEIS. On May 25, 2007 Deputy Forest Supervisor Dave R. Myers, acting for Supervisor Krueger, withdrew the decision.

After reviewing the West Bear Vegetation Management Project, Steve Ryberg, the Evanston District Ranger, determined specific areas in need of additional analysis or consideration. The interdisciplinary team was instructed to concentrate on the analysis of soils, vegetation, and some species of wildlife for a Draft Supplemental Environmental Impact Statement (SEIS). In March 2008 the Draft SEIS was distributed to the public. This Draft SEIS presented additional analysis to supplement information presented in the West Bear Vegetation Management Final FEIS. Based on comments received on the Draft SEIS, some additional changes and additions were made to the FEIS and documented in this Final Supplement to the FEIS. The SEIS does not replace the Final EIS in entirety. Instead, information provided in the SEIS replaces discrete sections of the FEIS or provides additional information to supplement the analysis presented in the FEIS. Both documents are available on the web at: http://www.fs.fed.us/r4/wcnf/projects/proposed/index.shtml.

Scope of the Final Supplemental Environmental Impact Statement

A supplemental document (40 CFR 1502.9 (b) (3), FSH 1909.15 § 18) can provide additional clarification of the previous analysis. This Final SEIS (FSEIS) presents additional analysis to supplement information presented in the West Bear Vegetation Management Final Environmental Impact Statement (FEIS).

Some sections of this document refer to maps, appendices, or other information contained in the West Bear Vegetation Management FEIS. The West Bear FEIS is available on the Wasatch-Cache National Forest website (http://www.fs.fed.us/r4/wcnf/projects/decisions/index.shtml). To obtain a CD of the FEIS, contact Larry Johnson by phone (307-798-3194) or email (lljohnson@fs.fed.us).

The following sections describe the purpose and need for action, the alternatives considered in detail, and compares the effects of the three alternatives. There has been no change in the purpose and need for action since the preparation of the FEIS. Corrections, clarification or supplemental analysis of information previously presented in chapters 1 through 4 follow this summary.

Purpose and Need for Action

For more detail about the purpose and need for action, refer to pages 3 through 6, Section 1.1 of the West Bear FEIS.

Alternatives, Including the Proposed Action

This FSEIS documents supplemental analysis of the same three alternatives considered in the West Bear Vegetation Management Project FEIS. These alternatives are summarized below and described in detail in Chapter 2 of the West Bear Vegetation Management Project FEIS. Differences between the alternatives are summarized below.

Alternative 1 - No Action

Under the no action alternative no timber harvest, prescribed burning, road construction, or road relocation would be implemented to accomplish project goals. Previously authorized projects, roads and facility maintenance, and other Forest management activities would remain ongoing. Road management would be in accordance with the current Mountain View/Evanston District Travel Plan (USDA Forest Service 2003a).

This alternative would not preclude Forest management activities identified under previous decisions, nor would it preclude the potential for activities to be identified under future decisions.

Alternative 2 – The Proposed Action

Alternative 2 includes timber harvesting, prescribed burning, construction of temporary roads, intermittent service roads, and minor reconstruction of existing system roads. Treatment would involve group selection harvest in spruce/fir and mixed conifer stands, small (1 to 5 acre) patch cutting in mixed aspen/conifer stands, conifer removal and prescribed burning in aspen/conifer stands, and prescribed burning in aspen stands. Approximately 1,686 acres within 38 units would be treated under the proposal. Approximately 326 acres of aspen and mixed aspen/conifer would be burned following removal of conifers on those acres. In addition, about 197 acres would be prescribed burned without prior conifer harvest. Access to the timber would require the construction of approximately 7.8 miles of temporary roads, 0.9 miles of intermittent service system roads, and relocation of approximately 0.6 miles of existing system roads to reduce sedimentation and improve drainage. All temporary roads would be recontoured / rehabilitated after harvest. Proposed reconstruction or relocation of existing roads would emphasize improving drainage design of the roads near stream crossings and relocating or improving drainage where the roads are near stream channels. Approximately 3.4 miles of firelines would be constructed where needed prior to burning to reduce the probability of fire escaping the boundaries.

Alternative 3

Alternative 3 provides an alternative that requires no new construction of roads and reduces the amount of temporary roads compared to Alternative 2. Alternative 3 also emphasizes prescribed fire without mechanical treatment. It would treat approximately 1,387 acres within 28 harvest units. It would require construction of approximately 1.9 miles of temporary roads, no intermittent service system road, and relocation of approximately 300 feet of an existing system road to reduce sedimentation and improve drainage. Temporary roads would be recontoured/rehabilitated after harvest as with the proposed action. An estimated 6.4 miles of firelines would be needed to accomplish the prescribed burning.

Conifers would not be harvested from Units 34 (Reservoir East Sale), 41 and 42 (Mill City Burn) prior to burning; the units would be burned without prior treatment other than fireline construction.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table Summary 1. Comparison of Alternatives.

Issue	Resource Values Analyzed		Effects of Alternatives		
			Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
Water Resources	Water yield increase in Acre-Feet / % (3.1.3.5, 3.1.4.3)	West Fk Bear	0	~164 acre feet / .5 %	~149 acre feet / .4 %
		West Fk Bear Above Whitney	0	~12.9 acre feet / .2%	~9.5 acre feet / .2 %
		Hayden Fork	0	~39 acre feet / .1 %	~39 acre feet / .1 %
	Timing of increased runoff (3.1.4.3)		No change	No change	No change
	Increase in peak flow (3.1.4.3)		No change	Slight increase	Slight increase
	Water Quality (3.1.4.2, 3.2.4)		No change	Very slight effect	Very slight effect
	Wetlands (3.1.4.1)		No change	Slight improvement from road relocation	No effect
	Floodplains (3.1.4.1)		No change	No effect	No effect
Soils	Wepp modeled erosion (3.2.4, 3.2.4.1)		No change	Very low	Very low
	Soil compaction (3.2.4.1)		No change	~12-15% of each activity area (harvest unit)	~12-15% of each activity area (harvest unit)
	Burning - hydrophobic soils (3.2.4.2)		No change	No effect	No effect
	Productivity (3.2.4.1)		No change	At least 85%	At least 85%
Aquatic Habitat	Riparian Habitat Conservation Areas (3.3.4.1)		No change	Slight increase in impacts	Slight increase in impacts
Threatened, Endangered and Sensitive Aquatic Species	Bonneville cutthroat trout (3.3.4.3)		No change	"May impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability"	"May impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability"
	Amphibians (3.3.4.4)		No change	Minor favorable and adverse effects	Minor favorable and adverse effects
Aquatic Management Indicator Species	Forest-wide trend in population of Bonneville cutthroat trout. (3.3.4.5)		No change	No effect	No effect

Issue	Resource Values Analyzed		Effects of Alternatives: Alternative 1 (No Action)	Effects of Alternatives: Alternative 2 (Proposed Action)	Effects of Alternatives: Alternative 3
Properly Functioning Condition	Age Class Diversity and Species Composition. (3.4.4.1)		Continued gradual move away from PFC (Gradual loss of aspen and continued shortage of young age classes)	Improvement in conifer and aspen age class diversity	Improvement in conifer and aspen age class diversity
Properly Functioning Condition	Fragmentation, biological diversity, and ecological integrity. (3.3.4, 3.4.4, 3.6.4)		No change in fragmentation. Continued trend toward mature and old forest habitat and potential for large stand replacing fires	Slight increase in fragmentation. Slight improvement in diversity of habitat. Ecological integrity maintained	Slight increase in fragmentation. Slight improvement in diversity of habitat. Ecological integrity maintained
Properly Functioning Condition	Disease and insect infestations (3.4.4.2)		Continued gradually increasing risk of landscape bark beetle epidemics	Age and species diversity and lower conifer density leading to future stand conditions that would be less likely to support beetle epidemics	Age and species diversity and lower conifer density leading to future stand conditions that would be less likely to support beetle epidemics
Properly Functioning Condition	Acres and percentage of forest type in fire regime condition classes. (3.5.4.1)		Gradual trend toward substantially altered fire regimes.	Slight improvement in watershed fire regime condition class	Slight improvement in watershed fire regime condition class
Properly Functioning Condition	Prescribed fire effects with and without fuel from conifer tops and limbs. (3.4.4.1)		No change	~418 acres of conifer/aspen moved to seral aspen based on 80% burn effectiveness.	~209 acres of conifer/aspen moved to seral aspen based on 40% burn effectiveness
Old Forest	Acres (%) of old forest in the ecosection. (3.4.4.4)	Spruce/Fir	No change, 83,319acres (67%)	Change in old forest structure on 575 acres	Change in old forest structure on ~389 acres
Old Forest	Acres (%) of old forest in the ecosection. (3.4.4.4)	Mixed Conifer	No change, 60,169 Acres (43%)	Change in structure on ~427 acres	Change in structure on ~348 acres
Old Forest	Acres of old forest in the analysis area. (3.4.4.4)	Spruce/Fir	No change	Change in old forest structure on ~575 acres	Change in old forest structure on ~389 Acres
Old Forest	Acres of old forest in the analysis area. (3.4.4.4)	Mixed Conifer	No change	Change in structure on ~427 acres	Change in structure on ~348 acres
Noxious Weeds	Effects on noxious weeds. (3.4.4.3)		No change	Increased risk mitigated by equipment washing and follow-up treatment	Slightly less risk than Alt 2 mitigated by equipment washing and follow-up treatment
Sensitive Plants	Effects on sensitive plants. (3.4.4.5)		No change	No effect, one identified site protected.	No effect, one identified site protected.

Issue	Resource Values Analyzed		Effects of Alternatives		
			Alternative 1 (No Action)	**Alternative 2 (Proposed Action)**	**Alternative 3**
Wildlife	Changes in forest habitat from timber harvest and prescribed burning. (3.6.4)		No change	Temporary increase in spruce/fir and mixed conifer forest gaps and large openings in conifer/ aspen forest	Same as Alt 2 with fewer spruce/fir and mixed conifer acres treated
	Effects of roads on noise, barriers to movement, fragmentation. (3.6.4)		No change	Increased traffic and equipment noise, Slight increase in snow compaction, temporary barriers to movement of some species.	Same as Alt 2 with proportionately less effect due to less road mileage.
	Effects of harvest and roads on migratory birds. (3.6.4.5)		Continued decline in forest habitat age and species diversity	Generally positive effects on aspen dependent and habitat generalists with minor adverse effects on old forest dependent species.	Same as Alt 2 with fewer effects on old forest dependent species.
Threatened, Endangered and Sensitive Terrestrial Species	Effects on Threatened, Endangered and Sensitive Terrestrial Species and their denning, nesting, and foraging habitat. (3.6.4.1)	Bald eagle	No change	"No effect"	"No effect"
		Canada lynx	No change	"May affect, but is not likely to adversely affect"	"May affect, but is not likely to adversely affect"
		Wolverine, boreal owl, great gray owl, three-toed woodpecker northern goshawk	No change	"May impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability"	"May impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability"
Terrestrial Management Indicator Species	Terrestrial Management Indicator Species and their denning, nesting, and foraging habitat. (3.6.4.4)	Snowshoe hare	No change	Slight short-term reduction in habitat and hares, increase after 10-15 years	Same as Alt 2 with fewer acres treated
		Beaver	No change	Minor favorable effect in Mill City area	Minor favorable effect in Mill City area
		Northern goshawk	Gradual long-term decline in nesting and foraging habitat associated with mixed conifer and aspen and early successional stands	Short-term reduction in suitable nesting habitat and foraging opportunities, long-term maintenance of conifer/aspen habitat	Same as Alt 2 except that fewer acres would be treated

Issue	Resource Values Analyzed		Effects of Alternatives: Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
	Forest-wide trend of Terrestrial Management Indicator Species (3.6.4.4)	Snowshoe hare	No change	No significant effect on forest-wide trend	No significant effect on forest-wide trend
		Beaver	No change	No significant effect on forest-wide trend	No significant effect on forest-wide trend
		Northern goshawk	No direct effects	No significant effect on forest-wide trend	No significant effect on forest-wide trend
Browsing / Aspen	Browsing impacts on past aspen treatment. (3.6.4.7)		No change	Possible minor effect on rapidity of aspen establishment	Possible minor effect on rapidity of aspen establishment
Recreational Use	Dispersed camp sites. (3.7, 3.8)		No change	Meets Forest Plan scenic integrity objectives, minimal direct effects on areas adjacent to 94 sites	Same as Alt 2
	Noise from timber harvest operations. (3.8.4.4)		No change	Adverse weekday effects on up to 109 campers at one time while harvest or haul operations are ongoing within ½ mile of camp sites	Same as Alt 2
	Effects of truck traffic on recreational traffic. (3.8.4.4)		No change	Estimated 4 loads per weekday with up to 9 loads per day using Whitney Road for ~308 days	Estimated 4 loads per weekday with up to 9 loads per day using Whitney Road for ~221 days
	Effects of road relocation on recreational use. (3.7, 3.8)		No change	Slightly improved access to some sites, removes shoreline road on Beaver Lake	Slightly improved access to some sites.
	Effects of harvest operations on snowmobiling. (3.8.4.1)		No change	Minor effect on opportunities before December 15	Same as Alt 2
Economic Efficiency	Estimated economic efficiency comparison of alternatives. (3.9.4)		0	Benefits: $1,104,867 Costs: $625,279 PNV: $479,589	Benefits: $621,445 Costs: $405,364 PNV: $216,080
Timber Utilization	Anticipated timber sale size. (3.9.4)		0	~1,489 acres, 12,000 Hundred Cubic Feet (CCF)	~864 acres, ~6,000 Hundred Cubic Feet (CCF)
	Anticipated timber sale scheduling. (2.1, 3.8, 3.9)		None	Moffit: ~4,000 CCF Reservoir: ~4,000 CCF Mill City: ~4,000 CCF	Moffit: ~3,000 CCF Reservoir E: ~3,000 CCF
	Anticipated size categories of timber to be offered. (2.1)		None	Moffit: Sawlogs Reservoir E: Sawlogs Mill City: Sawlogs and poles.	Moffit: Sawlogs Reservoir E: Sawlogs Mill City: None
	Volume of merchantable timber burned (3.9.4)		None	Up to 100 CCF	Up to 1,200 CCF

The Notice of Intent to prepare a supplement to the Environmental Impact Statement was published in the *Federal Register* on January 24, 2008 (vol. 73, no. 16). Public scoping is not required for supplements to environmental impact statements (40 CFR 1502.9(c)4(4)). The Notice of Availability for the Draft SEIS appeared in the Federal Register on March 14, 2008. At the same time the Draft SEIS was distributed to the public and government agencies. This Draft SEIS presented additional analysis to supplement information presented in the West Bear Vegetation Management Final FEIS. Based on comments received on the Draft SEIS, some additional changes and additions were made to the FEIS and documented in this Final Supplement to the FEIS.

Table of Contents
Final Supplemental Environmental Impact Statement

CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

Replace Section 1.5 Relationship to Revised Forest plan on page 7 of Chapter 1 of the West Bear Vegetation Management Project FEIS with the following 2 paragraphs. It updates information on the planning rule currently in effect and the consideration of science.

1.5 Relationship to Revised Forest Plan

The 2003 Revised Forest Plan sets forth management direction for managing the land and resources of the Wasatch-Cache National Forest. The Forest Plan is the result of programmatic analysis, which is addressed in the Forest Plan FEIS (USDA Forest Service 2003). The West Bear Vegetation Management EIS is a project-level analysis; its scope is confined to addressing the significant issues and possible environmental consequences of the project. Where appropriate, the West Bear Vegetation Management EIS tiers to the Forest Plan FEIS, as encouraged by 40 CFR 1502.20.

The 2008 National Forest Management Act regulations at 36 CFR 219 were effective on April 21, 2008 (73 FR 21468).

The techniques and methodologies used in this analysis consider current and accurate science. The analysis includes a summary of the credible scientific evidence which is relevant to evaluating reasonably foreseeable impacts. The analysis also identifies methods used and references scientific sources relied on. When appropriate, the conclusions are based on the scientific analysis that shows a thorough review of relevant scientific information, a consideration of responsible opposing views, and the acknowledgment of incomplete or unavailable information. Literature reviewed and considered by specialists in the analyses is referenced in the FEIS, Chapter 5.

CHAPTER 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Add the following to Section 2.01 Introduction on page 2-1 in the West Bear Vegetation Management Project FEIS.

2.01 Introduction

This chapter of the West Bear Vegetation Management Project Supplemental Environmental Impact Statement corrects and/or clarifies information presented in Chapter 2 of the West Bear Vegetation Management Project Final EIS (USDA Forest Service, 2007).

This chapter does not replace Chapter 2 of the West Bear FEIS in entirety. Instead, information provided in the chapter will replace discrete sections of the FEIS or is an addition. Some sections of the document refer to maps, appendices, or other information contained in the West Bear Vegetation Management FEIS (USDA Forest Service, 2007). This document is available at the following web site (http://www.fs.fed.us/r4/wcnf/projects/decisions/index.shtml)

Replace the last sentence under Alternative 2 – Proposed Action in section 2.1.2, Chapter 2, page 2 of the West Bear Vegetation Management Project with the following:

Approximately 3.4 miles of firelines would be needed.

