United States Department of Agriculture **Forest Service** **National Forests in North Carolina Supervisor's Office**
160A Zillicoa Street
P.O. Box 2750
Asheville, NC 28802
828-257-4200

File Code: 1950-1
Date: April 24, 2003

Dear Reader:

I am enclosing a copy of the Environmental Assessment (EA) for the Hazanet Project, Compartments 25-35 on the Cheoah Ranger District, Nantahala National Forest. Three alternatives were developed and analyzed, including "no action." I have identified Alternative 3 as the preferred alternative. It includes a variety of vegetation management activities to improve tree growth, harvest timber, improve wildlife habitat, and improve access to National Forest System lands in the Cheoah Mountains of Graham County, North Carolina.

Although a preferred alternative has been identified, my final decision has not been made. I will consider your written comments or concerns in reaching my final decision and address them in an appendix to the EA. Comments must be postmarked or received within 30 days beginning the day following publication of this notice in the Asheville Citizen Times. Comments must include the name, address, and phone number (if applicable) of the commenter, reference the Hazanet Project EA, and provide specific comments along with supporting reasons that the commenter believes I should consider. Comments should be sent to:

District Ranger
Cheoah Ranger District
1133 Massey Branch Road
Robbinsville, NC 28711
(828) 479-6431

Copies of the decision will be mailed to those who submit timely comments or who specifically request the Decision Notice for the Hazanet Project.

Sincerely,

/s/ John F. Ramey

JOHN F. RAMEY
Forest Supervisor

Enclosure

United States
Department of
Agriculture

Forest
Service

April, 2003

Environmental Assessment

Hazanet Project

Cheoah Ranger District
Nantahala National Forest

Graham County, North Carolina

Responsible Official
John F. Ramey
Forest Supervisor
160A Zillicoa Street
Asheville, NC 28801
(828) 257-4200

For Information Contact:
Cheoah Ranger District
1133 Massey Branch Road
Robbinsville, NC 28771
(828) 479-6431

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ABSTRACT:

The Cheoah Ranger District of Nantahala National Forest proposes to perform a variety of vegetation management activities to improve tree growth, harvest timber, improve wildlife habitat, and improve access on National Forest System lands in Graham County, North Carolina. The project area is comprised of approximately 7,968 acres north of Robbinsville, NC and south of Fontana Village, NC. About 20% of the area would receive some type of treatment. Treatments include prescribed burning, 2-Age and group selection regeneration, tree thinning, timber stand improvement and vine control, road construction and helispot development, designation of stands for future old growth, and development of vernal pools and grass/forb habitat for wildlife.

Issues include impacts to grass/forb and early successional habitat, impacts to threatened, endangered, and sensitive species, impacts to cerulean warbler and golden-winged warbler, impacts to scenery including views from the Appalachian Trail.

Three alternatives are analyzed. These are a No Action alternative, the Proposed Action, and one alternative developed to address potential impacts to cerulean warbler and to provide for a range in the development of early successional habitat. The activities in these alternatives are summarized in the table below.

	Alt. 1	Alt. 2	Alt. 3
Two-Age Harvest/Regeneration	0 acres	349 acres	430
Group Selection Harvest/Regeneration	0 acres	53 net acres	18 net acres
Thinning	0 acres	99 acres	51 acres
Prescribed Burning	0 acres	351 acres	351 acres
Oak Midstory Treatment	0 acres	235 acres	102 acres
Vine Control	0 acres	254 acres	254 acres
Other Timber Stand Improvement (may include vine control)	0 acres	260acres	260 acres
Slash/Burn/Plant Site Preparation	0 acres	40 acres	40 acres
Designate Small Patches of Old Growth	0 acres	684 acres	684 acres
Road Construction	0 miles	1.35 miles system; 2.3 miles temporary	1.35 mile system; 1.6 miles temporary
Watershed improvement	0 miles	0.1 miles	0.1 miles
Wildlife Habitat Improvements	None	11 waterholes created; 3 wildlife openings developed & 2 restored.	11 waterholes created; 3 wildlife openings developed & 2 restored.
Helispot development/improvement	None	4	4

The environmental consequences of each alternative are evaluated for each major issue and relevant resource area. The table below summarizes the environmental consequences.

Issue/Resource	**Alternative 1**	**Alternative 2**	**Alternative 3**
Grass/forb habitat	28 acres or 0.5% of 3B acres	46 acres or 0.9% of 3B acres	46 acres or 0.9% of 3B acres
Early successional habitat	77acres or 1% of 3B acres	442+77 acres = 519 or 10% of 3B acres	488+77=565 acres or 11% of 3B acres

Issue/Resource	Alternative 1	Alternative 2	Alternative 3
Cerulean warbler habitat	Habitat remains the same	Creating small openings in suitable habitat may improve habitat	While suitable habitat is avoided, creating adjacent small openings may be attractive to ceruleans
Golden-winged warbler habitat	Zero acres replacement habitat provided	221 acres replacement habitat provided	335 acres of replacement habitat provided
Threatened, Endangered, Sensitive species	No effect /No impact	**Not likely to adversely affect** the Indiana bat or the Appalachian Elktoe mussel; no effect on any other federally proposed or listed species; may impact individuals of *Euphorbia purpurea, Helianthus glaucophyllus*, *Scutellaria saxatilis,* northern bush katydid, rock-loving grasshopper, frosted elfin, Diana fritillary butterfly, Santeetlah dusky salamander, southern Appalachian salamander, *Gomphus consanguis,* and *Gomphus viridifrons,* but would not impact their viability across the Forest.	
Scenery, including along the Appalachian Trail	VQO's met	VQO's met; fewer acres of regeneration visible from the AT than in Alternative 3.	VQO's met; more acres of regeneration visible from the AT than in Alternative 2.
Soils	None	3.65 miles road constr. 0.6 miles road reconstr. 351 acres Rx burning	2.95 miles road constr. 0.6 miles road reconstr. 351 acres Rx burning
Aquatic Resources	None	3.65 miles road constr. 0.6 miles road reconstr. 4 new culverts 2 replacement culverts	2.95 miles road constr. 0.6 miles road reconstr. 3 new culverts 2 replacement culverts
Terrestrial Wildlife Management Indicator Species	Adverse	Beneficial	Beneficial

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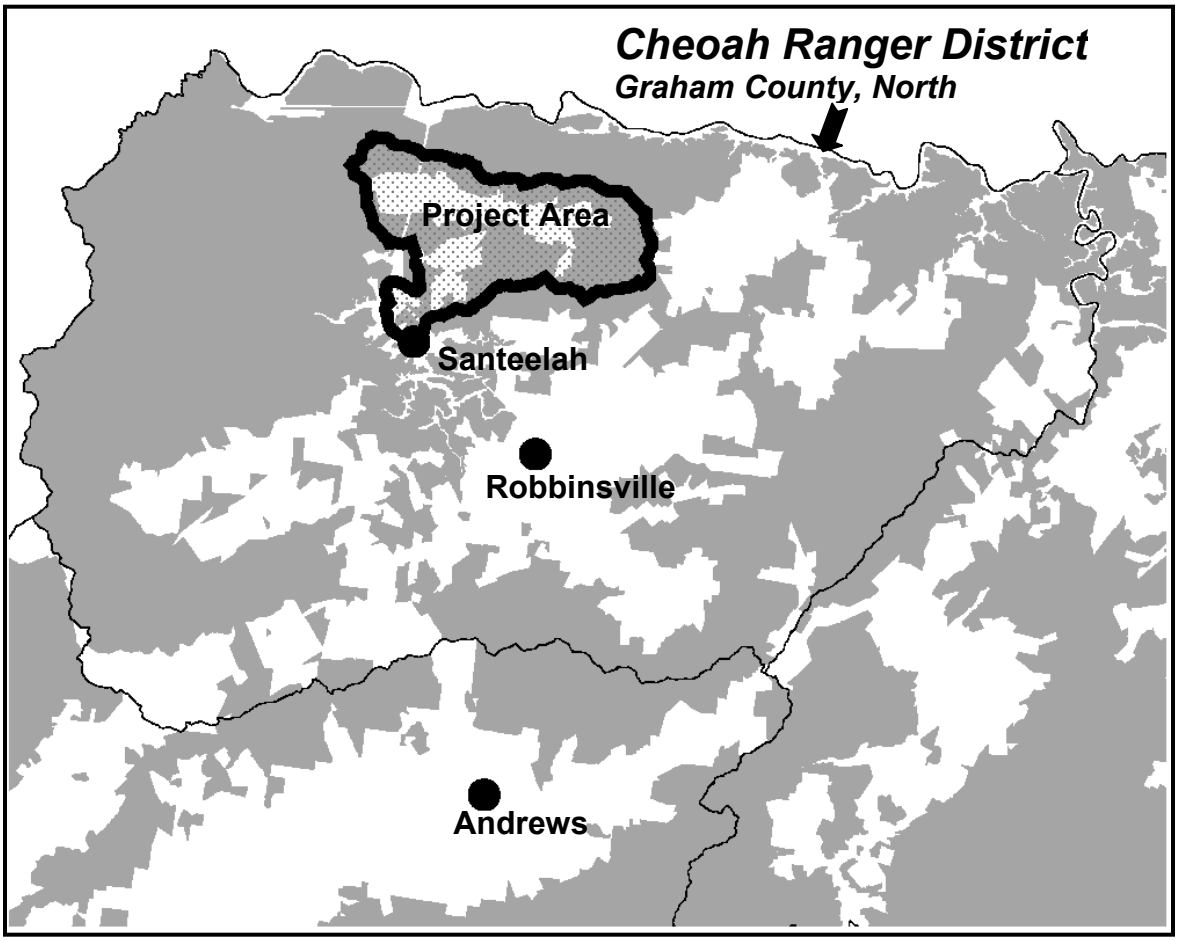


Figure 1-1. Hazanet Project Vicinity Map

1. PURPOSE AND NEED FOR ACTION

1.1 Introduction

The USDA Forest Service is proposing forest management activities on Nantahala National Forest lands in the Cheoah Mountains of Graham County, North Carolina. The project area is comprised of approximately 7,968 acres in the vicinity of Hazanet Knob and the Yellow Creek and Cochran Creek drainages of the Little Tennessee River basin. The Cheoah River follows much of the western boundary of the project area which is immediately northeast of Santeetlah Lake, south of Fontana Village, and north of Robbinsville, North Carolina. Elevations range from 1,800 to 4,000 feet. Vegetation is typical of the forests of Western North Carolina and includes predominantly cove hardwoods and upland hardwoods, with some pine/hardwood mixes and small amounts of white pine. The area has a long history of use for timber management and wildlife habitat management along with traditional recreational and social uses such as hiking, hunting, camping, cutting fuelwood and gathering of special forest products. Notable features include the Appalachian Trail which traverses the easternmost portion of the area, and Wauchecha Bald, which is a major communication site shared by multiple agencies and the Eastern Band of Cherokee. Figure 1-1 shows the general location of the project area.

Approximately 20 percent of the project area would receive some type of vegetation management such as prescribed burning, timber stand improvement or timber harvest. The purpose of this project is to implement the direction set forth in the Land and Resource Management Plan (refer to Land and Resource Management Plan, Nantahala and Pisgah National Forests, Amendment 5, March, 1994, hereafter LRMP).

The National Forest System (NFS) lands in the project area are assigned to a variety of Management Areas (MA) with differing resource emphases and desired conditions. Most proposed activities would take place in MA 3B. MA 3B emphasizes providing for a sustainable supply of timber, few open roads, and habitat for wild turkey, deer, and small mammals (LRMP pg. III-6). Table 1-1, Land Allocation in the Project Area, displays the number of acres assigned to the various management emphasis areas.

Table 1-1. Land Allocation in the Project Area

Management Areas and Resource Emphasis In the Hazanet Project Area	Acres in Project Area
2A – Driving for pleasure; timber management to maintain scenery	290
3B – Sustainable timber supply; limit motorized access; selected wildlife habitat	5,269
4A – Remote forest setting; closed to vehicles; timber management to maintain scenery	301
4C – Remote forest setting; mostly closed to vehicles; no timber management	1,922
12 – Developed recreation area	53
Unassigned – recent land acquisitions not yet assigned to a management area	133
TOTAL National Forest System Lands	7,968

The proposed activities would be a continuation of the vegetaton management that has occurred over recent decades. These activities are broadly designed to move this part of Nantahala National Forest toward desired landscape conditions established in the LRMP. The project would help provide better growing conditions for a diversity of tree species and maintain the value of past investments in wildlife habitat.

1.2 Project Objectives

The proposal includes a variety of silvicultural treatments to improve tree growth and promote better development of young trees; tree harvesting to be accomplished through timber sales; preparing and regenerating harvested areas for future forest production; prescribed burning to improve wildlife habitat or to prepare stands for regeneration; designation of stands for long term development of small patches of old growth; helispot development for fire control; road construction and reconstruction to facilitate access; road relocation for watershed rehabilitation; and the creation and/or improvement of wildlife habitat in and around the harvested areas. The major categories of proposed activities are described below along with the purpose and need for each activity. Acreage amounts are approximate.

Two-age and group selection regeneration harvest: Up to 450 acres would be regenerated. According to the LRMP the desired condition for MA 3B is to have no less than 5% and no more than 15% of an area in very young forest ten years old or less (early successional habitat). This is to provide conditions for a suite of wildlife species that regularly use young vegetation for cover, browse, or feed on the insects and berries that are more abundant in very young forests. Currently, about 1% of the 3B acres in the project area are less than 10 years of age. One purpose of this project is to fulfill the need to increase the percentage of very young forest to meet LRMP direction. This need is especially prominent in the Hazanet area due to the presence of a significant population of golden-winged warblers, a watch list species. In 1997 and 1998 Dr. David Buehler from the University of Tennessee and his students conducted an intensive study of this species in the Hazanet analysis area and located 30 breeding pairs. When the study took place a number of stands were in the young forest age range preferred by the bird. As these stands age they would loose the characteristics that make them attractive to golden-wings. By providing additional early successional habitat through this project, the area should continue to provide suitable habitat for golden-wings over the next decade.

This desired condition also helps facilitate the sustainable flow of timber from an area by regulating the amount of harvest and new growth in any ten-year period.

Thinning immature hardwood stands: Up to 100 acres would be thinned. Two LRMP goals are to restore oak-hickory forests essential for wildlife, and to produce high quality hardwood sawtimber. Thinning is sometimes needed, as it is in the stands proposed for treatment, to provide more favorable growing conditions for hard mast producers such as various species of oaks. The purpose of the proposed thinning is to remove small damaged trees and sprout clumps such as from yellow poplar that could interfere with good growth of the better formed trees for both mast production and sawtimber production.

Pre-harvest oak midstory treatments: Up to 235 acres of treatment would occur. Restoration of oak-hickory forests is critical for maintaining a good supply of acorns and hickory nuts as a source of food for wildlife. Studies have demonstrated the need to remove some midstory trees 10-15 years ahead of a timber harvest to provide growing conditions conducive to the development of large oak saplings. Then, when a removal of overstory trees takes place, these young oaks would be established enough to compete with species that grow more rapidly with the increased availability of sunlight following harvest. This is the purpose of the pre-harvest oak midstory treatment, and stands proposed for this treatment are good candidates. These stands have oak seedlings and saplings present that would benefit from a reduction in competition.

Vine Control and Other Timber Stand Improvements: In addition to stands being regenerated, up to another 520 acres would receive specific treatments to improve growing conditions for a diversity of tree species. The stands proposed for treatment have heavy growths of grapevines and smokevines that could damage the growing trees. However grapes are also an important source of food for wildlife. To accommodate the needs for high quality trees and wildlife habitat, the project proposes to slash damaging

grapevines and smokevines but leave one-half acre of grapevine clumps per twenty acres of treated stands. Other treatments to improve conditions for growing trees would thin out less desirable tree species competing with or overtopping desired vegetation. The purpose of all these actions would be to provide better growing conditions for a diversity of tree species that provide important wildlife habitat elements as well as merchantable timber products.

Slash, burn, and plant pines in damaged or sparsely stocked pine and pine-hardwood stands: About 40 acres would be treated. The LRMP directs that damaged or poorly stocked stands are good candidates for activities to promote full stocking in a timely manner. Drought, southern pine beetle, and oak decline have contributed to poor stocking conditions in the stands proposed for treatment. The purpose of planting pines in these stands would be to supplement natural regeneration.

Designate stands for small patches of old growth: A total of 684 acres would be designated. In order to meet LRMP direction, there is a need to designate at least 50 acres of every compartment for future old growth. The purpose of these small patches is to increase biological diversity by providing some structural components of old growth. With project implementation, every compartment in the project area would have at least 50 acres selected for long-term development of old growth characteristics. This would add to the desired condition for old growth established in the LRMP to have small, medium and large patches across the landscape.

Road Construction: Up to 2.65 miles of temporary and system road would be constructed. The LRMP directs that the road system be planned to progressively access all lands suitable for timber production. The road construction proposed would incrementally increase the accessibility of the suitable timberland in the project area. This would make future management activities more efficient.

Road Relocation for Watershed Improvement: Dummy Branch Road, FS 2440A, would receive treatment. It is desirable to minimize the amount of roadbed in riparian areas (streamside zones), especially when road conditions are allowing eroded soil to reach the water. The purpose of relocating portions of Dummy Branch Road would be to improve watershed conditions.

Wildlife Habitat Improvements: Up to 351 acres of prescribed burning, 11 vernal pools (waterholes) and 18 acres of additional grass/forb habitat would be created. There is a need to increase the amount of grasses and forbs and vernal pools in the project area. These habitat components are in short supply here, just as they are across the Nantahala National Forest. The LRMP directs the use of prescribed fire to create and maintain desired wildlife habitat. In this case an understory burn would clear underbrush and would be followed by a flush of herbaceous vegetation and berry production from invigorated soft mast producers. Activities to rehabilitate wildlife openings and construct small waterholes would improve the habitat for a variety of wildlife species.

1.3 Decision To Be Made

This analysis would provide the Forest Supervisor with the basis to make an informed decision regarding the natural resource management activities in the Hazanet area. Additionally, the analysis would provide information regarding management requirements and mitigation measures which should be used to protect other resources. Possible decisions could include: defer all activities until another time; approve the management activities proposed; require additional information from the interdisciplinary team, if the information presented is not adequate to make a decision; or, require the development of an Environmental Impact Statement.

1.4 Scoping

Scoping is defined by the National Environmental Policy Act as "an early and open process for determining the scope of issues to be addressed, and for identifying the issues related to a proposed action." Scoping continues throughout project planning and analysis.

After initial internal scoping with a Forest Service interdisciplinary team, the Hazanet Project was listed in the January, 1999 Schedule of Proposed Actions mailed to the Forest-wide list of over 100 recipients. The project was subsequently listed in every quarterly Schedule of Proposed Action since January 1999. In June 1999 a scoping letter was mailed to 70 persons. This letter included a map identifying the project area, and a request for comments. A notice requesting comments was also placed in the Graham Star on June 7, 1999. In response, comments were received from three individuals, two government agencies, and five non-governmental organizations.

1.5. Major Issues related to the Proposed Action

Internal scoping generated a list of 10 topic areas of concern. Comments from other persons and groups were consolidated into 70 stated concerns, some of which were duplicates. Of these 80 total concern statements, almost all were of a general nature, that is, they were not specific to this project. Some dealt with policy issues beyond the scope of this project. Some challenged decisions made in the LRMP, also beyond the scope of this project. Others were general environmental concerns expressed without identifying any particular applicability to the project area, or that have no applicability to the project area. NEPA regulations direct the Forest Service to emphasize the major issues relevant to a proposed action and focus the scope of the environmental analysis accordingly. The following issues were identified as having particular importance in regard to the Hazanet Project:

Impacts to grass/forb and early successional habitat: Some commenters stated that species need more grassy openings and young forest while others were of the opinion that this need is not valid, or that openings with accompanying edge effect are detrimental to species. LRMP directs forest managers to provide a certain amount of grass/forb and early successional habitat to benefit a wide variety of wildlife species. This issue would be addressed through the range of alternatives with varying amounts of early successional

habitat. Evaluation of this issue would use the following measures: amount of grass/forb habitat provided by each alternative and amount of early successional habitat provided by each alternative.

Impacts to endangered, threatened and sensitive species: A number of endangered, threatened, and sensitive species are known from Graham County. This issue would be addressed by establishing mitigation measures, if necessary, to limit impacts. Evaluation of this issue would be the determination of effects from the Biological Evaluation.

Impacts to the cerulean warbler and golden-winged warbler: This portion of Graham County is of particular note for the presence of cerulean warbler - a Forest Concern Species, and golden-winged warbler – a Watch List Species. This issue would be addressed through the development of Alternative 3. Evaluation of this issue would be the changes in habitat described for each alternative.

Impacts to scenery, including views from the Appalachian Trail: Various vegetation management activities in the project area might be seen from a variety of viewpoints. This issue would be addressed by establishing mitigation measures to limit impacts. Evaluation of this issue would be a scenery analysis that would disclose differences among alternatives regading project activities impacting the scenery, along with a qualitative description of what might be seen.

1.6 Other Issues

Impacts to Joyce Kilmer Wilderness: There was a perception that the project area is in close proximity to Joyce Kilmer Wilderness and could impact wilderness character or impact the usefulness of the project area as a wildlife corridor between Joyce Kilmer Wilderness and the Great Smoky Mountains National Park. The closest proposed activity is removed from the wilderness boundary by at least 3.5 miles of intervening terrain, with the bulk of activities over 5 miles away. Also, since the landscape matrix is well over 80% forested, this project would not change the ability of the area to serve as a wildlife corridor. Therefore these were not considered major issues for this project.

Other Concerns: Most of the remaining concerns mentioned in scoping comments dealt with general environmental or social concerns such as water quality, soils, plants, animals, recreation, roads, and economics. While not identified as major issues in this project, these would be addressed briefly in Chapter 3, Affected Environment and Environmental Consequences. Other comments had to do with policy such as uses of the national forests. These are beyond the scope of this analysis and are inappropriate to address at the project scale. Concerns such as global warming and carbon sequestration were also mentioned. These are also considered inappropriate for discussion at the project scale. A complete list of concerns is available in the project file.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Introduction

This chapter presents a detailed description of the alternatives. These alternatives were developed by the interdisciplinary team in response to issues and opportunities identified in the project area. Mitigation measures for activities in each alternative are also described in this chapter. Table 2-1 summarizes the management activities for each alternative. Acreage amounts are approximate.

Table 2-1. Summary of Management Activities by Alternative*

	Alt. 1	Alt. 2	Alt. 3
Two-Age Harvest/Regeneration	0 acres	349 acres	430
Group Selection Harvest/Regeneration	0 acres	53 net acres	18 net acres
Thinning	0 acres	99 acres	51 acres
Prescribed Burning	0 acres	351 acres	351 acres
Oak Midstory Treatment	0 acres	235 acres	102 acres
Vine Control	0 acres	254 acres	254 acres
Other Timber Stand Improvement (may include vine control)	0 acres	260acres	260 acres
Slash/Burn/Plant Site Preparation	0 acres	40 acres	40 acres
Designate Small Patches of Old Growth	0 acres	684 acres	684 acres
Road Construction	0 miles	1.35 miles system; 2.3 miles temporary	1.35 mile system; 1.6 miles temporary
Watershed improvement	0 miles	0.1 miles	0.1 miles
Wildlife Habitat Improvements*	None	11 waterholes created; 3 wildlife openings developed & 2 restored	11 waterholes created; 3 wildlife openings developed & 2 restored
Helispot development/improvement*	None	4	4

* Helispots would serve as wildlife openings when not needed for logging or fire control.

2.2 Alternatives Considered

2.2.1 Alternative 1 – No Action

This alternative proposes no activity to move the area toward the desired conditions described in the LRMP. Grass/forb habitat would continue to be provided in the current amount of 28 acres. The existing 77 acres of early successional habitat in the project area would be reduced to zero by 2007. Habitat for disturbance related species would decline while habitat for species that prefer closed canopy conditions would increase slightly. The views from the Appalachian Trail would continue as they are today. Previous investments in timber stand improvement and wildlife habitat improvements would not

be maintained. No additional access would be provided for vegetation management and fire control. Existing watershed rehabilitation needs would remain.

2.2.2 Alternative 2 – Proposed Action

Alternative 2 regenerates 402 acres through timber harvest, thins 99 acres, applies prescribed burning to 351 acres, and reestablishes 40 acres by planting following southern pine beetle attack. The oak midstory treatment to promote future oak regeneration would be applied to 235 acres, while vine control and other timber stand improvement investments would be made on an additional 514 acres. Additional access to the area would be provided in the form of 1.35 miles of system road construction, 2.3 miles of temporary road construction, 0.6 miles reconstruction of existing road, and development of four helispots. Eleven vernal pools (waterholes) would be developed. Watershed rehabilitation activities would improve conditions along FS 2440A, Dummy Branch Road, and the road to access stand 29-1.

This project was designed to meet the project objectives discussed in Chapter 1, while applying certain protective measures to activity areas that fall into the range of suitable habitat for cerulean warblers. Those measures include:

1. No timber harvest within 300 ft. around a known cerulean warbler occurrence.

2. Retain at least 60 square feel of basal area in treated stands; with leave trees consisting of the largest and tallest dominant canopy trees.

3. Group selection openings no larger than 0.5 acres, with groups comprising no more than 10 percent of the stand. Groups would be no closer than 300 feet. Thinning between the groups would retain at least 60 square feet of basal area; with leave trees consisting of the largest and tallest dominant canopy trees.

4. Roads constructed or reconstructed would be built to minimum road width standards and areas subject to daylighting would retain a minimum of 60 square feet of basal area.

To develop this alternative, an analysis was done to determine suitable habitat for cerulean warbler, known occurrences were mapped, and this information was compared with stands nominated for regeneration. As a result of this analysis three areas initially proposed for regeneration were determined to overlap suitable habitat. Treatment for these areas would be thinning to a minimum of 60 Residual Basal Area (RBA). These areas are Stand 31-9, the southernmost portion of Stand 31-1 and southwestern most portion of Stand 30-23. See the map Hazanet Alternative 2 for the location of these areas. Table 2.2.2 summarizes the activities in Alternative 2. A more detailed description follows. Two maps displaying the general locations of project activities follow the descriptions of the alternative. Acreages are approximate.

Table 2.2.2 Summary of Activities for Alternative 2

Compartment/Stands	Acres	Proposed Harvest	Other Proposed Treatments
25-2,15	29		Slash/burn/plant
25-2,3,5,7,8,10,21	215		Prescribed burning
25-7*	22	Thinning to 60 RBA**	
26-8,14			Helispots developed(<1 acre each)
27-4 or 9			Helispot developed(<1 acre)
28-15	38		Vine control
29-1,5	59	2-Age, 10-30 RBA natural regeneration	Preharvest treatment of small stems and vines; post harvest site preparation; 2 vernal pools in 29-1
29-1,11,12	100		Prescribed burning
29-2,4,9,17	119		Timber stand improvement (TSI)
29-3	42		Oak midstory treatment
30-9,26	90		Oak midstory treatment
30-11	32/8 net	Group selection	
30-13,23	50	2-Age, 10-30 RBA natural regeneration	Post harvest site preparation; 2 vernal pools in 30-13
30-15,24,29	75		Timber stand improvement
30-23	10	Thinning to 60 RBA	2-Age, 10-30 RBA natural regeneration
31-1	12	2-Age, 10-30 RBA natural regeneration	Preharvest treatment of small stems and vines; post harvest site preparation
31-1	15	Thinning to 60RBA	
31-1	20		TSI/Vine control
31-6, 10	39		Oak midstory treatment
31-8	33		Vine control
31-9	23	Thinning to 60 RBA	
33-8	72/18 net	Group selection	2 vernal pools
33-11	11		Slash/burn/plant; 1 vernal pool
33-19	46		Timber stand improvement
34-3,4,9,17A	130	2-Age, 10-30 RBA natural regeneration	Preharvest treatment of small stems and vines if needed; post harvest site preparation
34-7,9,13	36		Prescribed burning
34-8,10,12,14	100		Vine control
34-17B	109/27 net	Group selection	
35-3,9B,14	98	2-Age, 10-30 RBA natural regeneration	Preharvest treatment of small stems and vines if needed; post harvest site preparation; develop 3 vernal pools above 35-3
35-9			Develop vernal pool, rehab wildlife opening
35-9A,13,24	64		Oak midstory treatment
35-9C	29	Thinning to 60 RBA	
35-11,12,15	63		Vine control develop Helispot and rehab wildlife opening in 35-15 (approx. (<1 acre) 1 acre)

*If a stand is listed more than once it indicates that different treatments would be applied to different parts of the stand.

