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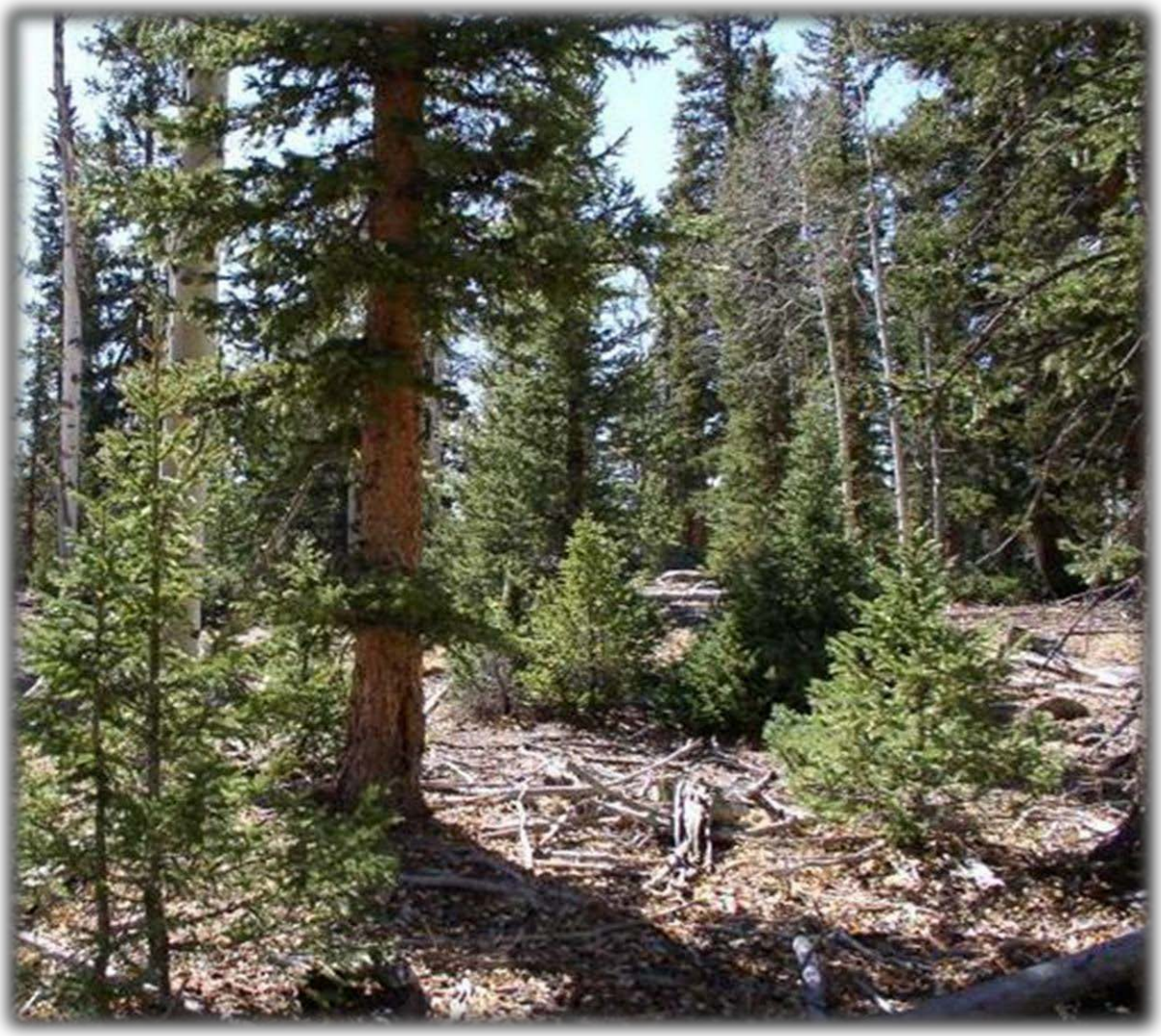
Environmental Assessment

Iron Springs Vegetation Improvement and Salvage Project

Escalante Ranger District, Dixie National Forest
Garfield County, Utah



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Summary

The Escalante Ranger District of the Dixie National Forest proposes to conduct a range of vegetation improvement treatments within the 8,306-acre Iron Springs project area, located on the Aquarius Plateau, some 15 miles northwest of Escalante, Utah. The Proposed Action includes: (1) intermediate harvest treatments, (2) salvage of timber killed by or dying as a result of beetle infestation, (3) regeneration of aspen, and (4) reforestation of previously harvested areas that do not meet required stocking levels.

These actions are needed because: (1) spruce/fir stand density is higher than desirable and age class diversity is lower than desired; (2) spruce/fir stocking is low in historic clearcut areas; (3) spruce/fir stands are susceptible to mortality by spruce beetle; (4) 80 percent of the aspen is in the mature to over-mature class, with the bulk of the aspen being greater than 80 years old; (5) most of the aspen clones are succeeding to spruce/fir and are at risk of being replaced by conifer; and (6) due to high stand densities and extensive downed material, both large and fine fuel loadings are above desired levels, creating a risk of catastrophic fire.

In addition to the Proposed Action, we are considering two alternatives: No Action and an additional action alternative, Alternative A. This alternative involves a variety of treatments (similarly to the Proposed Action), but emphasizes maintenance of Engelmann spruce/ subalpine fir old-growth areas. Based upon the effects of the alternatives, the responsible official will decide to: (1) implement the Proposed Action, (2) implement the Proposed Action with modifications, (3) implement Alternative A, (4) implement Alternative A with modifications, or (5) take no action at this time.

1 Introduction

1.1 Document Structure

The Forest Service has prepared this environmental assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This environmental assessment discloses the direct, indirect, and cumulative environmental impacts that would result from No Action, the Proposed Action and Alternative A. The document is organized as follows:

1. Introduction. The section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.

2. Description of the Alternatives, Including the Proposed Action. This section provides a more detailed description of the agency's Proposed Action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary of the environmental consequences associated with each alternative.

3. Affected Environment and Environmental Consequences. This section describes the environment within which action will take place. Resources considered include wildlife, sensitive plants, hydrology, soils, forest vegetation, recreation, scenery, roadless and undeveloped areas, range, noxious weeds, and fire and fuels. It also describes the environmental effects of implementing the Proposed Action and other alternatives.

4. Agencies and Persons Consulted. This section provides a list of preparers and agencies consulted during the development of the environmental assessment.

Appendices. A series of appendices provides maps and detailed information to support the environmental analyses.

Additional documentation, including the text of cited scientific literature is included in the project record, available in electronic format.

1.2 Background

The Iron Springs Vegetation Improvement and Salvage Project is one of a number of vegetation management projects that have been implemented or are scheduled to be implemented on the Aquarius Plateau in the next several years. The collective purpose of these projects is to improve the condition of the plateau's forest. Actions include thinning to decrease overstocking, removing diseased trees, and restoring conifer and aspen stands. The intent behind these actions is to improve stand quality, control pest infestation and other diseases, reduce risk of large catastrophic fires, improve wildlife habitat, and provide products for the local forest economy.

1.3 Project Area

The proposed 8,306-acre Iron Springs Vegetation Improvement and Salvage Project is situated in the Dixie National Forest approximately 15 miles northwest of Escalante, Utah, along National Forest System (NFS) Road 140. The project area is within the headwaters of three watersheds: Coyote Hollow-Antimony Creek, North Creek, and Upper North Creek, and covers portions of Township 33 South, Range 1 West, and Township 33 South, Range 1 East of the Salt Lake Base Meridian, Garfield County, Utah. See Map A – Vicinity Map (Appendix A).

Elevations range from 9,000 feet to 10,750 feet. Terrain is slightly rolling to level. The forest type is primarily Engelmann spruce/subalpine fir, with scattered aspen clones. No inventoried roadless areas are located within the project area. Nor are there any areas of wilderness potential as identified on the 2005 draft inventory map and evaluated during revision of the Dixie National Forest's Land and Resource Management Plan (Forest Plan) (USDA Forest Service 1986). The nearest designated wilderness area is Box Death Hollow Wilderness Area, located 12 air miles from the project area.

1.4 Purpose and Need for Action

The purposes and needs were determined through analyses of ecological and socioeconomic considerations. A summary of these analyses, and the resultant purposes and needs for the proposed project follow.

Ecological Considerations

The analyses of ecological considerations focused on the condition and potential improvement of spruce/fir stands and aspen stands. These analyses considered a range of ecological factors, including forest stand composition and condition, old growth characteristics, hydrology, and wildlife. The purpose of the analyses was to define "desired future conditions" for spruce/fir stands and for aspen stands within the project area and the gap between existing conditions and desired future conditions for both spruce/fir and aspen stands. For both spruce/fir and aspen, the first step was to characterize existing conditions for each vegetation type. The second step was to characterize "properly functioning conditions (PFC). The third step was to use the knowledge gained from characterizing PFC, the guidance from the Forest Plan, and other relevant considerations to define desired future conditions for each vegetation type. The fourth and final step was to identify the difference between existing conditions and the desired future conditions. This comparison indicates the need for the proposed treatments, that is, the actions that would be needed to transition the area from its current condition to the desired future condition.

The spruce/fir analysis found that stand density is higher than desired and that age class diversity is lower than desired. Stocking is low in historic clearcut areas. All stands are moderately susceptible to mortality by spruce beetle. The aspen analysis found that 80 percent of the aspen is in the mature to over-mature class, with the bulk of the aspen being greater than 80 years old. Most of the aspen clones are succeeding to spruce/fir and are at risk of being replaced by conifer.

Based on these ecological analyses the following ecological purposes and needs were identified.

Spruce/fir stand improvement

For spruce/fir, the project purpose is to create a healthy forest and move vegetation toward desired conditions, that is, improve the balance of age class distribution, decrease stand densities, and perpetuate aspen presence within the spruce and fir-dominated forest. This would create stand

conditions that do not promote spruce beetles or disease and that would increase the long-term sustainability of large-diameter trees. Related to this purpose, there are three needs within spruce/fir stands: first, a need to reduce stand densities to increase tree growth and vigor, and create stand conditions less conducive to infestation by spruce beetles and other diseases, second, a need to maintain old-growth characteristics by increasing species mix, density, and size of residual trees in old-growth stands, and third, a need to increase tree stocking in several stands that were harvested in the 1960s that are currently understocked.

Aspen stand regeneration and improvement

For aspen, as with spruce/fir, the project purpose is to create a healthy forest and move vegetation toward desired conditions, that is, restore the distribution and balance in age-class for aspen clones. Related to this purpose, there are two needs within aspen stands: first, a need to reduce the percent of aspen stands in mature and over-mature size classes and create younger seedling/sapling age classes, and second, a need to reduce conifer encroachment into aspen clones.

Economic and Social Considerations

The analysis of economic and social considerations focused on two topics: providing forest products and minimizing fire risk. The U.S. Forest Service's Organic Act calls for the Service to "furnish a continuous supply of timber for the use and necessities of the people of the United States." The Dixie National Forest's Land and Resources Management Plan (Forest Plan) sets harvest targets (outputs) that respond to this mandate. On December 21, 2010, in a memorandum to staff entitled Taking Stock and Looking to the Future, Forest Service Chief Thomas Tidwell has identified five focus points for the Forest Service's future, one of which was "Communities," and included service to communities, and included this statement: "We will engage communities to help America reconnect to the outdoors, expand on recreation benefits and create a wide range of opportunities for economic expansion. We will do everything we can to put America back to work."

The harvest analysis involved an inventory of potential harvest opportunities that would provide a meaningful and useful product for the public while promoting a healthy forest. The potential for commercial harvesting of trees affected by bark beetles was also analyzed. Adequate merchantable timber was identified to warrant commercial harvest. Harvest of these trees would also serve ecological purposes. The fire risk analysis involved an analysis of fuel loading. This analysis found that, due to high stand densities and extensive downed material, both large and fine fuel loadings are above desired levels.

Based on these analyses the following economic and social purposes and needs were identified.

Delivery of forest products

From a forest products perspective, the project purposes are to provide valuable commercial forest products to the forest products industry to benefit the local and regional economy, and to recover value from merchantable timber from trees affected by bark beetles. The specific need is to harvest both green and dead and dying timber for public use, and to do so in a manner that responds to the ecological purposes and needs stated earlier.

Fire risk

From a fire risk perspective, the project purpose is to reduce the long-term risk of large-scale fires. The corresponding need is to reduce the long term risk of large scale crown fire through the reduction of stand densities and rearrangement of ladder fuels to surface fuels.

1.5 Relationship to the Forest Plan

This analysis responds to and incorporates by reference the direction provided in the Dixie Forest Plan (1986), including all amendments. The proposed analysis is a project-level analysis not intended to re-examine the basic land use allocations made in the Forest Plan, nor propose broad changes in land use allocations. Instead, planning at the project level involves the development, analysis, and disclosure of likely environmental impacts associated with the implementation of specific actions designed to achieve the overall goals and objectives of the Forest Plan. The treatment area falls within Forest Plan designated management areas (MA) 1 (General Forest Direction), 2B (Roaded Natural Recreation), 6A (Livestock Grazing), and 7A (Wood Production and Utilization), with 7A encompassing the largest proportion of the project area.

Treatments proposed for Iron Springs would occur on Forest Plan-designated MAs 2B, 6A, and 7A. In MA 2B, the Forest Plan instructs decision makers to "**manage** tree stands using both commercia1 or noncommercial methods [to] [e]nhance visual quality, diversity and insect and disease control." In MA 6A the Forest Plan instructs decision makers to "[m]aintain and **manage** forested inclusions to provide a high level of forage production, wildlife habitat, and diversity." In MA 7A the Forest Plan instructs that "[**m]anagement** objectives will be directed toward . . . conversion of old growth to young, thrifty stands, and **[m]anagement** emphasis is on wood-fiber production and utilization of large roundwood of a size and quality suitable for sawtimber." None of the emphasis is in the Forest Plan. It has been added here to make the point that the stands included in the Iron Springs Project are part of the suitable and **managed** forest resource on the Dixie National Forest. The stands included in the Iron Springs Project are not designated as wilderness, research natural area, inventoried roadless area, unroaded/undeveloped area, or municipal watersheds.

1.6 Proposed Action

Within the project area are 5,240 acres of conifer stands, consisting primarily of Engelmann spruce and subalpine fir. There are an additional 256 acres of aspen stands. Actions proposed by the Forest Service to meet the purpose and need include:

> Intermediate harvest treatments within the conifer stands, including pre-commercial conifer thinning of 381 acres, commercial conifer thinning of 3,603 acres, and aspen cleaning of 388 acres.
>
> Commercial sanitation and salvage of all treated areas and an additional 366 acres of otherwise untreated conifer stands where trees have been killed by or dying as a result of beetle infestation.
>
> Reforestation through planting of 154 acres of previously harvested conifer that do not meet required stocking levels.
>
> Commercial aspen regeneration of 152 acres of aspen.

Of the 5,240 acres of conifer stands, 2,058 acres have old growth characteristics, of which 1,927 acres would receive treatment. Following treatment, approximately 80 percent of these 1,927 acres would retain old-growth status.

Implementation of these treatments would require use of 36.40 miles of existing NFS roads, including 0.23 miles of a motorized trail, as haul roads. An additional 9.61 miles of temporary road would be needed, including 7.26 miles of new temporary roads and 2.35 miles of re-opened roadbeds closed by the 2006 Griffin Springs Travel Management Decision. At the end of the project all 9.61 miles of temporary roads would be closed to motor vehicle traffic and either obliterated or made impassable. Also, approximately 200 feet of an existing forest road would be re-routed from a meadow to an upland location, with the abandoned portion obliterated.

1.7 Consideration of Available Science

Techniques and methodologies used in this analysis consider the best available science. The analysis included a review of scientific literature that is relevant to evaluating reasonably foreseeable environmental effects.

The conclusions are based on scientific analysis that shows a thorough review of relevant scientific information and a consideration of responsible opposing views.

Relevant literature includes information reviewed for basic understanding, science cited in the specialist reports, and science submitted as a responsible opposing view.

The analysis has considered the effects resulting from implementing other similar projects in the physiographic area.

For a list of literature used in reaching conclusions regarding environmental effects on wildlife, fish, plants, hydrology, soils, forest vegetation, recreation, scenery, undeveloped lands, range, noxious weeds, and fire and fuels, see the respective specialists reports contained in the project record.

1.8 Decision Framework

The Forest Supervisor is the official responsible for making this decision. Based on the project's purpose and need; effects of the alternatives; requirements of the Forest Plan; and applicable laws, regulations, and guidance, the Forest Supervisor will decide to implement the Proposed Action, implement the Proposed Action with modifications, implement Alternative A, implement Alternative A with modifications, or not to take any action at this time.

1.9 Public Involvement

The proposal was listed in Dixie National Forest's Schedule of Proposed Actions (SOPA) in April 2010, and provided to the public and other agencies for comment on May 5, 2010. A copy of the scoping document was mailed to 86 individuals, groups, agencies, and tribes.

In addition, the scoping document appeared on the Dixie National Forest public website located at http://www.fs.fed.us/sopa/forest-level.php?110407.

We received nine letters in response to the scoping document. Three of the letters were in support of the proposed project, two were from tribes with no concern at this time, and one stated a general policy position. Three letters contained concerns, recommendations and objections to the Proposed

Action. One commenter submitted an alternative to the Proposed Action, termed the “Sustainable Multiple Use” alternative.

Using the comments from the public, the interdisciplinary team developed a list of issues to address. Also, as a result of these comments, the interdisciplinary team created an additional alternative, Alternative A.

On April 8, 2011, the Forest Service released a Notice and Opportunity to Comment on the Proposed Action and Alternative A for the Iron Springs Vegetation Improvement and Salvage Project. In addition to No Action and the Proposed Action, the notice introduced Alternative A. It also included a summary of issues distilled from comments to the May 5, 2010 scoping document.

We received three letters in response to the April 8, 2011 Notice. The interdisciplinary team prepared a response to comments received pursuant to the April 8, 2011 Notice. That response is included in the project record in a document entitled “Iron Springs Response to Comments.”

1.10 Issues

Issues were identified through a 2010 scoping letter and a 2011 Notice and Opportunity to Comment letter. The Forest Service separated issues raised through these solicitations into two groups: key and non-key issues. Key issues were defined as those directly or indirectly caused by implementing the Proposed Action. Non-key issues were identified as those: (1) outside the scope of the Proposed Action; (2) already decided by law, regulation, Forest Plan, or other higher level decision; (3) irrelevant to the decision to be made; or (4) conjectural and not supported by scientific or factual evidence. Key issues were as follows:

Key Issue: A commenter suggested that this project, in combination with others, might result in a decrease in old growth within the forest.

Key Issue: A commenter suggested that other methods besides harvest should be considered to reduce fuels, including decomposition and the use of prescribed fire.

Key Issue: A commenter suggested that proposed commercial green tree spruce logging, salvage logging, and aspen regeneration harvests could result in loss of potential/proposed wilderness. (A wilderness proposal has been developed by a coalition of organizations; this proposal overlaps with 20+ percent of the project area.)

2 Alternatives Including the Proposed Action

This section describes and compares the alternatives considered for the Iron Springs Vegetation Improvement and Salvage Project. Maps of each alternative considered are included in Appendix A. The alternatives appear in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based on the design of the alternative, and some of the information is based on the environmental, social and economic effects of implementing each alternative.

2.1 Alternatives Considered in Detail

No Action

The No Action alternative is a requirement of the National Environmental Policy Act and provides a basis for comparing the Proposed Action and Alternative A to what would occur if neither of these alternatives were implemented. Under the No Action alternative, current management plans would continue to guide management of the Iron Springs project area. Fire risk would not change. No silvicultural treatments would be implemented to reduce stand densities and improve resiliency, to remove dead and dying Engelmann spruce/subalpine fir, to regenerate and maintain aspen, or to reforest under-stocked spruce/fir stands. The project design features listed below in Table 5 would not be implemented. The 200 feet of forest road proposed for re-routing under the Proposed Action and Alternative A would remain unchanged. That is, it would continue to run through a seasonally wet area.

Proposed Action

The intent of the Proposed Action is to implement a variety of treatments to improve the condition of both spruce/fir stands and aspen stands, provide wood products for the local forest products industry and reduce the long term risk of large scale crown fire. For a graphic representation of the Proposed Action, see Map B – Proposed Action. See Table 1 for a summary of vegetation treatments for the Proposed Action, Table 2 for a summary of transportation requirements for the Proposed Action, and Table 3 for a description of project design features related to the Proposed Action.

Treatments within Engelmann spruce/subalpine fir stands

Within the project area, there are 5,240 acres of Engelmann spruce/subalpine fir. Of these, approximately 3,603 acres would receive a commercial thinning treatment. This treatment would be designed to reduce stand densities, while maintaining a variety of tree sizes. Individual tree marking would designate trees that would be harvested. In addition to the commercial thin, there would be salvage and sanitation harvest of pockets of Engelmann spruce killed or infested with spruce beetle. Approximately 381 acres of the 3,603 acres of treated spruce/fir stands would receive pre-commercial thinning to remove trees less than 5-inches diameter that exceed stand density objectives or species mix. Trees greater than 5-inches diameter would be removed commercially. In the event that trees in the 5 to 7.9 inch diameter size class cannot be sold commercially they would be included in the pre-commercial treatment. This decision would be made during project implementation, with a sufficiency review document prepared if applicable. For purposes of the effects analysis it was assumed that trees in the 5- to 7.9-inch diameter size class would be removed through commercial thinning.

Approximately 388 acres of scattered aspen clones within spruce/fir stands would receive aspen cleaning through hand felling of conifer. Commercial-size conifer would be removed; non-commercial-size conifer and some aspen would be cut and left on site to discourage browsing by larger ungulates, primarily deer, elk, and livestock.

Consistent with Hamilton et al. (1993), and a 2007 Regional Office letter on the subject (USDA 2007), both of which are included in the project record, 2,058 acres of spruce/fir within the project area have old- growth characteristics. This determination was made based on an evaluation of stand data and field surveys. Data and findings are included in the project record. Thinning is needed in these stands to reduce timber loss due to beetle kill and to forestall the spread of beetle activity to additional trees. Thinning in these areas would be from below, and restricted to trees between 5 and 18-inches diameter. Of the 2,058 acres with old-growth characteristics, 1,927 acres would receive treatment. Approximately 80 percent of these 1,927 acres would retain old-growth status following treatment. Thus, of the 2,058 acres with old growth characteristic, approximately 1,672 acres would retain old growth characteristics. The Forest Plan requires that 7 to 10 percent of each drainage be managed as old growth. Retention of 1,672 acres as old growth meets the Forest Plan's requirement. Details are provided in the Forest Vegetation Specialist's Report. Sanitation/salvage timber harvest would
remove spruce beetle-infested or killed trees throughout the project area, as needed. Some stands that contain infested or killed subalpine fir would also be commercially removed. Under this treatment, merchantable, dead standing, and down spruce and fir would be harvested.

Approximately 366 acres in the spruce/fir stands are currently at the desired density. These 366 acres would receive commercial sanitation/salvage treatment only.

Finally, approximately 154 acres would be planted with Engelmann spruce seedlings using hand tools or augers. These areas are conifer strips in the south half of the project area that were clearcut in the 1960s and that do not contain the desired tree density.

Treatments within aspen stands

Of the 256 acres of aspen stands in the project area, approximately 152 acres would receive commercial clear-fell coppice treatment designed to regenerate aspen. In smaller stands the entire stand would be treated. In larger stands some areas of mature aspen would be left in groups or strips between coppice treatment areas. As stated on page IV-40 of the Forest Plan, "The maximum size of openings created by the application of even-aged silviculture will be 40 acres regardless of forest cover type."

Aspen stands receiving regeneration treatment would be monitored for aspen browsing. If, after one year, heavy ungulate browsing was evident, these areas would be fenced until stocking requirements are met and average height is 6 feet. For this purpose, heavy browsing is defined as less than 500 stems per acre remaining unbrowsed.

Treatments common to both spruce/fir and aspen stands

All commercial logging within spruce/fir and aspen stands would be implemented using ground-based skidders. The Forest Service would designate and approve skid trails and landings.

Slash treatments within units receiving pre-commercial thinning would include lop and scatter throughout cutting units and machine piling and burning of slash on landings. Burning of slash would be in accordance with an approved burn plan. Also, to reduce beetle risk, damaged non-commercial trees would also be lopped and scattered. Prior to burning, fuel wood removal from landings may be

allowed if material is available and this activity does not increase the risk that beetles may be spread to new areas.

A combination of Forest Service crews, commercial timber sales, service contracts, stewardship contracts, and personal use permits may be used to accomplish the various treatments.

Prescribed Fire

While the Proposed Action does not rely on prescribed fire as a vegetation management tool, it does employ pile burning, which, technically, is a form of prescribed fire.

Summary of the Proposed Action Alternative

Table 1 provides a summary of forest vegetation treatments included in the Proposed Action.

Table 1. Summary of forest vegetation treatments for the Proposed Action

Treatment	Acres
Commercial Aspen Regeneration (AR)	152
Commercial Conifer Thinning (CT)	3,603
Commercial Conifer Sanitation/Salvage (SS)	366
Aspen Cleaning (AC)	388
Pre-commercial Conifer Thinning (PT)	381
Planting of existing low stocked areas	154
TOTAL	5,044

Transportation needs for the Proposed Action

The transportation network needed to implement the Proposed Action is shown on Map B – Proposed Action, in Appendix A.

Two types of roads are considered here: National Forest System (NFS) roads, that is, roads that are components of the Dixie National Forest's Motorized Travel Plan, and temporary roads, that is, roads that would be constructed and used for project purposes and then closed.

National Forest System roads

Approximately 36.16 miles of existing National Forest System roads would be used as haul roads. Roads that could be used as haul roads for this project include National Forest System roads 140, 152, and 153; Forest Highway 17, and all other system roads in the project area. The 36.16 miles includes 0.42 miles of National Forest System road 31375, classified as an administrative road, which is outside of the project area. The 36.16 miles also includes 0.23 mile of an existing motorized trail (an ATV trail) that is an extension of NFS road 31375. This 0.23 mile would revert to a motorized trail upon project completion. To accommodate hauling, some portions of these roads may require maintenance, which might include adding fill, changing grade, and/or adding or improving drainage structures. The purpose of this maintenance will be to repair areas to haul standards, not to create an upgrade to a higher class of road. To prevent damage to a meadow, approximately 200 feet (0.04 mile) of NFS Road 1369 near the junction with NFS Road 140 would be rerouted from the edge of

the meadow to a drier upland area nearer the trees. Table 2 presents a list of all system roads in the project area, along with their status following the completion of the proposed project.

Table 2. System roads in the project area

Road Number	Road Length (Miles)	Operational Maintenance Level	MTP Designation	After Project
30140	10.45	3 – SUITABLE FOR PASSENGER CAR	Open to All	Maintain Status
30408	0.44	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
30463	0.56	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
30469	0.71	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
31369	2.58	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
31370	1.14	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
31372	1.16	2 – HIGH CLEARANCE VEHICLES	Seasonal	Maintain Status
31373	1.17	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
31374	1.02	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
31377	1.69	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
31906	0.48	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
31910	1.41	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
31963	0.25	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
33809	0.08	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
33810	0.13	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
33877	0.11	2 – HIGH CLEARANCE VEHICLES	Open to All	Maintain Status
30028	0.80	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
30304	0.53	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
30783	0.55	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
30984	0.67	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
31374	0.24	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
31375	0.24	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
31376	0.59	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
31377	0.99	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
31440	0.98	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
31908	0.69	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
31909	1.82	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
31963	1.58	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
32139	0.59	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
32148	0.22	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
32151	1.36	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
33811	0.07	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
33812	0.19	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
33816	0.26	1 – BASIC CUSTODIAL CARE	Admin	Maintain Status
Total	**35.75**	No Change	No Change	Maintain Status

Temporary roads

Construction of 9.61 miles of new low-standard temporary roads is proposed, including 0.76 miles of temporary road needed to access an old dike and a borrow pit. It may be possible to access the dike on frozen ground or over snow, alleviating the need for road construction. (For the purpose of effects analyses it was assumed that this temporary road construction would be required.) Included in the 9.61 miles of temporary roads are 2.35 miles of roads closed by the 2006 Griffin Springs Travel Management Decision and later incorporated into the Dixie National Forest's Motorized Travel Plan. These 2.35 miles would be temporarily re-opened to provide access to the project area. None of the temporary roads would be added to the permanent National Forest System. Following harvest activities, these roads would be obliterated and/or closed using barricades. Table 3 presents a list of temporary roads that would be used for this project.

Table 3. Temporary roads used to implement the Proposed Action

Road Number	Road Length (Miles)	Construction Type	After Project
T1	0.26	Existing Roadbed[1]	Decommission
T2	0.26	Existing Roadbed	Decommission
T3	0.22	New Construction	Decommission
T4	0.22	New Construction	Decommission
T5	0.41	New Construction	Decommission
T6	0.43	New Construction	Decommission
T7	0.75	New Construction	Decommission
T8	0.58	New Construction	Decommission
T9	0.31	New Construction	Decommission
T10	0.61	Existing Roadbed	Decommission
T11	0.19	New Construction	Decommission
T12	0.41	New Construction	Decommission
T13	0.73	New Construction	Decommission
T14	0.30	New Construction	Decommission
T15	0.38	New Construction	Decommission
T16	0.18	Existing Roadbed	Decommission
T18	0.17	New Construction	Decommission
T19	0.30	New Construction	Decommission
T20	0.59	New Construction	Decommission
T21	0.88	New Construction	Decommission
T22	0.22	New Construction	Decommission
T23	0.17	New Construction	Decommission
T24	0.65	Existing Roadbed	Decommission
T25	0.39	Existing Roadbed	Decommission
Total	9.61		All temporary roads to be decommissioned

[1] "Existing roadbed" refers to roads closed by the 2006 Griffin Springs Travel Management Decision that would be temporarily reopened for use during project implementation and then closed upon completion of the project.

Road fill

Fill used for road work would be excavated from three existing borrow pits, an old dike site and one new borrow site in an old well pad within the project area. One existing borrow just north of the project that was associated with the Recap Timber Project would also be used. These borrow pits are depicted on Map B in Appendix A. Access to three of these borrow pits would be from existing National Forest System roads. Access to the remaining two would be from temporary roads. At the completion of the project, the temporary roads leading to borrow pits would be closed.

The transportation system following project completion

With the exception of the 200-foot re-route, the transportation system remaining after project implementation will be the same as it is under the 2006 Griffin Springs Travel Management Decision and the April 2009 Record of Decision for the Motorized Travel. Following project completion, roads improved for project purposes would not be maintained to a higher standard than before the project. Table 4 presents a summary of transportation actions associated with the Proposed Action.

Table 4. Summary of transportation actions for the Proposed Action

Road Type	New Construction	Existing Roads or Motorized Trails to be used as Haul Roads	TOTAL
System (in project area)	0 miles	35.74 miles	35.74 miles
System (off project area)	0 miles	0.42 miles	0.42 miles
Motorized Trail	0 miles	0.23 miles	0.23 miles
Temporary (to be obliterated or blocked following project completion)	9.61 miles	0 miles	9.61 miles
System road reroute	0.04 miles	0 miles	0.04 miles
TOTAL	9.65 miles	36.39 miles	46.04 miles
Post–project system roads in the project area			35.74 miles

Project Design Features for the Proposed Action

The Proposed Action includes the design features shown in Table 5.

Table 5. Project design features for the Proposed Action

Range and Noxious Weeds
RNW-1 Reseed landings following the activity to take advantage of the seedbed and discourage the establishment of noxious weeds. Seed mixes would include species that germinate rapidly to provide quick cover of vegetation (the “nurse crop” technique). Seed mixes used for rehabilitation purposes would be noxious weed-free certified.

Table 5 (continued). Project design features for the Proposed Action

Range and Noxious Weeds
RNW-2 If used for rehabilitation purposes, only certified noxious weed-free hay, straw, and mulch would be used.
RNW-3 Should these become established, control noxious weeds on all disturbed areas as per direction in the Forest Service Handbook (2080.5), the 1999 Executive Order on Invasive Species, the Forest Service's 2000 Guide to Noxious Weeds Prevention Practices and the January 2000 Dixie National Forest Environmental Assessment for Noxious Weed Management.
RNW-4 Maintain all range improvements in the same condition as at the time of treatment.
Hydrology/Soils
HS-1 Project design features intended to protect soil and hydrologic resources are listed in a Soil and Water Conservation Practices Appendix to the Hydrology Specialist Report. (There are 40 identified as applicable to this proposed action.) These design features will be attached to the contract during implementation.
Forest Vegetation
FV-1 Within conifer treatment units, protect residual trees through the designation of skid trails and landings, directional felling, and limiting off-trail skidding to 1 to 2 passes. Over-snow operation may be used. Mechanized harvest equipment may also operate off skid trails. Designated skid trails should be located approximately 100 to 150 feet apart, depending on terrain.
FV-2 In aspen regeneration treatment units, protect aspen root systems through the designation of skid trails and landings, directional felling, and limiting skidding equipment to approved skid trails and only 1 to 2 passes off trail. If soils are frozen or are covered with 18 inches of snow, skidding equipment may operate off designated trails. To provide sufficient protection to aspen regeneration from excessive browsing, slash and logs not meeting utilization standards or adding to beetle risk shall be left throughout cutting units. If heavy browsing occurs, fences may be installed to restrict large ungulates (deer, elk, and livestock) until average seedling height exceeds 6 feet.
FV-3 To prevent spruce beetle spread, all Engelmann spruce cut prior to September 1 shall be removed before the end of the same year, and all Engelmann spruce cut after September 1 shall be removed before the end of the following year.
FV-4 To prevent spruce beetle spread, all live or recently killed Engelmann spruce felled or pushed over which exceed 14-inches diameter and 18 inches in length shall be skidded to a designated landing for disposal.
FV-5 To minimize additional fuel loading from harvest activities, ground-based skidding operations shall utilize whole-tree harvesting techniques.
FV-6 Landings shall not be located any closer than 100 feet from National Forest System road 30140.
Wildlife
WL-1 Project activities shall cease which "May Affect" threatened, endangered, or proposed species discovered within or adjacent to the project area during project layout or implementation that has not been addressed within the environmental analysis until the potential affect is removed or until consultation with the U.S. Fish and Wildlife Service is concluded. Also, project implementation shall cease if any sensitive species is discovered within or adjacent to the project area that has not been addressed within the environmental analysis until an assessment can be made to determine the impact and potential adverse effects to the species.

Table 5 (continued). Project design features for the Proposed Action

Wildlife
WL-2 To maintain hiding cover for big game within forested ecosystems, retain a minimum of 50 percent of the perimeter of natural openings, aspen regeneration treatments, and meadows, and 75 percent of the edge along arterial and collector roads, as described in DNF S&G IV-34.
WL-3 To maintain habitat for a variety of wildlife species all forested landscapes shall be managed for no less than 300 snags per 100 acres in the spruce/fir cover type and 200 snags per 100 acres in the aspen cover type. Guidelines in the goshawk amendment to the forest plan guideline F (USDA Forest Service 2000b, p. CC-21) are to be followed.
WL-4 To provide for the needs of a wide variety of wildlife, an average of 100 tons per 10 acres of coarse woody debris in the spruce-fir cover type and 30 tons per 10 acres in the aspen cover type shall be retained following the guidelines outlined in the goshawk amendment to the forest plan, guideline G (USDA Forest Service 2000b, p. CC-22).
WL-5 If new raptor nests are found within or adjacent to the project area, a buffer shall be placed around the nest, and a timing restriction will be established if the nest area is occupied. Buffer size, timing restrictions, and restrictions of harvest activities will be made on a case-by-case basis taking into consideration site-specific raptor needs and utilizing raptor protection guidelines from the U.S. Fish and Wildlife Service (2002b). If goshawk nests are found, the requirements in the forest plan are to be followed to protect the species.
WL-6 To maintain perching habitat for foraging peregrine falcons from a known eyrie, a foraging buffer shall be applied to the foraging area. Snags must not be removed from forested stands within 100 feet of the meadow/forest edge, as identified by the Falcon Foraging Buffer map located in the project record.
WL-7 To avoid impacts to successful breeding and nest site/territory use of known raptors, buffer size and timing restrictions for occupied nests will be applied during harvest activities. In applying the timing restriction, raptor protection guidelines from the U.S. Fish and Wildlife Service (2002), will be used in conjunction with site-specific raptor needs (e.g., high elevation influence on territory activities).
WL-8 To avoid impacts to known Utah prairie dogs within the project area, maintain a 350 foot no-treatment buffer around the colony and apply a seasonal timing restriction from April 30 to September 14 in the adjacent stands. An extension of the timing restriction will occur if prairie dogs are observed above ground during or after an evaluation of the colony at the end of the restriction period. The restriction will last until prairie dogs have gone underground for the year. The buffer area and adjacent stands with the associated timing restriction is identified by the Utah Prairie Dog Colony Map which is located in the project record.
WL-9 To avoid impacts to breeding northern goshawks, timing restrictions will be applied to all activities within the PFAs if nests are active as outlined in the goshawk amendment to the forest plan (USDA Forest Service 2000b). No activities are proposed in known goshawk nest areas.
WL-10 To provide habitat for the goshawk and its prey, the percent of the group acreage covered by clumps of trees with interlocking crowns should typically range from 40-70 percent in post-fledgling and foraging areas, as described in USDA Forest Service (2000b, p. CC-22). No activities are proposed in known goshawk nest areas.
Recreation
R-1 Restrict hauling on FR 154 (the north-south forest road that passes Posey Lake Campground) on weekends and holidays between Memorial Day and Labor Day.

Table 5 (continued). Project design features for the Proposed Action

Scenery
S-1 Cut stumps within 6” of the ground within sight distance of FR 140. (This is a scenic backway, and therefore has a concern level of one.) Cut stumps within 6” of the ground within 150’ of the Gap Trail. (This trail has a concern level of two.)
S-2 90 percent of slash on landings adjacent to trailheads or open roads will be disposed of by burning, chipping, firewood removal or other suitable method.
S-3 Utilize whole tree harvesting within 150’ (or sight distance whichever is longer) of FR 140.
S-4 Utilize whole tree harvesting within 150’ of the Gap Trail, existing and proposed trailheads, and all roads designated to be left open.
S-5 Locate no log landings adjacent to FR 140 or the Gap Trail.

Alternative A

The intent of Alternative A is to reduce the amount of harvest within Engelmann spruce/subalpine fir stands with old growth characteristics, while improving the condition of both spruce/fir stands and aspen stands, decreasing large scale crown fire risk, and providing wood products for the local forest products industry. For a graphic representation of Alternative A, see Map C – Alternative A. See Table 4 for a summary of vegetation treatments for Alternative A, Table 5 for a summary of transportation requirements for Alternative A, and Table 3 for a description of project design features related to both the Proposed Action and Alternative A.

Treatments within Engelmann spruce/subalpine fir stands

Under this alternative, only old-growth stands that have the highest risk of beetle outbreak would be treated. Thinning is needed within these stands to reduce the risk of loss from additional beetle activity. Consistent with Hamilton et al. (1993) and a 2007 Regional Office letter on the subject, there are 2,058 acres within the project area that were identified as having old-growth characteristics. Under Alternative A, 374 acres of the 2,058 acres would be treated. As with the Proposed Action, thinning would be from below and emphasize the small to intermediate sizes. This would be accomplished by commercially removing trees between 5- and 18-inches diameter. Following treatment, these 374 acres would retain old-growth status. This is consistent with Forest Plan requirements.

Under Alternative A, approximately 1,544 acres would receive a commercial thinning treatment. This treatment would be designed to reduce stand densities, while maintaining a variety of tree sizes. Individual tree marking would designate trees that would be harvested. In addition to the commercial thinning, there would be salvage and sanitation harvest of pockets of Engelmann spruce killed or infested with spruce beetle.

Approximately 134 acres of spruce/fir stands would receive pre-commercial thinning to remove trees less than 5-inches diameter that exceed stand density objectives or species mix. Trees greater than 5-inches diameter would be removed commercially. In the event that trees in the 5- to 7.9-inch diameter size class cannot be sold commercially they would be included in the pre-commercial treatment. This decision would be made during project implementation, with a sufficiency review document prepared if applicable. For purposes of the effects analysis it was assumed that trees in the 5 to 7.9 inch diameter size class would be removed through commercial thinning.

Approximately 388 acres of scattered aspen clones within the spruce/fir stands would receive aspen cleaning through hand felling of conifer. Commercial-size conifer would be removed; non-commercial-size conifer and some aspen would be cut and left on site to discourage browsing by larger ungulates (deer, elk, and livestock). Sanitation/salvage timber harvest would remove spruce beetle-infested or killed trees throughout the project area. Some stands contain infested or killed subalpine fir that would also be commercially removed. Under this treatment, merchantable, dead standing, and down spruce and fir would be harvested. Approximately 363 acres within the spruce/fir stands are currently at the desired density. These 363 acres would receive commercial sanitation/salvage treatment only.

Finally, approximately 154 acres would be planted with Engelmann spruce seedlings using hand tools or augers. These areas are conifer strips that were clearcut in the 1960s and that do not contain the desired tree density.

Treatments within aspen stands

Of the 256 acres of aspen stands in the project area, approximately 152 acres would receive commercial clear-fell coppice treatment designed to regenerate aspen. In smaller stands the entire stand would be treated. In larger stands some areas of mature aspen would be left in groups or strips between coppice treatment areas. In no case would an opening exceed 40 acres, the maximum allowable size for clearings as per the Forest Plan.

Aspen stands receiving regeneration treatment would be monitored for aspen browsing. If, after one year, heavy ungulate browsing was evident, these areas would be fenced until stocking requirements are met and average height is 6 feet. For this purpose, heavy browsing is defined as less than 500 stems per acre remaining unbrowsed.

Treatments common to both spruce/fir and aspen stands

The treatments described below are the same as for the Proposed Action:

All commercial logging within spruce/fir and aspen stands would be implemented using ground-based skidders. The Forest Service would designate and approve skid trails and landings.

Slash treatments within units receiving pre-commercial thinning would include lop and scatter throughout cutting units and machine piling and burning of slash on landings, in accordance with an approved burn plan. Also, to reduce beetle risk, damaged non-commercial trees would also be lopped and scattered. Prior to burning, fuel wood removal from landings may be allowed if material is available and this activity does not increase the risk that beetles may be spread to new areas.

A combination of Forest Service crews, commercial timber sales, service contracts, stewardship contracts, and personal use permits may be used to accomplish the various treatments.

Prescribed Fire

While the Proposed Action does not rely on prescribed fire as a vegetation management tool, it does employ pile burning, which, technically, is a form of prescribed fire.

Summary of Alternative A

Table 6 provides a summary of forest vegetation treatments included in the Proposed Action.

Table 6. Summary of forest vegetation treatments for Alternative A

Treatment	Acres
Commercial Aspen Regeneration only (AR)	152
Commercial Conifer Thinning (CT)	1,544
Commercial Conifer Sanitation/Salvage (SS)	363
Aspen Cleaning (AC)	388
Pre-commercial Conifer Thinning (PT)	134
Planting of existing low stocked areas	154
TOTAL	2,735

Transportation needs for Alternative A

The transportation network needed to implement Alternative A is shown on Map C – Alternative A. As with the Proposed Action, with the exception of the 200-foot re-route, the transportation system remaining after project implementation will be the same as it is under the 2006 Griffin Springs Travel Management Decision and the April 2009 Record of Decision for the Motorized Travel Plan. Following project completion, roads improved for project purposes would not be maintained to a higher standard than before the project.

As with the Proposed Action, two types of roads are considered here, National Forest System roads, that is, roads that are components of the Dixie National Forest's Motorized Travel Plan, and temporary roads, that is, roads that would be constructed and used for project purposes and then closed.

National Forest System roads

As with the Proposed Action, approximately 36.16 miles of existing National Forest System roads would be used as haul roads. Roads that could be used as haul roads for this project include National Forest System roads 140, 152, and 153; and FH17. The 36.16 miles includes 0.42 mile of National Forest System road 31375, classified as an administrative road, which is outside of the project area. The 36.16 miles also includes 0.23 mile of an existing motorized trail (an ATV trail) that is an extension of NFS road 31375. This 0.23 mile would revert to a motorized trail upon project completion. If a section of an existing road needs maintenance, this would include adding fill, changing grade, and adding or improving drainage structures. To prevent damage to a meadow, approximately 200 feet (0.04 mile) of NFS road 1369 near the junction with NFS road 140 would be rerouted from the edge of the meadow to a drier upland area nearer the trees. Otherwise, no new permanent roads would be constructed or added to the system.

Temporary roads

Construction of 6.31 miles of new low-standard temporary roads is proposed, including 0.76 miles of temporary road needed to access an old dike and a borrow pit. It may be possible to access the dike on frozen ground or over snow, alleviating the need for road construction. (For the purpose of effects analyses it was assumed that temporary road construction would be required.) Included in the 6.31 miles of temporary roads are 2.35 miles of roads closed by the 2006 Griffin Springs Travel Management Decision and later incorporated into the Dixie National Forest's Motorized Travel Plan. These 2.35 miles would be temporarily re-opened to provide access to the project area. None of the temporary roads would be added to the permanent National Forest System. Following harvest activities, these roads would be obliterated and/or closed using barricades. Table 7 presents a list of temporary roads that would be utilized with Alternative A.

Table 7. Temporary roads used to implement Alternative A

Road Number	Road Length (Miles)	Construction Type	After Project
T1	0.26	Existing Roadbed	Decommission
T2	0.26	Existing Roadbed	Decommission
T3	0.22	New Construction	Decommission
T4	0.22	New Construction	Decommission
T7	0.75	New Construction	Decommission
T8	0.58	New Construction	Decommission
T10	0.61	Existing Roadbed	Decommission
T15	0.38	New Construction	Decommission
T16	0.18	Existing Roadbed	Decommission
T18	0.17	New Construction	Decommission
T20	0.59	New Construction	Decommission
T21	0.88	New Construction	Decommission
T23	0.17	New Construction	Decommission
T24	0.65	Existing Roadbed	Decommission
T25	0.39	Existing Roadbed	Decommission
Total	6.31		All temporary roads to be decommissioned

Road fill

Fill used for road work would be excavated from three existing borrow pits, an old dike site, and one new borrow site in an old well pad within the project area. One existing borrow just north of the project that was associated with the Recap Timber Project would also be used. These borrow pits are depicted on Map C in Appendix A. Access to three of these borrow pits is from existing National Forest System roads. Access to the remaining two would be from temporary roads. At the completion of the project, the temporary roads leading to borrow pits would be closed.

The transportation system following project completion

With the exception of the 200-foot re-route, the transportation system remaining after project implementation will be the same as it is under the 2006 Griffin Springs Travel Management Decision and the April 2009 Record of Decision for the Motorized Travel Plan. Following project completion, roads improved for project purposes would not be maintained to a higher standard than before the project. Table 8 presents a summary of transportation needs for Alternative A.

Table 8. Summary of transportation actions for Alternative A

Road Type	New Construction	Existing Roads or Motorized Trails to be used as Haul Roads	TOTAL
System (in project area)	0 miles	35.74 miles	35.74 miles
System (off project area)	0 miles	0.42 miles	0.42 miles
Motorized Trail	0 miles	0.23 miles	0.23 miles
Temporary (to be obliterated or blocked following project completion)	6.31 miles	0 miles	6.31 miles
System road reroute	0.04 miles	0 miles	0.04 miles
TOTAL	6.35 miles	36.39	42.74
Post-project system roads in the project area			35.74 miles

Project Design Features for Alternative A

Alternative A would incorporate all of the project design features listed for the Proposed Action. See Table 5.

2.2 Alternatives Considered but Eliminated from Detailed Consideration

Two other alternatives were considered based on issues identified during public comment periods. Each of these alternatives was ultimately eliminated from further consideration. A description of these two alternatives and the reason or reasons they were eliminated from consideration follows.

1. Prescribed fire was proposed as a vegetation treatment alternative to mechanical treatments. It was eliminated from further consideration as spruce/fir is not fire tolerant and the risk of stand replacement is high. Also, use of prescribed fire would not meet the purpose and need as it would not provide wood products to the forest products industry to benefit the local and regional economy.

2. An alternative termed “the Sustainable Multiple Use Alternative” was proposed. A full description of the alternative is available in the project record in the June 4, 2010 comment letter from UEC et al. In summary, this alternative called for:

    a) recognition of a proposal for wilderness designation developed by a coalition of wilderness advocacy organizations, and alternative prescriptions aimed at preserving wilderness attributes within areas covered by that proposal,

    b) systematic and detailed monitoring,

    c) targeting “root causes” of undesirable trends in aspen clones,

d) conifer sanitation/salvage within 150 feet of roads,

e) spruce planting in areas not meeting specified thresholds, and

f) preserving late successional forests.

This alternative was eliminated from detailed study for the following reasons:

The proposal to recognize the proposed wilderness and manage accordingly was not considered further because the Forest Service does not have the authority to designate specific areas as proposed or designated wilderness areas. In accordance with the Wilderness Act, such classifications can only be made by the U.S. Congress.

With regards to monitoring, the Dixie National Forest already has a robust and scientifically valid monitoring program. This monitoring program has the advantage of being consistent throughout the Forest, which allows for systematic monitoring of multiple areas. Imposing a new monitoring program for this site would be duplicative, expensive, and potentially confusing for staff charged with monitoring multiple projects and sites. Further, the lack of consistency with monitoring on other sites within the Forest would make it difficult to conduct large-scale trend monitoring. For these reasons, this portion of the proposal was eliminated from further consideration.

Regarding aspen regeneration, the Proposed Action and Alternative A fully address this subject. While not stated directly, it appears that the commenter views the “root cause” of aspen issues to be ungulate browsing. Both action alternatives include provisions to monitor browsing and take action if this is excessive. Further, as proposed by the commenter, the aspen analysis did consider the findings of the Utah Forest Restoration Working Group, along with the relevant scientific literature on this subject. However, in the final analysis, and as required by law and regulation, it is the Forest Plan that provides the essential guidance for aspen regeneration. Given that aspen regeneration is being fully addressed in the Proposed Action and Alternative A, a new aspen regeneration alternative is not needed.

Regarding other provisions of the proposed alternative, the Proposed Action and Alternative A already incorporate sanitation/salvage along some authorized routes, planting of spruce in low stocked areas and conservation of late successional forests. Thus, there is no need to consider an additional alternative to address these considerations.

2.3 Comparison of Alternatives

This section provides a comparison of the three alternatives being considered. This information is presented as a series of three tables.

Table 9. Comparison of proposed vegetation treatments for each alternative.

Vegetation treatments	No Action	Proposed Action	Alternative A
Commercial aspen regeneration only	0 acres	152 acres	152 acres
Commercial conifer thinning	0 acres	3,603 acres	1,544 acres
Commercial conifer sanitation and salvage	0 acres	366 acres	363 acres
Aspen cleaning	0 acres	388 acres	388 acres
Pre-commercial conifer thinning	0 acres	381 acres	134 acres
Planting of existing low-stocked areas	0 acres	154 acres	154 acres
TOTAL	0 acres	5,044 acres*	2,735 acres*

*In some cases treatments overlap. The total number of acres treated is less than indicated here.

Table 10. Comparison of proposed transportation actions for each alternative.

Road Type	Proposed Action	No Action	Alternative A
System (in project area)	35.74 miles	0 miles	35.74 miles
System (off project area)	0.42 miles	0 miles	0.42 miles
Motorized trail	0.23 miles	0 miles	0.23 miles
Temporary	9.61 miles	0 miles	6.31 miles
System road reroute	.04 miles	0 miles	.04 miles
TOTAL	46.04 miles	0 miles	42.74 miles
Post-project (on project area)	35.74 miles	0 miles	35.74 miles
Post-project (off project area)	0.42 miles	O miles	0.42 miles
Post-project (on and off project)	36.16 miles	0 miles	36.16 miles

Table 11. Comparison of temporary roads used to implement each action alternative.

Road Number	Road Length (Miles)	Construction Type	Proposed Action	Alternative A	After Project
T1	0.26	Existing Roadbed	Yes	Yes	Decommission
T2	0.26	Existing Roadbed	Yes	Yes	Decommission
T3	0.22	New Construction	Yes	Yes	Decommission
T4	0.22	New Construction	Yes	Yes	Decommission
T5	0.41	New Construction	Yes	No	Decommission
T6	0.43	New Construction	Yes	No	Decommission
T7	0.75	New Construction	Yes	Yes	Decommission
T8	0.58	New Construction	Yes	Yes	Decommission
T9	0.31	New Construction	Yes	No	Decommission
T10	0.61	Existing Roadbed	Yes	Yes	Decommission
T11	0.19	New Construction	Yes	No	Decommission
T12	0.41	New Construction	Yes	No	Decommission
T13	0.73	New Construction	Yes	No	Decommission
T14	0.30	New Construction	Yes	No	Decommission
T15	0.38	New Construction	Yes	Yes	Decommission
T16	0.18	Existing Roadbed	Yes	Yes	Decommission
T18	0.17	New Construction	Yes	Yes	Decommission
T19	0.30	New Construction	Yes	No	Decommission
T20	0.59	New Construction	Yes	Yes	Decommission
T21	0.88	New Construction	Yes	Yes	Decommission
T22	0.22	New Construction	Yes	No	Decommission
T23	0.17	New Construction	Yes	Yes	Decommission
T24	0.65	Existing Roadbed	Yes	Yes	Decommission
T25	0.39	Existing Roadbed	Yes	Yes	Decommission
Total	9.61		9.61	6.31	All temporary roads to be decommissioned

3 Affected Environment and Environmental Consequences

Introduction

This section summarizes the physical, biological, social and economic environments of the affected project area, and the potential consequences (or effects) on the environment of implementation of three alternative, i.e., No Action, the Proposed Action, and Alternative A. The following environmental factors are evaluated:

Wildlife and Plants
Hydrology
Soils
Forest Vegetation (including Climate Change)
Recreation
Scenic Quality
Unroaded/Undeveloped Areas
Range
Noxious Weeds
Fire and Fuels

For each of the above topics, a description of the affected environment is presented, a desired future condition is identified, and, as applicable, the difference between the existing condition and the desired future condition (in other words, the need for action) is discussed. The environmental consequences of implementing each alternative are then presented, focusing on direct effects, indirect effects, and cumulative effects. A list of cited literature is also included. This information was derived from analyses conducted by resource specialists. Each specialist conducted a preliminary analysis, termed a "NFMA analysis," that included field work and review of available information, and resulted in a "NFMA table" that summarized existing conditions, desired conditions, and the difference between existing and desired conditions. Each specialist then prepared a "specialist's report." This section largely replicates the specialists' reports, though information is sometimes summarized if this does not change the substance of the report. Attachments to the reports are included. The complete specialists' reports, literature cited in the specialists' reports and other information necessary for an understanding of the specialists' reports are included in the project record.

3.1 Wildlife and Plants

Introduction

A description of the Alternatives considered in detail for the Iron Springs Vegetation Improvement and Salvage Project can be found in the Environmental Assessment.

The effects of fragmentation were considered for all species analyzed below. Any effects from fragmentation will be discussed under the individual species.

Information including population trends for species discussed in this document can be found in "Life History and Analysis of Endangered, Threatened, Candidate, Sensitive, and Management Indicator

Species of the Dixie National Forest, Version 6.0, March 2012" (Rodriguez et al. 2012). This report is located in the project record.

Wildlife Analysis

Wildlife Project Design Criteria are standards developed to protect the resource and meet the goals of the Dixie National Forest Land and Resource Management Plan. Table 12 includes the Wildlife Project Design Criteria that will be implemented for the Iron Springs Vegetation Improvement and Salvage Project.

Table 12. Wildlife Project Design Criteria.

Wildlife Resource	Description of Project Design Criteria
WL-1	Project activities shall cease which "May Affect" threatened, endangered, or proposed species discovered within or adjacent to the project area during project layout or implementation that has not been addressed within the environmental analysis until the potential affect is removed or until consultation with the U.S. Fish and Wildlife Service is concluded. Also, project implementation shall cease if any sensitive species is discovered within or adjacent to the project area that has not been addressed within the environmental analysis until an assessment can be made to determine the impact and potential adverse effects to the species.
WL-2	To maintain hiding cover for big game within forested ecosystems, retain a minimum of 50 percent of the perimeter of natural openings, aspen regeneration treatments, and meadows, and 75 percent of the edge along arterial and collector roads, as described in DNF S&G IV-34.
WL-3	To maintain habitat for a variety of wildlife species all forested landscapes shall be managed for no less than 300 snags per 100 acres in the spruce/fir cover type and 200 snags per 100 acres in the aspen cover type. Guidelines in the goshawk amendment to the forest plan guideline F (USDA Forest Service, 2000b, p. CC-21) are to be followed.
WL-4	To provide for the needs of a wide variety of wildlife, an average of 100 tons per 10 acres of coarse woody debris in the spruce-fir cover type and 30 tons per 10 acres in the aspen cover type shall be retained following the guidelines outlined in the goshawk amendment to the forest plan, guideline G (USDA Forest Service, 2000b, p. CC-22).
WL-5	If new raptor nests are found within or adjacent to the project area, a buffer shall be placed around the nest, and a timing restriction will be established if the nest area is occupied. Buffer size, timing restrictions, and restrictions of harvest activities will be made on a case-by-case basis taking into consideration site-specific raptor needs and utilizing raptor protection guidelines from the USDI Fish and Wildlife Service (2002b). If goshawk nests are found, the requirements in the forest plan are to be followed to protect the species.
WL-6	To maintain perching habitat for foraging peregrine falcons from a known eyrie, a foraging buffer shall be applied to the foraging area. Snags must not be removed from forested stands within 100 feet of the meadow/forest edge, as identified by the Falcon Foraging Buffer map located in the project record.

Table 12 (continued). Wildlife Project Design Criteria.

Wildlife Resource	Description of Project Design Criteria
WL-7	To avoid impacts to successful breeding and nest site/territory use of known raptors, buffer size and timing restrictions for occupied nests will be applied during harvest activities. In applying the timing restriction, raptor protection guidelines from the USDI Fish and Wildlife Service (2002b), will be used in conjunction with site-specific raptor needs (e.g. high elevation influence on territory activities).
WL-8	To avoid impacts to known Utah prairie dogs within the project area, maintain a 350 foot no-treatment buffer around the colony and apply a seasonal timing restriction from April 30 to September 14 in the adjacent stands. An extension of the timing restriction will occur if prairie dogs are observed above ground during or after an evaluation of the colony at the end of the restriction period. The restriction will last until prairie dogs have gone underground for the year. The buffer area and adjacent stands with the associated timing restriction is identified by the Utah Prairie Dog Colony Map which is located in the project record.
WL-9	To avoid impacts to breeding northern goshawks, timing restrictions will be applied to all activities within the PFAs if nests are active as outlined in the goshawk amendment to the forest plan (USDA Forest Service, 2000b). No activities are proposed in known goshawk nest areas.
WL-10	To provide habitat for the goshawk and its prey the percent of the group acreage covered by clumps of trees with interlocking crowns should typically range from 40-70 percent in post- fledgling and foraging areas, as described in USDA Forest Service (2000b, p. CC-22).

Effects Analysis

In this analysis, all past activities and events within the project area are included in the existing condition description. Much of the analysis contained in this document references and incorporates the vegetation analysis written by Orlemann (2012c), since the species contained forthwith depend on vegetation for their various habitat requirements. For the analysis of wildlife and plant species and their habitat to be congruent with the vegetation analysis, silvicultural activities that occurred more than about 20 years prior to 2010, identified as the baseline year in the vegetation analysis, will not be specifically mentioned. As disclosed in the vegetation report, time periods from 15 to 20 years are sufficient for evaluating the effect of silvicultural treatments. Table 13 lists the past, present, and reasonably foreseeable silvicultural treatments that fall within the various cumulative effects areas. Project area acres were not included in Table 13 because the applicability of these treatments to species varies and differences in cumulative effects areas exits. Other applicable activities or events beyond the scope of silvicultural treatments within the various cumulative effects areas will be identified in the pertinent species analysis.

Table 13. Past, present, and reasonably foreseeable silvicultural treatments.

Project Name	Date	Finding
Coyote Hollow Timber Sale	1988	Finding of No Significant Impact
Velvet Lake Timber Sale	1988	Finding of No Significant Impact
Black Forest Timber Sale	1988	Finding of No Significant Impact
Roundy Timber Sale	1992	Unavoidable Impacts
Coyote Hollow Timber Sale	1993	Unavoidable Impacts

Table 13 (continued). Past, present, and reasonably foreseeable silvicultural treatments.

Project Name	Date	Finding
Black Forest/Velvet Lake Salvage	1993	Finding of No Significant Impact
Pacer	1994	Unavoidable Impacts
Aquarius Salvage	1995	Finding of No Significant Impact
Lost Spring Aspen	2005	None
Bug Lake Salvage	2007	None
Clayton Salvage	2007	None
Pockets Resource Management	2009	Unavoidable Impacts

Within the defined cumulative effect areas disclosed in this document, both past, present and future management actions have the potential to add incremental impacts when combined with the possible direct and indirect effects of the present proposal. Listed actions (Table 2) will not be considered where they have not been found to "individually or cumulatively have a significant effect on the human environment (40 CFR 1508.4)."

All calculations of areal extent in this document are estimates. In general, estimated acres in this analysis are preceded by the word "approximately." Because GIS data are continually being updated, because stand and watershed boundaries are arbitrary digitizing exercises, or because differences between project areas and treatment areas exist, all calculations are estimates. To calculate NEPA effects down to the acre, or even tenth acre implies levels of accuracy and precision that are simply not realistic. Moreover, rounding errors may occur, such that a textual total of 519 acres may add up to 520 in the accompanying table.

California Condor (*Gymnogyps californianus*)

The California condor is included on the list of species that may occur on the Dixie National Forest. This species has been designated by the USFWS as an experimental non-essential population in this area (USDA Forest Service 2010). Incidental observations of condors have been documented on the Cedar City Ranger District near Strawberry Point and Panguitch Lake. No observations have been documented on the Escalante Ranger District. No nesting or roosting sites have been observed anywhere on the forest (Rodriguez et al. 2012).

Typical foraging sites for the California condor are grasslands or oak-savannah regions and roosting and nesting sites are located on cliffs (Rodriguez et al. 2012; Snyder and Schmitt 2002). The condor feeds exclusively on carrion which is primarily composed of large mammalian carcasses. Nests are most commonly found in caves on cliffs. Known breeding sites are found at or below approximately 6,000 feet (Snyder and Schmitt 2002).

The Iron Springs project area contains large open meadow areas that would provide foraging habitat that is open enough that food could be readily found and accessed. However, there is a general lack of a food supply and condor foraging excursions coinciding with food availability would be coincidental and unlikely. In addition, the project area is located between approximately 9,000 and 10,750 feet on a plateau top and the interior relatively flat meadows may not provide adequate conditions for takeoff and attainment of soaring flight, making condor occurrences in the project area even more unlikely. This type of flat topographic features may be a reason why condors avoided the San Joaquin Valley in California as described by Snyder and Schmitt (2002).

Cliffs found adjacent to the project area are typically between approximately 10,000 and 10,750 feet. Condors will not nest in the cliffs adjacent to the project area due to the high elevation.

Effects of the No Action

There will be no effects from the No Action due to the unlikely use of the area.

Effects of All Action Alternatives

As discussed above, use of the project area for foraging would be unlikely. If condors happen to be soaring above the project area during implementation, they would avoid foraging in the area. If activities started while individuals were foraging, they would disperse away from the project area. These effects, if any, are expected to be discountable because it is unlikely this species uses the project area. There will be no effects to nesting condors because suitable nesting habitat does not exist in or adjacent to the project area. Because effects will be unlikely to occur or discountable, there will be no cumulative effects. These unlikely or discountable effects at the project level will not affect the low incidental use of condor populations that opportunistically use the Forest.

Mexican Spotted Owl *(Strix occidentalis lucida)*

The Mexican spotted owl (MSO) is listed as a threatened species under the Endangered Species Act and is being managed under the direction of the Mexican Spotted Owl Recovery Plan. A final designation of critical habitat for the owl was published in the Federal Register on August 31, 2004. The project area is not in the critical habitat boundary. The closest critical habitat boundary is approximately 12 air miles to the south and southwest of the project area. The 2012 Recovery Plan classifies the habitat in the project area as high-elevation forest type (U.S. Fish and Wildlife Service 2012). The Plan does not proposed specific management guidelines for this forest type out side of Protected Activity Centers.

According to Rodriguez et al. (2012), no nesting Mexican spotted owls have been located on the Dixie National Forest (DNF). Despite extensive survey efforts across southwestern Utah, no nesting Mexican spotted owls have been located on Forest Service administered lands. Based on long-term monitoring on the DNF, data suggests birds located on the Forest were transient and not nesting (Rodriguez et al. 2012).

Mexican spotted owls hunt primarily at night, with their prey commonly consisting of small- and medium-sized rodents such as woodrats, mice, and voles. These owls also consume rabbits, bats, birds, reptiles, and insects. Their diet also varies by geographic location and likely reflects geographic variations in prey abundance and habitats of both the owl and its prey (U.S. Fish and Wildlife Service 2012).

A letter from Rodriguez (2003), Intermountain Region MSO Coordinator, discusses habitat modeling used in identifying potential nesting/roosting habitat. A letter from the U.S. Fish and Wildlife Service (Maddux 2002), outlines these habitat model criteria. The U.S. Fish and Wildlife Service provided the Forest Service with two GIS habitat models to evaluate potential MSO habitat (Maddux 2002). From these models potentially suitable habitat was identified on the forest (Rodriguez et al. 2012). Potentially suitable habitat validation was conducted across the district. A review of these surveys shows that no suitable breeding/roosting habitat exists in or near the project area. Validation surveys conducted within approximately 5 miles of the project area are located in the project file.

Recorded seasonal movements are variable for the Mexican spotted owl. Seasonal movements occurred in most areas where movements of radio-marked owls were monitored. Migrating owls typically left study areas in November or December, and returned from January to April. Distances ranged from 3 to 31 miles for owls whose wintering areas were located. Additional evidence has been

provided for down-slope migration in Mexican spotted owls. Information suggests that seasonal migration of some individuals occurs in many or most populations of Mexican spotted owls. Migration generally involves a change in elevations, with most owls moving down slope. Migration to lower elevations allows owls to winter in areas that are warmer than their breeding areas during the winter and that lack persistent snow. This may facilitate an energetic savings in maintaining homeostasis and hunting for small mammals, which comprise the bulk of their diet. Elevational migration may also allow owls to move to areas with more concentrated prey resources, as populations of small mammals reach their lowest level in owl breeding areas during the winter months. For example, one study compared the estimated available winter prey biomass in both the traditional breeding area and a wintering areas used by a pair of radio-marked owls. The study estimated that winter prey biomass was almost eight times greater within the wintering area than the breeding area (U.S. Fish and Wildlife Service 2012). The project area is located approximately between 9,000 and 10,750 feet on the plateau top. Seasonal transient owls will not utilize the project area because the elevation does not support a sustainable food supply during the time the owls have the potential to be present in the project area.

Dispersal by juvenile Mexican spotted owls has been studied using radio-marked individuals. Radio-marked juvenile owls began dispersing in September and October in all study areas, with most dispersing in September. Dispersing juveniles from all studies used a wide variety of habitats (U.S. Fish and Wildlife Service 2012). This information indicates dispersing juveniles are capable of moving through the project area during this time period. However, it is unlikely the area is utilized by dispersing juveniles due to the high elevation and lack of prey base.

Effects of the No Action

There will be no effects to the MSO since no treatment activities will occur and use of the area as juvenile dispersal habitat is unlikely to occur.

Effects of All Action Alternatives

Effects are unlikely or discountable because of the unlikely use of the project area by the species as described above. Because effects will be unlikely to occur or discountable, there will be no cumulative effects. These unlikely or discountable effects to juvenile dispersing individuals at the project level will not affect MSO populations that use the Forest.

Utah Prairie Dog *(Cynomys parvidens)*

The Utah prairie dog was downlisted from endangered to threatened in May 1994, and is currently being managed under The Utah Prairie Dog Recovery Plan and the Interim Conservation Strategy.

Figure 2 in the Utah Prairie Dog Recovery Plan (USDI Fish and Wildlife Service 1991) displays the Recovery Units. Prairie dog towns located on the top of the plateau are a part of the Awapa Plateau Recovery Unit. A small area of the northern Escalante Ranger District boundary is a part of this Recovery Unit.

The Utah prairie dog presently occurs in three areas: the Awapa Plateau, the Paunsaugunt region along the East Fork of the Sevier River, and the West Desert region of east Iron County. Approximately 32,500 acres of potentially suitable habitat has been identified across the Forest. The abundance of Utah prairie dogs within the Recovery Areas varies considerably from year to year. It has been determined that the species is increasing on the Paunsaugunt and West Desert recovery areas, and is variable on the Awapa recovery area (Rodriguez et al. 2012).

One small colony estimated at less than 10 individuals has been known to exist within the project area. This colony was located in 2005 and had active holes in 2005 and 2006. There were no active

holes in 2011 and 2012. Project Design Criteria WL-8 was developed to avoid adverse impacts to this species.

Cumulative Effects Area

The Cumulative Effects Area (CEA) for the Utah prairie dog is the suitable meadow habitat surrounding the colony within the project area (see Appendix B.1). This CEA is approximately 767 acres, is surrounded by forested habitat, and includes habitat that potentially could affect the expansion and functioning of the existing colony. The closest known colony is approximately 9.5 air miles away. This area was selected because the analysis for the proposed activities considered the direct and indirect effects to the existing colony in the project area and an analysis of the available suitable habitat for this colony is needed.

Effects of the No Action

There will be no effects to the Utah prairie dog.

Effects of All Action Alternatives

WL-8 states "To avoid impacts to known Utah prairie dogs within the project area, maintain a 350 foot no-treatment buffer around the colony and apply a seasonal timing restriction from April 30 to September 14 in the adjacent stands. An extension of the timing restriction will occur if prairie dogs are observed above ground during or after an evaluation of the colony at the end of the restriction period. The restriction will last until prairie dogs have gone underground for the year. The buffer area and adjacent stands with the associated timing restriction is identified by the Utah Prairie Dog Colony Map which is located in the project record." This will minimize effects to typical activity patterns including foraging behavior and reproductive success. The action alternatives may affect, but are not likely to adversely affect the Utah prairie dog. Implementing the Project Design Criteria WL-8 will avoid impacts to the prairie dog while possible individuals are above ground. Impacts to the prairie dogs are unlikely and therefore, there will be no changes to Forest-wide populations as a result of proposed activities.

Cumulative Effects of All Action Alternatives

Past, present, and future activities that affect prairie dog habitat are the Road 140 relocation and the Griffin fence installation (Appendix C.1). The Road 140 relocation improved riparian habitat and therefore improved foraging opportunities within the CEA. The riparian fence which encloses approximately 2 acres was proposed to also improve riparian habitat and improved foraging opportunities. The fence is located up against the forest edge and will not contribute to predation on potential prairie dog colony expansion within the CEA. This is because there are already snags available to perch in next to the fence that offer better opportunities for raptors. There are beneficial cumulative effects to potential habitat for possible future prairie dog expansion of this colony. These beneficial cumulative effects are not expected to affect Forest-wide populations since the new riparian fence improves a small area (2 acres). The 2 acres represent approximately 0.3 percent of the CEA and less than approximately 0.006 percent of the potentially suitable habitat on the Forest.

Yellow-billed Cuckoo (*Coccyzus americanus*)

The yellow-billed cuckoo is a candidate species and has not been located on the Dixie National Forest (DNF). Its presence on the DNF is unlikely because it is associated with low elevation cottonwood riparian areas with dense understories (Rodriguez et al. 2012). The project area is located approximately between 9,000 and 10,750 feet and therefore does not contain low elevation cottonwood riparian areas with dense understories. This species will not be discussed further in this document due to the lack of suitable habitat in the project area.

American Bald Eagle *(Haliaeetus leucocephalus)*

The bald eagle was recently delisted as a threatened species and is considered a Forest Service, Region 4 designated sensitive species. Bald eagle foraging does not occur in the project area due to lack of food. Wintering eagles begin arriving in Utah in November and begin leaving by March. During the winter, eagles are found where food is most available (UDWR 2004). Bald eagles are predominately observed during late fall and winter months where they forage near open water bodies. After the open water freezes, eagles generally move to lower elevations off of the Forest (Rodriguez et al. 2012). No open water bodies occur within the project area that would provide fall and early winter habitat. The closest open water body capable of supporting the species is in the Barker area. This area is approximately one air mile east southeast of the project area and below the plateau rim.

Data compiled from the Breeding Bird Survey database demonstrates that bald eagle numbers are on an upward trend throughout the western United States (Rodriguez et al. 2012). Almost all bald eagle use occurs outside of the breeding season on the Dixie National Forest (DNF). Bald eagle observations most likely fluctuate in southern Utah due to variable winter intensities. Trends on the DNF are stable to slightly down based on winter usage (Rodriguez et al. 2012).

The project area is located approximately between 9,000 and 10,750 feet. USDI Fish and Wildlife Service (1995) describes the spruce-fir type as a montane zone on the high plateau and contains short growing seasons, heavy snow accumulations, and strong ecological and floristic affinities to cold forests of higher latitudes. This elevation does not support a highly available food supply from winter through spring.

In summary, the project area does not provide adequate foraging opportunities for the bald eagle during the months the species may potentially occur. This is due to the lack of open water bodies in or adjacent to the project area that could be used as fall and early winter habitat, the project area does not contain potentially suitable wintering habitat, and the high elevation of the project area does not support an adequate food supply. Also, it is highly unlikely the species will use the area as stopover perching habitat along its migration due to the high elevation and lack of foraging opportunities in the area.

Effects of the No Action

There will be no effects to the bald eagle.

Effects of All Action Alternatives

Bald eagle foraging will not occur in the project area due to lack of food. Also, it is highly unlikely the species will use the area as stopover perching habitat along its migration due to the high elevation and lack of foraging opportunities in the area. In the unlikely event an individual were present during any activity, the bird would continue on its way towards its destination or find other stopover habitat. Since the presence of the species is highly unlikely, effects are unlikely to occur. Any effects would result in minor discountable disturbances. Because effects are minimal or non-existent, there will be no cumulative effects to the species or to Forest-wide population trends.

American Peregrine Falcon *(Falco peregrinus)*

The peregrine falcon is a Region 4 sensitive species. Nest sites in Utah are generally found on high ledges on cliffs and river gorges (Rodriguez et al. 2012). The average hunting area consists of a 10-mile radius around the nest. Eighty percent of foraging occurs within a mile of the nest (Spahr et al.

1991). Nest sites are often located near marshes, lakes, or rivers. Prey is the major factor in nest site selection. Prey species primarily include terrestrial birds, shorebirds, and waterfowl (Rodriguez et al. 2012).

There are eighteen known nest sites on the Dixie National Forest. The activity of these nests varies from year to year. In addition, three additional eyries have been located within a mile of the Forest boundary. Suitable habitat is abundant on the Forest (Rodriguez et al. 2012). Peregrine can capture prey above any habitat type that supplies prey species. Meadows (2,810 acres) in the project area account for approximately 0.5 percent of non-forested/non-woodland habitat on the Forest. Forested vegetation (5,496 acres) in the project area accounts for approximately 0.9 percent of forested habitat on the Forest. Available pinyon/juniper and riparian habitat on the Forest was not used in this calculation but could also provide foraging opportunities (DNF LRMP, p. II-19).

Suitable nesting habitat for the species exists immediately adjacent to the southwestern boundary of the project area. An eyrie was discovered and found to be active in this area in 2009. Wet meadows and lakes that provide important foraging habitat exist below the cliff habitat. Peregrines have been observed foraging in the project area along the large dry meadows that are near the known eyrie.

Cumulative Effects Area

The Cumulative Effects Area (CEA) for the peregrine falcon is a 1.5 mile area around the nest (see Appendix B.2). This area was chosen because 80 percent of foraging occurs within a mile of the nest and this was expanded to 1.5 miles to include the meadow areas the peregrine have been observed foraging in. A 10-mile radius was not chosen because cumulative effects would not be meaningful and measurable due to the large area and most of the foraging occurs within a mile of the nest. All past activities and events within the CEA are included in the existing condition description. The only silvicultural treatment included in the list of past, present, or reasonably foreseeable future activities (Table 2) within the CEA is the proposed Iron Springs project.

Effects of the No Action

There will be no effects to the peregrine falcon.

Effects of All Action Alternatives

Project Design Criteria WL-6 states, “To maintain perching habitat for foraging peregrine falcons from a known eyrie, a foraging buffer shall be applied to the foraging area. Snags must not be removed from forested stands within 100 feet of the meadow/forest edge, as identified by the Falcon Foraging Buffer map located in the project record.” In addition, WL-5 and 7 are designed to avoid impacts to successful breeding and nest site/territory use of known breeding raptors including peregrine falcons. These design features will also minimize effects to typical activity patterns including foraging behavior.

There would be minimal effects to the peregrine if it expanded its foraging activities outside the buffer area. This is because most foraging occurs within a mile of the nest, and Project Design Criteria WL-6 includes foraging habitat outside this mile buffer. If peregrine falcons were foraging outside these areas, they would disperse to other suitable foraging habitat that is available. Also, if the eyrie was not active but other peregrine falcon were utilizing the project area for foraging during project implementation, those individuals would also disperse to other suitable foraging habitat. These would be short-term effects and last until the project was completed.

The proposed action includes aspen regeneration, commercial conifer thinning, sanitation/salvage, aspen cleaning, pre-commercial conifer thinning, and planting treatments. These various treatments

will increase or restore vegetative diversity resulting in the enhancement of foraging habitat by increasing prey diversity.

In summary, Project Design Features will avoid impacts to successful breeding of peregrine and nest site/territory use. Minimal effects will occur to foraging falcons outside the established buffer or other individuals within the project area and not associated with the known eyrie. While dispersal to other suitable foraging habitat may occur if foraging individuals are present, effects will be short-term and minor. These effects will not affect Forest-wide populations due to the nature of these minor effects and the small amount of vegetation treated in the project area compared to the abundant habitat available across the Forest.

Cumulative Effects of All Action Alternatives

The only silvicultural treatment included in the list of past, present, or reasonably foreseeable future activities (Table 2) is the proposed Iron Springs project. Recreational use within the CEA is low and infrequent with the exception of the use of Road 140 and 469 (C. Calbaum, Recreation Staff Officer, personal communication, June 29, 2011). However, with the use of these roads, peregrines and two other raptors continue to choose this area to nest in. Proposed activities would cause minimal short-term effects to habitat effectiveness for the peregrine and therefore the contribution to cumulative effects will be discountable and effects to Forest-wide populations will not be measurable.

Desert Bighorn Sheep *(Ovis Canadensis nelsoni)*

Bighorn sheep are associated with rugged terrain, typically characterized by canyons, gulches, talus cliffs, steep slopes, mountain tops, and river benches. Open habitats with adjacent steep rocky areas are preferred, as these areas provide escape cover from most predators (UDWR 2000). The cliff habitat adjacent to the project area is not large and extensive enough to support bighorn sheep. The cliff habitat consists of one short section (approximately 1.25 miles) of narrow habitat. Bighorn sheep do not occur in or adjacent to the project area. This species will not be present in or near the project area, and therefore is not analyzed further in this document.

Boreal Toad *(Anaxyrus boreas boreas)*

Prior to the 1990s, boreal toad was documented in the Beaver (Tushar) Mountains, Boulder Mountain (Aquarius Plateau), Monroe Mountain, and Thousand Lake Mountain areas of southern Utah (Fridell et al. 2000; Thompson et al. 2004). UDWR surveys from 1995-2003 identified boreal toads and/or breeding areas on Monroe Mountain, Thousand Lake Mountain, the north slope of Boulder Mountain, and the upper portion of the East Fork Sevier River on the Paunsaugunt Plateau.

The Paunsaugunt Plateau population of boreal toad is the southernmost population in Utah and has been found to be genetically distinct from other populations (Switzer et al. 2009). Goebel (2005) even called for the elevation of the population to species status (*Bufo sevieri*). UDWR surveys from 1994-1998 found boreal toads at multiple locations throughout the Tropic Reservoir 6th field HUC (160300020302) and the Headwaters East Fork Sevier River 6th field HUC (160300020301) on the Paunsaugunt Plateau portion of the Powell Ranger District (Fridell et al. 2000). Individual sites included the upstream end of Tropic Reservoir, Skunk Creek, Seiler Creek, Left Fork Kanab Creek and a series of seven beaver ponds/complexes throughout the East Fork Sevier River upstream from Crawford Creek. Breeding activity was restricted to the beaver ponds/complexes upstream from Crawford Creek. Surveys and telemetry studies since that time have also found toads in Robinson Canyon and the Middle Fork of Kanab Creek, and have identified breeding activity in the Left Fork

Kanab Creek (Goates 2006; Goates et al. 2007; Golden 2009a; Lien and Wheeler 2010; Golden 2012). Fridell et al. (2000) observed an average of about 44 adult/juvenile toads per spring breeding survey on the Paunsaugunt Plateau between 1994 and 1998. In addition they found evidence of breeding at six different sites, often finding thousands of tadpoles or more than 20 egg strands. In 2001 chytrid fungus (*Batrachochytrium dendrobatidis*) was discovered from boreal toad on the Paunsaugunt Plateau (Thompson et al. 2004). Concurrently beaver activity declined throughout the areas upstream from Tropic Reservoir and many of the dam complexes have degraded causing a reduction in the amount of boreal toad breeding habitat. Chytrid fungus has been implicated in large-scale amphibian declines world-wide and recent studies have shown that beaver ponds can be correlated with the presence of pond-breeding amphibians (Stevens et al. 2007; Pilloid et al. 2010). Throughout the 2000s observations of both adult boreal toads and boreal toad breeding activity have declined. Successful breeding has only been documented in two locations for the past 7 years: the East Fork Sevier River boreal toad exclosure and the Left Fork Kanab Creek boreal toad exclosure (Golden 2012). Multiple survey efforts during the breeding season from 2009 and 2010 only found 3 groups of tadpoles in 2009 and one egg strand and one group of tadpoles in 2010 and two egg strands in 2011 (Golden 2009a; Golden 2009b; Golden and Mecham 2010a; Golden and Mecham 2010b; Golden et al. 2010a; Golden et al. 2010b; Lien and Wheeler 2010; Mecham and Haupt 2010; Mecham 2010a; Mecham 2010b; Mecham 2010c; Mecham 2010d; Golden 2012).

UDWR surveys on Boulder Mountain in 1997 and 1998 observed adult/juvenile boreal toads at Baker Spring and in the Pine Creek drainage downstream on the Fremont River Ranger District (formerly Teasdale Ranger District). DNF telemetry studies and UDWR surveys in the early 2000s observed evidence of boreal toad breeding activity (egg strands/tadpoles) from Baker Spring downstream to 0.2 miles downstream from Pine Creek Reservoir (UDWR unpublished data; Goates 2006; Goates et al. 2007). Baker Spring appeared to be the epicenter for boreal toad breeding in the area and was comprised of a series of beaver dams. Similarly, the downstream areas where breeding was observed were also in ponded areas behind beaver dams. Beavers have abandoned the area and breeding habitat has declined as the dams fall into disrepair and the ponded areas drain. Surveys of the Baker Springs population have had widely variable results; however over the course of the past 10-15 years the population appears to be stable (UDWR Native Aquatics Database; Wheeler 2007; Lien and Wheeler 2010; Golden 2012).