Replace the narrative describing the vegetation management under Alternative 2 – Proposed Action in section 2.1.2.1, Chapter 2, pages 3 through 4 of the West Bear Vegetation Management Project with the following:

Spruce-fir treatment would consist of the following:

1. Group Selection (patch cuts). Within the ~575 gross acres of spruce-fir stands identified for treatment, harvesting would create approximately 115 acres of small openings to establish spruce regeneration. Openings would range from ¼ acre to ½ acre in size, and planting containerized spruce seedlings after harvest would ensure adequate spruce regeneration. Openings in patches of spruce-fir would not exceed ½ acre in size. Existing small openings would be used whenever possible to meet treatment objectives.
2. Thinning. This treatment would thin dense groups of mature spruce-fir within approximately 460 acres of spruce-fir stands (575 acres minus 115 acres of group selection) to reduce the stand density. Thinning would be discontinuous concentrating on groups or "clumps" of trees. Spruce-fir clumps would be thinned to an average basal area of about 120 square feet to reduce the higher densities associated with "high hazard" ratings for spruce beetle with an objective of retaining at least 80 square feet of live trees (Schmid and Frye 1976). Thinning would remove both subalpine fir and spruce trees to perpetuate spruce on the landscape, while maintaining a mixed species stand to improve resistance to future spruce beetle activity. Standing and down trees would be retained to benefit wildlife in accordance with Forest Plan Guidelines.

3. Salvage. Harvest would remove existing insect killed and infested trees in excess of those needed to meet Forest Plan guidelines for snag and woody debris retention. Recently killed trees in the spruce-fir stands are generally individual trees or very small patches of trees.

Mixed Conifer stands contain substantial variation in species composition; therefore no single treatment would be applied uniformly throughout the stands. Rather the treatments would be determined by the composition of patches within the stand and would consist of the following:

1. Group Selection (patch cuts). Within the ~427 gross acres of mixed conifer, an estimated 85 acres of groups and/or small patches would be harvested to increase the amount of mixed conifer regeneration within the type. Openings in patches of spruce-fir would not exceed ½ acre in size; groups in lodgepole pine dominated patches would not exceed 2 acres in size.
2. Thinning. Thinning clumps of spruce-fir and/or lodgepole pine would reduce bark beetle hazard ratings on ~342 acres (427 acres minus 85 acres of regeneration). Spruce-fir clumps would be thinned to a basal area of about 120 square feet to reduce the higher densities associated with "high hazard" ratings for spruce beetle, while lodgepole pine clumps would be thinned to less than 100 square feet. Thinning would be done with an objective of retaining at least 80 square feet of live spruce and 60 square feet of live lodgepole pine.
3. Salvage. Harvest would remove existing insect killed and infested trees in excess of those needed to meet Forest Plan guidelines for snag and woody debris retention. Most of these are mountain pine beetle infested patches of lodgepole pine and are located primarily in units 30, 31, 36, and 37.

Aspen/Conifer treatment would consist of the following:

1. Harvest merchantable conifers from 5 stands totaling about 326 acres. Slash would be left scattered to provide fuel for prescribed burning.
2. Prescribed burn harvested areas to stimulate aspen regeneration. The fire is expected to burn about an additional 197 acres between harvested units. Assuming 80% burn effectiveness, about 418 acres would be regenerated.
3. Removal of conifers from 1-5 acre patches totaling about 40 acres of mixed aspen/conifer scattered within about 161 acres in units 7, 24, and 25 to create uneven-aged aspen patches.

Total acres harvested under any treatment prescription would not exceed those listed in Table 2.1.1.

Replace the Mill City Sale and Burn portion of Table 2.1.2 listing road and fireline miles for Alternative 2 in Chapter 2, pages 4 through 5 of the West Bear Vegetation Management Project with the following:

Table 2.1.2. Alternative 2 Roads and Firelines.

Sale Name	Unit #	Estimated Acres	Temp Rd (Mi.)	Int. Svc. Rd (Mi)	Road Reloc. (Mi)	Fireline (Mi)
Mill City Sale and Burn	41	43	0.5	0	0	0.3
	42	47	0.3	0	0	0.2

Sale Name	Unit #	Estimated Acres	Temp Rd (Mi.)	Int. Svc. Rd (Mi)	Road Reloc. (Mi)	Fireline (Mi)
	43	75	1.0	0	0	0.1
	44	120	0.9	0	0	0.6
	Burn	197	0.0	0	0	1.6
Mill City Totals	**5**	**482**	**2.7**	**0**	**0**	**3.2**
Totals	**38**	**1,686**	**7.8**	**0.9**	**0.6**	**3.4**

Replace Fireline Construction/Rehabilitation line of Table 2.1.3 Summary of the activities that would be included in this alternative for Alternative 2 in Chapter 2, page 5 of the West Bear Vegetation Management Project with the following:

Table 2.1.3. Summary of the activities that would be included in this alternative.

Alternative 2 - Activities Activity	Quantity
Fireline Construction/Rehabilitation	3.4 miles

Replace the narrative describing the vegetation management under Alternative 3 in section 2.1.3.1, Chapter 2, pages 6 through 7 of the West Bear Vegetation Management Project with the following:

Spruce-fir treatment would consist of the following:

1. Group Selection. Within the estimated 389 gross acres of spruce-fir stands identified for treatment, harvesting would create approximately 78 acres of small openings to establish spruce regeneration. Openings would range from ¼ acre to ½ acre in size, and planting containerized spruce seedlings after harvest would ensure adequate spruce regeneration. Groups in patches of spruce-fir would not exceed ½ acre in size. Existing small openings would be used whenever possible to meet treatment objectives.
2. Thinning. This treatment would thin dense groups of mature spruce-fir within approximately 311 acres of spruce/fir stands (389 acres minus 78 acres of group selection) to reduce the stand density. Thinning would be discontinuous concentrating on groups or “clumps” of trees. Spruce-fir clumps would be thinned to an average of about 120 square feet to reduce the higher densities associated with “high hazard” ratings for spruce beetle with an objective of retaining at least 80 square feet of live trees (Schmid and Frye 1976). Thinning would remove both subalpine fir and spruce trees to perpetuate spruce on the landscape, while maintaining a mixed species stand to improve resistance to future spruce beetle activity. Standing and down trees would be retained to benefit wildlife in accordance with Forest Plan Guidelines.
3. Salvage. Harvest would remove existing insect killed and infested trees in excess of those needed to meet Forest Plan guidelines for snag and woody debris retention.

Recently killed trees in the spruce/fir stands are generally individual trees or very small patches of trees.

Mixed Conifer stands contain substantial variation in species composition; therefore no single treatment would be applied uniformly throughout the stands. Rather the treatments would be determined by the composition of patches within the stand and would consist of the following:

1. Group Selection. Within the estimated 348 gross acres of mixed conifer, an estimated 70 acres of groups and/or small patches would be harvested to increase the amount of mixed conifer regeneration within the type. Groups in patches of spruce-fir would not exceed ½ acre in size; groups in lodgepole pine dominated patches would not exceed 2 acres in size.
2. Thinning. Thinning clumps of large spruce and/or lodgepole pine would reduce bark beetle hazard ratings on about 278 acres (348 acres minus 70 acres of regeneration). Spruce-fir clumps would be thinned to an average of about 120 square feet to reduce the higher densities associated with “high hazard” ratings for spruce beetle, while lodgepole pine clumps would be thinned to less than 100 square feet. Thinning would be done with an objective of retaining at least 80 square feet of live spruce-fir or 60 square feet of live lodgepole pine.
3. Salvage. Harvest would remove existing insect killed and infested trees in excess of those needed to meet Forest Plan guidelines for snag and woody debris retention. Most of these are mountain pine beetle infested patches of lodgepole pine and are located primarily in units 30, 31, 36, and 37.

Aspen/Conifer treatment would consist of the following:

1. Construct Firelines around burn units. No timber harvest would occur within the units.
2. Prescribed burn approximately 523 acres to stimulate aspen regeneration. Assuming 40% burn effectiveness, an estimated 209 acres would be regenerated.
3. Removal of conifers from 1-5 acre patches totaling about 32 acres of mixed aspen/conifer scattered within the estimated 127 acres in units 7, 24, and 25 to create uneven-aged aspen patches.

Total acres harvested under any treatment prescription would not exceed those listed in Table 2.1.4.

Add the following management direction to Table 2.1.7, Management Direction and Mitigation Measures, Soil, Water, Fisheries, and Aquatic Resources in Chapter 2, Page 9 of the West Bear Vegetation Management Project:

Table 2.1.7. Management Direction and Mitigation Measures

Management Direction and Mitigation Measure Description	Alternative
Soil, Water, Fisheries and Aquatic Resources	
Firelines would be water barred at the time of construction with slash scattered on their surfaces following their use, and where appropriate, seeded following use in compliance with Forest Plan Standard S2.	Alt. 2, Alt. 3

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Add the following to Section 3.01 Introduction in Chapter 3, page 1 in the West Bear Vegetation Management Project FEIS.

3.01 Introduction

This chapter of the West Bear Vegetation Management Project Supplemental Environmental Impact Statement presents analysis to correct and/or clarify information presented in Chapter 3 of the West Bear Vegetation Management Project Final EIS (USDA Forest Service, 2007).

This chapter does not replace Chapter 3 of the West Bear FEIS in entirety. Instead, information provided in the chapter will replace discrete sections of the FEIS or is an addition. Some sections of the document refer to maps, appendices, or other information contained in the West Bear Vegetation Management FEIS (USDA Forest Service, 2007). This document is available at the following web site (http://www.fs.fed.us/r4/wcnf/projects/decisions/index.shtml)

The information is this chapter is a summary of project-specific reports, assessments, and input prepared by Forest Service specialists, which are incorporated by reference in this final supplement to final environmental impact statement (SEIS). These reports or memoranda are part of the project record on file at the Evanston Ranger District.

This Final Supplemental EIS is also an opportunity to clarify the scientific methodology employed in the West Bear Vegetation Management Project. The techniques and methodologies used in this analysis consider current and accurate science. The analysis also identifies methods used and references scientific sources relied on. When appropriate, the conclusions are based on the scientific analysis that shows a thorough review of relevant scientific information, a consideration of responsible opposing views, and the acknowledgment of incomplete or unavailable information.

Replace the narrative describing the direct, indirect and cumulative effects of Alternative 2 – Proposed Action in Chapter 3, pages 27 through 28 in section 3.2.4.1 of the West Bear Vegetation Management Project FEIS with the following:

Alternative 2 – Proposed Action

Direct and Indirect Effects

Soil Erosion, Compaction and Severe Soil Burning: Under this alternative, erosion rates that exceed soil loss tolerance values were not predicted to occur on any harvest units as a result of a 6 year return period rain storm. Under the proposed action, erosion rates that exceed soil loss tolerance values were predicted to occur on harvest units containing the steeply sloping (40 to 60 % slope gradients) Namon soils found within soil type 491. However, Forest Plan standard S1 specifically prohibits the use of ground based skidding on slopes with gradients steeper than 40%, so this level of erosion would not be seen as a result of proposed activities (USDA Forest Service. 2003b). Also under this alternative, soil erosion rates exceeding soil loss tolerance values were predicted to occur, as a result of a 30 year return period rain storm, in proposed harvest units 7, 8, 31, 41, 42, 43, and 44, or about 22% of the activity areas (Flood, Paul. 2005a). Because these kinds of storms are not likely to occur within the time frame of harvest activity, the probability of detrimental soil erosion actually occurring in these units, as a result of proposed activities, is very low. Also, because this alternative avoids ground based skidding on the steep, erosive, and unstable slopes of soil type 491, Forest Plan guideline G9 is being met. Consequently no specific erosion control practices will be needed to mitigate this effect.

Soil types that are most susceptible to the effects of compaction occur in many of the harvest units in this alternative (Flood, Paul. 2005b). Unit 34 is the only unit on these soil types requiring fireline construction with 0.2 miles of fireline required. Most of the fireline would be accomplished by utilizing the fire line locations as skid trails. For these soil types, restricting mechanized harvest to a designated system of timber skidding trails will reduce unmitigated detrimental soil compaction to an average of about 13 % percent of the 20 activity areas that contain these soil types (See: Treatment Unit Disturbance Table for Alt. 2, below).

Normal requirements for skidding during the normal operating season or on frozen soils are adequate protection for those landtypes that are not the most susceptible to compaction. Under this alternative, because the units are proposed for prescribed fire treatments only during the fall, none will be subject to severe soil burning.

Treatment Unit Disturbance Table for Alt. 2

Unit #	Acres in Unit	Acres in LT 226	Unit Skidtrail acres	Unit Fireline acres	Unit Landing Acres	Temp Road Within Activity Area Acres	% Activity Area Left Disturbed
2*	19	0	2.1	0.0	0.4	0.0	13
3*	43	0	4.8	0.0	0.9	0.0	13
5*	18	0	2.0	0.0	0.4	0.2	14
6*	21	0	2.3	0.0	0.4	0.2	14
7	28	27	2.3**	0.0	0.6	0.2	11
8	16	15	1.8	0.0	0.3	0.2	14
9	13	0	1.4	0.0	0.3	0.0	13
10	16	0	1.8	0.0	0.3	0.0	13
11*	169	0	18.6	0.0	3.4	0.0	13
12*	57	0	6.3	0.0	1.1	0.2	13
13*	11	0	1.2	0.0	0.2	0.1	14
14*	8	0	0.9	0.0	0.2	0.1	15
15	25	0	2.8	0.0	0.5	0.2	14
16	8	0	0.9	0.0	0.2	0.1	15
17	21	0	2.3	0.0	0.4	0.2	14
18	22	0	2.4	0.0	0.4	0.2	13
19	6	0	0.7	0.0	0.1	0.0	13
20*	42	0	4.6	0.0	0.8	0.2	13
21	6	0	0.7	0.0	0.1	0.0	13
22	10	0	1.1	0.0	0.2	0.0	13
23	7	0	0.8	0.0	0.1	0.0	13
24*	80	0	6.6**	0.0	1.6	1.2	12
25*	55	0	4.5**	0.0	1.1	0.7	11
26*	14	0	1.5	0.0	0.3	0.1	14
27	22	0	2.4	0.0	0.4	0.3	14
30*	47	0	5.2	0.0	0.9	0.3	14
31*	19	15	2.1	0.0	0.4	0.0	13
32*	65	37	7.1	0.0	1.3	0.2	13
33*	60	0	6.6	0.0	1.2	0.2	13
34*	41	0	3.4**	0.2	0.8	0.7	12
35*	161	0	17.5	0.0	3.2	1.0	13
36*	56	0	6.2	0.0	1.1	0.0	13
37*	19	0	2.1	0.0	0.4	0.0	13
41	43	41	3.5**	0.4	0.9	0.9	13
42	47	47	3.9**	0.2	0.9	0.5	12
43	75	75	6.2**	0.1	1.5	1.7	13
44	120	120	9.9**	0.7	2.4	1.5	12
Burn Only	197	197	0.0	1.9	0.0	0.0	1

* Harvest units with the most compactible soils.

** Harvest units 7, 24, 25, 34, 41, 42, 43, and 44 contain an estimated 30% to 40% aspen. Since no aspen will be harvested, skid trail density is assumed to be 75% of that needed to harvest units with pure conifer.

The proposed action would result in very little additional detrimental soil disturbance or total soil resource commitment of the soil resource. Natural soil productivity would be maintained on at least 85% of the analysis area. Significant indirect effects from soil damage or disturbance on the ability of native vegetation communities to establish and maintain themselves would not occur as a result of this alternative

Cumulative Effects

The small amount of soil disturbance and damage that would occur as a result of silvicultural activities proposed in this alternative would be cumulative to the effects of other present and reasonably foreseeable activities that have occurred, or might occur, within the harvest units proposed under this alternative. These effects include soil erosion and compaction that could occur as a result of livestock grazing and dispersed recreation activities such as camping or off road vehicle use. The small amount of soil damage that could occur as a result of future wildfires in the area would be cumulative to the effects from present activities, but is unpredictable.

Proposed harvest units 7, 8, 9, 10, 11 had approximately 170 acres of past salvage harvesting (Meadow and Humpy Creek Sales) in all or portions of the units due to a spruce beetle infestation in the early 1990's. This harvesting was scattered in nature and included only those trees killed by beetles. Based upon recent monitoring of past timber harvest activities in the Meadow Creek and Humpy Creek watersheds, very little (less than 6%) of the areas actually treated show detrimental effects to soil quality from either erosion or compaction (Flood, Paul. 2004).

The same skid trails, landings, and roads from the Meadow and Humpy Creek sales will be used again to harvest additional trees under Alternative 2. No new skid trails would be needed where past harvesting was done. The impact to soils from these existing skid trails has been analyzed as part of the effects of Alternative 2.

In areas that were not accessed for the Meadow and Humpy Creek timber sales, additional skid trails would be needed. The impact to soils from these new skid trails has also been analyzed as part of the effects of Alternative 2

Consequently, the total impacted area of skid trails, existing or new, that contribute to detrimental soil disturbance has been analyzed as part of Alternative 2. There are no cumulative effects to detrimental soil disturbance from the past Meadow and Humpy Creek timber sales. For purposes of analysis, it was assumed that all portions of all proposed units would be accessed under this alternative.

No additional timber sales in this area are scheduled in this planning period, assumed for the purpose of this analysis to run through the end of all treatments (approximately 10 years). Cumulative detrimental soil disturbances would be about 13% of the timber harvest activity areas, within FP guidelines for Soil Quality.

All of the treatment units are in sheep grazing allotments. Most of the research on compaction by domestic livestock has been conducted on pasture and crop lands that are grazed at much higher intensity than the forest allotments in the West Bear area. According to Greenwood and McKenzie (2001), most soils under grazed pasture, even those managed to minimize soil physical degradation, will be compacted to some extent. However, the magnitude of this compaction is usually small, and limited to the upper 50–150 mm of the soil. Compaction to greater depth and other changes in soil physical properties are more likely in recently tilled or wet soils. The response of pasture to the poorer soil conditions caused by grazing is difficult to determine, but it is likely to be small compared with the defoliation effects of grazing. Maintenance of a vigorous pasture should be a major aim of grazing management and would also achieve the secondary aim of maintaining acceptable soil physical conditions.