**RBA = Residual Basal Area, an indicator of the amount of trees that would remain in a stand after harvest.

Two-Age Regeneration Harvests

Regenerate 12 stands totalling approximately 349 acres using the two-aged regeneration harvest method, with a desired average residual basal area (RBA) of 10-30 square feet per acre consisting of well-formed small sawtimber and poletimber trees and wildlife den trees. Carry the residual stems through mid-rotation (60 years) or full rotation (future option). Stands selected for this treatment and approximate acreages are 29-1 (33 acres), 29-5 (26 acres), 30-13 (27 acres), 30-23 (23 acres), 31-1 (12 acres), 34-3 (32 acres), 34-4 (24 acres), 34-9 (40 acres), 34-17A (34 acres), 35-3 (25 acres), 35-9B (38 acres), and 35-14 (35 acres). Regenerate these stands by natural regeneration.

Treat the following stands prior to regeneration harvesting: 1) Stands 29-1 and 29-5: chainsaw slash all stems 1"–7.5" dbh and grapevines and smokevines; 2) Stands 31-1, 34-4, and 34-17A: inject undesirable stems (striped maple, silverbell, black gum, sourwood, red maple, and black birch) 1" – 7.5" dbh with Garlon 3A and chainsaw slash grapevines and smokevines; 3) Stand 34-3, inject undesirable stems 1" – 7.5" dbh with Garlon 3A; 4) Stands 35-9B and 35-14: chainsaw slash all stems 1" – 7.9" dbh, stump treat undesirable stems with Garlon 3A, and slash grapevines and smokevines.

Use conventional ground skidding and yarding methods to harvest timber from stands 30-13, 30-23, and 35-3. Use a skyline logging system to harvest timber from stands 29-1, 29-5, 31-1, 34-4, and 35-14. Use conventional ground skidding and skyline yarding on stand 34-9. Use helicopter yarding on stands 34-3, 34-17A, and a combination of helicopter yarding and ground skidding on stand 35-9B.

Prepare the two-age harvest units listed above for natural regeneration by chainsaw felling of undesirable or damaged residual stems. Monitor regeneration composition and development in these stands and control undesirable reproduction (sprout clumps of red maple, striped maple, silverbell, sourwood, dogwood, yellow poplar, and blackgum) in stands where it exceeds 20% of stocking after the first growing season by treating with streamline application of Garlon 4 (triclopyr) herbicide in mineral oil (20% solution).

Slash/Burn/Plant

Three stands totalling approximately 40 acres (25-2, 25-15, 33-11) are insufficiently stocked or damaged by southern pine beetle. Prepare these stands for regeneration by chainsaw slashing and prescribed burning. Slash all stems in Stand 25-2, and only stems below 7.9" at diameter breast height (dbh) in Stands 25-15 and 33-11. After a summer burn, plant them with shortleaf or white pine on a 15-foot by 15-foot spacing. If planted with shortleaf pine, release these pines with a thinline application of Garlon 4 to competing vegetation one to three years after planting.

Thinning

Thin Stands 25-7 (22 acres), 31-9 (23 acres),35-9C (29 acres), and the southern portions of Stands 30-23 and 31-1 (10 acres and 15 acres), harvesting the smaller-diameter class,

poorer-quality, and damaged trees, favoring the better-quality "crop" trees. The thinning in stand 25-7 is for products such as firewood or small roundwood.

Group Selection

Commit about 213 acres to uneven-aged management with harvesting by group selection in stands 30-11 (32 acres, 8 net), 33-8 (72 acres, 18 net), and 34-17B (109 acres, 27 net). About 53 net acres would be harvested in groups with diameters up to twice the height of adjacent trees. Groups would be located to capitalize on patches of large mature timber, patches of sparse, low-quality, or damaged timber, and patches with good advanced reproduction. Some high-quality growing stock trees, den trees, and snags would be retained in groups as practicable. Group openings would be regenerated naturally to hardwoods, with site preparation by chainsaw slashing, with a summer prescribed burn in stand 33-8. Treat the groups prior to regeneration harvesting as follows: inject undesirable stems (striped maple, silverbell, black gum, sourwood, red maple, and black birch) 1" – 7.9" dbh with Garlon 3A,Garlon 4 thinline stems <1. After the first growing season, conduct a streamline application of a 20% solution of Garlon 4 (triclopyr) herbicide in mineral oil to sprout clumps of undesirable species in the groups in these three stands (black gum, silverbell, striped maple, red maple, yellow poplar, dogwood, and sourwood). Also, in stands 30-11 and 34-17B, thin "from above" between groups to salvage mature, overmature, and defective trees and/or thin "from below" as necessary to remove less desirable trees competing with the best-quality "crop" trees.

Oak Midstory Preharvest Treatment

Treat eight stands (235 acres) with an oak midstory preharvest treatment and vine control. These stands would be regenerated 10-15 years from the present time. These stands, with their site-specific treatments, are as follows: 1) Stand 29-3 (42 acres): inject undesirable stems (striped maple, silverbell, black gum, sourwood, red maple, and black birch) 1" – 7.5" dbh with Garlon 3A, thinline spray undesirable stems <1" dbh with Garlon 4, and slash grapevines and smokevines; 2) Stand 30-9 (70 acres): chainsaw slash all stems 1" – 6" and slash grapevines and smokevines. Two to three seasons later, treat undesirable sprouts with a Garlon 4 streamline spray treatment,; 3) Stand 30-26 (20 acres): inject undesirable stems 2" – 8" dbh with Garlon 3A, basal spray undesirable stems under 2" dbh, and slash grapevines and smokevines; 4) Stand 31-6 (20 acres): chainsaw slash all stems 1" – 6" dbh and slash grapevines and smokevines. One to three growing seasons later, treat undesirable sprouts with a Garlon 4 thinline treatment if needed; 5) Stand 31-10 (19 acres): same as #4; 6) Stand 35-9A (24 acres): same as #1; 7) Stand 35-13 (23 acres): same as #1; and 8) Stand 35-24 (17 acres): same as #1.

Vine Control and Other Timber Stand Improvement

Perform vine control work by chainsaw slashing on about 234 acres in the following stands: stand 28-15 (38 acres), stand 31-8 (33 acres), stand 34-8 (33 acres), stand 34-10 (21 acres), stand 34-12 (19 acres), stand 34-14 (27 acres), stand 35-11 (20 acres), stand

35-12 (23 acres), and stand 35-15 (20 acres). In these stands, leave one-half acre of grapevine clumps for every 20 acres.

Conduct timber stand improvement with herbicide in two stands totalling about 75 acres. These are stand 29-17 (29 acres) and stand 33-19 (46 acres). Treatment would consist of a thinline spray of Garlon 4 to undesirable stems competing with and/or overtopping desired vegetation.

Conduct timber stand improvement with herbicide and vine slashing in six stands totalling about 165 acres. These are stand 29-2 (35 acres), stand 29-4 (25 acres), stand 29-9 (30 acres), stand 30-15 (23 acres), stand 30-24 (28 acres), and stand 30-29 (24 acres). Treatment would consist of a thinline spray of Garlon 4 to undesirable stems competing with and/or overtopping desired vegetation. In addition, grapevines and smokevines would be chainsaw slashed, while leaving one/half acre of grapevine clumps for every 20 acres.

Perform a silvicultural cleaning treatment and vine control in stand 31-3 (20 acres). Select the best one or two stems per clump of existing merchantable species, and chainsaw slash the remaining stems in the clumps. Chainsaw slash grapevines and smokevines, leaving one/half acre of grapevine clumps in the stand.

Prescribed Burning

Conduct four prescribed burns for wildlife habitat improvement and fuels reduction during the late dormant season on approximately 351 total acres in the following stands: 1) Compartment 25, stands 3, 4, and 5 (100 acres); 2) Compartment 25, stands 7, 8, 10, and 21 (115 acres); 3) Compartment 29, stands 1, 11, and 12 (100 acres); and 4) Compartment 34, stands 7, 9, and 13 (36 acres). Use control lines along existing roads and creeks where possible, and also some handline.

Watershed Rehabilitation

Conduct watershed rehabilitation work on Forest Service (FS) road #2440A (Dummy Branch Road). Relocate this road from where it leaves state road (SR) #1242 to the gap (about 0.1 mile) to avoid the riparian area. Shift the road left and grade it into the gap. At milepost 0.2, the old culvert has washed out, cutting the road in two and causing off-site erosion. Replace the culvert and repair the slump. Install other culverts as needed. Install a gate to enable quick access in case of wildfire. Maintain the road by brushing and mowing.

Improving Access

Perform the following road construction work in order to provide additional access in the project area: 1) Stand 29-5: Construct 0.1 mile off of FS #438A to access the stand (temporary road); 2) Stand 29-1: A skid road would be upgraded to a haul road for 0.2 mile, and 0.3 mile would be constructed to access landings (0.5 mile temporary road); 3)

Stand 30-11: Construct 0.5 mile to access this stand (temporary road); 4) Stand 31-9: Construct 0.8 mile off of FS #2627 to this stand (temporary road); 5) Stand 33-8: Construct 0.5 mile off of Sarvis Branch Road to this stand (system road); 6) Stand 34-9: Construct 0.6 mile off of FS #2627C to access stand 9 and the lower part of stand 17 (system road); 7) Stand 35-3: Construct 0.25 mile off SR #129 to an existing landing to access this stand (system road); and 8) Stand 35-14: Construct 0.4 mile off of FS #2627A to access this stand (temporary road). Total road construction would be 1.35 miles of system road and 2.3 miles of temporary road.

Perform the following road reconstruction work in order to maintain and upgrade existing FS roads: 1) Stand 29-1: Reconstruct about 0.4 mile of temporary haul road to this stand, to include ditching, culvert installation, widening where ditches are needed, and gravel surfacing; 2) Compartment 33: Reconstruct about 0.2 mile of the Sarvis Branch Road. Total road reconstruction would be 0.2 miles of system road and 0.4 mile of temporary road.

Conduct helispot work in the following stands: 1) Stand 35-15 (an existing helispot/wildlife opening): Cut back saplings in the flight approach path, then do a summer prescribed burn. Thinline spray (Garlon 4) sprouts after the next growing season, and maintain the spot with prescribed burns as necessary; 2) Stands 26-8 and 26-14: Develop helispots on Yellow Creek Mountain along FS Trail #48. Slash down trees in late spring, prescribe burn in late summer, and seed with cover crop/grasses. Treat sprouts with thinline herbicide application (Garlon 4) after the first growing season. Maintain with periodic prescribed burns. Locate the helispots here for the additional purposes of fire control access; 3) Stands 27-4 and 27-9: same as #2.

Other Wildlife Habitat Improvements

Conduct a wildlife opening rehabilitation in stand 35-9C. Treatment would consist of resowing of perennial grasses and clover as necessary, liming and fertilizing the area, and develop a small pond or vernal pool.

Create several additional vernal pools in existing roadbeds or log landings in order to increase habitat and drinking water supplies for amphibians and bats. These ponds would be located in stands 29-1 (2 ponds), 30-13 (2 ponds), 33-8 (2 ponds), 33-11 (1 pond), and compartment 35 above stand 3 (3 ponds).

Following sale closure, seed roads and landings with a grass/clover mix, and maintain as linear wildlife openings. Rehabilitate existing openings by reseeding with a grass/clover mix and/or native species mixtures.

Old Growth Designations

Designate for small patches of old growth approximately 684 acres in the following stands: 25-18 (53 acres), 26-1 (52 acres), 27-10 and 11 (50 acres), stands 28-4, 5, and 13

(53 acres), 29-11 (102 acres), 30-3 (60 acres), 31-4 (50 acres), 32-3,4 and 5 (77 acres), 33-1 and 18 (67 acres), 34-7 (62 acres), and 35-7 and 8 (58 acres).

Mitigation measures are included as a part of this alternative and are listed in section 2.2.4 "Mitigation Measures Applicable to Alternatives 2 & 3."

2.2.3 Alternative 3 - Preferred

Alternative 3 avoids all management activities in cerulean habitat. Alternative 3 regenerates 448 acres through timber harvest, thins 51 acres, applies prescribed burning to 351 acres, and reestablishes 40 acres by planting following southern pine beetle attack. The oak midstory treatment to promote future oak regeneration would be applied to 102 acres, while vine control and other timber stand improvement investments would be made on an additional 514 acres. Additional access to the area would be provided in the form of 1.35 miles of system road construction, 1.6 miles of temporary road construction, 0.6 miles reconstruction of existing road, and development of four helispots. Eleven vernal pools (waterholes) would be developed. Watershed rehabilitation activities would improve conditions along FS 2440A, Dummy Branch Road, and the road to access stand 29-1. Table 2.2.3 on the next page summarizes the activities in Alternative 3. A more detailed description follows.

This project was designed to meet the project objectives discussed in Chapter 1, while avoiding activity areas that fall into the range of occupied and suitable habitat for cerulean warblers. To develop this alternative, an analysis was done to determine suitable habitat, known occurrences were mapped, and this information was compared with stands nominated for regeneration. As a result of this analysis some stands initially proposed for harvest were reconfigured or dropped to avoid cerulean habitat. Some stands prescribed for oak midstory treatment in Alternative 2 would now be regenerated to replace the dropped stands.

Table 2.2.3 Summary of Activities for Alternative 3

Compartment/Stands	Acres	Proposed Harvest	Other Proposed Treatments
25-2,15	29		Slash/burn/plant
25-2,3,5,7,8,10,21	215		Prescribed burning
25-7*	22	Thinning to 60 RBA**	
26-8,14			Helispots developed
27-4 or 9			Helispot developed
28-15	38		Vine control
29-1,3 and 5	82	2-Age, 10-30 RBA natural regeneration	Preharvest treatment of small stems and vines; post harvest site preparation; 2 vernal pools in 29-1
29-1,11,12	100		Prescribed burning
29-2,4,9,17	119		Timber stand improvement (TSI)
30- 9A, 13 and 23	80	2-Age, 10-30 RBA natural regeneration	Preharvest treatment of small stems and vines in 30-9A; Post harvest site preparation; 2 vernal pools in 30-13
30-15,24,29	75		Timber stand improvement
30-9B	19		Oak midstory treatment
31-1B and 6	49	2-Age, 10-30 RBA natural regeneration	Preharvest treatment of small stems and vines; post harvest site preparation
31-3	20		Timber stand improvement
31-5	19		Oak midstory treatment
31-8	33		Vine control
33-8	72/18 net	Group selection	2 vernal pools
33-11	11		Slash/burn/plant; 1 vernal pool
33-19	46		Timber stand improvement
34-3,9,17A, 17B	121	2-Age, 10-30 RBA natural regeneration	Preharvest treatment of small stems and vines if needed; post harvest site preparation
34-7,9,13	36		Prescribed burning
34-8,10,12,14	100		Vine control
35-3,9B, 14	98	2-Age, 10-30 RBA natural regeneration	Preharvest treatment of small stems and vines if needed; post harvest site preparation; develop 3 vernal pools above 35-3
35-9			Develop vernal pool, rehab wildlife opening
35-9A, 13,24	64		Oak midstory treatment
35-9C	29	Thinning to 60 RBA	
35-11,12,15	63		Vine control develop Helispot and rehab wildlife opening in 35-15

*If a stand is listed more than once it indicates that different treatments would be applied to different parts of the stand.

**RBA = Residual Basal Area, an indicator of the amount of trees that would remain in a stand after harvest.

Two-Age Regeneration Harvests

Regenerate 15 stands totalling approximately 430 acres using the two-age regeneration harvest method, with an average desired residual basal area (RBA) of 10-30 square feet per acre consisting of well-formed small sawtimber and poletimber trees and wildlife den trees. Carry the residual stems through mid-rotation (60 years) or full rotation (future option). Stands selected for this treatment and approximate acreages are 29-1 (33 acres), 29-3 (23 acres), 29-5 (26 acres), 30-9A (21 acres), 30-13 (36 acres), 30-23 (23 acres), 31-1B (20 acres), 31-6 (29 acres), 34-3 (32 acres), 34-9 (40 acres), 34-17A (34 acres), 34-17B (15 acres), 35-3 (25 acres), 35-9B (38 acres), and 35-14 (35 acres). Regenerate these stands by natural regeneration.

Treat the following stands prior to regeneration harvesting: 1) Stands 29-1 and 29-5: chainsaw slash all stems 1" – 7.5" dbh and grapevines and smokevines; 2) Stands 29-3, 30-9A, 31-1B, 31-6, 34-3, 34-17A and 34-17B: inject undesirable stems (striped maple, silverbell, black gum, sourwood, red maple, and black birch) 1" – 7.5" dbh with Garlon 3A and chainsaw slash grapevines and smokevines.

Use conventional ground skidding and yarding methods to harvest timber from stands 29-3, 30-23, 31-6, 34-9, and 35-3. Use a skyline logging system to harvest timber from stands 29-1, 29-5, 31-1B, and 35-14. Use conventional ground skidding and skyline yarding on stands 30-9A, 30-13, and 34-17B. Use helicopter yarding on stands 34-3 and 34-17A. Use a combination of helicopter yarding and ground skidding on stand 35-9B.

Prepare the two-age harvest units for natural regeneration by chainsaw felling of undesirable or damaged residual stems. Monitor regeneration composition and development in these stands and control undesirable reproduction (sprout clumps of red maple, striped maple, silverbell, sourwood, dogwood, yellow poplar, and blackgum) in stands where it exceeds 20% of stocking after the first growing season by treating with streamline application of Garlon 4 (triclopyr) herbicide in mineral oil (20% solution).

Slash/Burn/Plant

Three stands totalling approximately 40 acres (25-2, 25-15, 33-11) are insufficiently stocked or damaged by southern pine beetle. Prepare these stands for regeneration by chainsaw slashing and prescribed burning. Slash all stems in Stand 25-2, and only stems below 7.9" at diameter breast height (dbh) in Stands 25-15 and 33-11. After a summer burn, plant them with shortleaf or white pine on a 15-foot by 15-foot spacing. If planted with shortleaf pine, release these pines with a thinline application of Garlon 4 to competing vegetation one to three years after planting.

Thinning

Thin stand 25-7 (about 22 acres) and stand 35-9C (about 29 acres), harvesting the smaller-diameter class, poorer-quality, and damaged trees, favoring the better-quality "crop" trees. Thin stand 25-7 for firewood and/or small roundwood products.

Group Selection

Commit about 72 acres to uneven-aged management with harvesting by group selection in stand 33-8 (72 acres, 18 net). Groups would have diameters up to twice the height of adjacent trees. Groups would be located to capitalize on patches of large mature timber, patches of sparse, low-quality, or damaged timber, and patches with good advanced reproduction. Some high-quality growing stock trees, den trees, and snags would be retained in groups as practicable. Treat the groups prior to regeneration harvesting as follows: inject undesirable stems (striped maple, silverbell, black gum, sourwood, red maple, and black birch) 1" – 7.9" dbh with Garlon 3A,Garlon 4 thinline stems <1. Group openings would be regenerated naturally to hardwoods, with site preparation by chainsaw slashing, with a summer prescribed burn in this stand. After the first growing season, conduct a streamline application of a 20% solution of Garlon 4 (triclopyr) herbicide in mineral oil to sprout clumps of undesirable species in the groups in these three stands (black gum, silverbell, striped maple, red maple, yellow poplar, dogwood, and sourwood).

Oak Midstory Preharvest Treatment

Treat five stands (102 acres) with an oak midstory preharvest treatment and vine control. These stands would be regenerated 10-15 years from the present time. These stands, with their site-specific treatments, are as follows: 1) Stand 30-9B (19 acres): chainsaw slash all stems 1" – 6" dbh and slash all grapevines and smokevines except the clumps in ½ acre. Two or three growing seasons later, thinline spray all undesirable sprouts (striped maple, silverbell, black gum, sourwood, red maple, and black birch) with Garlon 4; 2) Stand 31-5 (19 acres): same as #1; 3) Stand 35-9A (24 acres): inject undesirable stems 1" – 7.5" dbh with Garlon 3A, thinline spray undesirable stems under 1" dbh with Garlon 4, and slash all grapevines and smokevines, leaving a ½-acre area of grapevines; 4) Stand 35-13 (23 acres): same as #3; 5) Stand 35-24 (17 acres): same as #3.

Vine Control and Other Timber Stand Improvement

Perform vine control work by chainsaw slashing on about 235 acres in the following stands: stand 28-15 (38 acres), stand 31-8 (33 acres), stand 34-8 (33 acres), stand 34-10 (21 acres), stand 34-12 (19 acres), stand 34-14 (28 acres), stand 35-11 (20 acres), stand 35-12 (23 acres), and stand 35-15 (20 acres). In these stands, leave one-half acre of grapevine clumps for every 20 acres.

Conduct timber stand improvement with herbicide in two stands totalling about 75 acres. These are stand 29-17 (about 29 acres) and stand 33-19 (about 46 acres). Treatment would consist of a thinline spray of Garlon 4 to undesirable stems competing with and/or overtopping desired vegetation.

Conduct timber stand improvement with herbicide and vine slashing in six stands totalling about 165 acres. These are stand 29-2 (35 acres), stand 29-4 (25 acres), stand

29-9 (30 acres), stand 30-15 (23 acres), stand 30-24 (28 acres), and stand 30-29 (24 acres). Treatment would consist of a thinline spray of Garlon 4 to undesirable stems competing with and/or overtopping desired vegetation. In addition, grapevines and smokevines would be chainsaw slashed, while leaving one/half acre of grapevine clumps for every 20 acres.

Perform a silvicultural cleaning treatment and vine control in stand 31-3 (20 acres). Select the best one or two stems per clump of existing merchantable species, and chainsaw slash the remaining stems in the clumps. Chainsaw slash grapevines and smokevines, leaving one/half acre of grapevine clumps in the stand.

Prescribed Burning

Conduct four prescribed burns for wildlife habitat improvement and fuels reduction during the late dormant season on approximately 351 total acres in the following stands: 1) Compartment 25, stands 3, 4, and 5 (100 acres); 2) Compartment 25, stands 7, 8, 10, and 21 (115 acres); 3) Compartment 29, stands 1, 11, and 12 (100 acres); and 4) Compartment 34, stands 7, 9, and 13 (36 acres). Use control lines along existing roads and creeks where possible, and also some handline.

Watershed Rehabilitation

Conduct watershed rehabilitation work on Forest Service (FS) road #2440A (Dummy Branch Road). Relocate this road from where it leaves state road (SR) #1242 to the gap (about 0.1 mile) to avoid the riparian area. Shift the road left and grade it into the gap. At milepost 0.2, the old culvert has washed out, cutting the road in two and causing off-site erosion. Replace the culvert and repair the slump. Install other culverts as needed. Install a gate to enable quick access in case of wildfire. Maintain the road by brushing and mowing.

Improving Access

Perform the following road construction work in order to provide additional access in the project area: 1) Stand 29-5: Construct 0.1 mile off of FS #438A to access the stand (temporary road); 2) Stand 29-3: Construct 0.5 mile off FS 438A to access this stand (temporary road); 3) Stand 29-1: A skid road would be upgraded to a haul road for 0.2 mile, and 0.3 mile would be constructed to access landings (0.5 mile temporary road); 4) Stand 31-1B: Construct 0.1 mile off FS 439 to access this stand (temporary) 5) Stand 33-8: Construct 0.5 mile off of Sarvis Branch Road to this stand (system road); 6) Stand 34-9: Construct 0.6 mile off of FS #2627C to access stand 9 and the lower part of stand 17 (system road); 7) Stand 35-3: Construct 0.25 mile off SR #129 to an existing landing to access this stand (system road); and 8) Stand 35-14: Construct 0.4 mile off of FS #2627A to access this stand (temporary road). Total road construction would be 1.35 miles of system road and 1.6 miles of temporary road.

Perform the following road reconstruction work in order to maintain and upgrade existing FS roads: 1) Stand 29-1: Reconstruct about 0.4 mile of temporary haul road to this stand, to include ditching, culvert installation, widening where ditches are needed, and gravel surfacing; 2) Compartment 33: Reconstruct about 0.2 mile of the Sarvis Branch Road. Total road reconstruction would be 0.2 miles of system road and 0.4 mile of temporary road.

Conduct helispot work in the following stands: 1) Stand 35-15 (an existing helispot/wildlife opening): Cut back saplings in the flight approach path, then do a summer prescribed burn. Thinline spray (Garlon 4) sprouts after the next growing season, and maintain the spot with prescribed burns as necessary; 2) Stands 26-8 and 26-14: Develop helispots on Yellow Creek Mountain along FS Trail #48. Slash down trees in late spring, prescribed burn in late summer, and seed with cover crop/grasses. Treat sprouts with thinline herbicide application (Garlon 4) after the first growing season. Maintain with periodic prescribed burns. Locate the helispots here for the additional purposes of fire control access; 3) Stands 27-4 and 27-9: same as #2.

Wildlife Habitat Improvements

Conduct a wildlife opening rehabilitation in stand 35-9C. Treatment would consist of resowing of perennial grasses and clover as necessary, liming and fertilizing the area, and develop a small pond or vernal pool.

Create several additional vernal pools in existing roadbeds or log landings in order to increase habitat and drinking water supplies for amphibians and bats. These ponds would be located in stands 29-1 (2 ponds), 30-13 (2 ponds), 33-8 (2 ponds), 33-11 (1 pond), and compartment 35 above stand 3 (3 ponds).

Following sale closure, seed roads and landings with a grass/clover mix, and maintain as linear wildlife openings. Rehabilitate existing openings by reseeding with a grass/clover mix and/or native species mixtures.

Old Growth Designations

Designate for small patches of old growth approximately 684 acres in the following stands: 25-18 (53 acres), 26-1 (52 acres), 27-10 and 11 (50 acres), stands 28-4, 5, and 13 (53 acres), 29-11 (102 acres), 30-3 (60 acres), 31-4 (50 acres), 32-3,4 and 5 (77 acres), 33-1 and 18 (67 acres), 34-7 (62 acres), and 35-7 and 8 (58 acres).

2.2.4 Mitigation Measures Applicable to Alternatives 2 & 3

For protection of health and safety: During prescribed burning adjacent to trails, trailheads would be posted with appropriate information, and lookouts would be placed to intercept through-hikers during the time of the burn. This would mitigate potential safety concerns.

For protection of water quality: Comply with the forest practices guidelines and standards found in the North Carolina Forest Practices Guidelines Related to Water Quality. Revegetate all disturbed soil promptly with seeding mixtures appropriate to the specific season; revegetate and/or mulch disturbed soil at stream crossings the same day. Use brush barriers, silt fence, or other measures for 300 feet either side of perennial stream crossings.

If rock is exposed during road construction or reconstruction, a soil scientist or geologist would be consulted to determine if exposed rock is of high iron sulfide content. If so, the acid producing rock would be removed to a dry waste area and encapsulated with twelve inches of limestone.

In order to protect the acid-producing rock disposal site adjacent to FS 2510, no ground disturbing activity would be allowed at the disposal site. Additional non-acidic fill could be added on top of the site if necessary to complete road reconstruction activities.

For protection of wildlife habitat: Leave up to ten well-formed dogwood, serviceberry and other soft-mast producers per acre during site preparation; do not treat grapevines with herbicide. Protect active den trees; leave an average of 2 snags per acre in regeneration harvest unit openings where possible.

Temporarily close roads to horse and/or bicycle use following seeding until the new grass/clover stand is sufficiently established.

For protection *Carex hitchcockiana*: Exclude the population of *Carex hitchcockiana* in Stand 34-17B from the two-age and group selection harvests, an area of approximately one acre along an unnamed tributary of Cochran Creek.

For protection of the Indiana Bat: This project would comply with the Terms and Conditions in the Biological Opinion of the U. S. Fish and Wildlife Service for the protection of the Indiana bat.