Within the Donkey Creek-Fremont River 6th field HUC (140700030305) DNF personnel found juvenile and adult boreal toad at several locations between Solitaire Lake and Grass Lakes during amphibian surveys and a boreal toad telemetry study in the early 2000s (DNF unpublished data; Goates et al. 2007). UDWR and DNF surveys since that time have continued to find juvenile and adult boreal toads throughout this drainage, most consistently in the Grass Lakes area, and breeding was finally documented in this area in 2011 (Golden 2012). Similarly, in the Boulder Creek-Fremont River 6th field HUC (140700030301) an adult boreal toad was found along Birch Creek during a 2006 Dixie National Forest fish monitoring effort. Hopefully, future survey work in this area can identify better sites for monitoring boreal toad abundance and breeding success.

The only historic record of boreal toad from the Escalante Ranger District is from the headwaters of the East Fork Boulder Creek (UDWR Native Aquatics database). No records indicate that boreal toad is present within the CEA (UDWR Native Aquatics database; Golden 2012). While toads are not known from the project area, the project area does contain ponds, wet areas, and uplands which may provide suitable habitat for boreal toad.

Cumulative Effects Area

The cumulative effects area (CEA) for the boreal toad is the three HUC 6 watersheds that are a part of the Iron Springs project area (see Appendix B.5). These three watersheds include Coyote Hollow-Antimony Creek, North Creek, and Upper North Creek. This area was chosen because the potential impacts from proposed activities would stay in the three drainages.

Effects of the No Action
No activities will occur in the project area and therefore there will be no effects to the boreal toad.

Effects of All Action Alternatives

Boreal toad individuals have the potential to be directly impacted by equipment used during harvest and road building activities while using upland habitat. However, the hydrologist report states that special protection and management will be given to all perennial streams, lakes, and other bodies of water. This protection includes a minimum of 100 feet from the edge of these areas or to the outer margin of the riparian ecosystem if wider than 100 feet. Tractor or other heavy equipment will not be allowed within this protection zone. Included are areas identified in the hydrologic concerns map, as well as those not identified in the NEPA process. The Soils Report states that detrimental soil displacement from proposed activities is very minimal and expected to stay the same through the implementation. Project Design Criteria for Hydrology and Soils will direct the identification of riparian and wetland areas of concern as well as determine applicable soil and water conservation practices for the protection of these areas.

Population level impacts will not occur since suitable breeding habitat will not be affected, and the species is not known to occur in the project area. Since there are no population level impacts, there will be no effects to Forest-wide populations.

Cumulative Effects of All Action Alternatives

Known breeding areas, and recent or historical records do not exist within the CEA. Implementation of all the action alternatives may result in the loss of individual amphibians using upland areas. However, this is based on the area containing potential habitat, not species occurrences. Potential breeding habitat will not be affected by activities, so no cumulative population level effects are expected. Consequentially, there will be no effects to Forest-wide populations. If the species was present, individuals may have been impacted from past activities.

Bonneville Cutthroat Trout *(Oncorhynchus clarki Utah)*

In southern Utah remnant populations of Bonneville cutthroat trout (BCT) were first identified in Birch Creek in the Beaver River drainage on the Fishlake National Forest and Reservoir and Water Canyons in the Virgin River drainage on the Dixie National Forest (Hepworth et al. 1997). By the mid-1990s remnant populations were also discovered in Deep Creek and Ranch Creek in the East Fork Sevier River drainage on the Dixie National Forest (Hepworth et al. 1997).

When the Dixie National Forest LRMP was signed in 1986, 7 acres of existing habitat was identified, and the total potential habitat listed at 2,500 acres (LRMP, II-16a). Since 1986, the amount of occupied Bonneville cutthroat trout habitat on the Dixie National Forest has increased because of an aggressive stream renovation program. Stream renovation and native cutthroat trout expansion

projects have been accomplished cooperatively with the UDWR. From the late 1970s through the present, UDWR has actively managed for BCT throughout the Southern Region. Oftentimes BCT have been reintroduced to streams with marginal habitat; therefore, occupied habitat varies annually with climatic conditions. By the 2000s conservation populations of BCT had been established in 17 streams (~47.9 maximum occupied miles) and 1 lake (2 occupied acres; Rob's Reservoir) on the Dixie National Forest (Table 3; Hepworth et al. 2003; Hadley et al. 2010; Hadley et al. 2011). BCT are also present as sport fishing populations in several lakes and reservoirs across the Forest.

UDWR and the Forest cooperatively monitor Forest BCT populations on an approximately 7-year interval. Monitoring on all Forest conservation populations of BCT occurred between 2008-2010 and showed that the current occupied habitat in the Forest is approximately 31 miles (Table 14; Hadley et al. 2010; Hadley et al. 2011). This represents a 35 percent reduction in the maximum known occupied habitat in these streams. The direct and indirect impacts of fire to stream habitat is the primary reason for this decline. In 2002 two large fires occurred on the Forest that affected streams with BCT Conservation populations: the Sequoia fire on the east side of the Pine Valley Mountains (Pine Valley Ranger District) and the Sanford fire on Mount Dutton (Powell Ranger District).

Table 14. Miles of stream habitat on the Dixie National Forest habitat occupied by conservation populations of BCT during 2008-2010 monitoring efforts, at their maximum observed distribution, and miles of potential perennial habitat in existing BCT stream or streams currently planned for restoration (Hepworth et al. 2003; UDWR 2007; Hadley et al. 2010; Hadley et al. 2011).

Stream	Ranger District	2008-2010 Occupied habitat	Known maximum occupied habitat	Potential habitat
Leeds Creek	Pine Valley	6.2	6.2	6.2
Horse Creek	Pine Valley	0.9	0.9	1.1
Pig Creek	Pine Valley	0.9	1.0	1.4
Spirit Creek	Pine Valley	0.9	1.1	1.8
South Ash Creek	Pine Valley	0	3.5	3.5
Harmon Creek	Pine Valley	0	2.0	2.7
Mill Creek	Pine Valley	2.2	5.0	7.2
Leap Creek	Pine Valley	0	3.3	5.1
Reservoir Canyon	Pine Valley	2.0	2.0	2.9
Water Canyon	Pine Valley	0.7	1.8	2.3
Threemile Creek	Cedar City	5.0	5.0	5
Delong Creek	Cedar City	2.1	2.1	3.7
Indian Hollow	Cedar City	0.9	0.9	1.5
Deep Creek	Powell	1.5	3.6	3.6
Cottonwood Creek	Powell	0	0	10.1

Table 14 (continued). Miles of stream habitat on the Dixie National Forest habitat occupied by conservation populations of BCT during 2008-2010 monitoring efforts, at their maximum observed distribution, and miles of potential perennial habitat in existing BCT stream or streams currently planned for restoration (Hepworth et al. 2003; UDWR 2007; Hadley et al. 2010; Hadley et al. 2011).

Stream	Ranger District	2008-2010 Occupied habitat	Known maximum occupied habitat	Potential habitat
Deer Creek	Powell	0	0	10.5
Left Fork Sanford Creek	Powell	0	1.8	6.0
Center Creek	Escalante	4.8	4.8	4.8
Ranch Creek	Escalante	2.9	2.9	5.0
Total		31.0	47.9	84.4

The Sequoia fire, along with the flooding and debris flows following it, extirpated the BCT populations in Harmon, Mill, and South Ash Creeks. Habitat in these streams was severely degraded as stream channels incised to bedrock in some areas and large volumes of fine sediment were deposited in others. Since then BCT have been reintroduced to Mill Creek, Leap Creek, Harmon Creek, and South Ash Creek; however, another large flood and debris flow event in 2009 appears to have eliminated BCT in South Ash and Harmon Creek. A small section of Mill Creek still contained BCT, but abundance of fish was low. The reintroduction into Leap Creek in 2006 appears to have been unsuccessful, although fish may have established downstream of the 2010 monitoring areas. Additional monitoring of the expansion of BCT from Mill Creek and potential reintroductions into other streams affected by the Sequoia fire will probably occur over the next few years.

Similarly, the Sanford fire, along with flooding and debris flows following it, effectively extirpated the BCT populations in Deep Creek and Left Fork Sanford Creek. Stream channels incised and fine sediment deposition occurred following the fire. Prior to the complete extirpation of BCT in Deep Creek, 250-300 fish were moved to Ten Mile Creek on the Fishlake National Forest. In 2005, 2006, 2008, and 2009 UDWR moved 40 to 50 Bonneville cutthroat trout back into Deep Creek from TenMile Creek. As of 2009 the occupied distribution of BCT in Deep Creek on the Dixie National Forest was thought to be approximately 1.5 miles (Hadley et al., 2010). BCT have not been reintroduced to Left Fork Sanford Creek pending further evaluation of stream habitat.

Conservation Agreement and Strategy projects to increase and improve habitat for BCT are continually being planned and implemented throughout their range and within the Southern GMU. Sandy Creek (~ 5.5 miles) on the Cedar City Ranger District has had BCT reintroduced, but the success of the reintroduction has not been measured. Additionally, Deer Creek (~ 10.5 miles) on the Powell Ranger District should have renovations to remove nonnative trout completed and BCT from the Manning Meadows brood stock was reintroduced in 2011. Cottonwood Creek (~ 10.1 miles) on the Powell Ranger District has also been identified for potential renovation and reintroduction (UDWR, 2007). These and future habitat restoration and fish reintroduction projects should increase BCT abundance and occupied habitat on the Forest.

According to the Hydrology Report, streamflow in most of the project area is spatially and temporally intermittent. There are two perennial streams located within the project area. Both streams are spatially intermittent. There are no fish bearing streams within the project area. North Creek is the

closest fish bearing stream downstream of the project area and it is approximately one stream mile away.

Effects of the No Action

No activities will occur in the project area and therefore there will be no effects to the Bonneville cutthroat trout.

Effects of All Action Alternatives

There are no fish bearing streams within the project area, therefore, there will be no direct effects to fish. The Hydrology Report states, "Nearly all of the perennial stream segments within the project boundary are located in meadows away from trees and their shade zone." As described in the report, the small perennial segments will not be treated. The Soils Report states that detrimental soil displacement from proposed activities is very minimal and expected to stay the same through the implementation. Finally, the Hydrology Report states that stream turbidity and suspended sediment is unlikely to be measurably impacted. There will be no indirect effects to fish from proposed activities. Since there are no direct or indirect effects, there are no effects to Forest-wide populations.

Colorado Cutthroat Trout *(Oncorhynchus clarki pleuriticus)*

Only the Fremont and Escalante River drainages offer historical habitat for Colorado cutthroat trout (CRCT) on the Dixie National Forest (Hirsch et al. 2006). CRCT were thought to have been extirpated from these drainages, until a remnant population was found in East Fork Boulder Creek in the 1980s and confirmed by genetic testing in 1990 (Hepworth et al. 2001). More extensive survey efforts in the 1990s found that 5 remnant populations of CRCT occupied approximately 8.2 miles of stream in the Escalante River drainage on the Dixie National Forest (Water Canyon Creek, White Creek, West Branch Pine Creek, West Fork Boulder Creek, and East Fork Boulder Creek; Hepworth et al. 2001). Since that time an aggressive effort has been made to expand these remnant populations through nonnative trout removal and create new populations through nonnative trout removal and/or CRCT reintroduction. As with BCT, CRCT are often found, or have been reintroduced, to streams with marginal habitat; therefore, occupied habitat varies annually with climatic conditions.

UDWR and the Forest cooperatively monitor Forest CRCT populations on an approximately 7-year interval. Monitoring on all Forest conservation populations of CRCT occurred in 2006-2007. This monitoring showed that the current occupied habitat in the Forest is approximately 34.6 miles in 7 streams in the Escalante River drainage and one stream in the Fremont River drainage (Table 15; Hadley et al. 2008). This represents over a 4-fold increase in occupied habitat since the 5 remnant populations were discovered. Conservation populations also occupy 16.5 acres of lake on the Forest (Table 16). As with BCT sport fishing populations of CRCT have been stocked in several other lakes on the Forest.

Table 15. Miles of stream habitat on the Dixie National Forest habitat occupied by conservation populations of CRCT during 2006-2007 monitoring efforts, at their maximum observed distribution, and miles of potential perennial habitat in existing CRCT stream or streams currently planned for restoration (Hadley et al. 2008).

Stream	Ranger District	2006-2007 occupied habitat	Known maximum occupied habitat	Potential habitat
Pine Creek	Fremont River	7.7	7.7	7.7
Water Canyon Creek	Escalante	3.0	3.0	3.0
Twitchell Creek	Escalante	2.2	2.2	3.4
White Creek	Escalante	1.7	1.7	1.7
West Branch Pine Creek	Escalante	2.5	2.5	2.5
Pine Creek	Escalante	6.8	6.8	6.8
West Fork Boulder Creek	Escalante	6.9	6.9	7.1
East Fork Boulder Creek	Escalante	3.8	3.8	7.7
Boulder Creek	Escalante	0	0	0.5
Total		34.6	34.6	40.4

Projects to increase and improve habitat for CRCT are continually planned and implemented. A project to renovate EF Boulder Creek (~ 7.2 miles) and small portions of Boulder Creek (~ 0.5 miles) and WF Boulder Creek (~ 0.25 miles) is currently in the planning process. If this action is completed, Short Lake (1.7 acres) would become a conservation population. This and future habitat restoration and fish reintroduction projects should increase CRCT abundance and occupied habitat on the Forest.

Table 16. Acres of lake habitat on the DNF occupied by conservation populations of CRCT.

Lake	Ranger District	Habitat acres
Dougherty Basin Lake	Escalante	2.8
Long Willow Bottom	Escalante	2.9
Round Willow Bottom	Escalante	7.1
Tall Four Reservoir	Escalante	0.7
Pine Creek Reservoir	Fremont River	3.0
Total		16.5

According to the Hydrology Report, streamflow in most of the project area is spatially and temporally intermittent. There are two perennial streams located within the project area. Both streams are spatially intermittent. There are no fish bearing streams within the project area. North Creek is the closest fish bearing stream downstream of the project area and it is approximately one stream mile away.

Effects of the No Action

No activities will occur in the project area and therefore there will be no effects to the Colorado cutthroat trout.

Effects of All Action Alternatives

There are no fish bearing streams within the project area, therefore, there will be no direct effects to fish. The Hydrology Report states, "Nearly all of the perennial stream segments within the project boundary are located in meadows away from trees and their shade zone." As described in the report, the small perennial segments will not be treated. The Soils Report states that detrimental soil displacement from proposed activities is very minimal and expected to stay the same through the implementation. Finally, the Hydrology Report states that stream turbidity and suspended sediment is unlikely to be measurably impacted. There will be no indirect effects to fish from proposed activities. Since there are no direct or indirect effects there will be no effects to Forest-wide populations.

Flammulated Owl *(Otus flammeolus)*

The flammulated owl is listed by the Forest Service as a Region 4 sensitive species (Rodriguez et al. 2012). It has a high preference for mature and old growth ponderosa pine and/or Douglas fir with open canopies in addition to habitat with dense foliage for roosting. High preference for these areas has been correlated with the high prey diversity and the structure of these forests (Hayward and Verner 1994). However, they have also been found in quaking aspen (Reynolds and Linkhart 1987b), fir, and remnant cottonwood groves (Rodriguez et al. 2012). In such situations, the aspen, cottonwoods, and firs are generally mixed with pine (Reynolds and Linkhart 1987b; Rodriguez et al. 2012). Hayward and Verner (1994) documented the preference for open ponderosa pine for foraging and nesting and the use of dense vegetation and the near absence from dense forest types for foraging. Goggans (1985) documented use of open, multilayered canopies for nesting and foraging and dense, multilayered stands for roosting. Use of dense nesting habitat has been reported in aspen stands in Douglas fir forest without other pines present and Gambel oak-ponderosa pine forest with high oak densities (Rodriguez et al. 2012). The project does not contain these two habitat types that may provide suitable nesting habitat.

Flammulated owls are insectivorous, preying almost entirely on moths, but they will also eat spiders, grasshoppers, crickets, beetles, and numerous lepidopteran larvae (Reynolds et al. 1989). They are also strictly nocturnal. Flammulated owls usually forage in forested stands of low to medium stem density (Hayward and Verner 1994). Open forested habitat allows for more grass and shrub growth, which provides habitat for arthropods (prey) (Hayward and Verner 1994; Reynolds and Linkhart 1992; Reynolds and Linkhart 1987b). Reynolds and Linkhart (1987b) states, "…there are up to 4-times as many lepidopteran species associated with ponderosa pine or Douglas-fir than with other common western conifers…." Also, at least three foraging tactics (hawking, hover-gleaning, and hawk-gleaning) require open habitat (Reynolds and Linkhart 1987b). Hayward and Verner (1994)

states "… the elevational limits of the species may be determined by the availability of prey species…." Forest/grassland edge had the highest foraging preference compared to all forests and grassland (Hayward and Verner 1994). According to Hayward and Verner, "…interior and exterior edge seem to be desirable if not necessary."

Use of the project area by the flammulated owl is low due to the lack of suitable habitat as described in the two previous paragraphs. It is highly unlikely the owl would be found in the spruce-fir due to the lack of use in this forest type, and the elevation restricting prey availability. The most likely area of use would be aspen habitat, especially along meadow openings. However, use would be very limited. This assessment is consistent with observations made in the Barney Top Project Area which is located on the District. The Barney Top Project Area contains the same spruce/fir, aspen, and meadow vegetation types and is within the same elevational ranges as the Iron Springs Project Area. A survey was conducted for the flammulated owl in areas where the species was most likely to be present; interior/exterior forest/grassland edge. No owls were detected. In addition, during Mexican spotted owl surveys of approximately 22,540 acres, most of which is on top of the plateau, five flammulated owl responses were documented on the plateau top (see Appendix A.1). Four of these responses were located in aspen clones and one was located in an aspen clone that was being encroached by conifer. Two of the owls were located along a meadow opening. These detections were response calls, not identified nesting trees. It is my determination due to the high elevation and the lack of preferred habitat as described above, that it is likely that these owls were not nesting. As noted in Reynolds (1987), one likely reason responding males were unpaired was the quality of their territory. Reynolds and Linkhart (1987a) stated, "Young males attempting to establish territories for the first time may be forced to occupy less suitable habitat …" In addition, male presence is not always an indicator of suitable habitat because many males remain unmated (McCallum et al. 1995). Surveys for the flammulated owl were conducted in 2012. The survey focused on areas proposed for aspen regeneration and cleaning treatments under the Iron Springs project but also included spruce-fir stands. No flammulated owls were detected thus supporting the disclosed statements above regarding lack of use due to lack of suitable habitat.

Aspen clones within the project area are seral stands within the subalpine fir potential vegetation type (Graham et al. 1999). These stands are being invaded by conifer, and exhibit a lack of regeneration and changes to the understory vegetation (Orlemann 2012c). In addition to these aspen clones within the spruce/fir, there are approximately 256 acres of the aspen vegetation type in the project area. In 2012, surveys were conducted for the flammulated owl in all proposed aspen cleaning and aspen regeneration treatments. No flammulated owls were detected.

Flammulated owl surveys have been conducted on the Dixie National Forest along with Mexican spotted owl surveys, which detected numerous flammulated owls across the Forest. The Forest contains approximately 472,635 acres of potentially suitable habitat (Rodriguez et al. 2012). The project area has 256 acres of aspen that is potentially suitable habitat for the owl, which is approximately 0.05 percent of the potentially suitable habitat on the Forest.

Cumulative Effects Area

The cumulative effects area (CEA) for the flammulated owl is the high elevation spruce-fir, aspen, and associated meadows contained within the three HUC 6 watersheds that are a part of the Iron Springs project area (see Appendix B.3). These three watersheds include Coyote Hollow-Antimony Creek, North Creek, and Upper North Creek. Cumulative effects will not occur beyond the CEA. This high-elevation community is consistent with the use of the project area and effects will be consistent across this marginal habitat for the flammulated owl. Habitat located at lower elevations were not included in the CEA because use of these areas by the species would not be consistent with

the use of the project area (i.e., marginal habitat). Occurrences of the flammulated owl will be low in the CEA. Appendix A.2 shows the flammulated owl responses on the entire plateau top during Mexican spotted owl surveys from 1990-1995, indicating this low occurrence. Aspen treatments that have or will occur beyond the proposed project activities but are within the CEA are: Coyote Hollow (65 acres), Pacer (19 acres), Lost Spring (33 acres), and Pockets (783 acres), (Orlemann 2012c). This is a total of approximately 900 acres. This is 2 percent of the cumulative effects area. Spruce/fir thinning projects within the CEA include: Coyote Hollow (2,029 acres) and Pacer (1,863 acres). This is 9 percent of the CEA. Together, the aspen and spruce/fir treatments total approximately 4,792 acres or 11 percent of the CEA. Other activities including grazing allotments, recreation, fuel wood gathering, Christmas tree cutting, and pole collection were also considered in this analysis.

Direct & Indirect Effects of the No Action

As discussed above, use of the project area by the flammulated owl is low due to existing conditions described above. While a reduction in suitable habitat is expected to occur over time as aspen is replaced by conifers, effects will not be detectable or measureable due to the low use of this area by the species. These undetectable and unmeasureable effects will not affect Forest-wide populations.

Direct & Indirect Effects of the Proposed Action

As discussed above, use of the project area by the flammulated owl will be low due to existing conditions as discussed above. There will be no direct effects to foraging individuals from project activities because the owl is strictly nocturnal and foraging would not occur during operations.

Openings created by logging in the spruce-fir type would increase quantity and quality of understory vegetation (Alexander 1987). This increase in vegetation growth provides habitat for arthropods (prey) for the owl (Hayward and Verner 1994; Reynolds and Linkhart 1992; Reynolds and Linkhart 1987b), and would increase prey availability in adjacent aspen stands. Therefore, proposed harvesting and pre-commercial thinning in the spruce-fir habitat will improve prey availability and increase foraging opportunities.

Although use of the project area is low, the species will most likely use aspen habitat. The proposed 388 acres of aspen weeding of aspen clones within spruce/fir stands which includes hand felling of conifer would improve habitat for the owl by retaining seral aspen stands and improving the openness of the stand. The 152 acres of aspen regeneration harvest would cause temporary negative effects by removing suitable nesting habitat. The 152 acres of the 256 total aspen acres represents 59 percent of the available aspen vegetation type in the project area. Temporary negative effects to nesting habitat would last approximately 40 years before a middle aged aspen stand develops. There will be beneficial effects from the increase in forest/grassland edge, the highest preference of foraging habitat for the species as documented by Hayward and Verner (1994). There will also be long-term benefits because aspen habitat will be maintained. Both beneficial and temporary negative effects will be minor because use of the project area by this species is low.

Effects to the owl from road activities include the removal of aspen habitat during construction of the new roads and will result in the loss of nesting habitat and the increase of edge foraging habitat. The amount of habitat affected will be minor due to the small area of road construction through aspen stands.

In conclusion, harvesting in the spruce-fir will improve prey availability and increase foraging opportunities. Cleaning in the aspen would improve habitat by retaining seral aspen stands and improving forest stand openness. Approximately 152 acres of aspen regeneration would cause

temporary negative effects by removing suitable nesting habitat, but would increase preferred foraging habitat in the form of forest/grassland edge. A minor amount of habitat will be lost in the aspen vegetation type from road construction. While these are effects to prey and habitat, effects to the species will be minor due to the low occurrence in marginal habitat. These minor effects combined with the minute amount of potentially suitable habitat on the Forest being affected will not affect Forest-wide populations.

Cumulative Effects of the Proposed Action

Cumulative effects are expected to be minor within the CEA. Harvesting in the spruce-fir would have and will improve prey availability and increase foraging opportunities. Aspen regeneration treatments have and will cause temporary negative effects by removing potentially suitable nesting habitat, but would have and will provide positive effects in the long term by maintaining aspen and increasing preferred foraging habitat. Together, the aspen and spruce/fir treatments total approximately 4,792 acres or 11 percent of the CEA. Other effects from livestock grazing, recreation, and other activities in the CEA will be minor due to low occurrences of the owl.

In summary, cumulative effects to the species will be minor due to the low occurrence in marginal habitat and the small area of treatment in relation to the available habitat. The project area consists of approximately 0.05 percent of the potentially suitable habitat on the Forest. Aspen and spruce/fir thinning treatments that have or will occur beyond the proposed project activities but are within the CEA consists of approximately 1 percent of the potentially suitable habitat on the Forest. The small percentage of acres affected in the CEA in combination with these minor effects will not affect Forest-wide populations.

Effects of Alternative A

Although some differences exist between the Proposed Action and Alternative A, such as a reduction in acres of commercial and pre-commercial conifer thinning and the minor amount of habitat lost from road reconstruction, effects to the flammulated owl for Alternative A will be the same as those of the Proposed Action. This is due to the low occurrence of the species in marginal habitat.

Cumulative Effects of Alternative A

Cumulative effects will be the same as the cumulative effects for the Proposed Action because of the low species occurrence in marginal habitat.

Greater Sage-grouse *(Centrocercus urophasianus)*

Meadows containing sagebrush within the project area primarily consist of interior meadows within forested habitat and are separated from the Coyote Hollow area which contains suitable habitat and sage-grouse. Therefore, the project area is not suitable habitat for the species. This species is not discussed further in this document due to the lack of suitable habitat within the project area.

Northern Goshawk *(Accipiter gentiles)*

The northern goshawk uses habitat ranging from Engelmann spruce and subalpine fir to pinyon-juniper/grasslands. A wide variety of forest types are utilized for nesting (Graham et al. 1999).

Goshawks generally nest in areas of high canopy closure, typically 60 percent or greater (Rodriguez et al. 2012). Nests are often located close to water and adjacent to a canopy break (Graham et al. 1999).

Goshawks prefer to forage in closed canopy forests with moderate tree densities. Prey is also taken from openings and these areas are usually hunted from perches near the edge. Prey items taken during the breeding season include medium to large-sized birds such as woodpeckers, robins, grouse, or jays, and mammals such as ground and tree squirrels and hares. Goshawks are opportunists and are able to adapt their diet to whatever species are abundant in a given habitat and year (Graham et al. 1999).

The northern goshawk forest plan amendment provides programmatic management direction for the northern goshawk. The goshawk amendment was designed to maintain and restore goshawk habitat at risk, and to minimize adverse effects of forest management on goshawk habitat. The amendment also emphasizes management of plant communities important for goshawk prey species (USDA 2000a; DN/FONSI, p 2). Included in this management direction are standards and guidelines for vegetative management treatments. According to the amendment, vegetative management treatments should provide for a full range of seral stages, and maintain or enhance mature and/or old structural stages if existing condition is at or below the desired percentage (USDA 2000b, p CC-21). The purpose and need of the project complies with these requirements of the goshawk amendment. The project will (1) perpetuate aspen presence within the spruce and fir-dominated forest, (2) restore the distribution and balance in age-class for aspen clones, (3) improve the balance of age class distribution in spruce/fir stands, and (3) maintain old-growth characteristics (Iron Springs Notice and Opportunity to Comment).

The forest plan was amended in 2000 to incorporate the Utah Northern Goshawk project. The amendment recognizes both management recommendations from Reynolds et al. (1992), who conducts the most long term goshawk study in Arizona, as well as those of Graham et al. (1999), who completed a goshawk habitat assessment for Utah and developed management recommendations specifically for Utah. In adopting the amendment, the forest service found that both the Reynolds et al. (1992) and Graham et al. (1999) recommendations to be the most appropriate for managing goshawk habitat on national forest system lands in Utah. The Dixie LRMP amendment of 2000 still represents the best available science for the Northern goshawk in Utah. This science includes: the Conservation Strategy and Agreement for the Management of Northern Goshawk Habitat in Utah (Utah National Forests et al. 1998), Management Recommendations for the Northern Goshawk in the Southwestern United States (Reynolds et al. 1992), and the Habitat Assessment and Management Recommendations for Utah (Graham et al. 1999).

There are three distinct components of a goshawks' nesting home range: nest area, post fledging-family area (PFA), and foraging area. The nest area encompasses all movements and behaviors associated with breeding. The PFA corresponds to the defended area of a goshawk pair. This area contains the concentrated use of the goshawk family from the time the young leave the nest until they are no longer dependent on the adults for food. The foraging area provides hunting opportunities for goshawks (Reynolds et al. 1992).

Surveys have been conducted in the project area in 1997, 2000-2006, and 2008-2012. One goshawk home range (territory) was identified during this survey work. Another territory was identified in 2001 by another crew. These two territories; Griffin Springs and Grass Lakes, are the only ones found in the project area. The Griffin Springs and Grass Lakes territories were last active in 2012 and 2008, respectively. Goshawk reproduction on the Dixie National Forest is tied to prey abundance. Goshawk activity showed a statistical relationship with climatic factors including maximum temperature and total precipitation. It has been determined the goshawk will continue to persist

across the Forest and increase in distribution and density (Rodriguez et al. 2012). There are approximately 654,473 acres of potentially suitable habitat on the Forest (Rodriguez et al. 2008). The forested acres in the project area consist of approximately 0.8 percent of the potentially suitable habitat on the Forest.

The Grass Lakes territory is made up of a 190-acre nest area, approximately 90 acres of which are in the project area; a 443-acre post-fledgling area, approximately 426 acres of which are in the project area; and a 5,600-acre foraging area, approximately 1,390 acres of which are in the project area. The Griffin Springs territory is made up of a 208-acre nest area, which is completely within the project area; a 492-acre post-fledgling area, approximately 444 acres of which are within the project area; and a 5,730-acre foraging area, approximately 2,924 acres of which are within the project area.

Each of the forest stands associated with these territories was analyzed for six vegetation structural stages (VSS) classes and canopy cover (Reynolds et al. 1992) using stand exam data. A vegetation structural stage is a description of forest growth and aging stages based on a specific diameter distribution of a stand. Table 17 shows a description of VSS classes and Table 18 shows the current VSS class distribution of the project area which also applies to the goshawk territories within the project area with the exception of the Grass Lakes nest area. According to the stand exam data, this nest area is made up of VSS 3 and 4 but is VSS 4 dominant.

Table 17. Properly functioning condition (PFC) structures and vegetation structural stages (VSS).

PFC Description	VSS Class	Diameter Range in Inches
Grass/forb/shrub	1	0.0 – 0.9
Seedling/sapling	2	1.0 – 4.9
Young forest	3	5.0 – 11.9
Mid-aged forest	4	12.0 – 17.9
Mature forest	5	18.0 – 23.9
Old forest	6	24.0+

Table 18. Current Iron Springs project area vegetation structural stage class distribution.

VSS 1	VSS 2	VSS 3	VSS 4	VSS 5	VSS 6
0%	0%	86%	14%	0%	0%

(Orlemann 2012b)

The desired VSS distribution described by Reynolds et al. (1992) for nest areas is 0-0-0-0-0-100, and for both post fledgling and foraging areas it is 10-10-20-20-20-20. This VSS distribution is desired because goshawks prefer to nest in older-aged stands and a variety of structural stages is needed to provide a diversity of habitat for goshawks and their many prey species (Reynolds et al., 1992). Stands associated with goshawk territories within the Iron Springs area are made up primarily of VSS classes 3 and 4. Goshawk guidelines direct that stands are to be classified as to VSS class using the "dominant" material in the stand by basal area. Un-even aged stands in the project area contain components of the other VSS classes, but they are not dominant. Generally, the project area is not

lacking in VSS classes 1 through 4. Field reconnaissance demonstrated sufficient clumps and patches of regeneration throughout the stands (Orlemann 2012c).

Because spruce beetle populations have been increasing to outbreak or epidemic levels the largest sized spruce individuals and groups have been affected. This has resulted in the reduction or elimination of large diameter spruce. Some spruce stands in the project area have experienced almost complete overstory mortality due to the recent spruce beetle epidemic. On the Aquarius Plateau, spruce beetle mortality is highest in clumps of large trees (Orlemann 2012c). Older age classes contain the most species at an abundant population level. Because large trees provide important habitat for goshawk nesting and prey (Reynolds et al. 1992), a continued reduction of this key habitat component will result in negative effects for the species.

Aspen clones within the project area are seral stands within the subalpine fir potential vegetation type (Graham et al. 1999). These stands are being invaded by conifer, and exhibit a lack of regeneration and changes to the understory vegetation (Orlemann 2012c). Management Recommendations for the goshawk identify aspen as one of the most important vegetation types for the goshawk in Utah, and predicts adverse impacts to the goshawk if the decline of aspen continues in the subalpine fir potential vegetation type (Graham et al. 1999).

The Fire and Fuels Report estimate the dead and downed woody debris at averages of 15-20 tons/acre within the aspen, 20-30 tons/acre in the mixed aspen/spruce-fir, and 35-40 tons/acre in the spruce-fir stands in the project area. The snag report (Orlemann 2011a) also demonstrates we are currently meeting the forest plan requirements in the project area.

Cumulative Effects Area (CEA)

The CEA for the goshawk is the complete home range of both the Griffin Springs and Grass Lakes Territories including the meadows within these territories (see Appendix B.4). This area was selected because the analysis for the proposed activities considered the direct and indirect effects to these territories in the project area. An analysis of cumulative effects must consider the complete territory. Past, present, and reasonably foreseeable future actions included in the cumulative effects analysis are shown on the CEA map. Other activities including grazing, recreation, fuel wood gathering, Christmas tree cutting, and pole collection were also considered in this analysis.

The cumulative effects area analyzed in the vegetation report (Orlemann 2012c) is the three HUC 6 watersheds that are a part of the project area. There are some differences between the CEA for the goshawk in this report and that found in Orlemann. An evaluation of these differences including the examination of stand exam data and elevational and vegetation type similarities showed there should be very little if any difference between effects described for the two CEAs (Orlemann 2011b). Aspen cleaning and regeneration treatments and spruce/fir thinning and sanitation/salvage treatments within the CEA are found in Table 19.

Table 19. Spruce/fir and aspen silvicultural treatments within the cumulative effects area for the northern goshawk.

Project	Treatment	Approximate Acres w/in CEA (percent of CEA)
Black Forest/Velvet Lake Salvage & Timber Sales	Salvage of dead Fuelwood and spruce/fir timber harvest	63 (0 percent)

Table 19 (continued). Spruce/fir and aspen silvicultural treatments within the cumulative effects area for the northern goshawk.

Project	Treatment	Approximate Acres w/in CEA (percent of CEA)
Bug Lake Salvage	Salvage 220 acres of dead spruce	220 (1 percent)
Coyote Hollow	Aspen patch cuts are NOT within the CEA boundary. Includes spruce/fir selection harvest	111 (1 percent)
Pacer	Aspen patch cuts are NOT within the CEA boundary. Includes spruce/fir selection harvest	182 (1 percent)
Pacer Amendment	Additional sanitation/salvage on same acres	N/A
Iron Springs – No Action		N/A
Iron Springs – Proposed Action	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	4,121 (25 percent)
Iron Springs – Alternative A	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	2,213 (14 percent)
Total – No Action		**576 (4 percent)**
Total – Proposed Action		**4,697 (29 percent)**
Total – Alternative A		**2,789 (17 percent)**

Direct & Indirect Effects of the No Action

Under the no action alternative, Engelmann spruce and subalpine fir will continue growing into aspen stands, replacing the aspen if left undisturbed (Orlemann 2012c). Management Recommendations for the goshawk identify aspen as one of the most important vegetation types for the goshawk in Utah, and predicts adverse impacts to the goshawk if the decline of aspen continues in the subalpine fir potential vegetation type (Graham et al. 1999). A continued loss of aspen will cause a decrease in the quality of available habitat in the project area, which will in turn result in a decrease in use of the project area.

The current trend in the Engelmann spruce/subalpine fir vegetation type is for subalpine fir to become dominant at the expense of Engelmann spruce. Larger-sized subalpine fir would not advance substantially into the next size classes because of their early maturity and susceptibility to insect and disease. Size class diversity would continue to decrease as the older and larger trees continue to succumb to spruce beetle-induced mortality. The loss of the larger-diameter spruce would continue to move stand conditions away from the long-term goal of creating and maintaining a diversity of size classes to include 40 percent mature and old forest. This will result in the degradation of habitat for the goshawk and selected prey species (Graham et al. 1999) and consequential decrease in use of the area by the goshawk.

The No Action alternative does nothing to maintain or restore habitat for goshawk or its prey. The management recommendations found in Graham et al. (1999), state, “Numbers and distribution of

large trees in the landscape should be increased." Older age classes contain the most species with an abundant population level of prey (Reynolds et al. 1992). The no action would have negative effects on the goshawk and its prey as a result of moving the area away from desired forest conditions (USDA Forest Service 2000b; Reynolds et al. 1992). The deficiency in the desired VSS distribution will decrease principal prey and use of the project area by goshawks.

In conclusion, the No Action will move the project area away from desired forest conditions for sustaining the northern goshawk and its principal prey species. This will cause the habitat in the project area to become less suitable for goshawk and their prey, resulting in a decrease in use of the area by goshawks. Although the No Action results in long-term negative effects for the goshawk, it will not affect population trends on the Forest. This is due to the small proportion (0.8 percent) of forested habitat in the project area compared to the amount of potentially suitable habitat across the forest, and the stability and persistence of meta-populations across the Forest (Rodriguez et al. 2008; Rodriguez et al. 2012).

Cumulative Effects of the No Action

The Grass Lakes and Griffin Springs territories mostly consist of spruce/fir with some aspen on top of the plateau, and aspen and mixed conifer below the rim. Generally, conifer stands are uneven-aged, overstocked in the VSS 3-4 size classes, and understocked in the VSS 5 and 6. According to Orlemann (2012c), conditions across the CEA are very similar to those within the project area. Sampling of additional forest stands within the goshawk territories outside the project area show stands are primarily comprised of VSS classes 3 and 4 (see Table 20).

Table 20. Iron Springs cumulative effects area by vegetative structural stage class under no action.

Cumulative Effects Area	VSS class (percent)					
	1	2	3	4	5	6
Dominant VSS Class	0	0	93	7	0	0

(Orlemann 2012c)

Untreated spruce/fir across the CEA is likely to lose mature and old forest components. Also, VSS classes 5 and 6 are likely to continue to decline (Orlemann 2012c). The loss of the larger-diameter spruce would continue to move stand conditions away from the long-term goal of creating and maintaining a diversity of size classes to include 40 percent mature and old forest. This will result in the degradation of habitat for the goshawk and selected prey species (Graham et al. 1999) and consequential decrease in use of the CEA.

There are no aspen regeneration and cleaning treatments planned in the CEA with the implementation of the no action (see Table 8). A continued loss of aspen will cause a decrease in the quality of available habitat in the project area, which will in turn result in a decrease in use of the CEA.

Fuelwood and pole collections have minimal impacts on the goshawk and its home range. Fuelwood removal takes smaller snags than those desirable for habitat (>18 inch DBH), and it is limited to areas adjacent to roads. Pole collections remove minor amounts of VSS 3, which currently exceeds desirable levels.

According to the Fuel Loadings discussion found in the Fire and Fuels Report, seedling, sapling and down woody debris densities exceed historical levels in all untreated vegetation types. Ladder fuels found in the area significantly increase the potential for crown fire initiation. In addition, as mortality

increases from spruce beetles and trees fall, this will result in increased dead and down woody debris. This will result in the increased potential for fire control difficulties and high intensity stand replacing fire situations. This increases the risk of substantial loss of home range and suitable habitat.

The cumulative effects of the No Action will continue the trend away from desired forest conditions for sustaining the northern goshawk and its principal prey species. Only 576 acres or 4 percent of the CEA has been treated under the No Action (see Table 8). Large sized spruce will be lost and aspen stands will eventually be replaced by conifer, increasing conifer dominance in the CEA, decreasing the long-term sustainability of large diameter trees, and increasing the extent of spruce mortality in the CEA. Also, there will be an increased risk of substantial loss of home range, suitable habitat, and prey as the risk of high intensity stand replacement fire increases. The cumulative effects of the No Action decreases suitable habitat and the availability of prey and will decrease the use of the two territories as foraging habitat, and will likely discontinue nesting use. Since (1) the goshawk is persistent and population numbers are likely to increase in distribution and density (Rodriguez et al., 2012), (2) the discontinued nesting use will occur on only two territories that are not consistently active, and (3) the forested habitat of the CEA consists of a very small proportion (2 percent) of the potentially suitable habitat across the Forest, these effects will not affect population trends on the Forest.

Direct & Indirect Effects of the Proposed Action

The proposed action is consistent with the Dixie LRMP amendment of 2000 (see Appendix D), and management recommendations found in Graham et al. (1999) and Reynolds et al. (1992). The proposed action will improve post-fledging areas, foraging opportunities, and increase goshawk sustainability and prey availability, thereby resulting in an overall improvement of the existing goshawk habitat in the project area. This is supported in the following analysis.

A properly functioning system incorporates all of the attributes important for the goshawk and its prey in foraging areas and general home ranges (Graham et al. 1999). The proposed treatments are designed to move existing conditions toward Properly Functioning Condition (PFC). Management objectives for foraging habitat include providing quality habitat for goshawk habitat and conditions that enhance foraging opportunities (Reynolds et al. 1992). Moving the area towards PFC, will sustain goshawks associated with the project area and enhance foraging opportunities. Wildlife Project Design Criteria that will be implemented and will protect and benefit the northern goshawk and its habitat and prey include WL- 1, 3, 4, 9, and 10.

Part of the purpose of the proposed action for the Engelmann spruce/subalpine fir component of the forest is to improve the balance of age class distribution, decrease stand densities, and perpetuate aspen presence within the spruce and fir-dominated forest. This would create stand conditions that do not promote spruce beetles or disease and would increase the long-term sustainability of large-diameter trees. Related to this purpose, there is a need to maintain old-growth characteristics by increasing species mix, density, and size of residual trees in old-growth stands to reduce stand risk rating factors and bark beetle populations (Iron Springs—Notice and Opportunity to Comment, DNF 2011). Both Graham et al. (1999) and Reynolds et al. (1992) management recommendations promote and emphasize maintenance of large trees or older age classes. Since treatments in spruce/fir include thinning and salvage and not regeneration harvest, opening size requirements will be met.

For the Grass Lakes 443-acre PFA, there is 426 acres in the project area. Of this, 154 acres would be thinned. There are 1,390 acres of the Grass Lakes foraging area in the project area boundary. The proposed action would treat 1,080 acres. For the Griffin Springs 492-acre PFA, there is 444 acres in the project area. Of this, 356 acres will be treated. Of the 2,924 acres of foraging area in the Griffin Springs territory within the project area boundary, 2,474 acres are proposed for treatment under the

proposed action. The proposed action does not treat in either of the goshawk nest areas. The potential effects of the proposed action in these stands are similar to those described under the no action alternative. Table 21 shows the results of the proposed action on VSS classes in the project area. Proposed treatments will move the balance of VSS classes toward the larger sizes (VSS 4-5) and away from the dominant VSS 3 resulting in moving the landscape toward the desired condition (Reynolds et al. 1992).

Table 21. Properly functioning condition structures and vegetation structural stages for Iron Springs under the proposed action.

PFC Description	VSS Class	Diameter Range in Inches	Current Condition of Iron Springs Treatment Areas (percent)	Structure of Treatment Areas after Implementation of the Proposed Action (percent)
Grass/forb/shrub	1	0.0 – 0.9	0	0
Seedling/sapling	2	1.0 – 4.9	0	0
Young forest	3	5.0 – 11.9	86	23
Mid-aged forest	4	12.0 – 17.9	14	72
Mature forest	5	18.0 – 23.9	0	6
Old forest	6	24.0+	0	0

(Orlemann 2012c)

The aspen regeneration cuts under the proposed action will create VSS 1 conditions on approximately 150 acres (~3 percent of the project area). As is noted above, however, the Reynolds method of designating
VSS classes requires selecting the "dominant" material based on basal area at breast height (4.5 feet). By this methodology, then, areas in VSS 1 generally will have little to no measurable basal area because the trees will not have a DBH (Orlemann 2012c).

Of the 256 acres of aspen stands in the project area, approximately 152 acres would receive commercial clear-fell coppice treatment designed to regenerate aspen. Individual regeneration acres will be limited to 40 acres, or the size of the clone, whichever is smaller. No clear-fell coppice treatments occur within nest areas or post-fledging family areas. The size of the openings created by this treatment will temporarily reduce suitable foraging habitat until stocking levels are restored (Reynolds et al. 1992). During restoration, regeneration areas including forest edges may still be utilized for foraging by goshawks but would not be included in calculating the foraging area acres (Reynolds et al. 1992). These treatments will benefit the species in the long-term by retaining important habitat for prey species (Graham et al. 1999).

For the purpose of defining home ranges for the northern goshawk based on ecological principles, Reynolds et al (1992) describes desired conditions for all forest types. Reynolds defines the desired condition for openings and does not restrict the creation of large openings within the foraging area and post-fledging family area (PFA), but states that created openings that are greater than 2 acres in the PFA and 4 acres in the foraging area should not be counted as part of the designated 420 acre PFA or 5,400 acre foraging area. The proposed activities within the Iron Springs Project are consistent with this best available science. Created openings greater than 4 acres in the foraging area will not be counted towards the defined home range of either of the two goshawk territories. No new openings are prescribed in the two PFAs. Foraging area acreage consistent with Reynolds et al. (1992) will be maintained on the two goshawk territories that occur in the project area.

Recommendations for the subalpine fir potential vegetation type include the development of early seral species (Graham et al. 1999). Part of the purpose of the proposed action for the aspen component of the forest is to restore both the distribution and balance of the age-classes for seral aspen clones. Approximately 388 acres of scattered aspen clones within spruce/fir stands would receive aspen cleaning through hand felling of conifer. Commercial-size conifer would be removed; non-commercial-size conifer and some aspen would be cut and left on site to discourage browsing by larger ungulates, primarily deer, elk, and livestock. Managing for greater aspen within the conifer stands would result in fewer impacts from spruce beetle mortality. USDA Forest Service (1999) states that forest changes including forests that are now dominated by mid- to late successional species instead of early successional species are suspected to result in a decline of goshawk populations. As a result of proposed treatments, aspen will not be replaced by conifer, and a mixture of aspen will be retained throughout the project area, thereby reducing the risk of a decline in goshawk use of the project area.

Salvage/sanitation would first remove spruce trees infected with spruce beetles. Dead spruce trees exceeding snag retention objectives will be removed, thereby reducing existing diversity and density of snags. However, the remaining snags meet goshawk habitat requirements. Snag retention requirements will satisfy old growth and goshawk guidelines, thereby meeting the needs of prey species that utilize snag habitat (Goshawk Amendment DNF LRMP, CC-21).

Commercial thinning activities would result in the reduction of the percentage of basal area in the smaller size classes, concentrating the remaining basal area in the mid-aged, mature, and old forest structures thereby promoting increased diameter growth and vigor of residual trees. Pre-commercial thinning would reduce the subalpine fir component. Large remaining trees will respond to the thinning with increased growth rates thereby redistributing growth potential to the most desirable trees (Orlemann 2012c). Thinning and the consequential increase in growth rates will improve habitat and move it towards the desired forest condition for sustaining the northern goshawk and its principal prey species as suggested by Reynolds et al. (1992). The desired VSS distribution is consistent with the management of goshawk foraging habitat requirements (Reynolds et al. 1992; USDA Forest Service 2000b). The proposed thinning action will improve foraging habitat and increase prey availability in most stands.

The East Velvet goshawk territory contains the same habitat type as the project area. The nest area is approximately 2 miles from the Iron Springs project area. The first nest was found during logging operations for the Black Forest/Velvet Lake Salvage. The Velvet Lake timber sale which included spruce/fir harvest had already been implemented and had occurred throughout the current designated nest area. This territory continues to be active and occupied, and new nests continue to be found (see Table 22). This nesting activity supports the effects disclosed, specifically that goshawks can continue to successfully breed and utilize their territories during and after these types of harvest activities have been implemented.

Table 22. East Velvet Northern Goshawk Nesting Activity (from 1998 through 2012).

Year	**'98**	**'99**	**'00**	**'01**	**'02**	**'03**	**'04**	**'05**	**'06**	**'07**	**'08**	**'09**	**'10**	**'11**	**'12**
Presence*	X	X	X		X	X	X	X			X		X	X	X
New Nest Found	X	X						X			X	X			

*Presence includes active and occupied status of the nest area.

Approximately 36.16 miles of existing National Forest System roads would be used as haul roads. Construction of 9.61 miles of new low-standard temporary roads is proposed, including 0.76 miles of temporary road needed to access an old dike and a borrow pit. It may be possible to access the dike on frozen ground or over snow, alleviating the need for road construction. Following the completion of the project, these temporary roads would be decommissioned and removed from service. During hauling activities, foraging individuals would not be utilizing the road prism and would disperse to other foraging habitat. This disturbance would be short-term lasting only during the duration of this project. Proposed harvest activities will also cause goshawk individuals to disperse to other foraging areas where activities are not occurring. Project Design Criteria WL-9 will protect fledging birds from being disturbed in the PFA during activities.

In summary, the proposed action is consistent with the forest plan and the goshawk management recommendations. Moving the project area towards PFC will increase the sustainability of goshawks associated with the area and enhance foraging opportunities. Aspen regeneration treatments greater than 4 acres will temporarily reduce suitable foraging habitat but will provide long-term benefits by retaining this important habitat for the goshawk and its prey. While these openings will not be counted towards suitable habitat, foraging area acreage consistent with Reynolds et al. (1992) will be maintained. The removing of conifer from 388 acres of aspen clones will reduce the risk of a decline in goshawk use of the project area. Snag requirements found in the goshawk forest plan amendment will be met, thereby meeting the needs of prey species. Commercial thinning will promote increased diameter growth, improving habitat for the species. Road use and harvesting activities will result in goshawk dispersal to other foraging habitat. Decommissioning of existing roads will decrease disturbance to foraging individuals in the long-term.

The net increase of benefits is substantially larger than the short-term negative impacts. There will be a higher likelihood of the two territories being occupied than compared to the No Action as a result of these effects. Due to (1) these effects described, (2) the small proportion (0.7 percent) of treated forested habitat in the project area compared to the amount of potentially suitable habitat across the forest, and (3) populations are persisting across the Forest and will continue to increase in distribution and density (Rodriguez et al. 2008; Rodriguez et al. 2012), these effects will not affect population trends on the Forest.

Cumulative Effects of the Proposed Action

The Grass Lakes and Griffin Springs territories generally consist of spruce/fir with some aspen on top of the plateau and aspen and mixed conifer below the rim. Generally, conifer stands are uneven-aged, and overstocked in the VSS 3-4 size classes and understocked in the VSS 5 and 6. The area is not lacking in VSS 1-4. Treatments that move stands towards a condition to improve the proportion of mature and old forest as well as long-term growth increases will move the area toward the desired condition. Conditions in the CEA should be diversified as a result of treatments such as Iron Springs which are designed to protect large-old trees by thinning from below. Thinning has and will improve individual tree vigor and growth and sanitation/salvage has and will result in the removal of infested trees (Orlemann 2012c). Approximately 356 acres of past thinning occurred that would have improved tree vigor and growth and approximately 283 acres of sanitation/salvage that would have removed infested trees (Table 8). These past projects and the Iron Springs project would have and will result in improved habitat for the goshawk and increase prey availability as (1) tree vigor and growth is improved; (2) resiliency to spruce beetle outbreaks is improved; (3) beetle mortality is reduced; and (4) bark beetle populations in local pockets of activity are suppressed (Orlemann 2012c). Some short-term negative effects will occur as a result of disturbance to foraging individuals. However, individuals will disperse to other foraging habitat.

USDA Forest Service (1999) states that forest changes including forests that are now dominated by mid- to late successional species instead of early successional species are suspected to result in a decline of goshawk populations. As a result of proposed treatments, aspen will not be replaced by conifer, and a mixture of aspen will be retained throughout the CEA, thereby reducing the risk of a decline in goshawk use of the CEA. Without the proposed action, there are no aspen treatment projects within the CEA (see Table 8).

The cumulative effect of the treatments proposed under Iron Springs would be to shift some of the stands in the two goshawk territories toward VSS 4 and 5, and eventually toward VSS 6. The three watersheds associated with the project area have and will continue to meet forest plan objectives for old growth (Orlemann 2012c).

Fuelwood and pole collections would have minimal impact on the goshawk and its home range. Fuelwood removal uses snags less than those most desirable for habitat (>18 inch DBH) and is restricted to road access. Pole collections remove minor amounts of VSS 3, which currently exceeds desirable levels.

According to the Fire and Fuels Report, the potential for catastrophic crown fires will be reduced. This decreases the risk of home range and suitable habitat loss. A stand replacement wildfire could still occur, but at a smaller risk than the No Action.

Recreational activities (i.e., sightseeing/driving for pleasure, dispersed camping, hunting, hiking, horseback riding, OHV use, and mountain biking) would also cause goshawks to disperse to other habitat if individuals were present. However, effects would be minor due to the generally low recreational use of the CEA (C. Calbaum, Recreation Staff Officer, personal communication, June 29, 2011).

The net increase of benefits is substantially larger than the short-term negative impacts. There will be a higher likelihood or the two territories being occupied than compared to the No Action as a result of these effects. Due to (1) these effects described, (2) the small proportion (0.7 percent) of treated forested habitat in the project area compared to the amount of potentially suitable habitat across the forest, and (3) populations are persisting across the Forest and will continue to increase in distribution and density (Rodriguez et al. 2008; Rodriguez et al. 2012), these effects will not affect population trends on the Forest.

Direct & Indirect Effects of Alternative A

Effects to the northern goshawk from Alternative A will be similar to the Proposed Action. The primary difference between the proposed action and Alternative A is the reduction in the number of acres proposed for commercial and pre-commercial thinning. Differences in effects will be discussed below.

All of the thinning would be dropped in the PFAs. As a result, the potential effects of these areas will be similar to those described under the no-action. Thinning will be reduced in the two foraging areas. The effect of the proposed action was to develop the balance of VSS classes toward the larger sizes (VSS 4 to 6) and away from the other smaller ones. With the alternative action, fewer acres will be treated, and therefore fewer acres will shift toward the larger size classes (Orlemann 2012c).

Some of the stands that currently qualify as old growth and were planned for thinning under the proposed action would not be treated under this alternative. If the large live trees continue to die at

rates similar to those observed for the last 10 years, an approximately 40 percent decrease in old growth will occur by 2020 (Orlemann 2012c).

The benefits observed under the proposed action will be less under this alternative. Fewer acres will be moving toward Properly Functioning Condition; therefore, suitable nesting habitat, foraging opportunities, and prey availability will not be enhanced as much as the Proposed Action. Due to (1) these effects described, (2) the small proportion (0.7 percent) of treated forested habitat in the project area compared to the amount of potentially suitable habitat across the forest, and (3) populations are persisting across the Forest and will continue to increase in distribution and density (Rodriguez et al. 2008; Rodriguez et al. 2012), these effects will not affect population trends on the Forest.

Cumulative Effects of Alternative A

Cumulative effects of Alternative A are similar to the cumulative effects for the proposed action. As with the proposed action, the cumulative effect of the treatments proposed under Alternative A would be to shift some of the stands in the two goshawk territories toward VSS 4 and 5 stages, and eventually toward VSS 6. This will primarily affect foraging areas, since none of the nest area stands will be treated and only a small area of aspen cleaning will occur in the Grass Lakes PFA. The shift will be relatively minor due to the small areas 766 acres (18 percent) and 1,169 (20 percent), respectively, being treated in the Grass Lakes and Griffin Springs goshawk foraging areas in the CEA under the alternative (Orlemann 2012c).

Due to the effects described under Alternative A, the two goshawk territories have a higher likelihood of remaining occupied than the No Action, and less than the Proposed Action. The net increase of benefits is larger than the short-term negative impacts. Due to (1) these effects described, (2) the small proportion (0.7 percent) of treated forested habitat in the project area compared to the amount of potentially suitable habitat across the forest, and (3) populations are persisting across the Forest and will continue to increase in distribution and density (Rodriguez et al. 2008; Rodriguez et al. 2012), these effects will not affect population trends on the Forest.

Pygmy rabbit *(Brachylagus idahoensis)*

The pygmy rabbit requires tall, dense clumps of big sagebrush (Rodriguez et al. 2012). The project area does not contain suitable sagebrush stands required by the species. This species is not discussed further in this document due to the lack of suitable habitat and species presence.

Southern Leatherside Chub *(Lepidomeda aliciae)*

Southern leatherside populations have been recently documented on the Cedar City, Powell, and Escalante Ranger Districts. Additional historical records exist on the Cedar City Ranger District. Historic records show southern leatherside present in Bear Creek, Duck Creek, Panguitch Creek, and Threemile Creek on the Cedar City Ranger District, the East Fork Sevier River from the Forest boundary upstream to the confluence with Kanab Creek and the lower end of Kanab Creek itself on the Powell Ranger District, and Clay Creek on the Escalante Ranger District (UDWR 2010). Historic records also show occurrences in Mammoth and Asay Creek downstream from the Cedar City Ranger District Forest boundary (UDWR 2010). In reality southern leatherside were probably historically present in most perennial streams that drain into the Sevier River of East Fork Sevier River on the DNF; however, at this point in time no one has tried to model historical southern leatherside habitat.

On the Cedar City Ranger District 2009 surveys showed that Bear Creek maintains a southern leatherside chub population for 1.6 miles upstream from the Forest boundary before the stream goes dry (Golden and Lords, 2009a; Golden 2009c). It appears that southern leatherside are present in Bear Creek downstream to the confluence with the Sevier River, on both BLM administered lands and private property, where the stream remains watered. Southern leatherside are also known to inhabit the lower 1.1 miles of Threemile Creek on the DNF, as well as watered habitat downstream to its confluence with the Sevier River (Morvilius and Fridell 2004a; Hadley et al. 2010). Duck Creek is not currently known to contain southern leatherside and is stocked and managed as a nonnative trout fishery (UDWR 2010). While Panguitch Creek lost a good portion of its fishery in 2006, when rotenone from the Panguitch Lake treatment effort continued downstream, UDWR translocated southern leatherside from the lower end of Butler Creek back into Panguitch Creek (Doyle and Fridell, 2006). Additional surveys showed that southern leatherside have redistributed themselves between the White Bridge Campground on the Dixie National Forest downstream to the City of Panguitch Diversion, roughly 3 miles downstream from the Forest boundary with the lower portion of Butler Creek being an important area for reseeding Panguitch Creek (Black and Golden 2007; Golden 2008; Bennion and Cox 2009).

On the Powell Ranger District, southern leatherside are now restricted to a 5.1 mile section of the East Fork Sevier River immediately below Tropic Reservoir (Bennion 2010). Below this section the East Fork Sevier River is dewatered throughout many sections until Deer Creek and Cottonwood Creek revive more perennial flow (Bennion 2010). Several surveys have been conducted upstream from Tropic Reservoir in the 2000s, but none have found a single southern leatherside (Morvilius and Fridell 2004b; Golden and Lords 2009b; Golden and Lords 2009c; Golden and Lords 2009d; Golden and Mecham 2010c; Golden and Mecham,2010d). Conversely, where there is water in the East Fork Sevier below Tropic Reservoir, southern leatherside are present downstream to the confluence with the Sevier River; however, with the exception of the first 5.1 miles downstream from Tropic Reservoir the sections of the East Fork Sevier on the Dixie National Forest are at least seasonally dry (Golden 2007; Bennion 2010).

On the Escalante Ranger District surveys by UDWR and DNF personnel in 2004 and 2006 noted southern leatherside throughout Clay Creek downstream from where FR30282 crosses the stream (Morvilius and Fridell 2004c; Golden et al. 2009). No sampling information was available upstream from FR30282 so the historic upstream extent of southern leatherside in Clay Creek is unclear. UDWR and DNF sampling efforts in 2009 and 2010 indicate that fish have been extirpated from Clay Creek (Golden et al. 2009; Borden and Cox 2010; Golden and Mecham 2010e). A 2008 summer flood carrying large volumes of bedload, completely rearranged the channel and appears to be the reason for the extirpation of fish from Clay Creek. With no connection to the East Fork Sevier River, recolonization by southern leatherside will be impossible without direct reintroduction by UDWR. Table 23 identifies stream habitat on the Dixie National Forest occupied by southern leatherside.

Table 23. Miles of stream habitat on the Dixie National Forest habitat currently occupied by southern leatherside, at their maximum observed distribution, and miles of potential perennial habitat in existing leatherside streams.

Stream	Ranger District	2010 occupied habitat	Known maximum occupied habitat	Potential habitat[a]
Bear Creek	Cedar City	1.6	1.6	1.6
Threemile Creek	Cedar City	1.1	1.1	10.2[b]
Duck Creek	Cedar City	0	3.8[c]	3.8
Panguitch Creek	Cedar City	11.4	11.4	15.2
Butler Creek	Cedar City	0.9	0.9	3.6
East Fork Sevier River	Powell	5.1	16.5	16.5
Kanab Creek	Powell	0	0.1	4.7
Clay Creek	Escalante	0	3.2	5.8
Total		20.1	38.6	61.4

[a] In reality most fish-bearing streams on the DNF draining into the Sevier River and East Fork Sevier River that fit the elevational and habitat constraints for southern leatherside may have been historic habitat for the species; however, no study has attempted to model the full historic distribution of southern leatherside, so potential habitat is restricted to where historic records of southern leatherside existed on the Forest.

[b] Includes Delong Creek and Indian Hollow.

[c] A single historic record exists from Duck Creek so the potential habitat was used as the known maximum occupied habitat.

The Southern Leatherside Conservation team is currently identifying and prioritizing streams for southern leatherside reintroduction throughout their range. Clay Creek, along with other potential historic stream habitat on the DNF, particularly streams that have already been renovated for BCT, will probably be included on this list. Such reintroductions as well as planned increases in stream connectivity, including two culvert replacements on Clay Creek, should help expand occupied habitat for southern leatherside on the DNF.

According to the Hydrology Report, streamflow in most of the project area is spatially and temporally intermittent. There are two perennial streams located within the project area. Both streams are spatially intermittent. There are no fish bearing streams within the project area. North Creek is the closest fish bearing stream downstream of the project area and it is approximately one stream mile away.

Effects of the No Action

No activities will occur in the project area and therefore there will be no effects to the Southern leatherside chub.

Effects of All Action Alternatives

There are no fish bearing streams within the project area, therefore, there will be no direct effects to fish. The Hydrology Report states, "Nearly all of the perennial stream segments within the project boundary are located in meadows away from trees and their shade zone." As described in the report, the small perennial segments will not be treated. The Soils Report states that detrimental soil displacement from proposed activities is very minimal and expected to stay the same through the implementation. Finally, the Hydrology Report states that stream turbidity and suspended sediment is unlikely to be measurably impacted. There will be no indirect effects to fish from proposed activities. Since there are no direct or indirect effects on this species, there will not be any effects to Forest-wide populations.

Spotted Bat *(Euderma maculatum)*

The spotted bat is known to occupy habitat from desert to montane coniferous forests (Oliver 2000). In Utah, the maximum elevation the spotted bat occurs in is 9,990 feet (UDWR 1997). Spotted bats have been documented in other states from below sea level to one occurrence at almost 10,600 feet (Luce and Keinath 2007). The project area ranges in elevation from approximately 9,000 to 10,750 feet. The project area contains approximately 2,512 acres of meadow habitat below 10,600 feet and approximately 736 acres of the total project area below 10,000 feet (see Appendix A.3 and A.4). The project area is in the upper limits and beyond the elevational habitat use range for this bat species.

In a study conducted by Rabe et al. (1998), the spotted bat was never captured and rarely heard in forested areas. Leonard and Fenton (1983) found there were no buzzes relating to feeding in various forested sites. They presumed these areas were used for commuting by the bats. They found the spotted bat to concentrate its foraging activities to open areas adjacent to ponderosa pine. Wai-Ping and Fenton (1989) found spotted bats to be the most active in marshes and open ponderosa-pine woodland. There are various reports of captured or detected spotted bats in Utah located in open areas (UDWR 1997). No spotted bats were detected during five separate surveys conducted in the Velvet Lake area approximately 1.3 miles from the project area boundary. These survey locations range from approximately 9,925 to 10,433 feet in open areas within forested habitat. These surveys are located in the project record. Approximately 736 acres of potential foraging habitat below 10,000 feet and approximately 2,512 acres of meadow habitat below 10,600 feet exist within the project area.

A critical habitat element needed by spotted bats is the availability of cracks and crevices of the right size for roosting (UDWR 1997). Spotted bats prefer cracks and crevices of steep, rocky cliffs and canyons (Barbour and Davis 1969; Rodriquez et al. 2012). Spotted bats may use trees along meadows for night-roosting (Rabe et al. 1998). There are cliffs that may contain suitable rock crevices for roosting adjacent to the southwestern boundary of the project area. Trees are available for night-roosting along meadows within and adjacent to the project area.

In summary, spotted bat numbers will be low or absent due to the high elevation of the project area. Open parkland meadows are available in and adjacent to the project area that could be used for foraging, as well as trees along the open meadows and some cliff habitat that could be used for roosting.

Effects of the No Action

The No Action will not affect foraging individuals or habitat. In addition, use is low or absent. Since there are no direct or indirect effects, there will be no cumulative effects or effects to populations on the Forest.

Effects of the Proposed Action

Proposed activities will not occur at night when the species has the potential to be in the project area. Foraging activities including night roosting will not be affected. Use of the area will be low or non-existent. Benefits from opening forested habitat due to road construction or aspen regeneration harvest will not be measurable due to the low or non-existent use by the bat. There will be no measureable effects to the species from proposed activities. Since there are no direct or indirect effects, there will be no cumulative effects or effects to Forest-wide populations.

Effects of Alternative A

Effects will be the same as the proposed action.

Three-Toed Woodpecker *(Picoides tridactylus)*

The three-toed woodpecker is restricted to high elevation conifer forest, and particularly spruce in Utah. Aspen is used within these conifer forests (UDWR 1997, pp. 399-400; Rodriguez et al. 2012). This woodpecker specializes in feeding on spruce bark beetles (Rodriguez et al., 2012). It will invade burns and strike dead or dying insect-infested trees (Bock and Bock 1974). The three-toed woodpecker has been reported in many areas within Utah as generally rare or uncommon (UDWR 1997, p. 399; Ryser 1985; Parrish et al. 2002). This is consistent with what has been observed as a result of three-toed woodpecker surveys on the District. Normally, three-toed woodpeckers are found in low numbers, but can be common in areas of Utah where beetle infestation has occurred (Parrish et al. 2002). However, this has not been observed on the Escalante Ranger District, and use of the project area is expected to be low. This is supported in an analysis for the Barney Top Resource Project, which is located south of the project area. The Barney Top Project Area contains the same spruce/fir, aspen, and meadow vegetation types and is within the same elevational ranges as the Iron Springs Project Area. This analysis showed surveys were conducted in 2003 for the three-toed woodpecker in proposed activity areas. Four detections were recorded and one nest was found. Beetle activity continued to increase to outbreak levels in the Barney Top project area, however, there was no indication that three-toed woodpecker populations were increasing. Surveys for the three-toed woodpecker occurred again in 2004, resulting in no detections. Surveys were also conducted for the three-toed woodpecker in approximately 2,500 acres of the adjacent (approximately 0.08 miles away) Pockets project area during the 2006 field season during beetle infestations. Results also indicate use of the Iron Springs project area will be low. The area surveyed represented approximately 33 percent of the suitable habitat acres for the species within the Pockets project area. Four three-toed woodpecker detections were documented. Only one nest was found as a result of nest searches. Three-toed woodpecker surveys were also conducted in 2012 in aspen cleaning treatments and all proposed aspen regeneration treatments. While other species of woodpeckers were found foraging in the project area, no three-toed woodpeckers were found.

Vegetation types that can support three-toed woodpecker in the 8,306-acre project area consist of 5,240 acres of spruce-fir and 256 acres of aspen.

There are approximately 2,098 acres of spruce/fir old-growth within the project area (Orlemann 2012c). The project area consists of approximately 5 percent of the 111,751 acres of spruce fir and less than 0.2 percent of the 105,792 acres of aspen on the Dixie National Forest (DNF LRMP p. II-19). Therefore, the project area comprises a small proportion of potential habitat for the three-toed woodpecker forest-wide.

Nesting habitat is not a limiting factor for the low number of individuals inhabiting the project area. Spruce beetle populations have been increasing to outbreak or epidemic levels increasing spruce beetle-induced mortality (Orlemann 2012c). According to Thomas (1979, pp. 388-389), 59 hard snags per 100 acres would support a 100 percent or maximum population of three-toed woodpecker in the habitat found in the project area. A hard snag is essentially composed of sound wood, particularly on the outside, as opposed to soft snags that are in advanced stages of decay and deterioration. Thomas classifies the forest ecosystem of the project area as a subalpine fir community. Thomas (1979) states, " . . . the capability of the forest to support snag-dependent species rests on two things - the percent of forested acres on which snags are found, and the number of snags of appropriate size." The Thomas model is based on: (1) the territorial requirements of individual woodpecker species which takes into account the area around the nest site that the occupants will defend against others of the same species; (2) the potential maximum population of a species per 100 acres which is derived by dividing the area by the territorial requirement of a species; (3) possible management levels for each species were selected at intervals between 10 and 100 percent of the potential maximum population; and (4) the snag requirement for nesting of each pair which was derived by considering: (a) the number of holes a year a species excavates; (b) the same tree is usually used only once by a particular pair of woodpeckers; and (c) the ratio of snags without cavities to snags with cavities determined from a sample size of about 8,000 snags. The potential maximum population formula the Thomas model uses is based on the assumption that there are enough suitable nest snags to prevent snags from being a limiting factor on the number of nesting pairs of woodpeckers. The average diameter of snags occupied by a woodpecker will exceed the minimum snag diameter because woodpeckers tend to select snags that are larger than the minimum size required for nesting. The minimum snag diameter that is generally needed to support three-toed woodpeckers is ≥12 inches diameter at breast height (dbh).

Based on stand exam data collected within forested acres for the project area, approximately 9.9 hard snags per acre, or 990 per 100 acres, greater than or equal to 12.0 inches dbh are present that serve as suitable nesting habitat for the three-toed woodpecker. Approximately 3.4 hard snags per acre or 340 per 100 acres ≥18.0 inches dbh are present that will contribute to the average diameter of snags occupied that exceed the minimum snag diameter. Also, there are 41.6 total snags per acre (Orlemann 2011a). Incorporating this hard snag data, and calculations by Thomas (1979), indicate that hard snags located in the project area are capable of supporting a 100 percent or maximum three-toed woodpecker population. This does not take into account soft snags that are available in the project area that would also provide nesting and foraging habitat. This indicates that nesting habitat is not limiting in the project area.

Spruce beetle activity was first identified in the project area in 1998. Beetle populations have been increasing to outbreak or epidemic levels since. Recent mortality of Engelmann spruce has reduced or eliminated large-diameter spruce, resulting in changes in species composition favoring subalpine fir (Orlemann 2012c). Since the three-toed woodpecker specializes in feeding on spruce beetles (Rodriguez et al. 2012), prey has been available for the species in the project area at outbreak and epidemic levels.

Cumulative Effects Area

The cumulative effects area (CEA) for the three-toed woodpecker is the high elevation spruce-fir, aspen, and mixed conifer contained within the three HUC 6 watersheds that are a part of the Iron Springs project area, (see Appendix B.3). These three watersheds include Coyote Hollow-Antimony Creek, North Creek, and Upper North Creek. Cumulative effects will not occur beyond the CEA. The habitat contained in the CEA is consistent with the use of the project area and contains the habitat required by the species. Aspen cleaning and regeneration treatments and spruce/fir thinning and sanitation/salvage treatments within the CEA are found in Table 24.

Table 24. Spruce/fir and aspen silvicultural treatments within the cumulative effects area for the three-toed woodpecker.

Project	Treatment	Acres w/in CEA (percent of CEA)
Aquarius Salvage	Salvage of spruce/fir after blowdown.	1,040 (2 percent)
Black Forest/Velvet Lake Salvage & Timber Sales	Salvage of dead Fuelwood and spruce/fir timber harvest	3,134 (7 percent)
Bug Lake Salvage	Salvage 220 acres of dead spruce	220 (0 percent)
Clayton Salvage	Salvage 248 acres of dead spruce	248 (1 percent)
Coyote Hollow	Aspen patch cuts (65 acres) and spruce/fir selection harvest	2,094 (5 percent)
Coyote Hollow Amendment	Additional sanitation/salvage on same acres	N/A
Lost Spring	Aspen regeneration	33 (0 percent)
Pacer	Aspen patch cuts (19 acres) and spruce/fir selection harvest	1,882 (4 percent)
Pacer Amendment	Additional sanitation/salvage on same acres	N/A
Pockets	Aspen regeneration/cleaning and spruce/fir sanitation/salvage	4,498 (10 percent)
Iron Springs – No Action		N/A
Iron Springs – Proposed Action	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	4,121 (9 percent)
Iron Springs – Alternative A	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	2,213 (5 percent)
Total – No Action		**13,149 (29 percent)**
Total – Proposed Action		**17,270 (38 percent)**
Total – Alternative A		**15,362 (34 percent)**

Direct & Indirect Effects of the No Action

According to Orlemann (2012c), size class diversity will continue to decrease as the older and larger trees continue to succumb to spruce beetle-induced mortality. Prey and nesting habitat will continue to be available for the species as live tree mortality continues as a result of spruce beetles.

As disclosed above, the three-toed woodpecker is generally rare or uncommon in the state of Utah, and use of the project area is low. The No Action will increase prey base in the project area. However, this will not produce measurable beneficial effects to the species since the proportion of available habitat and prey greatly exceeds what is needed to support the small number of individuals in the project area.

In conclusion, there will be no measurable impacts from the No Action on the three-toed woodpecker, and therefore no cumulative effects or effects to Forest-wide populations.

Direct & Indirect Effects of the Proposed Action

Wildlife Project Design Criteria WL-3 which is a summarization of the Dixie NF LRMP snag guideline, provides for a continuation of snag habitat sufficient to maintain three-toed woodpecker populations within the treatment areas after project implementation (Thomas 1979). Design criteria WL-3 or the DNF LRMP snag guideline will retain the largest diameter snags. To maintain habitat for maximum woodpecker populations, at least 59 hard snags per 100 acres are needed (Thomas 1979). With 200 to 300 snags per 100 acres representing all size classes above the minimum available on site, the Iron Springs Vegetation Improvement and Salvage Project maintains habitat to support a maximum (100 percent) population of the three-toed woodpecker in the project area, especially since population levels are low. Therefore, the reduction of dead trees in the treated acres will not affect the availability of nesting habitat.

Construction of 9.61 miles of new low-standard temporary roads is proposed, including 0.76 miles of temporary road needed to access an old dike and a borrow pit. It may be possible to access the dike on frozen ground or over snow, alleviating the need for road construction. Effects from the construction will not be measurable. While activities will reduce nesting habitat, effects will not be measurable because nesting habitat is abundant and increasing in the project area, and more importantly, use of the project area is low.

Aspen regeneration treatments will temporarily reduce nesting habitat. This reduction in nesting habitat will decrease the total nesting habitat available in the project area. This represents approximately 3 percent of the total forested habitat in the project area. Design Criteria WL-3 requires maintenance of snags in the treatment area. The effects of temporary nesting habitat removal on potential nesters will not be measurable due to the amount of habitat available in untreated areas and treated areas using the snag retention guidelines, as well as the low use of the area.

The salvaging of dead trees, aspen regeneration, and road construction may result in the loss of some nesting individuals; however, negative effects will be minor due to the low use of the project area. The salvage treatment in the spruce-fir vegetation type within the project area consists of approximately 4 percent of the 111,751 acres of spruce-fir on the Dixie National Forest (DNF LRMP, page II-19). Because the small amount of habitat impacted forest-wide and the low occurrence of the species in the project area, these minor effects are not predicted to effect overall woodpecker populations on the Forest as a whole.

Sanitation/salvage treatments would remove trees infested with spruce beetle, thereby reducing current insect populations. Also the coppicing (approximately 152 acres) and cleaning (approximately 388 acres) treatments in aspen will eliminate any current risk from spruce beetle mortality with the removal of all large-diameter live spruce. Thinning in spruce/fir can result in the reduced mortality from spruce beetle. The approximately 3,800 acres of conifer thinning should result in stands being more resilient to spruce beetle outbreaks. At periodic intervals, spruce beetle outbreaks will continue to occur in the spruce/fir and remove less than 20 percent of the spruce (Orlemann 2012c). While treatments may reduce prey availability in the project area, beetle outbreaks will continue, thereby providing foraging opportunities for the low number of potential individuals in the project area.

In conclusion, Project Design Criteria (WL-1, WL-3) will be implemented and will protect the three-toed woodpecker and its habitat. Snag habitat will not be a limiting factor in the project area due to retention requirements in treated areas, and available snags in untreated areas. Approximately 152 acres of aspen treatment (3 percent of the total forested habitat in the project area) will temporarily reduce nesting habitat. This will not produce measurable effects to the species since the proportion of available prey and habitat, including nesting, greatly exceeds what is needed to support the small number individuals in the project area. The salvaging of dead trees, aspen regeneration, and road construction may result in the loss of nesting individuals; however, because use of the project area is low, the number of individuals that could be potentially lost is extremely low. Since (1) use of the area is low, (2) proposed activities will not produce measurable effects, (3) the potential to affect nesting individuals is extremely low, and (4) this treatment represents approximately 2 percent of the spruce-fir and aspen on the forest, Forest-wide populations will not be affected.

Cumulative Effects of the Proposed Action

For the 45,423 acre CEA for the three-toed woodpecker, spruce/fir and aspen treatments have occurred, or are planned for, on approximately 17,270 acres (Table 13). Thinning treatments improve individual tree vigor and growth; sanitation/salvage removes infected trees from the stand; aspen enhancement treatments reduce the number of acres of host species for spruce beetles and retain aspen; and sanitation/salvage and aspen patch cuts affect available snags in the CEA. As a result, management actions designed to improve forest health have been, or will be implemented, on approximately 38 percent of the cumulative effects area. These treatments have the potential to affect potential nesting and foraging habitat for the three-toed woodpecker.

Management actions designed to improve forest health that have been or will be implemented are unlikely to stop a full-blown insect epidemic (Orlemann 2012c). Thinning in spruce/fir can result in the reduced mortality from spruce beetle. Sanitation treatments have and will remove trees infested with spruce beetle, thereby reducing insect populations. Patch cuts and cleaning treatments in aspen eliminate the risk from spruce beetle mortality with the removal of all large-diameter live spruce. Treatments comprise of approximately 38 percent of the CEA, leaving approximately 62 percent. While past treatments reduced prey availability in the CEA, beetle outbreaks have continued, thereby providing foraging opportunities for the low number of potential individuals in the project area. This will likewise occur for future projects.

The Forest Plan forest-wide standards have provided for snags since 1986. The Goshawk Amendment to the Forest Plan (USDA 2000b, Appendix CC, p. CC-21) requires vegetative treatments to retain a minimum number of snags. Past, present, and reasonably foreseeable future projects within the CEA (Table 13) have and will provide for snags (nesting habitat) for the three-toed woodpecker. This is demonstrated in the Iron Springs project area which represents

approximately 24 percent of the treatments within the CEA (Table 13). This area contains adequate snags to provide for three-toed woodpecker populations (see analysis disclosed above).

Past, present, and future beetle activity will continue to occur, focusing on large trees, providing snag and foraging habitat in the CEA. Past, present and reasonably foreseeable future vegetation treatments including clearcuts, patchcuts, and salvage logging, would have lost nesting individuals within the CEA; however, species numbers are low. Fuelwood and pole removal size restrictions would have removed smaller diameter trees than needed for nesting and would have been mainly limited to removal along existing roads. Effects to the species from activities described above would be minor due to the low use of the area and remaining nesting and foraging habitat available post-treatment. These minor effects will not affect Forest-wide populations.

Direct & Indirect Effects of Alternative A

Effects to the three-toed woodpecker will be the same as the Proposed Action. The acreage difference in the spruce-fir and aspen and miles of road construction is too small to determine a measurable difference in effects of an area that receives low use.

Cumulative Effects of Alternative A

Cumulative effects will be the same as the Proposed Action because of the lack of measurable differences between the Proposed Action and Alternative A.

Western Big-Eared Bat *(Plecotus townsendii)*

Roost site availability is important in determining population sizes and distributions of bats (Christy and West 1993). Abandoned caves and mine tunnels are used for roosting and are considered critical habitat for the species (Verts and Carraway 1998). No western big-eared bats were detected during five separate surveys conducted in the Velvet Lake area approximately 1.3 miles from the project area boundary. These surveys are located in the project record. The Escalante Ranger District does not contain any open mines or known caves that would provide suitable roosting habitat for the species. Since no roosting habitat exists in or near the project area that would support a population, there will be no foraging individuals in the project area. This species is not present in the project area, and therefore is not analyzed further in this document.

Northern Flicker *(Colaptes auratus)*

The northern flicker is a primary cavity nester and is a management indicator of available habitat for wildlife species that depend on cavity nests and snags (DNF LRMP II-15). Many wildlife species are secondary cavity nesters and are dependent on primary cavity nesters because they are unable to excavate their own cavities. Wildlife species including bluebirds, chickadees, wrens, swallows, kestrels, owls, bats, and squirrels use existing holes (Scott el al. 1980; Ritter 1997). Snags also attract insects, which serve as important sources of food for many wildlife species. Snags are used as storage areas for food, hunting and feeding perches, communication centers for birds, and other uses (Ritter 1997).

The northern flicker can be found in almost every habitat type below timberline that contains nest sites and open ground for foraging (Ritter 1997). The species prefers to use snags for nesting sites

(Ritter 1997; Ryser 1985). The northern flicker forages mostly on the ground (Ryser 1985), and its diet consists mostly of ants but will eat seeds, acorns, and nuts (Ehrlich et al. 1988).

Vegetation types that can support flicker in the 8,306-acre project area consist of 5,240 acres of spruce-fir, 256 acres of aspen, and 2,810 acres of meadow that includes areas of grass/forb and silver sagebrush. The project area consists of approximately 5 percent of the 111,751 acres of spruce fir, less than 0.2 percent of the 105,792 acres of aspen, and 0.7 percent of the 379,513 acres of grass/forb and sagebrush on the Dixie National Forest (DNF LRMP. p. II-19). In addition, the project area comprises of approximately less than 0.7 percent of potentially suitable habitat (approximately 1,196,146 acres) described by Rodriguez et al. (2012). Therefore, the project area comprises a small proportion of potential habitat for the flicker forest-wide.

The northern flicker is a cavity-dependent woodpecker that uses dead trees (snags) to excavate a hole for nesting and as a part of courtship. Flickers are territorial, defending an area surrounding the nest tree from other flickers. The number and size of available snags affect not only the presence or absence of flickers, but also flicker population levels. Using the territorial requirements of different species of woodpecker and the snag requirements of each pair of woodpecker, Thomas (1979) estimated the highest number of pairs of woodpeckers that could inhabit an area; the maximum (100 percent) potential population. Fewer snags per acre on average would create conditions where fewer woodpeckers would live, and produce lower population levels (depicted by a smaller percentage potential population).

According to Thomas (1979, pp. 388-389), 38 hard snags per 100 acres would support a 100 percent or maximum population of northern flicker in spruce-fir and aspen habitats. A hard snag is essentially composed of sound wood, particularly on the outside, as opposed to soft snags that are in advanced stages of decay and deterioration. Thomas (1979) states, ". . . the capability of the forest to support snag-dependent species rests on two things - the percent of forested acres on which snags are found, and the number of snags of appropriate size."

Thomas classifies the forest ecosystem of the project area as a subalpine fir community. The Thomas model is based on: (1) the territorial requirements of individual woodpecker species which takes into account the area around the nest site that the occupants will defend against others of the same species; (2) the potential maximum population of a species per 100 acres which is derived by dividing the area by the territorial requirement of a species; (3) possible management levels for each species were selected at intervals between 10 and 100 percent of the potential maximum population; and (4) the snag requirement for nesting of each pair which was derived by considering: (a) the number of holes a year a species excavates; (b) the same tree is usually used only once by a particular pair of woodpeckers; and (c) the ratio of snags without cavities to snags with cavities determined from a sample size of about 8,000 snags. The potential maximum population formula the Thomas model uses is based on the assumption that there are enough suitable nest snags to prevent snags from being a limiting factor on the number of nesting pairs of woodpeckers. The average diameter of snags occupied by a woodpecker will exceed the minimum snag diameter because woodpeckers tend to select snags that are larger than the minimum size required for nesting. The minimum snag diameter that is generally needed to support northern flickers is ≥12 inches diameter at breast height (dbh).