Greenwood et al. (1997), state that significant differences between ungrazed and grazed pastures were found for all soil physical measurements at all stocking rates. Compaction by sheep was limited to the upper 5 cm of the soil profile and resulted in lower porosity, mainly due to loss of pores larger than 1.2 mm equivalent diameter. However, after 30 years, the pastures grazed at 10, 15 and 20 sheep/ha had similar soil physical properties. Soil physical properties appear to be relatively insensitive to stocking rate in the long term and therefore other factors, such as maintenance of pasture cover, should be given a higher priority in grazing management decisions.

Sharrow (2007), found that the infiltration rate of silvopasture (pastures cultivated and then planted with widely spaced rows of trees and forage in between the rows of trees) soils in 2004 had increased to be similar to those of forests in 2002, however, forest soil infiltration rates also increased and continued to be higher than those of silvopastures. Plant production was not sensitive to changes in any of the soil parameters measured. Although livestock grazing did change soil infiltration rates, soil bulk density, and soil porosity, the effects were quickly reversed following cessation of grazing and had little detrimental effect on silvopasture forage or tree production.

Murphy et al. (1995) compared cattle and sheep grazing on smooth-stalked meadowgrass-dominant white clover sward. At similar stock densities (32 animal units per acre), soil compaction was 81% greater with cattle than with sheep. They speculated that the shape and small size of the sheep hoof might churn and till up the soil rather than compress it. Plants grew more vigorously under sheep, probably because they cycled higher levels of nutrients and created less soil compaction.

Sheep grazing as a cumulative effect is a potential concern only in the mixed aspen/conifer treatment areas. The spruce/fir and mixed conifer forest cover types are not as attractive to sheep grazing as the adjacent meadows for the following reasons:

- Conifer forest canopies result in low existing forage values under the canopy.
- Down logs discourage movement of sheep through many of these stands.
- Open herding allows sheep to use their preferred forage in the meadows.

After treatment there would be ¼ to ½ acre openings in the spruce/fir and ½ to 2 acre openings in the mixed conifer forest types and some thinning in between these openings. There would be skid trails or temporary roads accessing these openings. The openings, and to a lesser extent the thinning, are likely to increase understory vegetation and potential forage and access for sheep may be easier. However, the temporary roads would be obliterated and both the temporary roads and skid trails would have woody debris including logs scattered on top of them which would discourage sheep use of them.

There is a minor potential for cumulative soil compaction effects in the mixed aspen/conifer forest cover type due to higher forage production in the areas dominated by aspen and the presence of some small wet areas. The areas dominated by conifers have less likelihood of this effect due to the reasons stated above. Detrimental soil disturbance can occur on trails crossing wet soils due to preferred stream and wet area crossing locations. Soils outside of these wet areas are generally dry with the exception of short periods following thunderstorms during the grazing season of July 4 to September 20 on the allotments in the West Bear area. Since open herding is practiced on all of the allotments, the occurrence of these detrimentally compacted areas is quite limited. Wet areas and streams are excluded from timber harvest treatment units. Recent green line studies (Zobell 2005a) on 4 representative streams in the West Bear allotments showed 99.6%, 92.4%, 93% and 98% late seral plant representation. This indicates that detrimental soil compaction from stream crossings used by sheep is small. Zobell estimated that those crossing/water points along the greenline are usually less than 30 ft. wide and, along a given stream reach, are usually less than 1% of the total length of the stream banks. Riparian areas comprise less than 5% of the total area in the allotments. That means that detrimental soil disturbance from compaction by sheep would be less than .1% of the area. Even assuming there is a 1% cumulative impact of detrimental soil compaction in the burn only area under alternative 2, the total cumulative impact in the burn only area would be 2% detrimental soil compaction.

Replace the narrative describing the direct, indirect and cumulative effects of Alternative 3 – Reduced Roads in Chapter 3, pages 29 through 30 in section 3.2.4.1 of the West Bear Vegetation Management Project FEIS with the following:

Alternative 3 – Reduced Roads

Direct and Indirect Effects

Soil Erosion, Compaction and Severe Soil Burning: Under this alternative, erosion rates that exceed soil loss tolerance values were not predicted to occur on any harvest units as a result of a 6 year return period rain storm. This is because the alternative avoids placing soil disturbing timber harvest practices on any of the steep, erosive and unstable slopes that occur in the analysis area. This allows the alternative to meet direction provided under Forest Plan Standard S1 and Guideline G9. Soil erosion rates exceeding soil tolerance values could occur under this alternative, as a result of a 30 year return interval heavy thunderstorm event, in proposed harvest units 7, 8, 29, 31, and 32, or about 8% of the activity area (Flood 2005a). Because these kinds of storms are not likely to occur within the time frame of harvest activity, the probability of detrimental soil erosion actually occurring in these units, as a result of proposed activities, is very low. Consequently no specific erosion control practices will be needed to mitigate this effect.

Soil types that are most susceptible to the effects of compaction occur in many of the harvest units in this alternative (Flood, Paul. 2005b). Unit 34 is the only unit on these soil types requiring fireline construction with 1 mile of fireline required. For these soil types, restricting mechanized harvest to a designated system of timber skidding trails will reduce unmitigated detrimental soil compaction to an average of about 13 % percent of the 14 activity areas that contain these soil types.

Treatment Unit Disturbance Table for Alt. 3

Unit #	Acres in Unit	Acres in LT 226	Unit Skidtrail acres	Unit Fireline acres	Unit Landing Acres	Temp Road Within Activity Area acres	% Activity Area Left Disturbed
7	28	27	2.3**	0.0	0.6	0.2	11
8	16	15	1.8	0.0	0.3	0.2	14
9	13	0	1.4	0.0	0.3	0.0	13
10	16	0	1.8	0.0	0.3	0.0	13
11*	149	0	16.4	0.0	3.0	0.0	13
12*	57	0	6.3	0.0	1.1	0.2	13
13*	11	0	1.2	0.0	0.2	0.1	14
14*	8	0	0.9	0.0	0.2	0.1	15
15	25	0	2.8	0.0	0.5	0.2	14
16	8	0	0.9	0.0	0.2	0.1	15
17	21	0	2.3	0.0	0.4	0.2	14
20*	42	0	4.6	0.0	0.8	0.2	13
21	6	0	0.7	0.0	0.1	0.0	13
22	10	0	1.1	0.0	0.2	0.0	13
23	7	0	0.8	0.0	0.1	0.0	13
24*	54	0	4.5**	0.0	1.1	0.5	12
25*	45	0	3.7**	0.0	0.9	0.3	11
29	19	12	2.1	0.0	0.4	0.2	14
30*	43	0	4.7	0.0	0.9	0.0	13
31*	19	15	2.1	0.0	0.4	0.0	13
32*	28	19	3.1	0.0	0.6	0.2	14
33*	60	0	6.6	0.0	1.2	0.2	13
34*	41	0	0.0	1.2	0.0	0.0	3
35*	104	0	11.4	0.0	2.1	0.0	13
36*	56	0	6.2	0.0	1.1	0.0	13
37*	19	0	2.1	0.0	0.4	0.0	13
41	65	63	0.0	1.9	0.0	0.0	3
42	417	417	0.0	4.6	0.0	0.0	1

* Harvest units with the most compactible soils.
** Harvest units 7, 24, 25, 34, 41, and 42 contain an estimated 30% to 40% aspen. Since no aspen will be harvested, skid trail density is assumed to be 75% of that needed to harvest units with pure conifer

Normal requirements for skidding during the normal operating season or on frozen soils are adequate protection for those landtypes that are not considered the most compactible. Under this alternative, because the units are proposed for prescribed fire treatments only during the fall, none will be subject to severe soil burning.

This alternative would result in very little additional detrimental soil disturbance. Natural soil productivity would be maintained on at least 85% of the analysis area. Significant indirect effects from soil damage or disturbance on the ability of native vegetation communities to establish and maintain themselves would not occur as a result of this alternative

Cumulative Effects

The small amount of soil disturbance and damage that would occur as a result of silvicultural activities proposed in this alternative would be cumulative to the effects of other past, present and reasonably foreseeable activities that have occurred, or might occur, within the harvest units proposed under this alternative. These effects include soil erosion and compaction that have occurred, or could occur as a result of past harvest activities, livestock grazing and dispersed recreation activities such as camping or off road vehicle use. The small amount of soil damage that could occur as a result of future wildfires in the area would be cumulative to the effects from present activities, but is unpredictable.

Based upon recent monitoring of past timber harvest activities in the Meadow Creek and Humpy Creek watersheds, very little (less than 6%) of the areas actually treated show detrimental effects to soil quality from either erosion or compaction (Flood, Paul. 2004).

Proposed harvest units 7, 8, 9, 10, 11 had approximately 170 acres of past salvage harvesting (Meadow and Humpy Creek Sales) in all or portions of the units due to a spruce beetle infestation in the early 1990's. This harvesting was scattered in nature and included only those trees killed by beetles. Based upon recent monitoring of past timber harvest activities in the Meadow Creek and Humpy Creek watersheds, very little (less than 6%) of the areas actually treated show detrimental effects to soil quality from either erosion or compaction (Flood, Paul. 2004).

The same skid trails, landings, and roads from the Meadow and Humpy Creek sales will be used again to harvest additional trees under Alternative 3. No new skid trails would be needed where past harvesting was done. The impact to soils from these existing skid trails has been analyzed as part of the effects of Alternative 3.

In areas that were not accessed for the Meadow and Humpy Creek timber sales, additional skid trails would be needed. The impact to soils from these new skid trails has also been analyzed as part of the effects of Alternative 3

Consequently, the total impacted area of skid trails, existing or new, that contribute to detrimental soil disturbance has been analyzed as part of Alternative 3. There are no cumulative effects to detrimental soil disturbance from the past Meadow and Humpy Creek timber sales. For purposes of analysis, it was assumed that all portions of all proposed units would be accessed under this alternative.

No additional timber sales in this area are scheduled in this planning period, assumed for the purposed of this analysis to run through the end of all treatments (approximately 10 years).

Cumulative detrimental soil disturbances would be about 13% of the timber harvest activity areas, within FP guidelines for Soil Quality.

Effects of sheep grazing on soil compaction would be the same for timber harvest activity areas as Alternative 2. Even assuming a 1% cumulative impact of detrimental soil compaction in the burn only areas under alternative 3, the total detrimental cumulative disturbance in unit 41 would be 4% and in unit 42 would be 2%, well within the 15% detrimental soil disturbance standard.

Replace the narrative describing the spruce-fir forest type in Chapter 3, pages 50 and 51 in section 3.4.3.1 of the West Bear Vegetation Management Project FEIS with the following:

Spruce/Fir

This type represents a climax condition in the West Fork Bear River landscape and is found in both even-aged (one or two age classes) and uneven-aged (three or more age classes) stands. Spruce-fir stands in the analysis area are mature and old, with stand ages exceeding 150 years. Trees tend to be large and dense, with diameters of the overstory trees (those greater than 7") averaging over 12", and basal areas greater than 150 square feet per acre. The West Bear Ecosystem Management Project (USDA FS 2002) indicated the spruce-fir forest was outside the historic range of variation. In the long term, and in the absence of disturbance, subalpine fir may become more dominant. However, there are two schools of thought on this and neither is definitive. Research (Veblen 1986) indicates that because spruce is longer-lived than subalpine fir, it may continue to dominate a stand until a stand replacing event such as a large wildfire occurs. It is unlikely that spruce would not maintain some presence in stands where they are currently dominant or codominant. In systems with high fuel loading such as the spruce-fir in the West Bear analysis area, allowing any fire to burn involves the risk of a large stand replacing fire, given fairly rapid changes in weather that can occur. Most small fires can effectively be suppressed. Beetle outbreaks can also be suppressed in the early stages. The Forest Service is not always successful in suppressing fires that escape initial attack with heavy fuel loading and hot, dry, windy weather. The Forest Service is also not successful in suppressing bark beetle infestations once they are more than just small pockets of beetle infestation. Suppression of small fires and beetle outbreaks reduces the disturbance processes on the landscape. Without these disturbances it is likely that over a long period of time these stands could shift toward more predominance of subalpine fir (Steen et al. 2005). It will take a long period of time to complete all of the group selection entries needed to achieve an uneven aged stand of spruce-fir.

Schoennagel et al (2004) state that infrequent, high-severity, stand-replacing fires dominate the historical and contemporary fire regime in spruce-fir forests. Climatic variation, through its effects on the moisture content of live fuels and larger dead fuels, is the predominant influence on fire frequency and severity. Dense trees and abundant ladder fuels are natural in subalpine forests and do not represent abnormal fuel accumulations. Fire suppression has had minimal influence on the size, severity, and frequency of high-elevation fires. Mechanical fuel reduction in subalpine forests would not represent a restoration treatment but rather a departure from the natural range of variability in stand structure. They conclude that given the behavior of fire in

Yellowstone in 1988, fuel reduction projects probably will not substantially reduce the frequency, size, or severity of wildfires under extreme weather conditions. Keane et al. (2002) cites authors that the last 70 to 80 years of fire suppression have not had much influence on subalpine landscapes with fire intervals of 200 to several hundred years but there have been recent shifts in forest stand ages to older age classes. Fire exclusion effects in long fire interval fire regimes, such as those in lodgepole pine and spruce fir, are not yet manifest at the stand level, but are detectable at the landscape level. They mentioned young age classes are often missing from subalpine landscapes where fires have been excluded. The well substantiated relationship of reduced forest health due to fire exclusion in ecosystems characterized by high fire return intervals (for example, low-elevation ponderosa pine woodlands) cannot be applied to all mesic subalpine ecosystems with long fire return intervals. But despite these exceptions, the Rocky Mountain landscape, taken as a whole, is not burning at the pre-1900 rate. In spruce-fir forests of Colorado, spruce beetle (*Dendroctonus rufipennis*) outbreaks do not affect young (less than 80 years) postfire stands, which implies that long-term fire exclusion in the subalpine zone eventually would result in increased beetle activity as a larger portion of the landscape enters old-growth stages. Veblen (2003) found that the fire regime of the spruce-fir cover type in northern Colorado is characterized by infrequent, crown fires that burn large areas. High severity fires resulting in spruce-fir stands of high tree densities are part of the natural fire regimes of this ecosystem type. Although late seral stands with heavy fuel loading in spruce-fir are not uncharacteristic, the effects of a fire may not be desirable in a landscape being managed for multiple uses. About 19% of the spruce-fir type has reduced fuel loading due to past silvicultural treatments (FEIS Tables 3.4.1 and 3.4.7). The remaining 81% is in late seral stages with usually heavy fuel loading. Fire suppression is likely to continue on this landscape. The adverse effects of escaped wildfire in the spruce-fir type with heavy fuel loading at a landscape scale are evident in the recent (2002) East Fork Fire (USDA FS 2004c). All of the spruce in large patches were killed by the fire, leaving very little seed source. Very little spruce regeneration in this fire has been observed to date. Although the spruce-fir stands in West Bear are probably not outside the range of variation, a very large percentage of the spruce-fir at the landscape level is susceptible to stand replacing fire during drought cycles. A literature review by Keane et al. (2002) displays stand level and landscape effects of fire exclusion. At the landscape level a decrease in early seral communities, increased landscape homogeneity, increase in dominance of one patch type, and decreased patch diversity occurs along with larger and more severe fires, increase in crown fires, increased insect and disease epidemics, and increased contagion resulting in more severe insect and disease epidemics. Silvicultural systems can replace some of the effects of fire in landscapes where wildfires are not acceptable and where fire cannot be safely prescribed.

Data collected from 5 stands in Meadow Creek, 4 stands in Humpy Creek and 5 stands east of Whitney Reservoir in early fall of 2001 are summarized (Table 3.4.3). These data were extracted from stand tables on file in the Evanston Ranger District. The data indicate that the spruce component (PIEN) comprises 24 and 16 percent of all trees in the stand, respectively, with subalpine fir (ABLA) the majority species. It is interesting to note that the overstory (trees larger than 7" dbh) contains a much higher proportion of spruce. Of the 13 stands, only 2 have less than 40% spruce in the overstory. However, when the smaller diameter trees and seedlings are included, only 2 stands have 25% or more spruce. This indicates that the majority of the existing regeneration is subalpine fir.