This includes retention of standing trees with more than 25% exfoliating bark, shellbark, shagbark and bitternut hickories, snags, hollow, den, and cavity trees, trees in buffer zones along intermittent and perennial streams, and shade trees adjacent to some of the large snags. These measures would be implemented when the stands are marked for sale.

Prescribed burning: Prepare a burning plan, including smoke management guidelines, prior to prescribed burning; conduct a post-burn evaluation following treatment. Conduct prescribed burns so as to insure the duff layer remains intact and soil texture and color are not affected. Burns must be supervised by a certified burning boss, and must be conducted only when Cumulative Severity Index values are less than established critical values.

Herbicide use: Apply herbicides according to labeling and site-specific analysis; all formulations and additives must be registered with EPA and approved for Forest Service use. Use application rates at or below those listed as typical rates in the Record of Decision for the Final Environmental Assessment on Vegetation Management in the Appalachian Mountains (ROD, FEIS-Veg. Mgmt.); use selective rather than broadcast applications. Forest Service supervisors and contract representatives must be certified pesticide applicators. Sign treated areas in accordance with FSH 7109.11.

Apply no herbicides within 100 feet of public or domestic water sources, or within 30 feet of perennial or intermittent streams. Mix herbicides at the District work center and dispense into application equipment on National Forest land at least 100 feet from surface water.

In addition to the above measures, apply all standards and guidelines for the appropriate MAs, as found in the LRMP, as amended. Also, apply all 99 mitigating measures found in the ROD, FEIS-Veg. Mgmt., and incorporated in the LRMP by Amendment #2 in July 1989, as needed.

For protection of scenic quality:

Table 2.2.4 lists stands requiring mitigation to meet visual quality objectives (VQOs). Following Table 2.2.4 is the numbered list of mitigation measures that correspond to the numbers in the last column of the table.

Table 2.2.4. Stands requiring Mitigation to Meet Visual Quality Objectives
With implementation of the following mitigation, as specified in the preceding charts, proposed activities would meet or exceed their assigned VQOs.

Unit #	Proposed Trtmt	VP	DZ	VQO	Mitigation
25-2	Slash/burn/plant	27,28,43-45	FG, MG	M	None
25-7	Thin	27,28,43-45	FG,MG	M	1, 4
25-15	Slash/burn/plant	27,28,43-45	FG, MG	m	None
29-1	Two-Age	1-7,17,20,21,35,46	FG,MG,BG	PR,M	2
29-3 (alt. 3)	Two-Age	1-11,25,26	MG	PR,M	5, 7, 13
29-5	Two-Age	1-11,22,25,26	MG,BG	PR,M	3
30-9A (alt. 3)	Two-Age	1-11,25,26	MG	PR,M	5, 6, 8, 12
30-11 (alt. 2)	Group Selection	1-11,25,37,46	FG,MG,BG	PR,M	1, 4, 5, 12
30-13 (alt. 2)	Two-Age	1-10,25,26,46	MG,BG	PR,M	6
30-13 (alt, 3)	Two-Age	1-10,25,26,46	MG,BG	PR,M	5, 7, 12
30-23 (alt. 2)	Two-Age/Thin	1-8,25,26,34,35,46	FG,MG,BG	PR,M	4, 5, 6, 12
30-23 (alt. 3)	Two-Age/Thin	1-8,25,26,34,35,46	FG,MG,BG	PR,M	5, 6
31-1 (alt. 2)	Two-Age/Thin	1-3,23,25,26,46	MG,BG	PR,M	5, 7, 8
31-1B (alt 3)	Two-Age	1-3,23,25,26,46	MG,BG	PR,M	5, 7, 8

Unit #	Proposed Trtmt	VP	DZ	VQO	Mitigation
31-6 (alt 3)	Two-Age	1,25,26,46	MG,BG	PR,M	5,7, 12
31-9 (alt.2)	Thin	24-26	MG	M	None
33-8	Group Selection	29,43-45	FG,MG	M	4, 5
34-3	Two-Age	40,41,43-45,48	MG,BG	M	9
34-4	Two-Age	25,26,40,43-46,48	MG,BG	R,M	10
34-9	Two-Age	40,41,43-45,48	MG,BG	M	5,9
34-17A	Two-Age	26,43-45,48	MG	M	9
34-17B (alt. 2)	Group Selection	40,43-45	MG,BG	M	None
34-17B (alt. 3)	Two-Age	41,43-45	MG,BG	M	9
35-3	Two-Age	32,42	FG,MG	M	11
35-9B	Two-Age	26,27,39,43-45	FG,MG	M	1, 9, 12
35-9C	Thin	25,26,38,43-45	FG,MG	M	1, 4
35-14	Two-Age	32,33,42-45	FG,MG	M	5, 14

VP = viewpoint DZ = distance zone VQO = visual quality objective

Scenery Mitigation Measures

With implementation of the following mitigation, as specified in the preceding charts, proposed activities would meet or exceed their assigned VQOs.

1. No new roads or landings should be built on Wauchecha Bald Trail or Yellow Creek Mountain Trail.
2. Drop new road construction into eastern half of unit. Harvest only what can be accessed from existing roads. Leave a minimum of 35 rba/ac of trees with well-formed crowns. Minimize size of cable landings, and place on top of ridge to minimize cut/fill banks. Leave a 50-foot buffer of un-cut screen below existing roads. Screen cable landings to extent possible.
3. Leave a minimum of 35 rba/ac of trees with well-formed crowns. Minimize size of cable landing, and place on top of ridge to minimize cut/fill banks. Leave a 50 foot buffer of un-cut screen below new and existing roads. Screen cable landings to extent possible.
4. Lop and scatter, or burn logging debris to within 4 ft. of the ground, for 50 feet beyond the edge of open road or trail.
5. Screen all roads, skid roads and decking areas, i.e. vegetative screen between road and viewpoint (usually on downhill side). Screen cable landings to extent possible (where applicable).
6. Leave a minimum of 25 rba/ac throughout unit; select leave-trees with well-formed crowns.
7. Leave a minimum 30 rba/ac throughout unit; select leave-trees with well-formed crowns.
8. Minimize size of cable landing, and place on top of ridge to minimize cut/fill banks. Screen cable landing to extent possible.
9. Leave a minimum of 15 rba/ac throughout unit; select leave-trees with well-formed crowns.
10. Drop 4C portion of unit.

11. Limit opening along Gladdens Creek Road to 500 linear feet. Leave a 150 foot buffer along US 129. Leave a minimum of 25 rba/ac in western ½ of unit.
12. In Two-Age and Group Selection units, move boundary 100 feet below ridge (cutting only those trees necessary for cable corridors, where applicable).
13. Insure 330 ft. buffer between proposed and existing harvest areas if existing is less than 20% of adjacent stand height.
14. Leave a minimum of 20 rba/ac throughout unit; select leave-trees with well-formed crowns.

2.2.5 Alternatives Not Considered In Detail

An alternative consisting primarily of unevenaged harvesting was considered, but dropped from detailed analysis. This was due to the silvical characteristics, ages, and conditions of the tree species and stands proposed for harvesting. The single tree selection regeneration method is inappropriate for cove hardwood, upland hardwood, and mixed pine/hardwood stands in this proposal. Group selection regeneration is appropriate in upland and cove hardwoods in certain situations and this method has been included in the development of alternatives to the extent practicable, but two-age harvest is the predominant regeneration system proposed due to forest types, stand configurations, and terrain considerations.

An alternative using only helicopter logging was considered, but dropped from detailed analysis. This was due mainly to the expense of helipcopter logging. If harvest volumes and timber values are high enough in a stand, the expense of helicopter logging may be warranted. A few stands proposed for harvest warrant the expense, while the remainder do not. Harvesting only the stands that could be economically harvested by helicopter would not create sufficient early successional habitat to meet an important project objective.

2.2.6 Comparison of Alternatives

The table below summarizes the effects of implementing each alternative. For each issue or resource listed, one or more indicators of effects are displayed. Information in the table is focused on effects where different levels of impacts can be distinguished quantitatively or qualitatively among alternatives and does not include all effects discussed in Chapter 3. A more complete explanation of listed indicators and overall effects is in Chapter 3 – Environmental Consequences.

Table 2.2.6. Summary of Effects

Issue/Resource	Alternative 1	Alternative 2	Alternative 3
Grass/forb habitat	28 acres or 0.5% of 3B acres	46 acres or 0.9% of 3B acres	46 acres or 0.9% of 3B acres
Early successional habitat	77acres or 1% of 3B acres	442+77 acres = 519 or 10% of 3B acres	488+77=565 acres or 11% of 3B acres
Cerulean warbler habitat	Habitat remains the same	Creating small openings in suitable habitat may improve habitat	While suitable habitat is avoided, creating adjacent small openings may be attractive to ceruleans
Golden-winged warbler habitat	Zero acres replacement habitat provided	221 acres replacement habitat provided	335 acres of replacement habitat provided
Threatened, Endangered, Sensitive species	No effect /No impact	**Not likely to adversely affect** the Indiana bat or the Appalachian elktoe mussel; no effect on any other federally proposed or listed species; may impact individuals of *Euphorbia purpurea, Helianthus glaucophyllus*, *Scutellaria saxatilis,* northern bush katydid rock-loving grasshopper frosted elfin, Diana fritillary butterfly, Santeetlah dusky salamander, southern Appalachian salamander, *Gomphus consanguis,* and *Gomphus viridifrons,* but would not impact their viability across the Forest.	
Scenery, including along the Appalachian Trail	VQO's met; project activities visible from 0 viewpoints	VQO's met; fewer acres of regeneration visible from the AT than in Alternative 3.	VQO's met; more acres of regeneration visible from the AT than in Alternative 2.
Soils	None	3.65 miles road constr. 0.6 miles road reconstr. 351 acres Rx burning	2.95 miles road constr. 0.6 miles road reconstr. 351 acres Rx burning
Aquatic Resources	None	3.65 miles road constr. 0.6 miles road reconstr. 4 new culverts 2 replacement culverts	2.95 miles road constr. 0.6 miles road reconstr. 3 new culverts 2 replacement culverts
Terrestrial Wildlife Management Indicator Species	Adverse	Beneficial	Beneficial

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

This chapter forms the scientific and analytic basis for the alternative comparisons. The environmental effects described here include both beneficial and detrimental effects. Environmental effects include appropriate ecological, aesthetic, historical, cultural, economic, social, and human health related effects, which directly, indirectly, or cumulatively result from the proposed action. The environmental discussion would focus on the issues identified for this project during the scoping phase of the NEPA process, but also would disclose how forest resources would be impacted. Acreages are approximate.

3.2 Issue - Impacts To Grass/Forb And Early Successional Habitat

3.2.1 Affected Environment

The LRMP standard for permanent grass/forb habitat in MA 3B is 3%. Currently, there are only about 28 acres of permanent grass/forb in the entire 5,269 3B acres in the project area. To meet the desired condition would require 158 acres. Grass/forb habitat is created by establishing wildlife openings or seeding of roads and log landings with appropriate grass/forb mixtures. Some temporary grass/forb habitat may be created through prescribed burning.

The area has a very limited amount of early successional habitat and younger age classes. Openings are needed to provide age-class diversity in this area and improve habitat quality for wildlife. Species that would benefit from the creation of openings include black bear, eastern wild turkey, white-tailed deer, and ruffed grouse, which find tender browse, fruit and hiding cover in dense young stands. Neotropical migratory birds such as chestnut-sided and golden-winged warblers also breed in these regeneration openings. There are few young stands of upland hardwoods and almost no young stands of cove hardwoods. Regenerating cove stands would benefit the area and have less effect on hard mast production. Regenerating upland hardwood stands would provide for future hard mast production.

The LRMP standard for early successional habitat in MA 3B is 5% to 15%. Currently, there are only 77 acres of early successional habitat in the project area. The desired range would be between 263 and 790.

3.2.2 Environmental Consequences

Summary of Effects of Each Alternative on Grass/forb and Early Successional Habitat

	Alternative 1	Alternative 2	Alternative 3
Grass/forb	28 acres or 0.5%	46 acres or 0.9%	46 acres or 0.9%
Early Successional	77acres or 1%	442+77 acres = 519 or 10%	488+77=565 acres or 11%

Direct and Indirect Effects

Alternative 1 would not move the area toward the desired conditions established in the LRMP. Alternative 2 and Alternative 3 would both increase the amount of grass/forb habitat, moving toward the desired condition. Alternative 2 and Alternative 3 would also both meet the desired condition for early successional habitat by creating enough new early successional to place the 3B portion of the project area well within the 5% to 15% range, with Alternative 3 creating about 1% more than Alternative 2.

Cumulative Effects

About 86% of Graham County is forested and about 62% is part of Nantahala National Forest. In the Project Area, about 40% of the acres inside the project boundary are privately owned and mostly forested. Openings are predominantly in the valleys and along state roads and consist of mostly openings created for private residences. Some grass/forb habitat is likely provided on private land. Early successional habitat similar to that provided by timber regeneration is seldom provided by residential development, which is appropriately described as a change in land use.

A recent project created early successional habitat close to the Hazanet Project Area. The Poison Cove Project created about 700 acres of early successional over a period of several years, close to 15% of that project area. Some additional acres of grass/forb were also provided by this project. This area is roughly northeast of the Hazanet Project Area. The Cornsilk Project is planned for the near future. That area is roughly southwest of the Hazanet area. It would also probably provide some additional early successional and grass/forb habitat. Since these habitat elements are in short supply, the cumulative effect would be to keep conditions more desirable across a broad swath of the Cheoah Ranger District for a suite of species that favor or need early successional or grass/forb habitat. As one regenerated area starts to grow up into a new forest and lose the early successional character, another adjacent area would begin to provide those desired elements.

3.3 Issue – Impacts To Endangered, Threatened, And Sensitive Species

3.3.1 Affected Environment

Refer to sections 3.8, 3.9, 3.10 and Appendix A for a description of the affected environment.

3.3.2 Environmental Consequences

Proposed, endangered, threatened, and sensitive (PETS) species considered in this analysis are those included in the National Forests in North Carolina PETS species list (January, 2002). All PETS species that might occur on the Nantahala National Forest were considered. Potentially affected species were identified from information on habitat

relationships, element occurrence records of PETS species as maintained by the North Carolina Natural Heritage Program and field data on the project area.

Duke Rankin, Nantahala National Forest botanist, surveyed these sites and concluded that the project would have no effect on any federally listed or proposed plant species. Consultation with the U. S. Fish and Wildlife Service is not required. The project may impact individuals of the sensitive species *Euphorbia purpurea, Helianthus glaucophyllus,* and *Scutellaria saxatilis*, but are not likely to cause a loss of viability or a trend to federal listing. The action alternatives would not impact any other sensitive plant species. There would be no cumulative effects on any sensitive plant species from the activities (see attached Botanical Analysis).

Doreen Miller, Nantahala National Forest wildlife biologist, surveyed these sites and concluded that the project is not likely to adversely affect any federally listed or proposed terrestrial animal species

To reduce the likelihood of direct effects to Indiana bats and indirect effects to Indiana bat habitat, this project would comply with the Terms and Conditions in the Biological Opinion of the U. S. Fish and Wildlife Service for the protection of the Indiana bat.

Since the sequence of events that would result in a tree being cut down in which a bat is roosting is very unlikely, direct effects to Indiana bats should not occur. Because there is only a very minor loss of potential Indiana bat habitat in the area impacted, this action would not affect the availability of Indiana bat habitat in the project area.

This project **is not likely to adversely affect** the Indiana bat (*Myotis sodalis*). The project would have no effect on any other federally proposed or listed terrestrial animal species. The project may impact individuals of the northern bush katydid (*Scudderia septentrionalis*), rock-loving grasshopper (*Trimerotropis saxatilis*), frosted elfin (*Callophrys irus*), Diana fritillary butterfly (*Speyeria diana)*, Santeetlah dusky salamander (*Desmognathus santeetlah*) and southern Appalachian salamander (*Plethodon teyahalee)*, but would not impact their viability across the Forest. This project would not impact any other sensitive species. No cumulative effects on species viability across the Forest would result from this project. Consultation with the U.S. Fish and Wildlife Service **is required** (see attached Wildlife Analysis).

Jason Farmer, Nantahala National Forest fisheries biologist, concluded that the federally listed mussel *Alasmidonta raveneliana* and portions of its critical habitat are located within the project or analysis areas. The USDI Fish and Wildlife Service was contacted. In accordance with the USDI Fish and Wildlife Service recommendations, the Indiana Bat standards (Amendment 10 to LRMP) would provide the necessary protection for the Appalachian elktoe and its critical habitat. The project is not likely to adversely affect the Appalachian elktoe and would have no effect on any other federally listed aquatic animal species.

Sensitive species *Gomphus consanguis* and *Gomphus viridifrons* may occur within the project area. A *Gomphus sp.* individual (genus in which *Gomphus consanguis* is located) was collected by Pennington & Associates (2002). The habitats for these benthic macroinvertebrate species are common across their range. The implementation of this project may impact or stress individuals, but is not likely to adversely affect the viability of these species across the Forest. No risk to aquatic population viability of the two sensitive species above would occur as a result of this project. The project would have no effect on any other sensitive aquatic animal species (see attached Aquatic Analysis).

Determination of Effect

This project **is not likely to adversely affect** the Indiana bat or the Appalachian Elktoe mussel. The proposed project would have no effect on any other federally proposed or listed species. The project may impact individuals of *Euphorbia purpurea, Helianthus glaucophyllus*, *Scutellaria saxatilis,* northern bush katydid (*Scudderia septentrionalis*), rock-loving grasshopper (*Trimerotropis saxatilis*), frosted elfin (*Callophrys irus*), Diana fritillary butterfly (*Speyeria diana)*, Santeetlah dusky salamander (*Desmognathus santeetlah*), southern Appalachian salamander (*Plethodon teyahalee)*, *Gomphus consanguis,* and *Gomphus viridifrons,* but would not impact their viability across the Forest. The project would have no impact on any other sensitive species. Consultation with the USDI, Fish and Wildlife Service **is required**.

Additional information on individual species can be found in sections 3.8, 3.9, and 3.10.

3.4 Issue – Impacts To Cerulean Warbler

3.4.1 Affected Environment

The Cerulean warbler was known to occur at two locations along F.S. 438 on the eastern end of the project area and at several locations just to the north of the project area near Cable Gap. Breeding bird surveys were conducted in May of 1999, 2000 and 2001. A special emphasis was placed on determining whether Cerulean warblers occur in any activity areas. Cerulean warblers were located at additional sites in the project area. No other rare species were detected and no special habitats for any other terrestrial wildlife sensitive species were located.

The Cerulean warbler (*Dendroica cerulea*) is of conservation concern throughout its range. North American Breeding Bird Survey (BBS) data on the Cerulean warbler indicate a significant population decline in eastern North America, which is most pronounced in the core of the breeding range. The U. S. D. I. Fish and Wildlife Service lists the Cerulean warbler as a "Species of Concern". Partners-in-Flight ranks the Cerulean warbler as one of the top ten priority neo-tropical migratory bird species of conservation concern in the southern Blue Ridge.

Until 1994, the Cerulean warbler was known from just nine locations on the Nantahala and Pisgah National Forests. Most of these sites were in Graham County, between the town of Tuskegee and Fontana Village. The two other extant sites on the Forest

supported a few birds in Clay and McDowell counties. In 1994, breeding bird surveys conducted in preparation for a timber sale in the Hickory Knob area in Macon County located three birds on territory. (Surveys done during the last five years have not relocated the birds at this site.)

Between 1994 and 1998, surveys recorded an additional 30 individuals in the Cheoah and Yellow Creek Mountains of Graham County, including the Hazanet Project area. These birds were all found within areas already known to support Cerulean warblers. A total of 45 birds on territory have now been documented between Stecoah Gap and Fontana Village, an area encompassing about 40 square miles. During the last seven years, extensive surveys have been conducted for Cerulean warblers in all areas of suitable habitat where timber harvesting or other significant impacts to the vegetation were proposed. Despite this effort, no new occupied territories were documented in any additional areas of the Forest. During the 2002 season, a single bird was recorded from the Farley Cove area west of Santeetlah Lake. This site fills a gap between known sites east of the lake in the Cheoah Mountains and previous records in the Joyce Kilmer/Slickrock Wilderness Area.

In this analysis area, each stand proposed for treatment was evaluated for suitability as Cerulean warbler habitat. Stands were compared with known occupied habitat in this area and at other sites in Graham County and the Nantahala National Forest in making this determination. Stands dominated by white pine or rhododendron, xeric stands, and young stands lacking any large trees were not considered suitable. This resulted in about 400 acres (5% of the total area) estimated to provide potentially suitable habitat for Cerulean warblers. This habitat is located in Compartments 29, 30, 31, and 34, which are dominated by cove hardwoods.

The 400 acres is classified as about 74% cove hardwoods and 19% northern hardwoods. Within this habitat, surveys conducted during the last three years have located a total of 13 birds on territory. All of the birds were located in association with a break in the forest canopy, either adjacent to an open paved state road, a narrow gravel Forest Service road, or a significant canopy gap due to wind throw.

3.4.2 Environmental Consequences

Direct And Indirect Effects

Alternative 1 - No Action

This alternative would result in no additional openings being created in the project area. The habitat would remain in its current condition in the near future.

Alternative 2

The areas identified as suitable habitat for Cerulean warblers, if treated, would receive treatments that leave a high basal area of mature trees in place, and would utilize other

protective measures. These measures would apply to stands identified as suitable habitat, even if birds have not been located there during surveys. These include:

1) No timber harvesting would occur within a 300 ft. buffer around known occurrences.
2) Retain at least 60 square feet of basal area intreated stands; with leave trees consisting of the largest and tallest dominant canopy trees.
3) Group selection openings would be no larger than 0.5 acres, with groups comprising no more than 10 percent of the stand. Groups would be no closer than 300 feet. Thinning between groups would retain at least 60 square feet of basal area; with leave trees consisting of the largest and tallest dominant canopy trees.
4) Roads constructed or reconstructed within or adjacent to suitable habitat would be built to minimum road width standards and areas subject to day lighting (cutting trees alongside the road to increase the light level on the roadbed, thus providing a drier surface) would retain a minimum of 60 square feet of basal area.

Of the 400 acres identified as suitable habitat, 43 acres would be thinned. Small group openings would be created on another 103 acres, with thinning between the groups. The current basal area of these stands is between 100 and 130 square feet per acre. Thinning from below would remove intermediate and suppressed trees and reduce the basal area to a minimum of 60 square feet. This would alter the structure of the vegetation on about a third of the cerulean suitable acres. Since all of the Cerulean warblers found in the project area have been adjacent to canopy gaps, creating these small openings may improve the habitat. Thinning in between would break up the canopy and increase the structural diversity of the rest of the stand. Over time, growth would be concentrated on the residual larger trees. This may also improve the habitat. Preharvest treatments, timber stand improvements and other treatments involving vine control would be conducted on about 150 of the acres identified as suitable habitat. Grape vine slicks would be left at the rate of ½ acre per 20 acres.

Alternative 3

This alternative would exclude the areas identified as suitable habitat for Cerulean warblers from any timber harvesting. Some of proposed 2-age harvest units are quite close to areas identified as suitable habitat, but are generally on higher and drier upland hardwood sites. While not directly treating the habitat, this alternative would create additional openings in the general area occupied by the Ceruleans. The edges of these openings, adjacent to mature cove hardwood stands, may be attractive to Cerulean warblers in the near future. Pre-harvest treatments, timber stand improvements and other treatments involving vine control would be conducted on about 155 of the 400 acres identified as suitable habitat.

Cumulative Effects – A project recently implemented is the reconstruction of the Wauchecha Bald road. This project had direct impact the habitat of a known occupied

breeding territory. Impacts to the vegetation are limited to five feet from the top of the cut bank and five feet from the edge of the road on the downhill side. This would increase the size of the canopy gap in this area, but would result in limited impacts to the structure of this site. The project was implemented outside the normal breeding season of April 15 to July 1, to prevent adverse effects to the Cerulean warbler.

3.5 Issue – Impacts To Golden-Winged Warbler

3.5.1 Affected Environment

The **golden-winged warbler**, *Vermivora chrysoptera*, while not a Forest Concern species, is of management concern due to the significance of the population found in this area. It is also ranked as a priority neotropical migratory bird species by the USDI - Fish and Wildlife Service. North American Breeding Bird Survey (BBS) data indicate a significant population decline in eastern North America. Concern regarding the status of this species in surrounding states led to an interest in documenting its status in North Carolina.

Since 1995, golden-winged warblers identified during the course of other bird surveys on the Nantahala National Forest have been recorded. Birds have been located at 60 sites in Graham, Cherokee, Clay, and Macon counties. Nearly all of these birds were on the edge of 10 to 15 year old clearcuts between 3000 and 4000 feet elevation. A few were found using wildlife openings. Golden-winged warblers nest on or near the ground in grasses and herbaceous cover. In 1997 and 1998 Dr. David Buehler from the University of Tennessee and his students conducted an intensive study of this species in the Hazanet analysis area and located 30 breeding pairs; a significant population. When the study took place a number of stands were in the young forest age range preferred by the bird. As these stands age they would loose the characteristics that make them attractive to golden-wings.

The information collected indicates that this species is fairly common across the Nantahala at the present time. However, the reduction in timber harvesting that has occurred in the last five years means that the habitat that is currently available would not be replaced in the near future. In the absence of other significant disturbance events, the amount of suitable habitat available for this species would decline, both in the short and long term.

This species is a high elevation, early successional habitat associate. This suggests that habitat can be created on upland sites through burning and/or logging. Sites of 10 to 15 ha, which can support six pairs, may be close to optimum. The Partners in Flight Southern Blue Ridge Bird Conservation Plan recommends increasing the amount of early successional, shrub-scrub habitat in high-elevation hardwoods, Appalachian oak, and southern yellow pine in part to benefit this species.

About 240 acres in 11 to 30 year old stands are dominated by upland or cove hardwoods and may provide suitable habitat for golden-winged warblers. Another 260 acres were

regenerated in 1992, mostly in compartments 29 and 30, on the eastern side of the project area. The rest of the project area is lacking in early successional habitat. .

3.5.2 Environmental Consequences

Direct And Indirect Effects

Alternative 1

There would be no new regeneration areas to provide habitat for golden-winged warblers as existing sites decline through age.

Alternative 2 & 3

Regenerating some stands of upland hardwoods or mixed pine-hardwoods would provide replacement habitat for this species in the future. The 221 acres of regeneration of these types created in compartments 29, 30, 31, and 34 in Alternative 2 should provide suitable habitat for golden-winged warblers in the future.

The 335 acres regeneration of upland hardwoods or mixed pine-hardwoods created in compartments 29, 30, 31, and 34 should provide suitable habitat for golden-winged warblers in the future. The drier sites proposed in Alternative 3 are preferred since they would retain the habitat longer. The proposed prescribed burning may also improve habitat for this species.

Cumulative Effects: Regeneration in the two action alternatives should help sustain the suitability of the area as golden-winged warbler habitat over the next decade. Regeneration over the past decade in areas adjacent to the Hazanet area may provide habitat during the current decade.

3.6 Issue – Impacts To Scenery (including from the Appalachian Trail)

3.6.1 Affected Environment

The Hazanet Knob project area is located on the Cheoah Ranger District between Lakes Santeetlah and Fontana. Management areas in the project area include 2A, 3B, 4A, 4C & 14. All proposed activities are located within MA 4C, 14 and 3B.

Management area 3B has an assigned visual quality objective (VQO) of modification (M) for all sensitivity levels (SL) and distance zones (DZ) -- except where visible in the foreground (FG) and middleground (MG) from the Appalachian Trail (AT), where the VQO is partial retention (PR). Management area 4C has an assigned VQO of retention (R) in foreground SL 1 areas, and PR in all other distance zones and sensitivity levels. Management area 14 has a R VQO for all DZ and SL. Retention VQO must be met within one growing season, PR must be met within two, while modification is allowed

three growing seasons. Refer to the Nantahala and Pisgah Land and Resource Management Plan (LRMP) for specific definitions of visual management terminology, and management area standards.