Based on stand exam data collected within forested acres for the project area, approximately 9.9 hard snags per acre, or 990 per 100 acres, greater than or equal to 12.0 inches dbh are present that serve as suitable nesting habitat for the flicker. Approximately 3.4 hard snags per acre or 340 per 100 acres ≥18.0 inches dbh are present that will contribute to the average diameter of snags occupied that exceed the minimum snag diameter. Also, there are 41.6 total snags per acre (Orlemann 2011a). Incorporating this hard snag data, and calculations by Thomas (1979), indicate that hard snags located

in the project area are capable of supporting a 100 percent or maximum flicker population. This does not take into account soft snags that are available in the project area that would also provide nesting habitat. This indicates that nesting habitat is not limiting in the project area.

Flickers as well as secondary cavity nesters and other primary cavity nesters have been documented in the project area during northern goshawk and three-toed woodpecker surveys. These data sheets are located in the project record. Surveys completed across the Forest show a downward trend, however, detectability plays a role in the accuracy of population densities. The BBS data for the state of Utah shows a somewhat stable population (Rodriguez et al. 2012).

Cumulative Effects Area

The cumulative effects area (CEA) for the northern flicker is the high elevation forested habitat and meadows contained within the three HUC 6 watersheds that are a part of the Iron Springs project area, (see Appendix B.3). These three watersheds include Coyote Hollow-Antimony Creek, North Creek, and Upper North Creek. Cumulative effects will not occur beyond the CEA. The habitat contained in the CEA is consistent with the use of the project area. Other forested types that may be used by the flicker within the watersheds were not included in the CEA because proposed activities were not taking place in these forested types, cumulative effects will not occur beyond the CEA disclosed above, and the size of the CEA that would include other forest types would be so large that it would make the cumulative effects analysis in these areas meaningless. Aspen cleaning and regeneration treatments, and spruce/fir thinning and sanitation/salvage treatments within the CEA are found in Table 25.

Table 25. Spruce/fir and aspen silvicultural treatments within the cumulative effects area for the northern flicker.

Project	Treatment	Approximate Acres w/in CEA (percent of CEA)
Aquarius Salvage	Salvage of spruce/fir after blowdown.	1,040 (2 percent)
Black Forest/Velvet Lake Salvage & Timber Sales	Salvage of dead Fuelwood and spruce/fir timber harvest	3,134 (7 percent)
Bug Lake Salvage	Salvage 220 acres of dead spruce	220 (0 percent)
Clayton Salvage	Salvage 248 acres of dead spruce	248 (1 percent)
Coyote Hollow	Aspen patch cuts (65 acres) and spruce/fir selection harvest	2,094 (5 percent)
Coyote Hollow Amendment	Additional sanitation/salvage on same acres	N/A
Lost Spring	Aspen regeneration	33 (0 percent)
Pacer	Aspen patch cuts (19 acres) and spruce/fir selection harvest	1,882 (4 percent)
Pacer Amendment	Additional sanitation/salvage on same acres	N/A
Pockets	Aspen regeneration/cleaning and spruce/fir sanitation/salvage	4,498 (10 percent)

Table 25 (continued). Spruce/fir and aspen silvicultural treatments within the cumulative effects area for the northern flicker.

Project	Treatment	Approximate Acres w/in CEA (percent of CEA)
Iron Springs – No Action		N/A
Iron Springs – Proposed Action	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	4,121 (9 percent)
Iron Springs – Alternative A	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	2,213 (5 percent)
Total – No Action		**13,149 (29 percent)**
Total – Proposed Action		**17,270 (38 percent)**
Total – Alternative A		**15,362 (34 percent)**

Direct & Indirect Effects of the No Action

According to Orlemann (2012c), size class diversity would continue to decrease as the older and larger trees continue to succumb to spruce beetle-induced mortality. Beetle activity in the project area will result in an increase in snags. According to Thomas (1979) and the snag data disclosed previously, available nesting habitat is more than adequate to provide habitat to support the maximum population of flickers. Open ground for foraging will still be provided in the project area. There will be no effects as a result of the No Action. Also, because there are no direct or indirect effects, there will not be cumulative effects or effects to Forest-wide populations or trend.

Direct & Indirect Effects of the Proposed Action

Wildlife Project Design Criteria WL-3 which is a summarization of the Dixie NF LRMP snag guideline, provides for a continuation of snag habitat sufficient to maintain habitat for flicker populations in the treated areas of the project area after project implementation (Thomas 1979). More than adequate nesting habitat will remain in the untreated areas. Design criteria WL-3 or the DNF LRMP snag guideline requires retention of the large diameter snags. To maintain 100 percent habitat capacity for the flicker, 38 hard snags per 100 acres would be needed (Thomas 1979). With 200 to 300 snags per 100 acres representing all size classes above the minimum available on site, the Iron Springs Vegetation Improvement and Salvage Project would maintain habitat to support a maximum (100 percent) population of the northern flicker in the project area. Therefore, the reduction of dead trees within the treated acres will not affect the availability of nesting habitat.

Aspen regeneration treatments will temporarily reduce nesting habitat. This reduction in nesting habitat will decrease the available nesting habitat in the project area. This minor amount represents approximately 3 percent of the total forested habitat in the project area. Design Criteria WL-3 will maintain snags in the treatment area. This effect will not be measurable due to the amount of habitat available in treated and untreated areas. The increase in foraging habitat will benefit the species; however, effects will be minor due to the small acreage treated. Also, approximately 2,810 acres of meadow habitat is available for foraging in addition to the open areas within forested habitat.

Aspen regeneration and road construction may affect some nesting individuals; however, negative effects will be minor due to the small area of habitat being treated. The salvage treatment in the spruce-fir vegetation type within the project area consists of approximately 4 percent of the 111,751 acres of spruce-fir on the Dixie National Forest (DNF LRMP page II-19). Also, the project area comprises of approximately less than 0.7 percent of potentially suitable habitat on the Forest for the flicker. Design Criteria WL-3 will maintain snags in the treatment area. As disclosed above, the northern flicker can be found in almost every habitat type below timberline that contains nest sites and open ground for foraging (Ritter 1997). The effects on some nesting individuals will not affect the overall persistence of the species due to the small area being treated compared to the available forested habitat on the District as well as Forest-wide.

In conclusion, the northern flicker is a management indicator species for available habitat for wildlife species that depend on cavity nests and snags (DNF LRMP II-15). Habitat will continue to be provided for secondary cavity nesters. Project Design Criteria (WL-3) will be implemented and will protect the northern flicker and its habitat. Snag habitat will not be a limiting factor in the project area due to retention requirements in treated areas, and available snags in untreated areas. Snag habitat will be provided for secondary cavity nesters. Approximately 152 acres of aspen treatment will temporarily reduce nesting habitat but increase foraging habitat. This will cause minor effects because the treatment represents approximately 2 percent of the total forested habitat and nesting habitat is not a limiting factor in the project area. The salvaging of dead trees, aspen regeneration, and road construction may result in the loss of some nesting individuals; however the project area and treatments represent a very small portion of the spruce-fir, aspen, and open meadow habitat on the Forest as well as a small portion of available habitat on the District. The Forest-wide population and trend will not be affected by proposed activities since beneficial and negative effects are minor and the treatment represents approximately 0.4 percent of the potentially suitable habitat on the Forest.

Cumulative Effects of the Proposed Action

For the 45,423 acre CEA for the northern flicker, spruce/fir and aspen treatments have occurred, or are planned for, on approximately 17,270 acres which is 38 percent of the cumulative effects area (Table 14). Thinning treatments improve individual tree vigor and growth; sanitation/salvage removes infected trees from the stand; aspen enhancement treatments reduce the number of acres of host species for spruce beetles and retain aspen; and sanitation/salvage and aspen regeneration cuts affect available snags in the CEA. As a result, management actions designed to improve forest health have been, or will be implemented, on approximately 38 percent of the cumulative effects area. These treatments have the potential to affect potential nesting and foraging habitat for the northern flicker as well as other wildlife that depend on snags.

Management actions designed to improve forest health that have been or will be implemented are unlikely to stop a full-blown insect epidemic (Orlemann 2012c). Thinning in spruce/fir can result in the reduced mortality from spruce beetle. Sanitation treatments have and will remove trees infested with spruce beetle, thereby reducing insect populations. Patch cuts and cleaning treatments in aspen eliminate the risk from spruce beetle mortality with the removal of all large-diameter live spruce. Treatments comprise of approximately 38 percent of the CEA, leaving approximately 62 percent. While past treatments reduced snags in the CEA, beetle outbreaks have continued resulting in additional snags being created.

The Forest Plan forest-wide standards have provided for snags since 1986. The Goshawk Amendment to the Forest Plan (USDA 2000b, Appendix CC, p. CC-21) requires vegetative treatments to retain a minimum number of snags. Past, present, and reasonably foreseeable future projects within the CEA (Table 14) have and will provide for snags (nesting habitat) for the northern

flicker and other snag dependent wildlife. This is demonstrated in the Iron Springs project area which represents approximately 24 percent of the treatments within the CEA (Table 14). This area contains adequate snags to provide for northern flicker populations (see analysis disclosed above). Past, present, and reasonably foreseeable future vegetation treatments including clearcuts, patchcuts, and salvage logging, would have lost nesting individuals within the CEA. However, this area is minor and represents approximately 0.1 percent of potentially suitable habitat on the Forest (Rodriguez et al. 2012).

Fuelwood removal up until 2011 and pole removal size restrictions would have removed smaller diameter trees than needed for nesting and would have been mainly limited to removal along existing roads. The cumulative effects of the Proposed Action will not cause significant negative effects for the northern flicker or those that depend on cavity nests and snags. Forest population trends will not be affected since snags have been provided for in vegetative treatments since 1986, and the cumulative effects described for treatments in the CEA represent a small amount of the potentially suitable habitat on the Forest.

Direct & Indirect Effects of Alternative A

Effects to the northern flicker will be the same as the Proposed Action. The acreage difference in the spruce-fir and aspen and miles of road construction is too small to determine a measurable difference in effects of an area that represents a small portion of available habitat.

Cumulative Effects of Alternative A

Cumulative effects will be the same as the Proposed Action because of the lack of measurable differences between the Proposed Action and Alternative A.

Wild Turkey *(Meleagris gallopavo)*

The wild turkey is a management indicator of relatively undisturbed old growth ponderosa pine habitat (DNF LRMP II-15). Turkey utilizes a variety of habitat types in addition to ponderosa pine including mountainous areas with mixed conifer and woodlands (Dickson 1992). The Merriam's turkey occurs in the project area. Use of the project area by the wild turkey is limited to summer range due to the high elevation. Some turkeys will expand out of the spring range and into the project area to use as summer range.

Suitable habitat for the wild turkey must include two elements, grasses and trees. Grasses provide food and trees provide daytime resting, escape cover, and most importantly nighttime roosting. Summer habitat is important for rearing of young. During early summer, hens with broods utilize habitat that is abundant with insects, gradually transitioning their diet to include green vegetation. By late summer, seeds become an important food source as available green forage decreases. The wild turkey is a food generalist and is adaptable to changing food conditions brought about by erratic or unpredictable changes in weather, land use, and normal schedules of plant production (Dickson 1992).

Data suggests that during the summer, Merriam's turkeys use roosting areas with fewer trees and are less likely to depend on regular roost trees compared to winter (Dickson 1992). Scientific literature mainly focuses on ponderosa pine as the preferred species for roosting of the Merriam's turkey. Hoffman (1968) characterized roosting sites in Colorado where the turkey's range was limited to 7,000-11,000 ft. elevation. He found that ponderosa pine was the species that was most utilized for summer roosting. However, he also found that the turkey would use old-growth Engelmann spruce.

Guidelines for managing Merriam's turkey habitat produced by the Utah Division of Wildlife Resources (Nish 1973, p. 5) states that there is a distinct preference for ponderosa pine as a roosting site. This is probably due to the shape and openness of the crown, and relatively few, large, lateral branches. Another important factor for selection of roosting sites is the tallest trees with the largest DBH. According to Orlemann (2012c), spruce beetle populations have been increasing to outbreak or epidemic levels. Recent mortality of Engelmann spruce has reduced or eliminated large-diameter spruce. Within the project area there are 2,098 acres of old growth spruce/fir that would provide a source of roosting habitat.

Brood rearing areas used for foraging include small openings in or adjacent to timber stands, canyon heads, edges of large meadows, selectively logged areas, and aspen glens. Evidence of wild turkey in mixed conifer habitat showed preference of small patchy logged openings with abundant grass and forbs. These were preferred over meadows (Zeedyk 1987). The spruce-fir type is most often so dense that it contains very little understory vegetation. However, dry meadow openings found in this forest type contain vegetation for foraging. These openings are important in June and July for young turkeys (Nish 1973, p. 17). The project area contains dry meadow openings found within the spruce/fir, edges of large meadows, and aspen stands that would provide suitable foraging habitat. However, according to Orlemann (2012c), aspen stands within the project area are seral stands being invaded by conifer, and aspen stands currently exhibit a lack of regeneration and changes to understory vegetation. Most of the remaining aspen sprouts are in poor health with poor leader growth and minimal crown. This condition is most likely from competition with conifer seedlings and low light conditions.

It is likely turkeys stay in the project area until weather conditions induce movement. Studies show that seasonal movements between seasonal ranges are not controlled by availability of food or water, but rather by weather (Nish 1973, p. 14).

Merriam's turkey has been documented in the project area during northern goshawk surveys. Goshawk survey data sheets are contained in the project record. Use of the area is low due to the elevation restricting use to summer range and limiting turkey numbers to individuals that expand into the area from lower elevation nesting habitat. Turkey populations are increasing and are in an upward trend on the Dixie NF (Rodriguez et al. 2012). Although turkeys are not likely to utilize the interior of large meadows and therefore are not considered potentially suitable habitat, the 8,306 acre project area is approximately 1 percent of the potentially suitable habitat across the Forest (approximately 712,234 acres) described by Rodriguez et al. (2012).

Cumulative Effects Area (CEA)

Use of the project area by the wild turkey is limited to summer range due to the high elevation. The cumulative effects area for the wild turkey is the spruce-fir, aspen, and mixed conifer habitat on the plateau top that supports summer range within the three HUC 6 watersheds that are a part of the Iron Springs project area (see Appendix B.3). These three watersheds include Coyote Hollow-Antimony Creek, North Creek, and Upper North Creek. This area was chosen because the use that occurs in this CEA is consistent with the limited use of the project area in that it only includes brood rearing and summer use by turkeys. Lower elevation summer habitat is not included in the CEA because lower zones allow other uses (e.g., nesting) that have specific habitat requirements that should not be assessed for this area. Merriam's turkey brooding season is from April 15 to July 1. Turkeys will not use the project area the entire brood rearing season since habitat required for brood rearing is not available in mid-April. Use of the project area most likely starts in June most years due to snow limiting habitat use and availability. Summer use by Merriam's turkeys lasts until approximately November 1st unless snow pushes them out of the area. The CEA represents an area that is

characteristic of the potential use by turkeys in the project area. Aspen cleaning and regeneration treatments, and spruce/fir thinning and sanitation/salvage treatments within the CEA are found in Table 26.

Table 26. Spruce/fir and aspen silvicultural treatments within the cumulative effects area for the wild turkey.

Project	Treatment	Approximate Acres w/in CEA (percent of CEA)
Aquarius Salvage	Salvage of spruce/fir after blowdown.	1,040 (2 percent)
Black Forest/Velvet Lake Salvage & Timber Sales	Salvage of dead Fuelwood and spruce/fir timber harvest	3,134 (7 percent)
Bug Lake Salvage	Salvage 220 acres of dead spruce	220 (0 percent)
Clayton Salvage	Salvage 248 acres of dead spruce	248 (1 percent)
Coyote Hollow	Aspen patch cuts (65 acres) and spruce/fir selection harvest	2,094 (5 percent)
Coyote Hollow Amendment	Additional sanitation/salvage on same acres	N/A
Lost Spring	Aspen regeneration	33 (0 percent)
Pacer	Aspen patch cuts (19 acres) and spruce/fir selection harvest	1,882 (4 percent)
Pacer Amendment	Additional sanitation/salvage on same acres	N/A
Pockets	Aspen regeneration/cleaning and spruce/fir sanitation/salvage	4,498 (10 percent)
Iron Springs – No Action		N/A
Iron Springs – Proposed Action	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	4,121 (9 percent)
Iron Springs – Alternative A	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	2,213 (5 percent)
Total – No Action		**13,149 (29 percent)**
Total – Proposed Action		**17,270 (38 percent)**
Total – Alternative A		**15,362 (34 percent)**

Direct & Indirect Effects of the No Action

The spruce-fir type is most often so dense that it contains very little understory vegetation (Nish 1973, p. 17). However, aspen habitat contains vegetation for foraging (Zeedyk 1987). Under the No

Action, aspen stands and aspen clones found within the spruce/fir would continue to decline (Orlemann 2012c). This will reduce foraging habitat. However, spruce mortality may provide some foraging habitat by reducing spruce in the upper canopy layer and allow understory vegetation growth.

Spruce mortality is increasing and will result in the loss of larger trees. Untreated stands of old growth are likely to quickly lose the large live tree component. Within the next decade old-growth acres could decline by 525 acres (Orlemann 2012c). The approximately 1,573 remaining acres would still provide roosting habitat. Since turkeys are less likely to depend on regular roost trees during the summer (Dickson 1992), the reduction in roosting habitat would reduce use in portions of the project area as turkeys center their activities on the remaining roosting habitat.

In summary, the loss of aspen habitat would negatively affect the wild turkey by reducing foraging habitat. The loss of large trees will reduce roosting habitat and increase foraging habitat in the project area. The net reduction in roosting habitat will cause uneven use of the project area. This will not negatively affect overall populations of this species on the Forest since use of the area is low and the project area represents a small portion (1 percent) of the potentially suitable habitat on the Forest. However, the wild turkey is evaluated because of its status as a management indicator species for available habitat for relatively undisturbed old growth ponderosa pine habitat (DNF LRMP II-15). Although ponderosa pine is not found in the project area, the wild turkey can be used as an indicator of old growth. The net reduction in roosting habitat (large trees) will reduce use in portions of the area and utilization of the area will be centered on remaining roosting habitat by the turkey, as well as other old growth dependent wildlife.

Cumulative Effects of the No Action

Generally within the CEA, conifer stands are uneven-aged, overstocked in the VSS 3-4 size classes, and understocked in the VSS 5 and 6. Untreated spruce/fir across the CEA is likely to lose mature and old forest components. Also, VSS classes 5 and 6 are likely to continue to decline. Since no action was taken on the Griffin Springs Project, the spruce beetle has reduced old-growth spruce/fir acres anywhere from 10 to 40 percent in various stands across the plateau (Orlemann 2012c). The No Action alternative will reduce roosting habitat in the CEA and therefore will reduce turkey use. This however will be off-set by the increase of roosting habitat over time in the Pockets Resource Management Project area and subsequent increase in turkey use which is documented in the Wildlife Report for that project.

The continued loss of aspen in the CEA will reduce foraging habitat. The Pockets Resource Management Project will promote and maintain aspen habitat in the CEA by regenerating approximately 350 acres and remove conifer on 433 acres. Foraging habitat created by past projects such as logging (Zeedyk 1987) and riparian fencing would have increased foraging habitat. Approximately 31,464 acres have been treated in the CEA, most of which created more open stand conditions in the spruce/fir increasing available foraging habitat. While the habitat on the plateau generally receives low use by the turkey, the large amount of acres treated in the CEA would have slightly increased populations and contributed toward upward trends on the Forest in the past.

The cumulative effects of the No Action will not affect Forest populations and trend. While the low use of the project area by turkeys may decrease as discussed above, any reduction would be off-set by the beneficial effects of the Pockets project.

Direct & Indirect Effects of the Proposed Action

Thinning will promote increased diameter growth and vigor of residual trees (Orlemann 2012c). Guidelines for managing Merriam's turkey habitat produced by the Utah Division of Wildlife Resources (Nish 1973, p. 5) states that an important factor for selection of roosting sites are the tallest trees with the largest DBH. Therefore, thinning actions will increase roosting habitat over time as well as habitat for other large tree dependent wildlife. Thinning will also regulate diameter distribution which will result in more open stand conditions (Orlemann 2012c) and therefore increase understory vegetation. Aspen regeneration treatments will also occur. Remaining aspen clones will decrease as they are overtopped by conifer and effects to the turkey will be comparable to the No Action in these areas.

Under the proposed action it is highly unlikely that all the treated acres would drop out of the old growth classification that would provide roosting habitat. The Forest Vegetation Simulator showed none of the treated stands would become disqualified as a result of timber cutting. The Vegetation Analysis shows that if marginal stands and 23 acres of old growth receiving sanitation/salvage treatments dropped out of the old-growth classification, there would be approximately 1,567 acres of remaining old growth (Orlemann 2012c). Since turkeys are less likely to depend on regular roost trees during the summer (Dickson 1992), the reduction in roosting habitat would reduce use in portions of the project area as turkeys center their activities on the remaining roosting habitat. These old growth specific effects are the same as the no action alternative.

Brood rearing areas used for foraging include small openings in or adjacent to timber stands, canyonheads, edges of large meadows, selectively logged areas, and aspen glens. Evidence of wild turkey in mixed conifer habitat shows a preference for small patchy logged openings with abundant grass and forbs. These were preferred over meadows (Zeedyk 1987). Openings created by logging in the spruce-fir type would increase quantity and quality of forage (Alexander 1987). Aspen regeneration harvests would increase herbage production (Mueggler 1985). The retention of aspen clones will benefit the turkey by maintaining and increasing foraging habitat.

Construction of 9.61 miles of new low-standard temporary roads is proposed, including 0.76 miles of temporary road needed to access an old dike and a borrow pit. It may be possible to access the dike on frozen ground or over snow, alleviating the need for road construction. During treatments, turkey dispersal to other available habitat may occur due to increased human activity on improved roads. Also, disturbance from logging activities may displace turkeys to other locations in the project area or to surrounding habitat, producing a minor short-term negative effect. Following treatments, road density will be reduced as roads are decommissioned, and will reduce the disturbance to individuals from human activities.

In conclusion, within the project area there are 2,098 acres of old growth spruce/fir that would provide a source of roosting habitat. This represents about 40 percent of the forested habitat in the project area. Thinning will promote increased diameter growth and vigor of residual trees. Treatments within the spruce-fir will increase foraging habitat. Aspen retention treatments will maintain and increase foraging and brood rearing areas. The proposed action will produce negative short-term effects by displacing individuals to other suitable habitat. While road activities may cause short-term negative effects, long term beneficial effects to foraging and roosting habitat will increase turkey use within the project area.

However, this will be a small increase, and use will continue to be low due to the restrictions resulting from the elevation of the area. There will be no effects from the proposed action on Forest turkey

populations and trend due the small increase of turkeys combined with the project area representing a small portion (1 percent) of the potentially suitable habitat on the Forest.

Cumulative Effects of the Proposed Action

Approximately 17,270 acres have been treated in the CEA (Table 15). Past logging in the cumulative effects area would have increased foraging habitat for the wild turkey. This conclusion is consistent with Zeedyk (1987), which stated that turkeys preferred small patchy logged openings rather than meadows for foraging, and selectively logged areas for brood rearing foraging areas. Present and future timber harvests within the turkey CEA would also increase desirable foraging habitat. Most often the spruce-fir type is so dense that it contains very little understory vegetation (Nish 1973). Thinning of dense timber would improve the area for turkey habitat (Nish 1973), and therefore improve habitat within the CEA for the turkey. Continued outbreaks will occur resulting in the loss of large Engelmann spruce trees and subsequent roosting habitat. Roosting habitat has and will continue to be reduced due to this loss.

The aspen ecosystem is an early successional, sub-climax forest type and is dependent on periodic destructive disturbance for long-term survival (Gullion 1977). Aspen treatments that have or will occur beyond the proposed project activities but are within the CEA are: Coyote Hollow (65 acres), Pacer (19 acres), Lost Spring (33 acres), and Pockets (783 acres), (Orlemann 2012c). This is a total of approximately 900 acres. This is 2 percent of the cumulative effects area. While foraging habitat will continue to be reduced as aspen habitat is lost in the CEA, future timber harvest will promote the regeneration of some of the aspen. Management objectives for present and future timber projects include long-term retention of aspen dominated clones which will increase foraging habitat.

Past logging activities in the CEA would have increased human disturbance to the wild turkey. Present and reasonably foreseeable future timber harvests within the turkey CEA would also increase disturbance. This would cause turkeys to disperse to surrounding habitat away from logging activities. In addition, recreational activities (i.e., sightseeing/driving for pleasure, dispersed camping, hunting, hiking, horseback riding, OHV use, and mountain biking) would also cause the dispersement of turkeys. However, turkeys have and will disperse to other habitat. Since human disturbance will cause dispersal to other areas and use of the CEA is expected to be low, effects will be minor.

Livestock grazing has proven to be compatible with turkey management (Nish 1973). Grazing in the associated allotments has undergone NEPA analysis, including effects to the wild turkey. Allotment Management Plans (AMPs) have been established which limit livestock numbers and season of use and establish proper use guidelines, allowing for compatibility with turkey. In addition, as with the project area, use of the CEA is expected to be low.

In summary, past, present, and reasonably foreseeable future vegetation management activities including aspen treatments would have and will increase foraging and brood rearing habitat within the CEA. However, foraging habitat has and will continue to be reduced as aspen habitat is lost in the CEA. Roosting habitat has and will continue to be reduced due to the loss of large Engelmann spruce trees. Since human disturbance will cause dispersal to other areas and use of the CEA is expected to be low, effects will be minor. Effects to turkeys within the CEA will be minor because use of the high elevation CEA is low. As a result, there will be no effects to Forest populations and trend. Also, the project area represents a small portion (1 percent) of the potentially suitable habitat on the Forest and will not produce measurable additive effects that would influence Forest populations. Even with the proposed project combined with the beneficial long-term effects of future timber sales (approximately 17,270 acres; Table 15), this area of low use is approximately 2 percent of the potentially suitable habitat on the Forest.

Direct & Indirect Effects of Alternative A

Effects to the turkey will be comparable to the Proposed Action. The acreage difference in the spruce-fir and aspen is too small to determine a measurable difference in effects due to the low use of the area. Road construction in the Proposed Action produces minor effects; therefore, the minor difference between the Proposed Action and Alternative A is not measurable.

Cumulative Effects of Alternative A

Cumulative effects will be the same as the Proposed Action due to the comparable difference in effects from the Proposed Action and Alternative A.

Mule Deer (*Odocoilius hemonius*)

This species is a management indicator for distribution of forage and cover and other habitat factors. Pure conifer stands are used for hiding and thermal cover, but provide limited forage. Aspen is a highly utilized habitat type providing both cover and forage. The quality of forage taken from aspen by deer can potentially be very high, especially in summer (DeByle and Winokur 1985, pp. 142-145). The project area contains dry meadow openings, and aspen that would provide suitable foraging habitat, and conifer and aspen stands that would provide suitable hiding and thermal cover. For areas outside big-game winter range designated areas in the Dixie LRMP, there are no requirements for thermal cover unless in winter and transition ranges. In addition to aspen providing thermal cover as discussed above, old growth can also provide thermal cover. There are approximately 2,098 acres of old growth in the project area (Orlemann 2012c), that could also provide thermal cover.

The project area receives limited use by deer for summer range. Most summer use is concentrated underneath the rim (UDWR 2003). This area is not used for winter or transition range that would initiate the thermal cover guideline (DNF LRMP, p. IV-34). The project area is not designated as fawning or critical habitat by the UDWR. The project area currently meets the Dixie LRMP hiding cover guideline (see Appendix B).

According to the Orlemann (2012c), spruce beetle populations have been increasing to outbreak or epidemic levels, removing the largest sized spruce individuals and groups. This has resulted in the reduction or elimination of large diameter spruce. Some spruce stands in the project area have experienced almost complete overstory mortality due to the recent spruce beetle epidemic. This has resulted in the loss of cover for the species. Aspen stands within the project area are seral stands within the subalpine fir potential vegetation type (Graham et al. 1999). These stands are being invaded by conifer, and exhibit a lack of regeneration and changes to the understory vegetation. Most of the remaining aspen sprouts are in poor health with poor leader growth and minimal crown. These conditions are most likely from competition with conifer seedlings and low light conditions (Orlemann). This has resulted in the loss of cover and foraging habitat.

There are approximately 1,968,616 acres of potentially suitable deer habitat on the Forest. The project area comprises approximately 0.4 percent of that. Based on data collected, deer populations will continue to persist across the Forest (Rodriguez et al. 2012). Deer have been observed in the project area. Evidence of their presence can be found on goshawk survey data sheets which are located in the project record.

Cumulative Effects Area (CEA)

Use of the project area by deer is limited to summer range due to the high elevation. The cumulative effects area for the mule deer is the spruce-fir, aspen, and mixed conifer habitat on the plateau top that supports summer range within the three HUC 6 watersheds that are a part of the Iron Springs project area (see Appendix B.3). These three watersheds include Coyote Hollow-Antimony Creek, North Creek, and Upper North Creek. This area was chosen because the use that occurs in this CEA is consistent with the limited use of the project area in that it only receives minor deer use due to the elevation. Lower elevation summer habitat is not included in the CEA because lower zones allow other uses (e.g., fawning and high priority summer range) that have specific habitat requirements that should not be assessed for this area. The CEA represents an area that is characteristic of the potential use by deer in the project area. Aspen cleaning and regeneration treatments, and spruce/fir thinning and sanitation/salvage treatments within the CEA are found in Table 27.

Table 27. Spruce/fir and aspen silviculture treatments within the CEA for the mule deer.

Project	Treatment	Approximate Acres w/in CEA (percent of CEA)
Aquarius Salvage	Salvage of spruce/fir after blowdown.	1,040 (2 percent)
Black Forest/Velvet Lake Salvage & Timber Sales	Salvage of dead Fuelwood and spruce/fir timber harvest	3,134 (7 percent)
Bug Lake Salvage	Salvage 220 acres of dead spruce	220 (0 percent)
Clayton Salvage	Salvage 248 acres of dead spruce	248 (1 percent)
Coyote Hollow	Aspen patch cuts (65 acres) and spruce/fir selection harvest	2,094 (5 percent)
Coyote Hollow Amendment	Additional sanitation/salvage on same acres	N/A
Lost Spring	Aspen regeneration	33 (0 percent)
Pacer	Aspen patch cuts (19 acres) and spruce/fir selection harvest	1,882 (4 percent)
Pacer Amendment	Additional sanitation/salvage on same acres	N/A
Pockets	Aspen regeneration/cleaning and spruce/fir sanitation/salvage	4,498 (10 percent)
Iron Springs – No Action		N/A
Iron Springs – Proposed Action	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	4,121 (9 percent)
Iron Springs – Alternative A	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	2,213 (5 percent)
Total – No Action		**13,149 (29 %)**
Total – Proposed Action		**17,270 (38 %)**
Total – Alternative A		**15,362 (34 %)**

Direct & Indirect Effects of the No Action

Conifers will eventually replace the aspen if left undisturbed. Since aspen is a highly utilized habitat type (DeByle and Winokur 1985), and the quality of forage taken from aspen by deer and elk can potentially be very high, especially in summer (DeByle and Winokur 1985, pp. 142-145), conifer encroachment and eventual replacement of aspen will reduce important foraging habitat. Spruce mortality may provide some foraging habitat by reducing spruce in the upper canopy layer and allow understory vegetation growth. However, Severson and Rinne (1990) state the herbaceous understory is more productive and diverse in aspen stands than in conifer. The seral aspen habitat, which is more productive and favorable to big game than an Engelmann spruce climax community (UDWR 1998), would be reduced. The No Action will cause negative effects on deer foraging habitat.

Habitat that provides thermal cover will also be reduced but is not expected to result in measurable effects since there is abundant thermal cover provided by the old growth in the project area. As a result of the No Action, untreated stands of old growth are likely to lose the large live tree component and within the next decade old-growth acres could decline by 525 acres (Orlemann 2012c). However, the approximately 1,573 remaining acres would still provide adequate thermal cover in this area.

Because the area receives limited use by deer, effects will be minor for the species. The deer is a management indicator for distribution of forage and cover and other habitat factors (DNF LRMP II-15). Forage habitat for other wildlife species will be reduced as aspen is replaced by conifers, and cover habitat will be reduced as spruce mortality continues. The No Action will not affect Forest-wide populations due to the low use of the area and the project area represents a small portion (0.4 percent) of the potentially suitable habitat on the Forest.

Cumulative Effects of the No Action

Past timber sale treatments have favored spruce resulting in incidental aspen regeneration. Canopy reduction also resulted from this harvesting and subsequently an increase in understory vegetation growth would have occurred. Minor amounts of aspen regeneration has occurred in older sales and more aspen regeneration has occurred directly through recently designed treatments. Untreated areas have favored dominance of conifer over aspen and Engelmann spruce over subalpine fir in the overstory.

Important foraging habitat has and will continue to be reduced as aspen habitat is lost in the CEA. New treatments within aspen will increase foraging habitat. Past harvesting within the CEA reduced canopy cover and therefore increased foraging habitat and decreased cover for the species. Continued beetle outbreaks will occur resulting in the loss of Engelmann spruce and subsequent cover habitat. Effects to deer within the CEA will be minor because use of the high elevation CEA is low. As a result, Forest-wide populations will not be affected. Also, the CEA represents approximately 2 percent of the potentially suitable habitat on the Forest.

Direct & Indirect Effects of the Proposed Action

Of the 256 acres of aspen stands in the project area, approximately 152 acres would receive commercial clear-fell coppice treatment designed to regenerate aspen. Approximately 388 acres of scattered aspen clones within spruce/fir stands would receive aspen cleaning through hand felling of conifer. Commercial-size conifer would be removed, and non-commercial –size conifer and some aspen would be cut and left on site. This treatment would delay the succession of aspen to conifers. Aspen is a highly utilized habitat type providing both cover and forage (DeByle and Winokur 1985).

As a result of proposed treatments, aspen will not be replaced by conifer, and a mixture of aspen will be retained throughout the project area. The 152 acres of clear-fell coppice treatment will increase herbage production (Mueggler 1985), benefiting deer in the long-term by retaining this important habitat and increasing foraging habitat. Short-term negative effects include a decrease in cover. The 388 acres of cleaning will retain important habitat for the deer and increase and reduce the cover effectiveness.

Commercial thinning activities would result in more open stand conditions. Pre-commercial thinning would reduce the subalpine fir component. Openings created by logging in the spruce-fir type would increase quantity and quality of forage (Alexander 1987). Cover effectiveness will be reduced in treated stands.

The reduction of thermal and hiding cover will not affect deer numbers. Smith and Long (1987) describes thermal cover as habitat that provides protection from extreme heat or cold. The high elevation project area is only used for summer habitat and generally extreme cold and heat are not an issue. In addition, there will only be a reduction in thermal cover, not elimination. Under the proposed action it is highly unlikely that all the treated acres would drop out of the old growth classification that would provide thermal cover. The Forest Vegetation Simulator showed none of the treated stands would become disqualified as a result of timber cutting. The Vegetation Analysis shows that if marginal stands and 23 acres of old growth receiving sanitation/salvage treatments dropped out of the old-growth classification, there would be approximately 1,567 acres of remaining old growth (Orlemann 2012c). This would provide adequate thermal cover in the area. Hiding cover is not a limiting factor in the CEA because of the architecture of spruce-fir with foliage that extends to the ground, especially around edges of stands (Orleman 2012a). In addition, regeneration is generally abundant along the edge of stands providing even more hiding cover. Project Design Criteria WL-10 will maintain hiding cover.

Construction of 9.61 miles of new low-standard temporary roads is proposed, including 0.76 miles of temporary road needed to access an old dike and a borrow pit. It may be possible to access the dike on frozen ground or over snow, alleviating the need for road construction. Increased human activity on improved roads and during treatments will cause individuals to disperse to other areas including below the rim where most use occurs. The Proposed Action will not affect Forest-wide populations due to the low use of the area and the project area represents a small portion (0.4 percent) of the potentially suitable habitat on the Forest.

Cumulative Effects of the Proposed Action

For the 45,423 acre CEA for the mule deer, spruce/fir and aspen treatments have occurred, or are planned for, on approximately 17,270 acres which is 38 percent of the cumulative effects area (Table 16). Openings created by logging in the spruce-fir type would increase quantity and quality of forage (Alexander 1987). Past logging activities in the cumulative effects area would have increased understory vegetation and subsequent foraging habitat for the deer.

Aspen treatments that have or will occur beyond the proposed project activities but are within the CEA are: Coyote Hollow (65 acres), Pacer (19 acres), Lost Spring (33 acres), and Pockets (783 acres), (Orlemann 2012c). This is a total of approximately 900 acres. This is 2 percent of the cumulative effects area. Important foraging habitat has and will continue to be reduced as aspen habitat is lost in the CEA. While new treatments within aspen will increase foraging habitat, there will be a net loss because of the small amount of acres being treated. Past harvesting within the CEA reduced canopy cover and therefore increased foraging habitat. While negative effects and some benefits to foraging habitat will occur, effects to deer are not significant because use of the CEA is

low. As a result, Forest-wide populations will not be affected. Also, the CEA represents approximately 2 low. As a result, of the potentially suitable habitat on the Forest.

Direct & Indirect Effects of Alternative A

Effects to deer will be the same as the Proposed Action. The acreage difference in the spruce-fir and aspen is too small to determine a measurable difference in effects due to the low use of the area.

Cumulative Effects of Alternative A

Cumulative effects will be the same as the Proposed Action due to the minor difference in effects from the Proposed Action and Alternative A and the low use of the CEA.

Rocky Mountain Elk (*Cervus elephus*)

This species is a management indicator for distribution of forage and cover and other habitat factors. Pure conifer stands are used for hiding and thermal cover, but provide limited forage. Aspen is a highly utilized habitat type providing both cover and forage. The quality of forage taken from aspen by deer and elk can potentially be very high, especially in summer (DeByle and Winokur 1985, pp. 142-145). The project area contains dry meadow openings, and aspen that would provide suitable foraging habitat, and conifer and aspen stands that would provide suitable hiding and thermal cover. For areas outside big-game winter range designated areas in the Dixie LRMP, there are no requirements for thermal cover unless in winter and transition ranges. In addition to aspen providing thermal cover as discussed above, old growth can also provide thermal cover. There are approximately 2,098 acres of old growth in the project area (Orlemann 2012c), that could also provide thermal cover.

According to Orlemann (2012c), spruce beetle populations have been increasing to outbreak or epidemic levels, removing the largest sized spruce individuals and groups. This has resulted in the reduction or elimination of large diameter spruce. Some spruce stands in the project area have experienced almost complete overstory mortality due to the recent spruce beetle epidemic. This has resulted in the loss of thermal cover for the species.

Aspen stands within the project area are seral stands within the subalpine fir potential vegetation type (Graham et al. 1999). These stands are being invaded by conifer, and exhibit a lack of regeneration and changes to the understory vegetation. Most of the remaining aspen sprouts are in poor health with poor leader growth and minimal crown. These conditions are most likely from competition with conifer seedlings and low light conditions (Orlemann 2012c). This has resulted in the loss of important foraging habitat.

The Escalante Ranger District is part of the Boulder Wildlife Management Unit designated by the Utah Division of Wildlife Resources. The project area is located on the west side of the management unit. The project area receives low to moderate use by elk as summer range. This area is not used for winter or transition range that would initiate the thermal cover guideline (DNF LRMP, p. IV-34). The project area currently meets the Dixie LRMP hiding cover guideline (see Appendix D; Orlemann 2012a). Cow/calf pair use is low within the project area but occurs in the Pockets project area to the north within portions of Antimony Creek. The herd that utilizes the area is estimated to be 75-100 head (personal communication with Jim Lamb, Habitat Biologist, Utah Division of Wildlife Resources).

There are approximately 1,312,212 acres of potentially suitable habitat across the Forest. Based on collected data, it has been determined elk will continue to persist across the Forest (Rodriguez et al. 2012). The project area consists of approximately 0.6 percent of the potentially suitable habitat on the Forest.

Cumulative Effects Area (CEA)

Elk only use the project area for summer range because of it's high elevation. The cumulative effects area for the elk is the spruce-fir, aspen, and mixed conifer habitat on the plateau top that supports summer range within the three HUC 6 watersheds that are a part of the Iron Springs project area (see Appendix B.3). These three watersheds include Coyote Hollow-Antimony Creek, North Creek, and Upper North Creek. This area was chosen because the use that occurs in this CEA is consistent with the restricted high elevational use of the project area in that it only provides summer habitat for elk. Lower elevation summer habitat is not included in the CEA because lower zones allow other uses that have specific habitat requirements that should not be assessed for this area. The CEA represents an area that is characteristic of the potential use by elk in the project area. This area contains approximately 3 percent of the potentially suitable habitat on the Forest. Aspen cleaning and regeneration treatments, and spruce/fir thinning and sanitation/salvage treatments within the CEA are found in Table 28.

Table 28. Spruce/fir and aspen silvicultural treatments within the cumulative effects area for the elk.

Project	Treatment	Approximate Acres w/in CEA (percent of CEA)
Aquarius Salvage	Salvage of spruce/fir after blowdown.	1,040 (2 percent)
Black Forest/Velvet Lake Salvage & Timber Sales	Salvage of dead Fuelwood and spruce/fir timber harvest	3,134 (7 percent)
Bug Lake Salvage	Salvage 220 acres of dead spruce	220 (0 percent)
Clayton Salvage	Salvage 248 acres of dead spruce	248 (1 percent)
Coyote Hollow	Aspen patch cuts (65 acres) and spruce/fir selection harvest	2,094 (5 percent)
Coyote Hollow Amendment	Additional sanitation/salvage on same acres	N/A
Lost Spring	Aspen regeneration	33 (0 percent)
Pacer	Aspen patch cuts (19 acres) and spruce/fir selection harvest	1,882 (4 percent)
Pacer Amendment	Additional sanitation/salvage on same acres	N/A
Pockets	Aspen regeneration/cleaning and spruce/fir sanitation/salvage	4,498 (10 percent)
Iron Springs – No Action		N/A
Iron Springs – Proposed Action	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	4,121 (9 percent)

Table 28 (cont.). Spruce/fir and aspen silvicultural treatments within the cumulative effects area for the elk.

Project	Treatment	Approximate Acres w/in CEA (percent of CEA)
Iron Springs – Alternative A	Spruce/fir commercial thin, sanitation salvage, and aspen regeneration/cleaning	2,213 (5 percent)
Total – No Action		**13,149 (29 percent)**
Total – Proposed Action		**17,270 (38 percent)**
Total – Alternative A		**15,362 (34 percent)**

Direct & Indirect Effects of the No Action

Conifers will replace the aspen if left undisturbed. Since aspen is a highly utilized habitat type (DeByle and Winokur 1985), and the quality of forage taken from aspen by deer and elk can potentially be very high, especially in summer (DeByle and Winokur 1985, pp. 142-145), this will reduce important foraging habitat. However, spruce mortality may provide some foraging habitat by reducing spruce in the upper canopy layer and allow understory vegetation growth. However, Severson and Rinne (1990) state the herbaceous understory is more productive and diverse in aspen stands than in conifer. The seral aspen habitat, which is more productive and favorable to big game than an Engelmann spruce climax community (UDWR 1998), would be reduced. The No Action will cause negative effects on elk foraging habitat. Because important foraging habitat within the aspen will be reduced, this will result in the reduction of use of the project area by the herd that utilizes it. Overtime, as aspen and therefore forage continues to decline in this area, herd size will be reduced. The elk is evaluated because of its status as a management indicator for distribution of forage and cover and other habitat factors (DNF LRMP II-15). Forage habitat for other wildlife species will be reduced as aspen is replaced by conifers, and thermal cover habitat will be reduced as spruce mortality continues. The loss of thermal cover is not expected to result in measurable effects since there is abundant thermal cover provided by the old growth in the project area. As a result of the No Action, untreated stands of old growth are likely to lose the large live tree component and within the next decade old-growth acres could decline by 525 acres (Orlemann 2012c). However, the approximately 1,573 remaining acres would still provide adequate thermal cover in this area. The No Action will not affect Forest-wide populations since the project area represents a small portion (0.4 percent) of the potentially suitable habitat on the Forest.

Cumulative Effects of the No Action

Past timber sale treatments have favored spruce resulting in only incidental aspen regeneration. Canopy reduction was also a result of this harvesting and consequently an increase in understory vegetation growth would have occurred. Minor amounts of aspen regeneration has occurred in older sales and more aspen regeneration has occurred directly through recently designed treatments. Untreated areas have favored conifer over aspen and Engelmann spruce over subalpine fir in the overstory. Continued beetle outbreaks will occur resulting in the loss of large Engelmann spruce trees, a reduction in thermal cover, and an increase in foraging habitat.

The reduction of thermal cover will not affect elk numbers. Smith and Long (1987) describes thermal cover as habitat that provides protection from extreme heat or cold. The high elevation project area is only used for summer habitat and generally extreme cold and heat are not an issue. In addition, there will only be a reduction in thermal cover, not elimination. The CEA will still provide thermal cover in the case of an abnormal weather event.

Hiding cover is not a limiting factor in the CEA because of the architecture of spruce-fir with foliage that extends to the ground, especially around edges of stands (Orlemann 2012a). In addition, regeneration is generally abundant along the edge of stands providing even more hiding cover.

Important foraging habitat has and will continue to be reduced as aspen habitat is lost in the CEA. New treatments within aspen will increase foraging habitat. Past harvesting in the spruce-fir within the CEA reduced canopy and thermal cover and therefore increased foraging habitat for the species. Continued beetle outbreaks will occur resulting in the loss of Engelmann spruce, reducing cover habitat and increasing foraging habitat. The negative and beneficial effects to foraging habitat and the reduction in cover will not affect Forest populations. This is because the CEA represents 3 percent of potentially suitable habitat on the forest and is not classified as critical habitat for the elk.

Direct & Indirect Effects of the Proposed Action

Of the 256 acres of aspen stands in the project area, approximately 152 acres would receive commercial clear-fell coppice treatment designed to regenerate aspen. Approximately 388 acres of scattered aspen clones within spruce/fir stands would receive aspen cleaning through hand felling of conifer. Commercial-size conifer would be removed, and non-commercial –size conifer and some aspen would be cut and left on site. This treatment would delay the succession of aspen to conifers. Aspen is a highly utilized habitat type providing both cover and forage (DeByle and Winokur 1985). As a result of proposed treatments, aspen will not be replaced by conifer, and a mixture of aspen will be retained throughout the project area. The 152 acres of clear-fell coppice treatment will increase herbage production (Mueggler 1985), benefiting elk in the long-term by retaining this important habitat and increasing foraging habitat. Short-term negative effects include a decrease in cover. The 388 acres of cleaning will retain important habitat for the elk and increase and reduce the cover effectiveness.

Commercial thinning activities would result in more open stand conditions. Pre-commercial thinning would reduce the subalpine fir component. Openings created by logging in the spruce-fir type would increase quantity and quality of forage (Alexander 1987). Cover effectiveness will be reduced in treated stands.

The reduction of thermal and hiding cover will not affect elk numbers. Smith and Long (1987) describes thermal cover as habitat that provides protection from extreme heat or cold. The high elevation project area is only used for summer habitat and generally extreme cold and heat are not an issue. In addition, there will only be a reduction in thermal cover, not elimination. Under the proposed action it is highly unlikely that all the treated acres would drop out of the old growth classification that would provide thermal cover.

The Forest Vegetation Simulator showed none of the treated stands would become disqualified as a result of timber cutting. The Vegetation Analysis shows that if marginal stands and 23 acres of old growth receiving sanitation/salvage treatments dropped out of the old-growth classification, there would be approximately 1,567 acres of remaining old growth (Orlemann 2012c). This would provide adequate thermal cover in the area. Hiding cover is not a limiting factor in the CEA because of the architecture of spruce-fir with foliage that extends to the ground, especially around edges of stands (Orlemann 2012a). In addition, regeneration is generally abundant along the edge of stands providing even more hiding cover. Project Design Criteria WL-10 will maintain hiding cover.

Construction of 9.61 miles of new low-standard temporary roads is proposed, including 0.76 miles of temporary road needed to access an old dike and a borrow pit. It may be possible to access the dike

on frozen ground or over snow, alleviating the need for road construction. Increased human activity on improved roads and during treatments may impact and cause dispersal by some individuals. Elk are expected to move back into treatment areas soon after timber harvest activities have ended. They would likely move through active treatment areas at night after operations have stopped. As activities take place in treatment units, elk would have other human-free habitat in the general area. The availability of these human-free areas would allow the elk to remain in the general area and not be forced down to lower elevations. These conclusions are supported by studies done by Ward (1976) on elk behavior in relation to timber harvest operation.

The Proposed Action will not affect Forest-wide populations since the project area represents a small portion (0.4 percent) of the potentially suitable habitat on the Forest. Also, the treated area of the project represents approximately 0.3 percent of the potentially suitable habitat on the Forest.

Cumulative Effects of the Proposed Action

For the 45,423 acre CEA for the elk, spruce/fir and aspen treatments have occurred, or are planned for, on approximately 17,270 acres which is 38 percent of the cumulative effects area (Table 17). Openings created by logging in the spruce-fir type increases quantity and quality of forage (Alexander 1987). Past logging activities in the cumulative effects area focused on spruce-fir and would have increased understory vegetation and subsequent foraging habitat and decreased cover for the elk.

Aspen treatments that have or will occur beyond the proposed project activities but are within the CEA are: Coyote Hollow (65 acres), Pacer (19 acres), Lost Spring (33 acres), and Pockets (783 acres), (Orlemann 2012c). This is a total of approximately 900 acres and 2 percent of the cumulative effects area. This has and will increase foraging habitat and decrease cover. Important foraging habitat has and will continue to be reduced as aspen habitat is lost in the CEA. Untreated areas have favored conifer over aspen and Engelmann spruce over subalpine fir in the overstory. Continued beetle outbreaks will occur resulting in the loss of large Engelmann spruce trees, a reduction in cover habitat, and an increase in foraging habitat. However, old growth will be maintained as described in the Forest Plan guideline (Orlemann 2012c), and thermal cover will be available.

In summary, foraging habitat has and will increase through direct aspen treatments, indirectly through spruce-fir treatments, and logging in spruce-fir stands, and decrease through the loss of aspen. Changes described for foraging habitat will not change elk populations in the CEA because the net gain of foraging habitat is off-set by the decrease in highly utilized aspen foraging habitat. Changes described for thermal and hiding cover will not affect elk numbers. Smith and Long (1987) describes thermal cover as habitat that provides protection from extreme heat or cold. The high elevation project area is only used for summer habitat and generally extreme cold and heat are not an issue. In addition, there will only be a reduction in thermal cover, not elimination The CEA will still provide thermal cover in the case of an abnormal weather event. Thermal cover will be provided by old growth. Hiding cover is not a limiting factor in the CEA because of the architecture of spruce-fir with foliage that extends to the ground, especially around edges of stands. In addition, regeneration is generally abundant along the edge of stands providing even more hiding cover.

Use is expected to stay the same in the CEA since effects from changes in foraging and cover habitat will not result in changes to the population as described above. Since use is expected to stay the same, Forest-wide populations will not be affected. In addition, the CEA represents only 3 percent of potentially suitable habitat on the forest and is not classified as critical habitat for the elk.

Direct & Indirect Effects of Alternative A

Effects to elk will be similar to the Proposed Action. The acreage difference in the spruce-fir treatments will provide less of a benefit than described in the Proposed Action.

Cumulative Effects of Alternative A

Cumulative effects will be similar to the Proposed Action. The acreage difference in the spruce-fir treatments in the CEA will provide less of a benefit than described in the cumulative effects of the Proposed Action.

Open Road Density and Habitat Effectiveness

The three HUC 6 watersheds that are a part of the Iron Springs Project Area were used to calculate the open road density (see Appendix A.5). These three watersheds include; Coyote Hollow-Antimony Creek, North Creek, and Upper North Creek. The species of concern for habitat effectiveness is elk. However, the analysis of open road density will apply to various wildlife. Deer was not used due to the low use in the project area. This area was chosen because the drainages encompass habitat that may be used if project activities result in disturbance. The open road density guideline is 2 mi. /sq. mile and is found under General Direction of the Forest Plan. This calculation will be used to assess effects of the action alternatives on elk habitat effectiveness. Miles of roads within the road density area were calculated using GIS. Administrative roads were included in the calculations.

The existing open road density within the calculation area is 1.8 miles per square mile. According to Lyon (1983), the habitat effectiveness would be approximately 52 percent. The change in road density as a result of the new road construction for the Proposed Action and Alternative A is 1.9 miles per square mile. This amount is so minor that there is not a discernible change in habitat effectiveness. The proposed project alternatives will meet the forest plan open road density guideline. In addition, the new road construction is temporary and following harvest activities these roads will be obliterated thereby reducing the density back to 1.8 miles per square mile.

Migratory Birds

Agency responsibilities for the protection of migratory birds are set forth in the Migratory Bird Treaty Act (MBTA) and Executive Order (E.O.) 13186. A Memorandum of Understanding (MOU) on the Migratory Treaty Act between the U.S. Forest Service (FS) and the U.S. Fish and Wildlife Service (FWS) was signed in 2008 (USFWS 2008). The analysis found in the Biological Assessment, Biological Evaluation, and this document addresses and meets the requirements for the protection of migratory birds for the Iron Springs Vegetation Improvement and Salvage Project.

In accordance with the MOU, species of management concern were reviewed for the Project Area. Species were identified using Utah Partners in Flight Avian Conservation Strategy (Parrish et al. 2002), Birds of Conservation Concern (USFWS 2002a), Comprehensive Wildlife Conservation Strategy (Gorrell et al. 2005), survey data, and professional knowledge. From this review, priority migratory bird species were identified and submitted to the USFWS on February 21, 2012.

Conclusions resulting from the analysis of migratory birds and the Iron Springs Vegetation Improvement and Salvage Project have been based on scale and context, and long-term/short-term effects of the project. Effects for priority species are disclosed in the Biological Assessment, Biological Evaluation, and this report.

Priority migratory bird species that have been assessed in the Biological Assessment, Biological Evaluation, and this document because they are threatened, endangered, sensitive, candidate, or experimental nonessential include: bald eagle, Mexican spotted owl, yellow-billed cuckoo, California condor, peregrine falcon, greater sage-grouse, northern goshawk, flammulated owl, and three-toed woodpecker. It was determined the Iron Springs Vegetation Improvement and Salvage Project may affect but is not likely to adversely affect the Mexican spotted owl and the project may impact bald eagle, flammulated owl, northern goshawk, and three-toed woodpecker individuals, but is not likely to cause a trend toward federal listing or a loss of viability. The remaining species listed above had discountable effects, no suitable habitat in the project area, or no effects from proposed activities.

The "Utah Partners in Flight Avian Conservation Strategy, Version 2.0" [UPIF] (Parrish et al. 2002) and the Fish and Wildlife Service's Birds of Conservation Concern [BCC] (USFWS 2002) provides a list of their priority species for conservation action. UPIF also provides associated breeding habitats for these priority species. For the Sub-Alpine Conifer habitat, the representative UPIF priority species for conservation action is the three-toed woodpecker. Species that may be found in the project area that are on the BCC list includes the flammulated owl, golden eagle, Williamson's sapsucker, and prairie falcon. Effects to the three-toed woodpecker and flammulated owl were assessed in the Biological Evaluation (BE) for the preferred alternative and this report for the No Action and all Action Alternatives. The Williamson's sapsucker, golden eagle, and prairie falcon were not evaluated elsewhere for the Iron Springs Project. The Williamson's sapsucker utilizes and requires similar habitat as the three-toed woodpecker and northern flicker, including coniferous forests and aspen groves (Ehrlich et al. 1988, pp. 338, 346, 352; Smith 1982), and therefore, the effects disclosed for the three-toed woodpecker and flicker also apply to the Williamson's sapsucker. While the Williamson's sapsucker does not require open areas for foraging like the northern flicker, the effects to foraging habitat the species requires is discussed within the three-toed woodpecker analysis. The peregrine falcon was evaluated for the project and utilizes similar habitat to the prairie falcon. There is a known nest in the same vicinity as the peregrine falcon, as well as a golden eagle nest. A buffer has been applied to all three nest sites in accordance with the raptor protection guidelines (USFWS 2002b). Project Design Criteria WL-5, 6 and 7 are designed to avoid impacts to successful breeding and nest site/territory use of known raptors including these three species. In addition to these Project Design Criteria (see Table 1), WL-1, 3-4, 9, and 10 are also designed to avoid impacts and protect migratory birds and other species.

The analysis found in the Biological Assessment, Biological Evaluation, and this document addresses and meets the requirements for the protection of migratory birds for the Iron Springs Project. The project is in compliance with the MBTA, E.O. 13186, and the MOU between the FS and FWS.

Plant Analysis

Table 29 presents a list of Threatened and candidate plant species on the Escalante Ranger District. Plants on this list are the subject of the plant analysis.

Table 29. Threatened and Candidate plant species on the Escalante RD, Habitat Suitability, and rationale for elimination from further review. Habitat characteristics for each of the following species was reviewed and based on information found within Rodriguez et al. (2012), Madsen (2011a & 2011b), Atwood et al. (1991), and Spahr et al. (1991).

THREATENED & CANDIDATE SPECIES	DISTRIBUTION AND HABITAT	SUITABLE HABITAT OCCURS IN THE ANALYSIS AREA
Astragalus henrimontanensis Dana milkvetch Fabaceae – Pea family	Dixie National Forest; endemic to Garfield and San Juan Counties, Utah. Occurs between 7200 to 9200 feet elevation in mixed conifer, aspen, ponderosa pine, pinyon-juniper and sagebrush communities. Found on gravelly loam soil, April – May.	**No** This species is only known to occur on the District in sandstone derived soils east and in the Hell's Backbone area. Project area does not contain suitable soil types. There will be no further review.
Astragalus limnocharis var. tabulaeus Table Cliff Milkvetch Fabaceae – Pea family	Dixie National Forest; endemic to south-central Utah in Garfield County. Occurs at around 9500 feet elevation in western bristlecone pine/ Douglas-fir communities. Found on the White Limestone member of the Claron Formation in the Table Cliff Plateau and Horse Creek Top vicinity. June – August.	**No** Species only known to occur on Claron Limestone. There will be no further review.
Botrychium paradoxum Paradox moonwort Ophioglossaceae – Adder's tongue	Dixie and Ashley National Forests. Widely disjunct in Garfield and Duchesne Counties in Utah. Occurs at about 10,800 feet elevation in open, moist high elevation meadows in Utah. June – August.	**No** Species only known to occur for Dixie NF on moist hummocks of high elevation meadows of the Aquarius Plateau in the Jacobs Reservoir area. There will be no further review.
Castilleja aquariensis Aquarius paintbrush Scrophulariaceae – Figwort family	Dixie National Forest; endemic to south-central Utah on the Aquarius Plateau in Garfield and Wayne Counties. Occurs at 9800 to 11,300 feet elevation in Sagebrush/mixed forb meadow openings. Grows with *Ribes*, columbine, silver sagebrush, groundsel, yarrow, fescue, penstemon and cinquefoil in open spruce-fir stands. July – August.	**Yes**

Table 29 (continued). Threatened and Candidate plant species on the Escalante RD, Habitat Suitability, and rationale for elimination from further review.

THREATENED & CANDIDATE SPECIES	DISTRIBUTION AND HABITAT	SUITABLE HABITAT OCCURS IN THE ANALYSIS AREA
Castilleja parvula var. revealii Reveal paintbrush Scrophulariaceae – Figwort family	Dixie National Forest; endemic to southern Utah in Garfield, Iron and Kane Counties. Occurs between 7500 and 10,000 feet elevation in ponderosa and bristlecone pine communities on gravelly soils of the Wasatch Limestone Formation. Late June – August.	**No** Species only known to occur on soils of the Wasatch Limestone Formation. There will be no further review.
Cryptantha ochroleuca Yellow-white cryptanth Boraginaceae – Borage family	Dixie National Forest; endemic to Garfield and Iron Counties in south-central Utah. Occurs between 7500 and 9350 feet elevation in pinyon-juniper, ponderosa pine and bristle-cone pine communities. Grows on the Pink Limestone member of the Wasatch Formation on unconsolidated alluvium. May – June.	**No** Species only known to occur on soils of the Wasatch Limestone Formation. There will be no further review.
Cymopterus minimus Cedar Breaks biscuitroot Apiaceae – Parsley family	Dixie National Forest; endemic to Garfield, Iron and Kane Counties, Utah. Occurs between 8000 to 10,400 feet elevation in bristlecone pine, ponderosa pine and spruce-fir communities. Grows on Claron Limestone. July – August.	**No** Species only known to occur on Claron Limestone. There will be no further review.
Eriogonum aretoides Widtsoe buckwheat Polygonaceae – Buckwheat family	Dixie National Forest; endemic to Garfield County, Utah. Occurs between 7400 and 8700 feet elevation in bristlecone pine, ponderosa pine, Douglas fir and Rocky Mountain juniper communities. Grows on the Pink Limestone member of the Claron Formation. Late May to June – August.	**No** Species only known to occur on Claron Limestone. There will be no further review.
Heterotheca jonesii Jones goldenaster Asteraceae – Sunflower family	Dixie National Forest; endemic to southern Utah in Garfield, Kane and Washington Counties. Occur between 5200 and 9000 feet elevation in ponderosa pine, manzanita and Douglas fir communities. Grows on sandstone or in sand. May – September.	**No** Species only known to occur on sandstone in the Hells Backbone/Box Death Hollow vicinity of the Escalante Ranger District. There will be no further review.
Lepidium montanum var. neeseae Neese pepperplant Brassicaceae – Mustard family	Dixie National Forest; endemic to the Table Cliff Plateau in Garfield County, Utah. Occur between 7700 and 8800 feet elevation in ponderosa pine and spruce-fir communities. Grows mainly on the pink and white limestone members of the Wasatch Formation, also on Navajo Sandstone. May – June.	**No** Species only known to occur on sandstone in the Hells Backbone/Box Death Hollow vicinity of the Escalante Ranger District. There will be no further review.

Table 29 (continued). Threatened and Candidate plant species on the Escalante RD, Habitat Suitability, and rationale for elimination from further review.

THREATENED & CANDIDATE SPECIES	DISTRIBUTION AND HABITAT	SUITABLE HABITAT OCCURS IN THE ANALYSIS AREA
Penstemon bracteatus Platy penstemon Scrophulariaceae – Figwort family	Dixie National Forest; endemic to Garfield, Iron and Kane Counties, Utah. Occur between 6900 and 8500 feet elevation in ponderosa pine, limber pine and bristlecone pine/manzanita communities. Grows on stone slides and calcareous gravels of the Pink and White Limestone members of the Claron Formation. May – July.	**No** Species only known to occur on Claron Limestone. There will be no further review.
Penstemon parvus Aquarius penstemon Scrophulariaceae – Figwort family	Dixie and Fishlake National Forests; endemic to Utah in Garfield, Piute and Sevier Counties. Occurs between 8500 and 10,500 feet elevation in black sagebrush, silver sagebrush and grass-forb communities. Grows on sandy, gravelly loam and tertiary volcanic gravels. Late June – August.	**Yes**
Senecio malmstenii Podunk groundsel Asteraceae – Sunflower family	Dixie National Forest; endemic to the Sevier-Markagunt and Paunsaugunt Plateaus in Garfield, Iron and Kane Counties, Utah. Occur between 9500 to 10,500 feet elevation in western bristlecone pine, spruce-fir and mixed conifer woodlands on steep talus slopes of the Claron Limestone Formation. June – August.	**No** Species only known to occur on Claron Limestone. There will be no further review.
Silene petersonii Maguire campion Caryophyllaceae – Pink family	Dixie and Manti-LaSal National Forests; endemic to Garfield, Iron, Kane, Sanpete and Sevier Counties in Utah. Occur between 7000 and 11,300 feet elevation in ponderosa pine, aspen and spruce-fir communities. Grows on Flagstaff Limestone and the Claron Formation. July – August.	**No** Species only known to occur on Claron and Flagstaff Limestone. There will be no further review.
Sphaeromeria capitata Rock-tansy	Dixie National Forest; Disjunct on the Paunsaugunt Plateau around the fringes of Johns Valley. Also disjunct in western Millard County, Utah. Primary populations reported from Wyoming, Montana, and NW Colorado. Occurs between 7,500-8,000 feet only on open escarpments of Tertiary Claron Formation on the Dixie NF. May.	**No** Species only known to occur on open escarpments of Claron Limestone. There will be no further review.

Castilleja aquariensis* & *Penstemon parvus

Castilleja aquariensis is found within sagebrush meadows on the Aquarius Plateau. Potentially suitable open meadow habitat was surveyed within the project area that would receive new road construction. No *Castilleja aquariensis* or *Penstemon parvus* plants were found. The distribution of these plant species to the north of the project area does not extend into the meadow openings

associated with this project. Since no plants were found, this area may not be suitable habitat for the two species.

Direct & Indirect Effects of the No Action

Potentially suitable habitat for *Castilleja aquariensis* and *Penstemon parvus* and individuals will not be affected under the No Action.

Direct & Indirect Effects of the Proposed Action and Alternative A

Some potentially suitable habitat for these two plant species will be impacted by new temporary road construction. However, since no plants were found in the surveyed areas where proposed temporary road construction would occur, there will be no individuals impacted. Also, since no plants were found, this area may not be suitable habitat. Therefore, the project will have no impacts on *Castilleja aquariensis* and *Penstemon parvus* individuals or their associated habitats.

Best Available Science

An analysis of pertinent wildlife and plant species for the Iron Springs Vegetation Improvement and Salvage Project has been conducted. The resulting Biological Assessment, Biological Evaluations, and this report rely on scientific documents and literature to support the conclusions they contain. Documents are cited and are included in the project record. Local knowledge of the project and surrounding area was used in combination with these scientific documents and literature. Comparative analysis considering similar past projects and monitoring was conducted and is referenced in the analysis of the project. Field surveys and site specific data was collected to aid in the determination of potential impacts from project activities, and are part of the project record. In addition, contributions in the form of reviews, analysis, and/or surveys were received from the Forest Wildlife, Fisheries, and Rare Plant Program Manager; the Forest Fisheries Biologist; and the Forest Botanist. The potential effects from proposed activities are well documented and there are no significant scientific uncertainties regarding these effects.

Upon my review I am aware of the Beier et al. 2008 article concerning the northern goshawk and its conflicting or opposing views with Reynolds et al. 1992. The forest plan was amended in 2000 to incorporate the Utah Northern Goshawk project. The amendment recognizes both management recommendations from Reynolds et al. (1992), who conducts the most long term goshawk study in Arizona, as well as those of Graham et al. (1999), who completed a goshawk habitat assessment for Utah and developed management recommendations specifically for Utah. In adopting the amendment, the forest service found that both the Reynolds (1992) and Graham (1999) recommendations to be the most appropriate for managing goshawk habitat on national forest system lands in Utah. The Dixie LRMP amendment of 2000 still represents the best available science for the Northern goshawk in Utah (Rodriguez 2012). This science includes: the Conservation Strategy and Agreement for the Management of Northern Goshawk Habitat in Utah (Utah National Forests et al. 1998), Management Recommendations for the Northern Goshawk in the Southwestern United States (Reynolds et al. 1992), and the Habitat Assessment and Management Recommendations for Utah (Graham et al. 1999). Papers discussing Beier et al. 2008 and other opposing science on the subject can be found in the project record (Rodriguez and Young 2008; Rodriguez 2012). After considering the aforementioned material, it is my opinion the best available science has been considered regarding the wildlife and plant analysis.

Compliance with Other Laws and Regulations and the Forest Plan

The project is consistent with applicable Federal laws, executive orders, and interagency agreements related to wildlife and plants, as summarized below:

The project is consistent with the Endangered Species Act as amended, and with applicable Conservation Strategies and ESA Recovery Plans. A Biological Assessment was completed and a determination was made for the applicable species. These species were identified as a result of Dixie National Forests' consultation with the USFWS (USDA Forest Service 2010). This assessment was sent to the U.S. Fish and Wildlife (USFWS) Service on April 25, 2011. Concurrence from the USFWS on the analysis and determinations was documented on May 5, 2011.

The project is consistent with the Migratory Bird Treaty Act and associated Strategy for Implementing the Migratory Bird Treaty Act (USDA Forest Service 2009a), and the MOU between USFWS and the FS of December 2008 (USFWS 2008). The analysis for migratory birds is disclosed in this report. In accordance with the Strategy for Implementing the MBTA and EO 13186 on National Forest Lands in Utah, a letter was sent to the USFWS on February 21, 2012 disclosing the list of migratory bird species analyzed in this report.

With the implementation of project design features in Table 5, all action alternatives are consistent with management direction found in the Forest Plan. For a complete analysis of wildlife and plant-related Forest Plan consistency, see Appendix B15..

3.2 Hydrology

The existing condition of the following hydrologic components potentially affected by this management is discussed separately for each component. However, the discussion of a component will not be exclusive since they are interrelated and as such the existing condition of one component can't be adequately described without discussing to some degree the other components. The term "timber harvest" as used in this report will include, non-commercial thinning, commercial thinning, and other vegetation treatments involving the cutting of trees.

Background

Hydrologic Location

The Iron Springs project area is located within the Upper North Creek, North Creek, and Coyote Hollow-Antimony Creek 6th field subwatersheds (Figure 1) which are part of the Aquarius Plateau found adjacent to the Basin and Range province. This area receives an average of 31 inches of precipitation annually (PRISM), most of which comes in the form of snow during the winter time. The project area is located primarily within areas geologically described as being tertiary volcanic rocks with much of the soils being derived from this volcanic rock. The predominate soil types (see soils report) are deep and well drained with high runoff potential but the hazard of water erosion being low to moderately low. The topography is quite flat with the arithmetic mean within the project boundary being less than 7 percent (based on slope being calculated from 30 meter digital elevation data). Figure 2 shows streams (both perennial and intermittent) and springs in or near the project area. It also shows the location of 9A Riparian Areas designated in the Dixie National Forest LRMP.

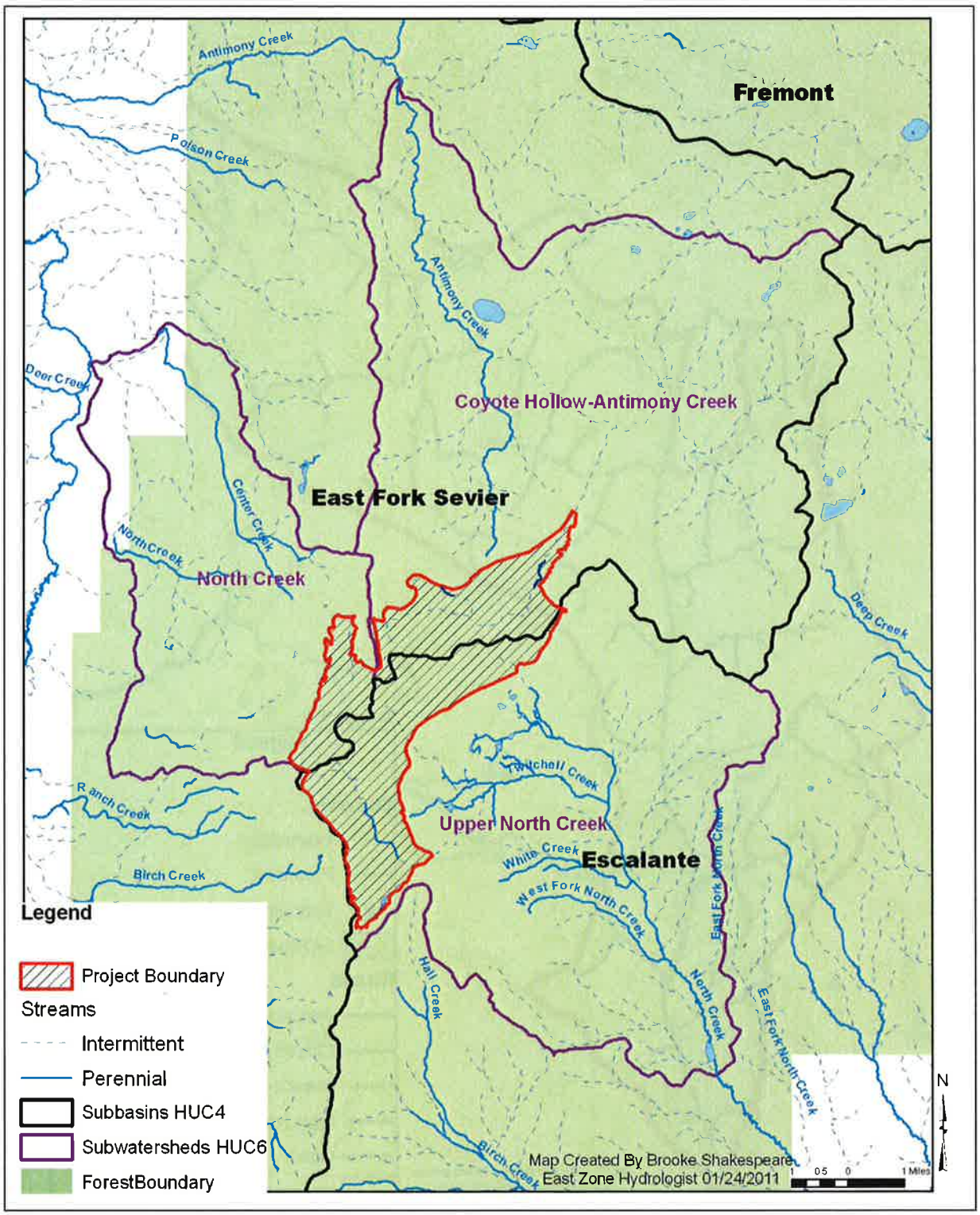

Figure 1. Location of project in relation to streams and drainages

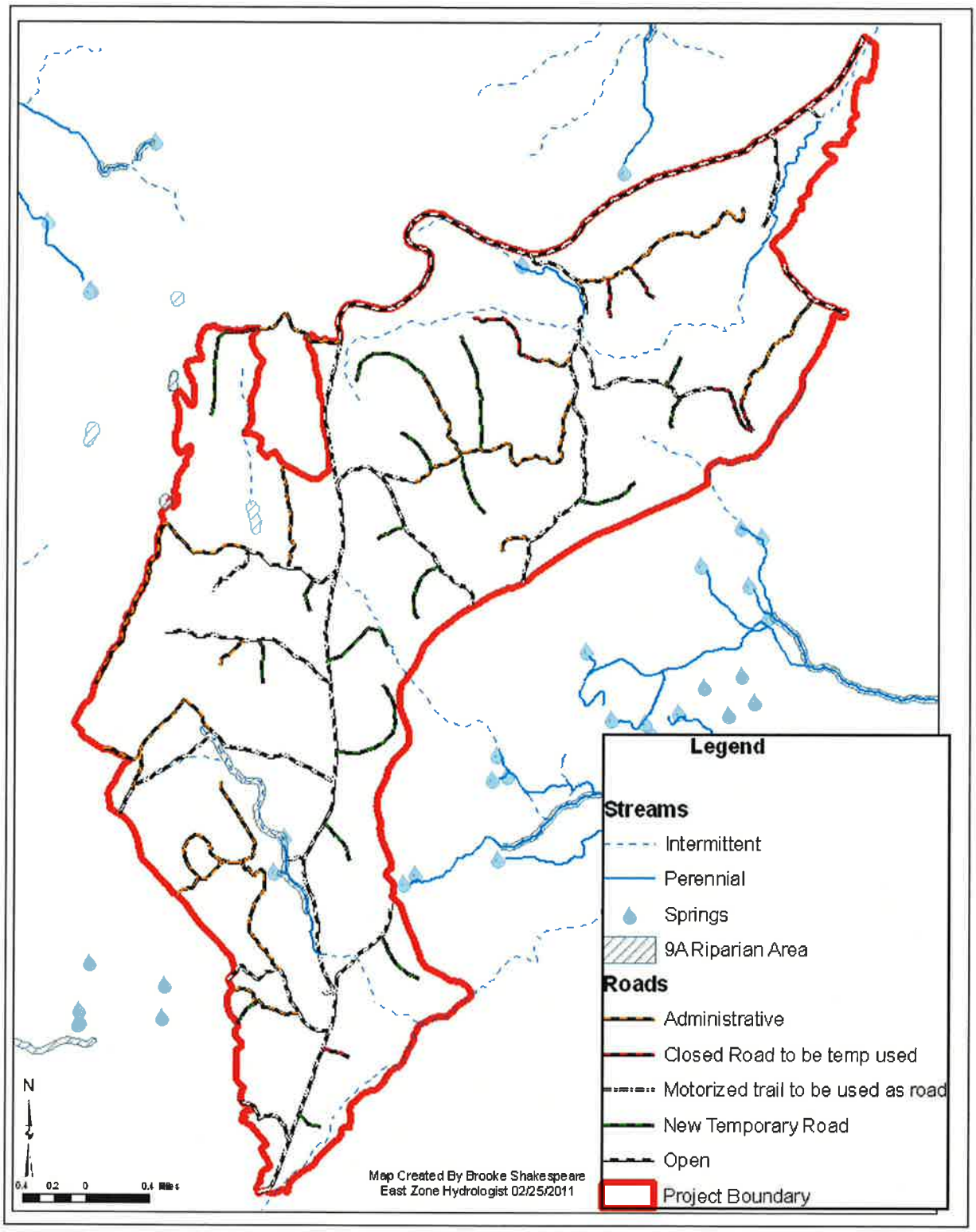

Figure 2. Areas of potential hydrologic concern

Environmental Variables Potentially Affected

Streamflow

Timber harvest has the potential to impact streamflow and annual water yields by increasing both peak flows and base flows (Moore and Wendzel 2005; Scherer and Pike 2003). Although much of the research dealing with forest harvest and stream flow is with clearcut or patch-cut harvest and does not look at watershed scale impacts to streamflow from thinning practices similar to those proposed in this project, there is some research literature suggesting that thinning or decreasing stand density (by at least 15 percent) has the potential to increase annual water yield (MacDonald and Stednick 2003). However, Madrid et al (2006) looked at current thinning practices in a southwest mixed conifer forest and concluded that partial thinning can be implemented without leading to significant increases in hillslope runoff. In theory, peak flows could be increased with current timber treatment practices by both removing some of the transpiring vegetation, reducing infiltration rates through soil disturbance as a result of equipment used to implement the treatment, and constructing roads which can increase impervious surface area and capture shallow subsurface flow along ditchlines. In the winter when the trees are not transpiring much water, they are still able to influence runoff by impacting snow interception. It has been shown that as more snow is intercepted by the vegetation there is a greater proportion of water lost to the atmosphere as evaporation and therefore less water for runoff (Storck et al. 2002; Stottlemyer and Troendle 2001). Because of the high elevation of this project, rain on snow events do not typically occur and would not be influenced by partial removal of the vegetation. With current thinning practices it is unknown how much less interception would take place since the shrubs and remaining trees are still able to catch snow. Additionally, partial removal of vegetation can lead to an increase in shrubs and increased vigor in remaining trees; these treated landscapes could transpire as much water as the untreated stand during the growing season (Kelliher et al. 1986). Therefore, it is more likely that the impacts to peak flows are due to soil disturbance and road networks capturing flow rather than partial removal of vegetation.

As with peak flows, in theory, base flows (stream flow not originating from runoff) could be increased by current thinning and prescribed fire practices due to the short term decrease in transpiration from the removal of vegetation. This would seem to make more water available for subsurface flow and groundwater recharge. However, as stated above under peak flows, the increase in shrubs and increased vigor in remaining trees could transpire as much water as the untreated stand leaving no more or less water in the subsurface for base flow. Additionally, vegetation in the riparian zone seems to have a greater influence on the severity of low flows than does vegetation elsewhere in the catchment (Moore and Wondzell 2005). Bond et al. (2002), one of the studies referenced by Moore and Wondzell (2005), state that for a small headwater catchment in western Oregon, transpiration in 0.1 to 0.3 percent of the catchment (i.e., most likely the riparian zone) accounted for the strong diel patterns in stream discharge observed in late summer. Therefore, thinning in the uplands is less likely to produce a change in base flows when compared to treatments that alter vegetation in the riparian zone.

Streamflow in the project area is predominately spatially and temporally intermittent (Table 30). This is primarily due to the seasonal distribution of precipitation received and amount of contributing area. There are only two perennial streams located within the project boundary (Figure 1); Griffin Springs and Iron Springs. Both of these streams are spatially intermittent, meaning that they have alternating reaches of perennial and ephemeral flow. Additionally, both of these streams have had alterations that impact the streamflow. Griffin Springs has a pond that the stream flows into and out of and also has had culverts raised on the NFS road 140 crossing as an attempt to aggrade the lower part of the stream channel and expand the riparian area. Iron springs has had a trans-basin diversion in the form

of an earthen dike that takes water from the Headwaters Escalante River Watershed (5th level HUC) and directs it into the Lower East Fork Sevier River Watershed (5th level HUC). This diversion primarily impacts spring runoff, although the first portion of the dike does capture perennial flow from Iron Springs which then subsurfaces shortly after being captured. The only known wetlands within this project boundary are also associated with these two streams. These wetlands, in both locations, are a series of small (less than one acre) wet areas interspersed with drier soils. The peak stream flows in the project area are primarily driven by spring snowmelt, having very rapid recessions with low summertime base flows. The summer low flow in these streams is also driven in large part by the spring snowmelt which recharges groundwater that ultimately feeds into the streams throughout the summer.

Table 30 presents a summary of the surface hydrology characteristics of the project area, presented by subwatershed.

Table 30. Subwatershed attributes for the Iron Springs Project Area

Subwatershed	Percentage of subwatershed in project area	Total Subwatershed Stream Miles[2] / Total Stream Miles in Project Area	Approximate Miles of Summer Stream Flow In Project Area
Upper North Creek	15%	78 / 7.6	1.0
North Creek	7%	34 / 0.9	< 0.1
Coyote Hollow - Antimony Creek	7%	78 / 7.0	0.5

Water Quality

Timber harvest has the capability to negatively impact water quality in a few ways; however, the water quality parameters most often impacted are water temperature and water turbidity. Other water quality parameters are closely correlated with these parameters (e.g., dissolved oxygen is strongly correlated with temperature and nutrients are strongly correlated with suspended sediment and turbidity) and therefore will not be discussed separately. With current thinning practices, water temperature would primarily be impacted by the removal of vegetation providing effective shade (Anderson et al. 2007; Northwest Forest Plan Temperature TMDL Implementation Strategies 2005). Water turbidity can be impacted by thinning practices leading to an increase in sediment and particulate matter delivery to the streams; these same increases in sediment and particulate matter delivery can also lead to an increase in nutrient loading derived from the erosion of soil and organic matter.

Acceptable water quality parameters and levels for streams are at least in part set by the designated beneficial uses for their respective drainage basins. The waters found in the project area lie within the Escalante and Sevier Subbasins 4th field HUCs and have designated beneficial use classes of 2B, 3A, and 4. See Table 31 for a description of the beneficial uses. There are no fish-bearing streams within the project boundary. North Creek is the closest fish bearing stream downstream of the project and is approximately 1 stream mile away.

[2] Total stream miles in this column include perennial, intermittent seasonal, and intermittent ephemeral streams.

Table 31. State-designated beneficial uses for the waters within the Iron Springs project area.

Beneficial Use Class	Description
2B	Protected for secondary contact recreation such as boating, wading, or similar uses.
3A	Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.
4	Protected for agricultural uses including irrigation of crops and stock watering.