Add the following paragraph under Lodgepole Pine in Chapter 3, page 50 in Section 3.4.3.1 of the West Bear Vegetation Management Project FEIS:

Kaufmann et al. (2008) in a review of the status of science on mountain pine beetles stated that "more research is required to fully understand fire behavior over time following a mountain pine beetle attack. Nonetheless, the extensive epidemic now occurring is precipitating enormous changes in fuel structure over large areas in Colorado and southern Wyoming, through changes in the condition and arrangement of the forest biomass (which is fuel for forest fires). The mature lodgepole pine trees that provided abundant but moist living fuels are now dead, dry, and falling, and have the potential to contribute to extreme fire behavior in post-beetle forests similar to historical fires in lodgepole pine forests. However, the realization of that potentially extreme fire behavior will depend on a number of contingencies, particularly future climatic conditions. In the initial phases of the epidemic when trees are being killed, needles die, turn red and dry out but persist on trees for two or three years. During this phase, needles and small branches provide dry fine fuel that could burn in a crown fire. The amount of fuel is relatively unchanged compared with the pre-epidemic forest. However, fuel moisture is lower, and some think it likely that a crown fire could ignite and spread under somewhat less extreme fire weather conditions than were required for initiating a crown fire in an equivalent forest of live trees. However, fuel moisture is lower, and some think it likely that a crown fire could ignite and spread under somewhat less extreme fire weather conditions than were required for initiating a crown fire in an equivalent forest of live trees. The fuel structure of dead lodgepole pine stands changes significantly when needles fall to the ground. During this phase, little fine fuel remains in the forest canopy to support an active crown fire that spreads from tree to tree. Furthermore, the fallen needles lie close to the ground surface and, in the absence of other fuels near the ground, provide a relatively poor fuel bed for generating significant flame heights. Increased growth of grasses, low shrubs and forbs may create a moist fuel bed during the growing season but provide dry fine fuels near the end of the growing season. However, large amounts of biomass in the boles and branches of standing trees remain well above typical flame heights, and without needles these canopy fuels are relatively unlikely to burn. Thus surface fires in years following needle fall may not be intense and crown fires may be nearly impossible (assuming the forest is relatively pure lodgepole pine and most or all large trees are dead). In some areas, rapid development of a tall shrub community (which may precede tree regeneration) may provide shade and protection from drying of fuels on or near the ground. However, this is unlikely in most lodgepole pine forests in Colorado and southern Wyoming (the focus area of this report), because few tall shrub species occur in these relatively dry forests. Instead, low shrubs such as huckleberry and buffaloberry are more common. Trees killed by mountain pine beetle may remain standing for a number of years, but as they progressively decay and fall to the ground (often aided by wind), the fuel structure changes once again. In this phase (typically 10-20 years or more after death), a large amount of biomass becomes available as fuel within flame heights that can be generated by the fine surface fuels. Some of the biomass is elevated above the ground where it dries out more easily and becomes available to support intense fire with a large release of heat. Such a fire is relatively hard to control and nearby structures may be hard to protect. Furthermore, fire intensities under these conditions could cause high mortality of young trees that survived or regenerated after the mountain pine beetle attack. If widespread fire mortality occurs before trees have matured to cone production age, rapid reestablishment of lodgepole pine on this site is less likely. At the scale of a stand, none of the changes in fire behavior that we have described would be outside the historical range of variability for this ecosystem. Even in stands with tremendous wood accumulation on the ground, fire behavior may differ little from historical fires within blow-downs or areas recently burned by stand-replacing fires. However, we are uncertain about fire behavior at landscape or regional scales because we have not seen systems with such heavy fuel loads over such extensive areas; and we know little about the ecological consequences of such fires at these scales."

Add the following paragraph under Mixed Conifer in Chapter 3, page 52 in section 3.4.3.1 of the West Bear Vegetation Management Project FEIS with the following:

Kaufmann et al. (2008) state that "Similar transitions in fuel structure (as compared with those in pure lodgepole pine stands) also will occur in the lodgepole pine-dominated component of subalpine and mixed conifer stands. But the mixture of dead lodgepole pine with live trees of other species creates a more complex fuel structure. An important effect of lodgepole pine mortality in mixed stands is a change in the environmental conditions and thus the fuel moisture near the forest floor. Prior to beetle mortality of the overstory, solar radiation is largely intercepted by the forest canopy, and air movement beneath the forest canopy is moderated by the overstory. The understory beneath the canopy remains relatively cool and moist.
When lodgepole pine trees die and needles fall from dead trees, radiation reaching the forest floor and air movement beneath the residual live tree canopy are increased, and both contribute to fuel drying. More open canopies also contribute to greater understory vegetation growth. The consequences of these changes on fire behavior are not fully understood, but such conditions may favor ignition and spread of fire more readily than in forests having few canopy gaps or fuels created by mountain pine beetle mortality, particularly later in the growing season when fuels near the ground become drier. Because several associated species, firs and spruces, typically have low crown bases due to poor selfpruning, higher surface fire intensity from added lodgepole pine fine fuels coupled with drier, warmer, windier surface conditions, could lead to an increase in potential for passive crown fire (torching). Furthermore, increased human activity in today's forests has increased fire ignitions compared with the historical period."

Add the following after the first two paragraphs in Section 3.4.3.7 – Insects and Disease, Chapter 3, page 58 in the West Bear Vegetation Management Project FEIS:

In an article addressing cross-scale drivers of natural disturbances prone to anthropogenic amplification, Raffa et al (2008) state that a variety of human activities can affect the processes that mediate interactions among conifers, bark beetles, symbionts, and natural enemies. Landscape scale management and land-use activities can reduce forest heterogeneity, a major constraint against populations surpassing the eruptive threshold. They cite Fettig et al. (2007) that silvicultural measures (e.g., thinning to reduce competition among trees) may prevent stand level eruptions because they enhance the defensive capacity of individual trees or interfere with beetle orientation, but they cite Safranyik and Carroll (2006) these seem unlikely to be effective past stand mesoscale eruptions. They state that once meso- and landscape-scale thresholds have been breached, no known feasible management action can stop an eruption. Such eruptions appear to continue until nutritionally suitable hosts are depleted or unseasonably cold temperatures (an external stochastic event) occur over large areas. In contrast, broadscale land-management policies that reduce the extent of susceptible host trees, and societal actions that ameliorate global climate change, could reduce the likelihood of future biomewide outbreaks.

Kaufmann et al. (2008) state that "The beetles are so numerous and spreading so rapidly into new areas that they will simply overwhelm any of our efforts where trees have not yet been attacked, and no management can mitigate the mortality already occurring. However, judicious vegetation management between outbreak cycles may help mitigate future bark beetle-caused tree mortality in local areas. In the current epidemic, it is impractical to expect that silvicultural treatment of lodgepole pine forests will prevent or even impede the advance of the epidemic in Colorado and southern Wyoming. There are simply too many suitable host trees over too large an area, and unusually high insect populations. Unless climatic conditions become less favorable for beetle reproduction and spread, the most likely scenario is that the epidemic will be sustained until host trees are depleted. Preventive spraying of high-value trees with insecticides is effective in protecting trees from bark beetle attack. Direct control measures such as removing infested trees may provide some mitigation on a small local scale but are not be effective at a landscape scale. The current epidemic is so extensive and severe in part because large areas of lodgepole pine forest are suitable hosts for mountain pine beetles. As noted earlier, it is unclear if epidemics occurred at such a large scale historically, though smaller-scale or less severe epidemics most likely did occur and are expected in the future. Active vegetation management between periods when lodgepole pine forests are vulnerable to a mountain pine beetle epidemic may reduce the magnitude of future landscape-scale outbreaks, if that is chosen as a management objective. Creating diverse patch ages and sizes (including young patches) and perhaps more mixed-species forests across the landscape may or may not reduce the spread of future mountain pine beetle outbreaks, but it likely would reduce the amount of forest susceptible through time to a monolithic disturbance, including mountain pine beetle attack or fire. Thus while unproven, this increased landscape heterogeneity may be effective for limiting the scale and severity of future mountain pine beetle impacts. The effectiveness of such measures cannot be assured, nor are all the ecological consequences known, though even in the current epidemic, stands and patches of younger lodgepole pine trees appear to have survived the epidemic with no or only limited mortality."

Fettig et al (2007) concluded in a literature review that recent epidemics of some native forest insects have exceeded historical records. Efforts to avoid such catastrophic events focus on returning the forest landscape to a normative relationship with natural disturbance agents. A variety of vegetation management practices are available to prevent epidemics from occurring and expanding when properly instituted at appropriate spatial and temporal scales. Experience has shown that even a course of no action is not without consequence. The review by Fettig et al (2007) of existing bodies of empirical and anecdotal evidence concerning variations in host susceptibility to bark beetle infestation by thinning and other vegetation management practices leads to several conclusions:

(1) Native tree-killing bark beetles are a natural component of forest ecosystems. Eradication is neither possible nor desirable and periodic outbreaks will occur as long as susceptible forests and favorable climatic conditions exist. Changes in forest structure and composition by natural processes and management practices have led to increased competition among trees for water, nutrients and growing space thereby increasing susceptibility to bark beetles and other forest insects. As trees become stressed, their insect resistance mechanisms are compromised. Trees of low vigor are more susceptible to bark beetle attack. Efforts to prevent undesirable levels of bark

beetle-caused tree mortality must change stand susceptibility through reductions in tree competition, disruption of pheromone plumes thus negatively affecting host-finding, and reductions in the fecundity, fitness and survivorship of target bark beetle species.

(2) Forested landscapes that contain little heterogeneity promote the creation of large contiguous areas susceptible to similar insect outbreaks. Efforts to prevent undesirable levels of bark beetle-caused tree mortality at the landscape level must also account for the spatial distribution of both cover types and stand ages. In many areas, treatments should be implemented to increase heterogeneity.

Landscape ecology considers interactions between spatial patterns and ecological processes. Fetting et al (2007) cite Coulson et al (1999) and Samman and Logan (2000) on the importance of spatial arrangement of forest stands. For example, in some areas, large forested landscapes contain little heterogeneity resulting in a landscape with contiguous areas simultaneously susceptible to certain outbreaks. They cite Schmid and Mata on management activities that are available to reduce susceptibility, but must be considered at both the stand and landscape level. This approach calls for a comprehensive strategy addressing the distribution of multiple land uses. It is important to note that even a course of no action is not without consequence and may lead to drastic changes at the landscape level. Citing Billings and Bryant (1983), Billings et al., (1985), Coulson et al., (1989, 1999), Samman and Logan, 2000, Dymond et al. (2006) and Wulder et al., (2006), they state that additional research is clearly needed to determine the short and long-term implications of vegetation management treatments on bark beetle populations and associated levels of tree mortality at appropriate spatial scales. They cite Schowalter et al., (1981) and Waldron et al. (in press) that maintenance of desirable (or sustainable) forest conditions may require multiple disturbances. For example, a thorough modeling effort of southern pine beetle-affected forests in the Appalachian Mountains suggested that while southern pine beetle plays an important role in maintaining these systems, the beetle could eventually lead to the replacement of xeric pine forests by other tree species if fire is not reintroduced. Complex and interacting climatic, topographic and biological features require careful consideration and planning of restoration efforts in such forests.

Add the following paragraph after the first two paragraphs for lodgepole pine in Section 3.4.3.7 – Insects and Disease, Chapter 3, page 59 in the West Bear Vegetation Management Project FEIS:

Fettig et al (2007) recommend thinning for maturing lodgepole pine stands based on data relating mountain pine beetle outbreaks to stand age, density and diameter distributions. They cite variations on thinning treatments that have been examined, including diameter limit cutting (McGregor et al., 1987), thinning to reduce basal area (Amman et al., 1977; Cahill, 1978), and selective removal of trees with thick phloem (Hamel, 1978). They cite Whitehead et al., (2004) and Whitehead and Russo, (2005) for current recommendations on spaced thinnings that optimize the effects of microclimate, and inter-tree spacing and tree vigor as a method to ‘‘beetle-proof’’ stands. The prescription requires thinning from below (low thinning) and wide residual intertree spacing to create stand conditions that are detrimental to beetle survival.

Add the following paragraph under Spruce-fir in Section 3.4.3.7 – Insects and Disease, Chapter 3, page 60 in the West Bear Vegetation Management Project FEIS:

Fetting et al (2007) cite Massey and Wygant (1954) reporting the mean diameter of attacked Engelmann spruce decreased during a spruce beetle outbreak on White River National Forest in Colorado thereby suggesting a preference by spruce beetle for larger diameter trees and that Dymerski et al. (2001) reported similar results in spruce beetle-affected Engelmann spruce stands in central Utah. They cite Hard et al. (1983) and Hard (1985) in Alaska, examining conditions during the beginning of a spruce beetle outbreak in white spruce. Attacked trees were characterized by low radial growth, which was inversely related to tree density. They cite Holsten (1984) establishing a transect across mixed spruce forests and reporting higher levels of tree mortality on north-facing slopes and a preference by spruce beetle for larger diameter trees. Periodic annual increment (last 5 years) was 0.25 cm for infested and 0.51 cm for uninfested trees. They cite Hard et al. (1983) who indicated that spruce beetle exhibited a preference for slow growing trees and Holsten et al. (1995) reporting that, following a spruce beetle epidemic, increased radial growth in surviving trees, primarily as a result of reductions in tree density and competition, reduced stand susceptibility to future infestations in the short term.

Replace the narrative describing the effects of Alternative 1 – No Action, Chapter 3, page 64 in section 3.4.4.1 of the West Bear Vegetation Management Project FEIS with the following:

Alternative 1 – No Action

Alternative 1 would have no direct effect on movement toward properly functioning condition (PFC). Stands would remain in their current conditions unless affected by unplanned disturbance such as insects, fire or windthrow. Wildfire suppression would continue on the landscape but the potential for an escaped fire would gradually increase due to increases in fuel loading over time. Allowing wildfires to burn in this area was determined to be unacceptable under the Wasatch-Cache National Forest Wildland Fire Use Plan due to downwind private property. Spruce-fir and mixed conifer stands are heavily skewed toward mature and old age classes. The Wasatch-Cache Forest Plan has desired landscape structure for spruce-fir and mixed conifer of about 40% in mature and old age classes with the remaining age classes in grass/forb, seedling/sapling, young forest and mid-aged forest. About 93 % of the spruce-fir and mixed conifer in the West Bear landscape is currently mature and old. Most of the lodgepole pine in the landscape is currently mature and old and is presently being threatened by a heavy mountain pine beetle infestation. The Forest Plan has a desired landscape structure of 30% old aspen forest with 40% in grass/forb and seedling/sapling age classes and, 30% in young, mid-aged, and mature forests. Only 3% of the aspen in the West Bear landscape is currently in the grass/forb and seedling sapling age classes.

An indirect effect of Alternative 1 would be continued mortality from mountain pine beetle in the mixed conifer and aspen/conifer types, and spruce beetle in the spruce-fir forest type. Increaased fuel loads that accompany most outbreaks put homes, businesses, and other structures in the wildland/urban interface at risk of damage or loss in both management (prescribed fires) and wildland fires, and risk of injury and death for residents and firefighters alike. Post-outbreak fuels management costs are significantly higher and more complex due to intermingled ownerships and the inherently high risk associated with tools such as prescribed fire (Samman et al 2000). If the current level of mountain pine beetle activity continues or increases, significant mortality would be expected, resulting in a possible shift of species composition toward subalpine fir, and a gradual increase in fuel loadings as the beetle-killed trees fall. The increased fuel loadings would increase the level of severity and the resistance to control in the event of a future wildfire in extreme fire weather conditions. In the spruce-fir type, this could result in large stand replacement fires due to similar conditions at an ecosection scale. Kulakowski et al (2003) stated that because stand-replacing fires create a mosaic of different age patches, their occurrence may prevent an entire landscape from being affected by a single outbreak. Conversely, a homogenization of the landscape due to suppression of stand-replacing fires may increase landscape susceptibility to outbreak. Spruce-fir stands burned under these conditions may take several decades to regenerate naturally, due to the hot, dry site conditions following the burn and loss of seed sources.

Increased fuel loadings could have positive benefits to PFC in the mixed conifer type and aspen/conifer types if a wildfire escaped initial attack suppression or wildland fire use were allowed in the future. Increased fuels could promote stand replacing fires which would in turn reduce the amount of fir regeneration and provide favorable conditions for early seral species such as aspen and lodgepole pine. This would reduce the amount of late seral stage forest and increase the early (grass/forb and seedling/sapling) age classes. Patch sizes would be determined by burning conditions and fuels, and may approximate historical patterns.

Replace the narrative describing the cumulative effects of Alternative 2 – Proposed Action Chapter 3, page 3-65 in section 3.4.4.1 of the West Bear Vegetation Management Project FEIS with the following:

Cumulative Effects

The regeneration of approximately 200 acres of the spruce-fir and mixed conifer forest into grass/forb, seedling/sapling age would reduce the acres of mature spruce-fir and mixed conifer acres within the analysis area to about 5,996, and increase the early seral stage to approximately 298 acres (current activity plus 98 existing acres in Pass Creek area). About 10 % of the spruce-fir and mixed conifer in the West Bear landscape would be in younger age classes. Creation of about 458 acres of aspen regeneration in addition to the 88 acres previously treated would result in about 556 acres of aspen regeneration, equal to approximately 16% of the mixed conifer/aspen and aspen in the analysis area. The fire regime condition class (FRCC) for the forested area is currently at the high end of "moderately departed" considering past harvest and fires. Alternative 2 would have a minor cumulative effect of reducing the departure from 66% to 65% in the West Bear watershed and from 65% to 62% in the Hayden Fork watershed (FEIS Table 3.5.8). Roads are necessary to provide access. These are narrow corridors that result in minor fragmentation of the forest. However, most of the roads are temporary and will therefore result in only temporary fragmentation. Firelines are necessary to provide firebreaks. They are on the perimeter and part of the opening created by the prescribed fire. The 0.9 miles of intermittent service road under Alternative 2 would be closed to public use and seeded following timber harvest and would therefore have less fragmentation effect than an open road. The landscape structure would still not be balanced for any of the forest cover types as described under Forest Plan Guideline (G14) to manage vegetation for properly functioning condition at the landscape scale. The landscape structure would remain skewed toward mature and old forest with less than desired in the grass/forb, seedling/sapling, young, and mid-aged forest. There is a heavy infestation of mountain pine beetles in progress in the lodgepole pine in the analysis area. The Coyote Road Hollow Sale has thinned much of the lodgepole pine dominated component. Lodgepole pine is being infested in the mixed conifer forest, which will result in some openings larger than 2 acres and a reduced percentage of lodgepole pine in the thinned areas. Spruce beetles are currently endemic throughout the area. If spruce beetle infestations or an epidemic were to develop, there would be a reduction in representation of spruce in the overstory of spruce-fir and mixed conifer stands and buildup of large down woody fuels especially in untreated areas. In a study of snag dynamics following fire on the east slope of the Cascade range (Everett et al 1999), approximately 50% of the small diameter lodgepole pine and subalpine fir snags <23 cm dbh fell or broke to a minimum (1.8 m) snag height during the first 7 – 12 years after the fire. Regression analysis predicted that approximately 50% of mid-diameter spruce and subalpine fir snags (23-41 cm dbh) fell within 25 years after fire, but 50% of similar size snags of lodgepole pine fell within 15 years. Although large Engelmann spruce snags (>41 cm dbh) initially fell rapidly (50% in 20 years), the species is predicted to maintain 30% of its initial snag density up to 80 years following fire. There are no cumulative effects with grazing since no range lands are being treated.