Scenery consists of the combination of landforms, rock outcrops, water bodies, and vegetation as seen across the landscape. From viewpoints analyzed for this project, modifications to the landscape can be seen on public lands in the form of clearings, roads, and timber harvests. National Forest lands seen in the middleground appear as a continuous hardwood-conifer forest with patches of younger trees in areas of past timber management. The logging roads and landings used to harvest these areas are seen as well. These 8-19 year old harvest areas vary in size and the degree to which they blend-in with the surrounding forest. Many views from local roads and trails would be screened by foreground vegetation during leaf-on season, and would be filtered during leaf-off season; others are open and unobstructed. Foreground views from the Appalachian Trail, Yellow Mountain Trail and Wauchecha Bald Trail are of mixed hardwood-conifer forests with an open understory in places and dense Rhododendron in others. Middleground views from these trails are of forested lands on the mountain slopes and open pasturelands in the valleys. Foreground views from Lake Santeelah, US 129, Yellow Creek Road, and other local roads are of light commercial, private residential and farmlands intermixed with forested areas. Along US 129, Lake Santeetlah and the Cheoah River are visible, as is Santeehlah Dam and the associated penstock. Middleground and background views from these roads and lake are primarily of National Forest lands, as described above.

Field surveys and computer analysis were used to identify viewpoints (VP) and determine visibility of proposed management activities. All travel corridors, water bodies and use areas in and around the project area were considered for potential viewpoints.

The following list identifies the number and location of VPs considered in the analysis. This is a comprehensive list of analyzed viewpoints. Analysis revealed that proposed activities are not visible from all VPs; therefore some do not show-up in the "Effects by Alternative" section of this report. Many of the locations listed are specific points, while others are segments of trail or road. Some of the views would be seen as the viewer is moving (in a vehicle, walking, horseback, etc.), others are from stationary vistas. Views may be filtered or screened by foreground vegetation; others are open and unobstructed. The degree of potential impact varies with these and several other factors such as distance from viewer, viewer position, slope, size, shape and type of proposed harvest or road, landing, etc. All of these factors are considered when determining what activities would meet assigned VQOs or what mitigation would be required.

Viewpoints:

VP1-VP21, Appalachian Trail from Walker Gap to Cody Gap
VP22-VP24, Yellow Creek Road
VP25-VP28, Yellow Creek Mountain Trail
VP29, SR1242
VP30-VP32, SR129

VP33, Santeetlah Lake near Santeetlah Dam
VP34-VP42, Wauchecha Bald Trail
VP43, Maple Springs Overlook
VP44-VP45, Haoe Lead Trail
VP46, Appalachian Trail at Shuckstack in Great Smoky Mountains National Park
VP47, Appalachian Trail on Hogback Mountain
VP48, Cochran Creek Road
VP49, Gladdens Creek Road

3.6.2 Environmental Consequences

Direct and Indirect Effects

A prescribed burn would blacken the ground temporarily and green-up the following spring. Other silivicultural or wildlife treatments would create minimal impacts to scenic resources. All areas proposed for prescribed burning and other wildlife or silivicultural treatments would meet assigned VQOs from all associated viewpoints. Analysis and mitigation for temporary road construction is addressed by alternative. Timber harvest activities and related road construction could create a greater level of disturbance to the scenery from the AT.

For Alternative 1, all VQO's would be met.

For Alternative 2 and 3, one or more project activities would be visible from 35 of the 49 evaluated viewpoints, including a number of views along the stretch of AT from Walker Gap to Cody Gap. All VQO's would be met with the scenery mitigations listed in the description of the alternatives. Alternative 2 would have lesser impacts to the views due to less visible acres of regeneration harvest.

Cumulative Effects

Past timber harvest areas and existing roads are visible on National Forest Lands from most VPs analyzed. Implementation of this project would add to the number of acres of visibly altered forest over the next decade. From some VPs, existing harvest areas would not be noticeable to the average viewer. However, there are visible treatment areas that need another 5-10 years of growth before they blend-in with the surrounding forest. Existing roads and landings may remain visible for many years, but are primarily seen during leaf-off season.

3.7 Soil Resources

3.7.1 Affected Environment

Geology

The Hazanet Project Area is composed predominantly of the Copper Hill Formation, with a small band of Slate of the Copper Hill Formation. The Copper Hill Formation is a light-gray, massive, coarse-and medium-grained clastic sedimentary rock, variably metamorphosed. Metagraywacke predominates and is commonly present as thick graded beds. Metaconglomerate beds are present throughout the formation as is nodular calc-silicate granofels. Minor mica schist, at places graphitic and sulphidic, is also present. It has a moderate risk for stream acidity, low risk for slope instability, and is of moderate potential for mineral resources. The Slate of the Copper Hill Formation is dark-gray to black, graphitic, sulphidic slate, phyllite, and schist; interlayered with dark-gray, locally graded Metagraywacke. This formation is high risk for both stream acidity and slope instability. It has moderate potential for mineral development.

Soil Characteristics

Ongoing soil surveys in Graham County, NC by the Natural Resource Conservation Service, have identified soils in the Hazanet Project Area as derived from metasedimentary geology. These soils have metagraywacke, metaconglomerate, metasiltstone, and metamorphosed fine-grained rocks ranging from slate to schist. The soil series and complexes where soils disturbing activities may occur are, from most common to least: Cheoah, Spivey-Whiteoak, Soco-Stecoah, Ditney-Unicoi, Junaluska-Brasstown, Snowbird, Junaluska-Tsali, Cheoah-Jeffrey, and Cullowhee-Swansee (trace). Some of these soil types have a potential association with acid producing rock, depending on the underlying geology. Soil types are briefly summarized below.

Cheoah Series: Dark surfaced, productive soils found on north facing slopes, east facing slopes, or on areas shaded by higher mountains. These soils are well drained, moderately permeable, showing very little runoff where forest litter is undisturbed or partially disturbed. Found in 16 proposed harvest areas, predominant in nine.

Spivey-Whiteoak: Dark surfaced, productive soils found in coves, drainageways, and on toe slopes. These soils are very deep, well-drained, with moderate to moderately rapid permeability. Surface runoff is slow to medium. Found in 18 proposed harvest areas, predominant in two.

Soco-Stecoah: Dark yellowish-brown, moderately deep to deep, well-drained soils on mountain side slopes and narrow ride tops. It has moderately rapid permeability, and runoff is slow where forest litter has not been disturbed to very rapid where there is no litter. This soil is less productive than Cheoah series, and is droughty. Found in nine proposed harvest areas, not predominant.

Ditney-Unicoi: Dark grayish-brown, shallow to moderately deep, well-drained to excessively drained soils on mountain sides and narrow ridge tops. Productivity is low and it may be droughty. Found in five proposed harvest areas, predominant in four.

Junaluska-Brasstown: Brown, moderately deep to deep, well-drained soils on side slopes and narrow ridgetops. This soil is of moderate permeability and runoff is slow where

forest litter has not been disturbed to rapid where there is no litter. It is of intermediate productivity. Found in five proposed harvest areas, predominant in one.

Snowbird: Dark surfaced, very deep soils on north-to east-facing head slopes or slopes shaded by higher mountains. This soil is of moderate permeability and runoff is slow where forest litter has not been disturbed to very rapid where there is no litter. Productivity is high. Found in three proposed activity areas, predominant in two.

Junaluska-Tsali: Brown, shallow to moderately deep, well-drained soils on side slopes and narrow ridge tops. It is of moderated permeability and runoff is slow where forest litter has not been disturbed to very rapid where there is no litter. It is of intermediate productivity. Found in one proposed harvest area, not predominant.

Cheoah-Jeffrey: Dark surfaced deep and moderately deep, well-drained soils on north-to-east-facing head slopes and side slopes. It is of moderate permeability and runoff is slow where forest litter has not been disturbed to rapid where there is no litter. Soil is highly productive. Slope instability can occur on these soils. Found in one proposed activity area, not predominant.

Cullowhee-Swansee (trace): Dark brown surfaced, very deep, somewhat poorly drained soils on flood plains of smaller streams. Surface runoff is slow. Soil compaction is a hazard. Found in one proposed activity area, not predominant.

Discussion

Erosion and compaction of soil can affect site productivity. Erosion that results in sediment entering streams can have detrimental effects to aquatic biota. Erosion is most likely to occur when forest litter or vegetation is removed from an area with steep slopes. Compaction starts with soil compression or loss of soil volume. Soil compression reduces infiltration capacity and can have a negative impact on tree growth. However more compacted soils have greater load-bearing capacity. Compaction is facilitated by high moisture content of the soil. Road construction and reconstruction are the proposed activities with the greatest potential for increasing erosion and compaction of soil.

Certain metasedimentary rocks in southwestern North Carolina contain variable amounts of iron sulfide materials that, when exposed to weathering, produce sulfuric acid with potentially harmful effects to streams and aquatic life. Soils linked with underlying geology give an indication of the likelihood of encountering acid producing rock in any particular area. While acid producing rock has not been encountered in the project area during past road construction, much of the area has at least a moderate risk for it. This becomes most important if road building is proposed in proximity to streams. The amount of new road construction is an indicator of the potential for encountering acid producing rock. There is a disposal site for acid producing rock in the project area. This disposal site was for a state road construction project and is located adjacent to FS 2510 in the western part of the project area.

Prescribed burning can also affect soils. Potential impacts on soil productivity depend on the intensity of the fire. If burning is not done under proper fuel and/or weather conditions, the results can be severe. If all litter and duff is consumed, mineral soil can be altered, resulting in reductions of soil biota, organic matter, and nitrogen, and loss of soil structure. If prescribed burning is carried out during the proper fuel moisture and weather conditions, fine fuels and litter can be consumed while leaving the duff layer and larger fuels mostly intact (Van Lear and Waldroop 1989 and FEIS, Vegetation Management, Appendix B). The amount of prescribed burning is an indicator of relative potential effects of this activity.

3.7.2 Environmental Consequences

Soil Impacts Indicators	Alternative A	Alternative B	Alternative C
Amount of new road construction	0 miles	1.35 miles system; 2.3 miles temporary	1.35 mile system; 1.6 miles temporary
Amount of road Reconstruction	0 miles	0.6 miles	0.6 miles
Amount of Prescribed Burning	None	351 acres	351 acres

Direct and Indirect Effects:

Alternative A: Alternative A is the "no action" alternative. As considered here, no action means none of the vegetation management (including prescribed burning) and associated road-related activities would occur. There would be no potential for affecting soil erosion or compaction, no potential for encountering acid producing rock and no potential for affecting soils from prescribed burning. There would be no effects to soil from this alternative.

Alternatives B and C:

Alternative B would have the more acres treated with some form of management action and a greater amount of new road construction than Alternative C. Road construction exposes bare soil and can result in erosion and compaction. As standard procedure to minimize effects, all road construction and reconstruction would be designed and built to LRMP standards and general direction (LRMP III-46-51), and to the North Carolina Forest Practices Guidelines Related to water quality. In addition, since this area is known to have some risk for exposing acid producing rock, Forest Engineers would be required to consult with a soil scientist in determining if any exposed rock is of high iron sulfide content. If exposed, this acid producing rock would be removed to a dry waste area and encapsulate it with twelve inches of limestone to mitigate potential impacts to aquatic systems. While the geology of most of the project area is of moderate risk for acid producing rock and low risk for slope instability, Stand 35-3 (in both Alternatives B & C) is located on a geological formation with a high risk for acid producing rock and slope instability. To minimize potential impacts the proposed access road would tie into existing landings and skid roads in an adjacent stand to access the ridge, thereby avoiding construction on the steepest slopes.

In order to protect the acid-producing rock disposal site adjacent to FS 2510, no ground disturbing activity would be allowed at the disposal site. Additional non-acidic fill could be added on top of the site if it is necessary to complete road reconstruction activities.

Alternative B has the same amount of prescribed burning acres as Alternative C. VanLear and Danielovich (1988) found that burning under the proper fuel moisture and conditions had little effect on infiltration rates, did not significantly increase mineral soil exposure, left residual forest floor and did not alter the root mat. Burning promoted vigorous shrub and herbaceous regrowth, which provided quick cover and protection of the soil. Other studies have yielded similar results. Similar effects are expected from the prescribed burning proposed in this project.

Cumulative Effects: About 32.43 miles of existing closed roads access the project area. Both Alternatives B and C would increase the amount of system roads to 33.78 miles. There is a reasonable expectation of similar vegetation management projects occurring in future decades that would add some additional miles of system road as more of the 3B management area is made accessible for long term management. Past road construction in the project area has not encountered exceptional erosion, sedimentation, or compaction issues that did not meet the standards discussed previously. However there can be such issues with roads in the project area that receive frequent use, such as if a road were open or used by special use permittees. None of the proposed new roads would be open and none are anticipated to have frequent use after the vegetation management activities are completed, therefore no cumulative effects to soils are expected from this project beyond the incremental increase in area compacted and converted to roadbed.

Acid producing rock has been encountered in other parts of the Cheoah District and with other road building projects, including projects outside Forest Service jurisdiction. Past road construction in the project area has not encountered acid producing rock, and none was encountered with similar projects adjacent to the project area such as with the Poison Cove and Walker Gap Projects. Measures would be in place as discussed above to deal with any such rock exposed during project activities. Therefore no cumulative effects to stream acidification is anticipated with this project.

3.8 Aquatic Resources

3.8.1 Affected Environment

The project is located in LRMP Watershed 23 in the Little Tennessee River Basin. This watershed was evaluated using a standard protocol for the Southeastern United States and was assigned a rating of "best" condition and "moderate" vulnerability to change. In a separate evaluation of aquatic resources for the Nantahala/Pisgah Forest Scale Roads Analysis (January 2003) the watershed received a rating "high" for aquatic biota vulnerability. This is due in part to the proximity of the Cheoah River, known for the presence of the endangered Appalachian Elktoe mussel.

There are approximately 81 stream miles in the project area including several miles of the Cheoah River.

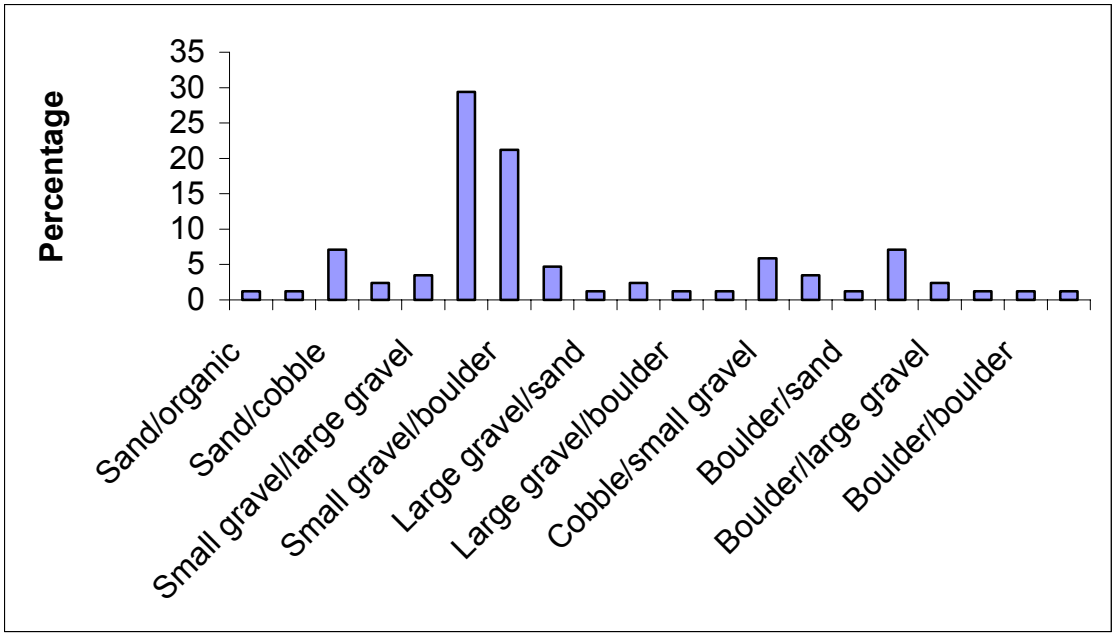
Culverts along the Forest Service Roads 438, 439, and 2627, the roads themselves, and existing old roads and skid trails in the project area are the existing threats to the streams and drainages. Impacts from these sources are limited to down slope movement of sediment from road runoff and culvert fills. It is suspected that sediments from these sources are deposited in the natural vegetative filters before they reach areas of perennial water since the roads (FS 438, FS 439, and FS 2627) are closed to all but administrative and fire control traffic (i.e. road disturbance is limited). No culverts in the analysis area were found to inhibit the ability for fish movement and the movement of other aquatic organisms.

FS 2440A, Dummy Branch Road has had a culvert blown out, cutting the road in two and causing off site erosion. A 0.1-mile section of the road where it leaves SR 1242 needs to be relocated away from the riparian area to resolve this erosion problem.

Aquatic Habitat

Substrate within the project area waters was evaluated and visually estimated. The three primary types of substrate that existed were documented at each macroinvertebrate sample site. This information is valuable for determining the amount of habitat available for Proposed, Endangered, Threatened and Sensitive (PETS) species, Management Indicator species (MIS) as well as any other aquatic organisms. An additional aquatic habitat survey was conducted on Cochran Creek in 2001 using the Basinwide Visual Estimation Technique (Doloff et al. 1993). The results of this survey are given in Table 3.8.1a.

Figure 3.8.1a Composition of Cochran Creek substrate in 2001. Percentage of the total samples that consisted of the following habitat types. Dominant and subdominant substrate types were estimated using standard BVET protocols. Eighty-five samples collected.



Bee Creek is adjacent to FS 438A and associated with units 13, 15, 23,24, and 29 in Compartment 30. The average width of Bee Creek is 3 meters to 4 meters and the riparian vegetation consists of rhododendron, hemlock, and mixed hardwoods. The tributary headwaters of Bee Creek are too small to support fish habitat due to restricted size and flow regimes. The substrate within these small streams consisted mainly of gravel (approximately 40%) and sand/silt (25%). The gradient of Bee Creek was approximately 40%, which is a measure of the slope of the stream channel.

Williams Branch has no roads adjacent to it and the stream is associated with units 9, 11, 13, and 15 in Compartment 30. The average width of Williams Branch is 2 meters to 3 meters and the riparian vegetation consists of mixed hardwoods. Williams Branch was sampled for macroinvertebrates and substrate was visually estimated. Substrate within Williams Branch was 10% gravel, 20% sand and silt and 45% cobble.

Lifting Rock Branch is located just below Unit 9 in Compartment 25. The average width of Lifting Rock Branch is 2 meters and the riparian vegetation consists of birch, yellow poplar, black gum, red maple, and rhododendron. Lifting Rock Branch was sampled for macroinvertebrates and identified to the family level. Substrate within this stream consisted of sand (20%), silt (10%), small gravel (30%), cobble (20%), and large gravel (20%). The stream gradient was 8%. No fish habitat exists in Lifting Rock Branch.

Sarvis Branch is located within Unit 8 in Compartment 33. The average width of Sarvis Branch is 1.5 meters and the riparian vegetation is made up of yellow poplar, red maple, ironwood, and beech. Substrate within this stream consisted of 50% sand, 10% silt, 10% small gravel, 20% cobble, and 10% large gravel. The gradient was 6%. No fish habitat exists within Sarvis Branch.

Peterson Branch is located in Units 3 and 4 of Compartment 25. The average width of Peterson Branch is 6 meters. The riparian vegetation consists of hemlock, yellow poplar, red maple, rhododendron, and dog hobble. Substrate within Peterson Branch consists of 15% sand, 5% silt, 10% boulder, 20% large gravel, 5% small gravel, 15% cobble, and 30% 6 –12 inch stone. The stream gradient was 12% and no fish habitat exists within Peterson Branch.

Colvin Branch is located in vine control Unit 10 and Unit 17 of Compartment 34. The average width of Colvin Branch is 3 meters and the riparian vegetation consists of birch, maple, yellow poplar, hickory, spice bush, stripe maple, stingweed, fern, and Virginia creeper. Substrate within Colvin Branch consists of 50% bedrock, 15% cobble, 5% sand, 5% silt, 5% organic, 10% 6 – 12 inch stone, and 10% gravel. This stream goes underground in several locations. The stream gradient was 80% and no fish habitat exists within the stream.

UT 4 to the Cheoah River is located in Unit 14 of Compartment 35. The riparian vegetation of UT Gladdens Creek consists of yellow poplar, birch, hickory, hemlock, stripe maple, spicebush, and stingweed. Substrate within this stream consists of 50% 6 – 12 inch stone, 15% bedrock, 15% sand, 10% small gravel, and 10% large gravel. The stream gradient is 25% and there is no fish habitat in this stream.

Aquatic Populations

Aquatic macroinvertebrates were sampled by the USFS in May and June 2002. Sample locations were predetermined based on location of project activity sites. Sites were located downstream of project activity, particularly below proposed culvert reconstruction or construction. Samples were collected by using a surber net in 3 different habitat types within each designated stream reach. These samples were preserved and identified by US Fish and Wildlife Associates, Inc. to family. EPT stands for the orders ephemeroptera, plecoptera and trichoptera (commonly called mayfly, stonefly and caddisfly). These orders are commonly used as indicators of water quality due to their sensitivity to pollution. The "somewhat tolerant families" include families from the odonata order (damsel and dragonflies), coleoptera (beetles), and crayfish. Tolerant taxa include crustaceans (isopoda and amphipoda), diptera (true flies), oligochaeta (worms), and planariidae (flatworms).

Table 3.8.1a Number of EPT Families Present.

STREAM NAME	EPT FAMILIES (Intolerant Taxa)	Abundance of Somewhat Pollution Tolerant families	Abundance of Pollution Tolerant Taxa
Bee Creek	7	4	1
Williams Branch	8	1	0
Gladdens Creek	8	2	0
Sarvis Branch	4	4	0
Lifting Rock Branch	5	1	0
Peterson Branch	8	2	1
Colvin Branch	5	2	0

In addition to the aquatic macroinvertebrate surveys performed by the USFS, Virginia Commonwealth University in Richmond surveyed the Cheoah River downstream of Santeetlah Dam. They found 8 species of adult dragonflies during their study (*Anax junius, Gomphus exilis, Stylogomphus albistylus, Celithemis elisa, Libellula luctuosa, Epicordulia princeps, Tetragoneuria cynosura,* and *Erythemis simplicicollis*. None of which are on our Regional Forester's Sensitive or Forest Concern lists.

Bee Creek, Williams Branch, Cody Branch, Cochran Creek, and Garrison Branch were all included in the 1995 Brook Trout Surveys conducted by the USFS and the NCWRC. Some of these surveys were conducted down stream of the analysis area but have been included in the analysis to show species distribution within the watershed. The stream channel of Cody Branch is braided above approximately 3100 feet; therefore, little fish habitat exists above this elevation. Additionally, Yellow Creek is listed by the NCWRC as a hatchery supported trout stream.

Table 3.8.1b. Species data from the 1995 Brook Trout Surveys (USFS, NCWRC)

STREAM NAME	SPECIES FOUND
Bee Creek	Rainbow Trout
Williams Branch	Rainbow Trout
Cody Branch	Rainbow Trout
Cochran Creek	Rainbow Trout
Garrison Branch	No Fish Collected

Table 3.8.1c. Species data from Cheoah River Surveys (NCWRC, TVA)

Sample Year	SPECIES FOUND
1981	Smallmouth bass, Rock bass, Northern hogsucker, Whitetail shiner
1993	Rainbow trout, Brown trout, River chub, Warpaint shiner, Whitetail shiner, Northern hogsucker, River redhorse, Flathead catfish, Rock bass, Smallmouth bass, Greenside darter, Greenfin darter, Tangerine darter
1997	Black redhorse, Greenfin darter, Greenside darter, Longnose dace, Mottled sculpin, Northern hogsucker, Rock bass, Rainbow trout, River chub, Smallmouth bass, Central stoneroller, Tennessee shiner, Warpaint shiner, Whitetail shiner
1999	Rainbow trout, River chub, Warpaint shiner, Whitetail shiner, Northern hogsucker, Flathead catfish, Rock bass, Smallmouth bass, Greenside darter, Greenfin darter, Tangerine darter

3.8.2. Environmental Consequences

Sedimentation. Sedimentation of aquatic habitats within the project area may occur with the maintenance of existing system roads, the reconstruction of roads and skid trails, the construction of a new road and with culvert installation at stream crossings. Sediment loading and turbidity can result in the loss of interstitial habitat within the substrate and cause direct mortality by the crushing or smothering of less mobile organisms such as aquatic invertebrates, fish eggs and juveniles.

Aquatic Impact Indicators	Alternative A	Alternative B	Alternative C
Amount of new road construction	0 miles	1.35 miles system; 2.3 miles temporary	1.35 mile system; 1.6 miles temporary
Amount of road Reconstruction	0 miles	0.6 miles	0.6 miles
Amount of new culverts installed involving streams	None	4	3
Amount of culverts replaced involving streams	None	2	2

EFFECTS OF ACCESS ON AQUATIC RESOURCES

DIRECT EFFECTS: Stream channel excavation for culvert installation on FS2440A, FS438, FS439, FS2510 would result in direct mortality to less mobile aquatic organisms (e.g. aquatic insects, freshwater mussels, and fish eggs and larvae) in the immediate vicinity if they are present; whereas, more mobile species such as crayfish, aquatic salamanders, and juvenile and adult fish are often able to escape direct effects by simply leaving the area. Aquatic organisms will begin to reestablish inside the culvert if the culverts are placed 1/3 of the way down into the substrate. This allows substrate to move into the culvert making it more accessible for movement of aquatic organisms. Project plans for culvert placement and replacement will minimize disturbance from construction activities.

Indirect Effects: Sediment loading and turbidity would occur with the installation of culverts. There may also be off-site movement of soil from road construction and reconstruction into project area waters.

Turbidity and sediment loading can cause mortality by injuring and stressing individuals or smothering eggs and juveniles. Available habitat, including the interstitial space within substrate used as spawning and rearing areas, may be covered with sediments. Larger, more mobile aquatic species, such as fish and hellbenders are able to temporarily escape the effects of sedimentation by leaving the disturbed area. Eggs and juveniles may be lost to reduced habitat or suffocation. This can result in the lost or reduced year class strength, which can lead to accelerated population fluctuations and suppressed population levels. These species, overtime, would recolonize areas as habitat conditions improve. Smaller less mobile organisms such as crayfish and aquatic insects may not be able to move to more suitable habitat. Populations of these species may decline locally or be lost through reduced productivity. These may recolonize from reaches of undisturbed streams as conditions improve with site rehabilitation. Implementation of the contract clauses, erosion control precautions, and stream crossing methods described above should minimize sediment effects and accelerate site rehabilitation.

Access may also cross ephemeral streams or spring seeps that feed these streams and others in the project area. If heavy rains occur while these ephemeral crossings are exposed, bare soil can be transported down slope to intermittent and ephemeral stream channels. Temporary stream crossings should be used across ephemeral channels to avoid the potential for sedimentation of down slope aquatic resources. These crossing could include the use of temporary bridges (e.g. simple log stringers or pre-fabricated

decking) or culverts, or channel armor (e.g. stone or brush). These crossing should be removed when the skid road or trail is rehabilitated.

Effects of Timber Harvest on Aquatic Resources

NC-FPG and the LRMP standards should be applied to the harvest activity. Applications of LRMP standards are intended to meet performance standards of the State regulations. Visible sediment as defined by the State regulations should not occur unless there is a failure of one or more of the applied erosion control practices. Should any practice fail to meet existing regulations, additional practices or the reapplication of existing measures would be implemented as specified by State regulations.

Water quality should not be affected as long as LRMP and NC-FPG standards are followed and timber sale contract clauses are implemented. Stream temperatures would not be affected since adequate shade would be maintained along perennial and intermittent streams. Sediment impacts would be minimized by the application of LRMP standards and NC-FPG compliance; and timber sale contract clauses, erosion control precautions, and stream crossing methods incorporated into the project. Watersheds with new or improved access roads or skid trails might experience a temporary increase in suspended sediment loading, particularly when stream crossings are installed.