Information for this table was taken from the State of Utah's Department of Environmental Quality web page.

In Utah's 2006 Integrated Report Volume I – 305(b) Assessment and Volume II 303(d) List of Impaired Waterbodies (UDEQ 2006) there are no waterbodies within or immediately downstream of the project area listed as impaired or requiring a Total Maximum Daily Load analysis (TMDL). The 2008 and 2010 draft 303(d) lists were also reviewed and there were no changes in listings for streams within or next to this project (these lists are included in the project record). Although not listed as impaired and requiring a TMDL, North Creek up to its headwaters is listed in Volume I as being an assessment unit with elevated levels of Total Phosphorus. However, the state of Utah has data that the 3A and 4 beneficial use classes are supported by the water quality.

The perennial portions of Griffin Springs and Iron Springs streams are mostly in meadows away from where trees could provide shading. Consequently, wide stream temperature fluctuations are common for these channels, especially Iron Springs where a large channel width and low gradient makes it so that higher stream temperatures are achieved (see Figure 3). Temperature was monitored in Iron Springs during the summer of 2010.

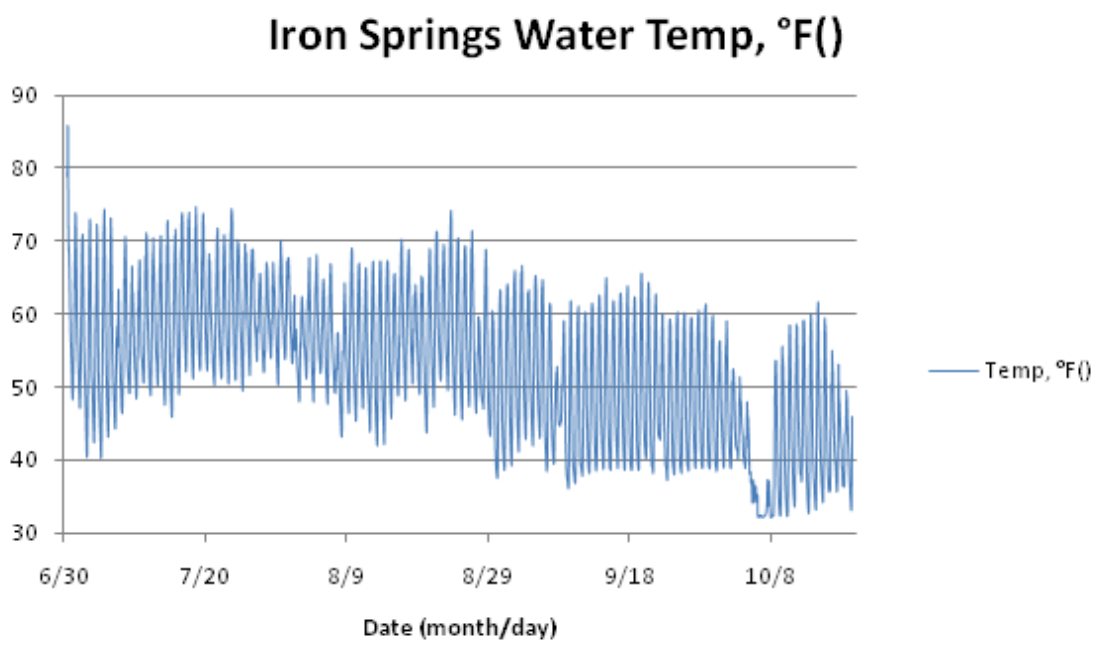

Figure 3. 2010 Iron Springs water temperature measured at same location as channel surveys.

Water temperature was discretely measured at 15-minute intervals using an Onset Tidbit© temperature logger.

Hydrology Regulatory Framework and Project Design Features

Forest Plan Direction

The Dixie National Forest Plan states that "Best Management Practices… should allow all streams on the National Forest to meet the requirements of the State of Utah anti-degradation policy" and "Comply with State water quality standards during land management activity." General Direction Forest-wide Standards and Guidelines for Management that are applicable to this project are:

1) Special protection and management will be given to land and vegetation for a minimum of 100 feet from the edges of all perennial streams, lakes and other bodies of water, which include wetlands, or to the outer margin of the riparian ecosystem if wider than 100 feet (for this project tractor or other heavy equipment will not be allowed within this protection zone).

2) Design and implement activities in management areas to protect and manage the riparian ecosystem.

3) Within the riparian ecosystem, late seral stages will be dominant and all age classes represented. Shrubs with multiple stems and canopy layers should be in contiguous patches with limited opening throughout. Native species should be dominant with grasses, forbs, shrubs, and litter present, dependent on ecological capability.

4) Prescribe silvicultural systems to achieve riparian area objectives.
   a. Maintain shade and stability and sediment standards as specified under Wildlife and Fish Resource Management, Standards and Guidelines.
   b. Maintain at least 70 percent of the linear distance of all riparian ecosystems in at least an upper mid-seral successional stage.

5) Locate and construct arterial and collector roads to maintain basic natural condition and character of riparian areas.

Best Management Practices

The State of Utah's Water Quality Anti-degradation Policy requires maintenance of water quality to protect existing in-stream Beneficial Uses on streams designated as Category 1 High Quality Waters. All surface waters geographically located within the outer boundaries of the Dixie National Forest whether public or private are considered Category 1 High Quality Waters. The Anti-degradation Policy states that no new point source discharges of wastewater will be allowed, and nonpoint sources of wastes shall be controlled through implementation of Best Management Practices (BMPs) or regulatory programs (Utah Division of Water Quality 2000). The State of Utah and the Utah National Forests have agreed, through a 1993 Memorandum of Understanding, to use Forest Plan Standard and Guidelines and the Forest Service Handbook 2509.22, Soil and Water Conservation Practices (SWCPs), to meet the water quality protection elements of the Utah Nonpoint Source Management Plan. The SWCPs applicable to water quality and hydrologic functioning in this project are listed with explanations in the Hydrology SWCPs document found in the hydrology specialist report's references in the project record.

Past monitoring for adherence to BMPs put in place for protection of stream courses and soil resources on ground disturbing vegetation treatment activities on the Dixie National Forest shows that the BMPs have generally been adhered to and have been effective (annual monitoring reports are included in the project record and can also be found on the Dixie National Forest public web page).

Channel Morphology

Stream channel morphology is defined by the cross sectional and longitudinal shape of a channel as well as the channel substrate size and distribution. Descriptive morphological characteristics such as width to depth ratios are important for assessing channel stability and susceptibility to temperature fluctuations (Bartholow 2000, Lile et al. 1995). Timber harvest can affect channel morphology primarily through increased peak flows adjusting the channel dimensions, and increased delivery of fine sediment to the streams. As stated under the stream flow section, the impact of current thinning practices on peak flows is not likely to be measurable and therefore increased sediment delivery to streams from current vegetation management practices is the most relevant impact regarding channel morphology. As soils are disturbed from ground harvesting equipment the ability to be detached during runoff is increased and in theory could be transported to nearby stream channels.

Additionally, road networks used in the timber harvest operations can capture and concentrate shallow subsurface flow and increase channel networks leading to increased sediment delivery to the stream channel from the road prism and the road ditchline (Foltz 1995; Luce and Black 1999). However, while recognizing the lack of research investigating current thinning practices and sediment yield impacts, one study concluded that current thinning practices can be implemented without leading to significant increases in sediment yield (Madrid et al 2006).

Streams in the Iron Springs project area have a wide range of channel slopes and shapes as well as substrate sizes and distributions. The trans-basin diversion dike has undoubtedly impacted channel morphology on Iron Springs by limiting the amount of spring runoff that is transported down the stream channel after diversion. However, because the channel morphology varies so much in Iron Springs due to the natural variations in hillslope and vegetation, it is unclear how much the morphology of the stream channel has been altered due to the diversion; it can reasonably be assumed that more fines have accumulated because of the decrease in transport competence from decreased flows. Due to the fact that most of the streams are intermittent and non-fish bearing there are no streams in the project area where there has been a Level II Riparian Habitat Survey completed which would gather channel morphology data. However, there have been discrete geomorphic surveys on one reach in Iron Springs Draw and one reach along Griffin Springs stream. Results are shown in Table 32. These locations have vastly different channel morphology with Iron Springs generally being a wider channel with a lower gradient and dominated by fines while the Griffin Springs channel is narrower, has a higher gradient, and has larger rocks in the substrate (Figure 4 and Figure 5). However, channel morphology varies along both streams such that channel slope and substrate size are drastically increased/decreased upstream and downstream of the perennial portions of the streams.

The lower perennial portion of Iron Springs is wider and shallower than expected due to unstable banks (see Figure 4). Over utilization by past livestock grazing practices (i.e., during the late 19th century and early part of the 20th century) has likely been the principle cause leading to the existing channel conditions. In 2004 an exclosure fence was installed for the purpose of protecting the stream channel and riparian area from livestock grazing and has led to improving channel conditions (based on ocular observation and photo comparison).

Near the headwaters of Iron Springs there is a wet meadow along NFS road 1369 that is currently being impacted by the road; the road runs next to and borders a segment of this wet meadow (approximately 100 feet). This wet meadow is actually a result of Iron Springs stream morphing into a wet meadow where the slope lessens and as a result has a high water table throughout the summer. During spring runoff and rainfall events sediment from the road is being deposited onto the meadow edge raising the soil surface elevation which in time becomes drier and unable to support existing

hydric vegetation (essentially shrinking the size of the wet meadow). Additionally, the close proximity of the road to the wet meadow renders the road susceptible to rutting during the early portion of the summer when the soil near the wet meadow is also wet.

Table 32 presents results of geomorphic stream surveys for Griffin Springs and Iron Springs streams.

Table 32. Results of geomorphic stream surveys for Griffins Springs and Iron Springs streams.

Stream	Year(s) Surveyed	Particle Size Distribution	Slope	Stream Flow (ft^3/s)	Width To Depth Ratio[3]
Iron Springs	2002	N/A	0.5 percent	Not Measured	11
	2010	Mostly Fine Sands		0.06	11
Griffin Springs	2003	N/A	1.2 percent	Not Measured	5
	2010	Bimodal (Silt/Cobble)		Not Measured	5

Figure 4. Iron Springs stream channel during the 2002 channel survey, looking upstream

[3] Width and depth were calculated from the top of the cut banks for each cross section and then averaged for a mean ratio.

Figure 5. Griffin Springs stream channel during the 2003 channel survey, looking downstream

Direct and Indirect Effects

Streamflow

Proposed Action

This project involves many different types of treatments. Although some of the treatment types are potentially less hydrologically impacting (e.g., they don't use heavy equipment for treatment), for analysis purpose it is assumed that vegetation treatments involve use of skidders and other heavy equipment. This is being assumed as most of the areas treated could involve some type of mechanical harvest. See Table 33, which shows that the treatment types that would likely use heavy equipment (AR, CT, and SS) comprise most of the areas being treated.

This project is in an area that is dominated by snowmelt. In a review of studies that investigated the impact of timber harvest on water yield, Moore and Wendzel (2005) acknowledged that there is a lack of studies reporting the effect of harvesting on water yield in snowmelt dominated systems (most have been in rain dominated systems). Nonetheless, while it is not specific to only snowmelt-dominated systems, the scientific literature discussing timber harvest and water yield suggests that at least 20 to 40 percent of a watershed's living forest overstory needs to be removed in order to detect a change in water yield (Peterson et al. 2009); therefore, it is unlikely that partially removing (i.e., thinning and patch cutting) no more than 8 percent of the watersheds' overstory spread over the course of a few years will lead to a measurable increase in water yield and peak flows (see Table 33).

Table 33. Comparison of the action alternatives on potential effects variables

Subwatershed	Upper North Creek	North Creek	Coyote Hollow- Antimony Creek
Percentage of subwatershed having some type of vegetation removal treatment–PA / AA	7.9 / 3.4	2.4 / 2.4	4.1 / 2.8
Percentage of area within project boundary drainage area being roaded[4]– PA / AA	1.3 / 1.1	1.1 / 1.1	1.4 / 1.4
Commercial Aspen Regeneration only (AR) PA/AA	0.3 / 0.3	0 / 0	0.2 / 0.2
Commercial Conifer[4] Thinning (CT) PA/AA	7.1 / 2.5	2.4 / 2.4	3.1 / 1.8
Commercial Conifer Sanitation/Salvage (SS) PA/AA	0.5 / 0.5	0 / 0	0.8 / 0.8
Aspen Improvement (AC) [5] PA/AA	3.2 / 1.0	1.7 / 1.7	1.6 / 0.8
Pre-commercial Conifer[4] Thinning (PT) PA/AA	<0.1 / <0.1	0 / 0	1.0 / 0.4
Planting of existing low stocked areas PA/AA	0.3 / 0.3	0.5 / 0.5	0 / 0

Proposed Action and Alternative Action are referred to as PA and AA, respectively. Calculations are approximate to within 0.1 percent.

Although there is a lack of research that has quantified the impact of roads alone on water flow at a scale greater than plot or segment (Coe 2004), one such study found no measurable change in peak flows with 5 percent of the watershed being roaded (Ziemer 1981) and another study found that at least 12 percent of a watershed must be roaded in order to detect a measurable change in peak flows (Harr et al. 1975). Another study had contrary results finding streamflow impacts with less than 5 percent of the drainage area being roaded (King and Tennyson 1984). However this study was conducted on nearly plot scale size drainages ranging in size from 70 to 360 acres, 2 to 3 orders of magnitude smaller than a 6th level HUC subwatershed. For the Iron Springs project, and at the smallest scale analyzed, the existing roads and temporary roads together will occupy only 1.4 percent of the drainage area within the project boundary. If landings and disturbed borrow sources were included in the roaded acres the percentage of roaded area would still be less than 5 percent, and far less than 12 percent. Monitoring on previous timber management projects on the forest has not shown detrimental compaction on skid trails used under current best management practices and therefore skid trails were not considered as having the same hydrologic impacts as roads and landings. Furthermore, the temporary roads will be obliterated after use, essentially removing compaction from the location where the road was constructed. Therefore it is unlikely that the roads used with this project will cause measurable changes in peak flow at the subwatershed scale.

Alternative A

(This alternative will primarily be discussed in terms of what potential effects variables would be different from the variables discussed in the Proposed Action alternative)

Under Alternative A the amount of area with trees removed through commercial thinning will be decreased primarily within the Upper North Creek subwatershed (Table 34). It would therefore be

[4] Roaded area was calculated by assuming an average width of 20 ft for all roads, including temporary roads.

[5] Many of the treatment units overlap in the proposed treatment for the units (e.g., AC, CT, and PT, all may occur within the same treatment unit). Consequently the sum of subwatershed % for all the treatment types is greater than the total % of subwatershed area being treated.

even less likely that a measurable change would occur to streamflow under this alternative when compared to the Proposed Action. It should be noted, however, that even under the Proposed Action (see section above), the amount of forested area with partial vegetation removal should not lead to a measurable change in streamflow. Consequently, there would be no measureable difference on the effects on streamflow between the Proposed Action and Alternative A.

Table 34. Comparison of the cumulative area of vegetation removal for past projects when combined with Proposed Action and Alternative Action; referred to as PA and AA, respectively

Subwatershed	Upper North Creek	North Creek	Coyote Hollow- Antimony Creek
Percentage of subwatershed having some type of vegetation removal treatment within the past 30 years[6] combined cumulatively with – PA / AA	14 / 10	7 / 7	20 / 19
Percentage of subwatershed having some type of vegetation removal treatment within the past 10 years combined cumulatively with – PA / AA	11 / 6	3 / 3	14 / 13

Calculations are approximate to within 1 percent.

No Action

Under the "No Action" alternative no removal of trees or building of temporary roads or landings would occur. Streamflow would not change if the vegetation within the subwatersheds continued to maintain itself in a condition similar to the current condition. However, if whole timber stands die from insect and disease, this could lead to a greater risk of catastrophic fire which if it occurred would in turn lead to increased peak flows and overland flooding.

Water Quality

Proposed Action

Nearly all of the perennial stream segments and wetlands within the project boundary are located in meadows away from trees and their shade zone. The exceptions are an approximately 350-foot reach of Griffin Springs and an approximately 400-foot reach of Iron Springs. The Iron Springs reach is not proposed for treatment and the Griffin Springs reach has already had encroaching conifers removed by hand (in an attempt to restore willows) and will not have additional treatment or ground disturbing equipment allowed within 150 feet of the stream or wetlands. Therefore, removal of shade-bearing trees under this alternative would be basically non-existent and water temperature would not be measurably impacted. Stream turbidity and suspended sediment is also unlikely to be measurably impacted from timber harvest due to the fact that there are no harvest units next to the perennial reaches of stream or wetlands and there are very few stream crossings and locations where the road even parallels the stream. Additionally, due to the low gradient topography and vegetation buffers around the stream, runoff with suspended sediment from roads is likely to infiltrate or drop the sediment before reaching the stream (Rashin et al. 2006). Expansion of borrow sources could lead to

[6] Amount of previous vegetation removal treatments were calculated based on GIS data for past vegetation removal activities, including prescribed and managed fire. All chaining were assumed to be within the past 30 years since dates were not available for those activities. The GIS data are found in the project record.

some additional contribution of sediment to the outflowing stream channels in the short-term during runoff events (which is primarily during spring snowmelt when the ephemeral drainages flow water). These depressions or pits will essentially be expanded and/or deepened by taking material from them. All but one of the borrow source locations are on existing manmade depressions that exist in ephemeral drainages and are being used for livestock and wildlife watering (the one borrow source location that is not used for livestock or wildlife watering is also located on a previously disturbed site but is not where water drains into it). However, the additional amount of sediment that could be contributed to the ephemeral drainages during these runoff events from expansion of the borrow sources is unlikely to be measureable because of the small amount of additional area being disturbed and the fact that most of these pits serve as catchment ponds. Furthermore, all of the locations on the ephemeral drainages are at least 1 stream mile away from reaching perennial water which allows for a greater chance of deposition and/or attenuation of sediment concentrations and therefore water quality as defined by the beneficial use (see affected environment) is unlikely to be measurably impacted by borrow source expansion.

No Action

As stated in the Proposed Action section above, nearly all of the perennial stream segments and wetlands within the project boundary are located in meadows away from trees and their shade zone. Therefore water temperature is not likely to be influenced with no management action to the timber stands. Suspended sediment and stream turbidity would not change if the vegetation within the subwatersheds continued to maintain itself in a condition similar to the current condition. However, if whole timber stands die from insect and disease this could lead to a greater risk of catastrophic fire which in turn could lead to increased overland flooding and transport of sediment.

Alternative A

(This alternative will primarily be discussed in terms of what potential effects variables would be different from the variables discussed in the Proposed Action alternative.)

Under Alternative A there would only be approximately 0.3 percent less roaded area within the project boundary drainages (Table 34); this would not be enough less to make a measurable change in effects to water quality even if there were to be any under the Proposed Action. Moreover, of those roads dropped under Alternative A, none cross or are near (within 700 feet) any of the streams. While there are fewer units treated under Alternative A, the proximity of timber treatments to streams would not increase and therefore there would still be no measurable effect on water temperature.

Channel Morphology

Proposed Action

As discussed under the streamflow and water quality sections, the proposed action is unlikely to have a measureable negative impact on peak flows and sediment delivery and transport. Because channel morphology is primarily influenced by stream flows and sediment delivery and transport, channel morphology would not be measurably impacted in a negative manner under this alternative. Conversely, there would be a positive impact to a wet meadow near the head of Iron Springs due to the proposed action relocating a segment (approximately100 feet) of road 1369 out of the wet meadow edge and upslope away from influencing the wet meadow. This would halt the contraction of the wet meadow being caused by the road’s current location and allow for future expansion of the wet meadow into the location where the road is being removed from.

No Action

Channel morphology is not likely to be altered under this alternative unless large scale tree mortality occurs leading to catastrophic fire. If this was to occur, peak flows and sediment delivery to streams would increase, temporarily leading to a wider stream channel that would be followed by downcutting and unstable banks until a more steady equilibrium is reached between stream flows, sediment supply, and channel shape (Legleiter et al. 2003).

Alternative A

(This alternative will primarily be discussed only in terms of what potential effects variables would be different than those variables discussed in the Proposed Action alternative)

There would be no change in effects to Streamflow and Water Quality as discussed in their respective paragraphs for Alternative A. Also, road 1369 would still be relocated under this alternative and therefore there would be no measurable negative change in channel morphology under Alternative A.

Cumulative Effects

See Table 35.

Climate Change

As it applies to this project, climate change in the western United States is thought to influence the hydrologic cycle by leading to lower snow water equivalences and earlier snowmelt and runoff (CCSP 2008). One study conducted in the Reynolds Creek experimental watershed found that indeed snow water equivalences have decreased over the last 40-year period although there has been no significant change in yearly precipitation or total streamflow (Nayak et al. 2010). These studies suggest that climate change leads to earlier runoff and lower amounts of yearly precipitation as snow which in turn could lead to lower late summer streamflow in areas similar to the project area. For streams found in the project area, this could lead to even less stream reaches that have perennial flow. Increases in minimum air temperatures as found in Nayak et al. 2010 could also lead to increased average water temperatures in the streams. However, because this project is unlikely to cause decreases in stream baseflow or increases in temperature, climate change will be unlikely to have a synergistic effect on any immeasurable impacts to water resources that may be associated with this project.

Table 35. Other activities within the subwatersheds that could have potential cumulative effects when added to the proposed project.

Project	Potential Effects	Overlap in		Cumulative Effect	Extent, Detectable
		Time	Space[7]		
Old Forest Service Timber Harvest Units	Streamflow	No	Yes	No	Projects are completed with no measurable remaining stream temperature, and water quantity effects due to mitigation implementation on the original projects and natural recovery. Even though one of the subwatersheds has a cumulative area of 20 percent of the subwatershed having some kind of vegetation removal (see table 5) most of the past treatments did not remove all of the canopy within that 20 percent area and have had vegetative re-growth; therefore the amount of actual canopy removal is below the 20-40 percent threshold cited earlier for detecting measurable change in streamflow. Stream channel morphology along some of the roads outside of the project area but within the subwatersheds (e.g. lower part of North Creek) has been altered due to past activities (mainly road construction) and still receives additional fines from the roads albeit in an area that naturally receives high amounts of sediment. The ISVISP would not measurably alter streamflow and sediment production and is far removed (more than 4 miles) from the stream channels that show some impacts from past projects and therefore there would be no measureable cumulative effect to channel morphology.
	Water Quality	No	Yes	No	
	Channel Morphology	No	Yes	No	
Forest Service Timber Harvest Activities Planned or Underway	Streamflow	Yes	Yes	Not Measurable	Although it is not known exactly when and how much near future timber harvest activity will occur, in general the treatments that are planned or underway in total represent between will primarily be removing dead trees and therefore are unlikely to lead to a measurable cumulative water quantity effects. Additionally a cumulative water quantity effect is unlikely to be measurable because of mitigation implementation, conformance with existing Forest Plan Standards and Guidelines, and natural recovery on both the existing and near future projects and Iron Springs Vegetation Improvement and Salvage Project (ISVISP).
	Water Quality	Yes	Yes	Not Measurable	There may be an overlap in timing of these projects with the project area; any minor changes in sediment would not be measurable due to implementation of mitigation measures and conformance with existing Forest Plan Standards and Guidelines on both the existing projects and IVISP. Additionally, ISVISP would not impact the primary shade zone so there should be no cumulative increase in stream temperature.

[7] For this table an overlap in space is defined as occurring within the same 6th level HUC subwatershed not necessarily overlapping the same ground.

Table 35. Other activities within the subwatersheds that could have potential cumulative effects when added to the proposed project.

Project	Potential Effects	Overlap in		Cumulative Effect	Extent, Detectable
		Time	Space[7]		
Livestock Grazing	Channel Morphology	Yes	Yes	No	Because there should be no measurable cumulative water quantity and quality effects due to mitigation implementation, conformance with existing Forest Plan Standards and Guidelines and natural recovery on both the existing projects and ISVISP, there should also be no measureable cumulative effect on channel morphology.
	Streamflow	Yes	Yes	No	While improper grazing can impact streamflow by increasing peak flows and decreasing the magnitude and duration of base flows (Meehan and Platts 1978; Staats 1995), utilization monitoring conducted in allotments within this project boundary show that standards have been met where monitored (Sweetwater-Griffin Top utilization monitoring 1992-2009) which suggests streamflow is unlikely to be measurably impacted by the grazing. The ISVISP would not measurably alter streamflow and therefore there should be no cumulative effect to streamflow.
	Water Quality	Yes	Yes	Not Measurable	Livestock grazing likely contributes fine sediment to the streams through hoof shearing of stream banks and displacing the soil near streams. However, because it is unlikely that the ISVISP would contribute a measurable amount of sediment, there should be no measurable cumulative effect on water quality from this project.
	Channel Morphology	Yes	Yes	No	Livestock grazing likely alters the channel shape in some locations by leading to wider shallower channels than in the absence of grazing. However, because the ISVISP is not likely to alter the channel morphology there should be no measurable cumulative effect on channel morphology from this project.
ATV Use	Streamflow	Yes	Yes	No	Because of the relatively flat topography and distance of use from streams within the project area, ATV use does not noticeably impact streamflow. However, outside of the project area but within the respective subwatersheds there are areas where ATV use is channeling water down slopes and into streams (instead of allowing infiltration into the forest soil) likely impacting both the timing and magnitude of peak flows locally. Nonetheless, ISVISP would not measurably alter streamflow and therefore there should be no cumulative effect to streamflow.
	Water Quality	Yes	Yes	Not Measurable	Like with streamflow, the relatively flat topography and distance of ATV use from streams within the project area prevents ATV use from noticeably impacting water quality. Outside of the project area but within the respective

Table 35. Other activities within the subwatersheds that could have potential cumulative effects when added to the proposed project.

Project	Potential Effects	Overlap in		Cumulative Effect	Extent, Detectable
		Time	Space[7]		
ATV Use	Water Quality	Yes	Yes	Not Measurable	subwatersheds there are areas where ATV use is channeling water down slopes and into streams leading to increased sediment delivery and turbidity at least locally. However, because it is unlikely that the ISVISP would contribute a measurable amount of sediment, there should be no measurable cumulative effect on water quality from this project.
	Channel Morphology	Yes	Yes	No	Like with Streamflow and Water Quality, Channel morphology is impacted by ATVs primarily through the capturing and rerouting of water on the hillslopes to the stream channel. Additionally, ATV use impacts channel morphology by leading to wider shallow stream channels at locations where ATVs cross the stream. However from what was observed with field reconnaissance within ISVISP current ATV use within the project area does not appear to be located in or around streams for the most part (especially true for perennial streams). While there are areas outside the project boundary where ATVs noticeably impact sections of channel morphology, the ISVISP is not likely to alter the channel morphology even if it leads to some areas receiving increased illegal ATV use where the trees have been removed and therefore there should be no measurable cumulative effect on channel morphology from this project (as mentioned in the water quality section of direct and indirect effects, most of the streams are in open meadows and not in timber stands and therefore if illegal ATV use does occur as a result of opening the forest, this use would not be near the streams or wetlands).

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Consideration of Available Science

The techniques and methodologies used in this analysis consider the best available science. The analysis includes a review 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, scientific uncertainty, and risk.

The relevant science considered for this analysis consists of several key elements. The elements of science used are:

On-site data. The project area was surveyed and stream channel data was collected in 2002, 2003, and 2010 using General Technical Report RM-245 protocol where it was applicable. Ocular observation of general stream conditions was also made during the summer of 2010. This data can only be used to describe existing conditions as there has not been enough data collected to determine trends.

Scientific literature. Peer-reviewed scientific literature was reviewed for basic understanding of hydrological variables potentially affected by timber management practices as well as likely impacts. Additional scientific literature such as Summaries of Literature Reviews and unpublished government agency documents were also reviewed for relevant information regarding the impacts to hydrological resources from similar projects. This information was used to determine the likely impacts of this project on hydrological resources. Additionally, a review of any relevant science with a responsible opposing view was conducted and has been discussed within the specialist report.

The collective knowledge of the project area by ID Team members through integration of science with local conditions. Experience gained from implementation of other similar vegetation treatment projects has been incorporated into the analysis.

Comparative analysis considering other local similar projects and past monitoring data. The effects to hydrologic resources in other similar projects on top of and near the Aquarius Plateau have been considered in the analysis.

Conclusion

The hydrologic analysis conducted for this project has not found there to be any measureable effects to the water resources under either action alternative if implemented with the best management practices identified in the project design features. Additionally, as illustrated in the cumulative effects analysis in Table 34, it is very unlikely that this project will have any measurable cumulative effects on water resources. Conversely, the no action alternative has the potential to lead to negative water quantity, and quality effects by leading to higher forest fuel loads conducive of large scale high intensity fire. Therefore, because of the increased area treated, the proposed action alternative shows the greatest potential to reduce the risk of high-intensity large-scale fire and associated negative effects to water resources.

3.4 Soils

Soil Desired Conditions for the Project

Soil productivity will be maintained, as required by the Dixie National Forest Land and Resource Management Plan (LRMP), page IV-22, (USDA Forest Service - Dixie National Forest, 1986).

Soil Management Direction

Forest Plan Direction

The following describes the goals, objectives, standards and guidelines concerning the soil resources for this project.

LRMP Goals Related to Soil Resources

Goal No. 29. Provide water and soil guidance to other resource activities to protect or improve water quality and quantity and soil productivity. (Page IV-8)

LRMP Standards and Guidelines Related to Soil Resources

> Minimize soil surface compaction and disturbance by curtailing logging activities during periods of high soil moisture. Design skid trails system to minimize extent of area compacted (Page IV-40)
>
> Special protection and management will be given to land and vegetation for a minimum or 100 feet from the edges of all perennial streams, lakes and other bodies of water or to the outer margin of the riparian ecosystem if wider than 100 feet. (Page IV-41)
>
> Design and implement activities in management areas to protect and manage the riparian ecosystem. (Page IV-41)
>
> Maintain soil productivity, minimize man caused soil erosion, and maintain the integrity of associated ecosystem. (Page IV-48)

Management Area Desired Future Condition, Direction, Standards

Forest Plan Goals, Objectives, Standards and Guides concerning the soil resource and/or other existing Forest Direction.

The Iron Springs Vegetation and Salvage Project is located within the LRMP management areas shown in Table 36.

Table 36. Affected LRMP management areas

LRMP Management Area	Acres	Management Area Descriptions
2B	2,478	Rural and Roaded Recreation Opportunities
6A	2,168	Livestock Grazing
7A	3,613	Timber Management
9A	47	Riparian Management
Total for Project Area	**8,306**	

Guidelines applicable to the soil resource in each of the above management areas are as follows:

Management Area 2B – Rural and Roaded Natural Recreation – No specific standards and guidelines, desired future condition or management direction for soils is listed within the rural and roaded natural recreation (2B) management area.

Management Area 6A – Livestock Grazing -- No specific standards and guidelines, desired future condition or management direction for soils is listed within the livestock grazing (6A) management area.

Management Area 7A – Wood Production and Utilization – No specific standards and guidelines, desired future condition or management direction for soils is listed within the wood production and utilization (7A) management area.

Management Area 9A – Riparian Management –

1. Rehabilitate disturbed soil areas where adverse impacts would occur according to the following priorities:

   Aquatic Ecosystems
   Riparian Ecosystems; and
   Riparian areas outside of Aquatic and Riparian Ecosystems

2. Minimize soil surface compaction and disturbance in riparian ecosystems. Allow use of heavy construction equipment for construction, residue removal, etc., during periods when the soil is least susceptible to compaction or rutting.

3. Maintain or enhance the long-term soil productivity of soils within the riparian ecosystem

Forest Service Intermountain Region Project-Specific Direction

No more than 15 percent of an activity area should have detrimentally disturbed soil after the completion of all management activities. In other words, at least 85 percent of an activity area should be in a non-detrimentally disturbed condition. (USDA Forest Service - Intermountain Region)

Following the cessation of disturbance in an activity area, the minimum effective ground cover should be sufficient to prevent detrimental erosion. (USDA Forest Service - Intermountain Region)

Above-ground organic matter (forest litter and/or large woody debris) is required to retain nutrients and microorganisms necessary to supply and cycle nutrients needed to maintain site productivity. Above-ground organic matter also provides for on-site moisture retention. (USDA Forest Service - Intermountain Region)

Issues

The following non-key issues concerning the soil resource were brought forward in the notice and comment process:

> ***Issue 1*** *– Please provide estimates of current detrimental disturbance in all previously established activity areas in the watersheds affected by the proposal.* The existing condition analysis within this specialist report addresses current detrimental soil disturbance.
>
> ***Issue 2*** *– Please disclose the link between current and cumulative soil disturbance in the project are watersheds to the current and cumulative impacts on water quantity and water quality. Please disclose if there are any WQLS streams or TMDL streams in the project area.* Detrimental

soil disturbance has been taken into account in this report and in the hydrology specialist reports regarding water quantity and quality. TMDL streams are addressed in the hydrology specialist report.

Issue 3 *– Please disclose measures of, or provide scientifically sound estimates of, detrimental soil disturbance or soil productivity losses (erosion, compaction, displacement, noxious weed spread) attributable to off-road vehicle use.* Detrimental soil disturbance and loss of soil productivity are discussed in this report and are based upon monitoring of similar soil types and treatments.

Issue 4 *– Please disclose how the proposed "treatments" would be consistent with Graham, et al., 1994 recommendations for fine and coarse woody debris, a necessary consideration for sustaining long-term soil productivity.* Coarse woody debris, litter and effective ground cover are all defined and analyzed within this report.

Indicators and Measures

For the purpose of this analysis, a series of indicators are used to determine level of existing soil conditions and to estimate the effects of the alternatives. Indicators are also used to address project issues and to determine consistency with Forest Plan direction. The indicators that were used in the analysis are presented in Table 37. These indicators are standard throughout the Intermountain Region of the Forest Service (see USDA Forest Service – Intermountain Region).

Table 37. Soil condition indicators and measures

Indicator	Measure
Detrimental Soil Disturbance defined by one or more of the following: Detrimental Soil Displacement Detrimental Soil Compaction Detrimental Soil Puddling Severely Burned Soil	Percent of detrimental soil condition based upon areal extent of each activity area.
Ground cover	Average percent of effective ground cover in an activity area.
Above-ground Organic Matter	Average amount of litter and coarse woody debris lying on the ground surface in an activity area
Road surface contributing to erosional losses	Amount of sediment production from roads within the project area.

Activity Areas

For the purpose of the soils analysis, an activity is an area impacted by a land management activity, excluding specified transportation facilities, dedicated trails, and mining excavations and dumps. Activity areas were identified for each alternative based upon similar land treatments that have similar potential effects to soil resources. Indicators were measured or estimated for each activity area. Table 38 shows the indicators that were measured or estimated in each activity area by alternative. See project record map for locations of each activity area unit.

Table 38. Indicators for each activity area by alternative

	Proposed Action Activity Areas (acres)	Alternative A Activity Areas (acres)
Detrimental Soil Disturbance (displacement, compaction, puddling and severely burned soils) Ground cover Above-ground Organic Matter	Commercial Aspen Regeneration (AR) – 152 acres Commercial Conifer Thinning (CT) – 3,603 acres Pre-Commercial Conifer Thinning (PT) – 381 acres Commercial Conifer Sanitation/Salvage Harvest (SS) – 366 acres Aspen Cleaning (AC) – 388 acres Planting of Existing Low Stocked Areas – 154 acres	Commercial Aspen Regeneration (AR) – 152 acres Commercial Conifer Thinning (CT) – 1,544 acres Pre-Commercial Conifer Thinning (PT) – 134 acres Commercial Conifer Sanitation/Salvage Harvest (SS) – 363 acres Aspen Cleaning (AC) – 388 acres Planting of Existing Low Stocked Areas – 154 acres
Road surface contributing to erosional losses	**8,306 acres** (Project Area) and 0.42 miles of road outside of the project area.	**8,306 acres** (Project Area) and 0.42 miles of road outside of the project area.

Existing Environment Documentation

Riparian/Wetland Soil Analysis

Wetlands and riparian areas were documented with on-site inventory. The riparian areas and wetlands are noted within the hydrology specialist report for the project.

Soil Resources

A soil resource inventory has been completed and verified for all the activity areas; a soils map (USDA Dixie National Forest 1999) of the all the activity areas showing each soil map unit has been verified. (Documentation of field visits such as forms, pictures, notes are in the project record.) Table 39(a-c) below show the approximate acres of each soil map unit by activity area.

Table 39. Summary of the amount of each soil type (acres) in the activity areas for the Proposed Action and Alternative A, and the project area

(a) Proposed Action

Soil Type	AR	CT	PT	SS	AC	PLANT
479	5.2	6.6	0	0	0	0
480	26.1	2.7	1.7	0	0	0
505	0	26.6	0	0	2.6	1.7
508	120.9	3567.1	378.9	366	385.5	152
Total	152	3603	381	366	388	154

(b) Alternative A

Soil Type	AR	CT	PT	SS	AC	PLANT
479	5.2	0	0	0	0	0
480	26.1	1.2	1.2	0	0	0
505	0	21.9	0	0	2.6	1.7
508	120.9	1,520.9	132.5	363	385.5	152
Total	152	1,544	134	363	388	154

AR - Commercial Aspen Regeneration
CT - Commercial Conifer Thinning
PT - Pre-Commercial Thinning
SS - Commercial Conifer Sanitation/Salvage Harvest
AC - Aspen Cleaning
PLANT - Planting of Existing Low Stocked Areas

(c) Amount of each soil type in the project area

Soil Type	Acres
417	1,978
478	1,092
479	12
480	28
505	99
508	5,097
Total	8,306

Summary Descriptions of Soil Types

Soil Condition Forms/Photos and Complete Soil Map Unit Descriptions are in the project record.

Soil type 417 (see Figure 6) will be affected by transportation management associated with the action alternatives. This soil type is on meadow openings with sheep fescue. This soil type typically is covered with 30 percent stones and boulders on the surface with loam topsoil and clay loam and clay subsoil textures to a depth of 60 inches or more. The slopes of this soil range from 2 to 15 percent within the project area.

Soil type 478 will be affected by transportation management associated with the action alternatives. This soil type is on meadow openings with silver sagebrush and sheep fescue. This soil type typically is covered with 35 percent stones and boulders on the surface with loam topsoil and very gravelly and extremely cobbly clay loam and clay subsoil textures to a depth of 60 inches or more. The slopes of this soil range from 3 to 20 percent within the project area.

Soil type 479 is found within the commercial aspen regeneration and the commercial conifer thinning treatments. This soil typically had an organic horizon of decomposing aspen leaves, twigs and other organic material from 2 inches with about 22 inches of loam, mollic colored soil material below. Below about 12 inches this soil map unit displays an increase in rock fragment with very cobbly and very stony loam textures being present. This soil is typical of what is described in the soil survey and is suitable for timber harvest. The slopes of this soil range from 20 to 35 percent within the project area.

Soil type 480 typically has an organic horizon of decomposed aspen leaves, fir needles and twigs from 2 to 3 inches with about 15 inches of loam, mollic colored soil material below. An argillic horizon was found in the underlying material with clay loam texture and numerous cobbles and gravel. Cut banks from nearby roads displayed the skeletal nature of this soil below 20 to 25 inches. This soil is typical of what is described in the soil survey and is suitable for timber harvest.

Soil type 505 is on steep sideslopes on the western edge of this project area. These soils are classified as unsuitable because it is technologically infeasible to utilized tractor based logging on this soil type. Trees on this unit would need to be directionally hand felled and then cabled out to areas that are suitable for tractor skidding operations. Areas of this map unit are suitable for timber harvest where they are close to more gentle slopes associated with soil type 508.

Soil type 508 (see Figure 7) is the dominant soil type that will be affected by the all the action treatments. This soil typically had an organic horizon of decomposing needles, twigs and other organic material from 2 to 4 inches with about 4-6 inches of gravelly loam, mollic colored soil material below. Below the first 8 to 10 inches a 10 to 14 inch layer of gravelly clay loam is found with evidence of clay films (argillic development). Below 20 to 25 inches this soil map unit displays an increase in rock fragment with very gravelly and very cobbly clay loam and loam being present. Cut banks from nearby roads displayed the skeletal nature of this soil below 20 to 25 inches. This soil is typical of what is described in the soil survey and is suitable for timber harvest. The slopes of this soil range from 2 to 15 percent through the project area. This is the dominant timber producing soil map unit on the Aquarius plateau, with most of the spruce-fir timber sales on the Escalante Ranger District occurring on this map unit.

Table 40 shows the soil unit interpretations for management for the dominant soils.

Figure 6. Soil type 417. Representative of high-elevation open meadow of sheep fescue that will only be affected by the transportation proposal associated with this project.

Figure 7. Soil type 508. The dominant soil type that will be managed for vegetation treatments.

Table 40. Soil unit interpretations for management for the dominant soils

Soil Type	Harvest Equipment Operability(1)	Soil Compaction Potential (2)
417	**NA**	**Moderate/High** risk of inducing soil compaction.
478	**NA**	**Moderate/High** risk of inducing soil compaction.
479	**Poorly Suited to Well Suited** based upon slope associated with harvest areas.	**Moderate** risk of inducing soil compaction.
480	**Well Suited**	**Moderate** risk of inducing soil compaction.
505	**Unsuited** with slopes more than 40 percent slope and soils with large amount of stones and boulders.	**Moderate** risk of inducing soil compaction.
508	**Well Suited**	**Moderate** risk of inducing soil compaction.

(1) Harvest Equipment Operability, Page 154 (USDA Forest Service Intermountain Region 2010)
(2) Soil Compaction Potential, Page 194, (USDA Forest Service Intermountain Region 2010)

Soil Suitability Ratings for Commercial Timber Harvest

The soil resource inventory identifies the physical and chemical properties of the soils in the activity areas. Interpretations are assessed to identify suitability and limitations of these soils for a variety of management uses. No mass stability hazards have been identified. A summary of the soil characteristics are identified in Table 41.

Table 41. Soil suitability ratings for commercial timber harvest

Soil Type	Suitability* (percent suitable)	Water Erosion Hazard
479	1 (100 percent)	Moderate
480	1 (100 percent)	Moderately Low
505	7 (100 percent)	High
508	1 (100 percent)	Moderately Low

*1 – Suitable Forest Land (Commercial Timber Harvest)
*7 – Technologically Unsuitable for Tractor Logging, Steep Slopes

Existing Condition

Natural erosion rates can be accelerated by human-caused disturbances that reduce vegetative cover, displace organic surface layers, or compact the soil. Some management activities caused only minor disturbances and short term increases in soil erosion, while other more intensive activities removed the natural vegetation and increased surface run-off. Soils committed to existing roads and past logging facilities (log landings and dedicated skid trails) are the primary sources of accelerated soil erosion within the project area. Within the existing condition analysis, past timber sales, reforestation and pre-commercial tree thinning, livestock grazing, dispersed recreation, travel management closures and other uses are also considered in the existing condition of soil resources.

Transportation System

Approximately 39 miles of existing roads occur within the project area. Transportation systems convert the soil resource to a non-productive condition, and most of the precipitation that falls on compacted road surfaces is transmitted as surface runoff. Table 42 provides a summary of all existing roads.

Table 42. Miles of existing roads on specific soil types within the 8,306 acres (Project Area) and 0.42 mile of road outside of the project area

Road Classification	Soil Type 417	Soil Type 478	Soil Type 508	Total
ML1 Administrative Roads	2.16	0.42	8.9	11.48
ML2 High Clearance Vehicle	6.15	2.15	3.24	11.54
ML3 Suitable For Passenger Cars	4.23	3.28	2.94	10.45
Closed Roads	0.18	0.6	1.58	2.36
Motorized Trails	0	0.24	0.09	0.33
Total Miles	12.72	6.69	16.75	36.16

Maintenance Level 1 (ML1) roads are for administrative use only and typically accessed only for forest service timber or range management.

> 8.9 miles of administrative roads on soil type 508 are closed with gates or rock barriers within the project area. These areas consist of stable roads that are not eroding and are typically revegetated with grasses, shrubs and tree saplings within the spruce/fir areas of the project. Some areas have had some intrusion for ATV circumventing around gates and barriers but it has not had a substantial problem to the erodibility of the soil surface. Typically forest service administrative vehicle traffic on these roads is very low due to the fallen trees on the road surface. These roads are stable and are not a significant source of erosion within the project area.

The remaining 2.58 miles of administrative roads are on soil type 417 and 478 which are on open meadows of sheep fescue and silver sagebrush. A closure for access to these roads is difficult due to the open nature of the landscape and is often trafficked illegally due to a lack of natural barriers to limit use. These soils are also more erodible based on lack of coarse woody debris to deter water flow, have loam soil texture with low amounts of rock fragment, and are often braided and/or widened to avoid wet areas or a rough rutted road prism. The roads on these soil types are very susceptible to soil puddling (rutting) due to these characteristics.

Maintenance Level 2 (ML2) roads are for high clearance vehicles and are open to the public.

3.24 miles of high clearance roads are on soil type 508 which are on the spruce/fir areas of the project. Typically use on these roads is low during most of the summer. These roads are stable because of good forest canopy and above ground organic matter and low slope (less than 15 percent) and are not a significant source of erosion within the project area.

The remaining 8.3 miles of high clearance roads are on soil type 417 and 478 which are on open meadows of sheep fescue and silver sagebrush. These soils are also more erodible based on a lack of coarse woody debris and forest canopy to deter water flow, have loam soil texture with low amounts of rock fragment, and are often braided and/or widened to avoid wet areas or a rough rutted road prism. The roads on these soil types are very susceptible to soil puddling (rutting) due to these characteristics.

Maintenance Level 3 (ML3) roads are for suitable for passenger cars and open to the public. All 10.45 miles of road at this maintenance level on all soil types is capped with 6 to 18 of road aggregate. The running surface of these roads is actively managed to deter erosional process by annual road blading and prism improvements to the road surface. These roads are stable and are not a significant source of erosion within the project area.

Closed roads are found on 2.36 miles of the project area.

1.58 miles of closed roads on soil type 508 are closed with gates or rock/vegetative barriers within the project area. These areas consist of stable roads that are not eroding and are typically revegetated with grasses, shrubs and tree saplings within the spruce/fir areas of the project. Some areas have had some intrusion for ATV circumventing around gates and barriers but it has not had a substantial problem to the erodibility of the soil surface. These roads are stable and are not a significant source of erosion within the project area.

The remaining 0.78 mile of closed roads are on soil type 417 and 478 which are on open meadows of sheep fescue and silver sagebrush. A closure for access to these roads is difficult due to the open nature of the landscape and is often trafficked illegally due to a lack of natural barriers to limit use. These soils are also more erodible based on lack of coarse woody debris to deter water flow, have loam soil texture with low amounts of rock fragment, and are often braided and/or widened to avoid wet areas or a rough rutted road prism. The roads on these soil types are very susceptible to soil puddling (rutting) due to these characteristics. Figure 8 is a photograph of ML2 roads with soils types 417 and 478.

Motorized trails within the project area have a very limited extent (0.33) and are typical to the existing condition of ML2 roads as described above.

Figure 8. Typical ML2 (31374) road on soil type 417 and 478.
The road surface is rutted on the left side and traffic begins to migrate to right to find a smooth driving surface. Sedimentation from these soils is typically retained within buffer areas that are adjacent to the road or at changes in slope. These roads typically have not seen any improvement and are essential two tracked roads on the existing soil surface.

Table 43 presents a summary of predicted sedimentation rates for existing roads and trails.

Table 43. Predicted existing condition transportation system sedimentation rates from Water Erosion Prediction Program (WEPP) (Elliot 1999)

Road Classification	Soil Type 417		Soil Type 478		Soil Type 508	
	Average annual sediment leaving road (lb)	Average annual sediment leaving buffer (lb)	Average annual sediment leaving road (lb)	Average annual sediment leaving buffer (lb)	Average annual sediment leaving road (lb)	Average annual sediment leaving buffer (lb)
ML1 and 2 Roads	185	5	175	5	77	0
ML3 Roads	180	6	174	8	259	8
Closed Roads	152	5	144	5	81	0
Motorized Trails	NA	NA	175	5	309	6

The accuracy of a predicted runoff or erosion rate is, at best, plus or minus 50 percent.

Transportation Management Soil Resource Improvements

Beginning in the summer of 2009, the forest began placing barriers and gates on ML1 roads and closing other unauthorized roads through the same methods to inhibit traffic within the Iron Springs Project Area. The roads were decommissioned within site view (typically 100 feet) and then the remaining road surface was left intact. The roads closed by these actions on soil type 508 had typically not been traveled significantly before this action and are recovering with grass reestablishment, natural coarse woody debris recruitment from trees falling and small amount of new tree saplings. A total of 4.9 miles of road was closed with a barrier of boulders, 6.5 miles closed with gate access and 12.7 miles that were naturally closed over the years from revegetation. In 2010 some closure problems have been noted on soil type 417 and 478 due to lack of natural barriers on open meadows to stop vehicle and ATV/UTV traffic., this will slow the recovery of these meadow soils through time.

In late fall 2004, approximately 0.4 mile of the main Griffin Top Road was relocated to protect the wetlands and intermittent drainage below Griffin Springs. The soils and vegetation recovery on the road obliteration has been slow on this high elevation meadow but has decreased the sediment sources directly into intermittent drainage below Griffin Springs. Also in the fall of 2006 NFS Road 30469 (access road to North Creek Lakes Trailhead) was hardened with a 12-inch lift of road aggregate to alleviate problems with road rutting (puddling) and the subsequent road widening on soil type 417.

As depicted in Figure 9, a new 0.4 mile of road was constructed in 2004 to avoid impacts to the Griffin Springs drainage. The actions described above have reduced sediment movement and restored soil productivity condition within the project area.

Figure 9. A 0.4 mile of road prism (NFS Road 30140) constructed in 2004 replaced an old road to avoid impacts to the Griffin Springs drainage

Detrimental Soil Disturbance Associated with Timber Harvest, Reforestation. and Pre-commercial Thinning

Past timber harvest has occurred within all the activity areas associated with the proposed action as shown in Table 36. The majority of the past harvest activities occurred over 30 years ago and the common altered soil properties such as soil compaction, and soil puddling have decreased naturally over time and recovered and did not have a long term effect on soils based upon evidence we see today. Existing soil compaction and soil puddling was shallow and these sites have recovered through natural means (frost heave, freeze-thaw and wet-dry cycles) (Jaros 2011, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest). There were no measureable differences in soil density (compaction) or evidence of soil puddling found on any of the previously timber harvest areas when compared to non harvest areas.

Existing detrimental soil displacement within the vegetation management activity areas is very minimal. Factors that lead to lack of soil displacement is the flat terrain (less than 7 percent slopes on average for the project area) on the Griffin Top plateau and the high amount of above ground organic matter (coarse woody debris and forest litter) and forest canopy that protects the soil surface from erosional events within the timber management activity areas. Detrimental soil displacement associated with roads is discussed within the transportation system discussion.

Reforestation and pre-commercial thinning are activities that do not have a significant impact on the soil resource. These activities are conducted via hand planting and hand felling to improve the forest vegetation.

The Dixie National Forest has implemented the practice of designing skid trails, end lining, and winter logging as methods used to minimize cumulative soil impacts. These practices, along with the other soil and water conservation practices implemented on timber harvest areas, has been successful in keeping cumulative effects of repeated harvest entries on detrimental soil disturbance within thresholds (Jaros 2011, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest). See Table 44 for a list of past timber projects within the activity areas since 1960.

Table 44. Past timber sales within the activity areas since 1960

Activity Areas	Proposed Action Past Timber Harvest Sale Name/ Decade Harvested/Acres	Alternative A Past Timber Harvest Sale Name/ Decade Harvested/Acres
Commercial Aspen Regeneration	Clayton Spruce / 1960 / 84 acres Griffin Spring / 1960 / 13 acres	Clayton Spruce / 1960 / 84 acres Griffin Spring / 1960 / 13 acres
Commercial Conifer Thinning	Clayton Spruce / 1960 / 669 acres Griffin Spring / 1960 / 432 acres Hall Creek / 1970 / 1 acre Iron Springs East / 1980 / 4 acres Willow Bottom / 1980 / 79 acres Recap / 1990-2000 / 1 acre	Clayton Spruce / 1960 / 505 acres Griffin Spring / 1960 / 213 acres Hall Creek / 1970 / 1 acre Iron Springs East / 1980 / 4 acres Willow Bottom / 1980 / 79 acres
Pre-Commercial Thinning	Clayton Spruce / 1960 / 153 acres	
Commercial Conifer Sanitation/Salvage Harvest	Clayton Spruce / 1960 / 298 acres Iron Springs East / 1980 / 62 acres Sink Hole 1 / 1980 / 15 acres Sink Hole 2 / 1980 / 29 acres	Clayton Spruce / 1960 / 84 acres Willow Bottom / 1980 / 79 acres
Aspen Cleaning	Clayton Spruce / 1960 / 63 acres Griffin Spring / 1960 / 37 acres	Clayton Spruce / 1960 / 63 acres Griffin Spring / 1960 / 37 acres
Planting of Existing Low Stocked Areas	Griffin Spring / 1960 / 154 acres	Griffin Spring / 1960 / 154 acres

Effective Ground Cover

Effective ground cover (EGC) consists of vegetation, litter and rock fragments larger than three-fourths inch in diameter. Effective Ground Cover is expressed as the percentage of material, other than bare ground, covering the land surface and includes live vegetation, dead vegetation, litter, cobble, gravel, stones and bedrock. It may include management-induced materials. The minimum effective ground cover, following the cessation of disturbance in an activity area, should be sufficient to prevent detrimental erosion. Detrimental erosion includes erosion rates that cause long-term productivity losses from an activity area or soil losses that are beyond those acceptable for the activity area. Minimum amounts of ground cover are necessary to protect the soil from erosion are a function of soil properties, slope gradient and length, and erosivity (precipitation factor). For the activity areas within this project, 90 percent effective ground cover (USDA Forest Service - Dixie National Forest 2010) is the minimum effective ground cover needed to protect the soil resource. The estimated existing ground cover by activity area is shown in Table 45.

Table 45. Existing condition, effective ground cover, above ground organic matter for activity areas

Activity Areas	Existing Effective Ground Cover (percentage)	Above Ground Organic Matter	
		Litter (centimeters)	Coarse Woody Debris (tons/acre)
Commercial Aspen Regeneration	>95 percent	5 to 10 cm	>10 tons/acre
Commercial Conifer Thinning	>95 percent	5 to 10 cm	>10 tons/acre
Pre-Commercial Thinning	>95 percent	5 to 10 cm	>10 tons/acre
Commercial Conifer Sanitation/Salvage Harvest	>95 percent	5 to 10 cm	>10 tons/acre
Aspen Cleaning	>95 percent	5 to 10 cm	>10 tons/acre
Planting of Existing Low Stocked Areas	>95 percent	5 to 10 cm	>10 tons/acre

Above Ground Organic Matter

Some litter or large (coarse) woody debris may be required to retain nutrients and microorganisms necessary to supply and cycle nutrients needed to maintain site productivity on forest and rangelands. The aboveground organic matter also provides for on-site moisture retention. See Table 45 for the estimated amounts of litter and coarse woody debris for each activity area.

Litter

The surface layer (Oi-horizon) of recently deposited and decomposed plant remains, mainly leaves and twigs (branches less than 3 inches in diameter). The minimum amount of litter required to sustain site productivity has identified as 3 centimeters on spruce/fir and 4 centimeters for aspen for this project. These litter retentions minimum were developed by evaluating existing soil profile information and retaining at least 50 percent of the litter after the management activity or disturbance. All activity areas have sufficient litter on the soil surface. Litter is critical in providing micro-sites for moisture retention

Coarse Woody Debris

Coarse Woody Debris (CWD) is organic materials such as plant stems, branches, and logs with a diameter greater than three inches. Included are both natural materials and management induced post-harvest slash. The amount of coarse woody debris required to maintain nutrient and moisture supplies adequate to sustain site productivity has identified as 10 tons per acre for this project.

All activity areas have sufficient existing CWD on the soil surface. CWD is critical in providing a barrier to overland flow of water by deterring the development of rills and subsequent detrimental soil displacement. CWD is also critical at developing micro-sites for moisture retention and the subsequent protection with shading in reforestation efforts.

Steep Slopes over 40 percent

Steep slopes (over 40 percent) on soil type 505 are unsafe for equipment operations and subject the soil surface to higher amounts of soil displacement. LRMP goals direct the forest to harvest timber in coordination with other resources; saw timber may be harvested on slopes between 40 and 70 percent slopes by cable or other overhead systems if it can be achieved without damaging soils. Slopes over 40 percent that are within the proposed activity areas are to be harvested or managed without mechanical equipment or soil surface disturbance. Techniques such as directional felling and end-lining will need to be implemented to protect these potential erosive areas from additional impacts.

Livestock Grazing

Livestock impacts to the soil resource are found mainly in localized areas of concentrated use such as around water developments, salt licks and major travel routes. The activity areas defined in this analysis have very minimal detrimental soil impacts from concentrated livestock use. The spruce/fir vegetation type typically does not provide a lot of forage for cattle, however they do get out and use some forested areas where the trees are not so dense and needle litter not so thick that some herbaceous forage can grow but overall this area is mostly traveled through to access more favorable open meadows of sheep fescue. (Mortensen 2010) The detrimental effects of soil displacement, compaction, and loss of vegetative cover in such areas can create bare soil areas that are susceptible to accelerated surface erosion. Soil conditions in overused areas can be improved through livestock rotations and construction and maintenance of allotment fences, which can allow for the recovery of vegetation and a reduction in accelerated erosion.

Dispersed Recreation

Dispersed recreation impacts to the soil resource are found mainly in localized areas of concentrated use near the Griffin Top Road (NFS road 30140) and along other high clearance roads from NFS road 30140. Very minimal detrimental effects of the soils have been created by dispersed recreation uses within the activity units identified in the analysis due to low use in the area, the lack of motorized access and unsuitable conditions such as thick vegetation and high amount of coarse woody debris that discourage dispersed camping and day use.

Other Uses

Other land uses that occur within the Iron Springs Vegetation and Salvage Project area include such uses as hunting, hiking, cross-country skiing, etc. These uses do not take National Forest land out of production nor do they have a significant impact on the soil resource.

Summary

The soil resource inventory and field verification identifies all the soil map units that occur within the Iron Springs Vegetation and Salvage Project area. Each soil component is given inherent soil erosion rating based on physical soil properties and slope. Most of the Iron Springs Vegetation and Salvage Project area occurs on relatively gentle slopes of the Aquarius Plateau, and the erosion hazard is dominantly moderately low.

The trend of erosion processes on the Iron Springs Vegetation and Salvage Project is stable. The probable extent of detrimental soil disturbance from past ground-based logging activities most likely occurred on heavy use areas such as log landings. Some long-term, adverse effects to site productivity still exist where topsoil layers were impacted from several equipment passes causing compaction on moist soils. Many of the soil disturbances between skid trails and away from landings were short term disturbances (less than five years), which have decreased through natural processes.

To ensure that long-term soil productivity and soil hydrologic function are maintained, the management options within the Iron Springs Vegetation and Salvage Project area considers soils rated as unsuitable forest lands due to irreversible resource damage and steep slopes as not being considered for mechanized equipment operation. Where soil types allow and management is proposed, applicable mitigation measures identified in the white paper (Jaros 2011, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest) will be applied.

Cumulative Effects Area – The cumulative effects analysis evaluates past as well as current management activities, the proposed activity, and foreseeable future management activities. The CEA for long term soil productivity are the same activity areas for direct and indirect effects. The CEA for on-site erosion (roads) is the project area boundary and 0.42 miles of roads outside of project boundary.

Effects Analysis of the No Action, Proposed Action, and Alternative A

Introduction

Timber harvest and associated activities may affect long-term soil productivity through changes to soil physical properties and organic matter levels. The desired future condition for the soil resource is to maintain or improve long-term soil productivity and soil hydrologic function. Soil management guidelines provide for the maintenance of soil properties that affect soil productivity and hydrologic function. Management activities can damage soils by compaction, displacement, severe burning, organic matter loss or accelerated surface erosion. Soil damage is detrimental when it adversely affects hydrologic function or results in long-term site productivity losses. Soil management guidelines set the limits of disturbance, or thresholds, beyond which there will be long-term losses in inherent soil productivity or hydrologic function. Guidelines are assessed by activity area, which is specifically described for each management activity. No more than 15 percent of an activity area should have detrimentally disturbed soil after the completion of all management activities. In other words, at least 85 percent of an activity area should be in a non-detrimentally disturbed condition.

Analysis Methods

The effects analysis included a determination of potential short and long-term soil productivity changes of each alternative. Soil properties that are easy to quantify are used as surrogates to determine effects on soil productivity. These properties include organic matter (both within and on the soil), soil porosity, and soil strength. These soil properties are maintained by the application of guidelines for the extent of detrimental soil, ground cover, and above-ground organic matter. (USDA Forest Service - Intermountain Region).

Field transects were used to calculate existing condition of the following soil properties that are used as surrogates to determine effects on soil productivity.

Detrimental Soil Displacement
Detrimental Soil Compaction
Detrimental Soil Puddling

Severely Burned Soils
Effective Ground Cover
Above Ground Organic Matter
- Litter
- Coarse Woody Debris

The following describes analysis procedures and assumptions and identifies the methods and/or protocols used to measure the indicators identified to compare alternatives.

Analysis procedure

Estimations of existing conditions were determined for each activity area by field visits and through past monitoring. Estimations of the effects of alternatives were made using literature, past monitoring information, project design features, mitigation measures, and modeling.

Precision and accuracy of estimations

Existing conditions were field verified using both quantified and qualified observations. The potential effects analysis of alternatives used the best information available to make estimations on potential detrimental soil disturbance and soil erosional losses.

Assumptions used

Concentrated use areas around log landings and multi-pass skid trails are likely areas for soil disturbance. Log landings are often heavily compacted and then burned, previous monitoring shows that approximately 1 to 4 percent of a timber sale activity area is detrimentally disturbed from log landing impacts (Jaros 2011, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest). Skid trails in five past spruce/fir sales do not show any evidence of soil bulk density levels that are detrimental. Mitigation measures (USDA Forest Service R1/R4 1988) will be implemented to keep the amount of detrimental disturbance within current Forest Plan and Regional guidelines and as minimal as possible.

Summary of Effects by Alternative

See Table 46 for a summary of the predicted effects of each alternative on soil resources.

Direct, Indirect, and Cumulative Effects of No Action Alternative

On-Site Soil Erosion and Long Term Soil Productivity

Under the No Action alternative, vegetation management and transportation construction would not occur. The condition, processes and trends described in the existing condition section would continue. Erosion rates are moderately low for the vast majority of the project area. Soil productivity would be maintained for those areas. The no action alternative would have potential for large scale wildfire, due to the high amounts of coarse woody debris, from dead spruce that would eventually fall on the soil surface. High amounts of woody debris would increase residence time of fire on the soil surface and increase the amount of severely burned soils. This could result in soil humus losses, soil structure changes, hydrophobicity and soil sterilization.

Cumulative Effects of No Action on Soils

The cumulative effects on the soil resource for each activity area are expected to remain as described in the existing condition.

Past, present and reasonably foreseeable future activities that are reflected in the existing conditions and therefore the no action alternative are summarized in Table 46.

Table 46. Summary of effects on soils by alternative

SUMMARY TABLE OF EFFECTS BY ALTERNATIVE													
Activity Areas (acres)	**Percentage of Detrimental Soil Disturbance[1]**				**Percentage of Effective Ground Cover[2]**			**Above-ground Organic Matter (Coarse Woody Debris tons/acre)[3]**			**Above-ground Organic Matter (Litter - cm)[4]**		
Alternatives PA-Proposed Action A1-Alternative A	Existing Condition	Proposed Action	Alternative A		Existing Condition	Proposed Action	Alternative A	Existing Condition	Proposed Action	Alternative A	Existing Condition	Proposed Action	Alternative A
Commercial Aspen Regeneration (152 acres)	1%	5%	5%		>95	>95	>95	>10	>10	>10	>5	>5	>5
Commercial Conifer Thinning (3603 acres - PA) (1,544 acres – A1)	1 %	5%	5%		>95	>95	>95	>10	>10	>10	>5	>5	>5
Commercial Conifer Sanitation/Salvage (366 acres - PA) (363 acres – A1)	1%	5%	5%		>95	>95	>95	>10	>10	>10	>5	>5	>5
Aspen Cleaning (388 acres)	1%	5%	5%		>95	>95	>95	>10	>10	>10	>5	>5	>5
Pre-Commercial Conifer Thinning (381 acres - PA) (134 acres – A1)	0%	0%	0%		>95	>95	>95	>10	>10	>10	>5	>5	>5
Planting of existing low stocked areas (154 acres)	0%	0%	0%		>95	>95	>95	>10	>10	>10	>5	>5	>5

[1]Percentage of Total Detrimental Soil Disturbance should not exceed 15 percent by activity area.
[2]Properly functioning goal for Effective Ground Cover is 90 percent.
[3]Properly functioning goal for Coarse Woody debris is more than 10 tons acre.
[4]Properly functioning goal for litter retention is 3 centimeters on spruce/fir and 4 centimeters for aspen.

ATV Use

ATV Use in the project area is located on all existing open roads; cross country travel is prohibited within the project area. The ATV travel roads would remain the same as existing condition.

Road Maintenance

Current road maintenance is described within the transportation management existing condition assessment.

Livestock Grazing

Livestock grazing is a use that occurs within Iron Springs Vegetation and Salvage Project; however spruce/subalpine fir areas are rated as transition range and grazing impacts are light. Any grazing that does occur on timber harvest areas is managed under proper use guidelines.

Riparian Exclosures

Riparian exclosures in the Griffin Springs area have been installed to protect mound fens from ungulate trampling. Additional riparian exclosure will also be installed in 2011 to protect additional riparian areas from excessive utilization. All of these areas are within the project area but will not affected by any action proposal.

Past Timber Sales

Soil erosion rates associated with past timber harvest are near natural levels (Jaros 2011, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest).

Dispersed Camping, Hiking Trails, Firewood Gathering, Christmas Tree Cutting and Other Uses

Past and present management activities in the project area include fuel wood gathering, Christmas tree cutting and recreational pursuits such as hunting, camping, hiking and trail riding with motorized and non-motorized vehicles. Along with these items, a multitude of multiple use management actions occur on lands administered by the Dixie National Forest. Such things as watershed rehabilitation projects; wildlife and fisheries habitat improvement projects; biking, snowmobiles, cross country skiing, etc. During the implementation of all these multiple use projects on the Dixie NF; each goes through a NFMA/NEPA analysis. Any project that results in soil disturbance has appropriate best management practices (USDA Forest Service R1/R4 1988) prescribed to minimize soil disturbance and to be within soil management guidelines.

Direct and Indirect Effects of Proposed Action on the Soil Resource

Detrimental Soil Displacement

Field transects (Jaros 2010, Field Data Transects of the Soil Resource for the Iron Springs Vegetation Improvement and Salvage Project) where completed in each activity area unit to determine detrimental soil disturbance relating to soil displacement. Soil displacement is defined as the movement of soil from one place to another by erosive or mechanical forces. Detrimental soil displacement includes areas where 1 meter by 1 meter or larger exhibits the loss of either 5 cm or one half of the humus enriched top soil (A horizon), whichever is less.

Existing detrimental soil displacement within the vegetation management activity areas is minimal and expected to stay the same through implementation of the proposed action. Factors that lead to lack of soil displacement is the flat terrain (less than 7 percent slopes on average for the project area) on the Griffin Top plateau and the high amount of above ground organic matter (coarse woody debris and forest litter) and forest canopy that protects the soil surface from erosional events within the timber management activity areas. Detrimental soil displacement associated with roads is discussed within the transportation system discussion.

Detrimental Soil Compaction and Soil Puddling

Site monitoring from similar previous timber sales on the Escalante Ranger District revealed that approximately 1 to 4 percent, on average, of an activity area has detrimental soil compaction and puddling

after project completion. The monitoring was conducted on similar spruce-fir sales in the areas that were compacted and puddled due to excessive compaction and wheel tracking at log landing areas.

Existing area skid trails within the Iron Springs Vegetation Improvement and Salvage Project on five timber sale areas were monitored for soil compaction. The results of this monitoring efforts are shown in Table 47.

Table 47. Effects of existing skid trails on soil compaction

Past Timber Sales	Average of Area Between Multi-Pass Skid Trail Soil Bulk Density (Range of Values)	Average of Multi-Pass Skid Trail Soil Bulk Density (Range of Values)
Barney Top	1.40 g/cm^3 (1.01 to 1.62)	1.33 g/cm^3 (0.68 to 1.69)
Coyote Hollow	0.94 g/cm^3 (0.91 to 0.99)	1.13 g/cm^3 (1.01 to 1.28)
Pacer Rim	1.27 g/cm^3 (1.08 to 1.48)	1.18 g/cm^3 (0.56 to 1.55)
Recap	1.32 g/cm^3 (1.19 to 1.43)	1.42 g/cm^3 (1.32 to 1.50)
Roundy	0.91 g/cm^3 (0.88 to 0.94)	1.21 g/cm^3 (1.17 to 1.24)

The proposed action alternative would cause an increase (typically 7-32 percent increase) in soil bulk density (compaction indicator) on the multi-pass skid trails within the timber harvest activity areas from pre-harvest conditions. None of the past skid trails monitored had an average at the root restriction initiation bulk density values (1.60 g/cm^3 for loam surface soil textures, (USDA Forest Service - Intermountain Region) that indicate detrimental soil compaction. Timber harvesting over snow, avoiding timber harvesting when the soils are too moist and utilizing coarse woody debris on skid trails, will be practices that will be used to protect the soil surface from detrimental compaction. The amount of rock fragment within the soil reduces the compaction effect. Generally the rockier the soil is the less likelihood of compaction. If greater than 40 percent rock fragments are present throughout the soil profile then low compaction levels are to be expected (Rust 2005). The majority of the soils affected by timber harvesting activities in the Iron Springs Vegetation Improvement and Salvage Project have more than 40 percent rock fragments.

The locations of log landing sites would follow soil and water conservation practices that are approved by the timber sale administrator. The photograph in Figure 10 depicts a typical log landing in the Dixie National Forest.

Figure 10. A typical log landing on the Dixie National Forest

Severely Burned Soils

The proposed action involves designating log landings (typically 1 to 4 percent of the timber harvest activity area, from soil compaction discussion above) to also be pile burned to assist in eliminating cull and limbed material from harvesting activities. These log landing will burn at a very hot temperatures with a long residence time and cause detrimentally disturbed severely burned soils. The aerial extent of these burned log landings is expected on the same previously compacted landings. Within the proposed action, all the treatment areas have been previously harvested; in these areas the old log landings will be utilized to avoid addition new effects to the soil resource.

Effective Ground Cover

The effective ground cover of an activity area is defined as vegetation, litter and rock fragments larger than three-fourths inch in diameter. After the proposed action is implemented more than 95 percent effective ground cover will be present in each vegetation management activity area, which is above the effective ground cover maintenance goals of 90 percent to protect the soil surface (USDA Forest Service - Dixie National Forest 2010).

Litter

Site monitoring indicates that current levels of litter are presently adequate. This surface layer (Oi-horizon) of recently deposited and decomposed plant remains, mainly leaves and twigs, (branches less than three inches in diameter) is more than 5 centimeters deep for this project, this level of litter is expected to be maintained during and after the proposed action is implemented in the vegetation management activity areas.

Coarse Woody Debris

Site monitoring indicates that current levels of more than 10 tons/acre of coarse woody debris (branches and logs with a diameter greater than three inches) are present. Coarse woody debris is important in

protecting the soil surface from erosional events and providing a source for soil microbial activity. The preferred amount of large woody debris required is more than 10 tons/acre on average for this project.

Steep Slopes

Steep slopes (over 40 percent) are unsafe for equipment operations and subject the soil surface to higher amounts of soil displacement. The Dixie Land and Resource Management Plan goals direct the forest to harvest timber in coordination with other resources; saw timber may be harvested on slopes between 40 and 70 percent slopes by cable or other overhead systems if it can be achieved without damaging soils. Steep slopes over 40 percent (soil type 505) that are within the proposed action will have to be harvested and/or managed without mechanical equipment soil surface disturbance. Techniques such as directional felling and end-lining will need to be implemented to protect these potential erosive areas from additional impacts.

Transportation System

Table 48 presents the soil types associated with roads that would be used for this project.

Table 48. Proposed Action - Miles of existing/temporary roads on specific soil types within the 8,306 acres (Project Area) and 0.42 mile of road outside of the project area

Road Classification	Soil Type 417	Soil Type 478	Soil Type 480	Soil Type 508	Total
ML1 Administrative Roads	2.16	0.42	0	8.9	11.48
ML2 High Clearance Vehicle	6.15	2.15	0	3.24	11.54
ML3 Suitable For Passenger Cars	4.23	3.28	0	2.94	10.45
Closed Roads	0.18	0.6	0	1.58	2.36
Motorized Trails	0	0.24	0	0.09	0.33
Total Miles – Existing Roads	12.72	6.69	0	16.75	36.16
New Temporary Road Construction	1.14	0.52	0.26	7.69	9.61

New temporary road construction will affect the following soils types with timber harvesting activities.

> 7.95 miles of new roads on soil type 480 and 508 are to be constructed for timber harvesting activities. These areas consist of soils that are stable and are not eroding with spruce/fir and aspen vegetation. These roads will need to be cleared of existing downfall and vegetation and will be constructed as native surface roads. These roads will be moderately susceptible to soil puddling (rutting) and compaction from use during wet conditions. The soils are protected with tree canopy and surface rock fragments that will dissipate soil puddling (rutting) and compaction. The estimated increase in sedimentation is 14 times the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200-foot buffer adjacent to the road system.
>
> The remaining 1.66 miles of new roads are on soil type 417 and 478 which are on open meadows of sheep fescue and silver sagebrush. These roads are highly susceptible to soil puddling (rutting), compaction and erosion due to a lack of coarse woody debris to deter water flow, have loam soil texture with low amounts of rock fragment, and are often braided and/or widened after construction to avoid wet areas or a rough rutted road prism. The estimated increase in sedimentation is 4 times the sediment leaving the road per year and only a very minor amount of

sediment (less than 10 pounds) that will leave the immediate 200-foot buffer adjacent to the road system.

Maintenance Level 1 (ML1) roads will affect the following soils types with timber harvesting activities.

8.9 miles of administrative roads on soil type 508 are to be opened for timber harvesting activities. These areas consist of stable roads that are not eroding and are typically revegetated with grasses, shrubs and tree saplings within the spruce/fir areas of the project. These roads will need to be cleared of existing downfall and vegetation and will be native surface roads. These roads will be moderately susceptible to soil puddling (rutting) and compaction from use during wet conditions. The soils are protected with tree canopy and surface rock fragments that will dissipate soil puddling (rutting) and compaction. The estimated increase in sedimentation is 14 times the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200-foot buffer adjacent to the road system.

The remaining 2.58 miles of administrative roads are on soil type 417 and 478 which are on open meadows of sheep fescue and silver sagebrush. These roads are highly susceptible to soil puddling (rutting), compaction and erosion due to a lack of coarse woody debris to deter water flow, have loam soil texture with low amounts of rock fragment, and are often braided and/or widened to avoid wet areas or a rough rutted road prism. The estimated increase in sedimentation is 4 times the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200-foot buffer adjacent to the road system.

Maintenance Level 2 (ML2) roads will affect the following soils types with timber harvesting activities.

3.24 miles of high clearance roads are on soil type 508 will be used for timber harvesting activities within the spruce/fir areas of the project. Typically use on these roads is low during most of the summer, but will increase during harvest activities and timber hauling. These roads are stabilized with good forest canopy, above ground organic matter (coarse woody debris), rock fragments on the soil surface and typically on low slope (less than 15 percent). These soils will be affected with soil puddling (rutting) and compaction as use increases but are not a significant source of erosion within the project area. The estimated increase in sedimentation is 14 times the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200-foot buffer adjacent to the road system.

The remaining 8.3 miles of high clearance roads are on soil type 417 and 478 which are on open meadows of sheep fescue and silver sagebrush. These soils are also more erodible based on a lack of coarse woody debris and forest canopy to deter water flow, have loam soil texture with low amounts of rock fragment, and are often braided and/or widened to avoid wet areas or a rough rutted road prism. The roads on these soil types are very susceptible to soil puddling (rutting) due to these characteristics. Sedimentation from these soils is typically retained within buffer areas that are adjacent to the road or at changes in slope. These roads typically have not seen any improvement and are essential two tracked roads on the existing soil surface. The estimated increase in sedimentation is 4 times the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200-foot buffer adjacent to the road system.

Maintenance Level 3 (ML3) roads are for suitable for passenger cars and open to the public. All 10.45 miles of road at this maintenance level on all soil types is capped with 6 to 18 inches of road aggregate. The running surface of these roads is actively managed to deter erosional process by annual road blading

and prism improvements to the road surface. These roads are stable and will be maintained during timber harvest activities and are not a significant source of erosion within the project area.

Approximately 200 feet (0.03 mile) of forest road 1369 is located within a wetland and will be relocated to the suitable drier upland location approximately 30 feet away from its original location. This section of road is inhibiting proper water flow across the meadow and is severely rutted. This action will have a positive effect on the soil resource by protecting the riparian area associated with the Iron Springs watershed.

Closed roads are found on 2.36 miles of the project area.

> 1.58 miles of closed roads on soil type 508 will be opened and consistent with the effects that are described in maintenance level 1 (ML1) roads discussion.
>
> The remaining 0.78 miles of closed roads are on soil type 417 and 478 will be opened and consistent with the effects that are described in maintenance level 1 (ML1) roads discussion.
>
> The estimated increase in sedimentation is from a range of 4 to 14 times in the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200 foot buffer adjacent to the road system.

Motorized trails within the project area have a very limited extent (0.33) and will be widened to approximately 14 feet to effects consistent to a level 2 (ML2) roads as described above.

When roads are converted from “closed” or “low use” to haul routes each road segment can produce an increase in sediment leaving the road. Roads on soil types 417 and 478 are the most susceptible to soil puddling (rutting), more than 13.5 miles of road on these soil types will see heavy hauling use at times and may be subjected to soil puddling (rutting) and sedimentation concerns on these native surface roadways. Some of these roads may get capped with 6 to 12 inches of road base to make then sustainable for logging operations depending on their use levels.

The drainage design of the roads typically moves water off the existing tread and sediment is retained on the road system or adjacent to the road prism. All roads improved or constructed within the project will adhere to Soil and Water Conservation Practices designs to minimize the sediment movement.

Upon completion of the proposed action, all pre-existing closed roads within the project area will be administratively closed through barricading and ripping. This closure action will improve long term soil productivity, by lessening soil compaction effects, allowing natural return of above ground organic matter to soil surface and increasing natural revegetation from a previous committed transportation facility back to vegetative production.

All roads with new temporary road construction will be completely obliterated, to remove impacts to the soil resource.

Within 3 to 5 years following the closure and obliteration of roads within the project area it is expected the sediment leaving the road surface will return to existing condition levels (Elliot, 1999).

Table 49 predicts the existing condition for average annual sediment leaving the road and buffers and the corresponding value for the action alternatives. Maintenance Level 3 (ML3) level roads do not have any changes in predicted sediment leaving the road surface as they are already high use roads and will remain high use during and after the implementation of this project.

The accuracy of a predicted runoff or erosion rate is, at best, plus or minus 50 percent.

Management of these roads with gravel surface application and additional cross drainage will also help lower sediment rates.

Table 49. Comparison table of existing condition and proposed action on the predicted sedimentation rates of the transportation system

Road Classification	Soil Type 417 Existing Condition / Action Alternative		Soil Type 478 Existing Condition / Action Alternative		Soil Type 480 Existing Condition / Action Alternative		Soil Type 508 Existing Condition / Action Alternative	
	Average annual sediment leaving road (lb)	Average annual sediment leaving buffer (lb)	Average annual sediment leaving road (lb)	Average annual sediment leaving buffer (lb)	Average annual sediment leaving road (lb)	Average annual sediment leaving buffer (lb)	Average annual sediment leaving road (lb)	Average annual sediment leaving buffer (lb)
ML1 and 2 Roads	185 / 672	5 / 9	175 / 635	5 / 10	NA	NA	77 / 1156	0 / 10
ML3 Roads	180 / 180	5 / 9	174 / 174	5 / 5	NA	NA	259 / 259	8 / 8
Closed Roads to Open Roads	152 / 672	5 / 9	144 / 635	5 / 10	NA	NA	81 / 1156	0 / 10
Motorized Trails to Harvest Roads	NA	NA	175 / 635	5 / 10	NA	NA	309 / 1156	6 / 10
New Temporary Roads	0 / 672	0 / 9	0 / 635	0/ 10	0 / 240	0 / 0	0 / 1156	0 / 10

Pre-Commercial Thinning

Manual thinning operations are conducted by foot with hand (chainsaw) operations and do not have a significant impact on the soil resource.

Reforestation (Planting of existing low stocked areas)

Manual planting methods would include hand scalping a 2′x 2′ area for site preparation and auger or hoedad planting of containerized conifer seedlings. All other aspects of plantings associated with scalping and planting are conducted by foot with hand operations and do not have a significant impact on the soil resource.

Summary

Table 50 summarizes the effects of the proposed project on soil resources.

Table 50. Summary table of the effects of the Proposed Action and foreseeable actions on the soil resource

Activity Areas (acres)	Percentage of Detrimental Soil Disturbance (acres)[1]	Percentage of Effective Ground Cover[2]	Above-ground Organic Matter (Coarse Woody Debris tons/acre)[3]	Above-ground Organic Matter (Litter)[4]
Commercial Aspen Regeneration (152 acres)	5 percent (8 acres)	>95 percent	> 10 tons/acre	>5 cm
Commercial Conifer Thinning (3603 acres)	5 percent (180 acres)	>95 percent	> 10 tons/acre	>5 cm
Commercial Conifer Sanitation/Salvage (366 acres)	5 percent (18 acres)	>95 percent	> 10 tons/acre	>5 cm
Aspen Cleaning (388 acres)	5 percent (19 acres)	>95 percent	> 10 tons/acre	>5 cm
Pre-Commercial Conifer Thinning (381 acres)	0 percent	>95 percent	> 10 tons/acre	>5 cm
Planting of existing low stocked areas (154 acres)	0 percent	>95 percent	> 10 tons/acre	>5 cm

[1]Percentage of Total Detrimental Soil Disturbance should not exceed 15 percent by activity area.

[2]Properly functioning goal for Effective Ground Cover of 90 percent will be achieved with implementation of the proposed action design features.

[3]Properly functioning goal for Coarse Woody debris of more than 10 tons acre will be achieved with implementation of the proposed action design features.

[4]Properly functioning goal for litter retention is 3 centimeters on spruce/fir and 4 centimeters for aspen will be achieved with a combination of natural process and management induced material.

Activity units associated with ground based timber harvest activities are expected to cause a 4 percent increase in detrimental soil disturbance during project implementation. Following completion of this project all activity areas will be within threshold values for detrimental soil disturbance established for this project.

Steep slopes over 40 percent will be restricted for use of ground based mechanical equipment operations to avoid soil resource degradation.

Improvement to roads and new roads will be susceptible to soil pudding (rutting) during the implementation of this project.

Above ground organic matter (litter and coarse woody debris) and effective ground cover are currently sufficient for this project to protect the soil resource.

The proposed action will meet the guidelines of the LRMP and Project Specific direction for soils. The implementation of SWCPs included with the project would ensure that increases in sediment will be managed and long term soil productivity will be maintained.

Cumulative Effects of the Proposed Action on the Soil Resource

Cumulative effects include past, present, and reasonably foreseeable future activities that may affect the soil resource. The analysis area is an activity area which is the same as that used for direct and indirect effects. See Table 50.