Replace the narrative describing the effects of Alternative 1 – No Action, Chapter 3, page 66 in section 3.4.4.2 of the West Bear Vegetation Management Project FEIS with the following:

Alternative 1 – No Action

Alternative 1 would have no direct effect on current beetle infestations or the forest's susceptibility to future outbreaks. The high basal areas, average diameters and proportion of spruce and lodgepole pine provide the necessary stand conditions suitable to sustain a beetle epidemic.

An indirect effect of Alternative 1 would be a shift in species composition and structure, at least in the short term, toward fir and, where aspen is present, mixed aspen and fir stands to replace the dead lodgepole pine and spruce. If a spruce beetle or mountain pine beetle outbreak were to occur, the primary response of vegetation to this scale and intensity of disturbance is the establishment of new stands (Oliver 1981; Veblen et al. 1991). This type of disturbance serves to reduce competition and increase nutrient availability resulting in the accelerated growth of understory plants and subcanopy trees (Veblen et al. 1991). The understory and subcanopy trees within the project area are primarily subalpine fir. There is uncertainty over whether or not spruce canopy composition in spruce-fir forests is significantly affected in the long term as described in FEIS Section 3.4.3.7. A large scale disturbance of this magnitude would affect the large tree character component of the existing forest. This effect would be greatest in the spruce-fir forest type, and somewhat less in the mixed conifer, due to the species diversity of the latter type. The loss of the large tree characteristic would have detrimental effects on other forest resources, such as visuals, recreation and wildlife habitat. Based on the beetle susceptible forest that currently exists and the mortality associated with other beetle epidemics within Utah, the majority of large diameter spruce would be killed if a spruce beetle outbreak occurred. If a beetle outbreak were to occur, most of the larger diameter spruce or lodgepole pine component would be lost within a 5-10 year period.

Kulakowski et al (2003) state that based on a study of fire and spruce beetle outbreak legacies on the disturbance regime of a subalpine forest in Colorado, the occurrence of severe fire following beetle outbreaks is not inevitable. They attribute the lack of stand replacing fire following an out break in their study area to possible increased moisture as evidenced by mesic herbs, and lack of dry weather events. They state that a response of fire-hazard mitigation following outbreak may not be necessary in order to maintain a normal fire hazard. Recent studies indicate that spruce beetle mortality does not influence the risk of wildfires in the spruce-fir zone unless accompanied by drought (Bebi et al. 2003). They state that there was no increase in fire density in the same area studied by Kulakowski et al. However, under extreme fire weather conditions, large quantities of dead fuels would contribute to more intense and widespread fire in spruce-beetle killed stands than in unaffected forests (Jenkins et al. 1998; Veblen et al. 1994; Veblen et al. 1991). The cumulative effect of widespread tree mortality also causes dead fuels to accumulate for decades, increasing the hazard of high-intensity fire over time (Arno 1980).

Add the following under Alternative 2 – Proposed Action in Section 3.4.4.2 – Insect Predation (Mountain Pine and Spruce Beetles) in the West Bear Vegetation Management Project FEIS:

The majority of the lodegepole pine thinning of the Coyote/Road Hollow area has been completed. Due to the intensity of the current mountain pine beetle infestation, the lodgepole pine in the Reservoir East (mixed conifer) area may or may not benefit from thinning. Fettig et al (2007) cite conflicting research on whether or not thinning benefits lodgepole pine stands in the face of an increasing epidemic:

- In a study conducted during increasing mountain pine beetle populations, McGregor et al. (1987) examined the effect of two diameter limit thinning treatments (all trees removed >25.4 cm and 30.5 cm dbh) and three thinning treatments to specified residual densities (18.4, 23.0 and 27.5 m2/ha). In general, the amount of mountain pine beetle-caused tree mortality was significantly reduced by thinning, however, there was no significant difference among levels of thinning.

- Amman et al. (1988) studied the effects of spacing and diameter distributions and concluded that tree mortality was reduced as basal area was lowered. However, if the stand was in the path of an ongoing mountain pine beetle epidemic, spacing and density had little effect. These data disagree with McCambridge and Stevens (1982) who reported decreases in the amount of mountain pine beetle-caused tree mortality in ponderosa pine in areas thinned during an active infestation.

- Whitehead et al. (2004) and Whitehead and Russo (2005) examined side-by-side comparison trials to investigate the efficacy of thinning treatments for reducing the amount of mountain pine beetle-caused lodgepole pine mortality in British Columbia.

> These treatments were installed in 1991 to determine if changes in microclimate and tree vigor translated to a lower frequency of mountain pine beetle attacks. Green to red attack ratios (based on absence or presence of crown fade), total number and density of trees attacked and mortality due to beetle attack were lower in thinned stands than in corresponding untreated areas at every site. In untreated units, >80% of all trees >20 cm dbh were attacked and mortality average 135 trees/ha compared to 31 trees/ha in thinned stands. The data strongly suggest that thinning mature lodgepole pine stands from below to a uniform residual intertree spacing of at least 4 m is an effective tool for preventing mountain pine beetle infestations.

Experiments have not been specifically conducted to determine the effects of thinning on spruce beetle activity. Single tree and group tree selection methods are often used to regenerate Engelmann spruce in the Rocky Mountains. Fetting et al (2007) cite Massey and Wygant, 1954 and Dymerski et al., 2001 that the creation of gaps within these uneven-aged stands promotes spatial heterogeneity and species and age class diversities and that although residual stand structure may initially be composed of larger numbers of large diameter trees that are more susceptible to spruce beetle disturbance, the gaps provide growing space for new age cohorts of younger trees that are much less susceptible to attack. They also cite Price (1997) that speculated that the presence of nonhosts or unsusceptible hosts masks the apparency of susceptible hosts thus reducing overall stand susceptibility. The relationship is not relevant to those forest types, such as ponderosa pine in the central Rockies, which are monotypic. To their knowledge (Fetting et al, 2007), published data are not available for other cover types and additional studies are required to address these knowledge gaps.

Add the following to Section 3.6.3.2 - Region 4 Sensitive Species, Chapter 3, page 85 in the West Bear Vegetation Management Project FEIS.

Northern Goshawk

Northern Goshawk (Humpy Nest)

The two known goshawk territories in the West Bear analysis area are referred to as the “Gold Hill” and “Coyote Hollow” goshawk territories. The nests are similar to all of the goshawk nests on the North Slope. All nests and territories consist of a large component of lodgepole pine. Nests may be found in a mixed stand (aspen/lodgepole) but the lodgepole vegetation type is associated with the nest and post-fledgling area.

A third potential nest, the “Humpy Creek” nest was documented on goshawk monitoring sheets because some characteristics associated with the nest were similar to other known goshawk occupied nests on the North Slope of the Uinta Mountain Range.

The Humpy Creek nest and its characteristics (location within stand and vegetation type) were analyzed to validate whether it was a goshawk nest. The Humpy “potential” territory is comprised mostly by spruce and fir vegetation. Scattered individual lodgepole pine can be found in areas of the stand but not enough to be delineated as dominant lodgepole patches (see table

3.6.1). There have been no documented goshawk nest territories in the spruce-fir vegetation type on the North Slope. It was not considered to be "representative" of other known goshawk territories in the project area or on the North Slope. Further, additional monitoring of the Humpy Creek nest has been completed since the completion of the Final Environmental Impact Statement (an unknown date in 2006 during nesting period, 5/24/07, 6/5/07, and 7/23/07) for activity or alternate nest locations. The nest has not been active in any year since being discovered and there have been no alternate nests located. A Cooper's hawk was observed with prey and aggressively harassing a Red-tailed hawk from the stand during the prior two visits.

The additional monitoring data collected, habitat analysis of the Humpy Creek nest, and knowledge of goshawk habitat selection on the North Slope of the Uintas confirms that the nest is not being utilized by a Northern goshawk. Consequently, within the Environmental Impact Statement the two known goshawk nests are analyzed and the Humpy Creek nest is not.

Supplemental Table 3.6.1 Acres of forested habitat within "known" and "potential" territories within the analysis area

Territory	Spruce-Fir	Lodgepole	Mixed conifer	Conifer/ Aspen	Aspen
Coyote	2076	965	87	380	385
Gold Hill	627	2243	10	229	1053
Humpy	1600	0	31	305	404

Add the following to the first paragraph in Section 3.6.3.4 – Terrestrial Management Indicator Species, Chapter 3, page 86 in the West Bear Vegetation Management Project FEIS.

The Forest updated the Management Indicator Species of the Wasatch-Cache National Forest Report in November 2007 (USDA, 2007). Additional survey field data was incorporated into the 2007 Report. Trend conclusions stated in the West Bear Vegetation Management Project Final Environmental Impact Statement did not change in the 2007 Report.

Replace Table 3.6.18 and the paragraph following this table in Chapter 3, Section 3.6.4.2 - Cumulative Effects Common to All Species, page 108 in the West Bear Vegetation Management Project FEIS with the following.

Table 3.6.18. Affected Sale Area and Haul Road Acres and Number of Years Affected.

Sale Area	Miles of road	Affected Acres	Expected Years of Harvest Operations	Log Haul on Whitney Road Segments
Coyote/Road Hollow Sale Area	5.67	1676	2005-2008	Middle and Lower Segments
Reservoir East Sale Area	10.42	3449	2009-2012	Middle and Lower Segments
Mill City Sale Area	4.44	1304	2008-2010	Lower Segment
Moffit Sale Area	19.82	5307	2009-2012	All Segments

As shown in Table 3.6.18 the Mill City sale area and the area surrounding the lower Whitney Road would be impacted for a longer period of time due to log haul on the Whitney road. Although the Mill City sale area would be treated in 2008-2010, there would be hauling on the Whitney road through these areas during 2011 and 2012 from the Moffit and Reservoir East sale areas. The lower Whitney road segment is approximately 2 miles from Hwy 150 to Mill City Creek, the middle is approximately 1 mile from Mill City Creek to Coyote Hollow, and the upper is approximately 3.5 miles from Coyote Hollow to the Meadow Creek Road junction including a segment that is on private land.

Replace Chapter 3, Section 3.6.4.2 – R4 Sensitive Species, Northern Goshawk, Cumulative Effects, page 108 in the West Bear Vegetation Management Project FEIS with the following.

Northern Goshawk – Cumulative Effects

There are a number of activities (motorized recreation, timber, and grazing) that occur within the analysis area and contribute a minor incremental effect to the goshawk; however, the loss of habitat for foraging and nesting may be the most significant to the goshawk.

There has been a total of 1636 acres of vegetation treatments in mixed-conifer, aspen/conifer, spruce-fir, and lodgepole habitat types in the analysis area of which 605 occur within the two known goshawk territories. Cumulative effects from Alternative 2 and 3 are described in terms of effects on the three components of a goshawk's home range (nesting, post-fledgling, and foraging) important to goshawk lifecycles.

Affected acres from past and current vegetation treatments in the three components are shown in Tables 3.6.2 and 3.6.3

Supplemental Table 3.6.2 Whitney/Coyote Territory affected acres

Whitney/Coyote Territory	Past	Current	Proposed Alt2	Proposed Alt3
Nest Area	0	0	0	0
Post-fledgling Area (PFA)	146	83	94	76
Foraging Area (FA)	485	239	590	451

Supplemental Table 3.6.3 Gold Hill Territory affected acres

Gold Hill Territory	Past	Current	Proposed Alt2	Proposed Alt3
Nest Area	0	0	0	0
Post-fledgling Area (PFA)	100	0	130*	30**
Foraging Area (FA)	166	178	418*	209**

*   harvested acres and 80% of treated acres within prescribed burn.
* *harvested acres and 40% of treated acres within prescribed burn.

In the *Utah Northern Goshawk Project Environmental Assessment (USDA, 2000)* guidelines and standards were established for the conservation of the goshawk. The intent of this direction was incorporated into the 2003 Revised Forest Plan. Direction from the Northern Goshawk Project EA that was not expressly incorporated into the Revised Forest Plan can be recommended as additional conservation guidance for any project (USDA, 2007).

Additional recommended conservation guidance for the desired percentage of VSS 4, 5, and/or 6 groups in the West Bear Vegetation Management Project is:

> Vegetative treatments designed to maintain or promote a VSS 4, 5 and/or 6 group, the percent of the group acreage covered by clumps of trees with interlocking crowns should typically range from 40-70% in post-fledgling and foraging areas, and 50-70% in nest areas. To manage outside this range, it should either be shown that the range is not within PFC for the site and the biological evaluation process determines that managing outside the range will be consistent with landscape needs of the goshawk and its prey. Use the best information available and deemed most reliable to make determinations. Groups are made up of multiple clumps of trees. Groups should be of a size and distribution in a landscape that is consistent with disturbance patterns defined in Regional or local proper functioning condition assessments (PFC). Clumps typically have 2-9 trees in the VSS 4,5 or 6 size class with interlocking crowns (Utah Northern Goshawk Project EA, Appendix CC, March 2000), .

Of the 11,164 forested acres within the analysis area, 1,742 or approximately 15% are in early to mid-seral stages. The remaining 85% are mature old (stand age greater than 100 years). Tables 3.4.2 through 3.4.5 in the FEIS West Bear Vegetation Management Project summarize the conditions of the stands in the analysis area by vegetation type (lodgepole pine, spruce-fir, mixed conifer and aspend/mixed conifer).

Nesting

Because none of the proposed treatments are within nesting habitat there is no incremental impact to nesting habitat resulting in cumulative effect

Post Fledgling

There have been 146 acres treated within the Whitney/Coyote and 100 acres within the Gold Hill Post-Fledgling Areas (PFA). Past treatments varied in prescription method but would be expected to provide habitat for goshawks. Regeneration in clearcut units provides foraging opportunities for prey species and in turn for goshawks. Thinned stands continue to provide habitat for prey species but may not provide suitable nesting habitat for goshawks. Currently in the Whitney/Coyote PFA there is an ongoing thinning project (Coyote/Road Hollow) to reduce the susceptibility of lodgepole pine stands to beetle infestation. Nesting habitat would not be available until a future time when regeneration is in a VSS 4 or 5 group. Foraging may be available in some stands for goshawks and prey species.

Both Alternatives 2 and 3 propose to clearcut and thin within stands found in the Whitney/Coyote PFA. In Alternative 2 there would be about 94 acres treated while in Alternative 3 there would be about 76 acres. Suitable habitat would be available upon the completion of each alternative and within the desired VSS groups for the PFA.

Alternatives 2 and 3 propose to clearcut and prescribe burn stands found in the Gold Hill PFA. In Alternative 2 there would be about 130 acres treated while in Alternative 3 there would be about 30 acres. As shown in Supplemental Table 3.6.4 below suitable habitat would be available upon the completion of each alternative and within the desired VSS groups for the PFA described earlier in the narrative as additional conservation guidance.

Supplemental Table 3.6.4 Goshawk Post Fledgling Area within VSS groups 4,5, and/or 6

Territory	VSS 4, 5, and/or 6 acres	Proposed Treated Acres Alt 2	Proposed Treated Acres Alt 3	% VSS 4, 5, and/or 6 post treatment Alt 2	% VSS 4, 5, and/or 6 post treatment Alt 3
Whitney/Coyote	**374**	**94**	**76**	**45**	**48**
Gold Hill	**408**	**130**	**30**	**46**	**62**

Foraging

There have been 485 acres treated within the Whitney/Coyote and 166 acres within the Gold Hill FA in the past. Some of the past harvest units provide foraging opportunities for goshawks and their prey species, however nesting habitat is not available. The Deer Creek Fire regenerated 128 acres which currently does not provide habitat for snowshoe hares or goshawks. Currently the Coyote/Road Hollow project has treated 239 acres in the Whitney/Coyote FA and 209 acres within the Gold Hill FA. Nesting habitat would not be available until a future time when regeneration is in a VSS 4 or 5 groups. Foraging may be available in some recently thinned stands in the Coyote/Road Hollow project for goshawks and prey species.

In the Whitney/Coyote FA, as shown on Supplemental Table 3.6.5 below, in Alternative 2 there would be 590 acres treated while in Alternative 3 there would be 451 acres treated. Spruce-fir stands that are thinned would not be expected to lose their function. Although canopy cover would be reduced the stand would still function in providing some goshawk habitat. Suitable habitat would be available upon the completion of each alternative and within the desired VSS groups for the FA.

In the Gold Hill FA, as shown in Supplemental Table 3.6.5 below, in Alternative 2 there would be 418 acres treated while in Alternative 3 there would be 209 acres treated. Spruce-fir stands that are thinned would not be expected to lose their function. Although canopy cover would be reduced the stand would still function in providing some goshawk habitat. Suitable habitat would be available upon the completion of each alternative and within the desired VSS groups for the FA.