Riparian Areas: There is no plan to harvest within the 100 foot riparian zone of any porject area stream thus riparian areas would remain in their current state

Effects Of Prescribed Burning on Water Quality

There are approximately 351 acres of prescribed burning proposed for the project area with both action alternatives. The proposed burn areas are located in Compartment 25 between Lifting Rock Branch and Peterson Branch and an area in the headwaters of Puncheon Camp Branch. Additional burn areas include Units 11, 12, and portions of Unit 1 in Compartment 29. Fire lines would be constructed in the headwaters area of Cody Branch. Existing trails and roads would be used for fire lines. Fire lines in Compartment 33 Unit 11 would consist of SR 129 and SR 1242. This burn area encompasses Sarvis Branch. In Compartment 34, fire lines would be constructed along a ridge top and existing Forest Service roads. Late winter or early spring burns are typically of low intensity. Any burning activity within riparian areas should not be intense enough to destroy riparian vegetation. All fire lines would be constructed with hand tools. If mineral soil is disturbed within riparian areas, it is possible that erosion could occur. Prescribed burn areas are inspected after treatment. Areas of erosion are identified and controlled during inspection to eliminate stream sediment sources. There should be no effect to aquatic resources from this activity.

Effects Of The Use Of Herbicides on Water Quality

It is proposed to use herbicides in compartments 29, 30, 31, 33, 34, and 35 for some preharvest treatments and some timber stand improvements. In accordance with the

Vegetation Management Final Environmental Impact Statement (VM-FEIS), herbicide spraying would not occur within 30 horizontal feet of water. In accordance with the LRMP, riparian areas are not suitable for timber management; therefore no herbicides would be used within 100 feet of any aquatic resource within these compartments.

Management Indicator Species

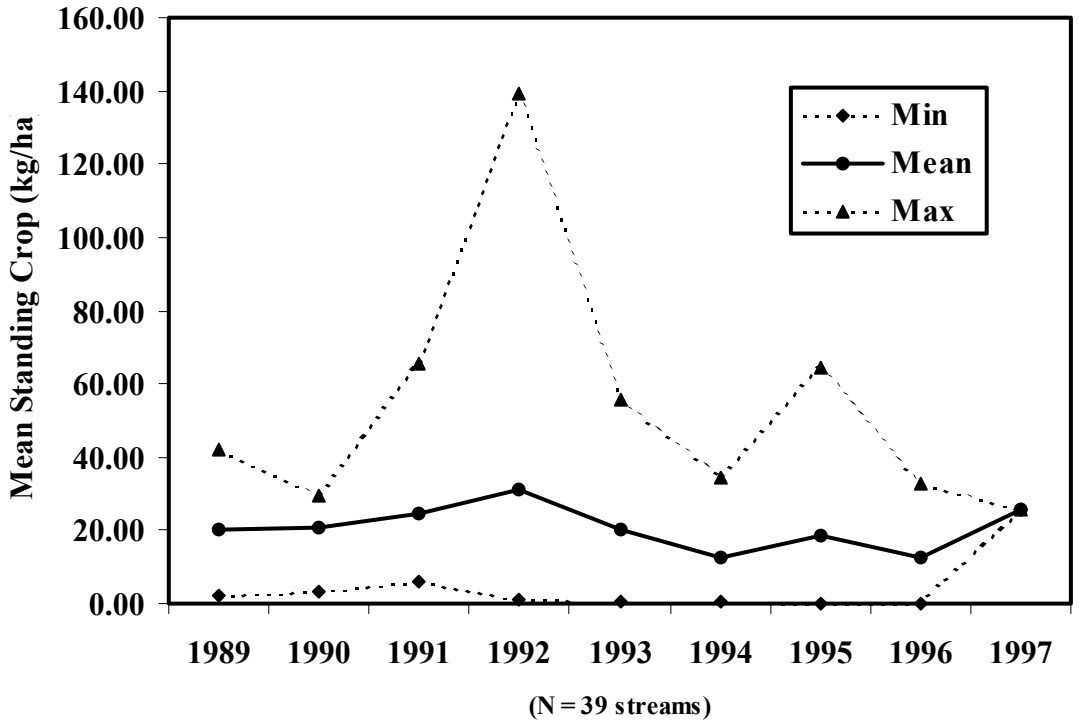
Rainbow trout (*Oncorhynchus mykiss*) has been chosen as an aquatic management indicator species (MIS) for this project. Rainbow trout were chosen for this project because of their presence in the areas of Cody Branch, Cochran Creek, Bee Creek, Williams Branch, Yellow Creek and the Cheoah River. Data for rainbow trout on the Nantahala National Forest is reliable and consistent. Smallmouth bass (*Micropterus dolomieu*) was also chosen as an aquatic management indicator species for this project. Smallmouth bass were chosen because they are present in the project waters of the Cheoah River. Smallmouth bass data for the Cheoah River was obtained from the North Carolina Wildlife Resources Agency (Loftis, 1993 and 1999). These data are reliable and sampling techniques were consistent for both years.

Aquatic MIS population monitoring results

Since 1989, rainbow trout populations in 39 streams across the Nantahala and Pisgah National Forests have been monitored by the USFS and NCWRC. Figure 3.8.2a summarizes a preliminary analysis of this data. Rainbow trout mean standing crop has ranged from 12.48 kg/ha to 30.94 kg/ha, with a mean standing crop over this time period of 20.69 kg/ha. Sixty-seven percent of the annual estimates are within one standard deviation of the mean standing crop over the monitoring period (i.e. between 14.80 kg/ha and 26.58 kg/ha). This indicates that there is perhaps not as much variability in rainbow trout populations over time as once thought. Rainbow trout population age-class structure does exhibit considerable variability over time and is discussed below.

Monitoring data shows that fish populations are not static over time, but rather that a range of population levels oscillate around some mean value, with some species or age classes supporting higher standing crops when environmental conditions are suitable or lower standing crops when conditions are adverse. Aquatic community structure is opportunistic in that as standing crops of one species or age class decline, standing crops of other species or age classes increase relative to their habitat requirements and the new habitat available from the declining stock. This give and take has proven to be cyclic, and that in the absence of catastrophic events (e.g. prolonged drought, successive floods, long-term sedimentation), fish communities would exhibit this cyclic pattern.

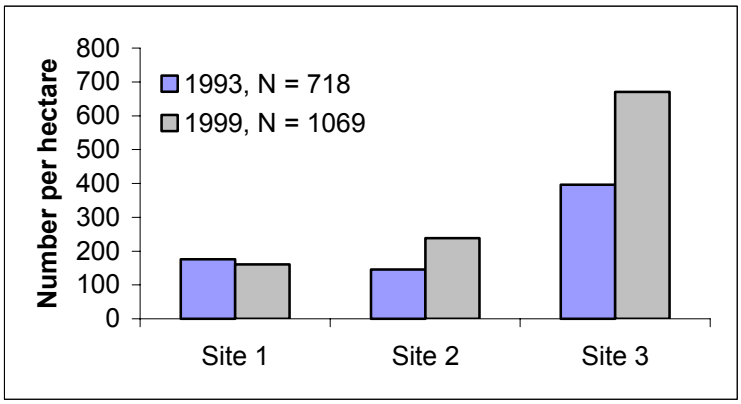
Figure 3.8.2a. Rainbow trout (*Oncorhynchus mykiss*) population trends across the Nantahala and Pisgah National Forests, 1989-2000.



Smallmouth bass occur throughout the Nantahala and Pisgah National Forests and are harvested throughout; thus, population viability is not a concern. By reviewing species data (TVA, NCWRC, and DENR) from cool and warmwater streams and rivers, numbers and distribution of smallmouth bass on the Nantahala and Pisgah National Forests are sufficient to support viable populations. Taking into account natural fluctuations in populations, smallmouth bass are expected to remain relatively stable in the future.

The Cheoah River smallmouth bass population was sampled in 1993 and in 1999 by the NCWRC. The data show that similar population levels existed at each of the three sites for the two years (Figure 3.8.2b). These three sample sites were all located within the Hazanet Timber Sale area. The relatively stable numbers of fish per hectare during the two years is indicative of a fairly stable population. There was an increase in the total number of fish per hectare in 1999 at Site 3. Site 3 contained greater numbers of fish during both years. This increase may be associated with improving water quality and habitat as the water moves downstream of Santeetlah Dam. Current dam operations allow very little water to flow past the dam on a daily basis, creating numerous pools downstream of the dam. As more tributaries enter the Cheoah River below the dam, habitat quality improves.

Figure 3.8.2b. Cheoah River smallmouth bass *Micropterus dolomieu* survey results, 1993 and 1999. Smallmouth bass total abundance is given as numbers of fish per hectare of surface water.



Based on a preliminary analysis of the monitoring data, there appears to be no difference in population dynamics across the Forests. It is important to remember that different streams have the inherent capability to support varying population levels, and that ultimately habitat quality and quantity and environmental variables control the fate of fish populations. Forest management activities, as well as natural events such as droughts and floods, have the potential to affect part of a fish population (e.g. spawning success may be affected by sedimentation), and that these effects may be long- or short-term, depending on the duration and magnitude of the event. It is possible to lose a year class of rainbow trout or smallmouth bass if spawning habitat is temporarily reduced during a poorly timed culvert installation, as well as during a spring flood. Very rarely does the loss of one-year class affect long-term population viability. The successive loss of year classes, however, can result in long-term declines in fish standing crops. It is important to note that environmental variables, man-induced land uses, or both can cause successive year class failures.

Based on rainbow trout monitoring efforts since 1988, it does not appear that any stream or its populations have suffered long-term effects of land management or of natural forces. A closer look at the data reveals single year-class failures for rainbow trout in one stream or another at some point, but successive year class failures were not found on any stream during the monitoring period.

Smallmouth bass monitoring by NCWRC indicates that no long-term effects of land management have occurred in the Cheoah River. While year-class failures may occasionally occur, these year-class failures do not affect the long-term viability of the population.

Management Indicator Species (MIS) *Oncorhynchus mykiss* are known to occur within the analysis area of Bee Creek, Williams Creek, Cochran Creek, Cody Creek, Yellow Creek, and the Cheoah River. *Micropterus dolomieu* are known to occur in the Cheoah River. There is no plan to harvest within the riparian areas. There would be off site movement of soil with the stream crossings associated with this project. This off-site

movement of soil may cause temporary fluctuations in turbidity in project area waters. Members of MIS would not be adversely affected. No risk to aquatic population viability would occur as a result of this project. The effects to aquatic MIS are summarized below:

	Alternative 1	Alternative 2	Alternative 3
Effects on Aquatic MIS	Existing habitat and population trends continue	May have temporary fluctuations in turbidity but not expected to permanently effect habitat or population viability	May have temporary fluctuations in turbidity. Not expected to permanently effect habitat or populations viability.

Aquatic Forest Concern Species

A Forest concern species (FC) is a species, which National Forests in North Carolina considers to be generally rare, and an important part of the biodiversity across the Forests that do not fall within one of the above categories. These species may or may not have a Federal or State status, and generally have a global rank of G3 or lower and a State rank of S1 or lower. These species are included in every AQUA conducted for projects within a watershed where the species is known to or is likely to occur.

Forest concern species *Cryptobranchus alleganiensis, Ceraclea sp. 1, Gomphus abbreviatus, Gomphus descriptus, Gomphus lineatifrons, Gomphus ventricosus, Cordulegaster erronea, Gomphus parvidens parvidens, Lanthus parvulus, and Percina aurantica* may occur within the project area. *Gomphus abbreviatus* and *Percina aurantica* are the only Forest concern species that were verified as occurring in the project area. Members of the genus *Ceraclea, Cordulegaster,* and *Lanthus* were found in the project area surveys (Pennington & Associates 2002; and Ridout 2002, unpublished data), which increases the likelihood of occurrence within the analysis area. This project may impact individuals but will not likely adversely affect the viability of any of the above species across the Forest. Habitats for the benthic macroinvertebrate species are common across their range. No risk to aquatic population viability of these Forest Concern species will occur as a result of this project. The effects to aquatic forest concern species are summarized below:

	Alternative 1	Alternative 2	Alternative 3
Effects on Aquatic Forest Concern Species	No impact to habitat or populations	May impact individuals. Not likely to adversely affect population viability across Forest	May impact individuals. Not likely to adversely affect population viability across the Forest.

Aquatic Threatened, Endangered, and Sensitive Species

The Appalachian Elktoe mussel, *Alasmidonta raveneliana*, was listed as endangered in 1994. This species is known to occur in the Cheoah River that runs along the western

boundary of the project area. Since federally listed mussel and portions of its critical habitat is located within the analysis area, the USDI Fish and Wildlife Service was contacted.

Sensitive species *Gomphus consanguis* and *Gomphus viridifrons* may occur within the project area. The implementation of this project may impact or stress individuals but not likely to adversely affect the species. A *Gomphus sp.* individual (genus in which *Gomphus consanguis* is located) was collected by Pennington & Associates (2002). No *Ophiogomphus edmundo, Macromia margarita, Ophiogomphus howei, Etheostoma vulneratum, Percina squamata,* or *Seratella spiculosa* were found in the surveys (Pennington & Associates 2002; and Ridout 2002, unpublished data). However, since the habitat for these individuals is present within the area, they were included in this report. The habitats for these benthic macroinvertebrate species are common across their range. No risk to aquatic population viability of the sensitive species above would occur as a result of this project. The effects to aquatic Threatened, Endangered, and Sensitive species are summarized below:

	Alternative 1	Alternative 2	Alternative 3
Effects on T & E species	Existing habitat and population trends continue.	Existing habitat and population trends continue.	Existing habitat and population trends continue.
Effects on Sensitive Species	No impact to habitat or populations.	May impact individuals. Not likely to adversely affect population viability across the Forest.	May impact individuals. Not likely to adversely affect population viability across the Forest.

Direct and Indirect Effects

Effects to aquatic resources would generally be the same for Alternative 2 and Alternative 3 except in the headwaters of Williams Branch and in the headwaters of UT 6 to Yellow Creek. Both of these streams would have crossings associated with access with Alternative 2. However, these crossings would be across the dry channels above the locations where these streams surface. Sediment may temporarily increase in these headwaters as a result of the culvert placement, particularly during storm events. These effects would not occur with Alternative 3.

Cumulative Effects

Past projects and events within the area of the Hazanet Project include wildfires along the Northwestern portion of Old Roughy (Compartment 35) and an area in the headwaters of Yellow Creek in Compartment 33. Five southern pine beetle suppression projects within the area have been undertaken in recent years. These areas include portions of Units 5 and 8 in Compartment 33 and Units 1 and 17 in Compartment 35. Approximately 25 acres were cut in 2001 and 2002.

A private trout farm exists in the headwaters of Cody Branch. This trout farm may cause an increase in nutrients and ammonia within Yellow Creek. Santeetlah Dam on the Cheoah River is located within the project area. Current dam operations restrict the flow

of the Cheoah River. However, the stream flow and habitat conditions improve below the dam as new tributaries enter the river.

It is very unlikely that, given the location and types of management proposed, any effects on aquatic resources would be measurable, and therefore contribute to cumulative effects. There has been a tremendous amount of planning and resource specialist involvement in the planning and design of the units proposed for the Hazanet Timber Sale. Critical aquatic resource areas were dropped from the overall proposal.

There should be no adverse cumulative effects to the analysis area aquatic resources, based on the Project activity assumptions included in this analysis.

3.9. Botanical Resources

3.9.1. Affected Environment

The mesic, concave slopes of the project area generally support a Rich Cove Forest community type, especially on calcareous soils at lower elevations (Schafale and Weakley 1990). The canopy of these forests is typically dominated by *Liriodendron tulipifera,* but also contains tree species such as *Quercus rubra, Tilia americana, Aesculus flava*, *Betula lenta, Fraxinus americana*, *Acer rubrum* and *Prunus serotina*. Subcanopy species include *Halesia carolina, Amelanchier arborea* and *Cornus florida*. The shrub layer is often open. Common shrubs include *Hydrangea arborescens*, *Cornus alternifolia*, *Lindera benzoin, Cornus alternifolia* and *Pyrularia pubera.* The herbaceous layer exhibits both high cover and high diversity. Common herbs include A*diantum pedatum, Aruncus dioicus, Actaea racemosa, Carex digitalis, Caulophyllum thalictroides*, *Clintonia umbellulata*, *Collinsonia canadensis, Desmodium glutinosum, Dryopteris marginalis, D. intermedia, Galium latifolium, Geranium maculatum*, *Goodyera pubescens, Hepatica acutiloba*, *Houstonia purpurea, Iris cristata, Lysimachia quadrifolia, Medeola virginiana, Mitchella repens, Orchis spectabilis, Oxalis grandis, Parthenocissus quinquefolia, Polygonatum biflorum, Polystichum acrostichoides, Sanguinaria canadensis, Thalictrum dioicum*, *Thelypteris noveboracensis, Tiarella cordifolia, Toxicodendron radicans, Trillium erectum*, *T. vaseyi*, *Sanguinaria canadensis, Smilax herbacea, Uvularia perfoliata, U. sessilifolia, Veratrum parviflorum*, *Viola canadensis* and *V. pubescens.* Drier sites exhibit correspondingly lower cover and diversity.

The cove landform on non-circumneutral soils generally supports an Acidic Cove Forest community type (Schafale and Weakley 1990). The canopy is dominated primarily by *Tsuga canadensis,* but also contains tree species such as *Liriodendron tulipifera*, *Betula lenta* and *Acer rubrum*. *Acer pennsylvanicum* and *Nyssa sylvatica* are common subcanopy trees. *Rhododendron maximum* strongly dominates the shrub layer, often forming dense, impenetrable thickets. Herbaceous cover is usually low, and often limited to deciduous patches between the evergreen shrubs. Common herbs include *Arisaema triphyllum, Clintonia umbellulata, Dryopteris marginalis, D. spinulosa, Geranium*

maculatum, Luzula acuminata, Medeola virginiana, Melampyrum lineare, Polystichum acrostichoides, Mainthemum racemosum = Smilacina racemosa, and *Viola blanda.*

Lower and more convex slopes across the project area generally support a montane Oak - Hickory Forest community type (Schafale and Weakley 1990). This community type is dominated by oak species, primarily *Quercus rubra* var. *borealis,* but also *Quercus alba*, *Quercus montana* and *Carya glabra,* with scattered individuals of *Liriodendron tulipifera* and *Acer rubrum*. *Ilex opaca* is also present at lower elevations. Shrub density varies. A few examples of the type exhibit high cover by *Gaylussacia ursina*. Most of examples of this community type, however, exhibit low shrub cover. These examples exhibit the highest herbaceous cover and diversity. Common herbs include *Aster patens, A. retroflexus, Botrychium virginianum, Carex communis, Carex digitalis, C. pensylvanica, C. virescens, Coreopsis major, Desmodium nudiflorum, Dichanthelium boscii, Prosartes lanuginosa = Disporum lanuginosum, Eupatorium purpureum, Galium latifolium, Helianthus microcephalus, Luzula bulbosa, Lysimachia quadrifolia, Medeola virginiana, Poa autumnalis, Prenanthes altissima, Solidago curtisii, Mainthemum racemosum = Smilacina racemosa, Stellaria pubera, Thelypteris noveboracensis, Toxicodendron radicans, Uvularia sessilifolia,* and *Viola pubescens*.

On sharper convex slopes, the montane Oak-Hickory Forest community may grade into a Chestnut Oak-Scarlet Oak Forest community type, dominated primarily by *Quercus coccinea* and *Quercus montana,* with scattered individuals of *Quercus velutina*, *Acer rubrum* and *Nyssa sylvatica* (Schafale and Weakley 1990). *Robinia pseudoacacia* can be common along roads, and pitch pine (*Pinus rigida*) can be found in the most xeric examples of the type. The canopy is typically broken, exhibiting 50 – 70% cover, and facilitating the development of a dense shrub layer, often approaching 100% cover. Common shrubs include *Kalmia latifolia*, *Gaylussacia ursina*, *G. baccata* and *Vaccinium pallidum*. These shrubs often form large, monoclonal patches. Understory plants are usually confined to small, open patches without shrub cover. As a result, herbaceous diversity is poor. Frequent herbs include *Chimaphilia maculata*, *Coreopsis major,* several *Dichanthelium* species, *Epigaea repens*, *Hypopitys monotropa, Hypoxis hirsuta*, *Melampyrum lineare, Pteridium aquilinum* and *Uvularia puberula*.

At higher elevations, especially on concave, north-facing slopes, the Rich Cove Forest may grade into a Northern Hardwood Forest community type (Schafale and Weakley 1990). Dominance in the overstory varies among *Betula alleghaniensis*, *Aesculus flava*, *Tilia americana* and *Fagus grandifolia*, although *Prunus serotina*, *Tsuga canadensis*, *Quercus rubra* var. *borealis* and *Acer saccharum* are also frequent. This community type exhibits an open understory, including small trees such as *Acer pensylvanica*, and shrubs such as *Hydrangea arborescens* and *Cornus alternifolia*. The herbaceous layer exhibits high cover, but less diversity than the Rich Cove Forest community. Common herbs in Northern Hardwoods Forest include *Actaea pachypoda*, *Ageratina altissima*, *Aster chlorolepsis*, *Aster macrophyllus*, *Cimicifuga americana*, *Claytonia caroliniana*, *Collinsonia canadensis*, *Dicentra cucullaria*, *Dryopteris intermedia, Erythronium umbilicatum*, *Laportea canadensis*, *Panax trifolius*, *Prenanthes roanensis*, *Stachys lanata*, *Trillium erectum*, and *Viola canadensis.*

Small rock outcrops are present across the project area, usually embedded within both the Rich Cove Forest community type and the montane Oak-Hickory Forest community type. These are typically herbaceous communities dominated by species such as *Heuchera villosa, Saxifraga michauxi, Carex debilis, Poa autumnalis, Dryopteris marginalis, Smilacina racemosa,* and *Asplenium montanum,* and non-vascular species such as *Polytrichum commune* and *Atrichum angustatum.*

Evaluated species survey information

The following species were identified during the proximity search of existing occurrence records:

[1] *Spiraea virginiana* [federally threatened]. Six populations along the Cheoah River, outside the western edge of the project area boundary.

[2] *Aconitum reclinatum* [forest sensitive]. One population in the upper Bee Creek area, approximately 0.5 miles northeast of the boundary of the proposed sale at Locust Licklog Gap. Examined of the specimen from this location concluded it is actually a white form of the normally blue-flowered *Aconitum uncinatum* (Gary Kauffman, personal communication).

[3] *Euphorbia purpurea* [forest sensitive]. One population south of the Wauchecha Bald area, approximately 0.5 miles south of the boundary of the project area.

[4] *Carex purpurifera* [forest concern]. One population north of the headwaters of Lifting Rock Branch, approximately 0.5 miles north of the boundary of the project area.

[5] *Trientalis borealis* [forest concern]. One population in the upper Bee Creek area, approximately 0.5 miles northeast of the boundary of the project area at Locust Licklog Gap. This is the same location as the *Aconitum reclinatum* record.

Surveys for endangered, threatened, sensitive, and forest concern species suspected of growing within the proposed Hazanet Project Area were conducted between 1998 and 2001 by Gary Kauffman, Allen Smith and Karin Heimen, and in July, 2002, by Wilson Rankin. Field survey methods consisted of a timed meander with intensity increased in the most diverse areas, and conducted until no new species or microhabitats were detected (Goff *et al.* 1982).

No federally endangered or threatened plant species was located during the field survey. Three sensitive plant species, *Euphorbia purpurea*, *Megaceros aenigmaticus* and *Scutellaria saxatilis*, were located in the proposed harvest areas. A small population of *Euphorbia purpurea* was found in Stand 34-17A. Five populations of *Megaceros aenigmaticus* were found in and near the project area: one population in Stand 31-1, two populations downstream of the prescribed burn stand in Compartment 29, one population downstream of Stand 30-9A, and one population downstream of Stands 30-23 and 29-1 in the Cody Branch watershed. Five populations of *Scutellaria saxatilis* were found in and

near the project area. Two populations were located inside proposed harvest stands, one inside Stand 31-9, and one inside the portion of Stand 34-17B common to both action alternatives. Two additional populations on National Forest land were located adjacent to proposed harvest stands, one adjacent to Stand 31-9, and one adjacent to the Action Alternative 2 configuration of Stand 34-17B. The fifth population of *Scutellaria saxatilis* was located on private land adjacent to Stand 31-9.

Table 3. 9.1a Federally-listed plant species and sensitive plant species known to occur in the proposed Hazanet project area.

Species	Type	Brief Habitat Description	Occurrence
Federally Listed Plant Species			
None Located	N/A	N/A	Not known to occur
2002 Region 8 Regional Forester's Sensitive Plant Species List			
Euphorbia purpurea	Herb	Rich Cove Forest, Mesic Oak-Hickory Forest	Known to occur in the activity area
Scutellaria saxatilis	Herb	Rich Cove Forest	Known to occur in the activity area
Megaceros aenigmaticus	Lichen	Streams	Known to occur in the activity area

Three forest concern plant species, *Calamagrostis porteri, Carex hitchcockiana* and *Carex leptonervia,* were also located in the project area. One population of *Calamagrostis porteri* was adjacent to Stand 35-9C. A population of *Carex hitchcockiana* was found in the portion of Stand 34-17B common to both action alternatives. Three populations of *Carex leptonervia* were found: one in the portion of Stand 34-17B common to both action alternatives, one in Stand 30-23, and one adjacent to northwestern portion of the Alternative 2 configuration of Stand 34-17B (Gary Kauffman, personal communication).

Table 3.9.1b Forest Concern plant species known to occur in the proposed Hazanet project area.

Species	Type	Brief Habitat Description	Occurrence
Calamagrostis porteri	Herb	Rich Cove Forest, Oak-Hickory Forest, Roadside Edge	Known to occur in the activity area
Carex hitchcockiana	Herb	Rich Cove Forest, Mesic Oak-Hickory Forest	Known to occur in the activity area
Carex leptonervia	Herb	Rich Cove Forest, Mesic Oak-Hickory Forest	Known to occur in the activity area

Populations of four additional species considered rare at the time of the field survey -- *Cardamine flagellaris*, *Carex manhartii, Panax trifolius* and *Prosartes maculata* -- were located in the project are. All three of the species, however, have since been dropped from the sensitive or forest concern lists, and would not be analyzed in this report.

3.9.2 Environmental Consequences

Table 3.9.2. Summary of Effects on T&E, Sensitive, and Forest Concern Species

Species	Alternative 1	Alternative 2	Alternative 3
Federally Threatened and Endangered Species			
Spiraea virginiana	No effect	No effect	No effect
2002 Region 8 Regional Forester's Sensitive Species List			
Euphorbia purpurea	No impact	May impact individuals but not likely to cause a trend to federal listing or a loss of viability	May impact individuals but not likely to cause a trend to federal listing or a loss of viability
Helianthus glaucophyllus	No impact	May impact individuals but not likely to cause a trend to federal listing or a loss of viability	May impact individuals but not likely to cause a trend to federal listing or a loss of viability
Hydrothyria venosa	No impact	No impact	No impact
Megaceros aenigmaticus	No impact	No impact	No impact
Scutellaria saxatilis	No impact	May impact individuals but not likely to cause a trend to federal listing or a loss of viability	May impact individuals but not likely to cause a trend to federal listing or a loss of viability
Forest Concern Species			
Calamagrostis porteri	No impact	No impact	No impact
Carex hitchcockiana	No impact	May impact individuals but not likely to cause a trend to federal listing or a loss of viability	May impact individuals but not likely to cause a trend to federal listing or a loss of viability
Carex leptonervia	No impact	May impact individuals but not likely to cause a trend to federal listing or a loss of viability	May impact individuals but not likely to cause a trend to federal listing or a loss of viability
Carex purpurifera	No impact	No impact	No impact
Trientalis borealis	No impact	No impact	No impact

(1) Endangered, Threatened, Sensitive and Forest Concern Plant Species

(A) THREATENED SPECIES

Spiraea virginiana

Spiraea virginiana is considered a G2/S1 species (6 - 20 global populations). The species is listed as federally-threatened due to the small number of populations in combination with the large number of threats. Potential threats to the species include changes in site hydrology due to impoundment, direct mortality from recreational activities, competition from exotic species, roadside maintenance in highway corridors, and natural processes such as flooding and herbivory. A population of *Spiraea virginiana* occurs along the Cheoah River.

Spiraea virginiana is included is this report due to the proximity analysis. Neither *Spiraea virginiana* nor its habitat was located in any of the proposed timber stands. Because *Spiraea* is a large plant with well-defined habitat requirements, it is unlikely to

be overlooked in the field. The only populations on the National Forest occur outside the boundaries of the Hazanet Project. As a result, it is highly unlikely the species would be damaged through indirect effects.