Past, present, and foreseeable activities that may affect soil resources include:

ATV Use

ATV Use in the project area is located on all existing open roads; cross country travel is prohibited within the project area. The ATV travel roads would remain the same as existing condition. All cross country ATV use will be illegal, but may continue in areas where the public does not follow designated routes to attain access for wildlife viewing, scenic ventures or connection of existing routes.

Riparian Exclosures

Riparian exclosures in the Griffin Springs area have been installed to protect mound fens from ungulate trampling. Additional riparian exclosure will also be installed in 2011 to protect additional riparian areas from excessive utilization. All of these areas are within the project area but will not affected by any action proposal.

Road Maintenance

Current road maintenance is minimal within the project area and mainly associated with maintenance level 3 roads. An increase in road maintenance activities is expected during and after implementation of this project.

Livestock Grazing

Livestock grazing is a use that occurs within Iron Springs Vegetation and Salvage Project; however the spruce/fir vegetation type typically does not provide a lot of forage for cattle, however they do get out and use some forested areas where the trees are not so dense and needle litter not so thick that some herbaceous forage can grow but overall this area is mostly traveled through to access more favorable open meadows of sheep fescue (Mortensen 2010). Any grazing that does occur on timber harvest areas is managed under proper use guidelines.

Past Timber Sales

Cumulative impacts to soil productivity are the result of additional projects on the same piece of ground (i.e., additional soil erosion, increased compaction, displacement, etc.) Soil management standards include threshold values for the amount of surface organic matter, soil displacement and amount of soil disturbance (USDA Forest Service - Intermountain Region). Increased soil erosion rates associated with past timber harvest are near natural levels (Jaros 2011, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest). Some loss of soil productivity may be lost in treatment areas, but none of the areas proposed for treatment would exceed soil management guidelines.

Areas designated for primary skid trails and log landings represent an allocation of the soil resource for other than production; long term soil productivity would be decreased in these areas.

Cumulative effects are within soil management standards, and long term soil productivity is maintained when unsuitable soils are excluded from management activities and SWCPs are applied on suitable soils to offset impacts (Jaros 2011, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest). Since this project meets these criteria, soil quality and long term productivity would be maintained.

District records identified a total of approximately 2,090 acres of past timber harvest within the activity areas of the project area. The proposed SWCPs when implemented would result in acceptable cumulative impacts to the soil resource and long term soil productivity would be maintained. Sufficient coarse woody debris would be left on site following treatment for long term maintenance of soil productivity.

When erosion on a treatment area is controlled or prevented by SWCPs, soil degradation would be minimized. Since SWCPs will be used, the proposed action would have minimal effect; with decreasing effects each year as freeze thaw and frost heaving cycles lessen timber harvest effects to the soil (Jaros 2011, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest).

Dispersed Camping, Hiking Trails, Firewood Gathering, Christmas Tree Cutting and Other Uses

Past and present management activities in the project area include fuel wood gathering, Christmas tree cutting and recreational pursuits such as hunting, camping, hiking and trail riding with motorized and non-motorized vehicles. Along with these items, a multitude of multiple use management actions occur on lands administered by the Dixie National Forest. Such things as watershed rehabilitation projects; wildlife and fisheries habitat improvement projects; biking, snowmobiles, cross country skiing, etc. During the implementation of all these multiple use projects on the Dixie NF; each goes through a NFMA/NEPA analysis. Any project that results in soil disturbance has appropriate best management practices (Jaros 2011, Soil and Water Conservation Practices (SWCPs) for the Iron Springs Vegetation Improvement and Salvage Project) prescribed to minimize soil disturbance and to be within soil management guidelines.

Direct and Indirect Effects of Alternative A on the Soil Resource

The direct and indirect effects for alternative A for detrimental soil displacement, detrimental soil compaction and soil puddling, severely burned soils, effective ground cover, litter, coarse woody debris and steep slopes (over 40 percent) are the same as described for the proposed action.

Transportation System

Table 51 identifies soil types associated with existing and proposed temporary roads within the project area.

Table 51. Alternative A – Miles of existing/temporary roads on specific soil types within the 8,306 acres (Project Area) and 0.42 mile of road outside of the project area

Road Classification	Soil Type 417	Soil Type 478	Soil Type 480	Soil Type 508	Total
ML1 Administrative Roads	2.16	0.42	0	8.9	11.48
ML2 High Clearance Vehicle	6.15	2.15	0	3.24	11.54
ML3 Suitable For Passenger Cars	4.23	3.28	0	2.94	10.45
Closed Roads	0.18	0.6	0	1.58	2.36
Motorized Trails	0	0.24	0	0.09	0.33
Total Miles – Existing Roads	12.72	6.69	0	16.75	36.16
New Temporary Road Construction	1.01	0.52	0.26	4.52	6.31

New temporary road construction will affect the following soils types with timber harvesting activities.

4.78 miles of new roads on soil type 480 and 508 are to be constructed for timber harvesting activities. These areas consist of soils that are stable and are not eroding with spruce/fir and aspen vegetation. These roads will need to be cleared of existing downfall and vegetation and will be constructed as native surface roads. These roads will be moderately susceptible to soil puddling (rutting) and compaction from use during wet conditions. The soils are protected with tree canopy and surface rock fragments that will dissipate soil puddling (rutting) and compaction. The estimated increase in sedimentation is 14 times the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200 foot buffer adjacent to the road system.

The remaining 1.53 miles of new roads are on soil type 417 and 478 which are on open meadows of sheep fescue and silver sagebrush. These roads are highly susceptible to soil puddling (rutting), compaction and erosion due to a lack of coarse woody debris to deter water flow, have loam soil texture with low amounts of rock fragment, and are often braided and/or widened after construction to avoid wet areas or a rough rutted road prism. The estimated increase in sedimentation is 4 times the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200 foot buffer adjacent to the road system.

Maintenance Level 1 (ML1) roads will affect the following soils types with timber harvesting activities.

8.9 miles of administrative roads on soil type 508 are to be opened for timber harvesting activities. These areas consist of stable roads that are not eroding and are typically revegetated with grasses, shrubs and tree saplings within the spruce/fir areas of the project. These roads will need to be cleared of existing downfall and vegetation and will be native surface roads. These roads will be moderately susceptible to soil puddling (rutting) and compaction from use during wet conditions. The soils are protected with tree canopy and surface rock fragments that will dissipate soil puddling (rutting) and compaction. The estimated increase in sedimentation is 14 times the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200-foot buffer adjacent to the road system.

The remaining 2.58 miles of administrative roads are on soil type 417 and 478 which are on open meadows of sheep fescue and silver sagebrush. These roads are highly susceptible to soil puddling (rutting), compaction and erosion due to a lack of coarse woody debris to deter water flow, have loam soil texture with low amounts of rock fragment, and are often braided and/or widened to avoid wet areas or a rough rutted road prism. The estimated increase in sedimentation is 4 times the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200-foot buffer adjacent to the road system.

Maintenance Level 2 (ML2) roads will affect the following soils types with timber harvesting activities.

3.24 miles of high clearance roads are on soil type 508 will be used for timber harvesting activities within the spruce/fir areas of the project. Typically use on these roads is low during most of the summer, but will increase during harvest activities and timber hauling. These roads are stabilized with good forest canopy, above ground organic matter (coarse woody debris), rock fragments on the soil surface and typically on low slope (less than 15 percent). These soils will be affected with soil puddling (rutting) and compaction as use increases but are not a significant source of erosion within the project area. The estimated increase in sedimentation is 14 times the

sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200-foot buffer adjacent to the road system.

The remaining 8.3 miles of high clearance roads are on soil type 417 and 478 which are on open meadows of sheep fescue and silver sagebrush. These soils are also more erodible based on a lack coarse woody debris and forest canopy to deter water flow, have loam soil texture with low amounts of rock fragment, and are often braided and/or widened to avoid wet areas or a rough rutted road prism. The roads on these soil types are very susceptible to soil puddling (rutting) due to these characteristics. Sedimentation from these soils is typically retained within buffer areas that are adjacent to the road or at changes in slope. These roads typically have not seen any improvement and are essential two tracked roads on the existing soil surface. The estimated increase in sedimentation is 4 times the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200-foot buffer adjacent to the road system.

Maintenance Level 3 (ML3) roads are for suitable for passenger cars and open to the public. All 10.45 miles of road at this maintenance level on all soil types is capped with 6 to 18 of road aggregate. The running surface of these roads is actively managed to deter erosional process by annual road blading and prism improvements to the road surface. These roads are stable and will be maintained during timber harvest activities and are not a significant source of erosion within the project area.

Approximately 200 feet (0.03 mile) of forest road 1369 is located within a wetland and will be relocated to the suitable drier upland location approximately 30 feet away from its original location. This section of road is inhibiting proper water flow across the meadow and is severely rutted. This action will have a positive effect on the soil resource by protecting the riparian area associated with the Iron Springs watershed.

Closed roads are found on 2.36 miles of the project area.

1.58 miles of closed roads on soil type 508 will be opened and consistent with the effects that are described in maintenance level 1 (ML1) roads discussion.

The remaining 0.78 miles of closed roads are on soil type 417 and 478 will be opened and consistent with the effects that are described in maintenance level 1 (ML1) roads discussion.

The estimated increase in sedimentation is from a range of 4 to 14 times in the sediment leaving the road per year and only a very minor amount of sediment (less than 10 pounds) that will leave the immediate 200 foot buffer adjacent to the road system.

Motorized trails within the project area have a very limited extent (0.33) and will be widened to approximately 14 feet to effects consistent to a level 2 (ML2) roads as described above.

When roads are converted from “closed” or “low use” to haul routes each road segment can produce an increase in sediment leaving the road. Roads on soil types 417 and 478 are the most susceptible to soil puddling (rutting), more than 13.5 miles of road on these soil types will see heavy hauling use at times and may be subjected to soil puddling (rutting) and sedimentation concerns on these native surface roadways. Some of these roads may get capped with 6 to 12 inches of road base to make then sustainable for logging operations depending on their use levels.

The drainage design of the roads typically moves water off the existing tread and sediment is retained on the road system or adjacent to the road prism. All roads improved or constructed within the project will adhere to Soil and Water Conservation Practices designs to minimize the sediment movement.

Upon completion of Alternative A, all pre-existing closed roads within the project area will be administratively closed through barricading and ripping. This closure action will improve long term soil productivity, by lessening soil compaction effects, allowing natural return of above ground organic matter to soil surface and increasing natural revegetation from a previous committed transportation facility back to vegetative production.

To remove impacts to the soil resource, all new temporary roads will be completely obliterated.

Within 3 to 5 years following the closure and obliteration of roads within the project area it is expected the sediment leaving the road surface will return to existing condition levels (Elliot 1999).

Table 52 predicts the existing condition for average annual sediment leaving the road and buffers and the corresponding value for the action alternatives. Maintenance Level 3 (ML3) level roads do not have any changes in predicted sediment leaving the road surface as they are already high use roads and will remain high use during and after the implementation of this project.

The accuracy of a predicted runoff or erosion rate is, at best, plus or minus 50 percent.

Management of these roads with gravel surface application and additional cross drainage will also help lower sediment rates.

Table 52. Comparison of existing condition and Alternative A on the predicted sedimentation rates of the transportation system

Road Classification	Soil Type 417 Existing Condition / Action Alternative		Soil Type 478 Existing Condition / Action Alternative		Soil Type 480 Existing Condition / Action Alternative		Soil Type 508 Existing Condition / Action Alternative	
	Average annual sediment leaving road (lb)	Average annual sediment leaving buffer (lb)	Average annual sediment leaving road (lb)	Average annual sediment leaving buffer (lb)	Average annual sediment leaving road (lb)	Average annual sediment leaving buffer (lb)	Average annual sediment leaving road (lb)	Average annual sediment leaving buffer (lb)
ML1 and 2 Roads	185 / 672	5 / 9	175 / 635	5 / 10	NA	NA	77 / 1156	0 / 10
ML3 Roads	180 / 180	5 / 9	174 / 174	5 / 5	NA	NA	259 / 259	8 / 8
Closed Roads to Open Roads	152 / 672	5 / 9	144 / 635	5 / 10	NA	NA	81 / 1156	0 / 10
Motorized Trails to Harvest Roads	NA	NA	175 / 635	5 / 10	NA	NA	309 / 1156	6 / 10
New Temporary Roads	0 / 672	0 / 9	0 / 635	0/ 10	0 / 240	0 / 0	0 / 1156	0 / 10

Pre-Commercial Thinning

Manual thinning operations are conducted by foot with hand (chainsaw) operations and do not have a significant impact on the soil resource.

Reforestation (Planting of existing low stocked areas)

Manual planting methods would include hand scalping a 2′x 2′ area for site preparation and auger or hoedad planting of containerized conifer seedlings. All other aspects of plantings associated with scalping and planting are conducted by foot with hand operations and do not have a significant impact on the soil resource.

Summary

Table 53 summarizes the projected effects of Alternative A on the soil resource.

Table 53. Summary of effects of Alternative A and foreseeable actions on the soil resource

Activity Areas (acres)	Percentage of Detrimental Soil Disturbance (acres)[1]	Percentage of Effective Ground Cover[2]	Above-ground Organic Matter (Coarse Woody Debris tons/acre)[3]	Above-ground Organic Matter (Litter)[4]
Commercial Aspen Regeneration (152 acres)	5 percent (8 acres)	>95 percent	> 10 tons/acre	>5 cm
Commercial Conifer Thinning (1544 acres)	5 percent (77 acres)	>95 percent	> 10 tons/acre	>5 cm
Commercial Conifer Sanitation/Salvage (363 acres)	5 percent (18 acres)	>95 percent	> 10 tons/acre	>5 cm
Aspen Cleaning (388 acres)	5 percent (19 acres)	>95 percent	> 10 tons/acre	>5 cm
Pre-Commercial Conifer Thinning (134 acres)	0 percent	>95 percent	> 10 tons/acre	>5 cm
Planting of existing low stocked areas (154 acres)	0 percent	>95 percent	> 10 tons/acre	>5 cm

[1]Percentage of Total Detrimental Soil Disturbance should not exceed 15 percent by activity area.

[2]Properly functioning goal for Effective Ground Cover of 90 percent will be achieved with implementation of the proposed action design features.

[3]Properly functioning goal for Coarse Woody debris of more than 10 tons per acre will be achieved with implementation of the proposed action design features.

[4]Properly functioning goal for litter retention is 3 centimeters on spruce/fir and 4 centimeters for aspen will be achieved with a combination of natural process and management induced material.

Activity areas associated with ground based timber harvest activities will have 4 percent detrimental soil disturbance following completion of this project. All activity areas will be within threshold values for detrimental soil disturbance established for this project.

Steep slopes over 40 percent cannot have mechanical equipment operations to avoid soil resource degradation.

Improvement to roads and new roads will be susceptible to soil pudding (rutting) during the implementation of this project.

Above ground organic matter (litter and coarse woody debris) and effective ground cover are currently sufficient for this project to protect the soil resource.

Alternative A will meet the guidelines of the LRMP and Project Specific direction for soils. The implementation of SWCPs included with the project would ensure that increases in sediment will be managed and long term soil productivity will be maintained.

Cumulative Effects of Alternative A on the Soil Resource

Cumulative effects encompass past, present and reasonably foreseeable future activities that may affect the soil resource. The analysis area is an activity area which is the same as that used for direct and indirect effects.

Past, present, and foreseeable activities include:

ATV Use

ATV Use in the project area is located on all existing open roads; cross country travel is prohibited within the project area. The ATV travel roads would remain the same as existing condition.

All cross country ATV use will be illegal, but may continue in areas where the public does not follow designated routes to attain access for wildlife viewing, scenic ventures or connection of existing routes.

Riparian Exclosures

Riparian exclosures in the Griffin Springs area have been installed to protect mound fens from ungulate trampling. Additional riparian exclosure will also be installed in 2011 to protect additional riparian areas from excessive utilization. All of these areas are within the project area but will not affected by any action proposal.

Road Maintenance

Current road maintenance is minimal within the project area and mainly associated with maintenance level 3 roads. An increase in road maintenance activities is expected during and after implementation of this project.

Livestock Grazing

Livestock grazing is a use that occurs within Iron Springs Vegetation and Salvage Project; however The spruce/fir vegetation type typically does not provide a lot of forage for cattle, however they do get out and use some forested areas where the trees are not so dense and needle litter not so thick that some herbaceous forage can grow but overall this area is mostly traveled through to access more favorable open meadows of sheep fescue. (Mortensen 2010) Any grazing that does occur on timber harvest areas is managed under proper use guidelines.

Past Timber Sales

Cumulative impacts to soil productivity are the result of additional projects on the same piece of ground (i.e., additional soil erosion, increased compaction, displacement, etc.) Soil management standards include threshold values for the amount of surface organic matter, soil displacement and amount of soil disturbance (USDA Forest Service - Intermountain Region). Increased soil erosion rates associated with past timber harvest are near natural levels (Jaros 2011, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest). Some loss of soil productivity may be lost in treatment areas, but none of the areas proposed for treatment would exceed soil management guidelines.

Areas designated for primary skid trails and log landings represent an allocation of the soil resource for other than production; long term soil productivity would be decreased in these areas.

Cumulative effects are within soil management standards, and long term soil productivity is maintained when unsuitable soils are excluded from management activities and SWCPs are applied on suitable soils to offset impacts (Jaros 2011, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest). Since this project meets these criteria, soil quality and long term productivity would be maintained.

District records identified a total of approximately 1,316 acres of past timber harvest within the activity areas of the project area. The proposed SWCPs when implemented would result in acceptable cumulative impacts to the soil resource and long term soil productivity would be maintained. Sufficient coarse woody debris would be left on site following treatment for long term maintenance of soil productivity.

When erosion on treatment area is controlled or prevented by SWCPs, soil degradation would be minimized. Since SWCPs will be used, the proposed action would have minimal effect; with decreasing effects each year as freeze thaw and frost heaving cycles lessen timber harvest effects to the soil (Jaros 2011, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest).

Dispersed Camping, Hiking Trails, Firewood Gathering, Christmas Tree Cutting and Other Uses

Past and present management activities in the project area include fuel wood gathering, Christmas tree cutting and recreational pursuits such as hunting, camping, hiking and trail riding with motorized and non-motorized vehicles. Along with these items, a multitude of multiple use management actions occur on lands administered by the Dixie National Forest. Such things as watershed rehabilitation projects; wildlife and fisheries habitat improvement projects; biking, snowmobiles, cross-country skiing, etc. During the implementation of all these multiple use projects on the Dixie NF; each goes through a NFMA/NEPA analysis. Any project that results in soil disturbance has appropriate best management practices (Jaros 2011, Soil and Water Conservation Practices (SWCPs) for the Iron Springs Vegetation Improvement and Salvage Project) prescribed to minimize soil disturbance and to be within soil management guidelines.

Consideration of Available Science

The techniques and methodologies used in this analysis consider the best available 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. The conclusions are based on the scientific analysis that shows a thorough review of relevant scientific information. For this analysis there was not any incomplete or unavailable information that would be necessary for this decision.

The relevant science considered for this analysis consists of several key elements. For the soil resource, the elements of science used are:

> On-site data and history. The project area was surveyed and data was collected in 2010 using soil survey field verification and site specific soil monitoring.
>
> Scientific literature. Effects analysis white papers on the soil resource (Jaros, Effects of Timber Harvest on the Soil Resource on the Dixie National Forest, 2011) from timber harvest and fire includes a summary of these actions on the soil resource and includes relevant literature for the basic understanding of effects on these resources relating to timber harvest and fire. The use of Soil and Water Conservation Practices (SWCP's) to ensure water quality is protected is addressed in the State of Utah NPS Task Force Non-Point Source Management Plan for Silvicultural

Activities which references the Clean Water Act and is also supported by the Environmental Protection Agency (EPA). The effects analysis listed above indicates that SWCP's are effective in protecting long term soil productivity.

The soil resource was analyzed using site specific soil monitoring to review existing conditions of the soil resource. The collective knowledge of the project area by ID Team members has been through the integration of science with local conditions. Experience gained from implementation of the timber sale projects has been incorporated into the analysis with comparative analysis considering these local similar projects and past monitoring data.

These determinations reached in the specialists report are based upon ground reconnaissance of the proposed project area, previous monitoring of similar types of activities on forest service lands, and a review of the literature that is cited in the specialist report. Finally, the potential effect of this Iron Springs Vegetation Improvement and Salvage Project on the soil resource is predictable and well documented. In my professional opinion, there are no significant scientific uncertainties or risks associated with this proposal. On the basis of the foregoing, it is my determination that I have considered the best available science relevant to the effect of this project on the soil resource of the Dixie National Forest.

Table 54 presents a summary of the soils monitoring plan that would be implemented for this project.

Table 54. Soils monitoring plan

Type of Monitoring	What to Monitor	Protocol	When	Who
Effectiveness	To determine if the sale exceeded more than 15 percent detrimental soil disturbance (by aerial extent) after the completion of all management activities.	Evaluation of soil displacement, compaction and puddling and severely burned soil.	After the activity area units have been completed.	Soil Scientist
Effectiveness	To determine how much of the timber sale area is affected by a 15 percent increase in bulk density (soil compaction).	Land and Resource Management Plan for the Dixie National Forest, Monitoring and Evaluation Program, Page V-8	After the salvage harvest sale units have been completed.	Soil Scientist
Effectiveness	To determine if above ground organic matter (coarse woody debris and litter) was effective in deterring erosion.	Visual inspection.	After implementation of each activity area.	Soil Scientist
Effectiveness	To monitor and evaluate the effectiveness of SWCPs. Specifically 13.06-Soil Moisture Limitations for Tractor Operation; 14.08-Tractor Skidding Design; 14.10-Log Landing Location and Design; and 14.15 Erosion Control on Skid Trails.	FSH 2509.22, 10, Page 3 to 5 of 71	During and after the activity area units have been completed.	Soil Scientist

3.5 Forest Vegetation

Introduction

The Iron Springs Vegetation Improvement and Salvage (Iron Springs) Project proposes intermediate harvest treatments, salvage of beetle-killed or dying timber, aspen regeneration, and reforestation on approximately 4,275 acres of the 8,306-acre project area. The Iron Springs Project is located on the Griffin Top, approximately 15 miles northwest of Escalante, Utah. The forest type is primarily Engelmann spruce/subalpine fir, with scattered aspen clones and large open meadows. For the spruce/fir vegetation type, the purpose of the proposal is to improve the balance of age class distribution, decrease stand densities, and perpetuate aspen presence within the spruce- and fir-dominated forest. For the aspen vegetation type, the purpose of the proposal is to restore both the distribution and balance in age class for aspen clones, most of which are currently succeeding to spruce/fir, and are at risk of being replaced by conifer. This Forest Vegetation Report will discuss management direction, the affected environment, and the potential environmental consequences of the proposal and any alternatives.

Management Direction

As a Federal agency, the Forest Service takes its direction from the United States Congress (Congress). Laws enacted by Congress that provide direction to the agency regarding the management of forest vegetation and the evaluation of environmental impacts include the National Forest Management Act (NFMA) of 1976 (16 United States Code (U.S.C,) 1600 et. seq.) and the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et. seq.). In addition to legislative direction, Congress also instructs Federal agencies to promulgate regulations that provide specific instructions for implementing the legislation. In this case, the NFMA regulations, also called the "Planning Rule" are found at 36 Code of Federal Regulations (CFR) 219, while the implementing regulations for the NEPA are found at both 40 CFR 1500 (Council on Environmental Quality) and 36 CFR 220 (Forest Service). For the local planning area and for this project in particular, the Dixie National Forest Land and Resource Management Plan (forest plan, USDA 1986)), promulgated under the NFMA, provides specific management direction. Finally, Federal courts sometimes provide legal interpretation and direction to land management agencies. In the present case, the Tenth Circuit Court of Appeals has provided relevant review and oversight to the Dixie National Forest (the Forest) in the past few years. First, the court issued its opinion on the Griffin Springs Project in 2006 (*Ecology Center, Inc.* v. *U.S. Forest Service*, 451 F.3d 1183 (10th Cir. 2006)). Second, the court upheld the Forest Service's Barney Top Project in 2008 (*Utah Environmental Congress v. Russell*, 518 F.3d 817 (10th Cir. 2008)). Each of these sources of management direction is considered in turn.

National Forest Management Act

The NFMA requires the Secretary of Agriculture to prepare management plans for each National Forest System unit and to update them every 15 years, or as necessary. These "integrated" plans are to form a single document or collection of documents which describes the uses for the entire unit. In compliance with the NFMA, the Dixie National Forest is managed under a forest plan that was signed in 1986.

In addition to the general discussion regarding forest plans, the Congress also instructs the Secretary of Agriculture to promulgate NFMA procedures for preparing such land management plans. These regulations are to include, inter alia, steps to "preserve the diversity of tree species similar to that existing in the region controlled by the plan." In addition to the rule-making direction, the Congress provided, through the NFMA, specific direction regarding timber harvest. For findings regarding compliance with these provisions (16 U.S.C. 1604, sub-parts g and m) in the present case, please see Appendix C1.

Dixie National Forest Land and Resource Management Plan

The Dixie Forest Plan provides management direction and management constraints associated with the forest vegetation resource. Goals and desired future conditions enumerated in the forest plan are listed below.

Goals (Forest Plan 1986, p. IV-7.) for the timber resource on the Dixie National Forest include:

> Emphasizing "harvesting productive sawtimber stands that are highly or moderately susceptible to attack by the mountain pine beetle and other forest pests."
>
> "Harvest[ing] timber in coordination with other resources."
>
> "Improv[ing] the growth rate in timber stands through silvicultural treatment."

Desired future conditions (Forest Plan 1986, p. IV-21.) for the timber resource on the Forest include:

> "Provid[ing] substantial progress in reducing losses from insects and disease . . . by identifying high risk stands, monitoring and thinning stands." (Forest Plan 1986, p. II-61.)
>
> Using "silvicultural harvest methods that maximize present net value . . . in conjunction with meeting multiple use objectives and associated [timber management] constraints."
>
> Using "intensive practices such as precommercial thinning . . . in all timber working groups except aspen."
>
> Emphasizing timber harvest in the spruce/fir type.
>
> Converting "slow growing overmature stands to younger, more vigorous stands [to] provide the benefits of increased timber growth and reduced susceptibility to insects and disease.
>
> Emphasizing harvest in "mature stands, stands of poor quality and low value species and stands with insect and disease problems [to] reduce mortality and growth loss."

For the purposes of identifying the needs of this project, the interdisciplinary team considered primarily the goals and desired conditions associated with the timber resource. The application of standards and guidelines comes as management proposals are checked against them and projects are designed to be compliant with them. For a review of this project's compliance with forest plan standards and guidelines, please see Appendix C3.

National Environmental Policy Act

It is the policy of the Federal Government "to create and maintain conditions under which man and nature can exist in productive harmony," and to "enhance the quality of renewable resources" (NEPA 1969, 40 U.S.C. 4332). In compliance with that policy, the Council on Environmental Quality has promulgated regulations to guide agencies in planning and decision making that may affect the environment. In addition, the Forest Service has codified its own NEPA procedures at 36 CFR 220. Each of these is discussed in turn.

Council on Environmental Quality Regulations

To assist with Forest Service planning and decision making under NEPA, the Forest has chosen to prepare an environmental assessment (EA) (40 CFR 1501.3(b)). As a result, this analysis will focus on the

regulatory language associated with an EA. First, agencies are directed to reduce paperwork and delay by preparing an EA and finding of no significant impact (FONSI) when an action will not have a significant effect on the human environment (40 CFR 1500.4(q)). Second, the purpose of the EA is to determine whether an environmental impact statement (EIS) is necessary due to potentially significant effects (40 CFR 1501.4(c)). If it is not, the agency will prepare a FONSI (40 CFR 1501.4(e)). Third, the EA is to be a concise document that provides evidence and analysis for determining whether to prepare an EIS or a FONSI (40 CFR 1508.9(a)(1)). Finally, the regulations provide direction on how to consider significant effects based on context and intensity (40 CFR 1508.27).

Forest Service National Environmental Policy Act Regulations

In 2008, the Forest Service codified its NEPA policies at 36 CFR 220. Specific direction associated with the preparation of an EA is found at 36 CFR 220.7. Much of this direction is taken directly from the Council on Environmental Quality regulations. See, for example, 36 CFR 220.7(b)(3)(i). The Forest Service regulations also allow the agency to analyze only the proposed action in an EA (36 CFR 220.7(b)(2)(i)), and do not require analysis of a no-action alternative (36 CFR 220.7(b)(2)(ii)).

Affected Environment

Existing Condition

In 2006, the Tenth Circuit Court of Appeals reversed and remanded the Griffin Springs ROD on the basis of its finding that the Dixie National Forest had failed to comply with the National Forest Management Act. Significantly for this project, however, the court found that "[t]he Forest Service's EIS and SEIS satisfy [NEPA's] 'hard look' requirement," and dismissed all NEPA challenges to the Griffin Springs EIS. As a result, the forest vegetation analysis from Griffin Springs was found to be NEPA compliant and is hereby incorporated by reference.

That analysis contains a substantial review of the history of many of the forest stands included in the present project (Keefe 2002), which will not be repeated here. The Keefe (2002) analysis also included references to a number of historical sources, such as Dixon (1935), Pfister (1968), and Hanley (1973). These documents have been reviewed and added to the project record for the Iron Springs Project.

In the time since the initial NEPA analysis of many of these stands was completed in 2002 and 2003, the Aquarius Plateau spruce beetle epidemic diagnosed by Hebertson (2000) has continued to run its course, resulting in significant mortality. In response, the Dixie National Forest has conducted several salvage operations in the area. These were designed to quickly remove beetle-killed trees while they retained economic value. The Bug Lake Salvage Project and the Clayton Salvage Project, each categorically excluded from NEPA evaluation in 2007, harvested dead and dying trees from 220 and 248 acres, respectively. These stands (location 36, site 7 for Bug Lake, and location 62, sites 17, 19, 20, 24, and 78 for Clayton Salvage) were originally part of the Griffin Springs Project, but are not included in the present proposal.

The treatments proposed for Iron Springs would occur on forest plan-designated management areas (MA) 2B#, 6A, and 7A. MA 2B# stands for Roaded Natural Recreation. The forest plan instructs decision makers to "manage tree stands using both commercia1 or noncommercial methods [to] [e]nhance visual quality, diversity and insect and disease control." MA 6A stands for Livestock Grazing. The forest plan instructs decision makers to "[m]aintain and manage forested inclusions to provide a high level of forage production, wildlife habitat, and diversity." MA 7A stands for Wood Production and Utilization. The forest plan instructs that "[m]anagement objectives will be directed toward . . . conversion of old growth

to young, thrifty stands, and [m]anagement emphasis is on wood-fiber production and utilization of large roundwood of a size and quality suitable for sawtimber." None of the emphasis is in the original. It has been added here to make the point that the stands included in the Iron Springs project are part of the suitable (see next section) and managed forest resource on the Dixie National Forest. The stands included in the Iron Springs Project are not designated as wilderness, research natural area, inventoried roadless area, draft unroaded area, semi-primitive, or municipal watersheds. The stands in the Iron Springs project area are managed forest stands.

Suitability

Using direction provided in the forest plan (pages IV-37 and V-7), each stand in the Iron Springs project area was rated for suitability for timber management (Keefe 2002). Table 55 shows the suitability for the project area.

Table 55. Suitability classification for the Iron Springs project area

Suitability Classification	Acres
Suitable Forest Land	5,479
Non-forest Land	2,826
Economically or Technically Infeasible	1
Total	**8,306**

Forest Composition

The Iron Springs project area contains vegetation types typical of the Aquarius Plateau. The project area is dominated by level to slightly rolling hills with a mosaic of forest and sagebrush-dominated meadows. Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) dominate the forest with seral aspen (*Populus tremuloides*) clones intermixed throughout. The larger aspen clones usually occur on the ridge tops or steeper slopes. Meadows tend to occupy the bottomlands.

Table 56 summarizes the vegetation or land types found within the project area. Acres were based on Geographic Information System (GIS) calculations using delineations at the stand level based on aerial photo interpretation, ground reconnaissance, or RMRIS database calculations. Various stand data attributes were compiled using the best available data (GIS, RMSTAND, FSVeg projections, stand reconnaissance, stand stratification, and aerial photo interpretation) to describe vegetation conditions at the stand level.

Table 56. Iron Springs Project vegetation types

Vegetation Type	Acres
Engelmann Spruce/Subalpine Fir	5,240
Aspen	256
Meadow	2,810
Total	**8,306**

Engelmann spruce/subalpine fir = Conifer stands within the Engelmann spruce (*Picea engelmannii*) or subalpine fir (*Abies lasiocarpa*) habitat.

Aspen = Stands within the aspen community type with aspen dominating more than 50 percent of forest canopy.

Meadow = Either a wet meadow (herbaceous vegetation and abundant moisture), mountain grassland (grass-covered opening within a continuous conifer forest), or sagebrush opening, contains less than 10 percent tree canopy cover, and is more than 3 acres.

Spruce/fir

The Engelmann spruce/subalpine fir (spruce/fir) vegetation type is widespread throughout southern Utah, growing especially on the higher mountains and plateaus (Alexander 1987). In older stands, Engelmann spruce tend to dominate the canopy due to its ability to regenerate on bare mineral soil, a superior rate of growth, and longevity (Veblen et al. 1991a). In response to spruce beetle outbreaks, however, the composition of these stands trends toward subalpine fir because of the reduction in spruce seed sources and the lack of soil disturbance (Schmid and Hinds 1974; Dymerski et al. 2001). In fact, subalpine fir can become dominant for up to 200 years after a spruce beetle outbreak because fir accounts for most of the advanced regeneration in undisturbed stands (Jenkins et al. 2008). Subalpine fir, given its insect and disease problems has less management potential than spruce (McCaughey and Schmidt 1982), especially in achieving large tree objectives.

Spruce beetle (*Dendroctonus rufipennis*) activity was first identified in the project area in 1998. Spruce beetle populations have been increasing to outbreak or epidemic levels since (Hebertson 2006; Skov 2008). Epidemics are defined as insect-infested trees exceeding two clumps of at least five trees per acre (Bentz and Munson 2000). Recent mortality of Engelmann spruce has reduced or eliminated large-diameter spruce, resulting in changes in species composition favoring subalpine fir. Stand exam data collected from 53 project area spruce/fir stands in 1993, and then again in 2008, show this trend. SeeTable 57.

Table 57. Iron Springs conifer composition trends

Year/Measure	Engelmann Spruce (percent)	Subalpine Fir (percent)
1993 Basal Area	77	12
2008 Basal Area	68	17
1993 Trees Per Acre	46	33
2008 Trees Per Acre	25	55

Aspen

Quaking aspen is a common tree species throughout Utah. It is important for providing wildlife habitat (Griffis-Kyle and Beier 2003) and biological diversity (Kay 1997) in landscapes dominated by conifers. Aspen is also in decline (Bartos 2001). Its health and reproductive success has been negatively affected by fire suppression, ungulate browsing, and insect and disease infestations—although perhaps not everywhere (Kulakowski et al. 2004). As a result, the protection and management of aspen is important to land managers across the western United States (Mueggler 1989). Aspen is very intolerant of shade, requiring full sunlight to thrive. Because of this, aspen is sensitive to competition from shade-tolerant species such as subalpine fir (Smith and Smith 2005). Methods to manage and enhance aspen include burning, fencing to protect suckers from browsing damage, and silvicultural treatments such as conifer removal (Jones et al. 2005) and coppice clear-felling (Shepperd 2001).

The aspen stands within the project area represent seral stands within the aspen/subalpine fir community type (Mueggler 1988) or subalpine fir potential vegetation type (Graham et al. 1999). Project area aspen stands have long been affected by browsing ungulates and fire suppression (Baker 1918; Bartos and Campbell 1998; Bradley et al. 1992; Kay and Bartos 2000). As a result, the project area aspen stands currently exhibit a lack of regeneration, invasion by conifer trees, and changes to understory vegetation. Healthy aspen in the seedling-to-sapling stage within the project area are limited to edges along the opening or logging disturbances. Most of the remaining aspen sprouts are in poor health with poor leader growth and minimal crown. This condition is most likely from competition with conifer seedlings and low light conditions (Shepperd 2001).

Forest Structure

Spruce/fir forests on the Aquarius Plateau can generally be described as multi-storied and uneven-aged (Keefe 2002, 2009). Project area spruce/fir stands that have not been harvested in the past contain an uneven-aged stand structure recently modified by spruce bark beetles. This recent mortality has reduced or eliminated large-diameter Engelmann spruce, resulting in loss of the larger size classes. The oldest of the large, live trees remaining in the overstory are, on average, 210 years old. The project area aspen stands are two- or three-storied, with mature aspen forming the overstory and invading conifers making up the understory layers. Due to the lack of recent disturbance, aspen stands are generally missing stems in the seedling-to-sapling stage. Mature aspen overstory trees are, on average, 90 years old.

For the purposes of NFMA and NEPA compliance, it is useful to consider forest structure in the context of forest plan direction and NEPA "issues." Unfortunately, to do that turns a seemingly simple subject into one of unwanted complexity. Forest plan direction, for example, is less than clear, and is generally applicable to the watershed or landscape level, not the project area. Moreover, because the "issue" associated with this NEPA process revolves around just one of several temporary forest structures, it becomes difficult to address structure in a unified way. Be that as it may, some clarity may be acquired by dividing the "Structure" section of this report into sub-sections. First, we will consider grassland since that is specifically addressed in the forest plan. Second, we will consider the six structures provided for in the properly functioning condition report. These six structures, fortunately, parallel the vegetation structural stages associated with the desired conditions for the northern goshawk, so the goshawk discussion will make up our third sub-section. Finally, the special discussion of "Old Growth" will be given its own section, as befits the issue of the day, and will not be found under this section.

Grassland

As is noted above, grassland structures are to be reported at the watershed level. Approximately 34 percent of the project area is currently in the grassland structural stage.

Properly Functioning Condition Structure

The properly functioning condition (PFC) structures are, likewise, to be measured at the "landscape" level (USDA 2000). Under the PFC, there are six structures. Because those structures are similar to the six vegetation structural stages (VSS) described by Reynolds et al. (1992) in the goshawk guidelines, they will generally be described and compared interchangeably in this report. Also, note that these structures apply to forested stands only and do not include the permanent grassland areas included in the subsection above. In the Iron Springs area, all of the forested acres are currently in VSS classes— structural stages—3 and 4 (Table 58). This is because the goshawk guidelines direct that stands are to be classified as to VSS class using the "dominant" material in the stand by basal area. Un-even aged stands in the project area do contain components of the other VSS classes, but they are not dominant and are, thus, hidden in the data (Orlemann 2012). In general, field reconnaissance and CSE data show that the project area is not lacking in the small to middle size classes—VSS classes 1 through 4 (Figure 10).

Table 58. Properly functioning condition (PFC) structures and vegetation structural stages (VSS) for Iron Springs forested area

PFC Description	VSS Class	Diameter Range in Inches	Percent of Iron Springs Forested Area
Grass/forb/shrub	1	0.0 – 0.9	0
Seedling/sapling	2	1.0 – 4.9	0
Young forest	3	5.0 – 11.9	86
Mid-aged forest	4	12.0 – 17.9	14
Mature forest	5	18.0 – 23.9	0
Old forest	6	24.0+	0

As noted, recent mortality of large Engelmann spruce from the spruce beetle outbreak has reduced or eliminated large-diameter spruce, resulting in loss of the old forest (VSS 6) structure. For example, stand 035-036, which was examined in 1999 and 2008, lost fully half of its stocking to spruce beetle mortality over that time period. Because the oldest and largest trees are most heavily impacted (McCambridge and Knight 1972), the stand shifted fairly dramatically away from its old forest classification (Table 59).

Table 59. Properly functioning condition structures and vegetation structural stages comparison for stand 035-036

PFC Description	VSS Class	1999 (percent)	2008 (percent)
Grass/forb/shrub	1	0	1
Seedling/sapling	2	5	15
Young forest	3	40	28
Mid-aged forest	4	20	39
Mature forest	5	10	11
Old forest	6	25	6

Note: The percentages in this table include each VSS class in this uneven aged stand. Under the Reynolds report, noted above, this stand would be classified as a VSS 3 (1999) or VSS 4 (2008) stand only.

Goshawk Territories

There are two northern goshawk territories in, or partially in, the Iron Springs project area. The first, called the "Grass Lakes" territory, is made up of a 190-acre nest area, approximately 90 acres of which are in the project area, a 443-acre post-fledgling area, approximately 426 acres of which are in the project area, and a 5,600-acre foraging area, approximately 1,390 acres of which are in the project area. The second goshawk territory, called the "Griffin Springs" territory, is made up of a 208-acre nest area, which is completely within the project area, a 492-acre post-fledgling area, approximately 444 acres of which are within the project area, and a 5,730-acre foraging area, approximately 2,924 acres of which are within the project area. The large number of stands sampled for inclusion in Table 59, above, include several thousand acres of these two goshawk territories. Thus, like the project area in general, the goshawk territories are dominated by VSS 3 and VSS 4 conditions.

Figure 11. Spruce trees in the Iron Springs project area

Insects and Disease

In the late 1990s, the spruce beetle (*Dendroctonus rufipennis*) populations on the Aquarius Plateau were considered to be at endemic levels (Keefe 2002). Since then, spruce beetle epidemics have spread across many of the high-elevation plateaus across southern Utah, resulting in widespread Engelmann spruce mortality. In fact, on the Markagunt Plateau, DeRose and Long (2007) concluded that the spruce beetle epidemic resulted in 98 percent mortality of spruce trees over 5 centimeters diameter-at-breast-height (d.b.h.). Similarly, on the Wasatch Plateau, Dymerski et al. (2001) found that 90 percent of the spruce greater than 5 inches d.b.h. were killed by the spruce beetle epidemic. On the Aquarius Plateau, Skov (2008) found that more than 100,000 Engelmann spruce trees had been killed since 2003. The progress of the epidemic can be traced through a series of management proposals the Escalante Ranger District considered—Griffin Springs (Keefe 2002), Barney Top (Keefe 2004), Pockets (Keefe 2009). When designing the Pockets Resource Management Project, the Dixie National Forest concluded that treatments in spruce forests would include salvage only, because “most, if not all of the [large] spruce trees have been killed by beetles” (USDA Forest Service 2009).

Some spruce stands in the project area have, likewise, experienced almost complete overstory mortality due to the recent spruce beetle epidemic, but the effect has not been uniform (Figure 12). With the epidemic potentially in decline (Hebertson 2006; Skov 2008), it may be that some project area stands continue to feature spruce in the overstory. Veblen et al. (1991b) found that trees that survive a beetle outbreak are “released,” leading to greater growth rates, an increase in stand density, and, eventually, high susceptibility to a new epidemic. Even at endemic levels, however, spruce beetles are numerous (Hansen et al. 2006) and can emerge from host trees in large numbers to attack nearby spruce (Alexander 1964). In the central portion of the project area, in fact, Skov (2008) found that some stands had recently returned to outbreak levels of infestation and featured areas of attacked trees greater than eight per acre.

Stand Density

Stand density index (SDI) can be used as an indicator of stand health as it relates to density. By using stand average SDI against the featured tree species’ maximum SDI, the stand’s relative health and vigor can be described (Long 1985; Drew and Flewelling 1979). For example, stands below 25 percent of maximum SDI have tree densities below the point at which trees in the stand are competing. Whereas, stands above 50 percent of maximum SDI would represent extremely high densities—tree vigor is low and susceptibility to insect attach is high (Table 60). (At 60 percent of maximum SDI, stand competition is high enough to induce mortality.)

For spruce/fir stands subject to beetle outbreaks, lower stand densities can improve tree vigor and reduce susceptibility to widespread mortality (Hard 1985; Jenkins et al. 2008). At high relative densities, on the other hand, stands can reach an “upper management” threshold beyond which insect-caused mortality is likely to be significant (Cochran et al. 1994). The maximum SDI for Engelmann spruce/subalpine fir in Utah is 625 (Keyser and Dixon 2008). Finally, the regional assessment sets as the “properly functioning condition” a threshold SDI of 335 (USDA 2000). In the project area, approximately 44 percent of the spruce/fir stands have SDIs that exceed the thresholds for tree vigor and resistance to insects and disease (Table 61).

Figure 12. Live and dead Engelmann spruce in the Iron Springs overstory

Table 60. Stand density and its effect on the stand

Percent of Maximum SDI	Stand Condition
Less than 25	Stand not fully stocked; no intra-tree competition
25 to 35	Trees begin to compete until the site is fully occupied
35 to 50	Stand growth is maximized while retaining individual tree vigor
More than 55 to 60	Stand begins self-thinning
100	Theoretical upper boundary of stand density

From Long (1985) and Long and Shaw (2005).

Table 61. Iron Springs Project percent of maximum stand density index (SDI) for measured spruce/fir stands

Percent of Maximum SDI	Spruce/fir	Project Area Spruce/fir Acres (percent)*
Less than 25	150	12 (less than 1 percent)
25 to 35	150 to 220	95 (3 percent)
35 to 50	220 to 310	1,712 (53 percent)
PFC Threshold	**335 to 350**	**116 (4 percent)**
Management/Mortality Threshold	**350 and up**	**1,306 (40 percent)**
100	625	N/A

*Stand data are available for 88 percent of the spruce fir stands proposed for thinning treatments.

Old Growth

Each forested stand within the project area was rated for old-growth habitat, as described in the "Characteristics of Old-Growth Forests in the Intermountain Region" publication (Hamilton 1993) and clarified by the Regional Clarification letter (USDA 2007). Ratings were completed using RMStand, STIMS, aerial photo interpretation, and field reconnaissance. Tree per acre calculations are based on live conifer trees per acre by diameter class at 15 inches or greater. Age ratings are based on the range of those trees that are 15 inches at d.b.h. or larger, adding 30 years to total age and adding the difference from the sample year to the present. Using these measurements, approximately 2,098 acres of the project area spruce/fir stands qualify as old growth because sufficient old spruce trees have survived previous spruce beetle infestations and harvests. All of the stands, excluding those previously clearcut contain the uneven-aged, down woody debris, canopy layers, and snags.

It is worth noting that, in describing the old-growth conditions in the Griffin Springs project area about 10 years ago, Keefe (2002) found that approximately 3,750 acres of spruce/fir were old growth in the 12,000-acre project area, or about 32 percent. Keefe (2002) also pointed out that, under the no-action alterative, much of the existing old growth might be lost to the spruce beetle since stands of dense, large, old trees provided the best habitat for an outbreak. Keefe's (2002) description of the potential effects of no action proved prescient and the spruce beetle killed hundreds of acres of project area old growth (Table 62). These stands no longer contain sufficient live trees to qualify for old growth and have been dropped from the current description of existing old growth.

Table 62. Iron Springs Project current old growth as compared to Griffin Springs Project old growth

Measure	Griffin Springs (in Acres)*	Iron Springs* (in Acres)
Total project area	11,835	8,306
Original old-growth calculation	3,752	2,862
Percent old growth in project area	32	34
Acres of old-growth mortality since Griffin Springs	N/A	764
Current old-growth calculation	N/A	2,098
Current percent old growth in project area	N/A	25

*The Iron Springs project area is a subset of the Griffin Springs project area; it is 3,530 acres smaller.

The aspen stands do not qualify as old growth because they are seral to conifer or lack the 12-inch d.b.h. component. The presence of conifer regeneration in the aspen stands indicates that these stands are not climax, but represent a seral stage of stand development for a spruce/fir-dominated stand, as found in the *Abies lasiocarpa/Ribes montigenum* habitat types. Therefore, the aspen stands would be judged for old-growth habitat on the basis of spruce/fir habitat types.

Role of Fire

High-elevation spruce/fir forests are generally subject to a low-frequency, high-severity fire regime (Sibold et al. 2006; Veblen et al. 1994). Fires of moderate severity are less common than either low-severity or stand-replacement fires because of the moisture regime in the project area. Severe fires destroy the stand and the replacement stand consists of resprouting aspen and conifer seedlings where a seed source is available (Veblen et al. 1991a). Low-severity fires perpetuate the all-aged structure by killing individual and tree groups that create openings for seedlings (Aplet et al. 1988).

Engelmann spruce and subalpine fir are both thin-barked species with relatively low resistance to fire injury (Ryan and Reinhardt 1988).

The recent spruce beetle outbreak on the Aquarius Plateau has added to the volume of standing dead fuels in the project area. Whether this contributes to a greater risk of catastrophic wildfire is unclear. Bebi et al. (2003) found no increased fire occurrence associated with a 1940s-era spruce beetle outbreak in Colorado, concluding that fire weather conditions and ignition sources are more important indicators of potential risk. Increased fire severity may, however, result from the presence of extensive fine, dead fuels following a spruce beetle outbreak in conjunction with extreme drought conditions (Bigler et al. 2005; Bigler and Veblen 2011). Locally, DeRose and Long (2009) modeled the effect of near complete spruce mortality on the Markagunt Plateau and found that the lack of crown continuity reduced crown fire potential significantly. At the same time, Jorgensen and Jenkins (2010) collected extensive ground, surface, and aerial fuels data from the Fishlake and Manti-LaSal National Forests and found enhanced flammability during the spruce beetle epidemic stage due to a “flush” of fine fuels.

The aspen stand in the project area is seral, the result of suckering (root sprouts) after disturbance such as fire (Brown 1985). Aspen stems have thin bark, and are heat sensitive and easily killed by fire (Brown and DeByle 1987). Once the overstory stem is killed, suckers originate from an extensive root system. Fire plays a significant role in maintaining and regenerating seral aspen: The infrequent, but severe, fires typical of high-elevation spruce/fir forests provide an opportunity for extensive aspen sprouting (Kulakowski et al. 2006). In the absence of fire, aspen may give way to conifers (Bradley et al. 1992).

Productivity

Site productivity can be expressed in potential stand volume growth; the growth potential of the stand expressed as the mean cubic foot (or board foot) annual increment of growing stock in a fully stocked natural stand at the age of culmination of mean annual increment. Site productivity represents the growth potential of a stand. Site productivity for Engelmann spruce/subalpine fir stands sampled in the project area ranges from 18 to 77 cubic feet per acre per year growth, with an average of 40 cubic feet per acre per year. Site productivity for aspen stands in the project area averages 29 cubic feet per acre per year (Table 63).

Table 63. Iron Springs Project forest productivity

Productivity (average)	Spruce/fir Stands	Aspen Stands
Annual cubic foot increment per acre	40	29
Annual merchantable cubic foot increment per acre	33	22
Annual merchantable board foot increment per acre	167	107
Existing cubic foot volume per acre	2,451	2,981
Existing merchantable cubic foot volume per acre	1,745	1,545
Existing merchantable board foot volume per acre	7,946	6,830

The dominant conifer habitat is *Abies lasiocarpa/Ribes montigenum*, *Ribes montigenum* phase (Youngblood and Mauk 1985). This phase represents the best opportunity for timber management in the *Abies lasiocarpa* series. Youngblood and Mauk (1985) suggest management favoring the Engelmann spruce, with silvicultural prescriptions considering the uneven-aged stand structure and need for site protection of spruce seedlings. The aspen stands fall within the aspen/subalpine fir community types (Mueggler 1988) and form a seral stage for the subalpine fir habitat types described above.

Site index for the individual stands can also be used as an indicator of potential site productivity. For the spruce/fir stands, based on a 100 base year (Alexander 1967), site index averaged 59 feet, with a range of 43 to 75.

Climate Change

The vegetation resources of the high-elevation plateaus in southern Utah are being affected by a changing climate. Aspen dieback may, for example, be associated with a warming and drying climate (Hogg et al. 2002; Worrall et al. 2010). Rehfeldt et al. (2009) have, in fact, found a "compelling" connection between aspen decline and a changing climate. In the spruce/fir type, the severity of recent beetle outbreaks may be exacerbated by a warming climate (Logan et al. 2003), perhaps due to a shortened life cycle for the spruce beetle (Hansen et al. 2001) or a reduction in beetle mortality due to cold weather (Bentz et al. 2010). Moreover, it is possible that warming temperatures in southern Utah may render the climate on the Dixie National Forest inhospitable to Engelmann spruce later this century (Rehfeldt 2004).

Desired Condition

Suitability

The NFMA instructs the responsible official to identify the suitability of lands for resource management (16 U.S.C. 1604(G)(2)(A)). The lands proposed for treatment under the Iron Springs Project have been identified as suitable. Suitability is not affected by project activities and will not be discussed further in this document.

Forest Composition

Spruce/Fir

The Dixie Forest Plan sets, as a long-term goal, the promotion of Engelmann spruce over subalpine (Forest Plan, IV-115). In addition, the regional scale assessment's key indicators of properly functioning condition (PFC) for Engelmann spruce/subalpine fir forests provide that spruce should be dominant, as fits the historical pattern (USDA 2000).

Aspen

The forest plan requires the retention of aspen where it occurs (Forest Plan, IV-25). In addition, the various PFC reports prepared for the project area—regional, sub-regional, sub-section, and landscape—hold that aspen should be maintained according to historic patterns, that aspen should not be succeeding to other cover types, and that conifer encroachment should be minimal (USDA 2000).

Forest Structure

Grassland

The forest plan holds that vegetation treatments should be planned at the watershed level to maintain at least 10 percent of the area in grassland. In addition, the forest plan directs that 7 to 10 percent should be managed as old growth. Old growth is discussed in its own section, below.

Properly Functioning Condition Structure

Finally, the forest plan says that the remaining area should be evenly distributed (20 percent each) in the remaining age classes. (Unfortunately, the forest plan then goes on to list five more age classes. Either that means that each of the remaining classes should comprise approximately 16 percent of the watershed, or that there is an extra age class listed in the forest plan that shouldn't have been included. The present author thinks the best construction could be made by proceeding down the latter path, but, at the risk of disappointing the reader, a discussion of administrative construction will be allowed to go by the by.) What that means has been clarified by the forest plan goshawk amendment, which says that projects should be designed to follow the regional PFC (Forest Plan, Goshawk Amendment, IV-33). The regional PFC assessment identifies, as a properly functioning condition, age distributions of 10 percent grass/forb, 10 percent seedling/ sapling, 20 percent young, 20 percent mid-aged, 20 percent mature, and 20 percent old forest.

Goshawk Territories

The desired VSS distribution for goshawk nesting, post-fledgling, and foraging areas are 0-0-0-0-100-100, 10-10-20-20-20-20, and 10-10-20-20-20-20 percent, respectively (Reynolds et al. 1992).

Forest Health

Insects and Disease

The Dixie Forest Plan desires "substantial progress in reducing losses from insects and disease . . . by identifying high risk stands, monitoring and thinning stands (Forest Plan, II-61.) as well as harvest in "mature stands, stands of poor quality and low value species and stands with insect and disease problems [to] reduce mortality and growth loss" (Forest Plan, IV-21). For spruce/fir stands, the PFC reports call for insect populations to be endemic and for mortality of less than five trees per acre (USDA 2000). In aspen, insect and disease should be endemic and there should be less than 30 percent "topkill and branch mortality in mature and old age classes" (USDA 2000).

Stand Density

The forest plan instructs managers to convert "slow growing overmature stands to younger, more vigorous stands [to] provide the benefits of increased timber growth and reduced susceptibility to insects and disease" (Forest Plan, IV-21). The PFC reports hold that, for spruce/fir, the SDI should not exceed 335 and that stand basal area should be less than 150 square feet per acre. For aspen stands, the SDI should not exceed 300 and the basal area should not be greater than 140 square feet per acre (USDA 2000).

Old Growth

The Dixie Forest Plan standard for old growth is to manage 7 to 10 percent of each drainage for old growth (Forest Plan, IV-35). At the landscape level, the PFC assessment calls for a balanced range of structural stages with approximately 20 percent in "old forest" in the spruce/fir type, and 30 percent in aspen (USDA 2000).

Role of Fire

The Dixie Forest Plan desired condition is to create and maintain mosaics of fuel types and to break up continuous fuels so as to allow for "appropriate" wildfire suppression and to reduce fire control costs (Forest Plan, II-61 and IV-13). The PFC report holds that, for spruce/fir forest types, fire regimes should

be within historical ranges—mixed severity fires are on a 50- to 80-year cycle with lethal fires returning every 100 to 300 years (USDA 2000). For the aspen type, a 20- to 50-year fire interval should slow conifer encroachment in seral stands (USDA 2000).

Productivity

The forest plan instructs managers to convert "slow growing overmature stands to younger, more vigorous stands [to] provide the benefits of increased timber growth" (Forest Plan, IV-21).

Climate Change

A desired future condition in relation to climate change has not been described by the forest plan (USDA 1986) or the PFC assessment (USDA 2000). Nor is there a legislative or regulatory requirement to do so. The topic is included in neither the NFMA (1976) nor its implementing regulations. As for the NEPA, the Council on Environmental Quality has issued draft guidance for addressing climate change in NEPA documents: "Consideration of the Effects of Climate Change and Greenhouse Gas Emissions" (Federal Register Volume 75, Number 35 page 8046). The Council on Environmental Quality, however, has explicitly excluded Federal land and resource management from the draft guidance.

Internally, the Forest Service has prepared agency guidance titled "Climate Change Considerations in Project Level NEPA Analysis." In general, that guidance recognizes that while some actions may warrant qualitative or even quantitative analysis of the effects of an action on climate change, some actions are at such a minor scale that the effects would be meaningless to a reasoned decision. The Ninth Circuit Court of Appeals recently agreed with that reasoning, finding that a project of similar scope as that proposed here did not warrant detailed analysis of the project's potential impacts on climate change (*Hapner* v. *Tidwell*, No. 09-35896 (9th Cir. 2010)).

In general, providing for ecological diversity across landscapes is a way to make them more resilient in the face of changing conditions. A number of strategies for accomplishing this include preventing the spread of invasive species, assisting the regeneration of native species following disturbance, and reducing the potential for future catastrophic disturbances (Bosworth et al. 2008). Caution in describing desired management in the face of potential climate changes is, however, warranted. While there is currently credible scientific work being done in an attempt to predict the future impacts of climate change, these are predictions only and, for the purposes of treating forest conditions on a small project area, are likely to produce only the most general (not to mention conjectural) conclusions. "[I]dentifying specific adaptation strategies at local scales is extremely challenging given the uncertainty surrounding key factors such as the ultimate effectiveness of internationally-driven climate change mitigation efforts, the accuracy of global and regional climate change models, the genetic adaptation and responses of plants to rapid climate change, and forecasting the effects of unforeseen disturbance agents such as fire, pests and the introduction of alien species" (McKenney et al. 2009).

Need for Change—Gap between Existing and Desired Condition

Forest Composition

Spruce/Fir

Both the forest plan and the PFC assessment for the Aquarius Plateau direct that Engelmann spruce should be favored over subalpine fir. In the project area, there is currently a trend away from spruce and toward fir. This is the result of beetle-induced mortality in the spruce, a lack of soil disturbance which

favors spruce regeneration, and the dominance of fir in the existing advanced regeneration. Thus, there is a gap between the current condition and the desired condition for spruce/fir composition in the project area. This proposal has been designed to partially address that gap (Table 64).

Aspen

The PFC assessments completed for the Aquarius Plateau have identified loss of the aspen type as highly probable. In the Iron Springs project area, the aspen stands are generally in decline. A variety of factors have created conditions that favor conifer encroachment and inhibit healthy aspen regeneration. As a result, there is a gap between the current condition and the desired condition regarding the composition of aspen in the project area. That gap may be partially ameliorated by active forest management treatments. The treatments described in this proposal are designed to do that.

Table 64. Summary of the need for change

Current Condition	Desired Condition	Management Opportunities
Species shift from spruce to fir; Lack of duff disturbance to regenerate spruce	Spruce is dominant; Conditions favor spruce regeneration	Mechanical cutting to favor spruce and disturb duff
Little to no aspen regeneration; Aspen invasion by conifer; Aspen extent in decline	Vigorous aspen regeneration; Minimal conifer encroachment; Aspen occupies historic area	Mechanical cutting to regenerate aspen and remove conifers; prescribed fire; fencing
Spruce beetle activity is currently reducing acreage that qualifies as mature and/or old forest	At least 40 percent of landscape in mature and old forest under both PFC and goshawk guidelines	Mechanical removal of small stems to enhance vigor of larger, older trees
Some stands at epidemic levels with mortality exceeding eight trees per acre	Stands thinned to reduce mortality to below five trees per acre	Mechanical thinning to increase tree vigor and health
SDI that, on average, exceeds 410; Basal area that, on average, exceeds 160 square feet per acre	SDI of less than 335; basal area of less than 150 square feet per acre	Mechanical thinning to reduce stand densities and basal area
Each project area watershed is currently meeting forest plan desired condition	Seven to 10 percent old growth per watershed	Mechanical thinning to promote retention of large, old trees
Fine fuels associated with tree mortality and drought may increase the risk of high-severity fire	All for fire suppression where appropriate; maintain historic fire return intervals	Mechanical treatments to break up continuous fuels
Stands too dense to produce rapid, vigorous growth	Slow-growing stands converted to young, vigorous stands	Mechanical thinning to promote tree growth and vigor
Regeneration of spruce slowed by project area conditions; some stands overly dense and at risk of disturbance	Forest stands are resilient in the face of changing conditions	Planting to assist spruce regeneration; mechanical thinning to improve forest health

Forest Structure

Aside from grassland, which is adequately represented in the project area as well as the cumulative effects area, and old growth, which is addressed in its own section, the forest plan directs that management of forest structure follow the PFC assessment. The PFC estimates that landscapes should contain

approximately 40 percent mature and old forest structural stages (for goshawk post-fledgling and foraging areas, these equal VSS classes 5 and 6). In the Iron Springs project area, the spruce beetle has reduced (especially) the old forest structural stage (VSS 6) over the past 10 or 15 years. Forest vegetation treatments have been designed to maintain and enhance mature and old structures (VSS 5 and 6) to slow their decline.

Forest Health

Insects and Disease

The forest plan and the PFC assessment hold that spruce/fir stands should be thinned to maintain insects at endemic levels and to reduce mortality to less than five trees per acre. In the project area, some spruce/fir stands are no longer at epidemic levels. In others, the spruce beetle outbreak is accelerating and the rate of mortality currently exceeds eight trees per acre. While forest management treatments cannot directly arrest an insect outbreak, they can be effective in preventing further susceptibility to infestation (Fettig et al. 2007).

Stand Density

The forest plan holds that forest stands should be treated to provide for increased timber growth; the PFC assessment sets 335 for the upper threshold of SDI in spruce fir, with basal areas below 150 square feet per acre. Currently at least 44 percent of the project area has SDI values that exceed these limits.

Old Growth

The Dixie Forest Plan requires that 7 to 10 percent of each watershed be managed for old growth. Each of the three watersheds—North Creek, Upper North Creek, and Antimony Creek-Coyote Hollow—in which the Iron Springs project area is located is currently meeting the forest plan requirements. Continued spruce beetle-induced mortality in the project area, however, may exacerbate what has become a downward trend for spruce/fir old growth, especially in the Antimony Creek-Coyote Hollow watershed.

Role of Fire

The forest plan directs managers to create and maintain mosaics of fuel types and to break up continuous fuels so as to allow for fire suppression where appropriate. In the spruce/fir type, the PFC calls for mixed severity fires on a 50- to 80-year cycle, with lethal fires returning every 100 to 300 years. In the project area, the conditions are not likely outside of the range of the PFC historic fire regime. The combination of insect epidemics and drought, may, however, lead to conditions that increase the risk of potential fire severity beyond that desired by the forest plan.

Productivity

The Dixie Forest Plan instructs managers to convert slow-growing stands to younger, more vigorous stands. The project area currently has numerous stands that exceed the densities required to maximize tree growth and vigor.

Climate Change

While there is currently no project area direction for addressing climate change, maintaining the resiliency of ecosystems by assisting in the regeneration of native species and reducing the potential for catastrophic disturbances are general principles. The Iron Springs Project is designed to both assist in

regenerating Engelmann spruce and thinning the forest stands to improve their vigor and resistance to disturbance.

Environmental Consequences

Methodology

Sources of Information

Selected vegetation components were sampled in 2008 using Common Stand Exam protocol (USDA 2010). These sampled vegetation types represent approximately 90 percent of the vegetation found on the project area. In addition to the stand exams, vegetation in the project area has been reviewed using aerial photos and field reconnaissance. Forest Vegetation Simulator (FVS) ready files of these exams were extracted from the Forest Service Vegetation (FSVeg) database for use in FVS modeling.

Various Dixie National Forest GIS layers were used as sources of information and for spatial analysis, including the following:

1) *Stand Data:* stand delineations and associated data such as cover type and stand size

2) *Old Growth Stands:* delineations of stands meeting criteria for effective and replacement old growth; most of these stands have been field-verified

3) *Current Roads and Proposed Temporary Roads:* roads designated under the Dixie National Forest Travel Management Plan, as well as proposed temporary road locations

4) *NAIP:* 2009 color orthophoto mosaic in digital format

Forest Vegetation Simulator

Current stand attributes and future stand attributes for the alternatives considered were modeled from the 2008 stand exam data using FVS Version 6.21, Utah variant.

The FVS was developed in the early 1970s as the “Prognosis” model (Stage 1973). Since then, FVS has undergone continual development efforts to expand its range and capabilities. During the last three decades, the Forest Service has made a substantial investment in research and development of FVS. Currently, FVS is used almost exclusively by the Forest Service, and is used heavily by other U.S. Government agencies such as the Bureau of Land Management, Bureau of Indian Affairs, National Park Service, U.S. Geological Survey, Department of Defense, and Department of Energy (Dixon 2002). Most state departments of natural resources use FVS and it is heavily used in the private forestry sector. Moreover, most major university forestry programs in the United States teach the use of FVS. In sum, over the last several decades, the FVS has become the forest vegetation modeling program of choice for forest researchers as well as practitioners (Finkral and Evans 2008, Reinhardt and Holsinger 2010).

The FVS is not a single growth and yield “model” but consists of a number of integrated models including those for predicting large-tree height-and-diameter increment, small-tree height-and-diameter increment, tree mortality, crown change, tree-regeneration establishment, shrub development, shrub and tree vertical canopy distribution, mountain pine beetle risk, Douglas-fir tussock moth hazard and impacts, economic analysis, western spruce budworm hazard and impacts, western root disease impacts, dwarf mistletoe impacts, white pine blister rust impacts, and fire effects.

The FVS has expanded its range of applicability from its roots in the Northwest through the creation of "geographic variants" that use research from various geographic regions of the United States to tailor equations such as those for tree growth, mortality, and volume to those regions. Currently, over 20 variants represent forests within the United States. Since FVS uses stand exam data, geographical variant equations for growth are further calibrated using the stand data. This, coupled with the use of such site variables as slope, aspect, elevation, habitat type, plant association, or ecoclass code, location (nearest national forest, and in some cases ranger district), site index, and stand density index maximums or basal area maximums, and tree measurements such as species, diameter-at-breast-height (d.b.h.), total tree height, tree height to a dead or broken top, diameter increment, age, crown ratio, and damages or diseases enables FVS to make accurate predictions.

Limitations of Models

The use of models such as FVS depends upon sample data, validity of the model itself, and assumptions made by the modeler. All three factors affect the modeled results. FVS is used in this analysis to generally characterize and display existing conditions and the nature and magnitude of treatment effects to support decisions to be made. Modeling results are not to be taken as reality (Stratton 2006), although effort is made during the modeling exercise to ensure consistent results. In the growth and yield modeling for this analysis, we allowed the FVS program to use the default parameters for maximum SDI and plant associations. Default parameters are developed for the variant of FVS from data collected in the area the variant is tailored for, but can be modified for individual stands if the site (e.g., plant association, slope, aspect, elevation) and tree-specific (e.g., diameter-growth increment, height-growth increment) information is available.

Incomplete and Unavailable Information

Common Stand Exam (CSE) data are routinely collected for forested stands on the Dixie National Forest. For the Iron Springs project area, CSE data are available from 1986, 1987, 1990, 1993, 1994, 1999, 2000, 2007, and 2008. Not every stand was sampled during each of these years. As a result, some stands have primarily older data, while others have been updated since 2007. For a few individual stands, no data are available. Overall, approximately 600 acres of the 5,400 acres of forested stands in the project area have no CSE data. In addition, around 10 percent of the acres proposed for treatment do not have CSE data. Estimates of effects take this into account by showing percentages based on existing data. Finally, the existence of complete CSE data for more than 90 percent of the treatment area is sufficient for making a reasoned analysis of potential effects.

All calculations of areal extent in this document are estimates. For the most part, the estimated number of acres under any given section is preceded by the word "approximately." This means approximately. Because GIS data are continually being updated, because stand and watershed boundaries are arbitrary digitizing exercises, and because, most importantly, the natural world, in its complexity, may ignore GIS data and digitized boundaries, all calculations are estimates. To calculate NEPA effects down to the acre, or even tenth acre, as this report does, implies levels of accuracy and precision that are simply not realistic. Moreover, rounding errors creep in, such that a textual total of 519 acres may add up to 520 in the accompanying table. Readers who discover such discrepancies should read and re-read this paragraph before setting pen to paper in an attempt to inform the forest supervisor of the malfeasance of his or her employees.

Spatial and Temporal Context for Effects Analysis

Temporal Scope of the Analysis

The baseline year used for this analysis is the year 2010. In this analysis, all past activities and events are included in the existing condition description. Activities that occurred more than about 20 years prior to the baseline will not be specifically mentioned. Most long-term studies of forest vegetation condition agree that time periods from 15 to 20 years are sufficient for evaluating the effect of silvicultural treatments (Hornbeck et al. 1993; Monleon et al. 1997; Zausen et al. 2005).

Likewise, in the effects discussion, below, the potential effects of the Iron Springs Project on the project area vegetation will not generally be forecast beyond about 20 years. The project is designed to improve growing conditions for residual trees. It is expected that these conditions will be improved and sustained over the next 20 years, decreasing insect risk, disease impacts and growing larger trees faster. Speculating about effects beyond the next two to three decades is unlikely to provide useful information to the decision maker.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The Dixie National Forest does not consider this proposal to be "connected" to any other action as defined by 40 CFR 1508.25(a)(1). Actions are connected if they "automatically trigger other actions, . . . [c]annot or will not proceed unless other actions are taken, [or] . . . depend on the [other] action for their justification." The proposed Iron Springs Project involves forest health treatments within the project boundary. Implementing these treatments does not automatically trigger any other action; the need for the project does not require that it be the precursor to any other action. Iron Springs forest health treatments are not dependent on any other action; they can and will proceed independently of any other action the Forest proposes. Treatments are justified by the need to protect forest health and to provide economically valuable forest products to the public; the proposal needs no other justification. In short, the Iron Springs proposal is founded on an independent necessity that neither depends upon nor derives its justification from any other action. As a result, it is not a connected action under the regulation.

The Council on Environmental Quality defines cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future action regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). Before these incremental impacts can be evaluated, the scope of the relevant cumulative effects area and must be defined and the other actions must be identified. In the case of a site-specific vegetation management project such as Iron Springs, the likely cumulative effects area (CEA) will be the affected watersheds or the areas of contiguous habitat. (See the Council on Environmental Quality's "Considering Cumulative Effects Under the National Environmental Policy Act," 1997.) In this case, the project area covers portions of three watersheds—North Creek, Antimony Creek-Coyote Hollow, and Upper North Creek—a total area of approximately 84,730 acres. This will be the areal extent of the CEA for the forest vegetation effects associated with Iron Springs. (See Table 65 for a summary of the CEA cover types.)

Table 65. Cumulative effects -- area cover types

Cover Type	Acres	Percent
Aspen	13,965	16
Blue Spruce	123	Less than 1
Meadow	21,398	25
Mixed Conifer	3,238	4
Oak	79	Less than 1
Pinyon-Juniper	8,368	10
Ponderosa Pine	7,323	9
Private	91	Less than 1
Rock	139	Less than 1
Spruce/fir	29,695	35
Water	312	Less than 1
Total	84,730	

Within the defined CEA, both past and present management actions have the potential to add incremental impacts when combined with the possible direct and indirect effects of the present proposal. It is worth noting, however, that listed actions will not be considered where they have not been found to "individually or cumulatively have a significant effect on the human environment (40 CFR 1508.4)." This is because significant effects must be present before they can accumulate; zero plus zero equals zero. Table 66 lists the past, present, and reasonably foreseeable projects in the CEA.

Table 66. Past, present, and reasonably foreseeable actions

Project Name	Date	Acres	Finding
Coyote Hollow Timber Sale	1988	1,200	Finding of No Significant Impact
Velvet Lake Timber Sale	1988	1,400	Finding of No Significant Impact
Black Forest Timber Sale	1988	800	Finding of No Significant Impact
Roundy Timber Sale	1992	2,800	Unavoidable Impacts
Coyote Hollow Timber Sale	1993	3,750	Unavoidable Impacts
Black Forest/Velvet Lake Salvage	1993	3,830	Finding of No Significant Impact
Pacer	1994	3,360	Unavoidable Impacts
Aquarius Salvage	1995	5,300	Finding of No Significant Impact
Lost Spring Aspen	2005	132	None
Griffin Springs Travel	2006	11,840	Finding of No Significant Impact
Livestock Grazing	2006	18,680	None
Bug Lake Salvage	2007	220	None
Clayton Salvage	2007	248	None
Pockets Resource Management	2009	8,560	Unavoidable Impacts

No Action

The no-action alternative is included here to provide a basis for comparing the proposed action and alternative A to what would occur if neither of these alternatives were implemented. Under the no-action alternative, current management plans would continue to guide management of the Iron Springs project area. No silvicultural treatments would be implemented to reduce stand densities and improve resiliency, remove dead and dying Engelmann spruce/subalpine fir, regenerate and maintain aspen, or reforest spruce/fir stands that are currently under-stocked.

Direct and Indirect Effects of No Action

Suitability

There would be no change in forest land suitability as described in the affected environment, above. This will not be addressed further under the no-action alternative.

Forest Composition

Spruce/Fir

The current trend in the Engelmann spruce/subalpine fir vegetation type is for subalpine fir to become dominant at the expense of Engelmann spruce. As noted in the description of the existing condition, this is because the spruce beetle is killing the large-diameter spruce while the advanced regeneration is becoming dominated by subalpine fir which grows more successfully in an undisturbed understory. In the absence of any forest management activities, this trend will continue for the next few decades (Table 66). While Jenkins et al. (2008) state that subalpine fir dominance can continue for up to 200 years after a beetle outbreak, the current infestation on the Aquarius Plateau has not resulted in the nearly complete destruction of the spruce seedling bank as has occurred elsewhere (DeRose and Long 2010).

Aspen

Within the aspen stands and aspen clones found within the spruce/fir, the no-action alternative would allow the trend of aspen decline, noted above, to continue. Engelmann spruce and subalpine fir would then occupy the canopy layers, and development would follow the early succession of the conifer stand. Aspen reestablishment would hinge on a stand-replacing disturbance.

Forest Structure

Grassland

Under the no-action alternative, there would be little to no change in the distribution of grassland within the project area, which is currently approximately 34 percent of the project area. Though there is no forest plan goal associated with project area grassland extent, this total will be part of the 10 percent per watershed consideration under the cumulative effects discussion.

Properly Functioning Condition Structure

Under the no-action alternative, size class diversity would continue to decrease as the older and larger trees continue to succumb to spruce beetle-induced mortality. Recent spruce beetle outbreaks in Utah have resulted in tree mortality exceeding 1 million spruce trees and the loss of up to 98 percent of the large spruce component (Dymerski et al. 2001; DeRose and Long 2007). Likewise, on the Aquarius Plateau, more than 100,000 trees have already been killed (Skov 2008).

Spruce beetles tend to kill the larger trees (greater than 6 inches diameter) (Dymerski et al. 2001; McCambridge and Knight 1972; Veblen et al. 2004). On the Aquarius Plateau, Keefe (2009) has found that spruce beetle mortality is highest in clumps of large trees. Mortality in the overstory would release the smaller-sized understory spruce and fir (Parish et al. 1999; Roovers and Rebertus 1993). The larger-sized subalpine fir, however, would not advance substantially into the next classes because of their early maturity and susceptibility to insect and disease (Alexander 1987). As noted, loss of the larger- diameter spruce would continue to move stand conditions away from the long-term goal of creating and maintaining a diversity of size classes, to include 40 percent mature and old forest.

Goshawk Territories

Under the no-action alternative, the forest stands associated with the two goshawk territories—Grass Lakes and Griffin Springs—will not be directly affected. The current situation, where territories are largely composed of VSS classes 3 and 4, would continue to develop. Indirectly, the lack of thinning might contribute to further declines in the areas that still retain some VSS 5 and 6 structural stages.

Forest Health

Insects and Disease

When Keefe (2002) analyzed many of these stands for inclusion in the Griffin Springs Project, he noted that, under a no-action scenario, the increasing age and density of the spruce/fir stands would likely result in heavy spruce beetle infestation, followed by significant mortality. That is, in fact, what has occurred in many of the project area stands—causing many of them to lose their mature and/or old forest condition. Under a continued policy of no action, there would be no opportunity to improve tree vigor and resistance to insects or disease in the stands that continue to have spruce in the overstory. As a result, the no-action alternative would continue the forest health trend predicted by Keefe 10 years ago.

Stand Density

As noted in the section describing the existing condition, above, stand densities are above the recommended management thresholds in 44 percent of the project area. To forgo any treatment under the no-action alternative means that stand densities would continue to increase along with spruce beetle susceptibility. While stand densities will eventually be reduced through the work of the spruce beetle, this does not meet the intent of the Forest's managed forest component under the forest plan which is to reduce losses from insects by thinning high-risk stands (Forest Plan 1986, p. II-61).

Old Growth

Old growth is a term used by the forest plan to describe a stage of forest development. Hamilton (1993) defines this stage, generally, as "ecosystems distinguished by old trees and related structural attributes; old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function." Significantly, Hamilton states that large, live trees are required for old growth. This requirement has been confirmed as policy on the Dixie National Forest (USDA Forest Service 2007). Because trees are living things and the development of structural stages occurs over time, an old growth or old forest structural stage is, by definition, temporary. It cannot be otherwise. Old growth today cannot be old growth tomorrow. Living things develop, die, and transition to the next stage. When the living things are spruce and fir trees—widely known for susceptibility to disturbances such as insect attack and fire—large, live trees can be "eradicated" (Hamilton's word) from large areas for long periods.

The idea, then, that forest management will preserve old growth structure in any particular stand into eternity is a false one. ("Once [spruce/fir] old growth develops it is dynamic and cannot be perpetuated indefinitely" (Roovers and Rebertus 1993).) It is well known, however, that silvicultural treatments can enhance and maintain the health of large, live trees (Dymerski et al. 2001; Fettig et al. 2007; Holsten et al. 1999; Jenkins et al. 2008; Samman and Logan 2000; Schmid and Frye 1977)— thus extending the old forest structural stage beyond what might be possible in the absence of treatment. In addition, it is well recognized that silvicultural treatments in managed forests can be used create conditions that accelerate the development of old-growth features (Bailey and Tappeiner 1998; Bauhus et al. 2009; Choi et al. 2007; Davis et al. 2007; Lindh and Muir 2004).

To leave a managed forest untreated, on the other hand, as a way to preserve old-growth structure into eternity is an equally false notion. It, however, suffers from the additional defect that, in doing nothing, the demise of the old-growth structure is accelerated. Clearly, those that prefer a no-action alternative in stands once containing sufficient large live trees to qualify as old growth are looking for an administrative solution to their feeling that it is wrong for the Forest Service to manage these stands. The term “old growth” is used as a means to administratively designate some portion of the managed forest resource as off limits to further management. Unfortunately, it is Dixie National Forest policy to designate as old growth only those stands that (temporarily) have sufficient large live trees to meet the Hamilton definition.

In any case, in the Iron Springs project area, the effect of no action is on full display. As was predicted by both forest entomologists and certified silviculturists during the analysis for, among others, the Griffin Springs project, untreated stands of old growth are likely to quickly lose the large live tree component in response to spruce beetle pressure. This has been, by now, well documented (Anhold 1999; Hebertson and Anhold 2000; Hebertson 2000; 2002, 2003, 2005, 2006; Keefe 2002, 2004, 2009; Skov 2008). To continue with a no-action treatment at this time will simply allow for continued live tree mortality and a continued decline of old-growth structural stages throughout the project area. As noted above, the number of acres in an old-growth structural stage within the project area fell by approximately 25 percent in the 10 years since Keefe assessed old growth under the Griffin Springs Project. If that rate of structural stage conversion continues for the next decade, the project area old-growth acres will decline by another 525 acres; and by 2030, another 400 would shift to an earlier stage of development.

Role of Fire

As the section on the existing condition points out, there is ongoing scientific debate about the long-term effect of forest treatments on subalpine forest environments affected by beetle outbreaks. It seems likely that, under the no-action alternative, the Dixie National Forest would forgo an opportunity to reduce the risk of catastrophic wildfire by breaking up continuous fuels and removing flammable material presently in the forest stands (Jorgensen 2010; Taylor and Fonda 1990). On the other hand, it seems unlikely that, under the no-action alternative, the characteristics of the long-term fire regime in spruce/fir/aspen forests would be altered (DeRose and Long 2009).

Productivity

Under the no-action alternative, thinning treatments in the project area conifer stands designed to reduce stocking levels and standing volume while producing commercial forest products would not occur. As a result, the benefits associated with reduced stocking—such as reduced mortality, improved diameter growth, and the production of commercial volume—would not be realized. Table 67 provides an estimate of growth rates and merchantable volume of dead trees for stand 65-7, which is proposed for commercial and precommercial thinning under the proposed action.) Moreover, the economic value of dead and dying trees in the project area would not be recovered. For suitable, managed forest areas such as this one, the no-action alternative does not meet the Dixie’s Forest Plan’s goal of improving the growth rate in timber stands through silvicultural treatment.

Table 67. Growth rates and mortality of merchantable volume under no action for stand 65-7

Year	Diameter Growth (inches)	Live Merchantable Cubic Foot Volume	Dead Merchantable Cubic Foot Volume
2010	0.03	2,740	720
2020	0.14	2,280	1,000
2030	0.18	2,590	30

Climate Change

Because there would be no direct emission of greenhouse gases from proposed activities, there would be no direct effect on climate change from the no-action alternative. Indirectly, forest stands would likely continue as carbon sinks until the next disturbance event (fire, wind, insect infestation, etc.) occurs. When the next forest stand-replacing disturbance event (high tree mortality) occurs, the affected areas would convert to a carbon source condition (emitting more carbon than is being sequestered). This state would continue for up to a decade or more until the rate of forest regrowth, assuming trees regenerate, meets and exceeds the rate of decomposition of the killed trees. As stands continue to develop, the strength of the carbon sink would increase (typically peaking at an intermediate age and then gradually declining, but remaining positive) (Pregitzer and Euskirchen 2004). Carbon stocks would continue to accumulate, although at a declining rate, until again impacted by subsequent disturbance.

For at least the short term, onsite carbon stocks would remain higher under the no-action alternative then under either action alternative. Nevertheless, caution is advised against interpreting carbon inventory maintenance or gains from deferred or foregone timber harvest in any specific forest or stand as affecting atmospheric concentrations of greenhouse gases. This only holds true if harvest does not occur elsewhere in the world to supply the same world demand for timber (Gan and McCarl 2007; Murray 2008; Wear and Murray 2004). The result can be a net carbon impact if the timber is replaced in the marketplace with higher carbon source products such as steel or concrete or is harvested in a manner that does not result in prompt reforestation (Lippke et al. 2010; Ryan et al. 2010).