Supplemental Table 3.6.5 Goshawk Foraging area within VSS 4,5, and/or 6

Territory	VSS 4, 5, and/or 6 acres	Proposed Treated Acres Alt 2	Proposed Treated Acres Alt 3	% VSS 4, 5, and/or 6 post treatment Alt 2	% VSS 4, 5, and/or 6 post treatment Alt 3
Whitney/Coyote	**2834**	**590**	**451**	**41**	**43**
Gold Hill	**3131**	**418**	**209**	**46**	**49**

Other activities that may result in a cumulative effect to goshawk are described below.

Motorized recreation occurs on a year round basis within the analysis area with snowmobiling in the winter and ATV use in the summer. Squires and Reynolds (1997) state "Human disturbance associated with timber practices and other activities may affect goshawks and can cause nest failure, especially during incubation." However, the USFWS (1998) reported that "disturbance generally does not appear to be a significant factor affecting the long-term survival of any North American goshawk population." (Roberson et al 2003). Lee (1981) concluded that goshawks may habituate to high levels of human activities including snowmobile traffic, cross-country and alpine skiing, hiking, horseback riding, and construction activities (Stangl 1996). The two goshawk territories are within high use areas and the birds have seemed to become habituated to human disturbance. There are nine other goshawk territories monitored across the North Slope that are within high use areas. The nests found in these territories occur near and/or adjacent to major roads, access routes, and producing oil wells. The goshawks within the analysis area, like others found in high use areas, have nested successfully.

The increased traffic from logging trucks could potentially increase the likelihood that the alternate nest found adjacent to the main Whitney road would not be utilized in the future. However, the increased log hauling traffic may not disturb the goshawk to a degree in which it abandons the territory. Reynolds and Roy (1998) state goshawk territories typically contain multiple alternate nests, generally in the central portion of territories, used by the resident goshawks over years. Territorial pairs of goshawks often move from year-to-year to alternate nests within their territories. Many pairs of goshawks have two or four alternate nest areas within their home range. All previously occupied nest areas may be critical for maintaining nesting populations because they contain the habitat elements that attracted the goshawk originally. Additionally, replacement nest areas are required because goshawk nest stands are subject to loss from catastrophic events and natural decline (Reynolds et al 1992). Replacement nest areas are available for each of the two territories within the analysis area.

Graham et al.'s Assessment (1999) identifies the nonforest understory vegetation in and/or associated with several forest cover types as being important goshawk prey-base habitat. Generally speaking coniferous forest cover types, other than ponderosa pine, are typically classified as unsuitable for range forage production. However, some coniferous forest may be classified as suitable rangeland depending on canopy cover and intermixing with nonforest cover types or aspen. Grazing is likely to reduce the available forage for some prey species within the analysis area in meadows or in forested stands where access is not limited. A rangeland report by Richard Zobell, Rangeland Management Specialist (Zobell 2005a) indicates that seven monitoring studies have been established with the analysis area that can be used to determine ground cover conditions. Three of the six monitoring studies indicate that ground cover conditions are meeting the Forest Plan standard (S7). Of the remaining four studies, three indicate a trend towards the standard. The cumulative effects from grazing and the loss of habitat for some species within the analysis area would not significantly affect the goshawk. Prey species would still be available in some treated and untreated stands within the analysis area.

There has been a total of 1696 acres of vegetation treatments in mixed-conifer, aspen/conifer, spruce-fir, and lodgepole habitat types in the analysis area. Forest regeneration methods differed within these habitat types and depending on the site regeneration may not provide habitat for all prey species. However, it is expected that avian and/or mammal prey species will continue to exist within the regenerating units even as the stand progresses in age.

The Coyote/Road Hollow proposed future treatments focus on lodgepole and mixed-conifer habitat types. The proposed project objectives are to remove and reduce the susceptibility of stands being infected with beetles. Some nesting habitat will be lost and unsuitable until a future time. Where thinning would occur the area may be suitable nesting habitat in a shorter time period than in areas where small patch cuts occur. Within the analysis area there is adequate nesting habitat available within the aspen/conifer vegetation type. This habitat is expected to be lost because of the absence of natural occurring wildfire. Within the lodgepole dominated stands nesting can occur where densities and canopy cover are suitable. This habitat will continue to exist across the landscape and within the analysis area but can be expected to decrease. The nesting habitat could potentially be affected by the increase in pine beetle activity. Currently the pine beetle levels are high within analysis area. Although goshawks have been known to nest in beetle degraded stands the likelihood for future utilization would decrease. As trees begin to drop the dead needles the canopy cover surrounding the tree would decrease. This decrease could potentially increase the predatory rate of the nest.

Potential foraging opportunities will be lost in the form of woodpecker or cavity nesting birds or rodents that require snags for foraging or nesting within patch-cut and removed trees. Depending on the needs of prey species some thinned stands may no longer provide the necessary canopy or security cover. These prey species will be displaced from the stands to other adjacent stands or other portions of the stand that are not disturbed. Habitat for woodpeckers and cavity nesting birds is available in other portions of the analysis area that are not being treated. The current level of beetles is expected to convert other the stands on the landscape to suitable habitat. Also, with the prescribed fire treatment area foraging and nesting habitat will be created.

Existing nest, post-fledging and foraging areas have been analyzed considering the past, ongoing and proposed treatments. Alternatives 2 and 3 would comply with Forest Plan Standard (S12) prohibiting forest vegetation treatments within active northern goshawk nest areas (approximately 30 acres) during the active nesting period and Forest Plan Guideline (G15) to design all management activities to maintain, restore, or protect desired goshawk and goshawk prey habitats including foraging, nesting and movement. Further, both alternatives would meet the recommended conservation guidance.

Determination

The proposed project would have a "may impact individuals, but is not likely to cause a trend toward federal listing or a loss of viability" determination or affect the Forest-wide population trend (USDA FS 2005e).

Add the following to Chapter 3, Section 3.6.4.4 - Management Indicator Species, page 111 in the West Bear Vegetation Management Project FEIS.

Snowshoe Hares - Cumulative Effects

The incremental effect from the proposed treatments may contribute to the cumulative effects from three other ongoing management actions and/or activities. Recreation, grazing, and timber management are the activities within the analysis area that are considered in the cumulative effects analysis below.

Recreation is popular within the analysis area in both summer and winter months. The cumulative impact from recreation would be considered minor because of the limited contact between recreationists and snowshoe hares. Impacts from recreationists would be hunting, collision, and disturbance. Snowshoe hare are not considered a high priority hunting species although some individuals may be taken by individuals with small game licenses or other opportunistic hunters. Snowshoe hares colliding with vehicles or other motorized equipment would be rare but occasionally does occur on roads in the analysis area. Motorized travel through forested stands may disturb or displace individuals where recreationists leave designated routes and trails.

Sheep grazing does occur within the analysis area and would be expected to contribute to the cumulative effects of proposed actions in Alternatives 2 and 3. Livestock would be expected to utilize some or all portions of the regenerating clear-cuts or prescribed burn areas. Although sheep grazing will not prevent regeneration of aspen based on monitoring of aspen regeneration on the north slope of the Uinta Mountains (Zobell 2005a), it will reduce the amount of new understory forage available for snowshoe hares that will result from treatments. Treated spruce-fir stands where thinning and small patch cuts occur may increase the access and utilization of sheep within the stand. Treatments in mixed-conifer stands would not change utilization by sheep because of the open structure of most stands. The cumulative effects of grazing on snowshoe hare habitat are minor because the mixed aspen/conifer stands that are most affected by the treatment currently have low value as snowshoe hare habitat as described in the snowshoe hare portion of FEIS Section 3.6.4.4. This effect is short term for conifer forest types as described under indirect and cumulative timber and grazing effects on lynx in FEIS Section 3.6.4.1. The value of habitat and its ability to support snowshoe hare would increase in the conifer forest types after 10 to 15 years as described in the snowshoe hare portion of FEIS

Section 3.6.4.4 and tables 3.6.21 and 3.6.22. Cumulative effects of grazing on wildlife habitat following treatment are also discussed in FEIS Sections 3.6.4.5 and 3.6.4.7.

As shown in Supplemental Table 3.6.6 below, there have been about 1637 acres of past and current management of vegetation within the analysis area in a variety of habitat types and locations across the analysis area. In some cases the past managed areas are adjacent to current proposed units.

Supplemental Table 3.6.6 Past harvest and proposed harvest activity within West Bear analysis area (acres).

Vegetation	Acres in Analysis Area	Treated or currently ongoing	No Treatment	Alt 2	Alt 3
Lodgepole	1542	617	925	0	0
Spruce-fir	3294	512	2782	575	389
Aspen	616	11	605		
Mixed-conifer	2902	420	2482	427	348
Aspen-conifer	2810	77	2733	684	650
Totals	11,164	1637	9527	1686	1387

As shown in Supplemental Table 3.6.7 below, habitat would still be available for snowshoe hare in forested vegetation types within the analysis area post harvest. There would be 86% of forested habitat available after treatments proposed in Alternative 2 and 90% of forested habitat available after treatments proposed in Alternative 3.

Supplemental Table 3.6.7 Affected acres from proposed actions in Alternatives 2 and 3

Available forested habitat in analysis area	Past treated or currently ongoing	Unsuitable SSH habitat not recovered and ongoing project acres	Suitable SSH habitat remaining in analysis area	Cumulative Effects from past unsuitable and Alt 2 treatments*	Cumulative Effects from past unsuitable and Alt 3 treatments*
11,164	1637	378	10,786	1502 (14%)	1062 (10%)

*actual affected acres and converted to unsuitable SSH habitat within Alternative 2 (1124) and Alternative 3 (684) was determined by considering the method and vegetation type.

Add the following to Chapter 3, Section 3.6.4.7 - Corridors, under Alternatives 2 and 3, page 114 in the West Bear Vegetation Management Project FEIS.

During dispersal, Murray et al. (1994) and Poole et al. (1996) have reported lynx movement through large areas of non-forest habitat. In addition, Squires and Laurion in Ruggiero et al

(1999) have specified that lynx can readily move across landscapes fragmented by commercial forestry. In relationship to effects to the wildlife corridor, the following is pertinent from the Notice (USDI 2003): "To significantly impact a local lynx population, an activity would have to occur across a very large area (presumably at least the size of several home ranges), create a homogeneous forest that does not provide the various stand ages, species composition, and structure that are good snowshoe hare and lynx habitat, or result in a barrier that effectively precludes dispersal." The Lynx Conservation Strategy (Ruediger et al. 2000) identifies highways, private lands utilized for commercial or residential development, high human use patterns, ski area development, and livestock grazing as actions which may influence movement/dispersal of lynx. The West Bear Vegetation Management Project will construct additional temporary roads and open administrative use only routes within lynx habitat. All these actions will be temporary and would not be open to the public during or after project implementation. After implementation, open road density would return to the current densities. It is important to emphasize, "At this time, there is no compelling evidence to suggest management of road density is necessary to conserve lynx" (Ruediger et al. 2000).

Replace Section 3.9.4 – Environmental Consequences on Financial Efficiency in Chapter 3, pages 3-132 through 3-134 of the West Bear Management Project FEIS with the following:

3.9.4 Environmental Consequences

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 Intermountain Region at this time are large diameter dead spruce trees suitable for houselogs. The stumpage values used in the analysis represent an average value for dead timber, which is significantly less that what would be expected for houselog material.

The Mill City Sale would have an estimated volume of about 4,000 CCF of merchantable conifers that would be harvested under Alternative 2 and burned under Alternative 3. There is up to 100 CCF of merchantable timber outside of harvest units under Alternative 2 that could be burned. The value of these conifers could be used to offset some of the costs of prescribed burning. The costs of burning are highly variable and have not been presented in the following tables.

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 3.9.1 compares the economic efficiency of the alternatives, and reflects the costs and benefits associated with the proposed action and alternatives to the proposed action. The Total Discounted Costs, Total Discounted Benefits and PNV reflect the value over a 60 year time period and are displayed in Table 3.9.2.

Table 3.9.1. Economic Efficiency Comparison of Alternatives. Compares the costs and benefits associated with the proposed action and alternatives (O'Dell 2005a)

Timber Sales	Alternative 1	Alternative 2	Alternative 3
Acres	0	1,489	864
Volume (CCF)	0	12,000	6,000
Total Timber Value ($1000)	0	$960,000	$480,000
Temp. Road Construction Cost *	0	$75,000	$15,000
System Road Construction Cost	0	$38,000	0
Mark/Cruise Cost	0	$192,000	$96,000
Sale Admin. Cost	0	$180,000	$90,000
Contract Prep Cost	0	$45,000	$30,000
Planting Cost	0	$80,000	$59,000

*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 3.9.2. Present Net Value of the Alternatives Over 60 Years.

Timber Sales	Alternative 1	Alternative 2	Alternative 3
Total Discounted Costs	0	-$625,279	-$405,364
Total Discounted Benefits	0	$1,104,867	$621,445
Overall PNV for Alternative	0	$479,589	$216,080

Alternative 1 – No Action

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 3.9.2)

Alternative 2 – Proposed Action

Alternative 2 would provide an estimated 12,000 CCF (5.9 MMBF) of timber volume offered for sale, the greatest amount of any alternative. This is approximately 60% of the annual volume needed to supply local mills. Planting would be accomplished the same as Alternative 1. The total PNV for this alternative over 68 years is estimated at $479,589 (refer to Tables 3.9.1 and 3.9.2).

Alternative 3 – Reduced Roads

Alternative 3 would provide an estimated 6,000 CCF (2.9 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. Planting would occur as with the other alternatives. The Present Net Value of the alternative over 68 years is $216,080 (refer to Tables 3.9.1 and 3.9.2).

CHAPTER 4. CONSULTATION AND COORDINATION

4.1 Preparers and Contributors

ID TEAM MEMBERS:

Core Team

Charlie Condrat, Hydrology, B.S. Forestry, M.S. Watershed Science, 15 years with Forest Service
Daniel Jauregui, Wildlife, B.S. Range and Wildlife Management, 7 years with Forest Service
Larry Johnson, ID Team Leader, B.S. Forestry, Continuing Education in Forest Ecology and Silviculture, 33 years with Forest Service
Kent O'Dell, Timber Management, B.S. Forest Management, M.S. Forest Ecology, 30 years with Forest Service (now retired)

Substantial Contributors

FOREST SERVICE:

Elizabeth Corbin, Fire Ecologist
Paul Cowley, Fisheries, B.S. Fish and Wildlife Management, M.S. Fisheries Management, 16 years with Forest Service
Marc Dasher, Forester, GIS, B.S. Forest Management, 4 years with Forest Service
Tom Flanigan, Archaeologist, B.A. Anthropology, M.A. Anthropology, 9 years with Forest Service
Paul Flood, Soils, B.S. Soil Science, 26 years with Forest Service
Dave Hatch, Scenery Management and Recreation, B.L.A. Landscape Architecture Environmental Planning, 15 years with Forest Service
Loren Jepsen, Silviculture, B.S., M.S. Forest Management, Tri-Regional Education in Ecology and Silviculture, 34 years with Forest Service
Oscar Mena, Civil Engineer, B.S. Civil Engineering, 5 years with Forest Service
Earl O'Driscoll, Recreation Management, 42 years with Forest Service
Wayne Padgett, Plant Ecologist, B.S. Biology, M.S. Rangeland Ecology, 20 years with Forest Service
Stephen Ryberg, District Ranger, B.S. Forest Management, M.S. Forestry, 26 years with Forest Service
Richard Zobell, Range Management, BS Range Watershed Science, 29 years with Forest Service

FEDERAL, STATE, AND LOCAL AGENCIES:

Utah State Historic Preservation Office
USDI, Fish and Wildlife Service

4.2 Distribution of the Final Supplemental Environmental Impact Statement

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of the environmental impact statement. Notification of availability of the Final supplemental environmental impact statement has been distributed to individuals who commented on the Draft and Final Environmental Impact Statement and its Supplement. In addition, information or the notice of availability on the Wasatch-Cache National Forest web site have been sent to the following Federal agencies, federally recognized tribes, State and local governments, and organizations representing a wide range of views regarding the West Bear Vegetation Management Project.

Federal Agencies

U.S. Advisory Council on Historic Preservation
USDA APHIS PPD/EAD
U.S. Army Engineer Division, South Pacific
U.S. Department of Energy
U.S. Department of Interior, Fish and Wildlife Service
U.S. Environmental Protection Agency
U.S. Federal Aviation Administration
USDA Natural Resources Conservation Service
USDA, National Agricultural Library
U.S. Office of Environmental Policy and Compliance

Federally Recognized Tribes

Ute Indian Tribe, Uinta and Quray Agency
N.W. Band of the Shoshone Nation

State and Local Governments

Bear River Water Commission
Coalition of Local Governments
Lyman, Wyoming
Mountain View, Wyoming
Summit County, Utah
Utah Division of Wildlife Resources
Uinta County, Wyoming
Utah Office of Planning and Budget
Utah State Planning Coordinator
Utah State Historic Preservation Office
Wyoming State Planning Coordinator

Organizations

Ayres and Baker Pole and Post
Backcountry Horsemen
Biodiversity Associates
Forest Guardians
Frontiers of Freedom, People for the USA
High Uintas Preservation Council
South and Jones Lumber Co.
The Nature Conservancy
Uinta County Citizens Coalition
Utah Environmental Congress
Western Wildlife Conservancy
Western Wood Products
Wyoming Farm Bureau

CHAPTER 5. LITERATURE CITED

All references were brought forward from the West Bear Vegetation Management Project Final Environmental Impact Statement since the supplemental analysis relies on the FEIS as its foundation. Several new references have been included as well.