Alternative 1 (No Action)

The current populations of *Spiraea virginiana* along the Cheoah River are threatened by competition from exotic plants and recreational use by fishermen. No action may allow these habitats to undergo further degradation.

Alternative 2

Spiraea virginiana was not located in any of the proposed treated stands. Neither the number of stands nor their management prescriptions would affect any populations of this species.

Alternative 3

Spiraea virginiana was not located in any of the proposed treated stands. Neither the number of stands nor their management prescriptions would affect any populations of this species.

(B) SENSITIVE SPECIES

Euphorbia purpurea

Euphorbia purpurea, the glade spurge, is a robust herb 3-4 feet in height. *Euphorbia purpurea* ranges from New Jersey, Pennsylvania and Ohio south to Virginia and the mountains of North Carolina (Weakley1998). All states in its range track the glade spurge as a rare species. Twenty-one populations have been documented in western North Carolina. Seven populations occur in the Nantahala and Pisgah National Forests, and five occur on the Blue Ridge Parkway (NCNHP database and Gary Kauffman, personal communication). In addition, three historic populations occurred on federal lands, one in Great Smoky Mountains National Park, and two on the Nantahala National Forest.

A small population of 3-4 plants was growing in a former skid trail within a rich cove forest community in Stand 34-17A.

Alternative 1 (No Action)

Euphorbia purpurea apparently grows well beneath a closed canopy. Not harvesting the trees would maintain the closed canopy, and probably produce little to no effect upon the species. The population should remain close to its current size.

Alternative 2

This alternative proposes a two-age harvest in Stand 34-17A. Direct effects from the selection and thinning harvests could result in the death of individual plants from both the construction of skid roads as well as the skidding of the logs. Indirect effects would result from the change in light and humidity at the forest floor. Because *Euphorbia purpurea* is most often associated with the closed canopy conditions of mature forest, any dramatic opening of the forest through harvest may degrade the habitat and negatively effect populations of *Euphorbia purpurea*.

In so far as *Euphorbia purpurea* responds positively to disturbance, however, harvest may improve the habitat for the species. For example, a large population of *Euphorbia purpurea* occurs in the Deep Gap area of Graham County. The surrounding forest community was heavily thinned during the Shepherd Creek timber sale. Two years later, the site contained a vigorous population of *Euphorbia purpurea* (Gary Kauffman, personal communication).

Alternative 3

This alternative proposes the same harvest procedures as Action Alternative 2. Direct and indirect effects would be the same as Action Alternative 2.

Effect of Fire

The perennating tissue of *Euphorbia purpurea* is a thick rhizome growing several inches beneath the surface of the soil. Prescribed fire should not be hot enough to damage this rhizome (Porter and Wieboldt 1994). Two forms of fire may, however, damage species. First, an extremely hot fire implemented during a long dry period could potentially burn through the upper layers of the soil and damage the rhizomes of the plants. Second, *Euphorbia purpurea* sprouts early in the spring; a fire late in the spring season may burn the above-ground sprouts. In general, however, fire should improve habitat for the species by opening the mid-story of the canopy.

Cumulative Effect

The Shepherd Creek Timber Sale effected one population of *Euphorbia purpurea*, but the population remains vigorous (Gary Kauffman, personal communication). The proposed County Line Timber Sale may effect two large populations of *Euphorbia purpurea*, but the proposed management procedures are thinnings unlikely to severely degrade the habitat of the species. The National Forests contains six *Euphorbia purpurea* populations that are currently undisturbed and unlikely to be actively managed in the foreseeable future. As a result, there should be no cumulative affect or loss of viability across the National Forest for this species.

Helianthus glaucophyllus

Helianthus glaucophyllus, the white-leaf sunflower, is a tall, rhizomatous perennial in the aster family. The species is a narrow southern Appalachian endemic occurring in northwestern South Carolina, western North Carolina, and eastern Tennessee (Cronquist

1980, Weakley 2000). In North Carolina, *Helianthus glaucophyllus* occurs in twelve counties, with historical records in three additional counties (Amoroso 2002, Gary Kauffman, personal communication). The species was formerly considered rare by the North Carolina Natural Heritage Program, but was downgraded to the watch list when the species had been located at 75 different sites (Alan Weakley, personal communication). Nantahala National Forest contains at least 60 populations. Given the number of populations in North Carolina alone, *Helianthus glaucophyllus* is probably a G4 plant (>100 populations).

Helianthus glaucophyllus generally flowers only in canopy gaps or along roadside edges (Weakley 2000). It is typically more common in open areas such as recent canopy gaps, burn areas that partially opened the canopy, and roadside edges (Gary Kauffman, personal communication). As a result, disturbance may benefit *Helianthus glaucophyllus* by opening the canopy and allowing additional light to the forest floor.

Helianthus glaucophyllus was found on private land adjacent to Stand 31-9. It was not located in any of the proposed harvest stands. Because it frequently occurs in disturbed habitats throughout the national forest, however, *Helianthus glaucophyllus* may be present in disturbed habitats in the proposed activity area.

Alternative 1 (No Action)

Helianthus glaucophyllus is most often associated with disturbed and open habitats. In the absence of disturbance, habitat for this species may decrease.

Alternative 2

Helianthus glaucophyllus was not located in any of the proposed harvest stands. Neither the number of harvest stands nor their management prescriptions would affect any populations of this species. Because *Helianthus glaucophyllus* is most often associated with disturbed and open habitats, disturbance associated with timber management may improve habitat for this species.

Alternative 3

Helianthus glaucophyllus was not located within any of the proposed timber stands. Neither the number of harvest stands nor their management prescriptions would affect any populations of this species. Because *Helianthus glaucophyllus* is most often associated with disturbed and open habitats, disturbance associated with timber management may improve habitat for this species.

Effect of Fire

The effects of fire on *Heilanthus glaucophyllus* are unknown. The genus *Helianthus* can be common in fire ecosystems such as prairies, and often responds to prescribed fire by increasing productivity. In addition, the edge habitats characteristic of this species are

unlikely to carry a hot fire that would potentially damage the long, subterranean rhizomes of the species. It seems unlikely that prescribed fire would negatively impact *Heilanthus glaucophyllus*.

Cumulative Effect

Because *Helianthus glaucophyllus* has not been formally tracked by the National Forests in North Carolina for the last 10 years, it is not known how many projects have impacted the species. Since 1997, the species has been located in at least six activity areas: three timber harvests, two proposed burn sites, and one road-widening project. Due to the large number of populations in the southern Appalachians and the Nantahala National Forest, however, there are no viability concerns for *Helianthus glaucophyllus* across the National Forest.

Hydrothyria venosa

Hydrothyria venosa, the waterfan, is an aquatic lichen with a gelatinized thallus that resembles brown algae. It is generally found attached to partially-submerged rocks on the edge of swiftly flowing, steep gradient streams. This species has two general ranges of distribution, the Pacific Northwest and a narrow portion of the southern Appalachians, including western North Carolina and eastern Tennessee (Brodo, *et al.* 2001). Within the last seven years, *Hydrothyria* has been located in eleven North Carolina counties, including Cherokee, Graham, Jackson, Swain, Macon and Transylvania (Amoroso 2002). Currently, Nantahala National Forest contains over 65 records for this species.

Hydrothyria may be sensitive to increased sedimentation. Sediments in solution may act as an abrasive that can shear the thallus from the rock face. Alternately, sediments may cover the thallus, blocking sunlight and therefore preventing photosynthesis.

Because *Hydrothyria* is small, brown, and grows under water in dense shade, it can be readily overlooked, and may be more common than indicated by the field survey. On the other hand, the lichen is virtually confined to free-flowing streams. Under the current forest plan, timber management is not allowed in these environments. As a result, the proposed harvest is unlikely to impact these populations except at stream crossings, where road construction may increase sedimentation directly downstream.

Hydrothyria venosa was not located in the project area during the field surveys. It is included in this report due to the proximity analysis.

Alternative 1 (No Action)

Hydrothyria venosa often grows in undisturbed streams surrounded by dense thickets of rhododendron. As a result, it is potentially one of the most tolerant and successionally stable species in the National Forest. In the absence of disturbance, populations should remain fairly stable.

Alternative 2

Hydrothyria venosa was located in streams on National Forest lands below Stand 34-17B. It was not, however, located within any of the proposed harvest stands. Given the proper implementation of erosion controls, as specified in the forest plan, neither the number of harvest stands nor their management prescriptions would effect any populations of this species.

Alternative 3

Hydrothyria venosa was located in streams on National Forest lands near Stand 30-9A. It was not, however, located within any of the proposed harvest stands. Given the proper implementation of erosion controls, as specified in the forest plan, neither the number of harvest stands nor their management prescriptions would effect any populations of this species.

Effect of Fire

Prescribed fire is unlikely to penetrate the moist, dense rhododendron stands that typically characterize the stream corridors that shelter populations of *Hydrothyria*. As a result, cool-season fire should not severely impact this species. Fire may, however, indirectly impact *Hydrothyria* by reducing the dense riparian vegetation characteristic of acidic cove communities.

Cumulative Effect

Two projects on the Tusquitee Ranger District (the Ritz Easement and Bates Creek Road Closure) include stream crossings that may impact populations of *Hydrothyria venosa*. In addition, *Hydrothyria venosa* has been located in the general area of the proposed Ray Branch Timber Sale on the Wayah Ranger District. Due to the large number of populations in on the Nantahala National Forest, however, there are no viability concerns for *Hydrothyria venosa* across the National Forest.

Megaceros aenigmaticus

Megaceros aenigmaticus, the Tusquitee hornwort, is a dark green, thalloid hornwort with erose margins (Hicks 1992, Schuster 1992). *Megaceros* forms green, irregular patches on shaded rocks in small streams. Technically, hornworts are determined by the presence of a single, large blue-green chloroplast in the center of each cell. Compared to other members of the group, *Megaceros* forms much larger plants. *Megaceros* is a narrow southern Appalachian endemic occurring in nine counties in North Carolina and Tennessee. It extends from the Tellico River in eastern Tennessee east to Burningtown Falls, northwest of Franklin, and south to Pounding Mill Creek, northeast of Shooting Creek, NC. Between 30 and 35 populations have been found on the Nantahala National Forest (Gary Kauffman, personal communication). In addition, large populations of *Megaceros* occur in the waters of the Joyce Kilmer/Slickrock Wilderness and Santeetlah Creek, which form the center of its distribution. *Megaceros* is also common in the

streams draining into Nantahala Lake. Globally, the species is ranked G2/G3. It is ranked S2/S3 in North Carolina, and S1/S2 in Tennessee (Natureserve 2001).

Megaceros grows on shaded rocks and boulders in small streams. These streams are characterized by shallow depths (usually less than 3 inches), infrequent flooding, and low sediment loads. This species suffers from at least two threats. First, increased sediment load and water flow may either dislodge the plants, increasing direct mortality, or bury them, decreasing photosynthesis and therefore indirect mortality. Second, decreased forest cover may increase light intensity and decrease humidity levels surrounding the stream, decreasing the depth of the water and facilitating the growth of competing species.

Alternative 1 (No Action)

Megaceros aenigmaticus often grows in undisturbed streams surrounded by dense thickets of rhododendron. As a result, it is potentially one of the most tolerant and successionally stable species in the National Forest. In the absence of disturbance, populations should remain fairly stable.

Alternative 2

This alternative proposes two-age harvests in Stands 29-1, 30-23 and 31-1, and a prescribed burn in Compartment 29. *Megaceros aenigmaticus* occurs within the boundaries of Stand 31-1, and downstream of the other stands. Because *Megaceros* grows only in streams, timber management would have no direct effects upon this species.

Indirect effects include sedimentation from stream crossings and improper erosion controls. In addition, loss of forest cover could increase stream flow, potentially impacting *Megaceros* by increasing the scouring action of the water. This effect, however, should be minimal because the increase in water flow should occur primarily during the spring and summer. This period usually exhibits the lowest seasonal flow, and should be within the normal annual fluctuation within this drainage (Richard Burns, USFS hydrologist, personal communication, to Gary Kauffman).

Given the proper implementation of erosion controls, as specified in the forest plan, neither the number of harvest stands nor their management prescriptions would effect any populations of this species.

Alternative 3

In regards to *Megaceros aenigmaticus*, this alternative proposes the same as management activities as Action Alternative 2, except Stand 31-1 is excluded. Stand 31-1 was the only proposed harvest stand in which *Megaceros* was located. As a result, Action Alternative 3 should exhibit no direct effects on *Megaceros aenigmaticus*.

This alternative also proposes a two-age treatment for Stand 30-9A. A small population of *Megaceros* is located downstream of this stand, in the headwaters of Williams Branch. As a result, this alternative may increase indirect effects on populations of *Megaceros aenigmaticus* compared to Alternative 2. These indirect effects include sedimentation from stream crossings and improper erosion controls. In addition, loss of forest cover could increase stream flow, potentially impacting *Megaceros* by increasing the scouring action of the water. This effect, however, should be minimal because the increase in water flow should occur primarily during the spring and summer. This period usually exhibits the lowest seasonal flow, and should be within the normal annual fluctuation within this drainage (Richard Burns, USFS hydrologist, personal communication, to Gary Kauffman).

Given the proper implementation of erosion controls, as specified in the forest plan, neither the number of harvest stands nor their management prescriptions would effect any populations of this species.

Effects of Fire

Because *Megaceros* is confined to permanent streams, direct impacts from prescribed burning are highly unlikely. In addition, the dense stands of rosebay (*Rhododendron maximum*) characteristic of *Megaceros aenigmaticus* habitat are difficult to burn, and a cool-season fire should not severely impact the riparian vegetation when rosebay is present (Gary Kauffman, personal communication). Fire may, however, indirectly impact *Megaceros* populations by reducing the dense riparian vegetation characteristic of acidic cove communities. In addition to the fire effects, fire line construction may increase sedimentation in the streams.

Cumulative Effect

Four recent timber sales on the Wayah and Cheoah Ranger Districts included road construction that could potentially impact populations of *Megaceros aenigmaticus* through sedimentation. In addition, at least one road improvement project in the past year, and two proposed road improvement projects in the current year, may impact populations of *Megaceros aenigmaticus*. None of these projects should impact *Megaceros aenigmaticus* populations, however, if erosion control measures are properly implemented. In addition, Nanthala National Forest contains 20 - 25 populations with no potential impacts from proposed projects. As a result, there are no viability concerns for *Megaceros aenigmaticus* across the National Forest.

Scutellaria saxatilis

Scutellaria saxatilis, the rock skullcap, is small, woodland herb in the mint family. The flowers are blue, approximately one half inch in length, and displayed on one side of a long, thin raceme. All skullcaps have a small, curved crest on the top of the calyx, resembling the crest of a medieval helmet. *Scutellaria saxatilis* is distinguished from other members of the genus by terminal, one-sided racemes in combination with cordate leaf bases (Cronquist 1980). *Scutellaria saxatilis* is widely distributed across eastern

North America, ranging from the Ohio valley south to Georgia, Alabama and Arkansas (Cronquist 1980, Weakley 2000). Most of the states in its range consider *Scutellaria saxatilis* rare. In North Carolina, *Scutellaria saxatilis* occurs in five counties in the southern Appalachians and western Piedmont, plus one historic record (1893) from Watauga County. Nantahala and Pisgah National Forests contain at least four populations of the species. *Scutellaria saxatilis* is considered a G3/S1 species.

The natural history of *Scutellaria saxatilis* is poorly understood. The NatureServe (2002) website, for example, does not list a refereed publication for this species. *Scutellaria saxatilis* is a woodland species, potentially confined to areas of unbroken canopy. Two small populations in Great Smoky Mountains National Park have responded positively to shrub and subcanopy clearing (Karen Rock, personal communication). Severe canopy disturbance, however, may alter the herbaceous microenvironment sufficiently to negatively impact the species. In addition, exotic competitors such as Japanese honeysuckle (*Lonicera japonica*) and stilt grass (*Microstegium vimineum*) may pose significant threats, especially following mild canopy disturbance.

Alternative 1 (No action)

Scutellaria saxatilis is most often associated with closed canopy conditions. In the absence of disturbance, habitat for this species should remain unchanged.

Alternative 2

This alternative proposes a two-age harvest in Stand 31-9 and a group selection in Stand 34-17B. Direct effects, produced by activities such as building the skid road and skidding the logs, could impact the *Scutellaria* populations in Stands 31-9 and 34-17B, and result in the death of individual plants. Indirect effects could result from the change in light and humidity at the forest floor. Because *Scutellaria saxatilis* is most often associated with the closed canopy conditions of mature forest, any dramatic opening of the forest may degrade the habitat and negatively impact populations of *Scutellaria saxatilis*. There is no evidence to suggest *Scutellaria saxatilis* responds positively to the extensive canopy disturbance characteristic of two-age harvests.

Populations of *Scutellaria saxatilis* adjacent to two-age harvests may respond positively to indirect effects such as the increased light in the margins of the harvests. This positive response would be short-lived, however, as the margins of the harvest stands fill with competing tree and shrub species.

Alternative 3

This alternative excludes the population of *Scutellaria saxatilis* in Stand 31-9 from the proposed harvest treatments. The population in Stand 34-17B, however, remains inside a group selection harvest. Direct effects, produced by activities such as building the skid road and skidding the logs, could impact this population, and result in the death of individual plants. Indirect effects could result from the change in light and humidity at the forest floor. Because *Scutellaria saxatilis* is most often associated with the closed

canopy conditions of mature forest, any dramatic opening of the forest may degrade the habitat and negatively impact populations of *Scutellaria saxatilis*. There is no evidence to suggest *Scutellaria saxatilis* responds positively to the extensive canopy disturbance characteristic of two-age harvests.

Populations of *Scutellaria saxatilis* adjacent to two-age harvests may respond positively to indirect effects such as the increased light in the margins of the harvests. This positive response would be short-lived, however, as the margins of the harvest stands fill with competing tree and shrub species.

Effects of Fire

The effects of fire on this species are unknown. Because *Scutellaria saxatilis* responds positively to shrub and subcanopy clearing, however, prescribed fire that eliminates the shrub layer of the forest should improve the habitat for this species.
Cumulative Effect

No other populations have been recently disturbed by Forest Service activities.

(C) FOREST CONCERN SPECIES

Calamagrostis porteri

Calamagrostis porteri, Porter's reedgrass, is a tall, rhizomatous perennial in the grass family. *Calamagrostis porteri* ranges from New York and the Ohio valley, through the mid-Atlantic states, and west to the Mississippi valley. It reaches its southern extent in the Appalachian mountains of Georgia. Eight states consider the species rare. Populations in Missouri and Arkansas are disjunct from the main range (Weakley 2000), and probably should be considered rare as well. In North Carolina, *Calamagrostis porteri* grows in six western counties, with one historical record (1981) in Transylvania County. Nantahala National Forest contains at least four populations. *Calamagrostis porteri* is considered an S1/G4 species.

Calamagrostis porteri grows in oak-hickory forests and along forests edges, often in association with mild canopy disturbance, and typically at mid- to high elevation. As a result, mild canopy disturbance such as thinning may benefit this species.

Alternative 1 (No Action)

Calamagrostis porteri is most often associated with recently disturbed forest communities. In the absence of canopy disturbance, habitat for this species may decrease.

Alternative 2

Calamagrostis porteri was not located in any of the proposed harvest stands. Because it forms large patches of ramets visible throughout the growing season, it is unlikely to be

overlooked during the field survey. As a result, it is unlikely that populations of Calamagrostis porteri grow in any of the harvest stands. Neither the number of harvest stands nor their management prescriptions would affect any populations of this species.

Because *Calamagrostis porteri* is most often associated with recently disturbed forest communities, disturbance associated with timber management may improve habitat for this species, especially moderate levels of canopy disturbance such as thinning and group selection.

Alternative 3

Calamagrostis porteri was not located in any of the proposed harvest stands. Because it forms large patches of ramets visible throughout the growing season, it is unlikely to be overlooked during the field survey. As a result, it is unlikely that populations of Calamagrostis porteri grow in any of the harvest stands. Neither the number of harvest stands nor their management prescriptions would affect any populations of this species.

Because *Calamagrostis porteri* is most often associated with recently disturbed forest communities, disturbance associated with timber management may improve habitat for this species, especially moderate levels of canopy disturbance such as thinning and group selection.

Effects of Fire

The effects of fire on this species are unknown. Because *Calamagrostis porteri* appears to respond positively moderate disturbance of the overstory, any treatment that reduces midstory canopy should improve the habitat for this species.

Cumulative Effect

No other populations of *Calamagrostis porteri* have been recently disturbed by Forest Service activities. In addition, the species may respond positively to disturbance. Even if this is not the case, *Calamagrostis porteri* is fairly common in the project area, and occurs in several locations that would not undergo harvest. As a result, there are no viability concerns for this species in either the project area, or across the National Forest.

Carex hitchcockiana

Carex hitchcockiana, Hitchcock's sedge, is a short, woodland herb in the sedge family. The species is widespread throughout eastern and central North America, ranging from the Great Lakes region through the mid-Atlantic region, and as far west as the Great Plains of Nebraska, Kansas and Oklahoma. It reaches the southern extent of its range in the southern Appalachians. Eleven states consider *Carex hitchcockiana* rare, including North Carolina. In North Carolina, the species occurs in four western counties: Buncomb, Graham, Jackson and Macon (Amoroso 2002). The Pisgah and Nantahala National Forests contain at least four populations.

No data exist regarding the natural history of *Carex hitchcockiana*, or its response to disturbance. *Carex hitchcockiana* was found growing in the portion of Stand 34-17B common to both action alternatives.

Alternative 1 (No Action)

Carex hitchcockiana is most often associated with closed canopy conditions. In the absence of disturbance, populations of this species should remain unchanged.

Alternative 2

This alternative proposes a group selection harvest in Stand 34-17B. Direct effects, produced by activities such as building the skid roads and skidding the logs, could impact *Carex hitchcockiana* populations, and result in the death of individual plants.

Indirect effects would result from the change in light and humidity at the forest floor. *Carex hitchcockiana* is most often associated with rocky outcrops in riparian communities. Compared to forest communities on deep soils, rocky outcrops often have thin soils that are unable to buffer the drier conditions associated with removal of the canopy. As a result, plants growing on rocks exposed by timber management are much more likely to suffer negative impacts than plants growing in adjacent communities. In addition, species adapted to the low light levels characteristic of riparian communities may be unable to adjust to higher light levels, especially in drier conditions. As a result, the indirect effects of timber management may be more detrimental for this species than the direct effects, and mitigation measures may be necessary to ensure the continued existence of the population in Stand 34-17B.

Alternative 3

This alternative proposes a two-age harvest in Stand 34-17B. In regards to *Carex hitchcockiana*, this treatment is essentially the same as Action Alternative 2. As a result, direct and indirect effects for this species should be the same as Action Alternative 2.

Effects of Fire

The effects of fire on this species are unknown. *Carex hitchcockiana* is most often found on rocky outcrops in riparian communities. These outcrops are characterized by high relative humidity and the absence of fuel. As a result, these habitats are unlikely to support a ground fire. Prescribed fire is unlikely to directly affect this species.

Cumulative Effect

No other populations have been recently disturbed by Forest Service activities.

Carex leptonervia

Carex leptonervia, the smooth wood sedge, is a short, woodland herb in the sedge family. The species is widespread throughout eastern and North America, ranging from the upper Great Lakes region through the mid-Atlantic region, and west to the Mississippi River. It reaches the southern extent of its range in the southern Appalachians. It is common throughout most of its range, including parts of New York, Vermont, Maine, Michigan, Pennsylvania, Minnesota and Ohio. Eight states, however, consider *Carex leptonervia* rare including North Carolina. In North Carolina, the species occurs in four western counties: Buncomb, Graham, Jackson and Macon (Amoroso 2002). The Pisgah and Nantahala National Forests contain at least four populations.

Carex leptonervia occupies a diverse set of woodland habitats, often colonizing disturbed areas with damp or muck soils. In the Appalachians, it is commonly associated with damp, high elevation communities such as northern hardwood forests, coniferous forests, woodland seeps, or disturbance corridors such as abandoned roads. Because it is often found in disturbed habitats, *Carex leptonervia* probably responds favorably to moderate canopy disturbance.

Carex leptonervia was founs at three locations in the project area. Two populations were associated with Stand 17-34B. One of these populations was located inside the boundaries of the stand, in portion of the stand common to both action alternatives. The second population was located outside the stand, near the western edge of the Action Alternative 2 configuration of the stand. A third population was located inside the boundaries of Stand 30-23.

Alternative 1 (No Action)

Carex leptonervia is often associated with disturbed habitats. In the absence of disturbance, habitat for this species may decrease.

Alternative 2

This alternative proposes a two-age harvest in Stand 30-23, and a group selection in Stand 34-17B. Direct effects, produced by activities such as building the skid roads and skidding the logs, could impact *Carex leptonervia* populations, and result in the death of individual plants. On the other hand, *Carex leptonervia* is often associated with moderate levels of canopy disturbance. Moderate disturbance, such as thinning and group selection, could improve habitat for this species by opening the canopy.

Indirect effects would result from the change in light and humidity at the forest floor. Although *Carex leptonervia* is often associated with canopy disturbance, it is also associated with wet soils. Timber management would increase amount of light reaching the soil surface, potentially decreasing soil moisture and negatively impacting the species. Two-age harvest would also produce a regeneration phase of thick saplings, increasing woody competition, and potentially eliminating populations of *Carex leptonervia*. Mild disturbance, on the other hand, may positively effect the species, especially if the disturbance occurs over existing populations on deep, wet soils such as seeps. It may be possible to mitigate, to some degree, the potential negative effects of

two-age harvest by thinning the canopy over *Carex leptonervia* populations adjacent to the harvest sites.

Alternative 3

This alternative proposes the same harvest treatment over the population of *Carex leptonervia* in Stand 30-23, and excludes the population next to Stand 34-17B. In regards to *Carex leptonervia*, this alternative proposes essentially the same harvest treatment as Alternative 2, and would therefore produce the same affects as Alternative 2.

Effects of Fire

The effects of fire on this species are unknown. Because *Carex leptonervia* appears to respond positively moderate disturbance of the overstory, any treatment that reduces midstory canopy should improve the habitat for this species. In addition, it is unlikely that the wet soils in which Carex leptonervia often grows would support a hot fire. In general, it seems unlikely that prescribed fire would negatively affect this species.

Cumulative Effect

No other populations have been recently disturbed by Forest Service activities.

Carex purpurifera

Carex purpurifera, the purple sedge, is a tufted woodland herb in the sedge family. The species belongs to a subgenus of common woodland sedges (Laxiflorae) that can be difficult to separate in the field. In general, sedges in the Laxiflorae are dark-green, tufted perennials with cylindrical, erect spikes. The anterior spike is staminate, the lower spikes pistillate, and the pistillate bracts form an elongated sheath around the stem. *Carex purpurifera* is distinguished in the field by its flame-red base, glaucous lower stem, pistillate spikes with 7 to 11 scattered perigynia, and long-peduncled, staminate spike (Weakley 2000, Gleason & Cronquist 1991). It ranges from western Virginia and southern Ohio into Kentucky and Tennessee, and south into northern Georgia and Alabama, with recent discoveries in North Carolina. Although most common in Tennessee and Kentucky, all states that contain *Carex purpurifera* consider the species rare. Prior to 1987, the range of *Carex purpurifera* within North Carolina was uncertain because the species had not been separated from *Carex manhartii* (Bryson et. al. 1987). During the past seven years, all historical records in North Carolina have been resurveyed, and *Carex manhartii* appears to be more common in North Carolina than *Carex purpurifera* (Gary Kauffman, personal communication). Eleven *Carex purpurifera* populations are currently known within North Carolina, all but one of which occur on the Nantahala National Forest. Five populations occur in or near the Nantahala River Gorge. In North Carolina, *Carex purpurifera* is considered an S1/G4 species.

Carex purpurifera occurs in rich cove and montane oak-hickory community types. It frequently grows on soils derived from mafic rock. This species may benefit from partial canopy removal (Kral 1983), and small populations in the Cable Cove area appear to

respond positively to canopy disturbance. The long-term response of the species to disturbance, however, is unknown. It occurs in forest communities with basal areas ranging from 40 to 100 sq. ft. per acre (Gary Kauffman, personal communication).