As discussed elsewhere, the risk of some high-mortality disturbance events is greater under the no-action alternative. The long-term ability of these forests to persist as a net carbon sink is uncertain—drought stress, forest fires, insect outbreaks, and other disturbances may substantially reduce existing carbon stock (Galik and Jackson 2009). Climate change threatens to amplify risks to forest carbon stocks by increasing the frequency, size, and severity of these disturbances (Barton 2002; Boisvenue and Running 2010; Breashears and Allen 2002; Dale et al. 2001; Littell et al. 2009; Running 2006; Westerling and Bryant 2008). Increases in the severity of disturbances, combined with projected climatic changes, may limit post-disturbance forest regeneration, shift forests to non-forested vegetation, and possibly convert large areas from an existing carbon sink to a carbon source (Allen 2007; Barton 2002; Galik and Jackson 2009; Kurz et al. 2008a, Kurz et al. 2008b; Savage and Mast 2005; Strom and Fulé 2007). Leaving areas of forest unthinned, as in the no-action alternative, maintains an elevated risk of carbon loss due to disturbance. Thinning, prescribed fire, and other management actions are often suggested as climate change “adaptation actions” because they may increase forest resilience to these multiple stresses, and thus increase the likelihood of sustaining forest carbon benefits in the long term (Joyce et al. 2008; Millar et al. 2007; Ryan et al. 2008). The no-action alternative forgoes such climate- change adaptation actions.

Cumulative Effects of No Action

Forest Composition

Spruce/fir

Commercial thinning in spruce/fir designed to promote the retention of spruce over fir has been implemented (or planned) for approximately 4,600 acres of the 84,730-acre Iron Springs CEA (Table 68). To forgo the treatments proposed under the Iron Springs Project would leave this total unchanged, and would fail to move the CEA toward the forest plan desired future condition for managed forest, which is to promote spruce over fir.

Table 68. Spruce/fir thinning projects within the Iron Springs cumulative effects area under no action

Project	Treatment	Acres w/in CEA (percent of CEA)	Percent of Spruce/fir w/in CEA
Roundy	Spruce/fir selection harvest	737 (1 percent)	2
Coyote Hollow	Spruce/fir selection harvest	2,029 (2 percent)	7
Pacer	Spruce/fir selection harvest	1,863 (2 percent)	6
Total		4,629 (5 percent)	16

NOTE: Projects such as Pockets, which is planned but has not been implemented, were not included in these calculations because they are sanitation/salvage projects only and do not include treatments designed to manage composition of the live tree component.

Aspen

Likewise, the aspen regeneration and cleaning treatments planned or implemented across the CEA are designed to shift species composition away from conifers and back toward aspen. For the 84,730-acre Iron Springs CEA, these treatments have totaled approximately 950 acres (Table 69). This is a tiny step intended to arrest the decline of aspen on the Aquarius Plateau. Under the no-action alternative for Iron Springs, this acreage total would remain unchanged.

Table 69. Aspen regeneration and/or cleaning projects within cumulative effects area under no action

Project	Treatment	Acres w/in CEA (percent of CEA)	Percent of Aspen w/in CEA
Roundy	Aspen patch cuts	50 (0 percent)	0
Coyote Hollow	Aspen patch cuts	65 (0 percent)	0
Pacer	Aspen patch cuts	19 (0 percent)	0
Lost Spring	Aspen regeneration	33 (0 percent)	0
Pockets	Aspen regeneration/cleaning	783 (1 percent)	6
Total		950 (1 percent)	7

Forest Structure

Grassland

Under the no-action alternative, there would be little to no change in the distribution of grassland, which is currently approximately 34 percent of the project area (Table 70). In addition, there would be little to no change in the distribution of grassland across the CEA, which currently meets forest plan direction for 10 percent grassland per watershed. Without direct effects, there can be no cumulative effects.

Table 70. Current grassland acreages for the Iron Springs cumulative effects area under no action

Watershed	Current Grassland Acres	Percent of Watershed in Grassland
Antimony Creek/Coyote Hollow	12,905	34
North Creek	5,390	31
Upper North Creek	3,103	10

Properly Functioning Condition Structure

As noted under the description of the current condition and the direct effects of no action, recent mortality of large Engelmann spruce from the spruce beetle outbreak has reduced or eliminated large-diameter spruce, resulting in loss of mature and old forest age classes. Because very little of the large-diameter spruce has been treated silviculturally in the past two decades (Table 66), the cumulative effect of no action under Iron Springs is simply to contribute additional acres to the approximately 85 percent of untreated spruce/fir across the CEA that are likely to lose mature and old forest components.

Goshawk Territories

Similarly, under no action, VSS classes 5 and 6 are likely to continue declining across the CEA, further reducing the larger trees throughout the two goshawk territories associated with the Iron Springs Project. The Iron Springs CEA includes approximately 170 acres of the 190-acre Grass Lakes nest area, approximately 441 acres of the 443 acre Grass Lakes post-fledgling area, and approximately 4,150 acres of 5,600-acre Grass Lakes foraging area. All components of the Griffin Springs goshawk territory are within the Iron Springs CEA. The conditions across the CEA are very similar to those within the project area itself. A sampling of additional forest stands within the goshawk territories but outside the project area are made up primarily of VSS classes 3 and 4 (Table 71).

Table 71. Iron Springs cumulative effects area by vegetative structural stage class under no action

Cumulative Effects Area	VSS class (percent)					
	1	2	3	4	5	6
Dominant VSS Class	0	0	93	7	0	0

The output from this exercise across the CEA is nearly identical to the output from the project area. These stands are dominated by VSS 3 and 4, primarily 3. As a result, the cumulative effect of no action is to continue to provide a very significant VSS 3 component across the landscape and throughout the two goshawk territories.

Forest Health

Insects and Disease

Many of the past, present, and reasonably foreseeable forest vegetation management projects within the Iron Springs CEA have been designed to promote forest health: Thinning treatments have been planned to improve individual tree vigor and growth; sanitation/salvage projects remove infested trees from the stand; and aspen enhancement treatments reduce the number of acres of host species (Table 72). Management actions designed to improve forest health have been, or will be implemented, on approximately 15 percent of the CEA. Because no forest health treatments would proceed in the Iron Springs project area under the no-action alternative, these potentially beneficial effects would not be extended beyond the existing project acres.

Table 72. Forest health treatments within the Iron Springs cumulative effects area under no action

Project	Treatment	Acres w/in CEA (percent of CEA)
Roundy	Aspen patch cuts and spruce/fir selection harvest	737 (1 percent)
Coyote Hollow	Aspen patch cuts and spruce/fir selection harvest	2,094 (2 percent)
Black Forest/Velvet Lake Salvage	Salvage of dead fuelwood	3,827 (4 percent)
Pacer	Aspen patch cuts and spruce/fir selection harvest	1,882 (2 percent)
Coyote Hollow Amendment	Additional sanitation/salvage on same acres	N/A
Pacer Amendment	Additional sanitation/salvage on same acres	N/A
Pockets	Aspen regeneration/cleaning and spruce/fir sanitation/salvage	4,498 (5 percent)
Total		13,038 (15 percent)

Stand Density

Likewise, while the control of stocking through the reduction of SDI can provide demonstrable increases in tree vigor, maximized tree growth, and reduced mortality, those benefits would not accrue under the no-action alternative. As a result, there would be no additional cumulative effects on stand density within the CEA beyond the acres noted in Table 72.

Old Growth

The forest plan provides that 7 to 10 percent of each watershed should be in an old-growth condition. At the time that the Griffin Springs Project was planned, Keefe (2002) found that the three watersheds in the present CEA contained from 17 to 37 percent old growth. Since that time, updates to the Forest's GIS layers, including watershed and stand boundaries, have changed the gross acreages and old-growth percentages slightly. These changes are reflected in Table 73. Note, the old-growth acreages are "original" calculations from before the spruce beetle outbreak; the purpose of the table is to ensure that there is no confusion between watershed names and sizes used for old-growth calculations in Griffin Springs and those used for this project.

Table 73. Comparison of original old-growth acreages for the three relevant watersheds

Griffin Springs Watershed Name	Total Acres	Old-Growth Acres (percent)	Iron Springs Watershed Name*	Total Acres*	Old-Growth Acres (percent)
Barker Reservoir	27,704	10,191 (37 percent)	Upper North Creek	29,593	10,621 (36 percent)
Center Creek	16,219	6,024 (37 percent)	North Creek	17,118	6,126 (36 percent)
Upper Antimony/ Coyote Hollow	37,907	6,596 (17 percent)	Antimony Creek/ Coyote Hollow	38,019	5,424 (14 percent)
Totals	81,820	23,541 (29 percent)	Totals	84,730	22,171 (26 percent)

*Name and gross acreage changes are due to GIS polygon updates, and reflect the most current data.

In contrast to the "original" old-growth acres in the CEA, the current old-growth acres in the CEA have been reduced by the spruce beetle in the period since Keefe first calculated them. As a result, the current condition of old growth across the CEA is somewhat different from what it was 10 years ago. Nevertheless, the three watersheds continue to meet forest plan objectives for old growth (Table 74).

Table 74. Current old-growth acreages for the Iron Springs cumulative effects area under no action.

Watershed	Current Old-Growth Acres	Percent of Watershed in Old-Growth Condition
Antimony Creek/Coyote Hollow	5,158	14
North Creek	5,676	33
Upper North Creek	10,284	35

Finally, under the no-action alternative, there is likely to be a continued decline of spruce/fir old growth acres across the CEA. During the last decade, since no action was taken on the Griffin Springs Project, the spruce beetle has reduced old-growth spruce/fir acres anywhere from 10 to 40 percent in various stands across the plateau. This is consistent with the findings of Keefe (2002), from the data he collected in the Coyote Hollow area. Should the effect continue over the next decade, the total old-growth acres for the three watersheds may decline by 298 to 1,193 acres in Antimony Creek-Coyote Hollow, by 63 to 250 acres in North Creek, and by 291 to 1,164 acres in Upper North Creek. It is worth noting, however, that, even on the high end (40 percent mortality), the three watersheds in question should still meet forest plan objectives for old growth under the no-action alternative.

Role of Fire

While the direct effect of the no-action alternative is unlikely to meet the forest plan objective to provide opportunities for appropriate fire-suppression response, the lack of treatment is also unlikely to have a significant direct effect on the long-term spruce/fir fire regime in the area. Without direct effects there can be no cumulative effects.

Productivity

Under the no-action alternative, the productivity gains associated with reduced stocking - such as reduced mortality, improved diameter growth, and the production of commercial volume - would not be realized

within the project area. As a result, there would be no additional cumulative benefits associated with increased productivity within the CEA beyond the acres noted in Table 74.

Climate Change

Under the no-action alternative, the indirect effects described above would be added to the portions of the CEA that are currently at risk from major disturbance events (Stephens et al. 2009). In addition, to forgo the proposed forest-thinning activities may add to areas lacking the ecological diversity to effectively adapt to a changing climate (Bosworth et al. 2008). On the other hand, it is unlikely that the cumulative effects of the no-action alternative would include a discernible impact on atmospheric concentrations of greenhouse gases or global warming, considering the limited changes in both rate and timing of carbon flux predicted within these few affected forest acres and the global scale of the atmospheric greenhouse gas pool and the multitude of natural events and human activities globally contributing to that pool.

Although not a statutorily defined purpose of National Forest System management, forests do provide a valuable ecosystem service by removing carbon from the atmosphere and storing it in biomass (Galik and Jackson 2009). Nationally, U.S. forests continue to be net carbon sinks. The most recent estimates indicate that U.S. forests and wood products sequestered approximately 792 teragrams of CO_2 equivalents in 2008, and the net annual sequestration rate has increased since 1990 (US EPA 2010). Carbon flux rates have not been calculated for the Iron Springs project area, but it likely will continue to be a net carbon sink under the no-action alternative considering the age and composition of the forest and the proportionally limited recent disturbance rate (natural or human).

Proposed Action

The proposed action involves approximately 4,300 acres of timber cutting and planting, including:

Commercial thinning with sanitation/salvage in spruce/fir stands: 3,603 acres

Precommercial thinning in spruce/fir: 381 acres (included in 3, 603 acres of commercial thin)

Spruce/fir sanitation/salvage only: 366 acres

Aspen cleaning: 388 acres (included in 3, 603 acres of commercial thin)

Aspen regeneration: 152 acres

Planting of Engelmann spruce seedlings: 154 acres

In addition, the proposed action includes temporary road construction (approximately 9.6 miles) and existing road maintenance (approximately 36 miles).

Proposed Action Design Features

Project design features represent practices established to protect Dixie National Forest resources. Project design features have been developed to meet the goals of the forest plan as well as other laws, regulations, and directives while avoiding potential significant environmental effects. Project design features are applicable to all action alternatives where corresponding activities are present.

Within conifer treatment units, protect residual trees through the designation of skid trails and landings, directional felling, and limiting off-trail skidding to one to two passes. Over-snow

operation may be used. Mechanized fellers/forwarders may also operate off skid trails. Designated skid trails should be located approximately 100 to 150 feet apart, depending on terrain.

To maintain stand productivity and compliance with forest plan, down logs and coarse woody debris would be retained by aspen and spruce/fir cover type guidelines (Forest Plan, Appendix CC, page CC-22, Section G).

In aspen regeneration treatment units, protect aspen root system through the designation of skid trails and landings, directional felling, and limiting skidding equipment to approved skid trails and only one to two passes off trail. If soils are frozen or are covered with 18 inches of snow, skidding equipment may operate off designated trails. To provide sufficient protection to aspen regeneration for excessive browsing, slash and logs not meeting utilization standards or adding to beetle risk shall be left throughout cutting units. If heavy browsing occurs, fences may be installed to restrict large ungulates (deer, elk, and livestock) until average seedling height exceeds 6 feet.

To prevent spruce beetle spread, all Engelmann spruce cut prior to September 1 shall be removed before the end of the same year and all Engelmann spruce cut after September 1 shall be removed before the end of the following year.

To prevent spruce beetle spread, all live or recently killed Engelmann spruce felled or pushed over, which exceed 14 inches diameter and 18 inches in length, shall be skidded to a designated landing for disposal.

To reduce fuel loading from harvest operations, ground-based skidding operations will utilize whole tree harvest techniques.

Landings shall not be located any closer than 100 feet from road 30140.

Direct and Indirect Effects of the Proposed Action

Suitability

There would be no change in forest land suitability as described in the affected environment. Only lands identified as suitable for timber harvest are included for treatment.

Forest Composition

Spruce/fir

The commercial thinning would favor Engelmann spruce over subalpine fir to meet forest plan objectives for spruce dominance. Subalpine fir is a short-lived species which has less management potential than spruce (McCaughey and Schmidt 1982). Regulation of diameter distribution would result in more open stand conditions favoring regeneration of less shade-tolerant spruce (Reynolds et al. 1992), promote increased diameter growth and vigor of residual trees, and reduce subalpine fir presence in the understory. Likewise, the 381 acres of pre-commercial thinning would reduce the subalpine fir component in the less than 8-inch-diameter classes, favoring retention of the healthiest Engelmann spruce.

The 366 acres of salvage/sanitation involves removing dead or dying Engelmann spruce trees. The first priority is to remove spruce trees infested with spruce beetles. The second priority would be to utilize

dead spruce trees exceeding snag retention objectives. These treatments would reduce the existing diversity and density of snags while reducing the risk of mortality to the larger live spruce (Hebertson and Anhold 2000).

Previously clearcut stands would continue stand establishment of conifer seedlings and growth of existing conifer. The addition of Engelmann spruce seedlings on 154 acres will increase the development of Engelmann spruce in understocked areas.

At periodic intervals, spruce beetle outbreaks would reduce the basal area and spruce component, focusing on the largest diameter classes and clumps (Hebertson and Anhold 2000). Such outbreaks would remove less than 20 percent of the spruce (Schmid and Amman 1992) and stimulate regeneration of aspen and spruce. The stands would then recover the loss of basal area and spruce, eventually attaining maximum site capabilities with both understory trees and regeneration. Over the long term, conditions would eventually precipitate larger spruce beetle outbreaks, in which up to 90 percent of the spruce is removed and forest succession starts over (Schmidt and Frye 1977). Understory Engelmann spruce and subalpine fir would release and eventually reoccupy the sites. Since subalpine fir seedlings are typically more numerous in the understory and faster growing (Shea 1985), the proposed stand regulation favoring Engelmann spruce would improve the long-term recovery potential of that species. Finally, managing for greater aspen within the conifer stands would result in fewer impacts from spruce beetle mortality, which would alter the current stand compositions.

Aspen

The aspen regeneration treatments would reduce the subalpine fir and Engelmann spruce in the existing aspen clones. Most, if not all, of the aspen's live tree component would be eliminated except for those trees left to meet wildlife criteria. Regeneration of aspen through suckering would result in dominance of the site by aspen, thus retaining greater diversity of aspen stands and age classes (Shepperd 2001). In addition, the 152 acres of aspen regeneration within the conifer stands will result in conversion of seral, maturing aspen clones with increasing conifers to young, aspen-dominated clones. Finally, the aspen cleaning treatments, which are designed to shift the composition of these stands away from the invading species (Smith 1986), would reduce the conifer trees that have become established under the canopy of the relatively healthy aspen. Over the long term, adjacent conifer seed sources would stimulate regeneration of more shade-tolerant conifers underneath the aspen.

Forest Structure

Grassland

Because the proposed action will not change the distribution of grassland within the project area, the discussion of grassland extent included under the direct, indirect, and cumulative effects of no action is adequate to show that the forest plan direction in relation to grassland will be met. There will be no further discussion of grassland in this document.

Properly Functioning Condition Structure

While there is no forest plan desired condition associated with forest structure on a project area basis, the general effect of the proposed action on forest structure is to reduce the percentage of basal area in the smaller size classes, concentrating the remaining basal area in the mid-aged, mature, and old forest structures. This effect is both immediate, as the pre-commercial thinning and thinning from below removes much of the material from the smaller size classes, and long term, as the large remaining trees respond to the thinning with increased growth rates (Smith 1986). For the stands in the Iron Springs

project area, this immediate effect is demonstrated in Table 75, where removal of smaller material moves the treated stands from 0 percent to 6 percent of them that are dominated by mature forest. This plays a role in moving the landscape toward the desired future condition of creating and maintaining size-class diversity to include 40 percent mature and old forest structure (USDA Forest Service 2000).

Table 75. Properly functioning condition structures and vegetation structural stages for Iron Springs under the proposed action

PFC Description	VSS Class	Diameter Range in Inches	Current Condition of Iron Springs Treatment Areas (percent)	Structure of Treatment Areas after Implementation of the Proposed Action (percent)
Grass/forb/shrub	1	0.0 – 0.9	0	0
Seedling/sapling	2	1.0 – 4.9	0	0
Young forest	3	5.0 – 11.9	86	23
Mid-aged forest	4	12.0 – 17.9	14	72
Mature forest	5	18.0 – 23.9	0	6
Old forest	6	24.0+	0	0

It is worth noting that the aspen regeneration cuts under the proposed action will create VSS 1 conditions on approximately 150 acres (approximately3 percent of the project area). As is noted above (page 9), however, the Reynolds method of designating VSS classes requires selecting the “dominant” material based on basal area at breast height (4.5 feet). By this methodology, then, areas in VSS 1 generally will have little to no measurable basal area because the trees will not have a d.b.h. (Orlemann 2012).

Goshawk Territories

Under the proposed action, no treatments would occur in either of the goshawk nest areas associated with the Iron Springs project area. As a result, potential effects of the proposed action in these stands are similar to those described under the no-action alternative. For the Grass Lakes post-fledgling area, the proposal will thin just 154 acres of the 426 acres within the project area, the remainder will be untreated. Of the 1,390 acres of foraging area in the Grass Lakes territory within the project area boundary, just 1,080 acres are proposed for treatment under the proposed action. For the Griffin Springs post-fledgling area, the proposal will thin 356 acres of the 444 acres within the project area, the remainder will be untreated. Finally, of the 2,924 acres of foraging area in the Griffin Springs territory within the project area boundary, 2,474 acres are proposed for treatment under the proposed action.

Where thinning does not occur—nest areas—or occurs on a very small portion of the affected area—Grass Lakes post-fledgling area—the results of the proposed action on VSS structures is very similar that of the no-action alternative. In the other goshawk territory components, primarily the foraging areas, the effect of the proposed action is to immediately push the balance of VSS classes toward the larger sizes (VSS 4-5) and away from the dominant VSS 3. Since this latter class is overly well represented across the landscape, this shift of project area balance moves the landscape toward the desired condition (Reynolds et al. 1992).

Forest Health

Insects and Disease

Thinning of forest stands can improve individual tree vigor and growth, as well as resistance to insects and disease (Fettig et al. 2007). As a result, forest entomologists who have reviewed the Iron Springs stands, as well as those from other areas of the Aquarius Plateau have recommended thinning

treatments (Anhold 1999; Hebertson and Anhold 2000; Hebertson 2000; Hebertson 2003; Skov 2008). In fact, Hansen et al. (2010) found, in a retrospective study of forest thinning that included stands on the Escalante Ranger District, that thinning can result in reduced mortality from spruce beetle. On the other hand, it has also been well documented that thinning alone cannot arrest landscape-level pest infestations, especially when "huge" beetle population numbers overcome the defenses of even the most vigorous trees (DeRose and Long 2007). The 3,800 acres of conifer thinning included in the proposed action are intended to provide the benefits of reduced competition on tree growth and vigor. The resulting stands should be more resilient to spruce beetle outbreaks though additional mortality may continue despite thinning if beetle populations expand to those seen on the Markagunt Plateau and elsewhere.

The sanitation treatments would remove trees infested with spruce beetle, thereby reducing current insect populations. Use of pheromone traps will attract the beetles to a known location in which any infested trees would be removed or destroyed. These techniques have been successfully used to suppress localized populations (Samman and Logan 2000). Bentz and Munson (2000) concluded that removal of infested trees effectively reduce insect mortality. Monitoring of similar treatments at other locations on the Aquarius Plateau has demonstrated successful removal of infested trees (Keefe 2002).

Salvage treatments involve removing dead trees from the stand. Objectives of this treatment are to suppress bark beetle populations in local pockets of activity and utilize the timber resource before it can deteriorate (Hinds et al. 1965). Salvage treatments will not affect mortality rates nor will they reduce the susceptibility of stands to subsequent bark beetle attacks (Hebertson 2005). Likewise, neither the proposed planting nor the precommercial thinning will influence current spruce beetle mortality rates. These treatments are designed to promote future development of structural diversity.

Finally, the coppicing and cleaning treatments in aspen will essentially eliminate any current risk from spruce beetle mortality with the removal of all large-diameter live spruce. In sum, management for aspen and structural conifer diversity will reduce the potential risk from spruce beetle infestation, since dense stands of large-diameter spruce are those most susceptible to losses from spruce beetle attacks.

Stand Density

Stand density management uses tree size and density relationships to control stand stocking to meet management objectives (Long 1985). The most commonly considered relationship is the one described by Reineke between quadric mean diameter and number of trees per unit area—although others have been proposed which may offer improvements (Zeide 2010). In any case, Reineke's Stand Density Index (SDI) provides a good guide to stand development signposts such as the onset of competition (25 percent of max SDI), the lower limit of full site occupancy (35 percent of max SDI), and the lower limit of self-thinning (60 percent of max SDI) (Long 1985). Stands managed at around 25 percent of max SDI display increased tree vigor, maximized tree growth, and reduced mortality (Long 1985).

For the Iron Springs project, the proposed commercial thinning would reduce SDI levels and standing volume while producing commercial forest products. Both the commercial and pre-commercial thinning would be implemented to reduce SDI toward 25 percent of maximum. Salvage/sanitation treatments would remove dead and dying trees, which would also have the effect of reducing SDI. As a result, thinning treatments would be adjusted to reflect these losses throughout the diameter distributions. The coppice-clearfelling treatments in aspen would remove most of the standing live trees, reducing SDI values to near zero. As a result, the effect of the proposed action on stand density would be to reduce the approximately 1,400 acres which currently exceed management thresholds toward 25 percent of maximum SDI.

Old Growth

Under the proposed action alternative, treatments in approximately 1,950 acres of current spruce/fir old-growth stands would reduce overall stand densities. The old-growth guidelines specify at least 15 live trees per acre greater or equal to 15.0 inch d.b.h. with a minimum 150- to 180–year-old canopy layer (Hamilton 1993). Because some trees 15 inches and larger could be removed under the Iron Springs proposal, it is possible that some stands could fall beneath this live tree threshold, and would no longer count as old growth. This outcome is most likely in existing old-growth stands where ongoing beetle attacks have already significantly reduced the large live tree component. For example, location 36-site 2 contained 31.8 large live trees per acre before the spruce beetle outbreak; it now has fewer than half that and, at 15.8 large live trees per acre, its classification as old growth is marginal.

It is, however, highly unlikely that all the treated acres would drop out of Hamilton's old growth classification. In fact, when tested in the Forest Vegetation Simulator, *none* of the treated stands became disqualified as a result of timber cutting. This is because the planned thinning is a thin from below favoring spruce. As a result, the trees removed would primarily be within the 7-inch to 15-inch sizes. Removal of these trees would leave the stands a sufficiently low density to improve their beetle risk rating while leaving essentially all of the spruce trees approximately 16 inches d.b.h. and larger.

For the sake of argument, let's say that the current old-growth stands that are truly marginal, having dropped to fewer than 17 large live trees per acre due to spruce beetle mortality, are the ones that will be affected by the Iron Springs proposed treatments. In that case, current project area old growth will be reduced by approximately 530 acres to approximately 1,580 acres (Table 76).

Table 76. Marginal old-growth stands potentially affected by proposed treatments

Location	Site	Acres	Current Large Live Tree Component
36	2	232	15.84
36	10	16	15.98
65	13	134	16.77
109	4	149	16.19
Total		531	
Remaining Old Growth		1,567	
Percent of Project Area		19	

In addition, approximately 23 acres of old growth would receive sanitation/salvage treatments. These treatments would remove dead and dying spruce trees and reduce the susceptibility of the larger spruce to loss. Stands will not lose the old growth values as a result of the harvest as long as sufficient large-diameter spruce trees are retained (Hamilton 1993).

Role of Fire

Forest thinning and salvaging operations, such as those proposed for the Iron Springs area, could be expected to reduce the risk of catastrophic wildfire by breaking up continuous fuels and removing flammable material from stands (Jorgensen 2010). In the case of Engelmann spruce/subalpine fir stands of the Rocky Mountains, however, there is ongoing debate about the effect of both spruce beetle outbreaks on the potential fire regime. On the one hand, bark beetle epidemics can be expected to increase the levels of dead and dry fuels both in the canopy and on the surface, as needles and small dead branches begin to fall (Jorgensen and Jenkins 2010; McCullough et al. 1998; Schmid and Amman 1992). On the other hand, research in Colorado has failed to find a link between bark beetle epidemics and subsequent fire extent or severity (Bebi et al. 2003; Kulakowski and Veblen 2007). On balance, it seems likely that the

proposed treatments in Iron Springs may help meet forest plan objectives for providing opportunities for appropriate fire-suppression response without necessarily having a significant effect on reducing the frequency or extent of future fires.

Productivity

Implementation of the thinning treatments in the project area conifer stands would reduce stocking levels and standing volume while producing commercial forest products. Reduced stocking would increase individual tree health and vigor, reduce mortality, focus growth on fewer stems, and produce commercial volume. Treatments would reduce stocking to levels that improve individual tree growth, although overall stand growth would be reduced. In addition, pre-commercial thinning would reduce stocking levels in the short term, allowing for optimum growth on the best available trees.

Implementation of the sanitation/salvage treatments for conifer stands would recover economic value of the dead and dying trees (Samman and Logan 2000) associated with the spruce beetle infestations. Dead Engelmann spruce trees can be valuable for house logs while recently killed stems could be used as sawlogs. Harvest methods would protect residual live trees for future stocking. Long-term density objectives would maintain total stand SDI within a range of 25 to 35 percent of maximum SDI.

Timeliness of the commercial removal is important for recovering the economic value of the infested trees. Schmid and Frye (1977) state, “Salvage of beetle-killed spruce can proceed for many years after the trees are killed depending on the product to be derived. Timber for sawlogs remained merchantable for about 5 years, then enough trees developed radial checking to make them unmerchantable for small sawn boards (Nelson 1954). . . . Each beetle-killed spruce deteriorates differently, so merchantability of a stand is variable. Enough trees may become unusable within a few years, causing the salvage cutting in the stand to become uneconomical.”

The FVS growth simulator was used to estimate harvest volume and growth of stands proposed for treatment. FVS growth projections are based on expected growth and normal mortality. Estimates for stand 65-7 indicate harvest would yield approximately 1,380 cubic feet of sawtimber per acre, leaving 2,080 cubic feet on site, which is expected to grow to 2,720 cubic feet by 2030 (Table 77). This is a mean annual growth increment of approximately 32 cubic feet per acre per year.

Table 77. Growth rates and removals of merchantable volume under proposed action for stand 65-7

Year	Diameter Growth (inches)	Live Merchantable Cubic Foot Volume	Dead Merchantable Cubic Foot Volume	Merchantable Cubic Foot Removals
2010	0.03	2,080	0	1,380
2020	0.13	2,390	16	0
2030	0.85	2,720	19	0

It is expected that implementation of these commercial treatments will produce approximately 8,000 thousand board feet (MBF) of forest products. These treatments would achieve the long-term goal described in the forest plan to improve the growth rate in timber stands through silvicultural treatment.

Climate Change

Under this alternative there would be direct greenhouse gas emissions associated with commercial timber treatments. These would include machinery and vehicle emissions from harvesting, yarding, and hauling

(Karjalainen and Asikainen 1996). For fewer than 4,000 acres of treatments, these emissions would be very small. Athanassiadis (2000), for example, estimated that carbon dioxide emissions from forest harvesting operations in Sweden accounted for just 1 percent of the total amount emitted by all sources nationwide. Moreover, emissions of carbon from forest operations are also tiny (approximately 1.4 percent) relative to the amount of carbon sequestered in the harvested timber (Berg and Karjalainen 2003).

Most importantly, however, U.S. forests are a strong net carbon sink, absorbing more carbon than they emit (Houghton 2003; U.S. EPA 2010). For the period 2000 to 2008, the net carbon sequestration of U.S. forests was more than 190 million tons carbon per year, with harvest wood products sequestering an additional 20 to 30 million tons per year (U.S. EPA 2010). The amount of carbon sequestered in U.S. forests annually offsets roughly 11 percent of the country's greenhouse gas emissions from fossil fuel combustion—the equivalent of eliminating the emissions from about 135 million passenger vehicles. Within the United States, land use conversion from forest to other uses (primarily for development or agriculture) are identified as the primary human activities exerting negative pressure on the carbon sink that currently exists in this country's forests (Conant et al. 2007; Ryan et al. 2010). In this case, the affected forests will remain forests, not converted to other land uses, and long-term forest services and benefits will be maintained.

Cumulative Effects of the Proposed Action

Suitability

There would be no change in forest land suitability as described in the Affected Environment. Only lands identified as suitable for timber harvest are included for treatment.

Forest Composition

Spruce/fir

Commercial thinning in spruce/fir stands has been designed to promote the retention of spruce over fir—which is desired by the forest plan, but affected by spruce beetle-induced mortality. Past studies have shown that, in addition to numerous other factors, these types of management actions can be expected to have at least a modest beneficial effect on forest composition (Hansen et al. 2010). For the 84,730- acre Iron Springs CEA, these treatments have occurred, or are planned for, approximately 8,200 acres (Table 78). As a result, the potential cumulative effect of the Iron Springs Project on the spruce/fir composition when added to the past, present, and reasonably foreseeable actions across the CEA is to roughly double the treated area from approximately 5 percent to approximately 10 percent. This is likely to have a slightly beneficial effect in relation to the forest plan desired future condition for spruce/fir composition as compared with doing nothing.

Table 78. Spruce/fir thinning projects within the Iron Springs cumulative effects area

Project	Treatment	Acres w/in CEA (percent of CEA)	Percent of Spruce/fir w/in CEA
Roundy	Spruce/fir selection harvest	737 (1 percent)	2
Coyote Hollow	Spruce/fir selection harvest	2,029 (2 percent)	7
Pacer	Spruce/fir selection harvest	1,863 (2 percent)	6
Iron Springs	Spruce/fir commercial thin	3,603 (4 percent)	12
Total		8,232 (10 percent)	28

NOTE: Project such as Pockets, which is planned but has not been implemented, were not included in these calculations because they are sanitation/salvage projects only and do not include treatments designed to manage composition of the live tree component.

Aspen

Likewise, the aspen regeneration and cleaning treatments are designed to shift species composition away from conifers and back toward aspen. These treatments have been successful elsewhere (Jones et al. 2005) and will move the project area toward the desired condition of retaining aspen in the project area. For the 84,730-acre Iron Springs CEA, these treatments have occurred, or are planned for, approximately 1,500 acres (Table 79). As a result, the potential cumulative effect of the Iron Springs Project on aspen composition when added to the past, present, and reasonably foreseeable actions across the CEA is to roughly double the treated area from approximately 1 percent to approximately 2 percent. This is likely to have a very slightly beneficial effect in relation to the desired future condition for aspen composition as compared with doing nothing. It is, however, unlikely to arrest the decline of aspen and, if anything, is of such negligible effect that it should be considered insignificant either way.

Forest Structure

Properly Functioning Condition Structure

The desired forest structure, under the PFC, is to have landscapes with a balanced range of structures, including 10 percent each of grass/forb/shrub and seedling/sapling structures, and 20 percent each of young, mid-aged, mature, and old forest (USDA Forest Service 2000). Across the Iron Springs CEA, it has been amply and extensively demonstrated, by this report et al. that the area is not lacking in the smallest or youngest four structures (grass/forb/shrub, seedling/sapling, young forest, and mid-aged forest). In fact, Keefe (2009) has documented that, in describing the existing condition of the Pockets project area (part of the CEA for Iron Springs), stands are generally dominated by the three smallest-youngest age classes. While data are not available for the entire CEA, other spruce/fir stands sampled across the CEA demonstrate much the same situation (Table 79).

Table 79. Aspen regeneration and/or cleaning projects in the Iron Springs cumulative effects area

Project	Treatment	Acres w/in CEA (percent of CEA)	Percent of Aspen w/in CEA
Roundy	Aspen patch cuts	50 (0 percent)	0
Coyote Hollow	Aspen patch cuts	65 (0 percent)	0
Pacer	Aspen patch cuts	19 (0 percent)	0
Lost Spring	Aspen regeneration	33 (0 percent)	0
Pockets	Aspen regeneration/cleaning	783 (1 percent)	6
Iron Springs	Aspen regeneration/cleaning	540 (1 percent)	4
Total		1,490 (2 percent)	11

As a result, it is evident that treatments to move stands toward a condition where they provide both immediate improvements in the proportion of mature and old forest as well as long-term growth increases focused on the larger stems will move the landscape toward the desired condition. Because approximately 3,600 acres of spruce-fir would be treated under the proposed action, and because the treatments would shift approximately 2,250 of those treated acres away from VSS 3, the change in the CEA for spruce-fir (approximately 30,000 acres) would be a seven percent and one percent gain in VSS 4 and 5, respectively. When extrapolated across the entire CEA (approximately 85,000), the change, in percent, would be quite small, just two percent.

Because widespread spruce beetle epidemics across the high-elevation plateaus of southern Utah have the effect of removing essentially ALL the mature and old forest structures, and much of the mid-aged structures (DeBlander et al. 2010; DeRose and Long 2007; Dymerski et al. 2001), treatments such as Iron Springs which are designed to protect large-old trees by thinning from below should have the effect of diversifying conditions in the CEA such that mature and old forest structures are maintained and produced over the long term.

Goshawk Territories

As is noted in the discussion of cumulative effects under the no-action alternative, the entire Griffin Springs goshawk territory is within the CEA for Iron Springs, while most, but not all, of the Grass Lakes territory is within the Iron Springs CEA. The current condition of both of those territories is, like the PFC structure discussed above, dominated by the smaller VSS classes, especially VSS 3. This condition has been exacerbated by the past and current effects of spruce beetle-induced mortality which has reduced the VSS 5 and 6 size classes across southern Utah (DeBlander et al. 2010) and the CEA (Keefe 2009).

The cumulative effect of the treatments proposed under Iron Springs would be to shift some of the stands in the Grass Lakes and Griffin Springs goshawk territories toward VSS 4 and 5 stages, and eventually toward VSS 6. This will primarily affect the foraging areas and the Griffin Springs post-fledgling area, since none of the nest area stands will be treated and only a small area of thinning will occur in the Grass Lakes post-fledgling area. (Also note, the direct effect of the proposed action on the Griffin Springs post-

fledgling area is essentially the same as the cumulative effect since nearly all of the post-fledgling area is within the treatment area.)

Forest Health

Insects and Disease

Most, if not all, of the treatments proposed for Iron Springs were designed to promote forest health, especially regarding mitigation of the effects of spruce beetle outbreaks: Thinning treatments improve individual tree vigor and growth; sanitation/salvage removes infested trees from the stand; and aspen enhancement treatments reduce the number of acres of host species. In addition, many of the past, present, and reasonably foreseeable forest vegetation management projects within the Iron Springs CEA have provided these types of treatments (Table 80). As a result, management actions designed to improve forest health have been, or will be implemented, on approximately 20 percent of the cumulative effects area. This has been shown to have a generally beneficial effect, although it is unlikely that silvicultural treatments can "stop" a full-blown insect epidemic (DeRose and Long 2007).

Table 80. Forest health treatments within the cumulative effects area for Iron Springs

Project	Treatment	Acres w/in CEA (percent of CEA)
Roundy	Aspen patch cuts and spruce/fir selection harvest	737 (1 percent)
Coyote Hollow	Aspen patch cuts and spruce/fir selection harvest	2,094 (2 percent)
Black Forest/ Velvet Lake Salvage	Salvage of dead fuelwood	3,827 (4 percent)
Pacer	Aspen patch cuts and spruce/fir selection harvest	1,882 (2 percent)
Coyote Hollow Amendment	Additional sanitation/salvage on same acres	N/A
Pacer Amendment	Additional sanitation/salvage on same acres	N/A
Pockets	Aspen regeneration/cleaning and spruce/fir sanitation/salvage	4,498 (5 percent)
Iron Springs	Aspen regeneration/cleaning and spruce/fir commercial thin w/ sanitation/salvage	4,121 (5 percent)
Total		17,159 (20 percent)

Stand Density

Likewise, the control of stocking through the reduction of SDI provides demonstrable increases in tree vigor, maximized tree growth, and reduced mortality. The beneficial effects of such treatments in the Iron Springs project area can be added to remaining effects associated with treatments across the CEA.

Old Growth

The Forest Plan provides that 7 to 10 percent of each watershed should be in an old growth condition. At the time that the Griffin Springs project was planned, Keefe (2002) found that the three watersheds in the present CEA contained from 17 to 37 percent old growth. Since that time, updates to the Forest's GIS layers, including watershed and stand boundaries, have changed the gross acreages and old growth percentages slightly. The old-growth percentages stated above are "original" calculations from before the

spruce beetle outbreak. In contrast to the “original” old-growth acres in the CEA, the current old growth-acres in the CEA have been reduced by the spruce beetle in the period since Keefe first calculated them. As a result, the current condition of old growth across the CEA is somewhat different from what it was 10 years ago. Nevertheless, the three watersheds continue to meet forest plan objectives for old growth (Table 81).

Table 81. Current old growth acreages for the Iron Springs cumulative effects area

Watershed	Acres of Lost Old Growth Due to Spruce Beetle Mortality	Current Old Growth Acres	Percent of Watershed in Old Growth Condition
Antimony Creek/ Coyote Hollow	265	5,158	14
North Creek	450	5,676	33
Upper North Creek	336	10,284	35

Finally, the effect of the Iron Springs proposal on the total old-growth acreage in each watershed of the CEA is, similarly, a potential reduction in the total, while still maintaining at least 7 to 10 percent (Table 82). It is also worth noting that, even if every old-growth acre proposed for treatment under Iron Springs were to lose the classification, each watershed would still maintain 7 to 10 percent old growth: Antimony Creek-Coyote Hollow (12 percent), North Creek (32 percent), and Upper North Creek (30 percent). As a result, there is no scenario under which the proposed action for Iron Springs will reduce old growth across the CEA in such a way as to be in conflict with the forest plan.

Table 82. Effect of Iron Springs proposal on old-growth acreages across the cumulative effects area

Watershed	Acres of Lost Old Growth Due to Proposed Action	Remaining Old Growth Acres	Post-Project Percent of Watershed in Old Growth Condition
Antimony Creek/ Coyote Hollow	134	5,024	13
North Creek	5	5,671	33
Upper North Creek	393	9,891	33

Role of Fire

While the direct effect of treatments such as those proposed for Iron Springs, as well as others throughout the CEA, can be expected to help to meet forest plan objectives for providing opportunities for appropriate fire suppression response, the treatments are unlikely to have a significant direct effect on the long-term spruce/fir fire regime in the area. Without direct effects there can be no cumulative effects.

Productivity

The proposed action would reduce stocking levels and standing volume in the Iron Springs project area while producing commercial forest products. In addition, sanitation and salvage treatments would recover the economic value of dead and dying trees. Benefits like this have occurred as the result of a number of projects across the CEA. For example, it is expected that the Pockets Resource Management Project will produce approximately 18.9 million board feet (MMBF) of forest products by recovering project area mortality and enhancing future productivity. Over the past decade, it is estimated that treatments in the CEA have made nearly 32 MMBF of forest products available to the public. See Table 83.

Table 83. Forest product volume estimates for cumulative effects area

Timber Sale Project Name	Estimated MMBF
Pacer	1.1
Bug Lake Salvage	2.2
Clayton Salvage	1.7
Pockets Resource Management	18.9
Iron Springs	8.0
Total	**31.9**

Climate Change

Carbon flux rates have not been calculated for the Iron Springs Project. Nor have they been calculated for past or planned projects within the CEA. It is highly unlikely, however, that the total greenhouse gas emissions associated with 15,000 to 20,000 acres of forest management across the CEA during the past 20 years has resulted in a discernible impact on atmospheric concentrations of greenhouse gases or global warming, considering the limited changes in both rate and timing of carbon flux predicted within these few affected forest acres and the global scale of the atmospheric greenhouse gas pool and the multitude of natural events and human activities globally contributing to that pool. Moreover, the United States' national forests provide a valuable ecosystem service by removing carbon from the atmosphere and storing it in biomass (Galik and Jackson 2009). Significantly, U.S. forests continue to be net carbon sinks. The most recent estimates indicate that U.S. forests and wood products sequestered approximately 792 teragrams of CO_2 equivalents in 2008, and that the net annual sequestration rate has increased since 1990 (U.S. EPA 2010).

Alternative A

In evaluating the comments received during the initial scoping for this project, the interdisciplinary team determined that the issue of "old growth" treatments was significant. As a result, an alternative to the proposed action was developed to address concerns about treatments in stands that currently meet the forest plan standards for old growth. This alternative has been dubbed "alternative A." The basic premise is that stands currently qualifying as old growth will be exempt from commercial thinning treatments, except where the risk of imminent beetle outbreak and mortality is highest. Seven stands fall into this latter category, for a total of 374 acres.

Alternative A involves approximately 2,200 acres of timber cutting and planting, including:

Commercial thinning with sanitation/salvage in spruce/fir stands: 1,544 acres

Precommercial thinning in spruce/fir: 134 acres (included in 1, 544 acres of commercial thin)

Spruce/fir sanitation/salvage only: 363 acres

Aspen cleaning: 388 acres (included in 1, 544 acres of commercial thin)

Aspen regeneration: 152 acres

Planting of Engelmann spruce seedlings: 154 acres

In addition, alternative A includes temporary road construction (approximately 6 miles) and existing road maintenance (approximately 36 miles).

Alternative A Design Features

The project design features listed under the Proposed Action (Table 5) are applicable to all action alternatives and will not be repeated here.

Direct and Indirect Effects of Alternative A

The actions proposed under alternative A are the same type and design as those of the proposed action. In addition, they are intended to meet the intent of the original purpose and need for the project. As a result, the primary difference between the proposed action and alternative A is a reduction in the number of acres proposed for commercial and precommercial thinning. The reduction amounts to about 2,100 acres.

For the purposes of comparing effects between alternatives, there is no need to repeat statements of general effect found in the analysis of the proposed action, such as “silvicultural treatments designed to reduce stand densities will result in increased tree vigor and resistance to disease.” The effect on the vegetation resource in the project area will, in short, be qualitatively similar under both the proposed action and its alternative. The only difference will be in quantity. In some cases that is more important than others. For example, it may be useful for the decision maker to consider the differences in the output of forest products between alternatives. Or, because it is “the issue,” an analysis of the effect on remaining old-growth acres between alternatives may be in order. On the other hand, it adds little to a meaningful NEPA analysis to repeat identical effects scenarios while changing only the number of acres affected.

Given the forgoing, this analysis will not include the details associated with forest suitability, forest composition, forest health, the role of fire, or climate change. A description of the effect of alternative A on these components can be found in the section regarding the proposed action. A more detailed analysis of the effect of alternative A will be provided here for forest structure, specifically as it relates to habitat components associated with the northern goshawk, for old growth, and for productivity, specifically as it relates to merchantable volume removals.

Forest Structure

Goshawk Territories

Under the alternative action, no treatments would occur in either of the goshawk nest areas associated with the Iron Springs project area. As a result, the potential effects of the proposed action in these stands are similar to those described under the no-action alternative. Likewise, for the post-fledgling areas, there would be a small amount of aspen cleaning under the alternative, but all of the proposed spruce-fir thinning would be dropped. As a result, the potential effects of the proposed action in these stands are similar to those described under the no-action alternative. Of the 1,390 acres of foraging area in the Grass Lakes territory that are within the project area boundary, just 766 acres are proposed for treatment under the alternative action. Finally, of the 2,924 acres of foraging area in the Griffin Springs territory within the project area boundary, 1,166 acres are proposed for treatment under the alternative action.

Where thinning does not occur—nest areas and post-fledgling areas—the results of the alternative action on VSS structures mirrors that of the no-action alternative. In the other goshawk territory components, primarily the foraging areas, the effect of the proposed action is to immediately push the balance of VSS classes toward the larger sizes (VSS 4 to 5) and away from the smaller ones (VSS 1 to 3). Since these latter classes are overly well represented across the landscape, this shift of project area balance moves the landscape toward the desired condition (Reynolds et al. 1992). In the case of the alternative action, the shift is simply less than that of the proposed action since fewer acres would be treated.

Old Growth

Under alternative A, seven spruce/fir stands that currently rate as old growth would be thinned to reduce overall stand densities (Table 84). The total acreage treated is approximately 374 acres. All thinning—in both action alternatives—will be done from below, which means that the stems selected for removal will come from the smallest crown classes, removing first the overtopped and intermediate trees, then proceeding to the co-dominants, while generally leaving the dominant trees in the stand (Smith 1986). In order to ensure that treatments in these selected stands retain old-growth character, however, pre-treatment timber surveys would be conducted to identify the number of dominant trees in a given area that **must** be left to meet Hamilton's old-growth standard. As a result of this precaution, those 374 acres will continue to be classified as old growth.

The remaining stands that currently qualify as old growth and were planned for thinning under the proposed action—23 stands—would not be treated under this alternative. As a result, the trajectory of those stands is likely to follow the one described in the no-action scenario. The scenario will play out on approximately 1,500 to 1,600 acres. If, as is noted in that part of this report, the large live trees continue to die at rates similar to those observed for the last 10 years, we can expect that perhaps 40 percent, or 600 to 640, of those acres will no longer qualify as old growth in 2020.

Table 84. Existing Iron Springs old growth at highest risk of beetle infestation and mortality

Location	Site	Alternative A Treatment
6	23	CT
6	24	CT
6	46	CT
35	25	CT
35	27	CT
36	9	CT
65	13	AC/CT/PT

Finally, approximately 23 acres of old growth—one stand—that had been proposed for sanitation and salvage under the proposed action would not be treated under alternative A. The purpose of sanitation is to halt the spread of infestation by removing beetle-infested trees. While this does not affect the large, live tree component and thus, in theory, does not affect the old-growth calculation, the short- and medium-term effect of foregoing the treatments may be to provide beetle populations for further infestations, and continued mortality in the stand.

Productivity

The direct and indirect effects of alternative A on area stands have been described in the proposed action. The forest productivity benefits associated with treatments would, however, accrue to approximately 1,400 fewer acres. In fact, stand 65-7, which was used to provide an example of growth rates, mortality, and potential commercial volume under the no-action and proposed action alternatives would not be treated under alternative A. As a result, the effects on that stand would be the same as the no-action alternative. Likewise, the estimate of potential forest product volumes provided to the public would be reduced to 4,500 MBF, as compared to 8,000 MBF under the proposed action.

Cumulative Effects of Alternative A

Forest Structure

Goshawk Territories

As is noted in the discussion of cumulative effects under the no-action and proposed action alternatives, the entire Griffin Springs goshawk territory is within the CEA for Iron Springs, while most, but not all, of the Grass Lakes territory is within the Iron Springs CEA. The current condition of both of those territories is, like the PFC structure discussed above, dominated by the smaller VSS classes, especially VSS 3. This condition has been exacerbated by the past and current effects of spruce beetle-induced mortality which has reduced the VSS 5 and 6 size classes across southern Utah (DeBlander et al. 2010) and the CEA (Keefe 2009).

The cumulative effect of the treatments proposed under the Iron Springs alternative would be to shift some of the stands in the Grass Lakes and Griffin Springs goshawk territories toward VSS 4 and 5 stages, and eventually toward VSS 6. This will affect primarily the foraging areas, since none of the nest area stands will be treated and only a small area of aspen cleaning will occur in the Grass Lakes post-fledgling area. The shift will, however, be relatively minor due to the small areas 766 acres (18 percent) and 1,169 acres (20 percent), respectively, being treated in the Grass Lakes and Griffin Springs goshawk foraging areas in the CEA under the alternative.

Old Growth

Like the no-action alternative, alternative A is likely to contribute to a continued decline of spruce/fir old growth acres across the CEA. With the exception of the 374 acres of old-growth thinning under alternative A, approximately 1,500 to 1,600 acres of existing old growth is likely to be subject to continued mortality at the rates estimated under the no-action alternative—10 to 40 percent. Assuming that the stands treated under alternative A continue to retain old-growth characteristics, the protection offered by thinning them will apply to just 4, 8, and 7 percent of the existing spruce/fir old growth, respectively, in the three watersheds at issue. See Table 85.

Removing those “protected” stands from the no-action calculations on page 169, yields potential total old growth losses of 286 to 1,145 acres in Antimony Creek-Coyote Hollow, 57 to 231 acres in North Creek, and 272 to 1,088 acres in Upper North Creek. It is worth noting, however, that, like the no-action alternative, the three watersheds in question should still meet forest plan objectives for old growth under alternative A, despite up to 40 percent continued mortality in the spruce/fir.

Table 85. Old-growth units “protected” by thinning treatments under alternative A by watershed

Watershed	Location	Site	Acres
Antimony Creek/Coyote Hollow	65	13	120
Watershed Total			**120 (4 percent)**
North Creek	6	46	30
	36	9	18
Watershed Total			**48 (8 percent)**
Upper North Creek	6	23	45
	6	24	11
	6	46	98
	35	25	23
	35	27	5
	65	13	12
Watershed Total			**194 (7 percent)**

Effects Relative to Significance Factors

In order to reach a finding of no significant impact (FONSI) under the NEPA, a decision maker must consider the potential significance of environmental effects as they relate to both context and intensity. Context and intensity are defined by the Council on Environmental Quality at 40 CFR 1508.27. Before considering the potential effect of the proposed Iron Springs treatments on the project area vegetation in regards to both context and intensity, it is worth noting a couple of general propositions.

First, the project was designed, in part, to improve and maintain the health of a managed forest. As a result, it is nearly impossible to find, from a silvicultural perspective, that the proposal will result in significant harmful impacts. If that were likely, there would be no sense in making the proposal. In other words, if the maintenance and improvement of a managed forest is the purpose of the activity, the activity, by definition, will not have significant negative impacts on the forest resource. For it to be otherwise would violate common sense.

Second, the Iron Springs project is proposed for a MANAGED forest. As a result, the vegetation will be modified to meet the goals of the forest plan, and will not appear to be influenced solely by the hand of nature. Many, if not most, of the forests of the Dixie National Forest have been left in an essentially unmanaged state. The Iron Springs forest is not one of them. The Dixie National Forest provides multiple uses, benefits, and products to the American public, including managed forests. Management is not, on its face, a significant impact. The managed forest remains a forest and provides the benefits associated with forests despite changes to the vegetation wrought by the hand of man.

Context

Significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, affected interests, and the locality. Significance varies with setting. In the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

In this case, proposed forest vegetation treatments are limited to approximately 5,000 acres or less of the Dixie National Forest. As a result, this is a site-specific action with minor localized effects on the forest resources of the area. To put this in perspective, the Forest is composed of approximately 2 million acres of public land, almost half of which is in an essentially “unmanaged” condition—wilderness areas, research natural areas, inventoried roadless areas—as noted above. In contrast, the Iron Springs proposal includes the treatment of a managed project area that composes less than 0.5 percent of the Forest’s areal extent. Moreover, as this report notes in numerous locations, the proposals do not result in deforestation or land-use changes, which are the primary large-scale impacts to forest vegetation resources of regional or global concern.

Intensity

Intensity refers to the severity of impact. The following factors are considered in evaluating intensity:

Impacts both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

The result of the proposed treatments on the forest vegetation in the project area is designed to be “beneficial” from a silvicultural perspective. As a result, there would likely be some beneficial effects from the proposed action, but these would not generally be considered “intense” or “severe.”

The degree to which the proposed action affects public health or safety.

Treating the forest vegetation resource in the Iron Springs project area would not affect public health or safety.

Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

No parklands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas are associated with the project area. The project area has been surveyed and analyzed for historical and cultural resources.

The degree to which the effects on the quality of the human environment are likely to be highly controversial.

The effects of any alternative on the quality of the human environment are not likely to be highly controversial. The project area is a managed forest; the proposal is limited in scope; and the project design features, including standard management requirements, are demonstrably effective in reducing impacts to national forest resources.

Degree to which possible effect on the human environment is highly uncertain or involves unique or unknown risks.

The conditions present within the project area and the proposed action are similar to forest vegetation treatment projects that have been implemented on the Dixie National Forest in the past. Potential effects from such projects are routinely considered, documented, and monitored by the Dixie National Forest. The effectiveness of project design features in minimizing or eliminating risks from forest management has been demonstrated.

The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about future consideration.

This proposal does not set a precedent for any other vegetation management projects that may be implemented to meet the goals and objectives of the Dixie Forest Plan. Any decision to treat the forest vegetation in Iron Springs applies to this project only and does not represent decisions about future actions. Thus, this action does not set a precedent for future actions or represent a decision in principle about a future consideration. Future actions will be analyzed on their own merits in compliance with NEPA.

Whether this action is related to other actions with individually insignificant but cumulatively significant impacts.

This analysis includes a list of potential past, ongoing and foreseeable future actions that may create cumulative effects. In general, those projects were designed, like the Iron Springs proposal, to have beneficial silvicultural effects to managed forests. Those incremental potential benefits are accounted for in this report, but are unlikely to be significant.

The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

This proposal cannot affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places because none exist within the project area. The proposal will cause no loss or destruction of significant scientific, cultural, or historic resources.

The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

A biological assessment has been completed to document analysis of potential effects of this project on endangered, threatened, and proposed species and their critical habitats. No known federally listed threatened, endangered, or proposed plant or animal species occur or have the potential to occur in the project area. The project does not remove suitable habitat or otherwise adversely affect any listed species (see wildlife specialist documents).

Whether the actions threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

The action alternatives would not violate Federal, State, or local laws or requirements. They are consistent with the 1986 Dixie National Forest Land and Resource Management Plan. This report demonstrates compliance with the National Environmental Policy Act of 1969 and with the National Forest Management Act of 1976.

Summary of Effects

The Dixie National Forest proposes treating forest vegetation within the 8,300-acre Iron Springs project area. Proposed treatments include commercial thinning, precommercial thinning, and sanitation/salvage in spruce/fir stands; regeneration and cleaning treatments in aspen; as well as tree planting in former clearcut strips. The treatments were developed to both improve forest health and provide forest products to the public. After scoping, an alternative was developed to avoid treatments in existing “old growth,” with the result that 1,500 to 1,600 acres of treatments were dropped from that alternative. Under either of these action alternatives, however, the existing project area vegetation would be impacted by commercial and non-commercial cutting.

The direct and indirect effects of this cutting would include: a shift of species composition toward spruce and away from subalpine fir, as well as toward aspen and away from conifers; a reduction in stand density and resulting increase in individual tree vigor; a potential short-term reduction in old growth through the removal of live trees (this would not occur under alternative A); the provision of forest products to the public and increased productivity as measured by volume growth per annum; no change to the fire regime or to the benefits provided by forests in sequestering atmospheric carbon.

The areal extent of treatments proposed in the Iron Springs project area account for approximately 5 to 6 percent of the cumulative effects area. As a result, the direct and indirect effects noted above will only modestly improve the forest health conditions across the cumulative effects area. The benefit of the Iron Springs proposal will be added to the effects from other recent treatments in the managed forests of the cumulative effects area. These projects include Pockets, Velvet Lake, Coyote Hollow, and Roundy, among others.

Because these effects are designed to be silviculturally beneficial to the forest resource and will accrue to a managed forest, which makes up a small percentage (a third or less) of the vegetation in the area, the overall effect of this proposal or its alternative on the vegetation resource is not significant. Moreover, the proposal has been shown to be in compliance with law (NEPA, NFMA, etc.), regulation (CFR), and policy; as well as with the forest plan. The proposal does not affect human safety, historic resources, or

ecologically critical areas. In sum, the Iron Springs proposal maintains a managed forest using approved silvicultural practices in compliance with regulatory direction.

Other Forest Vegetation-Related Considerations

The forest vegetation analysis also considered a range of legal and regulatory considerations. These included (1) Consistency with the National Forest Management Act, (2) Consideration of Best Available Science, and (3) Consistency with the Forest Plan. While these considerations were also addressed by other specialists, they were given particular emphasis in the forest vegetation analysis as Iron Springs is primarily a vegetation improvement project. Due to the length of the legal and regulatory discussion it has been placed in an appendix to this document. See Appendix C: Forest Vegetation.

3.6 Recreation

Introduction

The 8,306 acre project area is located at elevations ranging from 9,000 to 10,750 feet Mean Sea Level (MSL). The forest type is primarily Engelmann spruce/subalpine fir, with scattered aspen clones. The forested stands are interspersed with numerous sagebrush meadows.

Recreation use in the project area is low. Most of the recreation use occurs during the summer and fall. There is little use in the winter.

Forest Road 140 provides recreation access to the analysis area.

Forest Plan Direction/Other Direction

Within the project area recreation emphasis is designated for 2B (LRMP, Chapter IV, page 57, 68, USDA Forest Service 1986).

Affected Environment

Recreation Use Trends

The establishment of the Grand Staircase-Escalante National Monument (GSENM) in September of 1996 and the designation of Highway 12 as an All American Road in 2003 have resulted in a steady increase in visitation. (Escalante Interagency Office Visitor Count 2011). Both nationally and within the Rocky Mountain area increases in all land based recreation activities are projected (Cordell et al. 2004). Although, the majority of the increase visitation has most likely occurred in the Monument, there has likely been an increase in use on the forest as well.

There are a variety of dispersed recreational opportunities in the Iron Springs project area. Historically, the major recreation uses have been All Terrain Vehicle (ATV) use, hunting, dispersed camping, hiking, mountain biking, horseback riding and snowmobiling. There is no accurate data to indicate the number of people who have been using this area for recreation.

Current Recreation Activities

Dispersed Camping

Signs of dispersed camping can be found throughout the project area but are most common along road 140. Dispersed camping generally occurs throughout the summer and fall seasons. Most use occurs in the

fall and is associated with the elk hunting. Dispersed campsites within the project area are in good condition.

Hunting (Rifle and Bow)

Hunting occurs throughout the analysis area during. Hunting, particularly big game hunting, is often combined with dispersed camping and ATV riding.

Hiking

The gap, Great Western and Griffin Point non-motorized trails are partly located within the project area.

All-Terrain Vehicle Use

Currently there are over 23 miles of roads open to ATV travel within the project area. These miles include road 140 which is also the Great Western ATV trail and approximately 0.2 mile of the grass lakes ATV trail. Cross-country travel is not allowed. ATV use is light throughout the summer and increases in the fall during hunting seasons.

Winter Sports

Snowmobile use is permitted throughout the area. Road 140 is a marked snowmobile route. Cross country travel by snow machines is not restricted. Winter sports activities, including snowmobiling are not common uses of the area.

Horseback Riding

Horseback riding occurs in the area. Most of the use occurs in the late summer and fall in association with the hunting seasons.

Sightseeing/Driving for Pleasure

Sightseeing associate with driving for pleasure occurs mostly along roads 140 and 169. Road 140 is designated as a scenic backway. Pleasure Driving occurs in the summer and fall. Winter use of these roads is limited to over the snow machines.

Recreation Special Uses

Big game outfitter/guides are permitted to operate in the project area but use is light.

Environmental Consequences

Cumulative Effects Area

For the recreation resource the Cumulative Effects Area (CEA) is the area bounded on the west by Johns' Valley, on the south by State Highway 12, on the east by the Hells Backbone road (153) and the Aquarius-Teasdale Road (154), and on the north by the forest boundary. The CEA includes the communities of Escalante, Cannonville, Henrieville and Antimony. This area was selected because the above described roads provide access into the area and many of the recreation activities occurring in this area originate from the communities listed.

Within the CEA, past management activities that may affect recreation have included timber harvesting, precommercial thinning, tree planting, road closures, off road travel closures and livestock grazing.

Current management activities include livestock grazing, Pockets Vegetation Management Project, Barney Top Vegetation Management Project, and the South Creek Vegetation Management Project.

Foreseeable future management activities within the project area include the Bug Lake Timber Salvage Project and Clayton Timber Salvage Project.

Effects of No Action on Recreation

Direct and Indirect Effects

The recreation resource and, in effect, the forest visitor experience can be affected by changes to the characteristics of the area and changes to the facilities. Perceptions of a management activity vary depending on the biases of the individual, making objective measurements to change difficult. The environmental consequences disclosed in this section are presented subjectively.

The conditions described in the Affected Environment would prevail over most of the area. All recreational activities described in the Affected Environment, with the exception of fuelwood gathering, are expected to increase in response to the publicity the area is receiving as part of the Highway 12 All American Road designation and overall recreation use trends. Those activities associated with elk hunting (dispersed camping, ATV use and horseback riding) would continue to be the most popular. If lack of vegetation treatments result in increase in fire danger leading to catastrophic fire, a loss of this magnitude would directly affect those recreational activities where viewing scenery is an integral part of the recreational experience (i.e., hiking, sightseeing or driving for pleasure, horseback riding and to a more limited extent mountain biking and ATV riding). This impact on the recreational experience would reduce the number of individuals engaged in these activities within the project area, causing them to move elsewhere on the forest or leave the area entirely.

Cumulative Effects

Future recreation use under the no action alternative would depend on actual regional recreation growth patterns as well as travel and economic factors.

Effects of the Proposed Action on Recreation

Direct and Indirect Effects

Sight Seeing/Driving for Pleasure

The proposed Action would have a short term effect on sightseeing and/or driving for pleasure along the Griffin Top Road (140). Hauling on this road would be restricted on weekends and holidays between Memorial Day and Labor Day. Whole tree harvesting would be utilized to minimize logging slash within 150 feet or sight distance of the road (whichever is longer). Stumps would be cut to 6 inches of the ground and may be visible from the road immediately after and during harvest activities. Within a year or two stumps would turn gray and be hidden by low growing vegetation.

Driving within the project area would likely decrease while logging activity is actively occurring. After logging is completed stumps, skid trails and logging slash would be visible in the foreground of open roads. In the long term visual variety (color and texture) would be enhanced through the appearance of a live, healthy forest.

Dispersed Camping

Due to the size of the analysis area, the overall effect on dispersed camping would be minimal. The most noticeable impact would occur where haul roads intersect a harvested timber stand. Dispersed campsites are usually found close to roads and at the edge of timber stands. During management activities, dispersed camping participants would likely move to other sites, but would return to the area once the management activities are completed.

Hunting

The Proposed Action would have some effect on big game hunting. Disturbances from logging and hauling would likely push elk and antelope out of the immediate area. However, game would move back into the area after these activities end. After the sale, habitat for Elk and Turkey would improve; consequently, opportunities for hunting would improve.

ATV Riding

The proposed action would have minimal effect on ATV riding. Both the Grass Lakes motorized trail and road 140 would remain open at all times. During timber harvest activities ATV riders may choose to go elsewhere but use would be likely to return to normal after harvest activities are complete.

Hiking

Hikers within the project area would be affected by the Proposed Action. Since hikers travel at a slower speed, the visual effects of the proposed treatments would be more evident.

Horse Back Riding

The effects of implementing the Proposed Action would be similar to those described for hiking.

Mountain Biking

The effects of implementing the Proposed Action would be similar to those described for hiking.

Winter Sports

Snowmobiling and other winter recreation activities would not be affected by the Proposed Action and would continue at present rates.

Other Recreational Activities

The Proposed Action would have minimal, if any, effect on personal use Christmas tree cutting. There would be a short-term increase in the amount of firewood gathering. Firewood cutters would target wood left on the ground and in landing slash piles.

Cumulative Effects

The Cumulative Effects Area along with past, present and future management activities within the CEA are identified above. The combination of these activities would have only limited and isolated effects on recreation use in the area. Disruptions in recreation use within the analysis area due to the proposed management actions would cause some recreation participants to move elsewhere in the cumulative effects area or possibly outside the area. Such disruptions in recreation use would be short lived. The Proposed Action is not expected to affect recreation use trends. Long-term use is expected to increase at previously projected levels. Regional recreation growth patterns travel and economic factors would also cumulatively affect recreation in the project area.

Effects of Alternative A on Recreation

Direct and Indirect Effects

Disruptions in recreation use within the analysis area due to the management actions proposed in alternative A would be similar to the proposed action. Because fewer acres would be harvested disruptions caused by logging would be less that with the proposed action. Some recreation participants would move elsewhere in the cumulative effects area or possibly outside the area. Such disruptions in recreation use would be short lived. Alternative A is not expected to affect recreation use trends. Long-term use is expected to continue at previously projected levels and would not differ from the Proposed Action.

Cumulative Effects

The cumulative effects of Alternative A on recreation would be the same as the Proposed Action.

3.7 Scenic Quality

Introduction

The Scenery Management System (SMS) is the planning and design of the scenic aspects of multiple use land management. It is based on the criteria and guidelines in Landscape Aesthetics, A Handbook for Scenery Management, Agriculture Handbook No.701 (USDA 1995.) In 2000 the Dixie LRMP was amended to bring it into compliance with the SMS (USDA 2000).

Forest Plan Direction/Other Direction

The Scenery Management System amendment to the LRMP identifies the desired condition for visual quality as a managed appearance that blends with the natural landscape. The LRMP desired future condition allows some visual deterioration in managed areas, as long as the alterations meet scenic integrity objectives.

Affected Environment

The Scenic Setting

The Iron Springs analysis area is a lightly used dispersed recreation area situated on the Aquarius Plateau. The analysis area is not visible from the surrounding lower elevation areas. Forest Road 140, the Poison Creek ATV trail and Antimony Creek ATV trail provide recreation access to the analysis area.

Scenic Integrity Levels of Major Travel Corridors

Scenic Integrity is a measure of the degree to which a landscape is visually perceived to be "complete." The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the character valued by constituents for its aesthetic appeal. Scenic Integrity may be used to describe an existing situation (as in this section), a management standard, or a desired future condition.

> VERY HIGH scenic integrity refers to landscapes where the valued landscape character "is" intact with only minute, if any, deviations.
>
> HIGH scenic integrity refers to landscapes where the valued landscape character "appears" intact.

MODERATE scenic integrity refers to landscapes where the valued landscape character "appears slightly altered."

LOW scenic integrity refers to landscapes where the valued landscape character "appears moderately altered."

VERY LOW scenic integrity refers to landscapes where the valued landscape character "appears heavily altered."

UNACCEPTABLY LOW scenic integrity refers to landscapes where the valued landscape character being viewed "appears extremely altered."

Part of the analysis area is within the foreground or middleground view zones forest road 140 which is also the motorized Great Western Trail. The scenic integrity objective of this road is high.

Landscape Character and Variety Class

The characteristic landscape can be described as high mountain plateau ranging from 9,000 and 10,750 feet in elevation and covers plant communities ranging from sagebrush, aspen, and spruce/fir.

There are three variety classes that identify the scenic quality of a natural landscape:

Class A - Distinctive

Class B - Common

Class C - Minimal

Most of the analysis area has been classified as being "Common" (Class B) to the characteristic landscape as found in the vegetative makeup.

Form is found in the long tree lines. Line is expressed in the short vertical reaches of the trees and snags and the horizontal reaches of the road cuts. Color is currently dominated by the brown/gray of the dead trees. The dark greens of the live conifers, lighter green of the aspens and yellow-green of the high plateau meadows make up a lesser color component. In the fall, the yellow and gold colors of the aspen leaves provide striking contrast to the surrounding dead and live conifers.

Concern Level and Scenic Integrity Objectives

The Scenic Integrity Objectives (SIO's) for the analysis area are moderate for Management Areas 2B, 6A, and 9A, and low for area 7A.

Forest Road 140 is a scenic backway, therefore the concern level for this corridor is 1. The majority of people traveling along this road are there for recreation purposes and their concern for scenic quality is high. In the Foreground (1/4 to 1/2 mile from the travel route) management activities should repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.

Beyond the Foreground view zone is the Middleground, which extends from 0.5 mile to 4 miles. The SIO for the seen Middleground of a Concern Level 1 corridor is Moderate. In this case, noticeable deviations created by management activities must remain visually subordinate to the landscape character being viewed.

Current Visual Conditions

The topography is generally flat. The dominant visual characteristic is the color and texture of the forest and meadow vegetation. Where aspen are present the aspen color becomes visually dominant in the fall.

All of the analysis area meets or exceeds the SIO's for the various Management Areas and Concern Levels.

Cumulative Effects Area

For the scenery resource the cumulative effects area (CEA) is divided into two areas, one for the entire analysis area and one for the Forest Road 140 travel corridor. The CEA for the project area is the project area. This area was selected because the topographic features and vegetation within the project area restrict vision beyond the boundary. The CEA for the travel corridor of Forest Road 140 is the entire length of the road from the intersection with road 154 to the intersection with Forest Highway 17 at the Escalante Summit. This length of road was selected because persons driving the portion of this road that passes through the project area would likely be traveling the entire length of the road and other management activities that are visible along this road could cumulatively affect the driving experience.

Activities within the CEA that would affect scenery include past road closures and past timber harvest. Activities within the view shed of road 140 that would affect scenery include past and future timber harvest.

3.8 Roadless and Undeveloped Areas

Introduction

The term "Inventoried Roadless Area" refers to an area of at least 5,000 acres, without classified roads and substantially natural. A roadless area is specifically defined as an area that meets the minimum criteria for wilderness. The Wilderness Act of 1964 defines wilderness and wilderness attributes. Boundaries of inventoried roadless areas within the Dixie National Forest were identified during the nationwide Roadless Area Review and Evaluations (RARE and RARE II) in the 1970s, in 1983 during a forest-wide inventory and in 2001 in the Forest Service Roadless Area Conservation Final Environmental Impact Statement. There are no inventoried roadless areas within the project area. The Hog Ranch Inventoried Roadless area is located directly southeast of the project area. The nearest wilderness area is Box Death Hollow which is located approximately 10 miles east. The project will not have any effects on these areas.

Field Surveys

The project area was examined for areas that meet the criteria outlined in the Draft Intermountain Region Planning Desk Guide, Roadless Area Inventory and Evaluation Protocol, January 7, 2004 (USDA Forest Service 2004).

As described in the guide, there are 3 types of criteria that are used to evaluate an area's roadless or undeveloped character: size, presence of roads, and presence of facilities or influences of man. These criteria are described as follows:

Size: They contain 5,000 acres or more, or they contain less than 5,000 acres but:

a. Due to physiography or vegetation, they are manageable in their natural condition.

b. They are self-contained ecosystems such as an island.

c. They are contiguous to existing wilderness, primitive areas, Administration-endorsed wilderness, or roadless areas in other Federal ownership, regardless of their size.

Roads: Roadless areas do not contain classified roads. A classified road is identified as follows:

a. All roads determined through roads analysis to be part of the Forest Transportation system.

b. All roads placed in the Roads database, given road management objectives, given a forest road number, signed, and ascribed a maintenance level.

Presence of other facilities or influences of man: The presence of facilities, structures and features may disqualify an area from roadless inventory unless they are substantially unnoticeable. Features to consider include: airstrips and heliports, plantations, terracing, electronic installations, electric transmissions lines, evidence of historic mining, structural and nonstructural range improvements, recreation improvements, man-made lakes or reservoirs greater than 5 acres, heavily used dispersed recreation areas along travel routes, timber harvest areas where logging and prior road construction are evident, and any mechanical treatment greater than 5 acres in size.

Undeveloped/Unroaded Character

Based on the above criteria, the project area cannot be described as unroaded/undeveloped; consequently, there will be no effects to unroaded/undeveloped character and no cumulative effects. These resources will not be discussed further in this report.

3.9 Range

Affected Environment

The Iron Springs Vegetation Improvement and Salvage Project would occur within the Coyote, North Creek, and Sweetwater-Griffin Top (SGT) livestock grazing allotments. The majority of the project area is within the Big Swale/Clayton pasture (Coyote) and the Griffin Top pasture (SGT), with a small portion occurring within the Coyote Hollow and Pacer pastures (Coyote) and the Holby Bottom pasture (North Creek). The Coyote allotment encompasses approximately 74,101 acres. The six permittees on the Coyote allotment are permitted to graze 1,228 cow/calf pairs from June 16 to October 15. The Coyote allotment is managed using a five-pasture modified deferred rotation grazing system. The SGT allotment encompasses approximately 21,194 acres. The permittee on the SGT is permitted to graze 200 cow/calf pairs from June 6 to September 30. The SGT allotment is managed using a three-pasture modified deferred rotation grazing system. The North Creek allotment encompasses approximately 70,234 acres. The permittees on the North Creek allotment are permitted to graze 734 cow/calf pairs from June 16 to September 30. The North Creek allotment is managed using a three-pasture modified deferred rotation grazing system. Structural range improvements are also used to aid in managing the allotments, namely, 10 miles of fencing that separates allotments and pastures.

Within the Iron Springs Vegetation Improvement and Salvage Project area there are spruce/fir, mixed conifer, aspen, sagebrush meadows, and riparian vegetation types. The primary source of livestock forage is produced by the understory grasses within the sagebrush meadows and aspen stands. However, livestock will also utilize the riparian forage within the Iron Springs and Griffin Springs drainages. The project area encompasses 4.7 percent (3,512 acres) of the Coyote allotment, 22.5 percent (4,779 acres) of the SGT allotment, and 0.02 percent (15 acres) of the North Creek allotment. Approximately 5,240 acres (63 percent) of the project area are within the Engelmann spruce/subalpine fir vegetation types and currently produce very little forage for livestock use. Approximately 256 acres (3 percent) of the project

area (128.15 acres on Coyote and 24.12 on SGT allotments) are within the aspen vegetation type. Riparian and sagebrush/sheep fescue meadow vegetation types account for the remaining project area of which no treatments are proposed. Because only the aspen is proposed for treatment, the Iron Springs Vegetation Improvement and Salvage Project could potentially affect approximately 0.1 percent of both the SGT and Coyote allotments and much less of the North Creek allotment.

Environmental Consequences

Cumulative Effects Area

The geographic boundary of the Coyote and Sweetwater-Griffin Top (SGT) allotments is the cumulative effects area for the project area's rangeland resource. The project area is almost entirely within these two allotments, which are managed separately from each other and from any of their bordering Forest Service allotments and BLM, State, and private lands. The North Creek allotment is not included, as only 15 acres (0.02 percent of the allotment) are within the project area.

No Action

Direct and Indirect Effects

Under the No Action alternative there would be no direct effect to the rangeland resources. Indirect effects would include a loss of forage primarily within the aspen stands due to continual encroachment of conifer trees within this forest cover type.

Cumulative Effects

Within the cumulative effects area, 19 projects have been implemented in the past. Most of the projects included in the cumulative effects area have had a positive effect on the rangeland resource. Approximately 53.5 acres have been made unavailable to livestock utilization from either road construction or exclosures. During project implementation, an additional 3.7 to 391.7 acres could be temporarily unavailable to livestock. Cumulatively, the negative effects of previous projects impact less than 0.2 percent of the Coyote allotment and less than 1.1 percent of the SGT allotment, and therefore, do not have a significant effect on the rangeland resource.

Proposed Action

Direct and Indirect Effects

Direct effects of the Proposed Action would primarily be associated with the 9.56 miles of new low-standard temporary road construction. The new temporary roads will be constructed primarily within the spruce/fir stands. However, approximately 1.92 miles will be constructed within the aspen stands and sagebrush/sheep fescue meadows accounting for a temporary loss of forage on approximately 3.7 acres (1.4 acres on the Coyote allotment (0.002 percent of the allotment) and 2.2 acres on the SGT allotment (0.01 percent of the allotment). After the project is completed, the 9.46 miles of road will be closed using barricades and/or obliteration after the harvest activities are complete. Therefore, the direct effects will be temporary and will affect less than 0.02 percent of either allotment. This temporary loss of forage will not be significant enough to decrease permitted livestock.

An additional direct effect of the Proposed Action would be associated with fencing the 388 acres of aspen treatment if, after one year, heavy ungulate browsing was evident. This would result in a temporary

SGT (0.1 percent of the allotment)).

Range improvements (fences) could be damaged during treatment operations and gates could be left open, allowing livestock into pastures of the allotment when they are not scheduled to be in those pastures. This would be mitigated by stipulating in the timber contract that all damaged fences be repaired and that all gates remain closed during the grazing season.

Indirect effects would be an increase in herbaceous forage production within all the treatment areas totaling 4,428 acres (2.9 percent and 10 percent of the Coyote and SGT allotments, respectively), but primarily within the aspen treatments (0.2 percent and 1.1 percent of the Coyote and SGT allotments, respectively). Areas opened up within the heavy timbered areas along with the new temporary road construction could also help to better distribute livestock, resulting in a more uniform use of the forage resource. This increased forage production and distribution will not be significant enough to increase permitted livestock.

Cumulative Effects

During project implementation, 3.7 to 391.7 acres could be temporarily unavailable to livestock. Cumulatively, the negative effects of the Iron Springs Project and other previous projects impact less than 0.2 percent of the Coyote allotment and less than 1.1 percent of the SGT allotment and therefore will not have a significant effect on the rangeland resource.

Alternative A

Direct and Indirect Effects

Direct effects of Alternative A would primarily be associated with the 6.26 miles of new low-standard temporary road construction. The new temporary roads will be constructed primarily within the spruce/fir stands. However, approximately 1.79 miles will be constructed within the aspen stands and sagebrush/sheep fescue meadows accounting for a temporary loss of forage on approximately 3.4 acres (1.4 acres on Coyote (0.002 percent of the allotment) and 2.0 acres on SGT (0.009 percent of the allotment)). After the project is completed, the 6.26 miles of road will be closed using barricades and/or obliteration after the harvest activities are complete. Therefore, the direct effects will be temporary and will affect less than 0.01 percent of either allotment. This temporary loss of forage will not be significant enough to decrease permitted livestock.

An additional direct effect of the Proposed Action would be associated with fencing the 152 acres of aspen treatment if, after one year, heavy ungulate browsing was evident. This would result in a temporary loss of forage on the 152 acres (128.15 acres on Coyote (0.1 percent of the allotment), and 24.12 acres on SGT (0.1 percent of the allotment)

Fences could be damaged during treatment operations and gates could be left open, allowing livestock into pastures of the allotment when they are not scheduled to be in those pastures. This would be mitigated by stipulating in the timber contract that all damaged fences be repaired and that all gates remain closed during the grazing season.

Indirect effects would be an increase in herbaceous forage production within all the treatment areas totaling 2,904 acres (1.2 percent and 5.6 percent of the Coyote and SGT allotments, respectively), but primarily within the aspen treatments (0.2 percent and 1.1 percent of the Coyote and SGT allotments, respectively). Areas opened up within the heavy timbered areas along with the new temporary road

loss of forage on the 152 acres (128.15 acres on Coyote (0.1 percent of the allotment)), and 24.12 acres on construction could also help to better distribute livestock, resulting in a more uniform use of the forage resource. This increased forage production and distribution will not be significant enough to increase permitted livestock.

Cumulative Effects

The cumulative effects of Alternative A are similar to those of the Proposed Action.

3.10 Noxious Weeds

Affected Environment

Seven noxious weed species (*Cardaria draba* (white top), *Centaurea maculosa* (spotted knapweed), *Centaurea repens* (Russian knapweed), *Cirsium arvense* (Canada thistle), *Convovulus arvensis* (bindweed, morning glory), *Lepidium latifolium* (perennial pepperweed) and *Onopordum acanthium* (Scotch thistle)) are known to have occurred within the Escalante Ranger District. None of these noxious weed populations occur within the Iron Springs Vegetation Improvement and Salvage project area. The closest population on the Escalante Ranger District is located in Sweetwater Creek, approximately 15 to 20 miles to the south southwest of the project area. The currently known noxious weed populations are located along major roads. This indicates that campers, firewood cutters, or other recreational users are the likely means of introduction. Past vegetation management practices in the project area have not resulted in any known noxious weed infestations.

Environmental Consequences

Cumulative Effects Area

As with the range resource, the geographic boundary of the Coyote and Sweetwater-Griffin Top (SGT) range allotments is the cumulative effects area for noxious weeds.

No Action

Direct and Indirect Effects

There would be no direct or indirect effects to noxious weeds under the No Action alternative.

Cumulative Effects

Since the No Action alternative will not result in a direct or indirect effect on noxious weeds, there will be no cumulative effects.

Proposed Action

Direct and Indirect Effects

Direct effects of the Proposed Action would be the potential to transport and spread noxious weed seeds on equipment being used to complete the project within the project area. While noxious weeds can establish with or without disturbance, it is unlikely that this treatment will result in a spread of noxious weeds because no other similar projects on the Escalante Ranger District have resulted in the spread of noxious weeds.

Indirect effects of the Proposed Action are associated with the improvement of 36.3 miles of existing NFS roads and the 9.56 miles of new low-standard temporary road construction. This action could result in an increase of campers, firewood cutters, or other recreational users to this area which has the potential to spread noxious weeds. However, these roads are currently open and utilized by recreational users, and this has not yet resulted in a spread of noxious weeds. Therefore, it is unlikely that there will be an increase in recreational use and a subsequent spread of noxious weeds.

Cumulative Effects

Since it is unlikely that the Proposed Action will have a direct or indirect effect on noxious weeds, there can be no cumulative effects.

Alternative A

Direct and Indirect Effects

The effect of Alternative A on the spread of noxious weeds would be similar to the Proposed Action.

Cumulative Effects

The cumulative effects of Alternative A are similar to those of the Proposed Action.

3.11 Fire and Fuels

Affected Environment

Fire History

Historic fire regimes in the Iron Springs project area include infrequent mixed severity (aspen), infrequent stand replacement severity (mixed conifer and spruce-fir), and frequent mixed severity (meadows). Bradley et al. (1992) indicates that stand replacement fires occur in the spruce-fir forests on a 50-300 year cycle, probably associated with other disturbance regimes (i.e., beetle mortality and windthrow) and in combination with drought. Dendrochronology studies in the area indicate historical fire return intervals averaged 15 to 18 years in the mixed conifer type (Stein 1988). The studies also show an abrupt cessation of fire activity coinciding with settlement and grazing in the late 1800s. Since that time other land management practices including logging and fire suppression have increased fuel loads and stand densities beyond historical levels. The bark beetle activity in the area has created an increase in standing dead trees, which will lead to a further increase of dead and downed fuel loading as they fall.