General

Bartos, Dale L. 2001. Landscape Dynamics of Aspen and Conifer Forests. In: Sustaining Aspen in Western Landscapes: Symposium Proceedings; 13-15 June 2000, Grand Junction, CO. RMRS-P-18, Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. Pp.5-14.

McNab, W.H.; Avers, P.E. 1994. Ecological subregions of the United States: Section descriptions. Ecosystem Management Report WO-WSA-5. Washington, DC: U.S. Department of Agriculture, Forest Service. 284 p.

Schmid J.M., and R.H. Frye. 1976. Stand Ratings for spruce beetles. USDA Forest Service Res. Note RM-309. 4pp.

Schowalter, T.D, and Jay Withgott. 2001. Rethinking Insects: what would an ecosystem approach look like? Conservation Biology in Practice 2:11-16.

USDA FS. 1998. Sub-regional Assessment of Proper Functioning Conditions for Areas Encompassing the National Forests of Northern Utah. Unpublished manuscript on file at Wasatch-Cache National Forest, Salt Lake City, UT.

USDA FS. 2005. Wasatch-Cache schedule of proposed actions (SOPA) beginning in January, 2005 at: www.fs.fed.us/sopa/components/reports/sopa-110419-2005-04.html

USDA FS. 2005a. West Bear Roads Analysis, USDA FS, Evanston Ranger District, Evanston, Wyoming.

USDA FS. 2005b Wasatch-Cache National Forest Wildland Fire Use Plan 2005. Wasatch-Cache National Forest., 2005. Salt Lake City, Utah.

USDA FS. 2004c. East Fork Fire Salvage Final Environmental Impact Statement. Wasatch-Cache National Forest. June 2004. Salt Lake City, Utah

USDA FS. 2003. Wasatch-Cache Revised Forest Plan. Wasatch-Cache National Forest. Salt Lake City, Utah.

USDA FS. 2003a. Mountain View/Evanston District Travel Plan. Wasatch Cache National Forest. Salt Lake City, Utah.

USDA FS. 2002. West Fork Bear River Ecosystem Management Project. Wasatch-Cache National Forest. February 2002. Salt Lake City, Utah.

Utah State 2004. Historic Preservation Office Concurrence with Forest Service Determination dated October 19, 2004.

Veblen, T.T. 2003. Key issues in fire regime research for fuels management and ecological restoration. Pages 259-276 in: P. Omi and L. Joyce (technical eds). Fire, Fuel Treatments and Ecological Restoration: Conference proceedings; 2002 16-18 April; Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 475 p.

Water Resources

Bettinger, Pete and K. Norman Johnson. 1998. Evaluating the Association Among Alternative Measures of Cumulative Watershed Effects on a Forested Watershed in Eastern Oregon. Western Journal of Applied Forestry 13(1):15-22.

Bjornn, T. C. and D. W. Reiser. 1991. Habitat Requirements of Salmonids in Streams. American Fisheries Society Special Publication 19: 83-138.

Burroughs, E. R., Jr., and J. G. King. 1989. Reduction of Soil Erosion on Forest Roads. General Technical Report INT-264. USDA Forest Service, Intermountain Research Station.

Condrat, Charles R. 2005. Water Resources Technical Report for the West Bear Vegetation Management Project Available in the Project Record.

Condrat, Charles R. 2005. Water Resources Technical Report Addendum for the West Bear Vegetation Management Project Available in the Project Record.

Daniels, B, D. McAvoy, M. Kuhnz, and R. Gropp. (2004). Managing forests for water quality: streamside management zones. Utah State University Extension.

EPA. 2005. National Management Measures to Control Nonpoint Source Pollution from Forestry. EPA 841-B-05-001, May 2005. Available online at: http://www.epa.gov/nps/forestrymgmt

Fairbridge, Rhodes W. 1968. The Encyclopedia of Geomorphology, Encyclopedia of Earth Sciences Series, Volume III, edited by Rhodes W. Fairbridge. Rienholt Book Corporation, New York.

Flood, Paul. 2005. Soils Technical Report for the West Bear Vegetation Management Project Available in the Project Record.

Fulton, Stephanie and Ben West. 2002. Forestry Impacts on Water Quality in Southern forest resource assessment, Gen. Tech. Rep. SRS-53. Asheville, NC: U.S. Department of Agriculture. Forest Service, Southern Research Station by Wear, David, Greis, John G., eds. 2002.

Furniss, M. J., T. D. Roelofs, and C. S. Yee. 1991. "Road construction and maintenance." American Fisheries Society Special Publication 19: 297-324.

Harr, R. D., et al. 1975. Changes in Storm Hydrographs after Road Building and Clear-cutting in the Oregon Coast Range. Water Resources Research 11: 436-444.

Hauge, C. J., M. J. Furniss and F. D. Euphrat. 1979. "Soil Erosion in California's Coast Forest District." California Geology (June):120-129.

Jones, J. A., and G. E. Grant. 1996. "Peak Flow Responses to Clear-cutting and Roads in Small and Large Basins, Western Cascades, Oregon." Water Resources Research 32(4): 959-974.

Megahan, W. F. 1972. "Subsurface Flow Interception by a Logging Road in Mountains of Central Idaho. In Proceedings, Watersheds in Transition Symposium, American Water Resources Association, edited by S. C. Csallany, T. G. McGlaughlin and W. D. Striffler. Urbana, Illinois.

Phillips, R. W., et al. 1975. "Some Effects of Gravel Mixtures on Emergence of Coho Salmon and Steelhead Trout Fry." Transactions of the American Fisheries Society 104:461-466.

Reid, L. M. and T. Dunne. 1984. "Sediment Production from Forest Road Surfaces." Water Resources Research 20: 1753-1761.

Roby, K. B., D. C. Erman, and J. D. Newbold. 1977. "Biological Assessment of Timber Management Activity Impacts and Buffer Strip Effectiveness on National Forest Streams in Northern California." Earth Resources Monograph 11. Washington, DC: U.S. Department of Agriculture.

Seyedbagheri, Kathleen A. 1996. Idaho forestry best management practices: compilation of research on their effectiveness. Gen. Tech. Rep. INT-GTR-339. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 89 p.

Swanston, D. N. 1991. "Natural Processes." American Fisheries Society Special Publication 19.

Swanston, D. N. and F. J. Swanson. 1976. "Timber Harvesting, Mass Erosion, and Steepland Forest Geomorphology in the Pacific Northwest." In Geomorphology and Engineering, edited by D.R. Coates. Stroudsburg, PA: Dowden, Hutchinson, and Ross.

Troendle C.A. 1987. The Potential Effect of Partial Cutting and Thinning on Streamflow from the Subalpine Forest. Rocky Mountain Research Station, Research Paper RM-274.

Troendle, Charles A. and James M. Nankervis. 2000. Estimating Additional Water Yield From Changes in Management of National Forests in the North Platte Basin. Submitted to the Platte River Office, Bureau of Reclamation, Lakewood, Colorado.

USDA. Forest Service. 2002. West Fork Bear River Landscape Assessment. Wasatch-Cache National Forest. February, 2002.

USDA Forest Service. 2003. Wasatch-Cache National Forest Plan, Chapter 4, Western Uintas Management Area. USDA Forest Service.

Utah, State of. 2000. Standards of Quality of Waters of the State, Section R317-2, Utah Administrative Code. Utah Department of Environmental Quality, Division of Water Quality.

Utah, State of. 2002. Utah Water Quality Assessment Report to Congress 2002. Utah Department of Environmental Quality, Division of Water Quality.

Wemple, B. C., J. A. Jones, and G. E. Grant. 1996. "Channel Network Extension by Logging Roads in Two Basins, Western Cascades, Oregon." Water Resources Bulletin 32(6): 1195-1207.

Soil Resources

Alexander, E.B. and R. Poff. 1985. Soil Disturbance and Compaction in Wildland Management. In Earth Resources, Monograph 8. USDA Forest Service, Region 5, San Fransico, California. 170 p.

Condrat, Charles R. 2005. Water Resources Technical Report for the West Bear Vegetation Management Project Available in the Project Record.

Flood, Paul. 2004. Soils reconnaissance August 3 field notes for the Proposed West Fork Bear Timber Sale. Wasatch-Cache National Forest. Salt Lake City, Utah.

Flood, Paul. 2005. Soils Technical Report for the West Bear Vegetation Management Project Available in the Project Record.

Flood, Paul . March 2005a. Soils Technical Report For the West Fork Bear Timber Treatment EIS. Appendix A , "FSWEPP Modeling Results". Wasatch-Cache National Forest. Salt Lake City, Utah.

Flood, Paul. March 2005b. Soils Technical Report For the West Fork Bear Timber Treatment EIS. Appendix B , "West Fork Bear Timber Sale Soil Features". Wasatch-Cache National Forest. Salt Lake City, Utah.

Fulton, Stephanie and Ben West. 2002. Forestry Impacts on Water Quality in Southern forest resource assessment, Gen. Tech. Rep. SRS-53. Asheville, NC: U.S. Department of Agriculture. Forest Service, Southern Research Station by Wear, David, and John G. Greis, eds. 2002.

Greenwood, K.L. and B. M. McKenzie. 2001. Grazing Effects on Soil Physical Properties and the Consequences for Patures. Australian Journal of Experimental Agriculture. **41**, 1231-1250.

Greenwood, K.L., D.A. MacLeod, and K.J. Hutchinson. 1997. Long Term Stocking Rate Effects on Soil Physical Properties. Australian Journal of Experimental Agriculture. **37**, 413-419.

Harvey, A.E., M.F. Jurgensen, M.J. Larsen, and R.T. Graham. 1987. Decaying organic materials and soil quality in the inland Northwest: a management opportunity. Gen. Tech. Report INT-225. USDA-Forest Service, Intermountain Research Station, Ogden, UT. 13 pp.

Jurgensen, M.F., A.E. Harvey, R.T. Graham, D.S. Page-Dumroese, J.R. Tonn, M.J. Larsen, and T.B. Jain. 1997. Impacts of timber harvesting on soil organic matter, nitrogen, productivity, and health of inland northwest forests. Forest Science 43(2):234-251.

Murphy, W.M., A.D. Mena Barreto, J.P. Silman, and D.L. Dindal. 1995. Cattle and sheep grazing effects on soil organisms, fertility, and compaction in a smooth-stalked meadowgrass-dominate white clover sward. Grass and Forage Science 50:183-190

Sharrow, Steven H. 2007. Soil Compaction by Grazing Livestock in Silvopastures as Evidenced by Changes in Soil Physical Properties. Agroforest Syst 71:215-233.

Shestak, C.J. and M.D. Busse. 2005. Compaction Alters Physical but Not Biological Indices of Soil Health. Soil Sci. Soc. Am. J. 69:236-246 (2005). Soil Science Society of America. Madison, WI.

USDA Forest Service. 1995a. Unpublished soil survey of the North Slope of the Uinta Mountains. Wasatch-Cache National Forest. Salt Lake City, Utah.

USDA. Forest Service. 2002. West Fork Bear River Landscape Assessment. Wasatch-Cache National Forest. February, 2002.

USDA Forest Service. 2003 Wasatch-Cache National Forest Plan, Chapter 4, Western Uintas Management Area, Forestwide Standards and Guidelines. pp 4-36, 37.and Glossary. Page GL-1. Wasatch-Cache National Forest. Salt Lake City, Utah.

USDA Natural Resources Conservation Service. 2004. National Soil Survey Handbook, 430-VI-NSSH. Part 618. Exhibit 618-14, pp 73-82. Natural Resources Conservation Service, Soil Survey Center, Lincoln, Nebraska, February, 2004.

Zobell, Richard. 2005a. Specialist Report on grazing for the West Bear Vegetation Management Project Available in the Project Record.

Aquatic Resources

Cowley, P .1995. Fish surveys on the Wasatch-Cache National Forest. Uinta and Wasatch-Cache National Forest. USDA Forest Service. Salt Lake City, Utah

Cowley, P. 2003. Fish surveys on the Wasatch-Cache National Forest during 2003. USDA Forest Service. Salt Lake City, Utah

Cowley, Paul. 2005. Aquatic Resources Technical Report for the West Bear Vegetation Management Project Available in the Project Record.

Lentsch, L., M.J. Perkins, J.J. Wallace, P.D. Thompson, S.C. Hansen. 1995. Native fish, amphibians and reptile of Utah. Utah Division of Wildlife Resources Publication 85-20.

Lentsch, L., Y. Converse. And J. Perkins (1997): Conservation agreement and strategy for Bonneville cutthroat trout. Publication 97-19, Utah Department of Resources, Division of Wildlife Resources.

Minshall, G. W. 2003. Responses of stream benthic macroinvertebrates to fire. Forest Ecology and Management. 178:155-161

Peterson, C.S., and L.E. Speth. 1980. A history of the Wasatch-Cache National Forest. Wasatch-Cache National Forest, Salt Lake City, Utah

Stebbins, R.C. 1985. A field guide to western reptiles and amphibians. Houghton Mifflin Company, Boston. Map 50.

Thompson, P., B. Nadolski, P. Chase. 2003. Boreal Taod (Bufo boreas boreas) and Spotted Frog (Rana luteiventris) distributional surveys and monitoring in Northern Utah, 2002.

Thompson, P. 2003. Native cutthroat trout (Oncorhynchus clarki spp.) conservation activities in the Northern Region, 2003. Utah Division of Wildlife Resources. Salt Lake City, Utah.

United States Department of Interior (2001): Status review for Bonneville Cutthroat Trout (Oncorhynchus clarki utah). Draft; U.S. Fish and Wildlife Service, Regions 1 and 6, Portland, Oregon and Denver, Colorado.

Utah Division of Wildlife Resources (1997): Fish stocking and transfer procedures. State of Utah, Division of Wildlife Resources, Aquatics, No. W2ADM-1

USDA FS. 2003b. Final Environmental Impact Statement Wasatch-Cache National Forest. Intermountain Region. Forest Service. Salt Lake City, Utah.

White, G.C., D.R. Anderson, K.P. Burnhan, D.L. Otis. 1982 Capture-Recapture and removal Methods for sampling closed populations. Los Alamos National Laboratory, New Mexico. Department of Energy. LA-8787-NERP, UC-11

Zippin, C. 1958. The removal method of population estimation. Journal of Wildlife Management 22(1) pages 82-90.

Vegetation

Alexander, Robert R. 1987. Ecology, silviculture, and management of the Engelmann spruce-subalpine fir type in the central and southern Rocky Mountains. Agric. Handb. No. 659. Washington, DC: US Department of Agriculture Forest Service, 144 p.

Aplet, Gregory H., Richard D. Laven, and Frederick W. Smith. Patterns of Community Dynamics in Colorado Engelmann Spruce-Subalpine Fir Forests. Ecology 69(2): 312-319

Arno, Stephen F. 1980. Forest fire history in the Northern Rockies. Journal of Forestry. 78(8): 460-465.

Baker, James B. and others. 1996. Uneven-aged silviculture for the loblolly and shortleaf pine forest cover types. Gen. Tech. Rep. SO-118. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 65 p.

Bartos, Dale L. 2001. Landscape Dynamics of Aspen and Conifer Forests. In: Sustaining Aspen in Western Landscapes: Symposium Proceedings; 13-15 June 2000, Grand Junction, CO. RMRS-P-18, Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. Pp.5-14.

Bebi P., D. Kulakowski, and T.T. Veblen. 2003. Interactions between fire and spruce beetle in a subalpine Rocky Mountain forest landscape. Ecology 84(2): 362-371.

Bentz, B.J. and A.S. Munson. 2000. Spruce beetle population suppression in Northern Utah. Western Journal of Applied Forestry 15(3):122-128.

Dymerski, Alan D., J.A. Anhold, and A.S. Munson. 2001. Spruce beetle outbreak in Engelmann spruce in central Utah, 1986-1998. Western North American Naturalist 61(1):19-24.

Everett, R., J. Lehmkulhl, R. Schellhaas, P.Ohlson, D. Keenum, H. Riesterer, D. Spurbeck. 1999. Snag dynamics in a chronoseequence of 26 wildfires on the east slope of the Cascade Range in Washington State, USA. International Journal of Wildland Fire 9(4):223-234.

Christopher J. Fettig, Kier D. Klepzig, Ronald F. Billings, A. Steven Munson, T. Evan Nebeker, Jose F. Negro´n, John T. Nowak. 2007. The effectiveness of vegetation management practices for prevention and control of bark beetle infestations in coniferous forests of the western and southern United States. Forest Ecology and Management 238 (2007) 24–53

Hamilton, Ronald C. 1993. Characteristics of Old-Growth Forests in the Intermountain Region. USDA Forest Service. Intermountain Region. Ogden, Ut.

Holsten, E.H., R.W. Their, A.S. Munson and K.E. Gibson. 1999. The spruce beetle. USDA Forest Service, Forest Insect and Disease Leaflet #127, Washington, D.C., 12pp.

Jenkins MJ, Dicus CA, Hebertson EG. 1998. Postfire succession and disturbance interactions on an intermountain subalpine spruce-fir forest. In Teresa L. Pruden and Leonard A. Brennan (eds.). Fire in ecosystem management: shifting the paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings, No. 20. Tall Timbers Research Station, Tallahassee, FL, pp. 219-229.