Carex purpurifera was not located in the project area during the field surveys. It is included in this report due to the proximity analysis.

Alternative 1 (No-Action)

Carex purpurifera is most often associated with closed canopy conditions. In the absence of disturbance, habitat for this species should remain unchanged.

Alternative 2

Carex purpurifera was not located in any of the proposed timber stands. Neither the number of timber stands nor their management prescriptions would affect any populations of this species. Based on the populations at Cable Cove, some canopy disturbance may benefit this species, should populations occur within a harvest stand. The effects of two-age management on this species, however, are unknown.

Alternative 3

Carex purpurifera was not located in any of the proposed timber stands. Neither the number of timber stands nor their management prescriptions would affect any populations of this species. Based on the populations at Cable Cove, some canopy disturbance may benefit this species, should populations occur within a harvest stand. The effects of two-age management on this species, however, are unknown.

Effects of Fire

The effects of fire on this species are unknown.

Cumulative Effects

For *Carex purpurifera*, four other timber sales have documented populations within the proposed activity areas (Gary Kauffman, personal communication). Three occur in the Cheoah Ranger District, the fourth in the Tusquitee Ranger District. All but one decision excluded activities surrounding the affected populations of *Carex purpurifera*. The other activity thinned around a portion of the *Carex purpurifera* population. This population appeared robust one year after the treatment (Gary Kauffman, personal communication). As a result, there should be no cumulative loss of viability for *Carex purpurifera* across the Forest with implementation of the action alternatives.

Trientalis borealis

Trientalis borealis, the northern starflower, is a short, woodland herb in the primrose family. *Trientalis borealis* is widespread and common throughout the northeast and

midwest regions of the United States, the subartic region of Canada, and the west coast of North America. It reaches the southern extent of its range in the Appalachians of Georgia. A northern species widespread in the mountains of Virginia, *Trientalis borealis* was first located in North Carolina in 1988 (Weakley 2000, Dellinger 1989). Six states consider it rare, including North Carolina. In North Carolina, *Trientalis borealis* occurs in three western counties: Graham, Cherokee and Haywood (Amoroso 2002). Nantahala National Forest contains at least two populations.

Trientalis borealis characteristically grows in northern hardwood and rich cove forests, often in second growth communities (Weakley 2000). As a result, canopy disturbance may benefit this species.

Trientalis borealis was not located in the project area during the field surveys. It is included in this report due to the proximity analysis.

Alternative 1 (No Action)

In so far as the species depends upon canopy openings, mild disturbance may benefit the species. In the absence of disturbance, the habitat for this species may diminish.

Alternative 2

Trientalis borealis was not located in any of the proposed timber stands. Neither the number of timber stands nor their management prescriptions would affect any populations of this species. Some canopy disturbance may benefit this species, should populations occur within a harvest stand. The effects of two-age management on this species, however, are unknown.

Alternative 3

Trientalis borealis was not located in any of the proposed timber stands. Neither the number of timber stands nor their management prescriptions would affect any populations of this species. Some canopy disturbance may benefit this species, should populations occur within a harvest stand. The effects of two-age management on this species, however, are unknown.

Effects of Fire

The effects of fire on this species are unknown.

Cumulative Effect

No other populations have been recently disturbed by Forest Service activities.

(2) Biodiversity & Old Growth

No rare communities are located within the proposed activity areas.

The proposed Hazanet project area lies in Administrative Watershed 9, which encompasses the lower drainage of the Cheoah River, from Wauchecha Bald, Santeetlah Dam and Saddle Tree Gap north to Fontana Lake. This 50,286 acre watershed contains 25,663 acres of National Forest land.

The Land and Resource Management Plan (LRMP) requires the National Forest to designate old growth restoration forest. Designated old growth areas on the Nantahala and Pisgah National Forests currently encompass 205,081 acres. These designations can be placed into one of three categories, based on areal extent: large patches, medium patches, and small patches. Large patches contain at least 2500 contiguous acres, and are distributed according to administrative watersheds. Thirty-four large patches, totaling 178,000 acres, have been designated across the National Forest. The large patch in Watershed 9 is the Joyce Kilmer/Slick Rock Wilderness.

In watersheds containing at least 2500 acres of national forest land, but without the contiguous old growth forest necessary for a large patch, the forest plan requires the designation of a medium patch. The medium patch must contain a minimum of five percent of the national forest land in the watershed. Thirteen medium patches, totaling 13,100 acres, have been designated across the National Forest. Because it contains a portion of a large patch, no medium patch is required in Watershed 9.

In each compartment containing at least 250 acres of national forest land, but without a large or medium patch, the forest plan requires the designation of a small patch. Small patches must be at least 50 acres or five percent of the acreage in the compartment. Approximately 300 small-sized patches, totaling 13,800 acres, have been designated by compartment across the National Forest. Small patches must be designated prior to any ground-disturbing activities in the compartment. To meet LRMP direction for small-sized patches, the Hazanet project proposes that seven stands be designated as small-sized, old growth patches, as listed below.

By compartment, the following stands are proposed for designation as small patches of old growth forest:

Compartment 25. One stand, approximately 74 years old, encompassing 53 acres of yellow pine - oak forest in Stand 18. The stand is adjacent to Highway 129, and would protect visual resources in the Cheoah River corridor.

Compartment 26. One stand, approximately 108 years old, encompassing 52 acres of oak - hickory forest in Stand 1. The stand is the oldest timber in the compartment. It occupies a south-facing, high elevation cove on the western edge of the compartment.

Compartment 27. Two stands (50 total acres), ranging in age from 58 to 88 years: eleven acres of yellow pine - oak forest in Stand 10, and 39 acres of oak - hickory forest in Stand 11. The stands occupy the ridge and south-facing slopes of Walker Gap on the

northern edge of the compartment, and would partially protect the Appalachian Trail corridor.

Compartment 28. Three stands (53 total acres), ranging in age from 65 to 90 years: 24 acres of oak - hickory forest in Stand 4, thirteen acres of oak - hickory forest in Stand 5, and sixteen acres of rich cove forest in Stand 13. The stands occupy the ridge and south-facing slopes of High Top on the northern edge of the compartment, and would partially protect the Appalachian Trail corridor.

Compartment 29. One stand, approximately 73 years old, encompassing 102 acres of oak - hickory forest in Stand 11. The stand occupies the ridge from Yellow Creek Gap to Cody Gap, and would partially protect the Appalachian Trail corridor.

Compartment 30. One stand, approximately 75 years old, encompassing 60 acres of acidic cove forest in Stand 3. The stand occupies the east-facing slope above Bee Creek. It is one of the few old growth stands at low elevation in the timber sale, and is the only small patch designation in the Hazanet proposal that protects acidic cove forest.

Compartment 31. One stand, approximately 88 years old, encompassing 50 acres of oak - hickory forest in Stand 4. The stand occupies the north-facing slope above Foster Cove, and lies adjacent to Stand 7, Compartment 34. Stand 4 contains the largest contiguous block of old growth timber in the compartment.

Compartment 32. Three stands, ranging in age from 52 to 122 years old: 52 acres of oak - hickory forest in Stand 3, five acres of oak - hickory forest in Stand 4, and 20 acres of oak - hickory forest in Stand 5. Stand 3 occupies the north-facing slope of Cochran Peak, and contains some of the oldest timber in the compartment. Stand 4 lies adjacent to Stand 1, Compartment 33, and contains some of the oldest timber in the compartment. Stand 5 occupies the north-facing slope of Cochran Peak and lies adjacent to Stand 3.

Compartment 33. Two stands, ranging in age from 97 to 117 years: 48 acres of oak - hickory forest in Stand 1, and 19 acres of oak - hickory forest in Stand 18. Stand 1 occupies the north-facing slope of Cochran Ridge in the northwest corner of the compartment, and contains the oldest timber in the compartment. Stand 18 also occupies the north-facing slope of Cochran Ridge, and lies adjacent to Stand 1.

Compartment 34. One stand, approximately 93 years old, encompassing 62 acres of oak - hickory forest in Stand 7. The stand occupies the south-facing slope of the ridge above Cochran Creek, and lies adjacent to Stand 4, Compartment 31. Although Stand 7 does not contain the oldest timber in the compartment, it contains old growth timber that, in combination with Stand 4, Compartment 31, forms a 102-acre patch across the top of the ridge.

Compartment 35. Two stands, both approximately 73 years old: 36 acres of xeric (pitch) pine - oak forest in Stand 7, and 22 acres of oak - hickory forest in Stand 8. The two stands occupy a south-facing slope in the upper drainage of Gladdens Creek. Stand 7

would protect pitch pine - oak forest, an unusual community type in the analysis area. Stand 8 is necessary to meet the LRMP direction for the minimum size of small patches.

The proportion of old growth communities in designated patches was compared to the proportion of forest communities in the both the National Forest as a whole and the proportion of forest communities in Watershed 9. Four ecological zones (spruce-fir forest, northern hardwoods forest, xeric pine-oak and oak heath, and high elevation red oak forest) are over-represented in the current old growth designation -- meaning, they occupy a substantially greater percentage of the designated old growth patches than they occupy on the National Forest as a whole. Two zones (mesic oak-hickory forest and shortleaf pine-oak heath) have been under-represented in the current old growth designation. To offset some of these discrepancies, the Hazanet project proposes to designation a relatively high percentage of mesic oak-hickory and a relatively small percentage of xeric pine-oak forest as small patches of old growth forest.

(3) Efects of Fire

The natural incidence of fire in the southern Appalachians is poorly understood (Barden and Woods 1974). Historical evidence of fires in the early twentieth century indicates that large fires were more common during below-average precipitation years (Harmon 1982). Rainfall dampens the leaf litter and diminishes the spread of fire if a lightning strike should ignite the vegetation. These lightning sets do occasionally smolder in hollow trees, however, and reignite the surrounding litter once it dries (Martin 1991). This was the mechanism behind two recent lightning strike fires in the Great Smokies Mountains National Park and Pisgah National Forest. In addition to natural fire, Native Americans and early European settlers frequently set fires (Williams 1998, Harmon 1984, Barden and Woods 1973). A study of fossil pollen and charcoal by Delcourt and Delcourt (1998) concluded fires set by prehistoric Native American increased the percentage of oak and chestnut in forest communities.

Based on survey work and the ecological zone models, most of the proposed burn area is dominated by some form of oak forest. Fire appears to be especially important in forest communities dominated by oak and hickory. Various researchers believe oaks need recurrent fire for their long-term stability and regeneration (Lorimer 1985, Abrams 1992). Oak and oak-hickory communities do not regenerate exclusively by tree fall gap disturbance patterns (Peet and Christensen 1987). Fire may have a beneficial influence on oaks by reducing competition from fire-sensitive species (Lorimer 1985).

Fire disturbance may also play a direct role in selecting against mesic hardwoods. Communities across the Chattooga River watershed appear to be changing from oak dominance to more shade tolerant red maple, black birch and blackgum (Bratton and Meier 1998). Historical records and analysis of current canopy trees of old growth forest indicate fire was a dominant force in the watershed during early European settlement (Meir and Bratton 1996). Since the time of fire suppression in the Great Smoky Mountain National Park, however, *Quercus montana* has experienced poor regeneration (Harrod, *et al.* 1998).

As a result, oak-hickory forests communities are probably fire dependent, and would change composition unless managed with prescribed burning. Given the uncertain role of fire in the landscape, any fire management scheme should be monitored to determine the effects of fire on community structure and composition.

The proposed burn area may impact acidic cove forest at lower elevation. The higher humidity in these communities, combined with the backing movement of the fire off the surrounding ridges, should result in a patchy ground fire. Fire impacts should be minimal within the heavy evergreen shrub layer of the acidic cove forest. A previous stand-replacement fire in the Wine Spring area, designed to regenerate a declining pine-oak/heath community, resulted in a mosaic of fire intensities (Vose, *et al.* 1997). Only a low-intensity litter fire was carried in the cove forest along the south facing draws of Indian Camp Branch, and the fire did not carry across much of the northwest-facing slope with heavy *Rhododendron maximum* cover (Gary Kauffman, personal observation). The acidic cove community surrounding the riparian zone should be impacted the least of any community because high relative humidity and constantly damp *Rhododendron* leaf litter should quickly extinguish any fire.

(4) Invasive Plant species

Exotic introduced species are a problem throughout the southern Appalachians (Bowen 1996), and a major ecological problem worldwide (Williamson 1996). A list of the most invasive species within the Pisgah and Nantahala National Forest lands includes the following plant species: *Pueraria lobata, Rosa multiflora, Microstegium vimineum, Ligustrum sinense, Lonicera japonica, Miscanthus sinensis, Celastrus orbiculata, Spiraea japonica, Ailanthus altissima, Paulownia tomentosa, Dioscorea oppositifolia, and Albizia julbrissin*. While other exotic species, such as *Vinca minor* or *Hedera helix*, are also widely dispersed in the Forest, they are not as invasive as the listed species, and therefore have less of an impact on plant communities.

In many cases, exotic plants hold a competitive edge over native plants because their natural enemies present in their native lands are not present here. The most invasive species are capable of dispersing rapidly and producing copious numbers of propagules. They also have the potential to overtake native vegetation, particularly in areas of recent disturbance. Ground disturbance and increased light conditions to the forest floor that results from timber harvest, road construction and reconstruction contribute to more suitable acreage for invasive exotic species.

Preliminary occurrence data for some invasive exotic species have been recently compiled from field survey notes on the Nantahala and Pisgah National Forest. Over 1050 communities were analyzed on the Nantahala and 220 on the Pisgah National Forest. *Microstegium vimineum* was present on 16% of the Nantahala sites and 12% of the Pisgah sites. A second invasive species, *Lonicera japonica*, was present on 12% of the Nantahala sites and 10% of the Pisgah sites. Both species occur frequently in mesic sites, although *Lonicera japonica* has a greater tolerance for drier sites. The species were most frequent on sites below 2500 feet in elevation.

Although fire is often used to reduce the influence of invasive plant species, fire may increase certain species adapted to fire regimes. For example, a fire study in the Great Smoky Mountains National Park has detected an increase in *Paulownia tomentosa* in some burned areas (Gary Kauffman, personal communication). In addition, surveys conducted during 2001 in the Steels Creek area and across the Linville rim in Burke County have detected a profusion of *Paulownia tomentosa* seedlings since a wildfire swept across the area in the fall of 2000. For some of these sites the closest mature *Paulownia* tree was one mile away. *Paulownia* trees, while not in the Hazanet proposed activities areas, are present along Highway 129, and their small, and their light seeds could be blown into the proposed activity areas.

In the project area, the most invasive species are *Microstegium vimineum* and *Lonicera japonica*. *Microstegium vimineum* is common on old logging roads in mesic sites. *Lonicera japonica* can be common is edge habitats and disturbed forest communities. The proposed harvest activities would most likely result in an increase in *Lonicera japonica* and *Microstegium vimineum* in the short term. With increasing development of small tracts in the lower elevations of the project area, both species should increase in the surrounding landscape. It is not known how long these species would persist following harvest and the closure of the overstory canopy.

The no-action alternative is less likely to facilitate the spread exotic species in the forested areas than either of the action alternatives. Both action alternatives consist of relatively small harvest areas (< 40 acres), a management technique that maximizes edge habitat in proportion to the total area of the harvest. Alternative 3 creates approximately 26.1 miles of edge habitat in forested communities, while Alternative 2 would create approximately 27.5 miles of edge habitat. Alternative 3 would also involve the construction or reconstruction of approximately 1.95 miles of system road and 1.6 miles of temporary road. Alternative 2 would involve the construction or reconstruction of approximately 1.95 miles of system road and 2.3 miles of temporary road. As a result Alternative 3 would create approximately 5% less forest edge habitat and approximately 30% less road edge habitat.

3.10 Terrestrial Wildlife Resources

[Cerulean Warbler and Golden-Winged Warbler were discussed in sections 3.4 and 3.5 and are not included here]

3.10.1 Affected Environment

The area has a very limited amount of early successional habitat and younger age classes. Openings are needed to provide age-class diversity in this area and improve habitat quality for wildlife. Species that would benefit from the creation of openings include black bear, eastern wild turkey, white-tailed deer, and ruffed grouse, which find tender browse, fruit and hiding cover in dense young stands. Neotropical migratory birds such as chestnut-sided and golden-winged warblers also breed in these regeneration openings.

There are few young stands of upland hardwoods and almost no young stands of cove hardwoods. Regenerating cove stands would benefit the area and have less effect on hard mast production. Regenerating upland hardwood stands would provide for future hard mast production. Standards in the Forest Land and Resource Management Plan (FLRMP) specify that no more than 10% of MA 4A and 15% of MA 3B be in early successional habitat (0-10 years old) at any one time.

Early successional habitat is currently lacking in eight of the 11 compartments, and would soon be lacking in the other three. Grass-forb brood habitat is lacking. Hard mast production may be limited in the four compartments (25, 26, 33, 35) with a significant component of white pine dominated forest types. In particular, about 50% of compartment 33 is dominated by white pine. There are no upland hardwood stands younger than 40 years in these compartments. It would be beneficial to emphasize the regeneration of hard mast-producing hardwoods in these areas to benefit wildlife. Both of the main access roads are closed year-round, so the open road density is very low across the project area.

Populations of eastern wild turkey are limited by the availability of grass-forb habitat for young broods. In most of the project area compartments, wild turkey is a management indicator species. The desired density of grass-forb habitat is at least 3% in these areas.

Many species of wildlife in the southern Appalachians are dependent on hard mast production, with populations rising and falling in relation to good and poor mast years. Forest management that provides a diversity and abundance of hard mast producing trees would benefit wildlife. The hard mast capability model provides a numerical description of the project area incorporating both age-class and forest-type diversity. Areas dominated by mature upland hardwoods would receive a higher rating. Areas dominated by cove hardwoods and pines would rate lower. Mixed stands rate in the middle. Special efforts should be made to regenerate and/or retain hard mast producing trees in areas rated at less than 150 lbs per acre.

Old growth is most beneficial to wildlife when it contains large diameter den trees that are not subject to human disturbance. Designated old growth should be well distributed and located on good sites that are not easily accessible to humans. Standards in the FLRMP specify that the density of open roads should be less than 0.50 miles per square mile in MA 3B and less than 0.25 miles per square mile in MA 4A. Limiting the density of open roads is meant to provide areas free from disturbance of motorized vehicles for species such as black bear and eastern wild turkey. In areas of high open road density, these species are subjected to greater hunting pressure than desired, and enforcement of hunting regulations is more difficult. With no open roads in the project area, the desired condition for eastern wild turkey and black bear habitat is being met in this area.

Riparian areas should provide large diameter den trees and small trees for wildlife food and cover. Where these trees are lacking, extensive rhododendron coverage can prevent any new trees from becoming established. The desired condition is to provide high quality riparian areas by reducing rhododendron coverage where needed and establishing

young hardwood trees.

3.10.2 Environmental Consequences

Habitat Diversity

Alternative 1 - No Action

Alternative 1 would result in no change in early successional habitat in the short term. Grass-forb habitat would remain at current levels.

Alternative 2

This would result in the creation of new early successional habitat in seven of eleven compartments. Standards for MA 3B to provide at least 5% and no more than 15% in early successional habitat would be met in four compartments. The additional early successional habitat created would be beneficial to many species of wildlife. Grouped by area, none of the northern portion, about 6% of the eastern portion, about 10% of the central portion, and about 9% of the western portion along the Cheoah River would be in early successional habitat. Though at low levels, this habitat would be fairly well distributed across the project area. (The northern section is in management area 4C, which is categorized as unsuitable for timber production.)

Eighteen additional acres of grass/forb habitat would be created on roads and log landings in compartments 29, 30, 31, 33, 34, and 35. To meet objectives for grass/forb habitat, many more acres would need to be created. Some additional acreage may be created as a result of the prescribed burns.

Stands 25/2, 25/15, and 33/11 would be planted in shortleaf pine. There is already a significant component of white pine in these compartments.

Alternative 3

This would result in the creation of new early successional habitat in seven of eleven compartments. Standards for MA 3B to provide at least 5% and no more than 15% in early successional habitat would be met in six compartments. The additional early successional habitat created would be beneficial to many species of wildlife. Grouped by area, none of the northern portion, about 9% of the eastern portion, about 11% of the central portion, and about 8% of the western portion along the Cheoah River would be in early successional habitat. Though at low levels, this habitat would be fairly well distributed across the project area. (The northern section is in management area 4C, which is categorized as unsuitable for timber production.)

Eighteen additional acres of grass/forb habitat would be created on roads and log landings in compartments 29, 31, 33, 34, and 35. To meet objectives for grass/forb habitat, many more acres would need to be created. Some additional acreage may be created as a result of the prescribed burns.

Stands 25/2, 25/15, and 33/11 would be planted in shortleaf pine. There is already a significant component of white pine in these compartments.

Management Indicator Species

Most of the project area is designated as MA 3B, where forest-wide direction is to provide habitat conditions for species such as eastern wild turkey, ruffed grouse, white-tailed deer, and travel corridors and foraging habitat for black bear. Standards for MA 3B are to provide at least 5% and no more than 15% in early successional habitat, and a minimum of 0.5% and a desired density of 3% in permanent grass-forb openings. A significant portion of the area is in MA 4C, (not suitable for timber management), where direction is to emphasize visual quality in all activities.

Table 3.10.2a. Known and potential management indicator species evaluated for this project.

Species	Type	Habitat Elements	Status
Eastern wild turkey (*Melagris gallapavo*)	bird	hard mast, soft mast, grass/forb	likely to occur
Ruffed grouse (*Bonasa umbellatus*)	bird	hardwood saplings	likely to occur
White-tailed deer (*Odocoileus virginianus*)	mammal	hard mast, browse, grass/clover	may occur
Black bear (*Ursus americanus*)	mammal	hard mast, soft mast, dens	may occur

Forest interior dependent species would find some suitable habitat in the project area. The landscape as a whole is about 86% forested, and a relatively small amount of edge habitat would be created by management activities. The best quality forest interior habitat is provided by the Forest Interior Breeding Bird Habitat Areas distributed across the Forest. One of these habitat areas includes compartments 26, 27 and 28, on the north side of the project area. The criteria for this area is stands must be greater than 40 years old, with a minimum basal area of 60 square feet, breaks in the canopy cannot exceed 100 feet, and all portions of the area should be greater than ½ mile in width.

This habitat area (which includes portions of compartments 23, 24, and 119) currently provides only 1908 acres that meet the criteria for forest interior habitat. The desired acreage is for a contiguous 2500 a. patch. The proposal to create helispots in stands 26/8, 26/14, and 27/4 or 9 would further reduce the size of this Forest Interior Breeding Bird Habitat Area by creating openings in the canopy greater than 100 feet in diameter. Due to the location of these openings, the resulting Habitat Area would be about 1044 acres in size.

Other than stream crossings, riparian areas would not be affected in any alternative. None of the activity areas are within the 100 ft. riparian management area.

Direct and Indirect effects**:**

The current open road density in the project area is 0 miles of open road per square mile. This density meets habitat objectives for eastern wild turkey and black bear. Open road density would not change in any alternative.

The existing barriers to animal movement across the landscape would not be affected by the action alternatives. The most likely movement corridor at Yellow Creek Gap would not be affected. Existing regeneration areas would be replaced with new areas in the action alternatives. Only the no action alternative would result in a significant change in habitat conditions.

The action alternatives are likely to result in direct mortality of wildlife. Direct effects from crushing are possible for any alternative that uses heavy equipment for ground disturbing activities. Road building and harvesting activities would undoubtedly result in direct mortality of some species. While large animals may escape harm, insects, arachnids, mollusks, amphibians, reptiles and bird nests would be affected. These common animals would readily reoccupy disturbed areas, if the habitat remains suitable. Other animals, such as salamanders, require moist conditions and may initially disappear from regenerated stands, but would return quickly once the litter has reformed.

As long as project activities do not result in direct mortality of very rare species or a loss of specialized habitats, there would not be a significant decline in populations of any species in the analysis area. Effects to rare species and specialized habitats are addressed in another section of this report.

Regeneration activities would result in some new habitat for early-successional associates and less habitat for mature forest associates. The creation of new regeneration areas would provide some suitable habitat for neotropical migratory birds of management concern, such as the chestnut-sided warbler and the golden-winged warbler. These areas would also provide soft mast for use by bear, deer, turkey, and other species. When this habitat is provided on private lands it is often not utilized due to human disturbance.

Eastern wild turkeys require large areas moderately free from the disturbance of motorized vehicles and intensive timber harvesting. The main effect of these alternatives on wild turkey would be due to the potential effect on hard mast production and the increase in grass-forb habitat. Desired habitat conditions are; open road density less than 0.5 miles per square mile over 5 square miles, 20 acres of grass/forb brood habitat per square mile, early successional habitat more than 5%, but less than 15% per square mile, and a minimum of 150 pounds per acre of hard mast production per square mile. These desired habitat conditions would be provided by the action alternatives, due to the creation of new regeneration and grass/forb habitat.

This species utilizes a variety of habitat types and benefits from a diverse forest landscape. The creation of new regeneration areas would provide new early successional habitats to replace the stands that are maturing into young pole timber stands. Across the Forest, habitat for this species has declined in recent years with the decreasing amount of regeneration activities. Although some brushy areas are created from the loss of mature pine trees due to the southern pine beetle, and some habitat may be created from prescribed burns and wildfire, this probably does not compensate for the lack of active management.

Across the Forest, wild turkey populations have also increased due to factors other than habitat management. The dramatic population growth of the eastern wild turkey in recent years is due to the restocking programs of the North Carolina Wildlife Resources Commission. This species is just now occupying the available habitat. As populations increase, the lack of active management across the Forest would increasingly constrain population levels.

Ruffed Grouse is strongly associated with mid-successional (5 to 20 years) forest habitats characterized by thick, shrubby growth. Ruffed grouse often uses downed woody debris of various sizes for drumming. The creation of new regeneration areas would provide new early successional habitats to replace the stands that are maturing into young pole timber stands. The availability of grass/forb habitat on seeded roads improves the quality of the existing habitat. Four prescribed burns are proposed for wildlife habitat improvement, totaling 345 acres. This may also improve grouse habitat by stimulating shrubby growth. In addition to the timber harvest units, vine control is proposed for 469 acres. Grape slicks would be left at the rate of one acres for every 25 acres treated in order to limit the adverse effect of this activity on ruffed grouse habitat.

Across the Forest, habitat for this species has increased recently as previously cut stands entered the suitable age classes. With the decreasing level of timber harvest, habitat for this species would be greatly reduced in the near future. There are few young stands available to replace existing habitat.

White-tailed Deer is associated with both early successional habitat and hard-mast production. The species uses stems and leaves of woody and herbaceous green plants, fungi and fruits. Deer require hard mast for reproductive success and subsequent fawn survival. Grass/forb plantings can help to buffer the effects of poor mast crop. The creation of new regeneration areas would provide new early successional habitats to replace the stands that are maturing into young pole timber stands. Hard mast production may be limited in the four compartments (25, 26, 33, 35) with a significant component of white pine dominated forest types. In particular, about 50% of compartment 33 is dominated by white pine. There are no upland hardwood stands younger than 40 years in these compartments. It would be beneficial to emphasize the regeneration of hard mast-producing hardwoods in these areas to benefit wildlife.

Across the Forest, white-tailed deer populations are stable to slightly increasing. While hard mast capability has increased in recent years, the amount of early successional habitat has declined. Grass/forb planting have probably not increased significantly. Within the range of deer densities and overstory conditions that exist on public lands in the Southern Appalachians, timber harvesting is not likely to significantly improve the nutritional quality of the winter diet of deer.

Black bears require large areas free from disturbances of motorized vehicles, frequent human activity, and intensive timber harvesting. Bears in much of the eastern United States depend on hard mast for the energy needed for reproduction and hibernation. A

bears' home range would increase as the amount of area in regeneration increases, resulting in greater rates of mortality. This species utilizes a variety of habitat types and benefits from a diverse forest landscape. The creation of new regeneration areas would provide new early successional habitats to replace the stands that are maturing into young pole timber stands. Across the Forest, habitat for this species has declined in recent years with the decreasing amount of regeneration activities. Although some brushy areas are created from the loss of mature pine trees due to the southern pine beetle, and some habitat may be created from prescribed burns and wildfire, this probably does not compensate for the lack of active management.