The majority of the Iron Springs project area is located within the central portion of the Griffin Point Fire Management Unit, a small part of the north east end of the project area falls in the Round and Posey Fire Management Units (Dixie FMP 2010). That said the entire project area is on the Aquarius Plateau. Records dating from 1960 through 2009 reveal the Aquarius Plateau to have relatively few and small fires. Lightning is the predominant ignition source although smoking, campfires and arson have been attributed to approximately 30 percent of the ignitions. Prior to 1999 ignitions within this FMU were scattered occurrences with one or more years between fire events. Since 2000 fire ignitions have occurred on a generally constant annual basis. The basic fire statistics for the Griffin Point Management Unit are shown in Figure 13.

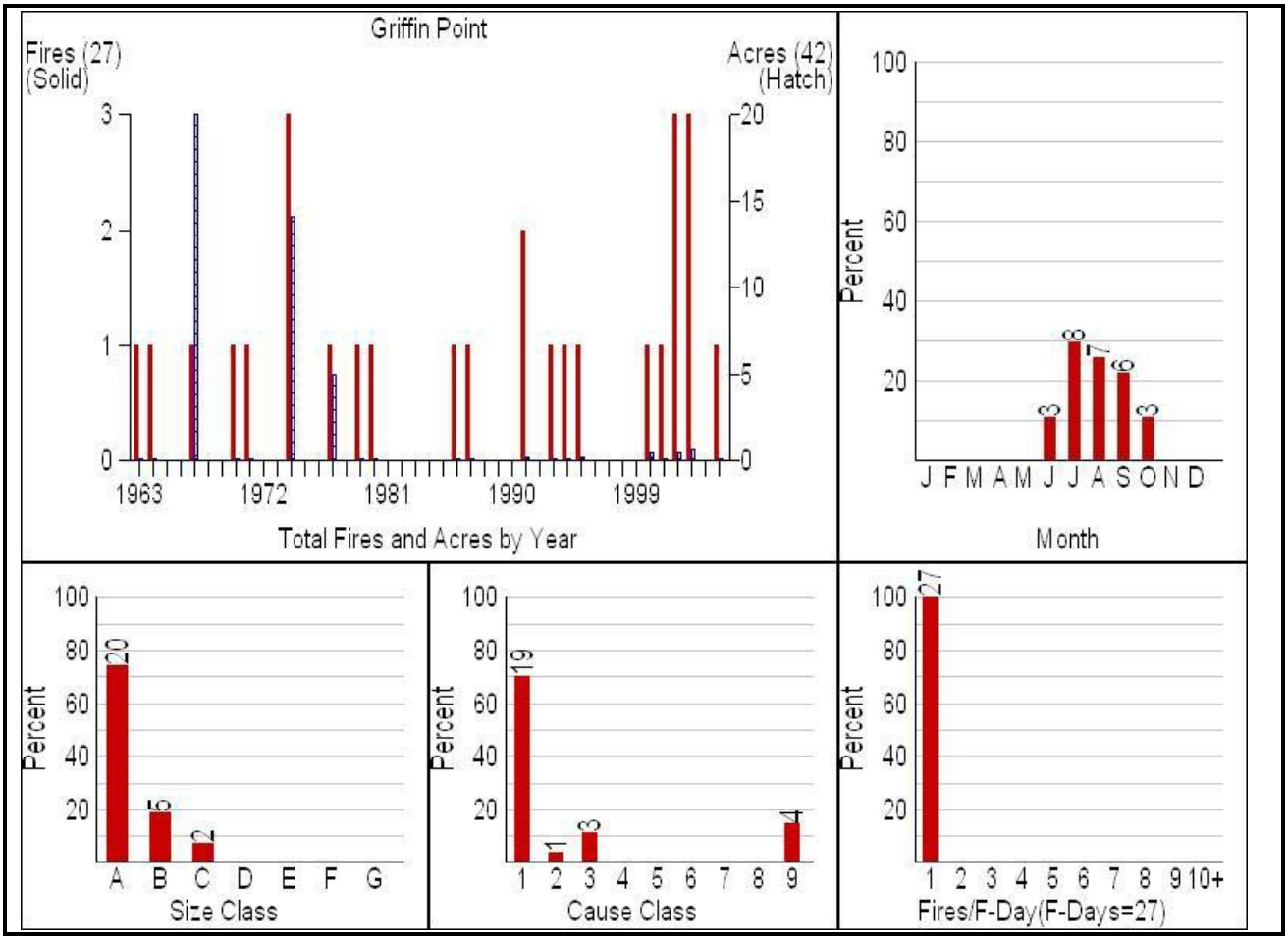

Figure 13. Fire statistics for the Griffin Point Management Unit

The Fire Environment

The fire environment is influenced by three interacting items; fuels (vegetation); existing topography; and weather. These elements together define fire behavior. Of these, only fuels can be altered by management actions.

Many elements of fuels work together to influence fire behavior including; vertical and horizontal distribution and continuity, moisture and chemical content, compaction, size and shape of fuels, and fuel loading. These elements of the fire environment can be modified to reduce potential fire behavior.

Vegetation Description

The Iron Springs project area vegetation consists largely of spruce – fir forest with the drainages in throughout the project area covered with sage – grass, meadows. There are also several patches of Aspen within the project boundaries.

Topography

Topographic influences on fire behavior include slope, aspect, and elevation, shape of the land, and the influence of topography on wind. Slopes in the Iron Springs project area are fairly level, in some areas there are short slopes in excess of 50 percent. Slope increases fire behavior by preheating fuels upslope of

the fire and enabling spotting from rolling and aerial firebrands. Flame length and rate of spread increase with increasing slope.

Aspect is the direction a slope faces. All aspects are represented. In the Iron Springs project area slopes are fairly evenly split between north and south aspects. South and southwest aspects typically experience the more severe fire behavior due to the duration of sun exposure and dominant wind directions in this portion of the country. Fires in the project area usually experience a downslope move late in the afternoon and into evening hours with the diurnal wind switch.

Weather

The weather in the Iron Springs area can be described as summers that are typically cool and dry, with daytime temperatures averaging in the mid 70s with low relative humidity. The monsoonal pattern typically begins to set up in mid-July, but is neither predictable nor reliable. Lightning caused fires occur primarily in July and August associated with the monsoons. These storms produce lightning and strong winds, often with little or no moisture. Of particular concern are the strong, gusty winds that are usually associated with a frontal passage, especially dry cold fronts.

Fire Ecology

Nearly all forests and grasslands in this region evolved and adapted as a result of widespread fire from lightning and burning by Native Americans (Kay 1994). These adaptations enabled plant species to survive and regenerate in the presence of fire. The unintended consequences of logging, livestock grazing, and fire control resulted in significant changes to species composition and structure. These changes, in turn, predisposed extensive areas to many of today's wildland fire and forest ecosystem health problems.

The Dixie National Forest compiled data on a forest level scale and estimated the current condition classes of all vegetation types. The primary vegetation types found within the Iron Springs project area analysis area are displayed in Table 86.

Table 86. Project area vegetation types condition class and fire regime

VEG ID	Vegetation	Fire Regime	Condition Class
G-F	Grass-Forb	2	II
ARTRV	Mountain Big Sage	2	II
POTR,S-F	Aspen, Spruce fir	4	III
POTR/MC	Aspen/Mixed Conifer	4	III
MTN BRU	Mountain Brush	3	III
S-F	Spruce Fir	5	III
POTR	Aspen	4	III

Analysis of the Iron Springs project area shows that the original and most often used 13 standard National Forest Fire Laboratory (NFFL) fuel models (FM) do not correctly represent the fuels and the fire behavior that would occur. Therefore the FMs set developed by Scott and Burgan "Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model" (Scott and Burgan 2005) were used to more accurately represent the Iron Springs Project Area. This fuel model group is sub-divided into 7 categories:

Grass Fuel Type Models (GR) (9 models).

Grass-Shrub Fuel Type Models (GS) (4 models).

Shrub Fuel Type Models (SH) (9 models).

Timber-Understory Fuel Type Models (TU) (5 models).

Timber-Litter Fuel Type Models (TL) (9 models).

Slash-Blowdown Fuel Type Models (SB) (4 models).

Non-burnable Fuel Type Models (NB) (5 models).

Four of the above FMs are represented in the project area: GR1, SH1, TL5, and SB1. Following are brief descriptions of the FM models found in the Iron Springs project area.

GR1 (101) – Short, Sparse Dry Climate Grass (Dynamic)

The primary carrier of fire in GR1 is sparse grass, though small amounts of fine dead fuel may be present. The grass in GR1 is generally short, either naturally or by grazing, and may be sparse or discontinuous. The moisture of extinction of GR1 is indicative of a dry climate fuelbed, but GR1 may also be applied in high-extinction moisture fuelbeds because in both cases predicted spread rate and flame length are low compared to other GR models.

Fine fuel load (t/ac) 0.40

Characteristic SAV (ft-1) 2054

Packing ratio (dimensionless) 0.00143

Extinction moisture content (percent) 15

SH1 (141) – Low Load Dry Climate Shrub (Dynamic)

The primary carrier of fire in SH1 is woody shrubs and shrub litter. Low shrub fuel load, fuelbed depth about 1 foot; some grass may be present. Spread rate is very low; flame length very low.

Fine fuel load (t/ac) 1.7

Characteristic SAV (ft-1) 1674

Packing ratio (dimensionless) 0.00280

Extinction moisture content (percent) 15

TL5 (185) – High Load Conifer Litter

The primary carrier of fire in TL5 is high load conifer litter; light slash or mortality fuel. Spread rate is low; flame length low.

Fine fuel load (t/ac) 1.15

Characteristic SAV (ft-1) 1713

Packing ratio (dimensionless) 0.01925

Extinction moisture content (percent) 25

SB1 (201) – Low Load Activity Fuel

The primary carrier of fire in SB1 is light dead and down activity fuel. Fine fuel load is 10 to 20 t/ac, weighted toward fuels 1 to 3 inches diameter class, depth is less than 1 foot. Spread rate is moderate; flame length low.

Fine fuel load (t/ac) 1.50

Characteristic SAV (ft-1) 1653

Packing ratio (dimensionless) 0.02224

Extinction moisture content (percent) 25

Fire Behavior

To determine fire behavior, local weather data was collected from the Buck Flat weather station for the period of 2001-2010. Utilizing the program Fire Family Plus (version 4.0), Historical weather conditions were determined by the monthly seasonal mean. The BEHAVE Plus Fire Behavior Prediction and Fuel Modeling System program was utilized to process the weather records. Fire behavior characteristics, including rates of spread (ROS), flame lengths (FL), and fire line intensities (FLI) were produced using a standard 15 percent slope. Rate of spread is recorded in chains (66') per hour, flame lengths are recorded in feet and fire line intensity is recorded in BTU/FT/S. The predictions for each individual fuel model would not represent the appropriate fire behavior if a crown fire would occur, but rather predicts a ground fire scenario. Favorable conditions for a crown fire include: dry fuels, low humidity and high temperatures, heavy accumulation of dead and downed litter, conifer reproduction and other ladder fuels, continuous forest of conifer trees and etc. (Rothermel 1991). Data for June through October were used in all fire behavior and weather-related calculations.

Fuel loads were determined by utilizing photo series appropriate for the vegetation types and fuel models in the treatment area. (Ottmar et. al. 2000a, Ottmar et al. 2000b) and Browns transect data collected during the summer of 2006 and 2007. Fuels accumulations (fuel loads) vary throughout the analysis area. Fuel loads and stand structures have changed from historical conditions, due to past management practices including fire suppression (Bradley et al. 1992). An increase in biomass, insect/disease activity, and lack of fires influence has led to declining forest health. There has been an increase of young shade tolerant species, with clumps of regeneration (Arno and Harrington 1995). Fuels of this nature have the potential to lead to fire control difficulties and stand replacing fire situations, which are costly to suppress.

Table 87 describes the modeled fire behavior by vegetation type. ROS is rate of spread (measured in chains, 1 chain = 66′) FL is flame length, and FLI is fireline intensity.

Table 87. Modeled fire behavior by vegetation type.

Grass Meadows Fuel Model GR1							
	June	July	August	September	October	90th	97th
ROS	0.1	0.6	7.5	16.7	15.0	30.0	63.1
FLI	0	1	10	26	20	60	136
FL	0.1	0.4	1.3	2.0	1.8	3.0	4.3
Sagebrush Flats Fuel Model SH1							
	June	July	August	September	October	90th	97th
ROS	0.4	0.2	1.5	11.1	21.4	20.3	48.1
FLI	1	0	2	61	152	161	430
FL	0.3	0.1	0.6	3.0	4.5	4.7	7.3
Spruce/Fir/Aspen Fuel Model TL5 (Spruce / Fir)							
	June	July	August	September	October	90th	97th
ROS	6.1	4.2	3.3	3.4	3.9	7.7	13.0
FLI	45	29	21	20	24	68	123
FL	2.4	2.1	1.8	1.8	1.9	3.1	4.1
Spruce/Fir/Aspen Fuel Model SB1 (Spruce / Fir / Aspen)							
	June	July	August	September	October	90th	97th
ROS	8.6	5.9	4.7	6.0	5.6	16.3	18.1
FLI	104	66	49	66	55	233	279
FL	3.8	3.1	2.7	3.1	2.9	5.5	6.0

Fire Regime Description

Groups I and II include fire return intervals in the 0-35 year range. Group I includes, ponderosa pine, other long needle pine species and dry-site Douglas fir. Group II includes the drier grassland types, Tall grass prairie, and some chaparral ecosystems. Groups I and II differ due to severity of the upper canopy; Group I is described as having low severity (<25 percent mortality under historical conditions) and Group II would normally have higher severity. Group III and IV include fire return intervals in the 35-100 + year range, again differing from one another due to the amount of severity that would be anticipated in those types given historical conditions. Group V is the long interval (infrequent), stand replacement fire regime. Fire regime groups III and IV occupy much of the higher elevation zones across the US, including mixed conifer and spruce/fir systems. Table 88 presents a summary of historic natural fire regimes.

Table 88. Five historic natural fire regime groups

Fire Regime Descriptors	Frequency (fire return Interval)	Severity
I	0-35 years	Low severity
II	0-35 years	Stand Replacement severity
III	35-100 + years	Mixed severity
IV	35-100 + years	Stand Replacement severity
V	> 200 years	Stand Replacement severity

Current Condition Class Attributes

Three Condition Classes have been developed to categorize current conditions with respect to each of the five historic Fire Regime Groups. Current condition is defined in terms of departure from the historic fire regime, as determined by the number of missed fire return intervals-with respect to the historic fire return interval- and the current structure and composition of the system resulting from alterations to the disturbance regime. The relative risk of fire caused losses of key components that define the system

increases for each respectively higher numbered condition class, with little or no risk at the Class I level. Table 89 describes these three condition class levels.

Table 89. Condition Class Descriptions[1]

Condition Class	Fire Regime	Example Management Options
Condition Class I	Fire regimes are within an historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within an historic range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
Condition Class II	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystems components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This results in moderate change to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.	Where appropriate, These areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments to be restored to the historical fire regime.
Condition Class III	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystems components is high. Fire frequencies have departed from historical frequencies by multiple return intervals (either increased or decreased). This results in dramatic changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.	Where appropriate, These areas may need high levels of restoration treatments, such as fire use and hand or mechanical treatments to be restored to the historical fire regime.

[1] Source: RMRS-GTR-87, 2002. Current conditions are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire suppression, timber harvest, grazing, introduction and establishment of exotic plant species, insect or disease (introduced or native), or other past management activities (RMRS-GTR-87. 2002).

Historically fire suppression has been very effective in the project area. Ignitions seldom reach significant size and are of short duration. Potential wildland fire control problems include: poor access/egress, long travel time for suppression resources, and few water sources. Safety issues in the area include; evacuation of visitors, permittees and contractors; few escape routes and safety zones, limited lookout points.

Currently, all naturally ignited wildland fires are considered for managing to benefit the resource. If qualifying criteria for this is not met, then the appropriate management response of contain, confine and/or control is implemented, consistent with the Dixie LRMP and Forest Service Manual (FSM 1986) 5100 and the Dixie NF Fire Management Plan (FMP 2010).

Fuel Loadings

Seedling, sapling and down woody debris densities exceed historical levels in all untreated vegetation types due to lack of fire. These ladder fuels significantly increase the potential for crown fire initiation. The current bark beetle infestation has led to an increase in the standing dead spruce trees. While this breaks up the continuity of live canopy fuels, it will increase the dead and downed woody fuel component as these trees fall.

Dead and downed woody fuel loading is estimated at averages of 15-20 tons/acre within the aspen stands, 20-30 tons/acre mixed aspen/spruce-fir stands in the project area and 35 to 40 tons/acre in the spruce-fir stands (Ottmar 1998, 2000a; Anderson 1982).

Cumulative Effects Area

The Cumulative Effects area for the fire and fuels analysis is the Griffin Point FMU (see attached Map). Fire management units are a basic geographical area. Fires which started within the Griffin Point FMU would generally spread to the north east and should be contained within this FMU.

Consideration of Available Science

The techniques and methodologies used in this analysis consider the best available science. The analysis includes the literature cited that is relevant to evaluating reasonably foreseeable environmental effects.

The conclusions are based upon the scientific analysis that shows a thorough review of relevant scientific information, and a consideration of responsible opposing views. There may also be incomplete or unavailable scientific information that poses uncertainty and risk.

Relevant literature includes information reviewed for basic understanding, science actually cited in the specialist report, and a review of science submitted as a responsible opposing view.

Fire and fuels were analyzed using the First Order Fire Effects Model and Behave models.

The effects to the fire and fuels in other similar projects in the area have been considered in the analysis.

Environmental Effects

Direct and Indirect Effects of the No Action Alternative - Fire and Fuels

Surface and ladder fuels would remain relatively constant in the short term. In the long-term surface and ladder fuels would continue to accrue as spruce and fir encroach into aspen stands, needle litter accumulates and dead snags fall. There would not be an improvement to current condition class. Most of the project area is currently characterized as Fire Regime Condition Class (condition class) II (an ecosystem with moderate 33 to 66 percent, departure from its historical range of vegetative variation) and would continue to depart from historic levels with each missed fire return interval eventually leading to a condition class III (an ecosystem with high departure from historical range of vegetative variation, greater than 66 percent). Without treatment in the other proposed areas, this fire group would be at risk to a high intensity stand replacing fire situation. Current fuel configurations are more prone to high intensity stand replacement fires. Fires of this nature are difficult to control and costly to suppress

Dixie LRMP Consistency

Under the No Action Alternative, there would be no conflict with the Dixie LRMP Standards and Guidelines. However, Desired Conditions and Need for Change listed within the Dixie LRMP, for both fuels management and prescribed fire would not be met. The opportunity to move the analysis area towards the desired future condition as described in the Proposed Action would be lost. As compared to the other Iron Springs alternatives, the No Action alternative would do the least in addressing the Purpose and Need to reduce long term risk of large scale, catastrophic fire in the project area.

Cumulative Effects of the No Action Alternative

Within the CEA, past and present activities and fire suppression policies have led to conditions that differ from historic conditions that are conducive to large-scale, catastrophic wildland fires (Federal Wildland Fire Management Policy and Program Review 1995). Under current policies, all naturally ignited fires in the area will be considered for management of the fire for multiple resource objectives and such fires will be allowed to burn and will be managed to accomplish objectives. However, if environmental conditions are outside the parameters that are determined acceptable, management strategies will shift to contain, confine and control to minimize possible negative effects. All non-natural ignitions will continue to be suppressed consistent with the Dixie LRMP (1986) and Forest Service Manual (FSM) 5100 and the Dixie NF Fire Management Plan (2010).

Past and present timber harvest and thinning activities (See Iron Springs Forest Vegetation Report) have potentially reduced the severity and scale of fires within the area by opening the stand canopies, reducing understory stocking levels, reducing ladder fuel heights, creating fuels breaks and creating motorized access. Except for areas where whole tree harvest is done, these same timber activities in the short term (1-10 years) have potentially increased the risk to non-natural fire ignitions and greater fire intensity by increasing the tons per acre of slash, and adding user days to the area through motorized access.

Motorized access via forest roads increase the need for fuels management and fire suppression activities. At the same time, fire resources benefit from greater access into the area which allows suppression forces quicker response to ignitions and access for suppression equipment to increase fire fighter production rates. These access routes also provide for fire firefighter safety, act as anchor points and fire breaks. There is a slight negative effect for fire resources from motorized access in that 15 percent of the documented fires in the Griffin Springs Fire Management Unit have been caused by human activities (Dixie National Forest Fire Management Plan 2010). Fuels management activities benefit from increased access by having routes and fuel breaks in place to assist in containment of prescribed activities. Fuel wood and post/pole gatherers assist by removing biomass materials and further opening canopies.

Large wildland fires are difficult, dangerous, and costly to suppress. The risk of wildland fire is particularly important in terms of fires which may have the potential to burn onto private lands from National Forest Lands. Fires of this scale and intensity would be outside the historical intensity levels. In general the potential number of fire starts would remain constant. The severity of these fires burning would continue to increase over time. Currently, there is National emphasis being placed managing naturally ignited fires to more closely resemble the natural fire disturbance regime.

Direct and Indirect Effects of the Proposed Action - Fire and Fuels

Vegetation treatments under the Proposed Action would vary in their effect on stand density and fuel loading in addressing the Purpose and Need to reduce long term risk of large scale, catastrophic fire. Though it is recognized that vegetation treatments to reduce fire severity are less effective in high elevation ecosystems such as the Iron Springs project area (Raymond and Peterson 2005), it can be expected that the Proposed Action would reduce the risk of catastrophic fire by breaking up continuous fuels and removing flammable material from treated stands (Jorgensen 2010). The most effective vegetation treatments are those that would be done in conjunction with whole tree harvesting. Though whole tree harvesting will be done to maintain aesthetics along FR 140, the Gap Trail, and all open system roads, this treatment in conjunction with timber harvest would be very effective in reducing both stand density and any additional fuel loading in the form of slash from the proposed treatment. Whole tree harvesting brings a high percentage of the slash being generated to designated landings where it is piled. Following the completion of the project, piles can be made available to firewood cutters and/or burned to get rid of the slash. It is estimated that 473 acres along open roads

within the project area and 55 acres along the Gap Trail will be effectively treated through the combination of timber harvest and whole tree harvest. These treatments will create several fuels breaks along the open roads within project area along the Gap Trail where it crosses the project area and along the northern boundary of the project area. Likewise all the other open roads off FR 140 and along the Gap Trail where this treatment occurs will act as fuel breaks.

Another effective fuels reduction treatment under the Proposed Action would be the aspen cleaning and aspen regeneration prescriptions. Proposed for 388 acres and 152 acres respectively, these treatments would remove the conifer overstory and thin the understory in order to regenerate new and/or maintain existing aspen stands across the project area. Though there would be a short term (1-10 years) increase in slash from the conifer thinning within these stands, in the long term (+10 years) the aspen dominated stands created by this treatment would tend to be very fire resistant and act as a firebreak (Sheppard 2008).

Lastly, because it would just harvest dead standing and down trees, the commercial sanitation/salvage treatment would reduce the existing fuel loading across 366 acres in the project area. Under this treatment there would be little to no short term increase in slash due to fact that there would be no harvest or thinning of live trees within these stands.

The remaining approximately 3,600 acres of commercial conifer thinning treatments proposed under the Proposed Action would in the long term be effective in breaking up continuous fuels and creating a mosaic of fuel types by opening the stand canopies, reducing understory stocking levels, and reducing ladder fuel heights. Outside of areas where whole tree harvest would take place, these same harvest activities in the short term would potentially increase the risk to non-natural fire ignitions and greater fire intensity by increasing the tons per acre of slash, and adding user days to the area through motorized access. It is anticipated that the highest short term increase in slash would occur on the 381 acres where both commercial and pre-commercial thinning is proposed.

Though it will unlikely affect the fire regime interval and condition class, the Proposed Action will reduce the risk of large-scale stand replacement wildfires. The area is currently characterized as a condition class II and would remain in condition class II after the treatment. Vegetation attributes have been moved back closer to their historical range. The potential for crown fires has been reduced over the long term (+10 years) in the project area through the reduction of stand densities, promotion of aspen, and rearrangement of available fuels. Since the treatments in the project area under the Proposed Action will improve forest health and vigor, will create forest conditions that are less homogenous, and will increase tree age and size class diversity there will be increased resilience to expected natural disturbance such as wildfires.

Dixie LRMP Consistency

Under the Proposed Action there would be no conflict with the Dixie LRMP Standards and Guidelines. Desired Conditions and Need for Change listed within the Dixie LRMP, for fuels management, air quality, and prescribed fire would be met. The opportunity to move the analysis area towards the desired future condition as described in the Proposed Action would be met. As compared to the other Iron Springs alternatives, the Proposed Action would do the most in addressing the Purpose and Need to reduce long term risk of large scale, catastrophic fire in the project area.

Cumulative Effects of the Proposed Action

Within the cumulative effects area, past and present activities along with fire suppression policies have led to conditions that are more conducive to large-scale, catastrophic wildland fires (Federal Wildland Fire Management Policy and Program Review 1995). Contain, confine, and control strategies of all past wildland fire ignitions have led to condition classes and fire return intervals that deviate from historic conditions. All naturally ignited fires in the area will be allowed to burn and managed to accomplish objectives. However if environmental conditions are outside the parameters that are determined acceptable then the management strategies of contain, confine and control will still be used in the future to minimize the possible negative effects of naturally occurring fires. All non-natural ignitions will continue to be suppressed consistent with the Dixie LRMP and Forest Service Manual (FSM) 5100 and the Dixie NF Fire Management Plan, Dixie LRMP and Forest Service Manual (FSM) 5100.

Motorized access via forest roads increases the need for fuels management and fire suppression activities. At the same time, fire resources benefit from greater access into the area which allows suppression forces quicker response to ignitions and access for suppression equipment to increase fire fighter production rates. These access routes also provide for fire firefighter safety, act as anchor points and fire breaks. There is a slight negative effect for fire resources from motorized access in that 15 percent of the documented fires in the Griffin Springs Fire Management Unit have been caused by human activities (Dixie National Forest Fire Management Plan 2010). Fuels management activities benefit from increased access by having routes and fuel breaks in place to assist in containment of prescribed activities. Fuel wood and post/pole gatherers assist by removing biomass materials and further opening canopies.

Past timber harvest activities in conjunction with the Proposed Action treatments (See Iron Springs Forest Vegetation Report) would reduce the potential severity and scale of fires within the area by opening the stand canopies, reducing understory stocking levels, reducing ladder fuel heights, creating fuels breaks, and creating motorized access. In the short term, these same timber activities have potentially increased the risk to non-natural fire ignitions and greater fire intensity by increasing the tons per acre of slash, and adding user days to the area through motorized access. In the long term, past and proposed treatments would create more resilient forest conditions with less stand density and fuel loading that would have a lower probability of being affected by a large scale, catastrophic fire.

When a wildfire occurs, these conditions will make it more likely that the fire will be a surface fire rather than a crown fire. Outside of areas that will have whole tree harvest, residue slash from thinning will in the short term (1-10 years) increase surface fuel loading, which may result in a more intense surface fire. However, surface fires are less complex to manage than stand replacement, crown fires. Although there will be a continued need for fire suppression to meet the goals and objectives of the Forest Plan, there will be increased safety for fire suppression crews because of the decreased probability of larger, stand replacement fires.

Direct and Indirect Effects of Alternative A - Fire/Fuels

As with Proposed Action, vegetation treatments under Alternative A would vary in their effect on stand density and fuel loading in addressing the Purpose and Need to reduce long term risk of large scale, catastrophic fire. The big difference between the two action alternatives is Alternative A would treat approximately half the acreage that is included under the Proposed Action. The most effective vegetation treatments from a fire risk stand point are those that would be done in conjunction with whole tree harvesting. It is estimated that 166 acres along the area's open roads and 55 acres along the Gap Trail will

be effectively treated through the combination of timber harvest and whole tree harvest. As compared to the Proposed Action, the fuel breaks created by this treatment would be on a much smaller scale.

Under Alternative A, aspen cleaning, aspen regeneration, and sanitation/salvage treatment acres would be only three acres less than what is included under the Proposed Action prescriptions. So the effects of these treatments would basically be the same as described under the Proposed Action. The remaining approximately 1,500 acres of commercial conifer thinning treatments proposed under the Alternative A would in the long term be effective in breaking up continuous fuels and creating a mosaic of fuel types. It is anticipated that the highest short term increase in slash would occur on the 134 acres where both commercial and pre-commercial thinning is proposed.

Dixie LRMP Consistency

Under the Alternative A there would be no conflict with the Dixie LRMP Standards and Guidelines (DNF 1986). However, Desired Conditions and Need for Change listed within the Dixie LRMP, for both fuels management and prescribed fire would not be met. As compared to the other three Iron Springs alternatives, the Alternative A would only be exceeded by the Proposed Action in addressing the Purpose and Need to reduce long term risk of large scale, catastrophic fire in the project area. Because it only treats approximately half the acreage as the Proposed Action, Alternative A would be less effective in moving the analysis area towards the desired future condition.

Cumulative Effects of Alternative A

Past timber harvest activities in conjunction with the Alternative A treatments would reduce the potential severity and scale of fires within the area. Because it only treats approximately half the acreage as the Proposed Action, Alternative A would be less effective in moving the analysis area towards the desired future condition of creating forest conditions that would have a lower probability of being affected by a large scale, catastrophic fire.

4 Consultation and Coordination

Following are the individuals who participated in the preparation of the environmental assessment and the Federal, State, and local agencies, tribes and individuals that the Forest Service consulted with during the development of the environmental assessment.

4.1 ID Team Members

Cindy Calbaum, District Recreation Specialist
Terry DeLay, Escalante District Ranger
Kim Dolatta, District Rangeland Management Specialist
Patricia Goude, TEAMS editor
Marian Jacklin, Forest Archaeologist
Rich Jaros, Forest Soil Scientist
Robert Miller, Zone Engineering Specialist
Ron Mortensen, Kimberley Dolatta, District Rangeland Management Specialists
Andrew Orlemann, TEAMS Forester
Drew Parkin, Zone Environmental Coordinator
Brooke Shakespeare, Zone Hydrologist
Chance Stewart, District Fuels Specialist
Lisa Young, District Wildlife Biologist
Kevin Zeman, Zone Timber Management Assistant, Team Lead

4.2 Federal, State, and Local Government

Congressman Rob Bishop
Congressman Jason Chaffetz
Congressman Jim Matheson
Five County Association of Governments
Garfield County Commission
Mayor, City of Escalante
Mayor, City of Boulder
Mayor, Town of Cannonville
United States Department of the Interior
- Bureau of Land Management
- Fish and Wildlife Service

Utah Governor’s Office of Public Lands
Utah Department of Natural Resources
- Utah Division of Forestry, Fire, and State Lands
- Utah Division of Wildlife Resources

4.3 Tribes

Scoping and Notice and Opportunity to Comment letters were mailed to five local tribes, including the Hopi Nation, the Kaibab-Paiute Tribe, the Navajo Nation, the Paiute Tribe of Utah, and the Ute Tribe.

4.4 Others

Scoping and Notice and Comment letters were also mailed to several non-governmental organizations and individuals who had indicated an interest in this or similar projects. The names of these organizations and individuals are included in the project record.

5 Literature Cited

The primary sources of information for the environmental analyses described in this document were the specialist reports prepared by Forest Service resource specialists. These included:

Calbaum, C. 2011. Iron Springs Vegetation Improvement and Salvage Project: Recreation, Scenery and Roadless and Undeveloped Area Specialist Report. Dixie National Forest NEPA specialist report.

Jaros, R. 2012. Iron Springs Vegetation Improvement and Salvage Project: Soils Specialist Report. Dixie National Forest NEPA specialist report.

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Young, L. 2012. Iron Springs Vegetation Improvement and Salvage Project: Vertebrate & Plant Specialist Report. Dixie National Forest NEPA specialist report.

In turn, these specialist reports relied on scientific literature, field survey reports, and other factual information. The information cited in the various specialist reports follows.

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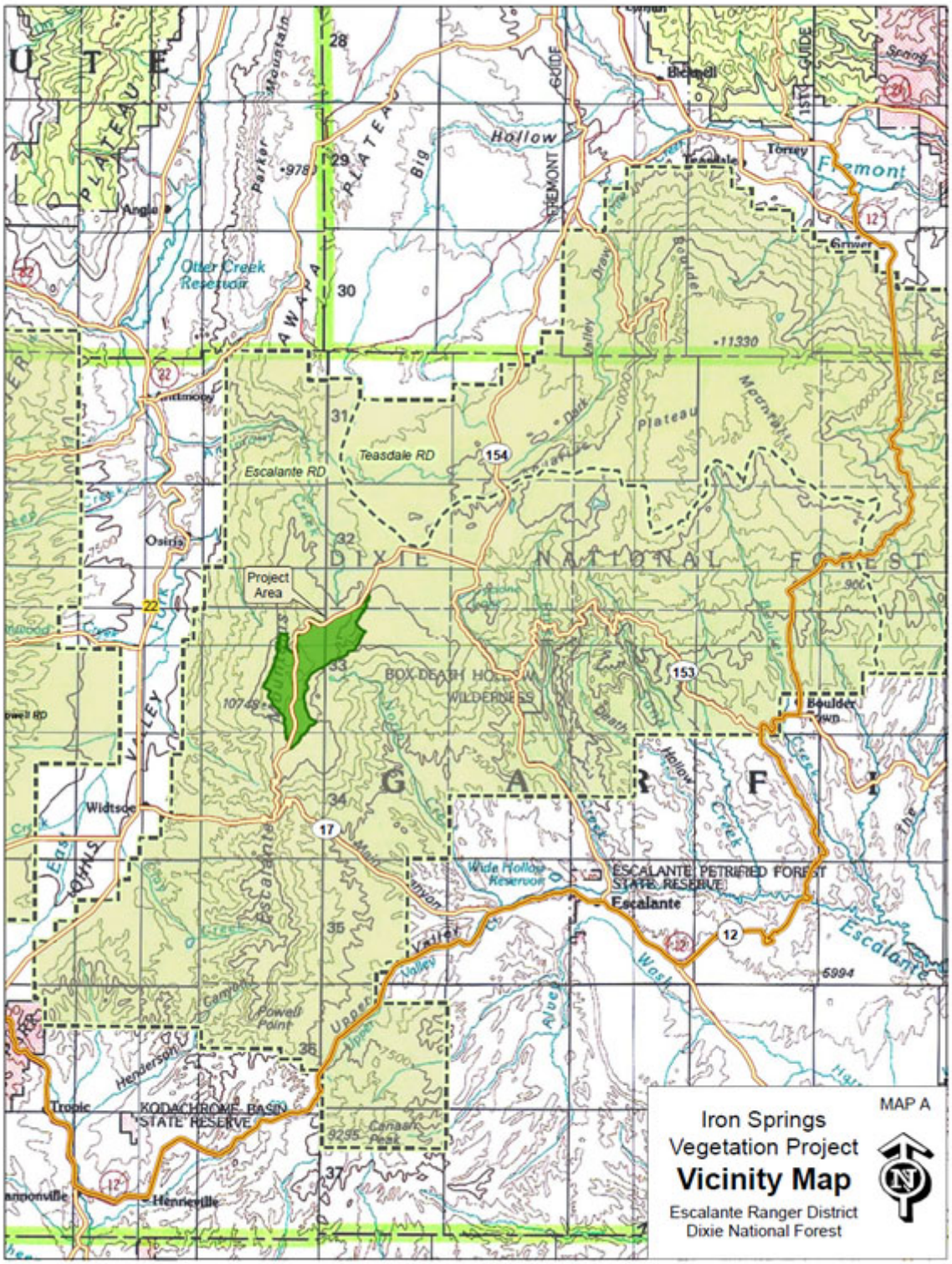
Appendices

Appendix A. Vicinity and Alternative Maps

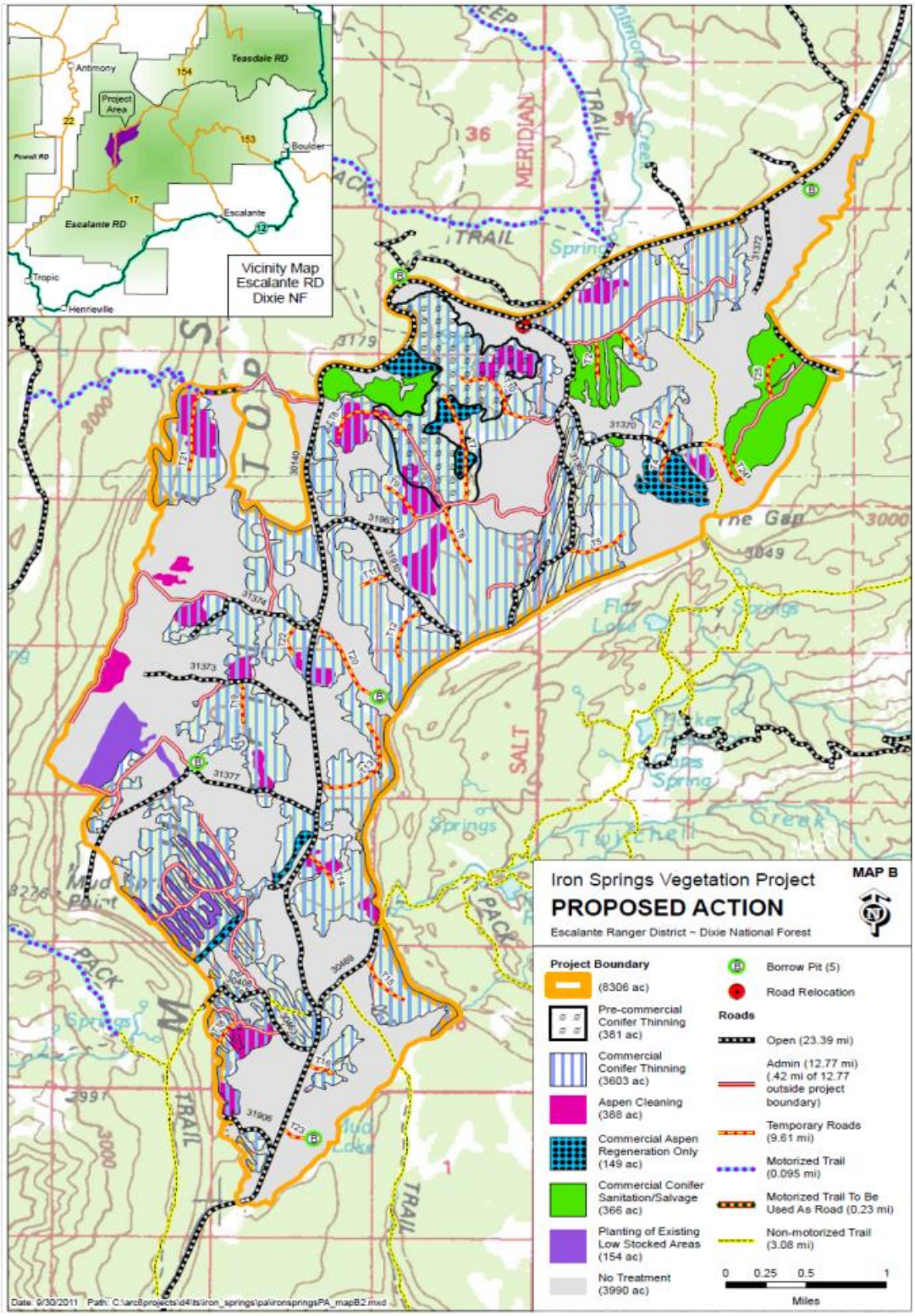
Appendix B. Wildlife Maps & Forest Plan Checklist

Appendix C. Forest Vegetation Compliance, Documentation & Checklist

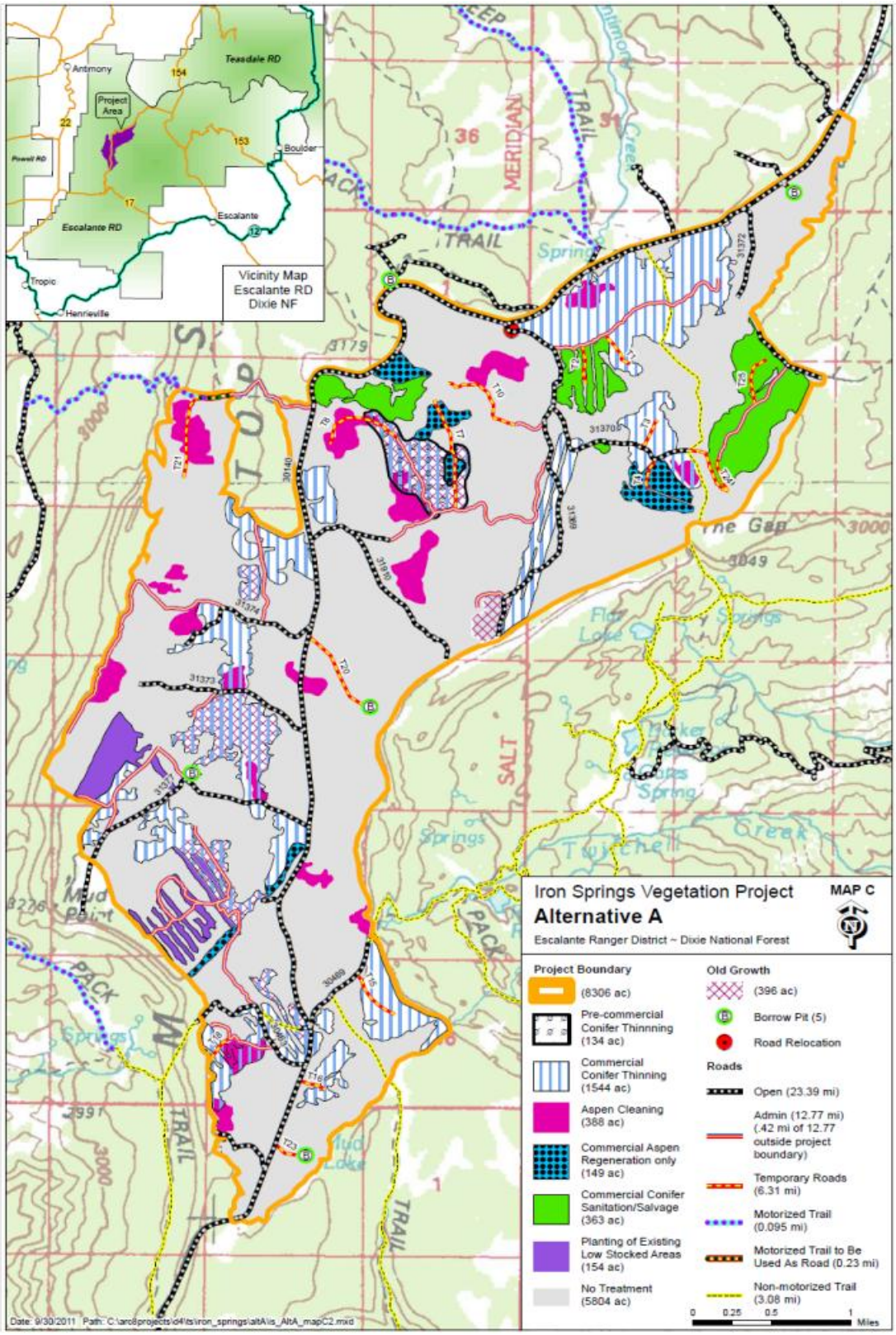
Map A1 - Vicinity



Map A2- Proposed Action



Map A3 – Alternative A



Appendix B. Wildlife Maps & Forest Plan Checklist

B1 – Previous Mexican Spotted Owl Surveys and Flammulated Owl Responses

B2 – Iron Springs Project Area Boundary and Flammulated Owl Detections on the Plateau Top

B3 – Potentially Suitable Bat Habitat

B4 – Potential Habitat Below 10,000 Feet Elevation

B5 – Iron Springs PA and Associated HUC 6 Watersheds

B6 – Utah Prairie Dog Cumulative Effects Area

B7 – Peregrine Falcon Cumulative Effects Area

B8 – Wildlife Cumulative Effects Area

B9 – Northern Goshawk Cumulative Effects Area

B10 – Boreal Toad Cumulative Effects Area

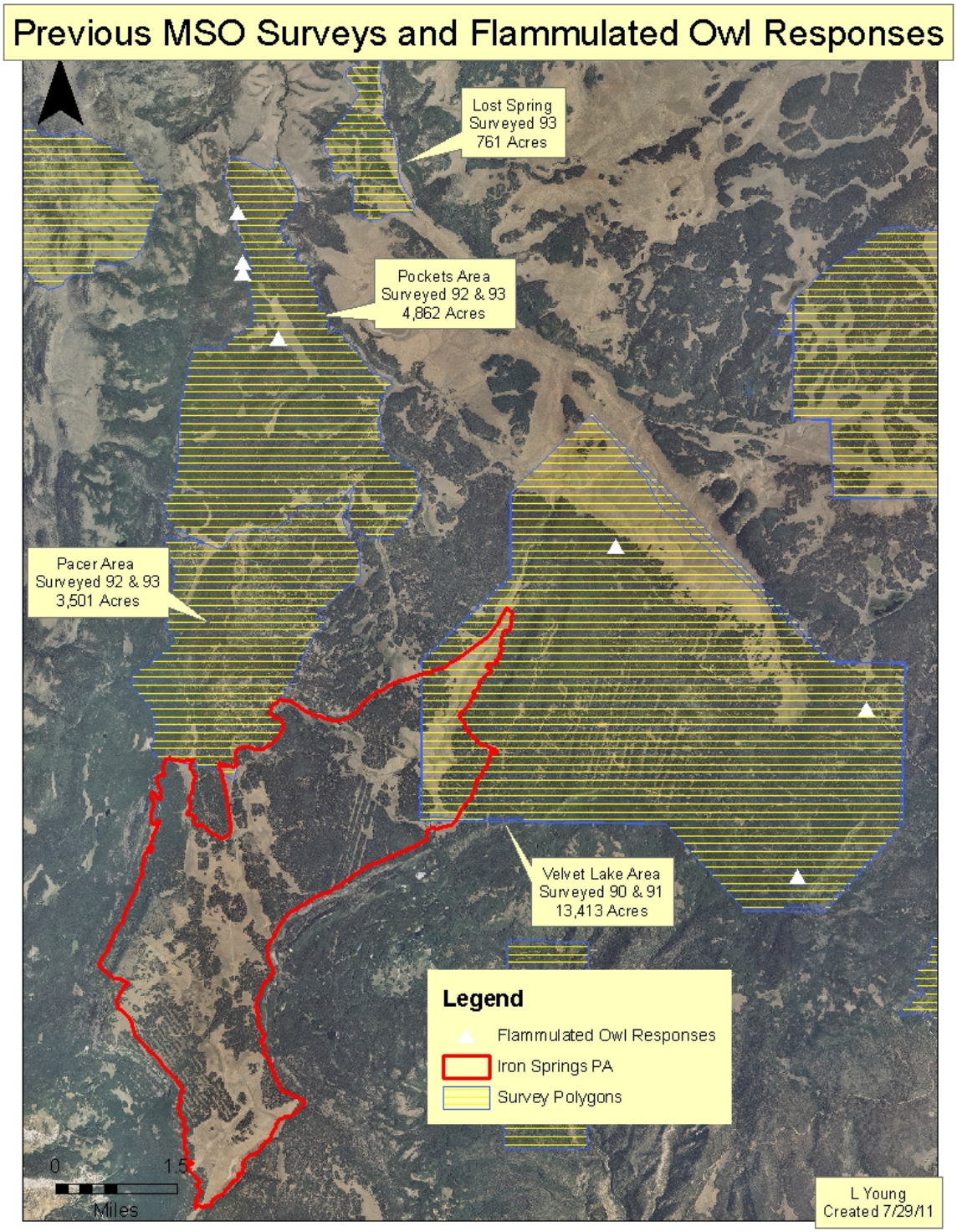
B11 – Iron Springs Vegetation Project; Road Reroute 30140 and Griffin Springs Exclosure

B12 – Plateau Top/Watershed Cumulative Effects Area with Grazing Allotments

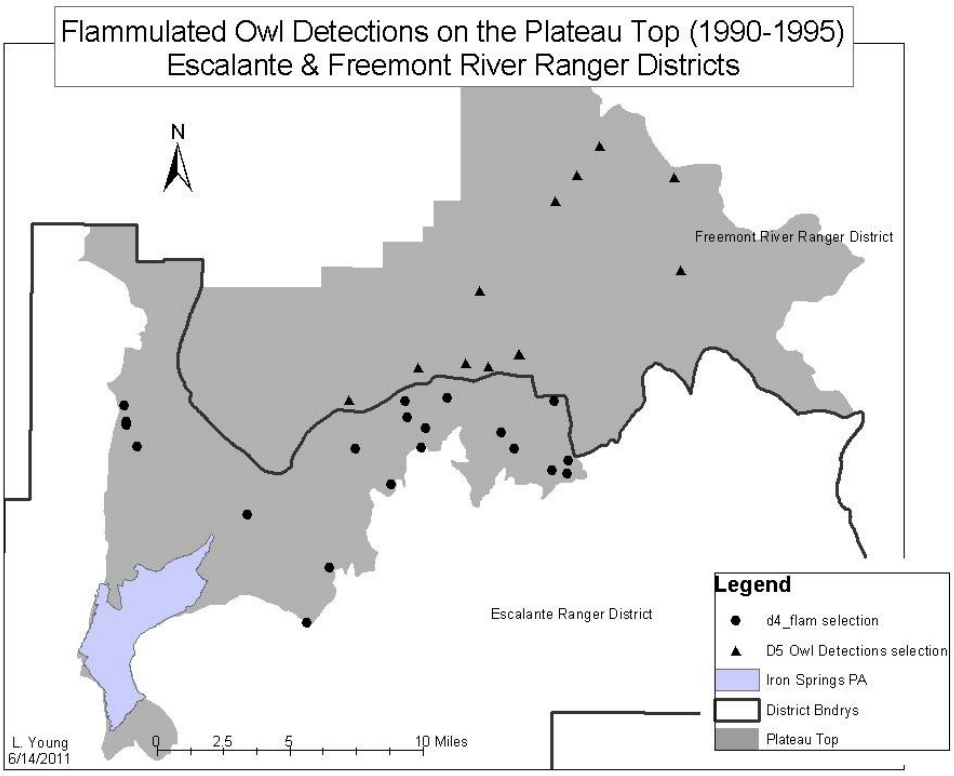
B13 – Northern Goshawk Cumulative Effects Area with Grazing Allotments

B14 – Boreal Toad Cumulative Effects Area with Grazing Allotments

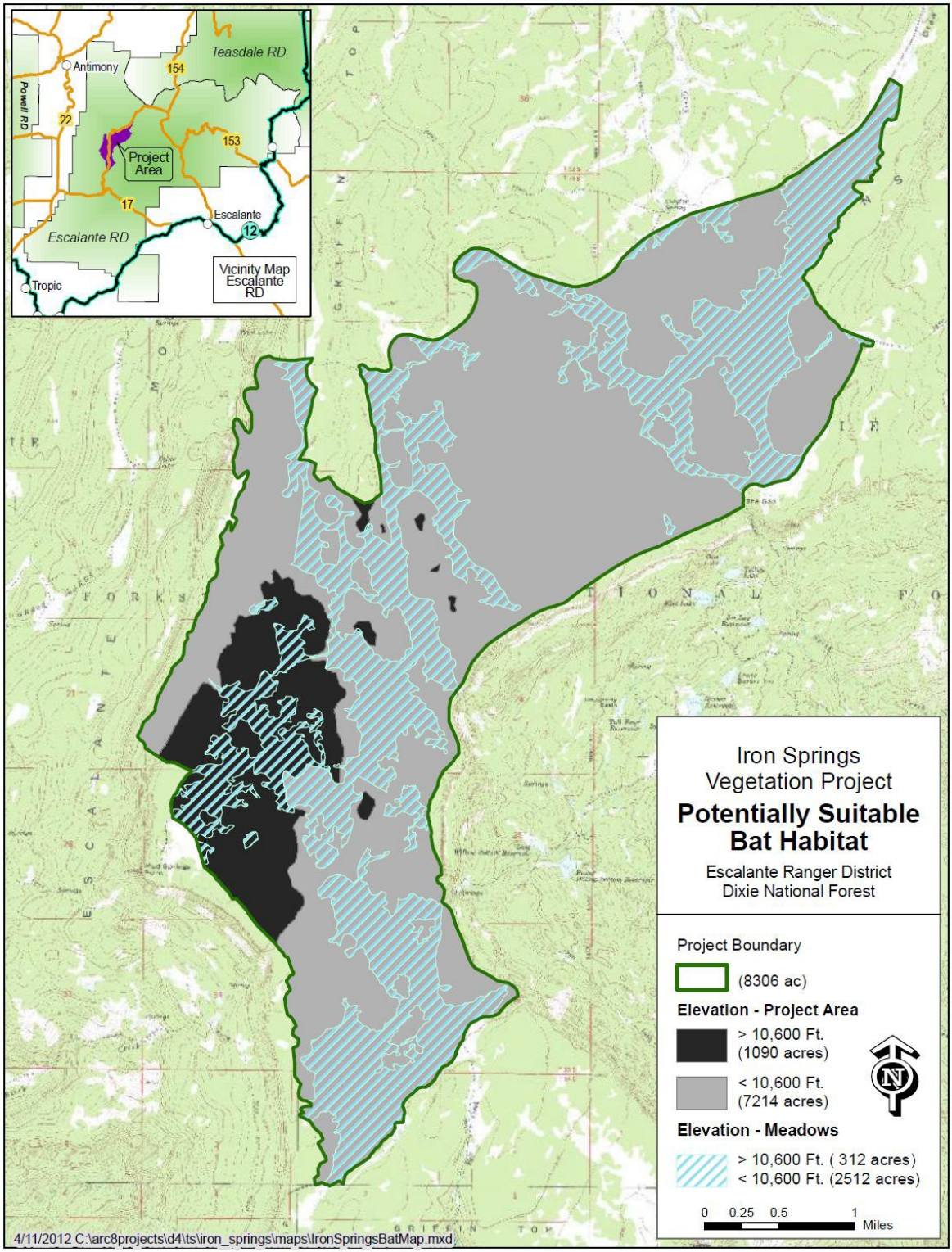
B15 – Forest Plan Consistency Checklist for Wildlife and Fish



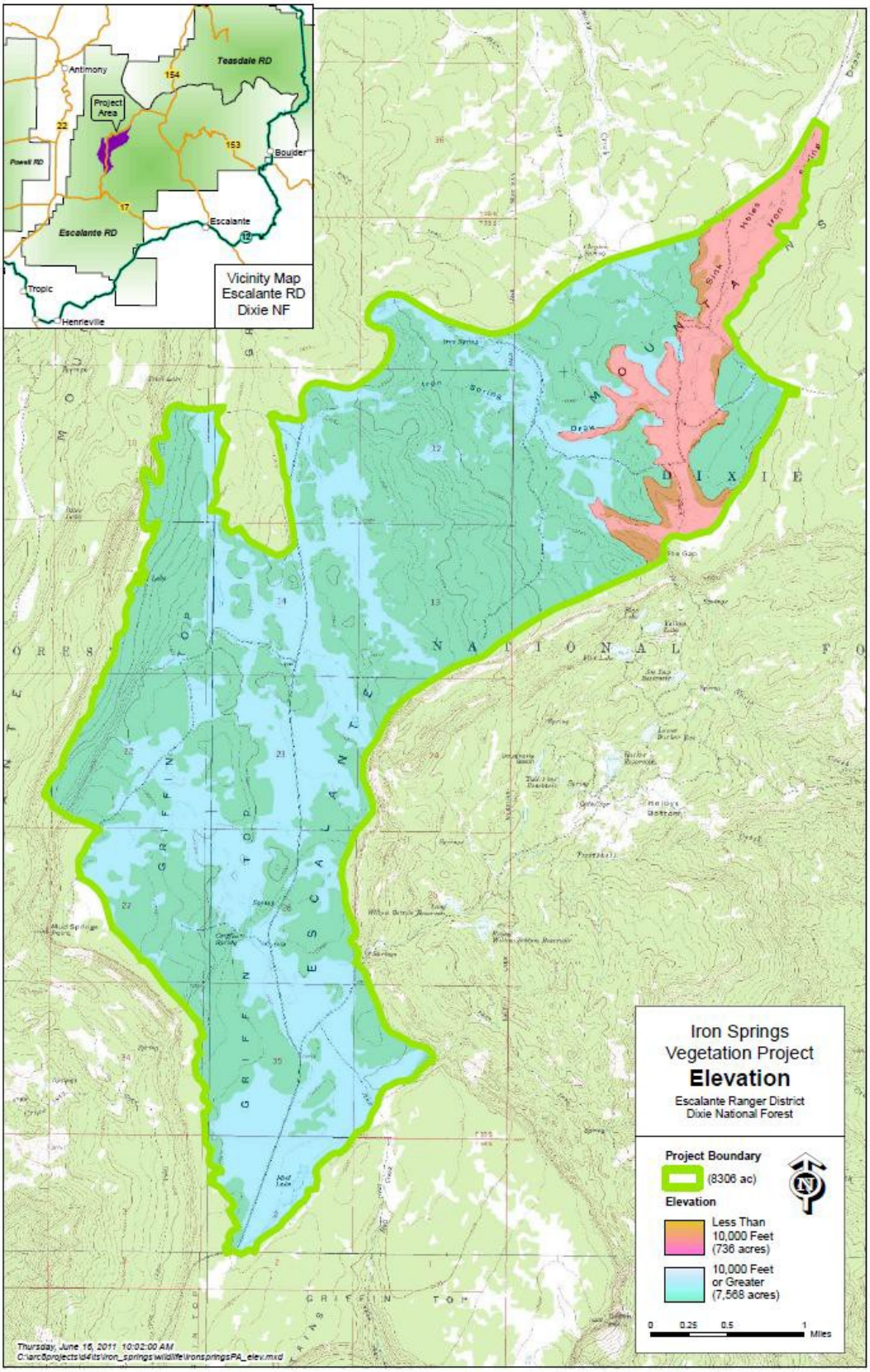
B1. Previous Mexican Spotted Owl Surveys & Flammulated Owl Responses.



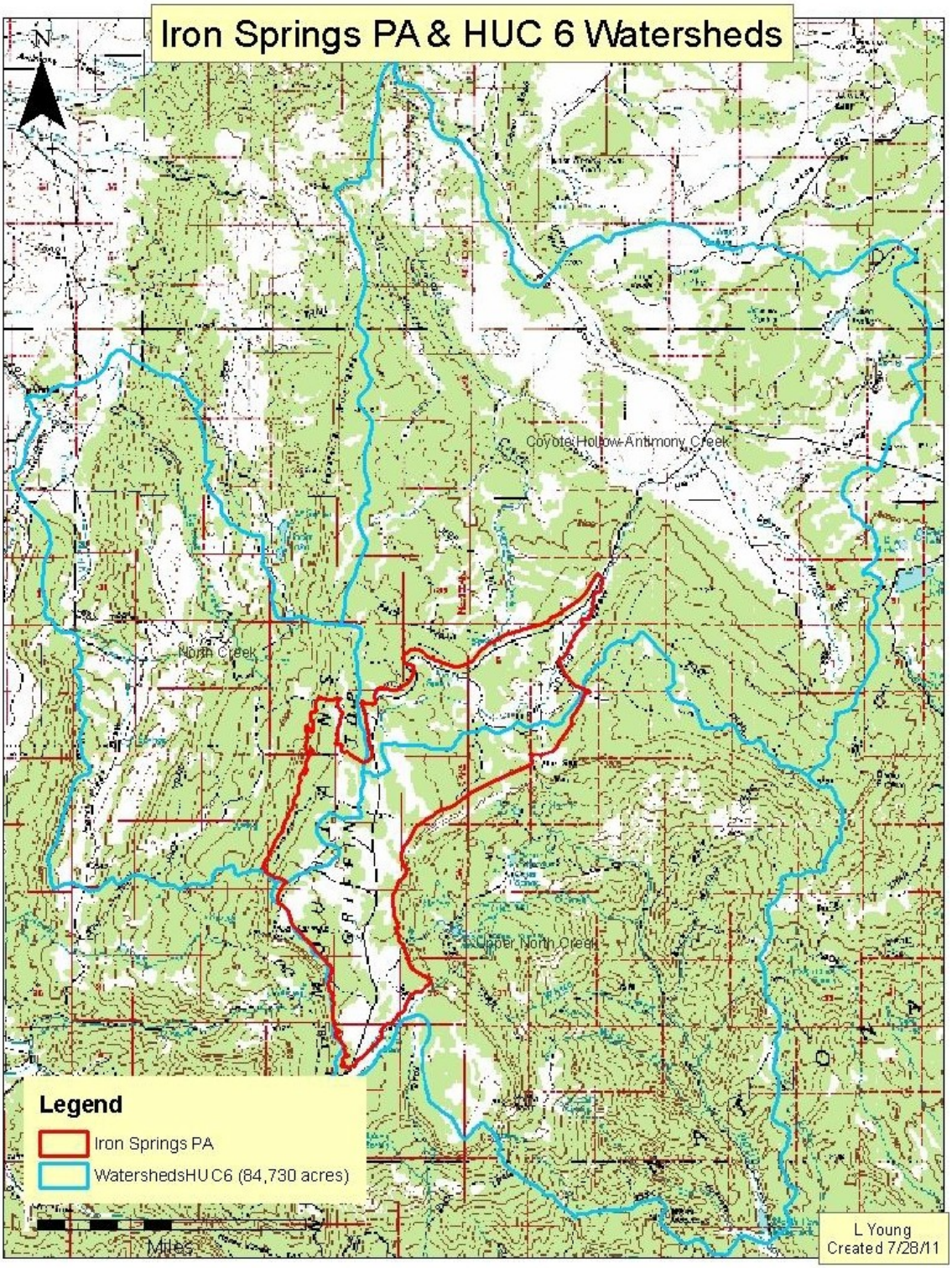
B2. Iron Springs Project Area Boundary & Flammulated Owl Detections on the Plateau Top



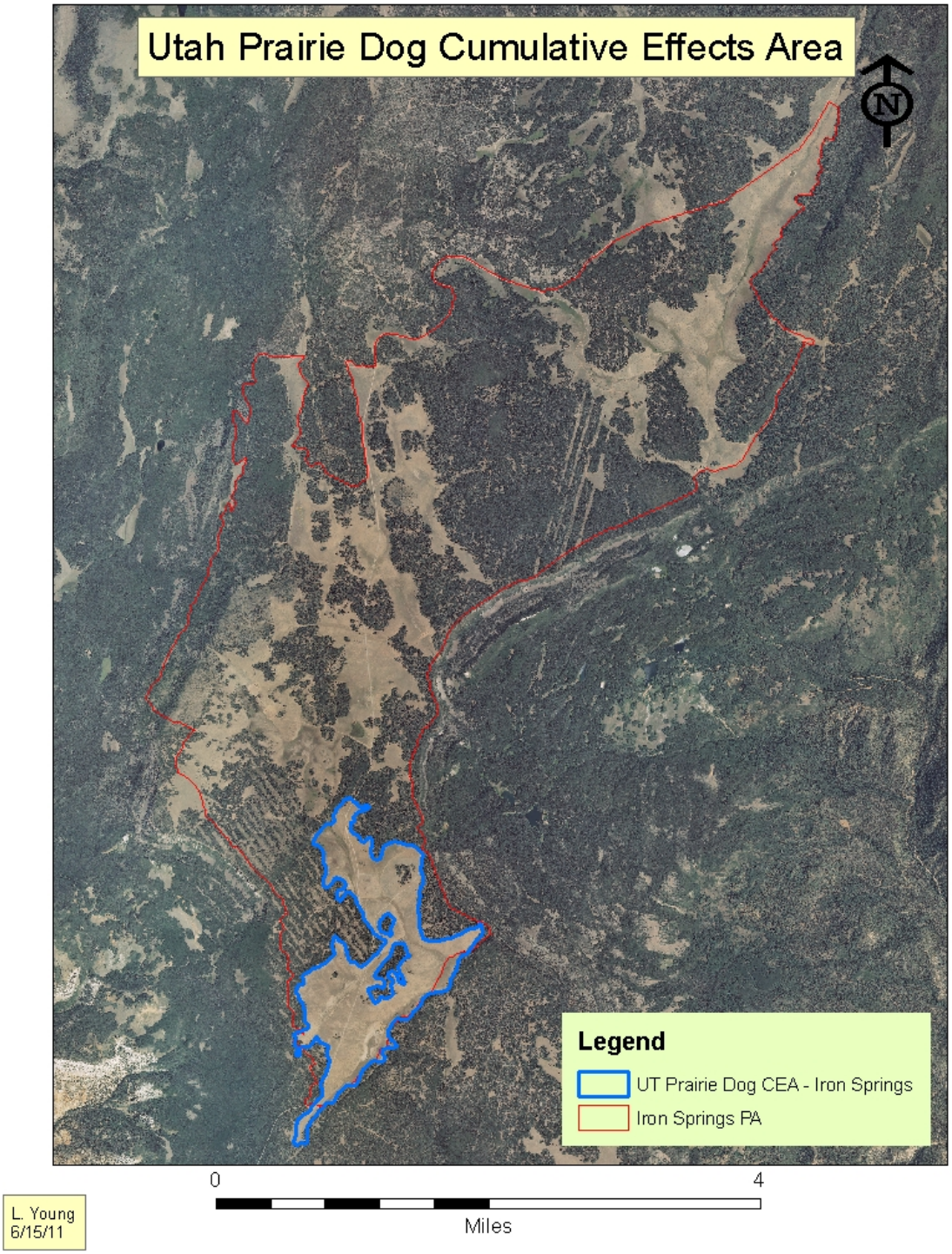
B3. Potentially Suitable Bat Habitat



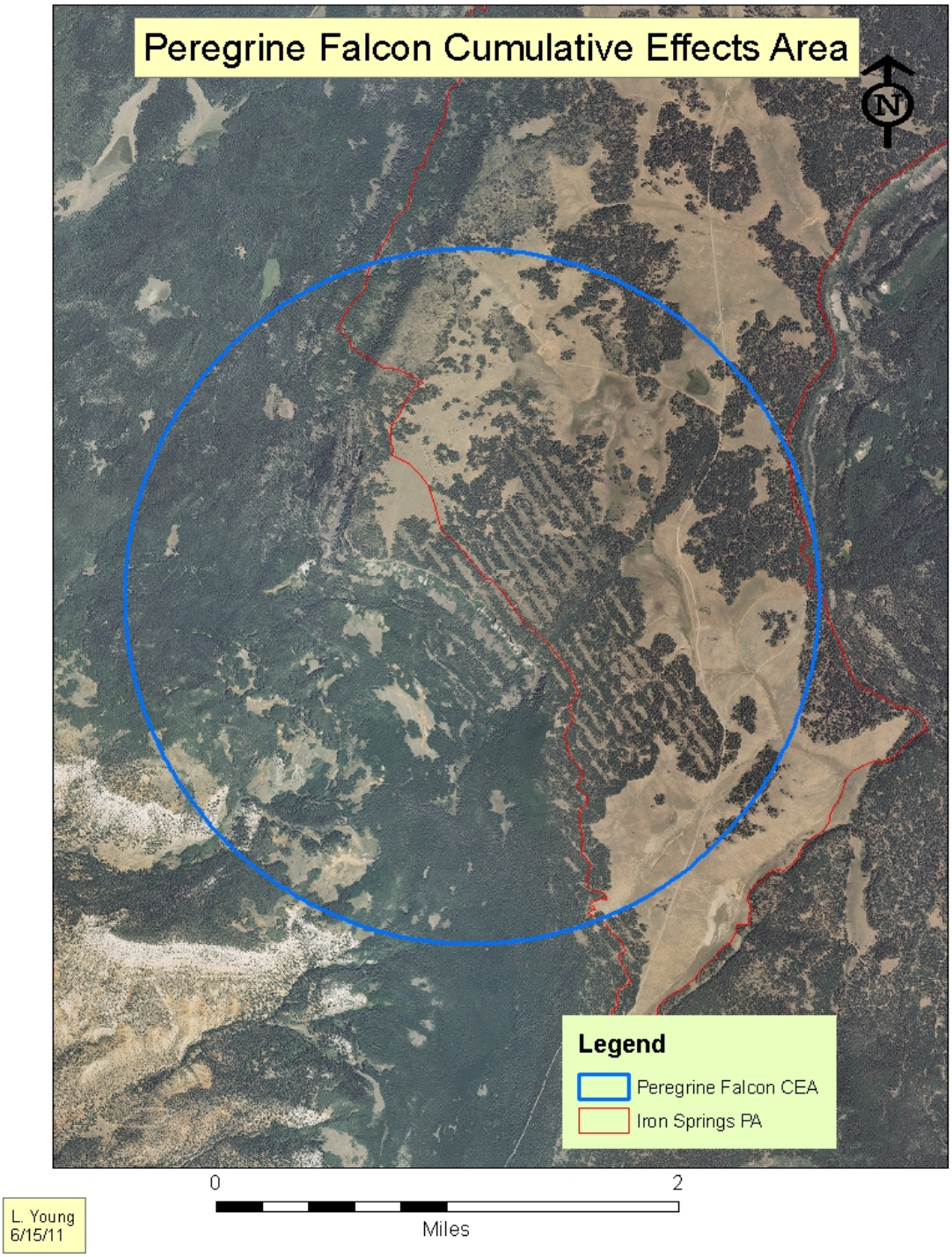
B4. Habitat Below 10,000 Feet Elevation within the Iron Springs Project Area



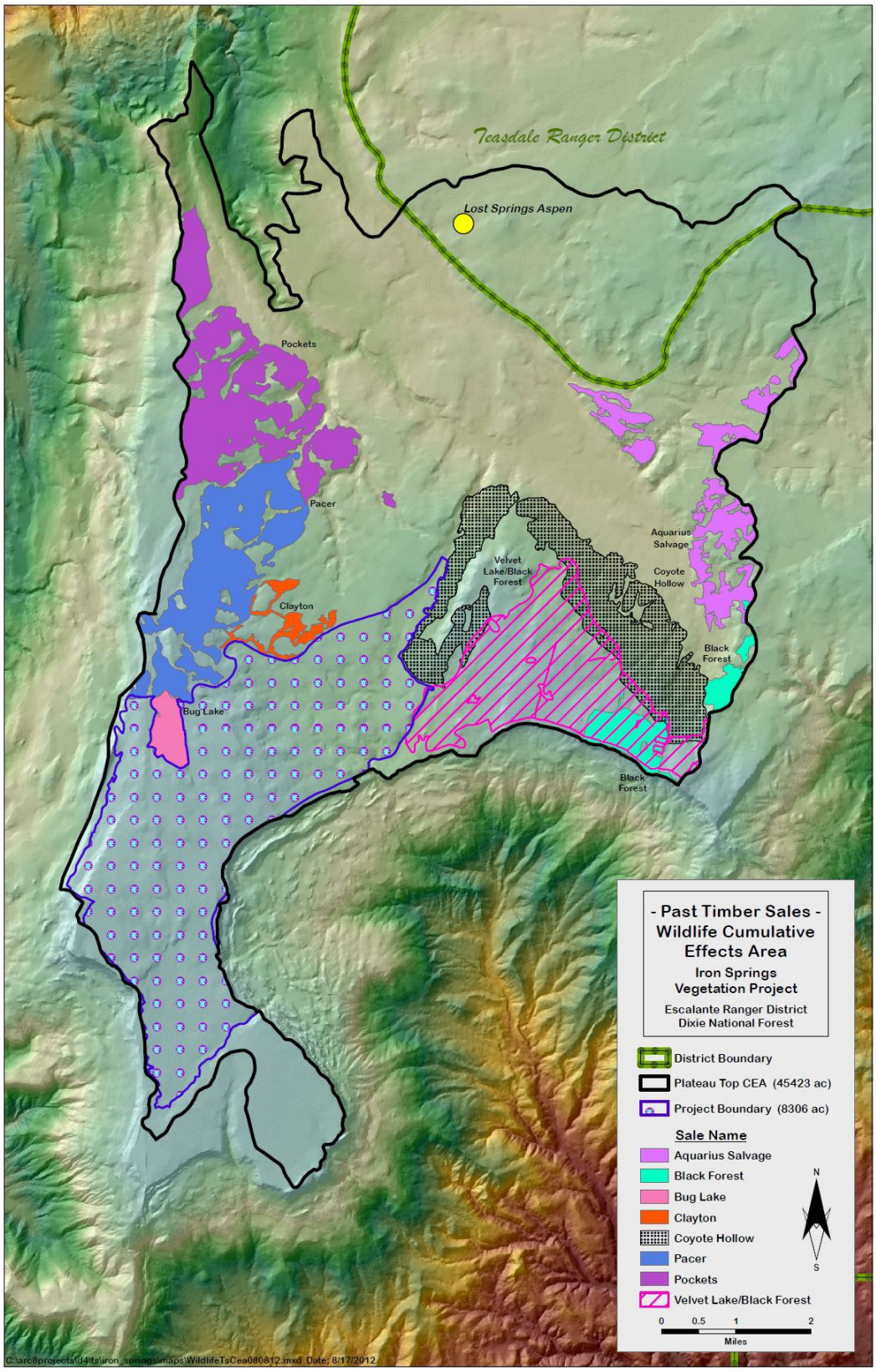
B5. Iron Springs PA and Associated HUC 6 Watersheds.