Kaufmann M.R., G.H. Aplet, M. Babler, W.L. Baker, B. Bentz, M. Harrington, B.C. Hawkes, L. Stroh Huckaby, M.J. Jenkins, D.M. Kashian, R.E. Keane, D. Kulakowski, C. McHugh, J. Negron, J. Popp, W.H. Romme, T. Schoennagel, W. Shepperd, F.W. Smith, E. Kennedy Sutherland, D. Tinker, and T.T. Veblen. 2008. The status of our scientific understanding of lodgepole pine and mountain pine beetles – a focus on forest ecology and fire behavior. The Nature Conservancy, Arlington, VA. GFI technical report 2008-2.]

Keane, Robert E.; Ryan, Kevin C.; Veblen, Tom T.; Allen, Craig D.; Logan, Jessie; Hawkes, Brad. 2002. Cascading effects of fire exclusion in the Rocky Mountain ecosystems: a literature review. General Technical Report. RMRSGTR-91. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 24 p.

Kulakowski, Dominik, Thomas T. Veblen, Peter Bebi, 2003. Effects of fire and spruce beetle outbreak legacies on the disturbance regime of a sublapine forest in Colorado. Journal of Biogeography 30, 1445-1456.

O'Dell, Kent. 2005. Timber Resources Technical Report for the West Bear Vegetation Management Project Available in the Project Record.

O'Dell, Kent. 2005a. Financial Efficiency Calcualtions for the West Bear Vegetation Management Project Available in the Project Record.

Oliver, C.D., 1981. Forest development in North America following major disturbances. Forest Ecol. Manage., 3:153-168.

Raffa, Kenneth F., Brian H. Aukema, Barbara J. Bentz, Allan L. Carroll, Jeffrey A. Hicke, Monica G. Turner, and William H. Romme. 2008. Cross-scale Drivers of Natural Disturbances Prone to Anthropogenic Amplification: The Dynamics of Bark Beetle Eruptions. June 2008 / Vol. 58 No. 6 • BioScience, Pages 501-517

Rebertus, Alan J., Thomas T. Veblen, Lynn M. Roovers, and Joy Nystrom Mast. Paper presented at the Old-Growth Forests in the Southwest and Rocky Mountain Region Workshop, Portal, AZ, March 9-13, 1992.

Samman, Safiya; Logan, Jesse, tech. eds. 2000. Assessment and response to bark beetle outbreaks in the Rocky Mountain Area. Report to Congress from Forest Health Protection, Washington Office, Forest Service, U.S. Department of Agriculture. Gen. Tech. Rpt. RMRS-GTR-62. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 46p.

Schoennagel, Tania, Veblen, Thomas T., Romme, William H. 2004. The interaction of fire, fuels, and climate across Rocky Mountain forests. BioScience 54(7):661-676

Schowalter, T.D, and Jay Withgott. 2001. Rethinking Insects: what would an ecosystem approach look like? Conservation Biology in Practice 2:11-16.

Schmid J.M., and R.H. Frye. 1976. Stand Ratings for spruce beetles. USDA Forest Service Res. Note RM-309. 4pp.

Sheppard, Wayne D. 2001. Manipulations to regenerate aspen ecosystems. In Sustaining Aspen in Western Landscapes: Symposium Proceedings. In Proceedings RMRS-P-18. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 460p.

Steen, O.A., R.A. Coupé, H.M. Armleder, and R.J. Dawson. 2005. Development and structure of three high-elevation old spruce-fir stands in the Quesnel Highland of east-central British Columbia. B.C. Min. For., Res. Br., Victoria, B.C. Res. Rep. 26.

USDA. Forest Service. 2002. West Fork Bear River Landscape Assessment. Wasatch-Cache National Forest. February, 2002.

USDA FS. 2003b. Final Environmental Impact Statement Wasatch-Cache National Forest. Intermountain Region. Forest Service. Salt Lake City, Utah.

U.S.D.A. FS. 2005d. Old Forest on the Wasatch-Cache National Forest. Results of database queries and reports. West Bear Project Record. 2005. Salt Lake City, Utah.

U.S.D.A. Forest Service 2006. Biological Evaluation for Botanical Species. West Bear EIS Project Record. Wasatch-Cache National Forest, Evanston Ranger District, Evanston, Wyoming.

Veblen, Thomas T. 1986. Treefalls and the Coexistence of Conifers in Subalpine Forests of the Central Rockies. Ecology 67(3): 644-649.

Veblen, T.T., K.S. Hadley, M.S. Reid, and A.J. Rebertus. 1991. The response of subalpine forests to spruce beetle outbreak in Colorado. Ecology 72(1): 213-231.

Veblen, T.T., K.S. Hadley, E.M. Nel, T. Kitzberger, M.Reid, and R. Villalba. 1994. Disturbance regime and disturbance interactions in a Rocky Mountain subalpine forest. Journal of Ecology 82: 125-135.

Fire / Fuels

Barrett, Steve. 2003. Fire Regime Condition Class (FRCC) Interagency Handbook Reference Conditions for Interior West Lower Subalpine Forest #1 (SPFI1), dated 11/25/03. Available from www.frcc.gov.

Goodrich, Sherel and Elizabeth Neese. 1986. Uinta Basin Flora. USDA Forest Service – Intermountain Region publication.

Havlina, Doug. 2003. Fire Regime Condition Class (FRCC) Interagency Handbook Reference Conditions for Cool sagebrush (mountain big sagebrush) with Trees (CSAG2), dated 8/29/03. Available from www.frcc.gov.

Padgett, Wayne and Elizabeth Corbin. 2005. Vegetation and Fire Technical Report for the West Bear Vegetation Management Project Available in the Project Record.

Zobell, Richard. 2005. Personal Communications. Rangeland Management Specialist for the Mt. View/Evanston District of the Wasatch-Cache National Forest.

Wildlife

Beier, Paul, Erik C. Rogan, Michael F. Ingraldi and Steven S. Rosenstock. 2008. Does Forest Structure Affect Reproduction of Northern Goshawks in Ponderosa Pine Forests? Journal of Applied Ecology, 45, 342–350

Blackwell, Boyde H. Jordan C. Pederson. 1993. Beaver Distribution, Habitat and Population Survey (1971-1982). Project Summary and Recommendations for Action. Utah Division of Wildlife Resources. Salt Lake City, Utah.

Bunnell, Kevin. 2004. Unpublished work on Masters, Phd. Thesis. Brigham Young University, Provo, Ut.

Department of the Interior FWS. Endangered and Threatened Wildlife and Plants; Notice of Remanded Determination of Status for the Contiguous United States Distinct Population Segment of the Canada Lynx; Clarification of Findings; Final Rule. 50 CFR 17. Federal Register/Vol. 68, No. 128/Thursday, July 3, 2003/Rules and Regulations. p. 40090.

Flinders, Jerran T., Kevin Bunnell, Justin J. Shirley, Michael L. Wolfe, and John A. Bissonette 2004. Forest Carnivores Occurrence, Distribution & Limiting Factors: Canada Lynx & Wolverine Surveys in Utah. Final Report to: Utah Division of Wildlife Resources, U.S. Forest Service And U.S. Fish and Wildlife Service.

Goggans, Rebecca., Rita D. Dixon, and L. Claire Seminara. 1988. Habitat use by Three-toed and Black-backed woodpeckers, Deschutes National Forest, Oregon. Non-game project number 87-3-02, Oregon Department of Fish and Wildlife. USDA Deschutes National Forest.

Graham Russell T., Ronald L. Rodriguez, Kathleen M. Paulin, Rodney L. Player, Arlene P. Heap, Richard Williams. 1999. The Northern Goshawk in Utah: Habitat Assessment and Management Recommendations. USDA General Technical Report RMRS-GTR-22 February 1999.

Hargis, Christina D., John A. Bissonette. 1995. The Effect of Forest Fragmentation on American Marten Populations and Prey Availability. Final Report for the Utah Division of Wildlife Resources, Wasatch-Cache National Forest, Ashley National Forest and Utah Wilderness Association. December 31, 1995. Contract 91-9166.

Hatler, David. 1988. Management Guidelines in British Columbia. July 1988.

Hayward, Gregory D. 1994. Conservation Status of Great Gray Owls in the United States. Page 205 in G. Hayward and J. Vernor, technical editors. Flammulated, boreal, and great gray owls in the United States: A technical conservation assessment. Gen. Tech. Rep. RM-253. United States Department of Agriculture. Forest Service. Rocky Mountain Forest and Range Experiment Station 214p. 3 maps.

Hilfiker, E.L. 1991. Beaver - Water, Wildlife, and History. Windswept Press, Interlaken, New York. 195 pgs.

Jauregui, Daniel. 2005. Wildlife Technical Report for the West Bear Vegetation Management Project Available in the Project Record.

Koehler, G.M. and J.D. Brittell. 1990. Managing spruce-fir habitat for lynx and snowshoe hares. Journal of Forestry 10:10-14.

Krebs, C.J., R. Boonstra, V. Nams, M. O'Donoghue, K.E. Hodges, and S. Boutin. 2001. Estimating Snowshoe hare population density from pellet plots: a further evaluation. Can. J. Zool. 79:1-4.

Lee J.A. 1981. Habituation to human disturbance in nesting accipiters. Raptor Research15(2):48-52.

Montana Partners in Flight. 2000. Partners In Flight Bird Conservation Plan Montana. Version 1.0 Montana Partners in Flight. January 2000.

Ministry of Environment, Lands and Parks Resources Inventory Branch for the Terrestrial Ecosystems Task Force Resources Inventory Committee. 1998.

Murray, D. L., J.D. Roth, E. Ellsworth, A.J. Wirsing, and T.D. Steury. 2002 Estimating low-density snowshoe hare populations using fecal pellet counts. Can. J. Zool. 80:771-781.

Murray D. L.; Boutin, S.; O'Donoghue, M. 1994. Winter habitat selection by lynx and coyotes in relation to snowshoe hare abundance. Canadian Journal of Zoology. 72: 1444-1451.

NatureServe Explorer 2004. An online Encyclopedia of Life. http://www.natureserve.org/explorer

Noss, Reed., George Wuerthner, Ken Vance-Borland, and Carlos Carroll. 2001. A Biological Conservation Assessment for the Utah-Wyoming Rocky Mountains Ecoregion: Report to The Nature Conservancy.

Parrish, J. R., F. P. Howe, R. E. Norvell. 2002. Utah Partners in Flight Avian Conservation Strategy Version 2.0. Utah Partners in Flight Program, Utah Division of Wildlife Resources, 1594 West North Temple, Salt Lake City, UT 84116, UDWR Publication Number 02-27.i–xiv + 302 pp.

Poole, K. G.; Wakelyn, L. A.; Nicklen, P. N. 1996. Habitat selection by lynx in the Northwest Territories. Canadian Journal of Zoology. 74: 845-850.

Primack, Richard 1993. Essentials of Conservation Biology. Sinauer Associates Inc. Sunderland, Massachusetts. Pp. 131, 132 and 137.

Provan, Timothy H. 1980. Utah Furbearer Harvest Report and Management Recommendations 1979-80. Publication NO. 80-12. Utah State Division of Wildlife Resources. Salt Lake City, Utah.

Reynolds, Richard T.; Graham, Russell T.; Reiser, M. Hildegard; and others. 1992.Management recommendations for the northern goshawk in the southwestern United States. Gen. Tech. Rep. RM-217, Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. p. 13

Reynolds, Richard T., Joy, Suzanne M. 1998. Distribution, Territory Occupancy, Dispersal, and Demography of Northern Goshawks on the Kaibab Plateau, Arizona. Final Report for Arizona Game and Fish Heritage Project No. 194045 p. 11.

Roberson, Aimee M., Andersen, David E., and Kennedy, Patricia L. 2003. The Northern Goshawk (*Accipiter gentilis atricapillus*) in the Western Great Lakes Region: A Technical Conservation Assessment. Pp. 53-54.

Ruggiero, Leonard F., Keith B. Aubry, Steven W. Buskirk, L. Jack Lyon, William J. Zielinski. 1994. The Scientific Basis for Conserving Forest Carnivores American Marten, Fisher, Lynx, and Wolverine in the Western United States. USDA General Technical Report RM-254. U.S.D.A. Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, Colorado. 184 pgs.

Ruggiero, Leonard F., Keith B. Aubry, Steven W. Buskirk, Gary M. Koehler, Charles J. Krebs, Kevin S. McKelvey, and John R. Squires. 1999. Ecology and Conservation of Lynx in the United States. General Technical Report. RMRS-GTR-30WWW. October 1999. U.S.D.A. Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, Colorado.

Ruediger, Bill, Jim Claar, Steve Gniadek, Bryon Holt, Lyle Lewis, Steve Mighton, Bob Naney, Gary Patton, Tony Rinaldi, Joel Trick, Anne Vandehey, Fred Wahl, Nancy Warren, Dick Wenger, and Al Williamson. 2000. Canada lynx conservation assessment and strategy. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Forest Service Publication #R1-00-53, Missoula, MT. 142 pp.

Sousa, Patrick J. 1983. Habitat Suitability Index Models: Williamson's Sapsucker. Habitat Evaluation Procedures Group Western Energy and Land Use Team. U.S.Fish and Wildlife Service Fort Collins, CO. p.1-2.

Stangl, JT. 1996. Compiled goshawk Information. Species Response to Disturbance Including Management. p. 4

Utah Division of Wildlife Resources 2003. Wolves in Utah Website: http://www.wildlife.utah.gov/wolf/wolves-in-utah.html

Utah Division of Wildlife Resources. 2003a. Utah Sensitive Species List. December 18,2003. p63.

Utah Division of Wildlife Resources. 2004. http://dwrcdc.nr.utah.gov/rsgis2/Search/Display.asp?FINm=gulogulo

U.S.D.A. Forest Service. 2007. Correspondence from Wasatch-Cache National Forest Deputy Forest Supervisor David R. Myers. Subject: Forest Plan Direction for Northern Goshawk. May 23, 2007.

U.S.D.A. Forest Service. 2007. Management Indicator Species on the Wasatch-Cache National Forest. Wasatch-Cache National Forest, Version 2007-1, November, 2007. Salt Lake City, Utah.

U.S.D.A. Forest Service. 2006a. Management Indicator Species on the Wasatch-Cache National Forest. Wasatch-Cache National Forest, Version 2006-1, February 15, 2006. Salt Lake City, Utah.

U.S.D.A. Forest Service. 2006b. Monviso Subdivsion Map and Plans. West Bear EIS Project Record. Wasatch-Cache National Forest, Evanston Ranger District, Evanston, Wyoming.

USDA FS. 2005b Wasatch-Cache National Forest Wildland Fire Use Plan 2005. Wasatch-Cache National Forest., 2005. Salt Lake City, Utah.

U.S.D.A. Forest Service 2005e. Biological Evaluation for Aquatic and Terrestrial Species. West Bear EIS Project Record. Wasatch-Cache National Forest, Evanston Ranger District, Evanston, Wyoming.

U.S.D.A. Forest Service 2005f. Biological Assessment for Terrestrial Threatened, Endangered and Proposed Species. West Bear EIS Project Record. Wasatch-Cache National Forest, Evanston Ranger District, Evanston, Wyoming.

U.S.D.A. Forest Service 2004. Coyote Road Hollow Beetles Project File for an October 24, 2004 Decision Memo. Wasatch-Cache National Forest, Evanston Ranger District, Evanston, Wyoming.

U.S.D.A. Forest Service 2003b. Wasatch-Cache National Forest Final Environmental Impact Statement. 2003. Rangeland Capability and Suitability, Livestock Grazing/Range Management. Table RN-3. Rangeland Condition and Trend. P3-353.

USDA. Forest Service. 2002. West Fork Bear River Ecosystem Management Project. Wasatch-Cache National Forest. February, 2002.

U.S.D.A. Forest Service. 1997. Poison Table Vegetation Management. Finding of No Significant Impact And Environmental Assessment. Wasatch-Cache and Uinta National Forests, Mountain View Ranger District.

U.S.D.I American Beaver Utah Gap Analysis: An Environmental Information System. 1997. USDI National Biological Service and Utah State University. State of Utah Natural Resources. Division of Wildlife Services.

USDI FWS. 2003. Endangered and Threatened Wildlife and Plants; Notice of Remanded Determination of Status for the Contiguous United States Distinct Population Segment of the Canada Lynx; Clarification of Findings; Final Rule. 50 CFR 17. Federal Register/Vol. 68, No. 128/Thursday, July 3, 2003/Rules and Regulations. p. 40090.

USDI FWS 2005. Biological Assessment Concurrence Letter, Sept 27, 2005. West Bear EIS Project Record. Wasatch-Cache National Forest, Evanston Ranger District, Evanston, Wyoming.

Wolfe, Michael L., Brian D. Maxfield. Utah Furbearer Harvest Report 1998-1999. Publication NO. 02-06. Utah Department of Natural Resources. 2002. Salt Lake City, Utah.

Zobell, Richard. 2005. Personal Communications. Rangeland Management Specialist for the Mt.View/Evanston District of the Wasatch-Cache National Forest.

Zobell, Richard. 2005a. Specialist Report on grazing for the West Bear Vegetation Management Project Available in the Project Record.

Scenery and Recreation

Hatch, David. 2005. Scenery Technical Report for the West Bear Vegetation Management Project Available in the Project Record.

Hatch, David. 2005a. Recreation Technical Report for the West Bear Vegetation Management Project Available in the Project Record.

USDA Forest Service. 2004a. National Visitor Use Monitoring Results, Wasatch-Cache National Forest, June 2004

USDA Forest Service 2004b. Visual Quality Objectives in Douglas-Fir Forest USDA Department of Agriculture, Portland, OR. Publication No: R6-REC-TP-016-90.

USDA Forest Service. 1995. Landscape Aesthetics, A Handbook for Scenery Management. Agricultural Handbook Number 701.