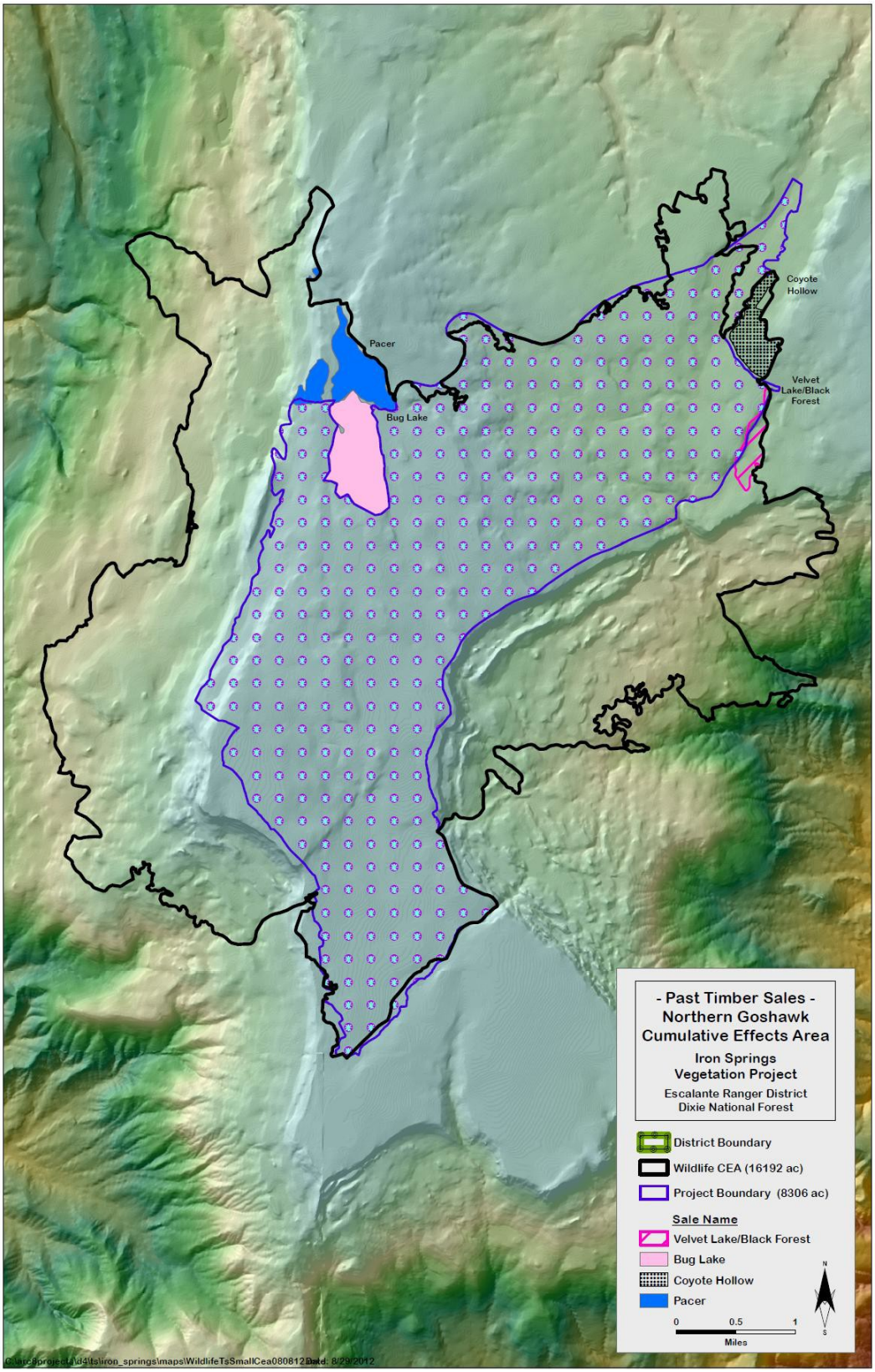
B6. Utah Prairie Dog Cumulative Effects Area



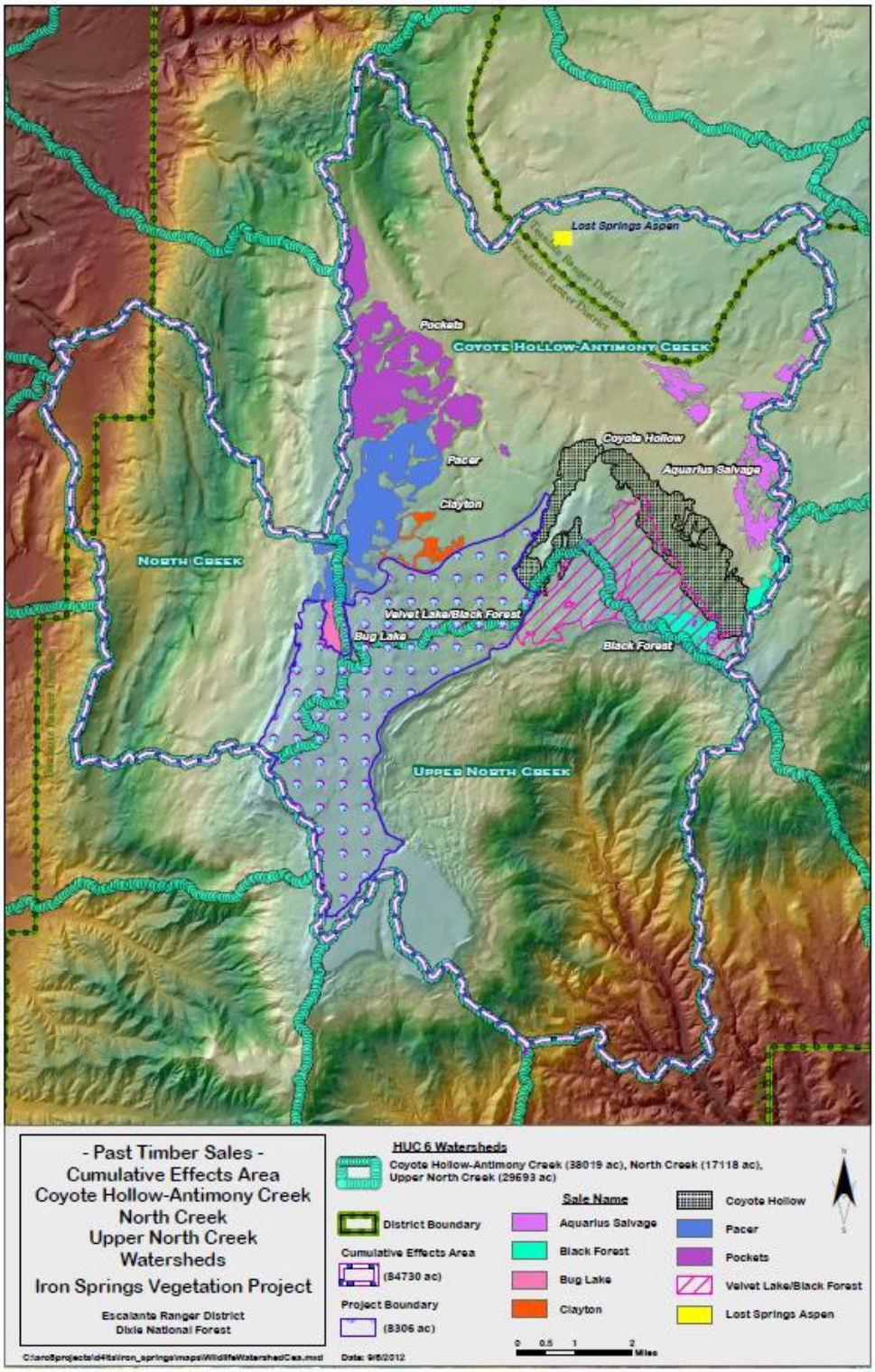
B7. Peregrine Falcon Cumulative Effects Area



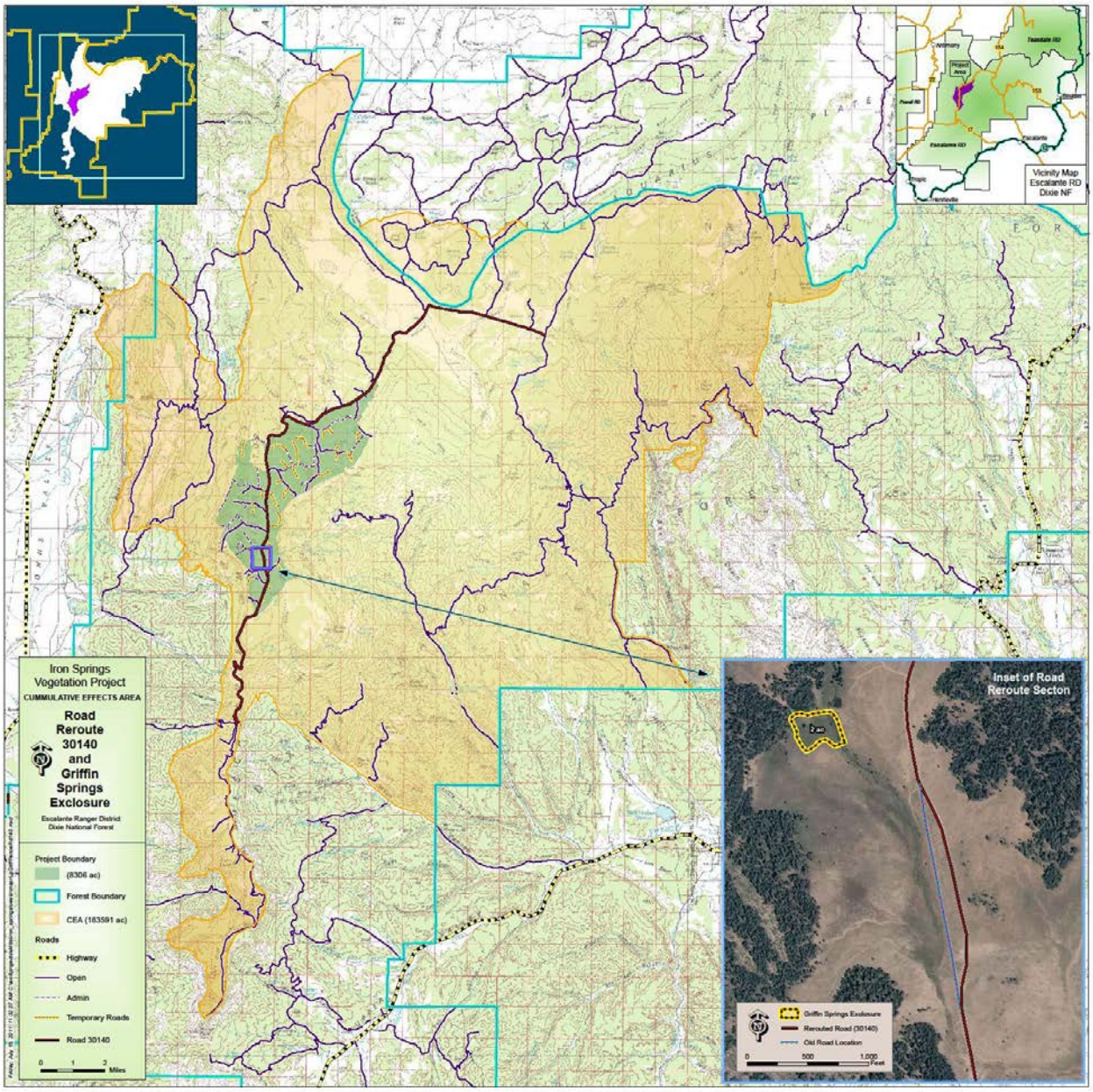
B8. Wildlife Cumulative Effects Area



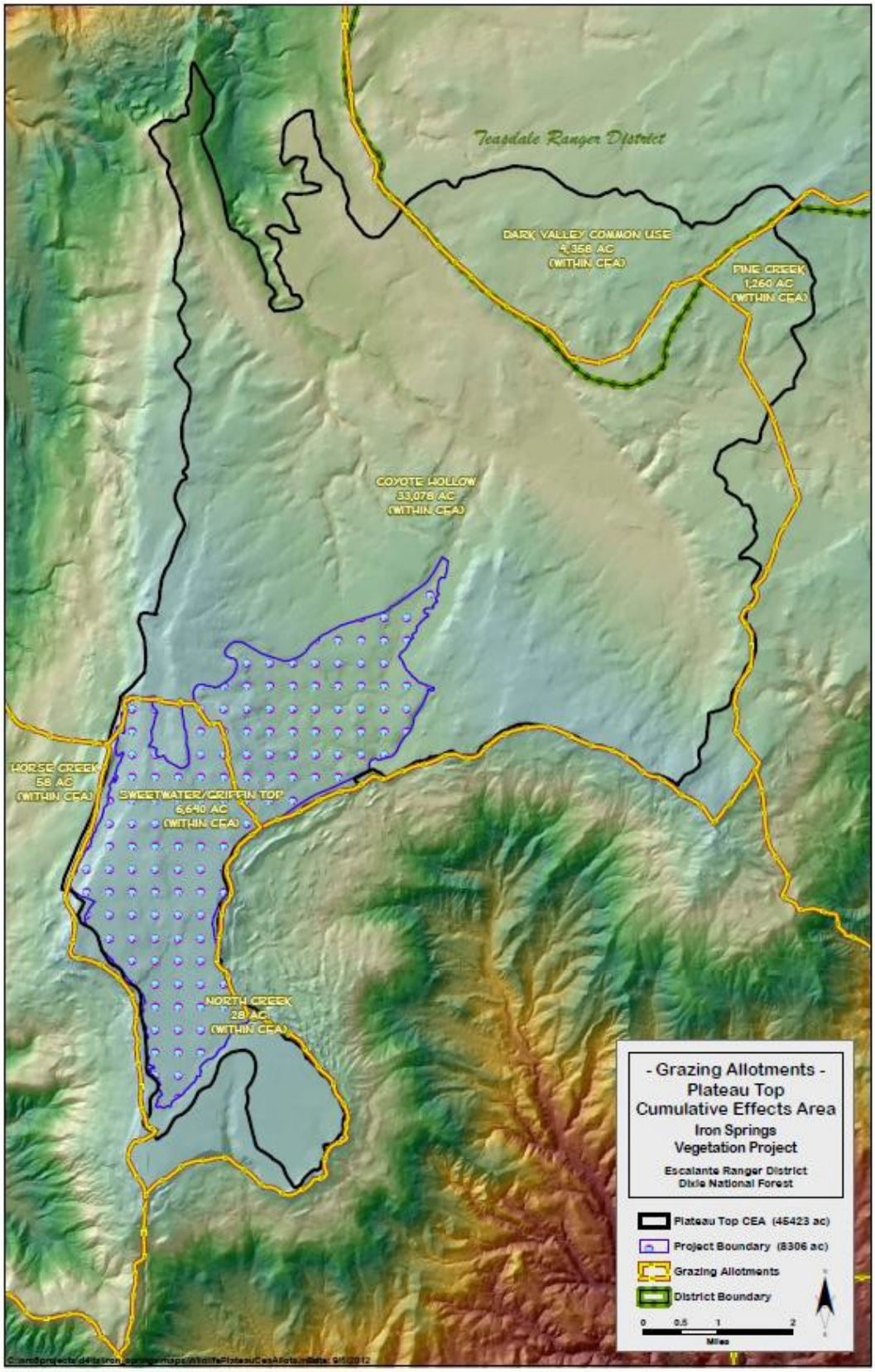
B9. Northern Goshawk Cumulative Effects Area



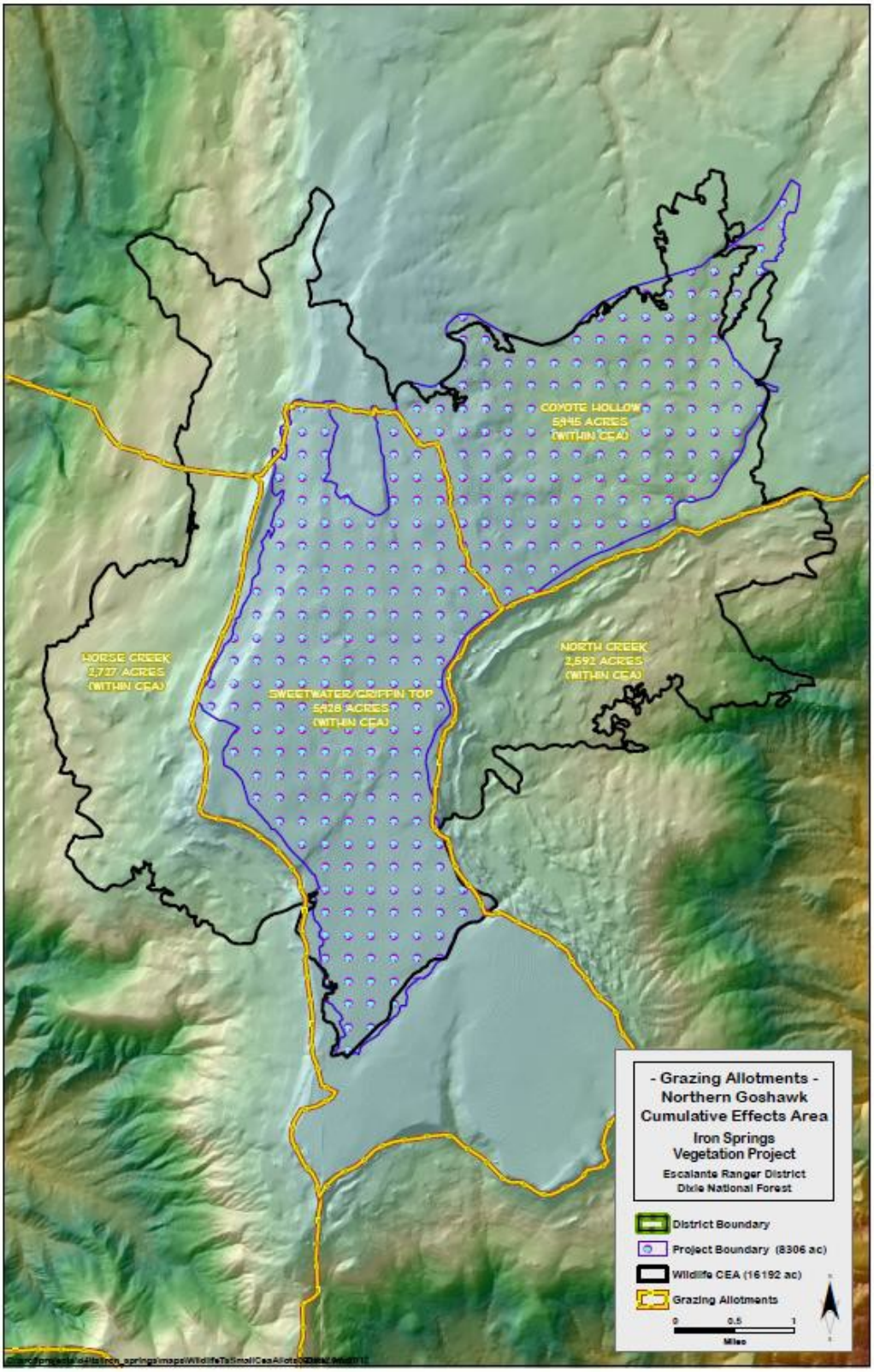
B10. Boreal Toad Cumulative Effects Area



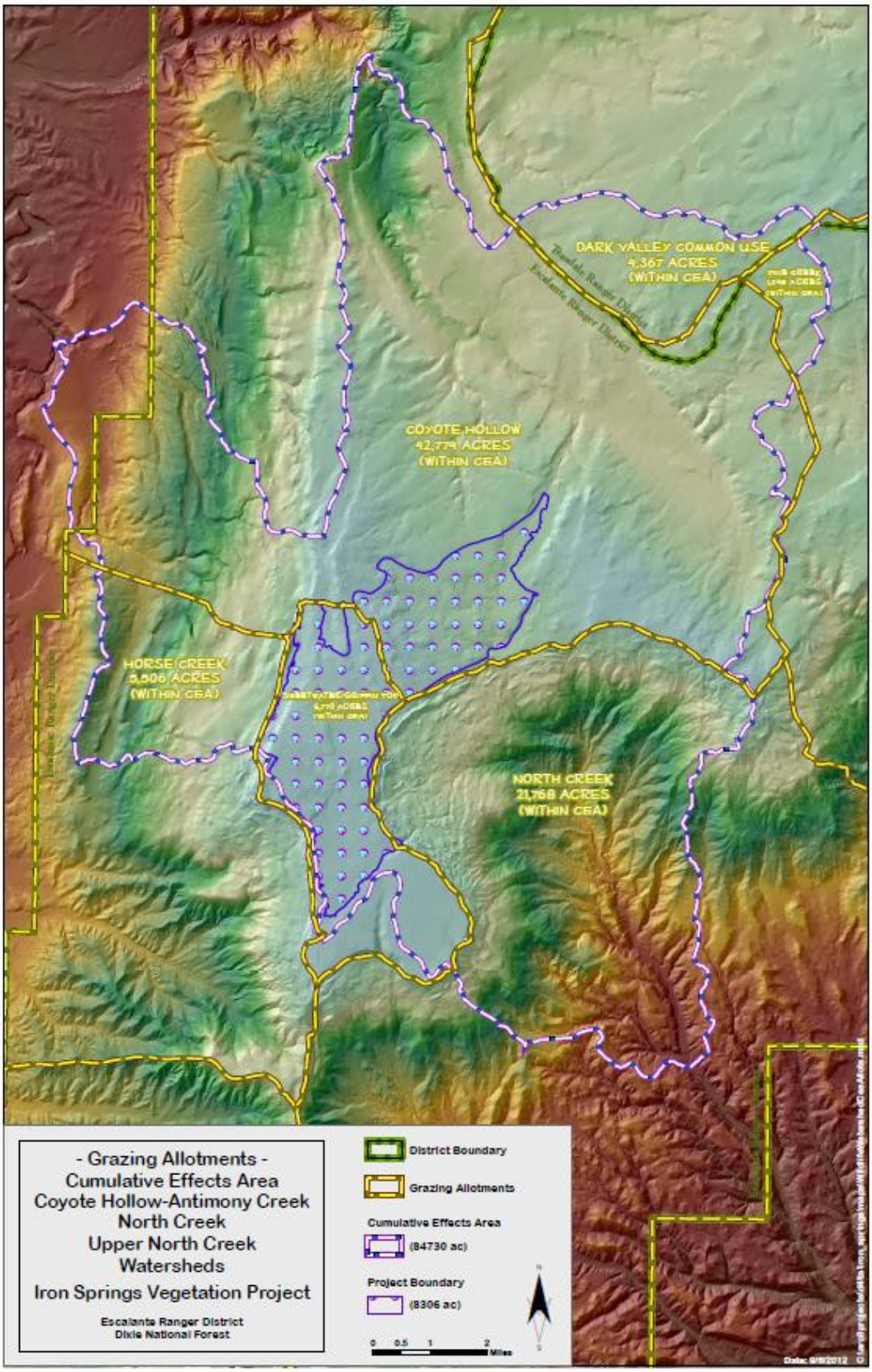
B11. Iron Spring Project Area, Road Reroute 30140 & Griffin Springs Exclosure



B12. Plateau Top/Watershed CEA with Grazing Allotments



B13. Northern Goshawk CEA with Grazing Allotments



B14. Boreal Toad CEA with Grazing Allotments

B15. Forest Plan Consistency Checklist for Wildlife & Fish

Iron Springs Vegetation Improvement and Salvage Project

Management Areas 1, 2B, 6A, 7A, and 9A – Wildlife Standards and Guidelines

Table A1. LRMP Standard and Guideline Applicability and Consistency.

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
1/IV-25	Maintain size of individual treated areas is 500 acres.	No	--	The general direction for this standard/guideline refers to areas dominated by grassland or shrubland. Non-forested areas consist of approximately 34% of the project area. This area is not dominated by grassland or shrubland.
1/IV-33	Maintain 40% or more of overhanging grasses, forbs, sedges, and shrubs along banks of streams.	No	--	This guideline is specific to waters capable of supporting self-sustaining trout populations. Stream segments in the project area do not have fish and are not capable of sustaining trout populations due to the spatially and temporally intermittent flow of the streams.
1/IV-33	Maintain 50% or more of total stream bank length in stable condition.	No	--	See stream bank response above.
1/IV-33	No more than 25% of stream substrate should be covered by inorganic sediment less than 3.2 mm in size.	No	--	See stream bank response above.
1/IV-34	Maintain overall stream habitat condition at or above 40 percent of optimum.	No	--	See stream bank response above.
1/IV-34	In forested areas, where biologically feasible, manage for hiding cover 1/ on 50 percent or more of the perimeter of all natural and created openings along at least 75 percent of the edge of arterial and collector roads 2/ and along at least 50 percent along streams and rivers. In areas of winter and transition ranges at least 20 percent of the cover should qualify as thermal	Yes	Yes	Currently approximately 78% of the stands along arterial and collector roads* are meeting this guideline (Orlemann, 2012). Project Design Criteria WL-2 will maintain hiding cover and will be implemented using the silvicultural prescription and marking guide. When developing the sample of stands for the calculation of current conditions, the perimeter of natural and created openings were included when the surrounding forested stand was within 200' of a qualifying road.

Table A1. LRMP Standard and Guideline Applicability and Consistency.

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	cover.			
1/IV-34	In management areas dominated by non-forested ecosystems, maintain deer and elk hiding cover as follows: *(cont.)* % of Unit Forested — % of Forested Area in Cover 35-50 — At least 50% 20-34 — At least 60% Less than 20 — At least 75% These levels may be exceeded temporarily during periods when stands are being regenerated to meet the cover standard, or to correct tree disease, problems, in aspen stands, or where windthrow or wildfire occurred. In critical big game habitat maintain hiding cover along at least 75 percent of the edge of arterial and collector roads, and at least 60% along streams and rivers, where trees occur.	No	--	Non-forested ecosystems in the project area comprise of approximately 34% of the area. *(cont.)* This area is not dominated by non-forested ecosystems.
1/IV-35	Alter age classes of browse stands in a management area, no more than 25 percent within a ten-year period.	No	--	General Direction for this standard applies specifically to silvicultural practices, indicating browsing within forested stands. Our interpretation of what constitutes a browse stand is forested stands that contain understories dominated with browse species that provide at least good forage value for wildlife such as *Purshia tridentata*. No browse stands have been identified in the project area. The forested areas within the project area consist of spruce-fir stands that contain very little understory vegetation and aspen stands. During survey work, stand exam, and general observations, none of the aspen stands were identified as having understories dominated with browse species.
1/IV-35	Where silviculturally practical, maintain edge contrast of at least medium or high between tree	Yes	Yes	The only regeneration treatment proposed in the project area is the aspen regeneration cuts. Using the Contrast By

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	stands created by evenaged management.			Age Class table in the Forest Plan, clear-fell coppice treatments would be classified as SSS (Shrub-Seedling-Sapling) age class. To maintain at least medium or high between tree stands requires old growth, mature, or poles adjacent to clear-fell treatments. All clear-fell coppice treatments have been reviewed and all have adjacent tree stands that are either old growth, mature, or pole *(cont.)* age class.
1/IV-35	Utilize both even and unevenaged timber management systems and a variety of harvest methods.	Yes	Yes	The project includes aspen regeneration, commercial conifer thinning, sanitation/salvage, aspen cleaning, pre-commercial conifer thinning, and planting of conifer. These various treatments demonstrate this project is consistent with the Forest Plan. However, this standard/guideline is not intended to be met at the project scale.
1/IV-35	A portion of each drainage should be in each age class. Seven to ten percent should be managed as old growth and no less than 10% should be grassland. The remainder should be more or less evenly distributed in the other age class (20% ± 3% in each).	Yes	Yes	The Old Growth and Grassland sections of the cumulative effects analysis found in the Vegetation Report (Orlemann, 2012c) documents the compliance of the project for old growth and grassland by drainage. The report also shows an uneven distribution of age classes and that the proposed activities will improve the distribution.
1/IV-42	Maintain fish passage during all flow levels except peak flow events.	No	--	See stream bank response above.
1/IV-50	Road densities should not exceed 2 miles per square mile of wildlife habitat. The higher the road density, the more wildlife habitat effectiveness is decreased.	Yes	Yes	Wildlife road density shows existing road density calculated to be 1.8 miles per square mile and a temporary increase of 1.9 with the proposed action and alternative A.
1/CC-20, Goshawk Amendment	Management actions should be designed to encourage conditions that are within the historic range of variation (HRV) as defined by Regional or local properly functioning condition (PFC) assessment. PFC operates within	Yes	Yes	During project development, existing conditions were identified for each vegetation type. Properly functioning conditions (PFC) were then identified for these areas. The Regional (USDA Forest Service, 2009b), Sub-Regional (USDA Forest Service, 1996) and district-level (Dixie

Table A1. LRMP Standard and Guideline Applicability and Consistency.

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	the range of HRV where extreme events are not desired. Actions should remain within the variability of size, intensity, and frequency of native disturbance regimes characteristic of the subject landscape and ecological processes.			National Forest, 1997) PFC assessments were used in this development. The knowledge gained from characterizing PFC, the guidance from the Forest Plan, and other relevant considerations were used to define desired future conditions for each vegetation type. The difference between existing conditions and the desired future conditions defined the need for the proposed treatments.
1/CC-20, Goshawk Amendment	Within disturbed ecosystems, management actions should be designed to be consistent with *(cont.)* restoration objectives.	Yes	Yes	The results of spruce beetle outbreaks or epidemic levels would meet the definition of disturbed ecosystems. Management *(cont.)* actions are consistent with restoration objectives. Restoration objectives were developed by determining desired future conditions that were defined by properly functioning conditions (PFC) for this habitat. This resulted in management actions that would create stand conditions that do not promote spruce beetles or disease and would increase the long-term sustainability of large-diameter trees.
1/CC-20, Goshawk Amendment	Utilize native plant species from locally adapted seed sources in management activities when and where practical. Non-native plant species have the potential to cause systems to move outside of historic range of variation (HRV), therefore the use of non-native species would be justified to indicate how their use is important to maintain or restore a cover type to functioning conditions.	No	--	Treatments do not include seeding. Trees acquired for planting are grown from local seed sources collected on the District.
1/CC-21, Goshawk Amendment	When initiating vegetative management treatments in forested cover types, provide for a full range of seral stages, by forested cover type, that achieve a mosaic of habitat conditions and diversity. Each seral stage should contain a strong representation of early seral tree species.	Yes	Yes	Part of the purpose for treatments within the project area is to improve the balance of age class distribution for spruce/fir and aspen. This purpose generated proposed treatments within the project area. Aspen stands in the project area would receive clear-fell coppice treatments designed to regenerate aspen. Scattered aspen clones within spruce/fir stands would also have

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	Recruitment and sustainability of early seral tree species in the landscape is needed to maintain ecosystem resilience to perturbations.			conifer removed. By perpetuating aspen presence within the spruce and fir-dominated forest, conditions would be created that would reduce stand risk rating factors and bark beetle populations. As described in the Vegetation Report (Orlemann, 2012c) patches of regeneration occur throughout the spruce-fir stands. Proposed activities move the area towards achieving recruitment and sustainability of early seral tree species in the landscape. Forested areas within the project area are characterized as subalpine fir potential vegetation type with aspen being the early *(cont.)* seral species as defined by Graham et al. (1999). As disclosed in this Wildlife Report, managing for more aspen within the conifer stands would result in fewer impacts from spruce beetle mortality thereby improving ecosystem resilience to perturbations.
1/CC-21, Goshawk Amendment	Planned vegetative management treatments (excluding unplanned and unwanted wildland fire) in the mature and/or old structural groups in a landscape that is at or below the desired percentage of land area in mature and old structural stages (40% conifer, 30% aspen), should be designed to maintain or enhance the characteristics of these structural stages. Within these landscapes the percentage of land area in mature and old structural stages treated should not move out of the mature and old structural stage. Planned treatment may vary from this guideline if the action was assessed through the biological evaluation (BE) process, and the BE concluded that the action is consistent with the intent	Yes	Yes	The project was designed to improve the balance of age class distribution and create stand conditions that would increase the long-term sustainability of large-diameter trees (Iron Springs - Notice and Opportunity to Comment). The project was designed to protect large-old trees by thinning from below (Orlemann, 2012c). Cumulative effects described in the Wildlife Report for the Proposed Action and Alternative A state there will be a shift of some of the stands in the two goshawk territories toward VSS 4 and 5, and eventually toward VSS 6. No stands are moving out of the mature and old structural stages. In addition, the BE concluded the proposed action is consistent with the intent of the Conservation Strategy and Agreement for Management of the Northern Goshawk in Utah.

Table A1. LRMP Standard and Guideline Applicability and Consistency.

<table>
<tr><th>Manage-ment Area/Page #</th><th>Standard/Guideline</th><th>Applic-ability</th><th>Consis-tent</th><th>Rationale</th></tr>
<tr><td></td><td>of the Conservation Strategy and Agreement for Management of the Northern Goshawk in Utah.</td><td></td><td></td><td></td></tr>
<tr><td>1/CC-21, Goshawk Amendment</td><td>When initiating vegetative management treatments in forested cover types, leave the following minimum number and size of snags. If the minimum number of snags is unavailable, green trees should be substituted. If the minimum size is unavailable, then use the largest trees available on site. It is desirable to have snags represented in all size classes above the minimum on the site. The number of snags should be present at the stand level on average and, where they are available, distributed over each (cont.) treated 100 acres. This distribution is needed to meet the needs of prey species that utilize this habitat.
<table>
<tr><th>COVER TYPE</th><th>MIN SNAGS (PER 100 AC)</th><th>MIN PREFER-ED SIZE</th></tr>
<tr><td>Ponderosa Pine</td><td>200</td><td>18 in DBH, 30 feet tall</td></tr>
<tr><td>Mixed Conifer and Spruce/Fir</td><td>300</td><td>18 in DBH, 30 feet tall</td></tr>
<tr><td>Aspen</td><td>200</td><td>8 in DBH, 15 feet tall</td></tr>
</table></td><td>Yes</td><td>Yes</td><td>Project Design Criteria WL-3 provides for the retention of snags. This will be implemented using the silvicultural prescription and marking guide.</td></tr>
<tr><td>1/CC-22, Goshawk Amendment</td><td>When initiating vegetative management treatments, prescriptions should be designed to retain the following minimum amount and size of down logs and woody debris. These habitat components should be present at the stand level on average and, where they are available, distributed over each treated 10 acres. This distribution is needed to meet the needs of prey species that utilize this habitat.</td><td>Yes</td><td>Yes</td><td>Project Design Criteria WL-4 provides for the retention of coarse woody debris. This will be implemented using the silvicultural prescription.</td></tr>
</table>

<table>
<tr><th>Manage-ment Area/Page #</th><th>Standard/Guideline</th><th>Applic-ability</th><th>Consis-tent</th><th>Rationale</th></tr>
<tr><td></td><td>
<table>
<tr><td>COVER TYPE</td><td>Min Down Logs</td><td>Min Log Size</td><td>Min Coarse Woody >=3”</td></tr>
<tr><td></td><td>(# per 10 acres)</td><td>Mid-point diameter</td><td>(Tons per 10 acres)</td></tr>
<tr><td>Ponderosa Pine</td><td>30</td><td>12 inch, 8 feet long</td><td>50</td></tr>
<tr><td>MixedCon Spruce/Fir</td><td>50</td><td>12 inch, 8 feet long</td><td>100</td></tr>
<tr><td>Aspen</td><td>50</td><td>6 inch, 8 feet long</td><td>30</td></tr>
</table>
</td><td></td><td></td><td></td></tr>
<tr><td>1/CC-22, Goshawk Amendment</td><td>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 (cont.) 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 patters defined in Regional or local proper functioning condition assessments (PFC). Clumps typically have 2 to 9 trees in the VSS 4, 5 or 6 class with interlocking crowns.</td><td>Yes</td><td>Yes</td><td>As disclosed in the Vegetation Report (Orlemann, 2012c) and this Wildlife Report, conifer thinning treatments are designed to develop/maintain VSS structure and promote Engelmann spruce. Thinning guidelines would retain un-infested clumps of spruce for interlocked canopies of VSS 4-6 requirements. Thinning treatments are in part designed to promote and retain spruce within groups and avoid thinning of clumps (cont.) due to windthrow concerns. Treatments are designed to minimize loss of the larger VSS classes to spruce beetle and enhance future development. This guideline will be implemented using the silvicultural prescription and marking guides.</td></tr>
<tr><td>1/CC-22, Goshawk Amendment</td><td>Use the latest Regionally accepted Biological Prefield Research form (USFS Region 4) to determine the</td><td>Yes</td><td>Yes</td><td>A Prefield Research form has been completed.</td></tr>
</table>

Table A1. LRMP Standard and Guideline Applicability and Consistency.

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	level of goshawk field survey(s) needed to complete the Biological Evaluation. Completion of this form is required to document where surveys are not required.			
1/CC-22, Goshawk Amendment	Where goshawk field surveys are required, complete surveys for territory occupancy within suitable habitat. Surveys will be completed during the nesting and/or post-fledgling period, and must be conducted at least one year prior to implementation of management actions.	Yes	Yes	Goshawk surveys have been completed within suitable habitat. The last survey was completed in 2011. All surveys were conducted during the nesting and post-fledgling period. Goshawk field surveys will be completed two consecutive years prior to implementation.
1/CC-23, Goshawk Amendment	Where goshawk field surveys are required and when project planning permits, two consecutive years of surveys for territory occupancy prior to implementation of management actions is preferred.	Yes	Yes	More than two years of goshawk surveys have been completed. The last survey was completed in 2011. Goshawk field surveys will be completed two consecutive years prior to implementation.
1/CC-23, Goshawk Amendment	If a historic nest is not associated with an active nest area, manage direction for home range habitat should be applied.	N/A	--	There are no historic nests within the project area.
1/CC-23, Goshawk Amendment	When an active nest area has *(cont.)* been identified, identify 2 alternate nest areas and 3 replacement nest areas. The next two guidelines provide recommended direction for implementation of this standard.	N/A	--	This is outside the scope of this project. *(cont.)* Nest areas have already been established for active nests following the standards and guidelines found in the Goshawk Amendment and Reynolds (1992).
1/CC-23, Goshawk Amendment	Each nest area (active, alternate and replacement) should be approximately 30 acres (total of approximately 180 acres) in size when sufficient suitable habitat exists. If sufficient amounts of suitable habitat are not present, use existing suitable habitat that is available.	N/A	--	See nest area response above.
1/CC-23, Goshawk Amendment	Alternate nest areas should be identified in suitable habitat with similar vegetative structures as	N/A	--	See nest area response above.

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	the active nest areas. Replacement nest areas should be identified in habitat which will develop similar vegetative structures as the active nest area at the time the active and alternate nest areas are projected to no longer provide adequate nesting habitat.			
1/CC-23, Goshawk Amendment	Prohibit forest vegetative manipulation (timber harvest, prescribed burning, fuelwood, thinning, weedings, etc.) within active nest areas (approximately 30 acres; i.e. *Guideline N.*) during the active nesting period. The active nesting period will normally occur between March 1st and September 30th.	No	--	Treatments are not occurring in nest areas.
1/CC-23, Goshawk Amendment	In active nest areas (approximately 30 acres; i.e. Guideline N.), restrict Forest Service management activities and human uses for which Forests issue permits during the active nesting period (does not include livestock permits) unless it is determined that the disturbance is not likely to result in nest abandonment. If the disturbance *(cont.)* is likely to result in abandonment, a biological evaluation (BE) must be completed. To implement the action, the BE must conclude that the action is consistent with the intent of the Conservation Strategy and Agreement for Management of the Northern Goshawk in Utah.	No	--	Treatments are not occurring in nest areas.
1/CC-23, Goshawk Amendment	Forest vegetative manipulation within active, alternate and replacement nest areas should be designed to maintain or improve desired nest area habitat. Use the	No	--	Treatments are not occurring in nest areas.

Table A1. LRMP Standard and Guideline Applicability and Consistency.

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	active nest area habitat characteristics as an indicator of the desired nest area habitat, and as the best available information for nest area habitat for that cover type.			
1/CC-24, Goshawk Amendment	Identify a Post-Fledgling Area (PFA) which encompasses the active, alternate and replacement nest areas and additional habitat needed to raise fledglings. A PFA should be approximately 420 acres in size (exclusive of nest area acres) when sufficient suitable habitat exists. If sufficient amounts of suitable habitat are not present, use existing suitable habitat that is available.	N/A	--	This is outside the scope of this project. PFAs have already been established for the territories found within the project area following the guidelines found in the Goshawk Amendment and Reynolds (1992).
1/CC-24, Goshawk Amendment	Forest vegetative manipulation within the PFAs should be designed to maintain or improve the same habitat features as discussed for the goshawk home range (i.e., stand structure, snags, down logs, nest trees important in life histories of the goshawk and its prey species common to the geographic location), except: a) Openings, as defined in glossary and Reynolds et al., created as a result of mechanical vegetative treatments (does not *(cont.)* include wildland fire) should not exceed the following by cover type: Cover Type — Maximum Created Opening Size Ponderosa Pine and Mixed Conifer — 2 acres Spruce/Fir — 1 acre Aspen and Lodgepole Pine — Follow current management direction b) Management activities should be restricted	Yes	Yes	▪ Treatments are designed to maintain or improve the same habitat features as the home range. Only thinning is occurring within PFAs. This will improve habitat by increasing growth rates of large remaining trees thereby redistributing growth potential to the most desirable trees. These effects are disclosed in the northern goshawk section of this Wildlife Report. ▪ Openings will not be created during thinning treatments. ▪ Project Design Criteria WL-9 will *(cont.)* implement the necessary timing restrictions associated with the two goshawk territories in the project area. ▪ During development of the project, the transportation system was designed by the wildlife biologist, engineers, and the silviculturist to minimize disturbance to PFAs. Approximately .41 miles of temporary road construction would take place within one of the PFAs

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	during the active nesting period. The active nesting period will normally occur between March 1st and September 30th. c) Where timber harvest is prescribed to achieve desired forest conditions, plan the transportation system to minimize disturbance to the PFAs. For example, small, permanent skid trails should be used in lieu of roads to minimize disturbance in goshawk PFAs. Variance may occur if it is determined that a combination of new permanent or temporary roads and permanent skid trails would result in less overall disturbance to PFA habitat.			under the Proposed Action. It was determined during the project development collaboration that this would result in the least amount of disturbance to the goshawk.
1/CC-24, Goshawk Amendment	Through the landscape assessment process identify plant communities important to goshawk prey species that contain seed, mast, and foliage components that are important to these prey species.	N/A	--	The landscape assessment process described in the Goshawk Amendment has the specific objective of determining opportunities for habitat maintenance or enhancement for the goshawk and its prey. This project was not initiated with the purpose of maintaining or enhancing habitat for the goshawk or its prey. This project was driven by other resource needs. A landscape assessment that results in the identification of important plant communities for goshawk prey species is *(cont.)* outside the scope of this project area analysis.
1/CC-24, Goshawk Amendment	Where it is determined through the landscape assessment process that ungulate grazing is contributing to an identified functioning-at-risk condition relative to habitat needed to support goshawk and its prey,	N/A	--	The landscape assessment process described in the Goshawk Amendment has the specific objective of determining opportunities for habitat maintenance or enhancement for the goshawk and its prey. This project was not initiated with the purpose of maintaining or enhancing

Table A1. LRMP Standard and Guideline Applicability and Consistency.

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	modify grazing practices to maintain or restore the desired seed, mast, and foliage production defined in the landscape assessment process. Review success of modifications annually. If modifications are not providing for the desired progression toward production objectives defined in the landscape assessment, modify practices through the next annual operating plan. This guideline does not apply to non-forest patches.			habitat for the goshawk or its prey. This project was driven by other resource needs. A landscape assessment that results in the identification of functioning-at-risk conditions and changes grazing management is outside the scope of this project area analysis.
1/CC-25, Goshawk Amendment	To help determine opportunities for habitat maintenance or enhancement for goshawk and its prey, conduct landscape analyses at the 5th to 6th order HUC or equivalent ecological scale (10's to 100's of thousands of acres). These assessments provide information concerning resource conditions, risks, and opportunities in a systematic way, thereby enhancing the agency's ability to estimate direct, indirect, and cumulative effects of management actions that may affect habitat for the goshawk and its prey. With this information in hand, managers have a better opportunity to balance the needs of resources and humans and are less likely to negatively impact far-ranging species such as the northern goshawk or other species of concern. Essentially, actions are proposed within the *(cont.)* context provided by the landscape assessment. As a minimum, landscape assessments should describe current status of resources, risks and opportunities (as discussed below) using the	No	--	The landscape assessment process described in the Goshawk Amendment has the specific objective of determining opportunities for habitat maintenance or enhancement for the goshawk and its prey. A district level landscape PFC assessment was conducted and used in the development of desired future conditions (Dixie National Forest, 1997) for this project. While this assessment did not specifically have goshawk habitat objectives, it did provide added information concerning resource conditions and risks to aid in understanding the effects at the broader landscape context. This assessment identified risks and opportunities that will steer projects like this one into improving goshawk habitat. In addition, the intent of a landscape assessment has been met through project development and analysis. During project development, existing conditions were identified for each vegetation type. Properly functioning conditions (PFC) were then identified for *(cont.)* these areas. Knowledge gained from characterizing PFC, utilizing the district-level PFC assessment, guidance from the Forest Plan, and other relevant considerations were used to define desired future conditions. Stand exam data was

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	best information available locally at the time of the assessment. ▪ *Status* in the condition of the resources relative to the historical condition. The historical condition should be depicted through the identification of the historic range of variation (HRV) for the resource attribute of interest (i.e., forest structure, composition, canopy closure), as defined in Regional or local properly functioning condition (PFC) assessments. ▪ *Risk* should include both short- and long-term risks of adversely affecting the current condition of these resources (i.e., insect, disease, wildfire, human related development). ▪ *Opportunities* are situations where either improvements in resource condition or a reduction in risk can be achieved in a landscape through some form of subsequent management decisions. These decisions will be made either through site-specific project decisions or future adjustments in land use plans, both of which include additional analysis and public involvement. Landscape assessments are not *(cont.)* necessary where the Forest or project interdisciplinary team determine that the intent of			available for conditions at a larger scale. Also, information on the Aquarius Plateau regarding the effects of spruce beetle killed trees and forest structure as outlined in the Vegetation Report (Orlemann, 2012c) contributed to resource conditions at the landscape scale. Existing conditions of the spruce/fir at a larger scale were also ascertained through a series of management proposals including; Griffin Springs, Clayton, Bug Lake, Barney Top, and Pockets. Adequate information was available to determine the existing conditions and effects within the cumulative effects area for wildlife that includes the two goshawk territories totaling approximately 12,663 acres and for old growth that includes three watershed drainages totaling approximately 84,730 acres. Sufficient information exists regarding resource conditions and risks to understand effects of the project on goshawk habitat. The list of project level analyses and information of conditions on the Aquarius Plateau described above met the Interdisciplinary Teams' desire for an analytical assessment at a landscape scale.

Table A1. LRMP Standard and Guideline Applicability and Consistency.

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	the assessment has been met through other analytical processes. Meeting the intent means that sufficient information exists concerning resource conditions and risks to understand the effects (direct, indirect, and cumulative) of a proposed site- specific project on goshawk habitat relative to the broader landscape context.			
1/CC-25, Goshawk Amendment	When non-vegetative management activities (for example: land exchanges, recreation facility development, ski resort construction, utility corridors, etc.) are proposed that would result in loss of suitable goshawk habitat, sufficient mitigation measures will be employed to insure an offset of the loss. The biological evaluation (BE) process will be used to document findings, recommend mitigation measures, and evaluate consistency with the intent of the Conservation Strategy and Agreement for Management of the Northern Goshawk in Utah.	N/A	--	This is a vegetative management project.
1/CC-26, Goshawk Amendment	To provide the greatest reduction in risk to loss of habitat needed to support goshawk populations across Utah, treat those acres rated as high or optimum value to goshawks and its prey that are at risk to dropping into the low or moderate value. Variance in this prioritization may occur when management objectives for goshawk habitat in concert with other resource needs, necessitate. In these cases, changes to the quality of goshawk habitat across a landscape should not impact meeting landscape habitat	No	--	The landscape assessment process described in the Goshawk Amendment has the specific objective of determining opportunities for habitat maintenance or enhancement for the goshawk and its prey. This guideline takes information gained from this landscape assessment process and focuses management attention on problem or potential problem areas when goshawk management is the primary objective. This project was not initiated with the purpose of maintaining or enhancing habitat for the goshawk or its prey. This project was driven by other resource needs. Since part of the purpose and need of the project is to move the area towards properly functioning

Manage-ment Area/Page #	Standard/Guideline	Applic-ability	Consis-tent	Rationale
	(cont.) objectives for goshawk habitat quality, quantity and connectivity identified in the landscape assessment.			*(cont.)* condition (PFC), there will be ancillary benefits to goshawk habitat in the project area and across the landscape. Landscape effects are disclosed in the old growth and goshawk cumulative effects found in the Vegetation Report (Orlemann, 2012c) and this Wildlife Report, respectively. Proposed project treatments are consistent with the Habitat Assessment and Management Recommendations (Graham et al., 1999) and the Management Recommendations (Reynolds et al. 1992) as disclosed in this Wildlife Report.
6A/IV-112	Maintain habitat capability at 70 percent of potential.	N/A	--	This standard and guideline applies to rangeland habitat capability. The project is designed to treat forest vegetation and does not involve livestock grazing management nor does it impact rangeland habitat capability.
6A/IV-112	When conflicts arise develop utilization standards for big game. Resolve conflicts in favor of big game.	N/A	--	The project is designed to treat forest vegetation and does not involve livestock grazing management.
9A/IV-138	Where natural biologic and geologic conditions will allow, maintain or improve overall stream habitat condition at or above 50 percent of optimum.	N/A	--	The Management Direction for this guideline refers to fish species the DWR has population goals for. See stream bank response above.

*The Environmental Impact Statement (EIS) for the Dixie National Forest Land and Resource Management Plan (DNF LRMP), Appendix C, defines an arterial road as a road that provides service to large land areas and usually connect with public highways or areas or other Forest arterial roads to form an integrated network of primary travel routes (USDA Forest Service, 1986, p. C-2). Using the definition found in the EIS, road #30140 was identified as the only arterial road in the project area. This road is also the only Maintenance Level 3 road in the project area. The EIS also defines a collector road (p. C-6), as a road that collects traffic from Forest Roads or terminal facilities. Facilities are defined (p. C-12) as improvements that are used for shelter or support of Forest Service programs. There are no roads within the project area that access facilities. The only roads identified as collector roads that collect traffic from other Forest Roads within the project area is road #31910 and #31369.

Since the forest plan defines hiding cover within forested stands as that needed to hide 90 percent of a standing deer or elk at a distance of at least 200 feet. Using GIS, a 200 foot buffer

was placed on both sides of roads #30140, #31910, and #31369. Forested stands that had any part within the buffer and had adequate stand exam data were used in calculating hiding cover using Forest Vegetation Simulator (FVS).

Appendix C. Forest Vegetation Regulatory Compliance Documentation & Forest Plan Checklist

C1 – Compliance with the National Forest Management Act

C2 – Best Available Science

C3 – Forest Plan Consistency Checklist

C1 – Compliance with the National Forest Management Act

Because this project involves vegetative management treatments, compliance with the timber harvest provisions of the National Forest Management Act (NFMA) is required.

16 U.S.C. 1604 (g)(3)(E)

Under 16 U.S.C. 1604 (g)(3)(E), a responsible official may authorize site-specific projects and activities on NFS lands to harvest timber only where:

1. Soil, slope, or other watershed conditions will not be irreversibly damaged (16 U.S.C. 1604 (g)(3)(E)(i)).

Response: Soil and water conservation practices implemented in project design and contract initiation are effective in minimizing impacts to site productivity and conserving soil and water resources. These are discussed in the Soils and Hydrology reports. Contract clauses will be used that implement soil and water conservation practices, such as directional felling, designated skid trails, endlining, etc. There has been no finding of irreversible damage to soils, slopes, or other watershed conditions from proposed treatments.

Soil disturbance and watershed condition is monitored through adherence to the timber sale contract which contains the soil and water conservation practices. Finally, the project area is mostly level to slightly sloping.

2. There is assurance that the lands can be adequately restocked within five years after final regeneration (16 U.S.C. 1604 (g)(3)(E)(ii)).

Response: Stands proposed for commercial harvest treatment in the Engelmann spruce have been identified as being capable of adequate restocking within five years of final harvest. Treatments are designed to maintain stand density levels above stocking rates. Past tree planting within the project area has resulted in certified stocked stands.

Aspen stands proposed for regeneration treatment have been designed to optimize suckering rates and survival from browsing pressures as disclosed in the vegetation section. These treatments are located on areas suitable for timber harvest. The design of the project uses current research and experience on the district in treating large blocks, removing competing conifer, and clearfelling aspen to stimulate sprouting. District experience shows following these techniques can result in adequately stocked stands of aspen regeneration. Monitoring would be used to assess the success of regeneration efforts following project completion. Desired results and forest plan standards would be specifically stated in the detailed silvicultural prescriptions written for each area.

3. Protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment where harvests are likely to seriously and adversely affect water conditions or fish habitat (16 U.S.C. 1604 (g)(3)(E)(iii)).

Response: Analysis of both action alternatives shows that there would be no change to water quantity in any of the affected watersheds. Affects to water quality and fish habitat would be negligible due to the implementation of the required soil and water conservation practices. Soil and water conservation practices provide protection for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water. There has been no finding that project activities are likely to

seriously and adversely affect water conditions or fish habitat through changes in water temperatures, blockages of water courses, or deposits of sediment.

The forest plan requires a 100-foot treatment buffer on all perennial streams in Dixie National Forest. The road system has been revised through time to avoid wet areas and the crossing of perennial or intermittent streams. Moreover, timber sale layout procedures include intensive surveying of ground conditions and identification of additional wetland features.

4. The harvesting system to be used is not selected primarily because it will give the greatest dollar return or the greatest unit output of timber (16 U.S.C. 1604 (g)(3)(E)(iv)).

Response: While forest product outputs were considered in the decision process, other factors related to reducing the impacts of wildfire, enhancing diversity of aspen, and protecting resources within the project area are the primary factors used to determine the harvesting system. The reasons for the decision are described in the Decision Notice.

16 U.S.C. 1604 (g)(3)(F)

Under 16 U.S.C. 1604 (g)(3)(F), a responsible official may authorize site-specific projects and activities on National Forest System lands using clearcutting, seed tree cutting, shelterwood cutting, and other cuts designed to regenerate an even-aged stand of timber as a cutting method only where:

1. For clearcutting, it is determined to be the optimum method; for other methods it is determined to be appropriate and meets the objectives and requirements of the applicable land management plan (16 U.S.C. 1604 (g)(3)(F)(i)).

Response: Under the Iron Springs action alternatives, aspen clearcutting is proposed. Based on past district experience, as well as research, clearcutting has proven to be the optimum method of aspen regeneration. Design of the treatment is based on best meeting the purpose and need for actions.

Even-aged treatments are included in this proposal. These treatments have proven to be the best method of regenerating aspen and are designed to meet the objectives described for this project. Aspen is a shade-intolerant species that regenerates by sprouting in response to disturbance. The forest plan also provides direction regarding clear-felling of aspen (Forest Plan, pp. IV-68, IV-71, IV-112, IV-116, IV-119).

2. The interdisciplinary review has been completed and the potential environmental, biological, aesthetic, engineering, and economic impacts on each advertised sale area have been assessed, as well as the consistency of the sale with the multiple use of the general area (16 U.S.C. 1604 (g)(3)(F)(ii)).

Response: The Iron Springs EA and decision notice constitute the interdisciplinary review of the potential environmental, biological, aesthetic, engineering, and economic impacts. The project is consistent with the multiple uses of the general area.

The interdisciplinary review has considered the potential environmental, biological, aesthetic, engineering, and economic impacts of the Iron Springs Project. This is summarized in the EA, and further documented in the project record. The cutting methods are consistent with the Dixie Forest Plan multiple-use management program.

3. Cut blocks, patches, or strips are shaped and blended to the extent practicable with the natural terrain (16 U.S.C. 1604 (g)(3)(F)(iii)).

Response: The proposed treatments areas are located within the natural terrain features of the project area and generally follow natural stand boundaries.

4. There are established according to geographic areas, forest types, or other suitable classifications the maximum size limits for areas to be cut in one harvest operation, including provision to exceed the established limits after appropriate public notice and review by the responsible Forest Service officer one level above the Forest Service officer who normally would approve the harvest proposal: Provided, that such limits shall not apply to the size of areas harvested because of natural catastrophic conditions such as fire, insect and disease attack, or windstorm (16 U.S.C. 1604 (g)(3)(F)(iv)).

Response: Maximum size limits for areas to be treated with regeneration harvests, including clearcuts, are set by the forest plan at 40 acres (Forest Plan, p. IV-40). The Iron Springs action alternatives do not include regeneration cuts that exceed this size limit

5. Such cuts are carried out in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation, and esthetic resources, and the regeneration of the timber resource (16 U.S.C. 1604 (g)(3)(F)(v)).

Response: The effects on each resource are disclosed in the Iron Springs EA and Decision Notice. The effects of implementing the regeneration harvests proposed by the project are consistent with the protection of soil, watershed, fish, wildlife, recreation, and esthetic resources, as well as the regeneration of the timber resource. This is supported by the project record.

16 U.S.C. 1604 (m)

Under 16 U.S.C. 1604 (m), the Secretary shall establish:

Standards to insure that, prior to harvest, stands of trees throughout the National Forest System shall generally have reached the culmination of mean annual increment of growth (calculated on the basis of cubic measurement or other methods of calculation at the discretion of the Secretary): Provided, That these standards shall not preclude the use of sound silvicultural practices, such as thinning or other stand improvement measures: Provided further, That these standards shall not preclude the Secretary from salvage or sanitation harvesting of timber stands which are substantially damaged by fire, windthrow or other catastrophe, or which are in imminent danger from insect or disease attack; . . . (16 U.S.C. 1604 (m)(1)).

Response: Harvest treatments within the conifer stands are salvage intermediate within an uneven-aged system; no regeneration harvest is proposed. Proposed even-aged regeneration treatments within the aspen stands occur in mature, seral stands which have exceeded rotation age. Furthermore, the stands proposed for harvest have attained culmination of mean annual increment of growth. Debyle and Winokur (1985) suggest an average rotation age of 80 to 100 years given various factors for judging culmination of mean annual increment. The aspen stands proposed for cutting are mature and are declining due to age, disease, and competition from conifer trees.

C2 – Best Available Science

In addition to the references cited directly in this report, the interdisciplinary team collected, reviewed, and considered numerous papers, reports, and peer-reviewed articles regarding forest vegetation. These documents constitute the best science available to the agency at this time. They were used to inform project design as well as effects analysis, and are addressed specifically where appropriate.

Many of the special interest groups that disagree with the mission of the Forest Service routinely submit documents that purport to prove that "science" is opposed to whatever forest management treatments the agency might propose. In letters to the agency during scoping and other comment periods, these groups often state, inter alia, that the agency may not proceed with management because "science" is against it and that the agency has not used the best available science in its process because it has adopted a position on scientific disputes that is different from theirs.

It is, however, possible for the Forest Service to consider a scientific document and reach a conclusion about it that is different from the conclusion that a special interest group will reach. That is a permissible outcome. The Forest Service is not required to agree with the conclusions reached by special interest groups. "Competing" views of the scientific literature are common. The Forest Service considers the competing view but is not required to adopt it.

This fact has recently been noted numerous times by the Federal courts in California. In *Earth Island Institute* v. *Carlton*, 2:09-cv-02020-FCD-EFB (E.D. Cal. Aug. 20, 2009), California interest groups raised this exact topic in court. In response, the court, following a very strongly worded order from the Ninth Circuit in *The Lands Council* v. *McNair*, said that, "the role of the court is necessarily at its most deferential when assessing the agency's consideration of technical matters." That court went on to find that "the [Forest Service] FS considered [plaintiff]'s views and simply did not agree with his conclusions. Instead, the FS chose to follow other scientific opinions. (NEPA only requires the FS to consider and respond to comments, not to agree with them). The FS's decision, after considering [plaintiff]'s views, to follow scientific opinions contrary to [plaintiff]'s does not violate NEPA." (Internal citations omitted.)

For this vegetation specialist report, the Dixie National Forest has considered scientific documents submitted by the public during the process, obtained by its own specialists during the process, and reviewed by experts on other national forests. A partial list of those activities is included here:

Review and consideration of science evaluation conducted by the Nez Perce National Forest for the Antler post-fire salvage project.

Review and consideration of science evaluation conducted by the Malheur National Forest for the Egley Project.

Review and consideration of science evaluation conducted by the Kaibab National Forest for the Warm Fire Recovery Project.

Review and incorporation of a previous science evaluation conducted by the Sequoia National Forest for the Vista Fire Restoration and Recovery Project.

Direct review, citation, and bibliography of approximately 120 scientific documents in the body of this report itself.

Review and consideration of legal opinions specifically applicable to the issue of "competing" science. For example, *The Lands Council* v. *McNair* (9th Cir.) has been considered and added to this project record. As has *Earth Island Institute* v. *Carlton* (E.D. Cal.).

Each of these documents is part of the project record for the Iron Springs Project, which is available for review upon request.

This forest vegetation report has been based on the relevant science, has reviewed and discussed responsible opposing views where necessary, and has disclosed the hundreds of documents relied upon in its analysis. In short, this forest vegetation report has thoroughly considered the best available science.

Aspen

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Durham D.A., and C.B. Marlow. 2010. Aspen response to prescribed fire under managed cattle grazing and low elk densities in southwest Montana. *Northwest Science* 84(2):9.

Edenius, L., and G. Ericsson. 2007. Aspen demographics in relation to spatial context and ungulate browsing: Implications for conservation and forest management. *Biological Conservation* 135:293–301.

Harniss, R.O., and K.T. Harper. 1982. Tree dynamics in seral and stable aspen stands of central Utah. Res.Pap. INT-297. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 7 pp.

Hildebrand, D.M., and W.R. Jacobi. 1990. Comparisons between aspen harvest units with and without adequate resprouting in the Rocky Mountain Region. Tech. Rep. R2-46A. Lakewood, CO: USDA Forest Service, Timber, Forest Pest, and Cooperative Forestry Management. 41 pp.

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Hittenrauch, H.R. 1984. Aspen management via commercial timber sales. Proceedings of a symposium; 1984 May 22–24, Colorado Springs, CO. Aspen Symposium.108–111.

Kay, C.E. 1995. Aboriginal overkill and native burning: Implications for modern ecosystem management. *Western Journal of Applied Forestry* 10:121–126.

Kaye, M.W., D. Binkley, and T.J. Stohlgren. 2005. Effects of conifers and elk browsing on quaking aspen forests in the central Rocky Mountains, USA. *Ecological Applications* 15(4):1284–1295.

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Oukrop, C.M. 2010. Assessing quaking aspen (*Populus tremuloides*) decline on Cedar Mountain in southern Utah using remote sensing and geographic information systems. Utah State University Graduate Theses and Dissertations. Paper 582.

Rolf, J.M. 2001. Aspen fencing in northern Arizona: A 15-year perspective. Pages 193–196 in: Shepperd, W.D., D. Binkley, D.L. Bartos, T.J. Stohlgren, L.G. Eskew, compilers. 2001. Sustaining Aspen in Western Landscapes: Symposium Proceedings; 13–15 June 2000; Grand Junction, CO. Proceedings RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Rumble, M.A., T. Pella, J.C. Sharps, A.V. Carter, and J.B. Parrish. 1996. Effects of logging slash on aspen regeneration in grazed clearcuts. *The Prairie Naturalist* 28(4):199–209.

Schier, G.A. 1975. Deterioration of aspen clones in the middle Rocky Mountains. Res.Pap. INT-170. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 20 pp.

St. Clair S.B., K.E. Mock, E.M. LaMalfa, R.B. Campbell, and R.J. Ryel. 2010. Genetic contributions to phenotypic variation in physiology, growth, and vigor of western aspen (*Populus tremuloides*) clones. *Forest Science* 56(2):222–230.

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Utah Forest Restoration Working Group. 2010. Guidelines for aspen restoration on the national forests of Utah. Utah State University, DigitalCommons@USU. 48 pp.

Witt, C. 2010. Characteristics of aspen infected with heartrot: Implications for cavity-nesting birds. *Forest Ecology and Management* 260(6):1010–1016.

Bark Beetles

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Bentz, B.J., R. Jacques, C.J. Fettig, E.M. Hansen, J.L. Hayes, J.A. Hicke, R.G. Kelsey, J.F. Negrón, and S.J. Seybold. 2010. Climate change and bark beetles of the Western United States and Canada: Direct and indirect effects. *BioScience* 60(8):602–613.

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Craighead, F.C., J.M. Miller, J.A. Evenden, and F.P. Keen. 1931. Control work against bark beetles in western forests and an appraisal of results. *Journal of Forestry* 29:1001–1018.

Eisenhart, K.S., and T.T. Veblen. 2000. Dendroecological detection of spruce bark beetle outbreaks in northwestern Colorado. *Canadian Journal of Forest Research* 30:1788–1798.

Goyer R.A., M.R. Wagner, and T.D. Schowalter. 1998. Current and proposed technologies for bark beetle management. *Journal of Forestry* 96(12):29–33.

Hebertson, E.G., and M.J. Jenkins. 2007. The influence of fallen tree timing on spruce beetle brood production. *Western North American Naturalist* 67(3):452–460.

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Massey, C.L., and N.D. Wygant. 1954. Biology and control of the Engelmann spruce beetle in Colorado. USDA Circular Number 944. Washington, D.C. 35 pp.

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Parker, T. J., K.M. Clancy, and R.L. Mathiasen. 2006. Interactions among fire, insects and pathogens in coniferous forests of the interior western United States and Canada. *Agricultural and Forest Entomology* 8:167–189.

Pretzlaw T., C. Trudeau, M.M. Humphries, J.M. LaMontagne, and S. Boutin. 2006. Red squirrels (*Tamiasciurus hudsonicus*) feeding on spruce bark beetles (*Dendroctonus rufipennis*): Energetic and ecological implications. *Journal of Mammalogy* 87(5):909–914.

Raffa, K.F., B.H. Aukema, B.J. Bentz, A.L. Carroll, N. Erbilgin, D.A. Herms, J.A. Hicke, R.W. Hofstetter, S. Katovich, B.S. Lindgren, J.A. Logan, W. Mattson, A.S. Munson, D.J. Robison, D.L. Six, P.C. Tobin, P.A. Townsend, and K.F. Wallin. 2009. A literal use of “forest health” safeguards against misuse and misapplication. *Journal of Forestry* 107(5):276–277.

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Schmid, J.M., and R.H. Frye. 1976. Stand ratings for spruce beetles. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Research Note RM-309.

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Climate Change

Aber, J., R.P. Neilson, S. McNulty, J.M. Lenihan, D. Bachelet, and R.J. Drapek. 2001. Forest processes and global environmental change: predicting the effects of individual and multiple stressors. *Bioscience* 51(9): 735–751.

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Boerner, R.E.J., J. Huang, and S.C. Hart. 2008. Fire, thinning, and the carbon economy: effects of fire and fire surrogate treatments on estimated carbon storage and sequestration rate. *Forest Ecology and Management* 255(2008):3081–3097.

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Bottcher, H., A. Freibauer, M. Obersteiner, and E. Schulze. 2008. Uncertainty analysis of climate change mitigation options in the forestry sector using a generic carbon budget model. *Ecological Modeling* 213(2008):45–62.

Brown, T.J., B.L. Hall, A.L. Westerling. 2004. The Impact of Twenty-First Century Climate Change on Wildland Fire Danger in the Western United States: An Applications Perspective. *Climatic Change* 62(1): 365–388.

Cathcart, J.F., J.D. Kline, M. Delaney, and M. Tilton. 2007. Carbon Storage and Oregon's Land-Use Planning Program. *Journal of Forestry* 105(4):167–172.

Depro, B.M., B.C. Murray, R.J. Alig, and A. Shanks. 2008. Public land, timber harvests, and climate mitigation: Quantifying carbon sequestration potential on U.S. public timberlands. *Forest Ecology and Management* 255(2008):1122–1134.

This article by Depro et al. uses simulation modeling to evaluate the forest carbon implications of three broad scenarios of management of U.S. public forests. Their analysis concludes that a “no timber harvest” scenario results in more carbon stored in public forests over coming decades nationwide than a “business-as-usual” scenario of 15 to 20 million cubic feet of timber harvest volume per decade. This conclusion, and their entire model, is based on the assumption that fire, insects, disease, and other natural mortality would remove timber volume on 140,000 acres annually on all public forests in the contiguous 48 States, a small fraction of actual recent forest disturbance rates (Westerling et al. 2006). The paper does not specifically address the forest types, current conditions, or natural disturbance regimes of the project area. Most significantly, the paper grossly underestimates or ignores the role of fire, forest insects, and forest pathogens in the forest carbon cycle. Throughout the Rocky Mountains, these natural disturbance processes have much greater impacts on carbon stocks and rates of carbon sequestration by forests than timber harvesting and fuels management. Attempting to maximize forest carbon storage in these forests may be counter-productive because increasing tree density often increases drought stress, vulnerability to mortality from bark beetles, and probability of crown fire. Indeed, in some forest types, increasing tree density may lead to the loss of old trees and substantial loss of carbon stocks (Fellows and Goulden 2008).

Fellows, A.W. and M. L. Goulden 2008. Has fire suppression increased the amount of carbon stored in Western U.S. forests? Geophysical Research Letters 35, L12404, doi:10.1029/2008GL033965.

Westerling A.L., Hidalgo H.G., Cayan D.R., Swetnam T.W. 2006. Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity. Science 313(5789):940-943.

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Harmon, M.E. 2001. Carbon sequestration in forests - Addressing the scale question. *Journal of Forestry* 99(4):24-29.

Harmon, M.E., Ferrell, W.K., Franklin, J.F. 1990. Effects on Carbon Storage of Conversion of Old-Growth Forests to Young Forests. *Science* 247(4943):699-702.

Harmon, M.E., Marks, B. 2002. Effects of silvicultural practices on carbon stores in Douglas-fir-western hemlock forests in the Pacific Northwest, USA: results from a simulation model. *Canadian Journal of Forest Research* 32(5):863-877.

Harmon et al. (1990) and Harmon (2001) provide general descriptions of the carbon cycle for forests in western Oregon and Washington. These papers make the point that old forests generally store more carbon than younger forests. While we agree with that fact, it is also true that the forests of western Oregon and Washington have disturbance and succession dynamics, and thus carbon dynamics, that differ substantially from the Dixie National Forest.

Similarly, Harmon and Marks (2002) focus primarily on the aspects of dynamics of Douglas-fir/western hemlock forests in western Oregon and Washington. This study uses a computer model to examine the carbon implications of several silvicultural practices. This study found that: forests protected from fire stored the greatest amount of landscape-level carbon; carbon stores increased with rotation length (assuming no natural disturbance); and carbon stores decreased as the fraction of trees harvested and detritus removed increased. Pertinent to the commenters suggested policy prescription, the authors concluded that in the case of high wood products utilization and severe slash-burning, increasing rotation length from 40 to 120 years increased landscape-level carbon stores more than 2.5 fold. The authors concluded that partial timber harvest with minimum use of slash-burning may increase carbon stores to two-fold compared to silvicultural practices that authors describe as traditional for the study area. In addition, based on their model simulations, the authors concluded that if carbon storage was the only land management consideration conversion to an old-growth dominated landscape would be the best option because the model suggests such a landscape would store close to 90 percent of the potential maximum. Again, we note that these conclusions for forests of western Oregon and Washington are unlikely to apply to the Dixie National Forest.

Hennigar, C.R., D.A. MacLean, and L.J. Amos-Binks. 2008. A novel approach to optimize management strategies for carbon stored in both forests and wood products. *Forest Ecology and Management* 256(2008):786–797.

Hogg, E.H., and P.Y. Bernier. 2005. Climate change impacts on drought-prone forests in western Canada. *Forestry Chronicle* 81(5):675– 682.

Homann, P.S., Harmon, M., Remillard, S., Smithwick, E.A.H. 2005. What the soil reveals: Potential total ecosystem C stores of the Pacific Northwest region, USA. *Forest Ecology and Management* 220(1-3):270-283.

Homann et al. (2005) measured total ecosystem organic carbon in 35 old growth forest stands in Oregon and Washington. All but four stands were in relatively warm and wet forests in coastal forests or on the west-side of the Cascade Mountains. The authors extrapolated the carbon measurements from these stands to estimate the theoretical potential carbon stores for the entire region (western Oregon and Washington). Comparing the results of this extrapolation to estimates of existing carbon stocks from other studies (using different methods), the authors concluded that current carbon storage in western Oregon and Washington is less than half the **theoretical** potential. The authors acknowledged that converting to a “theoretical landscape without catastrophic natural or human disturbance” is **unrealistic**. This paper, and a very similar paper by many of the same authors (Smithwick et al. 2002), explain that natural disturbance regimes and

other factors will result in regional carbons sequestration capacities that may be much different from the theoretical potential reported in Homann et al. (2005).

Smithwick, E.A., M.E. Harmon, S. M. Remillard, S.A. Acker, and J.F. Franklin. 2002. Potential upper bounds of carbon stores in forests of the Pacific Northwest. *Ecological Applications* 12: 1303-1317.

Hudiburg, T., Beverly Law, David P. Turner, John Campbell, Dan Donato, and Maureen Duane. 2009. Carbon dynamics of Oregon and Northern California forests and potential land-based carbon storage. *Ecological Applications* 19(1):163–180.

Hurteau, M.D., W.K. George, and B.A. Hungate. 2008. Carbon protection and fire risk reduction: toward a full accounting of forest carbon offsets. *Frontiers in Ecology and the Environment* 6(9):493–498.

Irland, L.C., D. Adams, R. Alig, C.J. Betz, C.C. Chen, M. Hutchins, B.A. McCarl, K. Skog, and B.L. Sohngen. 2001. Assessing Socioeconomic Impacts of Climate Change on US Forests, Wood-Product Markets, and Forest Recreation. *BioScience* 51(9):753–764.

Kashian, D.M., W.H. Romme, D.B. Tinker, M.G. Turner, and M.G. Ryan. 2006. Carbon storage on landscapes with stand-replacing fires. *Bioscience* 56(7):598–606.

Liu, G., and S. Han. 2009. Long-term forest management and timely transfer of carbon into wood products help reduce atmospheric carbon. *Ecological Modeling* 220(2009):1719–1723.

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Maness, T.C. 2009. Forest management and climate change mitigation: Good policy requires careful thought. *Journal of Forestry* (2009):119–124.

Manning, A.D., P. Gibbons, and D.B. Lindenmayer. 2009. Scattered trees: a complementary strategy for facilitating adaptive responses to climate change in modified landscapes? *Journal of Applied Ecology* 46(2009):915–919.

McKenzie, D., Gedalof, Z., Peterson, D.L., Mote, P. 2004. Climatic change, wildfire, and conservation. *Conservation Biology* 18(4):890-902.

The McKenzie paper concludes that, ”Climatic change, fire policy, and fuel-treatment strategies are complex biosocial issues, and integrating them with wildlife conservation objectives is challenging.” This is a conclusion with which we can all agree. This conclusion is not, however, applicable to the Dixie’s management of the Iron Springs area. Moreover, in picking through specific species of concern, the authors conclude that management, when combined with the uncertainties of climate change, may have negative consequences (sage grouse), positive consequences (black-backed woodpecker), or consequences that are “difficult to identify” (amphibians). In other words, the McKenzie paper simply highlights a number of uncertainties associated with climate change and speculates about possible future affects. In conclusion, McKenzie et al., state: “Reasoned discussions among decision makers, public-land managers, and stakeholders at local and regional scales can help in the development of resource management strategies that mitigate risk to ecosystems and sensitive species.” This sounds like a recommendation that matches the efforts of the Escalante Ranger District, the Dixie

National Forest, and the interdisciplinary team to reach out to local land owners, special interest groups, and regional and national agencies for collaboration on this and other proposed management activities.

McNulty, S.G., and J.D. Aber. 2001. U.S. national climate change assessment on forest ecosystems: An introduction. *BioScience* 51(9):720–722.

Mitchell, S.R., M.E. Harmon, and K.E.B. O'Connell. 2009. Forest fuel reduction alters fire severity and long-term carbon storage in three Pacific Northwest ecosystems. *Ecological Applications* 19(3):643–655.

North, M., M. Hurteau, and J. Innes. 2009. Fire suppression and fuels treatment effects on mixed-conifer carbon stocks and emissions *Ecological Applications* 19:1385–1396.

Reyer, C., M. Guericke, and P.L. Ibisch. 2009. Climate change mitigation via afforestation, reforestation and deforestation avoidance: and what about adaptation to environmental change? *New Forests* 38(2009):15–34.

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C3 – Forest Plan Consistency Checklist

Table C3a. Forest plan standard and guideline applicability

Management Area/Page No.	Standard/Guideline	Applicability	Rationale
Forestwide/ IV-37	Identify lands available and suitable for timber production by following the process described in FSM 2412.	Yes	See Table C3b.
Forestwide/ IV-37	Stand volume growth data will be collected during stand examination.	No	Prior to initiating the Iron Springs Project stand exam data were collected, including volume data.
Forestwide/ IV-39	Apply a variety of sllvlculture systems and harvest methods which best meet resource management objectives.	Yes	See Table C3b.
Forestwide/ IV-39	To facilitate the control of soil erosion within acceptable tolerance soil surveys or site specific soil data will be used to develop project level harvest systems.	Yes	See Table C3b.
Forestwide/ IV-39	Clearcuts may be applied to dwarf mistletoe infected stands of any forest cover type	No	The Iron Springs Project does not include clearcuts in dwarf mistletoe infected stands.
Forestwide/ IV-39	Assure that all even-aged stands scheduled to be harvested during the planning period will generally have reached the culmination of mean annual increment of growth.	Yes	See Table C3b.
Forestwide/ IV-40	Minimize soil surface compaction and disturbance by curtailing logging activities during periods of high soil moisture. Design skid trail system to minimize extent of area impacted.	Yes	See Table C3b.
Forestwide/ IV-40	The maximum size of openings created by the application of even-aged silviculture will be 40 acres regardless of forest cover type.	Yes	See Table C3b.
Forestwide/ IV-40	Acceptable management intensity activities to determine harvest levels	Yes	See Table C3b.
Forestwide/ IV-41	Make Christmas trees available in areas where other resource objectives can be accomplished through	No	The Iron Springs Project does not have objectives to be accomplished by Christmas tree sales.

Table C3a. Forest plan standard and guideline applicability

Management Area/Page No.	Standard/Guideline	Applicability	Rationale
	commercial or personal use Christmas tree sales.		
Forestwide/ IV-41	Examine modifications to silvicultural techniques and harvest practices in the spruce-fir and mixed conifer timber types to increase water yield. Implement changes when not inconsistent with other multiple use management goals.	No	The purposes of the Iron Springs Project include improving forest health and providing forest products to the public. Techniques for improving water yield are not included in these goals.
Forestwide/ IV-41	Establish a satisfactory stand on cutover areas, emphasizing natural regeneration within five years, where feasible, after final harvest	Yes	See Table C3b.
Forestwide/ IV-41	Do not apply final shelterwood removal cut until the desired number (as specified) of well-established seedling/acre are expected to remain following overwood removal.	No	The Iron Springs Project does not include any shelterwood cuts.
Forestwide/ IV-41	Use trees of the best genetic quality available which are adapted to the planting site.	Yes	See Table C3b.
Forestwide/ IV-41	Where appropriate, use K-V funds for soil and watershed rehabilitation and/or wildlife habitat improvement.	No	The Iron Springs NEPA process has identified no soil and watershed rehabilitation or wildlife habitat improvement needs. Nor does this report address any source of funding.
2B/IV-69	Do not go below an adopted VQO of partial retention.	N/A	Visual quality objectives (VQO) have been replaced by the Scenery Management System per Forest Plan Amendment #8. Scenic integrity objectives are addressed in Table C3b.
2B/IV-69	Maintain or establish a minimum of 30 percent of the forested area within a unit to provide horizontal diversity.	N/A	See VQO response above.
2B/IV-69	Maximum recreation use and capacity levels.	No	The Iron Springs Project makes no decisions regarding recreation use or capacity.

Management Area/Page No.	Standard/Guideline	Applicability	Rationale
2B/IV-70	Manage local roads for public use. Designate routes and areas which can be periodically closed: —Gathering firewood. —Operating oversnow vehicles.	No	The Iron Springs Project makes no decisions regarding road closures or designations. Travel management in the project area was decided under Griffin Springs Travel Management Decision Notice and FONSI in 2006.
2B/IV-70	Specify off-road vehicle restrictions based on ORV use management.	No	As a result of the 2006 Griffin Springs Travel Management decision, this area is closed to off-road travel.
2B/IV-71	When the VQO of an area is partial retention, the regenerated stand shall meet or exceed all of the following characteristics before a [Conifer] cutover area is no longer considered an opening: 150 trees per acre, 25 foot tree height, 30 percent crown closure, 60 percent stocking. For Aspen, the characteristics are: 300 trees per acre, 25 foot tree height, 30 percent crown closure, 75 percent stocking.	N/A	See VQO response above.
2B/IV-71	Include applicable special stipulations [when processing mineral lease applications, permits, and licenses].	No	The Iron Springs Project is designed to treat forest vegetation and does not involve mineral lease applications, permits, or licenses.
2B/IV-72	On all nonforested areas, motorized trail and local road density is not to exceed 2 miles per square mile.	No	The Iron Springs Project makes no decisions regarding road closures or designations.
6A/IV-110	Do not go below an adopted VQO of modification.	N/A	See VQO response to 2B/IV-69.
6A/IV-110	When projects require clearing of vegetation and/or soil disturbance, use irregular clearing edges and shapes to blend with the natural landscapes.	N/A	See VQO response to 2B/IV-69.
6A/IV-110	Maximum recreation use and capacity levels.	No	The Iron Springs Project makes no decisions regarding recreation use or capacity.

Table C3a. Forest plan standard and guideline applicability

Management Area/Page No.	Standard/Guideline	Applicability	Rationale
6A/IV-111	Specify off-road vehicle restrictions based on ORV use management.	No	As a result of the 2006 Griffin Springs Travel Management decision, this area is closed to off-road travel.
6A/IV-112	Maintain habitat capability at 70 percent of potential.	No	This standard and guideline applies to rangeland habitat capability. The Iron Springs Project is a forest vegetation treatment and does not impact rangeland habitat capability.
6A/IV-112	When conflicts arise develop utilization standards for big game. Resolve conflicts in favor of big game.	No	Iron Springs is designed to treat forest vegetation and will have no significant effect on forage; no conflicts have been identified.
6A/IV-112	Base range condition on the standards in Range Analysis Handbook.	No	The Iron Springs Project is designed to treat forest vegetation and will have no effect on range condition.
6A/IV-112	Base economic analysis on Project Effectiveness Analysis Handbook.	No	This standard and guideline applies to “grazing management.” The Iron Springs Project is a forest vegetation treatment and makes no decisions regarding grazing management.
6A/IV-112	Structural improvements will not adversely affect big game movement.	No	There are no structural improvements associated with this project.
6A/IV-112	Apply release and weeding as needed to improve visual quality.	N/A	See VQO response to 2B/IV-69.
6A/IV-112	When the VQO of an area is partial retention, the regenerated stand shall meet or exceed all of the following characteristics before a [Spruce/Fir] cutover area is no longer considered an opening: 150 trees per acre, 6 foot tree height, 30 percent crown closure, 60 percent stocking. For Aspen, the characteristics are: 300 trees per acre, 6 foot tree height, 30 percent crown closure, 75	N/A	See VQO response to 2B/IV-69.

Management Area/Page No.	Standard/Guideline	Applicability	Rationale
	percent stocking.		
7A/IV-117	Do not go below an adopted VQO of partial retention within the foreground of arterial/collector roads and primary trails. Modification on all other areas.	N/A	See VQO response to 2B/IV-69.
7A/IV-117	Apply rehabilitation practice where the VQO objectives are not currently being met.	N/A	See VQO response to 2B/IV-69.
7A/IV-117	Maximum recreation use and capacity levels.	No	The Iron Springs Project makes no decisions regarding recreation use or capacity.
7A/IV-118	Specify off-road vehicle restrictions based on ORV use management.	No	As a result of the 2006 Griffin Springs Travel Management decision, this area is closed to off-road travel.
7A/IV-119	Vary utilization standards with grazing system and ecological condition. Specify standards in the allotment management plan.	No	This standard and guideline applies to range management. The Iron Springs Project is a forest vegetation treatment and makes no decisions regarding range management.
7A/IV-119	Maximum grazing use on transitory ranges resulting from clear cuts is grasses 50 percent of current growth.	Yes	See Table C3b.
7A/IV-119	When the VQO of an area is modification or maximum modification, the regenerated stand shall meet or exceed all of the following characteristics before a [Spruce/Fir] cutover area is no longer considered an opening: 150 trees per acre, 6 foot tree height, 30 percent crown closure, 60 percent stocking. For Aspen, the characteristics are: 300 trees per acre, 6 foot tree height, 30 percent crown closure, 75 percent stocking.	N/A	See VQO response to 2B/IV-69.
9A/IV-136	Do not go below an adopted VQO of partial retention.	N/A	See VQO response to 2B/IV-69.
9A/IV-136	Maximum use and capacity levels	No	The Iron Springs Project makes no decisions regarding recreation use

Table C3a. Forest plan standard and guideline applicability

Management Area/Page No.	Standard/Guideline	Applicability	Rationale
			or capacity.
9A/IV-137	Specify off-road vehicle restrictions based on ORV Use Mgmt.	No	As a result of the 2006 Griffin Springs Travel Management decision, this area is closed to off-road travel.
9A/IV-138	Where natural biologic and geologic conditions will allow, maintain or improve overall stream habitat condition at or above 50 percent of optimum.	No	The Iron Springs Project proposes treatments in forested areas and does not address stream habitat condition.
9A/IV-138	Utilization standard for a rest rotation system: up to 60 percent of grass/forb/willows (trampled areas and streambank damage caused during use year should be healed or stabilized within the following rest year). Utilization standard for deferred rotation system: up to 50 percent of grass/forb/willows (browse utilization within the riparian ecosystem will not exceed 50 percent of new leader production).	No	This standard and guideline applies to range management. The Iron Springs Project is a forest vegetation treatment and makes no decisions regarding range management.
9A/IV-139	When the VQO of an area is partial retention, the regenerated stand shall meet or exceed all of the following characteristics before a [Conifer] cutover area is no longer considered an opening: 150 trees per acre, 25 foot tree height, 30 percent crown closure, 60 percent stocking. For Aspen, the characteristics are: 300 trees per acre, 25 foot tree height, 30 percent crown closure, 60 percent stocking.	N/A	See VQO response to 2B/IV-69.
9A/IV-140	Implement mitigation measures when present or unavoidable future facilities are located in the active floodplain to ensure that State water quality standards, bank stability criteria, flood hazard reduction and instream flow standards are met during and immediately after construction.	No	No present or future facilities are associated with the vegetation treatments proposed for Iron Springs.

Management Area/Page No.	Standard/Guideline	Applicability	Rationale
9A/IV-141	Limit changes in channel rating or classification scores to an increase of 10 percent or less.	No	The Iron Springs Project proposes treatments in forested areas. No changes will be made to riparian channels.
9A/IV-141	Maintain at least 80 percent of potential ground cover within 100 feet from the edges of all perennial streams, lakes and other water bodies, or to the outer margin of the riparian ecosystem where wider than 100 feet.	Yes	See Table C3b.
9A/IV-142	Prohibit the depositing of soil material from drilling, processing, or site preparation in natural drainageways.	No	No drilling, processing, or site preparation is proposed.
9A/IV-142	Locate the lower edge of disturbed or deposited soil banks outside the active floodplain.	Yes	See Table C3b.
9A/IV-142	Prohibit stockpiling of top soil or any other disturbed soil in the active floodplain.	No	No stockpiling of soil is proposed.
9A/IV-142	Prohibit mineral processing (milling) activities within the active floodplain.	No	No mineral processing is proposed.
9A/IV-142	Discontinue [mining] equipment use when soil compaction, rutting, and puddling are present.	No	No mining is proposed.
9A/IV-142	Locate drilling mud pits outside the active floodplain unless alternate locations are more environmentally damaging. If location is unavoidable, seal and dike all pits to prevent leakage.	No	No drilling mud pits are proposed.
9A/IV-142	Drain and restore [mining] roads, pave and drill sites immediately after use is discontinued. Revegetation to 80 percent of ground cover in the first year. Provide surface protection during stormflow and snowmelt runoff events.	No	No mining roads or drill sites are proposed.
9A/IV-142	Include applicable no surface occupancy special stipulation [in mineral leases].	No	No mineral leases are proposed.

Table C3a. Forest plan standard and guideline applicability

Management Area/Page No.	Standard/Guideline	Applicability	Rationale
9A/IV-143	Do not parallel streams when road location must occur in riparian areas except where absolutely necessary. Cross streams at right angles where possible. Locate crossings at points of low bank slope w/ firm surfaces.	No	No existing or proposed temporary roads associated with Iron Springs will occur in MA 9.

Table C3b. Proposed action and alternatives consistent with forest plan standards and guidelines

MA	Standard/Guideline	Action	Consistency	Comment
FW	Identify lands available and suitable for timber production by following the process described in FSM 2412.	Vegetation treatments on available and suitable lands.	Yes	Project area is suitable and available. Suitability is the forest vegetation specialist's report.
FW	Apply a variety of sllvlculture systems and harvest methods which best meet resource management objectives.	Application of management activities in existing sawtimber, pole, sapling, and seedling stands.	Yes	Commercial and pre-commercial thinning expressly desired for meeting management objectives.
FW	To facilitate the control of soil erosion within acceptable tolerance soil surveys or site specific soil data will be used to develop project level harvest systems.	Proposed Action Project Design Feature HS-1.	Yes	PDF HS-2 designates harvest design under soil and water conservation practice 14.08 such that forest plan objective is met.
FW	Assure that all even-aged stands scheduled to be harvested during the planning period will generally have reached the culmination of mean annual increment of growth.	Even-aged treatments in aspen.	Yes	Culmination of mean annual increment is addressed in Appendix A of this document.
FW	Minimize soil surface compaction and disturbance by curtailing logging activities during periods of high soil moisture. Design skid trail system to minimize extent of area impacted.	Proposed Action Project Design Feature HS-1.	Yes	PDF HS-2 designates soil moisture limits under soil and water conservation practice 13.06 such that forest plan objective is met.
FW	The maximum size of openings created by	Coppice clear-felling in	Yes	Under Iron Springs, the size of the openings

Table C3b. Proposed action and alternatives consistent with forest plan standards and guidelines

MA	Standard/Guideline	Action	Consistency	Comment
	the application of even-aged silviculture will be 40 acres regardless of forest cover type.	aspen.		created by clear-felling is limited to forty acres.
FW	Acceptable management intensity activities to determine harvest levels	Thinning, salvaging, and regenerating.	Yes	Thinning, planting, and salvage explicitly designated for spruce-fir. Clearcutting designated for aspen.
FW	Establish a satisfactory stand on cutover areas, emphasizing natural regeneration within five years, where feasible, after final harvest	Natural regeneration of aspen cuts.	Yes	Natural regeneration of aspen cuts is addressed in Appendix A of this document.
FW	Use trees of the best genetic quality available which are adapted to the planting site.	Planting of understocked spruce-fir.	Yes	Only native, site-adapted seedlings will be used for planting.
2B	Natural Appearing Landscape with Moderate Scenic Integrity: Management activities may be dominant, but harmonize and blend with the natural landscape.	Salvage dead and dying spruce/fir from 3,805 acres. Thin stands exceeding desired density.	Yes	The Iron Springs Project will remove dead trees from a single stand and commercially thin overstocked stands. Patchcut actions will not “clear” vegetation and will not affect dozens of other forested stands on the landscape. Thus, while project activities may be evident, the natural character of the landscape will be unaffected.
6A	Natural Appearing Landscape with Moderate Scenic Integrity: Management activities may be evident, but harmonize and blend with the natural landscape.	Salvage dead and dying spruce/fir from 3,805 acres. Thin stands exceeding desired density.	Yes	Aspen treatments will be evident on the landscape until the clones regenerate. The project will not, however, affect tens of thousands of acres of additional cover types designated as MA 6A across the Griffin Top landscape. Thus, while project activities may be evident, the natural character of the landscape will be unaffected.
7A	Natural Appearing Landscape with Low Scenic Integrity: Management activities	Salvage dead and dying spruce/fir from 3,805 acres.	Yes	Forest vegetation management activities occurring in MA 7 are unlikely to be visually

Table C3b. Proposed action and alternatives consistent with forest plan standards and guidelines

MA	Standard/Guideline	Action	Consistency	Comment
	are not evident or remain visually subordinate along Forest arterial and collector roads and primary trails.	Thin stands exceeding desired density.		evident from road 30140—this includes all action alternatives.
7A	Maximum grazing use on transitory ranges resulting from clear cuts is grasses 50 percent of current growth.	Proposed Action—clear cuts fenced if necessary.	Yes	Fence regenerating aspen until a height of six feet is reached.
9A	Maintain at least 80 percent of potential ground cover within 100 feet from the edges of all perennial streams, lakes and other water bodies, or to the outer margin of the riparian ecosystem where wider than 100 feet.	Proposed Action Project Design Feature HS-1.	Yes	PDF HS-1 designates riparian protection areas under soil and water conservation practice 14.06 such that forest plan standard is met.
9A	Locate the lower edge of disturbed or deposited soil banks outside the active floodplain.	Proposed Action Project Design Feature HS-1.	Yes	PDF HS-1 designates floodplain protection areas under soil and water conservation practice 15.06 such that forest plan standard is met.