Across the Forest, black bear populations have increased due to factors other than habitat management, probably due to the benefits of the state black bear sanctuary system. As young bears migrate from these protected areas, they increasing occupy habitats with little or no hunting pressure, allowing the population to increase further.

Table 3.10.2b. Indirect Affects Of Each Alternative On The Evaluated Management Indicator Species

Species	Alt. 1	Alt. 2	Alt. 3
Eastern wild turkey	Adverse	Beneficial	Beneficial
Ruffed grouse	Adverse	Beneficial	Beneficial
White-tailed deer	Adverse	Beneficial	Beneficial
Black bear	Adverse	Beneficial	Beneficial

THREATENED, ENDANGERED, SENSITIVE, AND FOREST CONCERN TERRESTRIAL WIDLIFE SPECIES

TERRESTRIAL WILDLIFE TES EVALUATION: SPECIES LEVEL EVALUATION

Species Evaluated and Rationale

Proposed, endangered, threatened, and sensitive (PETS) species considered in this analysis are those included in the National Forests in North Carolina PETS species list (January, 2002). All 30 PETS terrestrial animal species that might occur on the Nantahala National Forest were considered. Potentially affected species were identified from information on habitat relationships, element occurrence records of PETS animals as maintained by the North Carolina Natural Heritage Program and field data on the project area.

Table 3.10.2c. Known and potential proposed, endangered, and threatened species, sensitive species, and forest concern species evaluated for this project.

Species	Type	Habitat description	Likelihood of occurrence
Federally Proposed, Endangered, and Threatened Species			
Indiana bat (*Myotis sodalis*)	mammal	roosts in caves and hollow trees	may occur
2002 Region 8 Regional Forester's Sensitive Species			
Northern bush katydid (*Scudderia septentrionalis*)	insect	treetops at edges of broadleaved forest	may occur
Rock-loving grasshopper (*Trimerotropis saxatilis*)	insect	lichen covered rock outcrops	may occur
Frosted elfin (*Callophrys irus*)	butterfly	open woods and borders, in dry situations	may occur
Diana fritillary butterfly (*Speyeria diana*)	butterfly	deciduous and pine woodlands	may occur
Glossy supercoil (*Paravitrea placentula*)	snail	leaf litter on wooded hillsides and ravines	may occur
Santeetlah dusky salamander (*D. santeetlah*)	amphib.	stream headwaters and seepage areas	known to occur
Junaluska salamander (*Eurycea junaluska*)	amphib.	wider portions of streams below 2395’	known to occur
S. appalachian salamander (*Plethodon teyahalee*)	amphib.	moist forests at all elevations	known to occur
Southern water shrew (*Sorex palustris puntulatus)*	mammal	small streams 12-15' wide above 3000'	may occur
Forest Concern Species			
Tawny crescent butterfly (*Phyciodes batesii ma*.)	butterfly	dry hillsides, upland pastures	known to occur
Queen crater (*Appalachina chilhoweensis*)_	snail	leaf litter in deciduous forests	may occur
Pink glyph (*Glyphyalinia pentadelphia*)	snail	moist leaves in upland woods	may occur
Ramp cove supercoil (*Paravitrea lacteodens*)	snail	leaf litter in mesic coves	known to occur
Open supercoil (*Paravitrea placentula)*	snail	leaf litter on hillsides and ravines	known to occur
Cerulean warbler (*Dendroica cerulea*)	bird	large trees on steep slopes	known to occur

Table 3.10.2d. Summary of Effects to T&E, Sensitive, and Forest Concern Species

Species	Alternative 1	Alternative 2	Alternative 3
Federally Proposed, Endangered, and Threatened Species			
Indiana bat	No effect	Not likely to adversely affect	Not likely to adversely affect
2002 Region 8 Regional Forester's Sensitive Species			
Northern bush katydid	No impacts	May impact*	May impact
Rock-loving grasshopper	No impacts	May impact	May impact
Frosted elfin	No impacts	May impact	May impact
Diana fritillary butterfly	No impacts	May impact	May impact
Glossy supercoil	No impacts	No impacts	No impacts
Santeetlah dusky salamander	No impacts	May impact	May impact
Junaluska salamander	No impacts	No impacts	No impacts
Southern Appalachian salamander	No impacts	May impact	May impact
Southern water shrew	No impacts	No impacts	No impacts
Forest Concern Species			
Tawny crescent butterfly	No impacts	May impact	May impact
Queen crater	No impacts	May impact	May impact
Pink glyph	No impacts	May impact	May impact
Ramp cove supercoil	No impacts	No impacts	No impacts
Open supercoil	No impacts	No impacts	No impacts
Cerulean warbler	No impacts	May impact	May impact

*may impact = "may impact individuals but is not likely to cause a trend to federal listing or a loss of viability across the Forest"

Existing Condition

The Santeetlah dusky salamander is known to occur at one location on the eastern edge of the project area near Yellow Creek Gap. It has also been collected from sites immediately to the south.

The Junaluska salamander is known to occur in the Cheoah River, which is the western boundary of the project area.

The southern Appalachian salamander is known to occur near Big Spring on the eastern end of the project area.

The ramp cove supercoil is an endemic known only from the vicinity of Tuskeegee in Graham County. This record is the type specimen and paratypes collected by H.E. Sargent in 1899. There is an additional unconfirmed record near Murphy in Cherokee county.

The open supercoil has been recorded from one location in Graham County; it is a pre-1945 record from "Tuskeegee Mountain between the heads of Tuskegee and Yellow Creeks". The only other site in North Carolina is also from Graham County, "along the Cheoah River near the junction of Yellow Creek".

New Surveys or Inventories Conducted

The project area was evaluated as suitable habitat for PETS species. Impacted areas were surveyed for the presence of special habitats (such as wetlands, boulderfields, caves or mines) that could be adversely affected by project activities. No special habitats were located.

The terrestrial snail fauna was sampled in each area proposed for regeneration harvesting in April of 2001 to determine the possible occurrence of rare molluscs. These sites were surveyed because canopy removal may adversely affect the habitat of these species. The animals collected were identified by John Slapcincsky, senior biologist, Florida Museum of Natural History, University of Florida. The pink glyph, *Glyphyalinia pentadelphia*, was collected from unit 17B. The queen crater, *Appalachina chilhoweensis*, was collected from four locations in compartment 29: Unit 29/3, Unit 29/5, near Unit 29/1A, and in a 10-15 year old clearcut nearby.

Species For Which Inventories Not Conducted and Justification -

Inventories were not conducted for the Indiana bat, katydid, grasshopper, two butterflies, or the southern water shrew. These six species were considered as potentially occurring within the project area. Inventories were also not conducted for the Santeetlah dusky salamander, the Junaluska salamander, or the southern Appalachian salamander, since these species are already known to occur in the project area.

For the Indiana bat (*Myotis sodalis*), potentially suitable summer roosting and foraging habitat does exist within the project area, however, this project would comply with the "Terms and Conditions" in the biological opinion of the U.S. Fish and Wildlife Service for the protection of the Indiana bat on the Nantahala and Pisgah National Forests.

The northern bush katydid (*Scudderia septentrionalis*), and rock-loving grasshopper (*Trimerotropis saxatilis*) utilize habitats that are common across the Forest. Although individuals may be impacted if they are present, the project would not affect the availability of suitable habitat across the Forest.

The frosted elfin (*Callophrys irus*) occurs in open woods and borders in dry situations. Little of this habitat would be affected. Although individuals may be impacted if they are present, the project would not affect the availability of suitable habitat across the Forest. This habitat is common across the Forest.

The Diana fritillary butterfly *(Speyeria diana)* has been found at more than 34 different locations in and near the National Forest in the last five years. The species is widely distributed and occurs in different forest types, but seems to prefer roadsides through cove forests. The frequency with which this species has been encountered indicates that it is much more abundant than previously thought. Small-scale disturbances are unlikely to affect the availability of suitable habitat. The main threat to this species would be from the large-scale use of insecticides.

The Santeetlah dusky salamander (*Desmognathus santeetlah)* is known to occur in stream headwaters and seepage areas of hardwood, cove hardwood and spruce-fir forests in the Great Smoky, Unicoi, Cheoah and Great Balsam Mountains of North Carolina and Tennessee. There are 11 records from the National Forest, 10 from Graham county and one from Cherokee county. The extent of the species range on the Forest is not well established, but it generally occurs in moist forests above 3000'. Direct effects to this species are possible from any activity that impacts seepage areas and other suitable habitat. With the implementation of Forest-wide standards to protect riparian areas, adverse effects to this species should be minor and temporary, in most cases.

The Junaluska salamander (*Eurycea junaluska)* is known to occur in Tululah, Snowbird and Santeetlah creeks and in the Cheoah River in Graham county. It occurs in wider, base-level portions of streams with sluggish side pools, below 2395' elevation. Direct effects to this species are possible from any activity that degrades the water quality of suitable sites or uses heavy equipment or disturbs the soil in the riparian areas alongside suitable habitat. Activities at some distance from suitable habitat which degrade water quality may also adversely affect this species.

The southern Appalachian salamander *(Plethodon teyahalee)* is found in moist forests in the southwestern mountains at all elevations. The Biological Conservation Database of the North Carolina Natural Heritage Program has records from 12 locations in western North Carolina, eight of which are on the Nantahala. It is thought to be fairly common across Graham, Swain, Cherokee, Clay and Macon counties. Dr. Richard Highton's collection at the Smithsonian lists 1007 records for this species from 10 counties at elevations from 1160 feet to 6000 feet. This includes 267 records on the National Forest, distributed across the same 10 counties and four ranger districts. Direct effects to this species are possible from any activity that uses heavy equipment or disturbs the soil. Since the species is widely distributed, potentially occupying nearly a half million acres of National Forest land, current management is unlikely to affect the availability of suitable habitat.

The Appalachian water shrew *(Sorex palustris punctulatus)* is known to occur on small first order streams up to 12-15' wide, with rhododendron cover across Macon, Swain and Clay counties. Nine sites have been recorded on the Nantahala, most of these being recent records from Macon county from Dr. Joshua Laerm and his students surveying small mammal populations. The species is thought to be widespread, but occurs in low densities and is difficult to capture. Direct effects to this species are possible from any activity that degrades water quality or disturbs the riparian area. With the implementation of Forest-wide standards to protect riparian areas, adverse effects to this species should be minor and temporary, in most cases.

EFFECTS OF ALTERNATIVES BY SPECIES

Direct and Indirect effects:

PROPOSED, ENDANGERED AND THREATENED SPECIES

Indiana Bat

On July 25, 1999, two Indiana bats were captured in a mist-net located in the upper Santeetlah Creek drainage in Graham County, North Carolina. Monitoring of the roost tree documented use by 28 bats. Given the species communal roosting habits, it is probable that all 28 bats were Indiana bats. Most of the cave sites and cavelike habitats available in western North Carolina do not provide suitable conditions for significant wintering habitat for Indiana bats. Thus, North Carolina was not considered likely to provide either significant wintering habitat or maternal roosting habitat. The capture of a reproductively active female Indiana bat in Graham County provides new information on the status and distribution of this species in North Carolina. At present, this is the southernmost known Indiana bat maternity colony. It is possible that other Indiana bat maternity colonies occur on the Forest, as well as individual roosting males. Direct effects may occur between April 15 and October 15 if a tree that a bat is roosting in is cut. Indirect effects may also occur to potential Indiana bat roosting and foraging habitat.

This project may impact a maximum of 589 acres of suitable habitat. To reduce the likelihood of direct effects to Indiana bats and indirect effects to Indiana bat habitat, this project would comply with the Terms and Conditions in the Biological Opinion of the U. S. Fish and Wildlife Service for the protection of the Indiana bat.

This includes retention of standing trees with more than 25% exfoliating bark, shellbark, shagbark and bitternut hickories, snags, hollow, den, and cavity trees, trees in buffer zones along intermittent and perennial streams, and shade trees adjacent to some of the large snags. These measures would be implemented when the stands are marked for sale.

Calculation of the habitat suitability index resulted in a 2% change from the baseline.

Based on the small number of currently suitable or potential roost trees that would be affected, effects on the bat population would be unlikely, and would not reach the scale

where an adverse affect or actual take occurs. The sequence of events that would result in a tree being cut down in which a bat is roosting is unlikely.

Removing a small number of trees would not make the area unsuitable as summer habitat for Indiana bats. Indiana bats are known to use highly altered and fragmented landscapes. They may respond positively to habitat disturbance, particularly where forests are even-aged and closed-canopied. A diverse landscape may benefit Indiana bats, as long as sufficient mature forest and numbers of quality roost trees are provided. Given the amount of harvesting, the area would still provide vast numbers of roost trees and potentially suitable habitat for Indiana bats.

Since the sequence of events that would result in a tree being cut down in which a bat is roosting is very unlikely, direct effects to Indiana bats should not occur. Because there is only a very minor loss of potential Indiana bat habitat in the area impacted, this action would not affect the availability of Indiana bat habitat in the project area. This project **is not likely to adversely affect** the Indiana bat.

SENSITIVE SPECIES

Species-specific effects are described below by alternative. Recommendations are based on best available information and include direct and indirect effects to PETS species off site or on private land.

Alternative 1 - No Action

This alternative would have no impact on any PETS species.

Alternatives 2 and 3

The northern bush katydid (*Scudderia septentrionalis*), and rock-loving grasshopper (*Trimerotropis saxatilis*) utilize habitats that are common across the Forest. Although individuals may be impacted if they are present, the project would not affect the availability of suitable habitat across the Forest.

Little of the habitat for the frosted elfin (*Callophrys irus*) would be affected. Although individuals may be impacted, the project would not affect the availability of suitable habitat across the Forest.

The Diana fritillary butterfly *(Speyeria diana*) may occur in the project area and individuals may be adversely affected by project activities. Since the species utilizes nectar plants found in openings, it is possible that ground disturbance would improve habitat for this species.

The glossy supercoil (*Paravitrea placentula*) was not located in the units surveyed. There would be no impacts to this species.

The Santeetlah dusky salamander (Desmognathus santeetlah) may occur in stream headwaters and seepage areas in hardwood and cove hardwood forests at elevations above 3000' throughout the Cheoah Mountains. Although there is only one existing record in the project area, the species may occur at suitable sites throughout.

Loss of habitat may occur from road construction across riparian areas. This may occur in sections of new road construction proposed for stands 29/1, 34/9 and 35/14. With the implementation of Forest-wide standards to protect riparian areas, the majority of habitat in the project area would be protected. This project is not expected to adversely affect the availability of suitable habitat in the project area or across the Forest.

The Junaluska salamander (*Eurycea junaluska*) is known to occur in the Cheoah River, which forms the western boundary of the project area. New road construction proposed to access stands 33/8, 35/3 and 35/14 is a potential source of sedimentation into occupied habitat. With the implementation of Forest-wide standards to protect riparian areas, adverse effects to this species should be minor and temporary. This project would have no impacts on the Junaluska salamander.

The southern Appalachian salamander (*Plethodon teyahalee)* may occur in project activity areas. There may be a substantial effect from regeneration harvesting because of the openings in the canopy, but this would occur in only in a small part of the project area. Much suitable habitat would remain. Habitat may be temporarily decreased where ground litter is disturbed and/or insolation increases from removal of canopy trees. Project activities would not significantly affect the availability of suitable habitat in this area. This project may impact individuals of this species, but is not likely to cause a trend to federal listing or a loss of viability.

Forest plan standards that limit the amount of regeneration allowed in any compartment, management area and analysis area prevent any cumulative effects to this species.

The Appalachian water shrew *(Sorex palustris punctulatus)* may occur within project activity areas. With the implementation of Forest-wide standards to protect riparian areas, adverse effects to this species should be minor and temporary. This project would have no impacts on the Appalachian water shrew.

FOREST CONCERN SPECIES

The tawny crescent butterfly (*Phyciodes batesii maconensis*) is known from seven counties in western North Carolina, Buncombe, Haywood, Jackson, Macon, Graham, Clay, and Swain. It occurs on dry hillsides and upland pastures. The host plants are Aster undulates and Andropogon sp. It has been recorded from three locations in the project area, none of which are in activity areas. Since the species utilizes nectar plants found in openings, it is possible that ground disturbance would improve habitat for this species. There is unlikely to be any adverse effects to this species from the proposed project.

The queen crater (*Appalachina chilhoweensis*) is known from Graham, Haywood, Madison and Swain counties. It was collected from two activity areas and from two locations outside of the activity areas, including a 10-15 year old clearcut. The presence of this species within a previous regeneration unit indicates that removing the canopy does not make the area completely unsuitable for an extended period of time. Populations may have been reduced, but apparently some individuals survived the harvest. It is unlikely that a species with such limited mobility was extirpated from the site and then reoccupied it recently.

Individuals of the queen crater occurring within Units 29/3 and 29/5 may be adversely affected by harvesting activities, but this unlikely to significantly affect populations in the project area or across the Forest. Habitat within the unit may be limited for a period of time. Individuals and habitat outside the unit would not be affected. Potential adverse effects would be minimized if additional canopy were retained in the vicinity of the collection site.

The pink glyph, *Glyphyalinia pentadelphia*, is known from five counties in North Carolina; Cherokee, Clay, Graham, Macon, and Swain. There are seventeen records from these counties from a variety of forest types and elevations. Populations of this species in Unit 17B may be adversely affected immediately after the stand is harvested due to drying of the leaf litter. The proper habitat conditions would be reestablished as the stand matures. This is not likely to adversely affect populations of this species in the project area or across the Forest.

The ramp cove supercoil (*Paravitrea lacteodens*) and the open supercoil (*Paravitrea placentula)* were not located in the units surveyed. There would be no impacts to these species.

Cumulative Effects

The effects of past practices are displayed in the current existing condition described above. On private lands, past practices include conversion of forested lands to agricultural crop-production, timber harvesting, etc. The cumulative effect on mast production and projected age-class distributions are discussed under each proposed alternative. The effects of these projects are included in the age class distribution listed for the analysis area above. There are no other timber sales actively being planned in the analysis area at this time. If additional projects are proposed in the future, cumulative effects would be evaluated at that time.

3.11 Heritage Resources

In compliance with Federal Laws and Regulations, and the Programmatic Memorandum of Agreement (PMOA) with the N.C. State Historic Preservation Officer (SHPO), a Heritages Resources Survey was conducted for the alternatives described in Chapter 2 of this document. Prior to fieldwork, the area was rated by the Forest Service and considered a likely area for containing archeological sites.

One previously unrecorded archeological site was located and recorded during the survey for the Hazanet Project. Site 31GH430 is a small lithic scatter. This site rated Class III and is not considered eligible for listing in the National Register of Historic Places.

A copy of the archeological report was sent to the North Carolina State Historic Preservation Officer and a letter of concurrence was received dated January 2, 2003.

A copy of the archeological report was also sent to the Eastern Band of Cherokee Indians Tribal Historic Preservation Officer for review and comment.

3.12 Recreation

3.12.1 Affected Environment

Recreation use in the project area consists of hunting, fishing, hiking, backpacking, mountain biking, horseback riding, dispersed camping and picnicking. Developed recreation areas in the project area include Cheoah Point Campground, swimming beach and boat ramp on Lake Santeetlah. The Appalachian National Scenic Trail traverses the easternmost edge, the Waucheucha Bald Trail and the Yellow Mountain Trail are also in the project area.

3.12.2 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – With this alternative the recreational opportunities would remain the same and there would be no immediate impacts.

Alternative2 and Alternative 3 – All potential impacts would be temporary in nature. With either of the action alternatives, similar impacts would occur. First, portions of the hiking trails would be used as fire breaks for some of the prescribed burning activities. This would impact the use of the affected trail portions during the time the burning took place, since foot traffic would need to be curtailed during that time. In the longer term, prescribed fire can reduce underbrush, making for a more pleasurable hiking experience. The extent of the effects would be the same for both action alternatives.

Second, wildlife habitat improvements would make better conditions for some game species, which would tend to support future hunting opportunities in the project area. Both alternatives create similar amounts of grass/forb habitat, while Alternative 3 creates slightly more early successional habitat than Alternative 2.

Third, horseback riders or mountain bikers may encounter an occasional logging truck or activity when riding system or temporary roads, and views of additional timber harvest areas may be seen along these roads as well. Hikers, campers, swimmers and picnickers may hear the distant sounds of logging activities or may encounter an occasional logging truck, but no recreation opportunities would be permanently altered or diminished.

Cumulative Effects

Alternative 1 – Lack of wildlife habitat improvements in the context of a short supply of certain habitat elements across the district would result in worsening conditions for some game species, which could lessen hunting opportunities in the long-term.

Alternative 2 and Alternative 3 – The activities in these alternatives would tend to perpetuate the availability of habitat for game species across the broader landscape. Projects to the north and northeast of this project area created some early successional over the past decade, and this project would extend that availability into the future. The cumulative impact on recreation would be to maintain the availability of hunting opportunities into the future and across a broad landscape.

3.13 Road Management

3.13.1 Affected Environment

About 32.45 miles of existing closed roads access the project area. A project scale roads analysis was performed to identify potential opportunities and risks from the transportation system, to identify any unneeded roads as well as future transportation needs. A few roads were identified as needing additional maintenance such as culvert replacement and gravel. No unneeded roads were identified. There are still portions of the area that are not accessible by road. All Forest Service roads in the project area are closed, and the open road density from all roads is very low.

3.13.2 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – There would be no effects to the transportation system from this alternative. Existing road maintenance issues would not be addressed, and no road construction or reconstruction would occur. The amount of the project area accessible from a road would remain as it is.

Alternative 2 and Alternative 3 - Both action alternatives would increase the amount of the project area accessible from a road by adding 1.35 miles of additional system road. Road maintenance would improve the condition and lessen the current environmental risks of some road segments by replacing culverts and adding gravel. A 0.1-mile section of road would be relocated away from a creek to resolve a sedimentation risk. There would be no effect to open road density sense the new roads would be closed when the project is completed.

Cumulative Effects – Both action alternatives would result in an increase in the amount of system roads in the project area to 33.78 miles, and increase the amount of area accessible from a road. There would be no cumulative effect to open road density.

3.14 Financial Analysis

3.14.1 Affected Environment

The Cheoah Ranger District provides timber related products to the private wood industry in Graham County, as well as other surrounding counties in North Carolina, Tennessee, and Georgia. The Hazanet project contributes directly to the employment and income of people involved directly in the local timber industry. There are also indirect affects to the employment and income of people providing products and services to the local timber products industry. Finally, people who earn their income, directly or indirectly, as a result of the timber products industry go on to spend their wages in the local area creating an "induced" effect to the local economy.

3.14.2 Environmental Consequences

Alternative 1 (No Action) – No products would be made available to the timber industry from Forest Service lands in the Hazanet project area. There would be no timber sale revenues to the United States Treasury. Costs to the Forest Service are limited to those costs associated with project development, resource analysis and documentation of that analysis.

Alternative 2 – The project would benefit the local economy by providing timber products to the local timber products industry (approximately 8,348 hundred cubic feet or CCF). Work would be provided to people with skills in timber cutting, road construction, truck hauling, and wood processing and manufacturing. There would be people employed in timber sale preparation and harvest administration. Timber stand improvement and site preparation activities preceding and following a harvest would provide work to skilled laborers. Receipts from the sale of timber would be approximately $448,000 (refer to Table). Costs associated with the planning and implementation of the project would be approximately $117,500. Pre-harvest and post-harvest timber stand improvement/site prep treatments associated with development of a new stand of trees would be approximately $95,400. There would be a benefit/cost ratio of 1.03, or in other words $1.03 would be returned to the United States treasury for each $1.00 spent.

Alternative 3 – The project would benefit the local economy by providing timber products to the local wood industry (approximately 8,016 CCF). Work would be provided to people with skills in timber cutting, road construction, truck hauling, and wood processing and manufacturing. There would be people employed in timber sale preparation and harvest administration. Timber stand improvement and site preparation activities preceding and following a harvest would provide work to skilled laborers. Receipts from the sale of timber would be approximately $447,000 (refer to Table). Costs associated with the planning and implementation of the project would be approximately $114,000. Pre-harvest and post-harvest timber stand improvement/site prep treatments associated with development of a new stand a of trees would be

approximately $113,100 There would be a benefit/cost ratio of 1.03, or $1.03 would be returned to the United States treasury for each $1.00 spent.

Cumulative Effects – Alternatives 2 and 3 would have a benefit/cost ratio greater than 1.00, indicating that revenues associated with the harvest of timber would exceed the cost associated with the harvest. Implementation of either Alternative 2 or 3 would contribute towards an above-cost timber sale program on the Nantahala National Forest.

Table3.14.2: Economic Projections for Hazanet Project

	Alternative 1	Alternative 2	Alternative 3
Harvest Acres	0	501 Acres	499 Acres
Sawtimber Volume (CCF)	0	6,292 CCF	6,010 CCF
Roundwood Volume (CCF)	0	2,056 CCF	2,006 CCF
Total CCF	0	8,348 CCF	8,016 CCF
Revenue			
Sawtimber	$0	$438,688	$438,216
Roundwood	$0	$9,358	$9,206
Total Revenue	$0	$448,132	$447,422
Costs			
Analysis and Documentation	$30,250	$30,250	$30,250
Sale Preparation	$0	$59,688	$57,314
Harvest Administration	$0	$27,548	$26,453
Stand Improvement/Site Prep	$0	$95,400	$113,100
Road Construction	$0	$67,500	$67,500
Road Reconstruction	$0	$7,200	$7,200
Helicopter Yarding	$0	$54,100	$54,100
Cable Yarding	$0	$94,7400	$79,770
Total Costs	$30,250	$436,426	$435,687
Sale Value	-$30,250	$11,706	$11,735
Benefit/Cost Ratio	N/A	1.03	1.03

3.15 Health And Safety Considerations

3.15.1 Affected Environment

The affected environment for health and safety considerations is the forested land in the project area and the State and national forest roads leading to the project area.

3.15.2 Environmental Consequences

Alternative 1 - There would be no effects on human health and safety resulting from this alternative.

Alternatives 2 and Alternative 3 -There would be a risk of injury to forest workers engaged in timber falling, limbing, and bucking from the use of chainsaws and from falling trees or limbs. There would be risk of injury to forest workers and equipment operators from log skidding and loading operations. These risks would be reduced by the use of personal protective equipment normally used during logging and other forest work activities, such as hardhats, gloves, work boots, chainsaw chaps, and eye and ear protection. There would be a risk for vehicular accidents on the roads resulting from log truck traffic hauling products off the national forest. Appropriate posting of warning signs at the national forest gates would be mandated by the Forest Service if the proposal is implemented.

Prescribed burning produces some particulate emissions, which impair visibility and can have an adverse impact on human health. The greatest effects would occur near the fires; potential adverse health effects would be highest for personnel conducting the burning. Farther away, the effects of particulate matter would be reduced as smoke dispersion occurred. Particulate matter emission would be greatly reduced by burning under conditions that enhance flaming and reduce smoldering. Burning when atmospheric conditions are most conducive to smoke dispersion would lessen the effects of particulate matter on smoke-sensitive areas.

During prescribed burning adjacent to trails, trailheads would be posted with appropriate information, and lookouts would be placed to intercept through-hikers during the time of the burn. This would mitigate potential safety concerns.

All other standard mitigations for prescribed fire and herbicide use would be followed to minimize potential health and safety risks in regard to these actions.

The potential effects to health and safety would be similar in type and extent from those associated with previous projects across the district and would not be significant. Any effects to health and safety would be limited to the immediate project area and the time of project implementation. There would be no cumulative effects to health and human safety from implementing any alternative in this project.

LIST OF PREPARERS AND AGENCIES/PERSONS CONSULTED

USDA Forest Service Preparers and Persons Consulted

Ruth Berner, Biological Scientist - Natural Resources Planner
Joan Brown, Silviculturist - Former ID Team Leader
Jim Buckel, Forester
Doreen Miller, Wildlife Biologist
Jason Farmer, Fisheries Biologist
Duke Rankin, Botanist
Frank Findley, Resource Assistant
Erik Crews, Landscape Architect
Dan Manning, Soil Scientist
Horace Mitchell, Archeologist

Other Persons or Agencies, or Governments Consulted

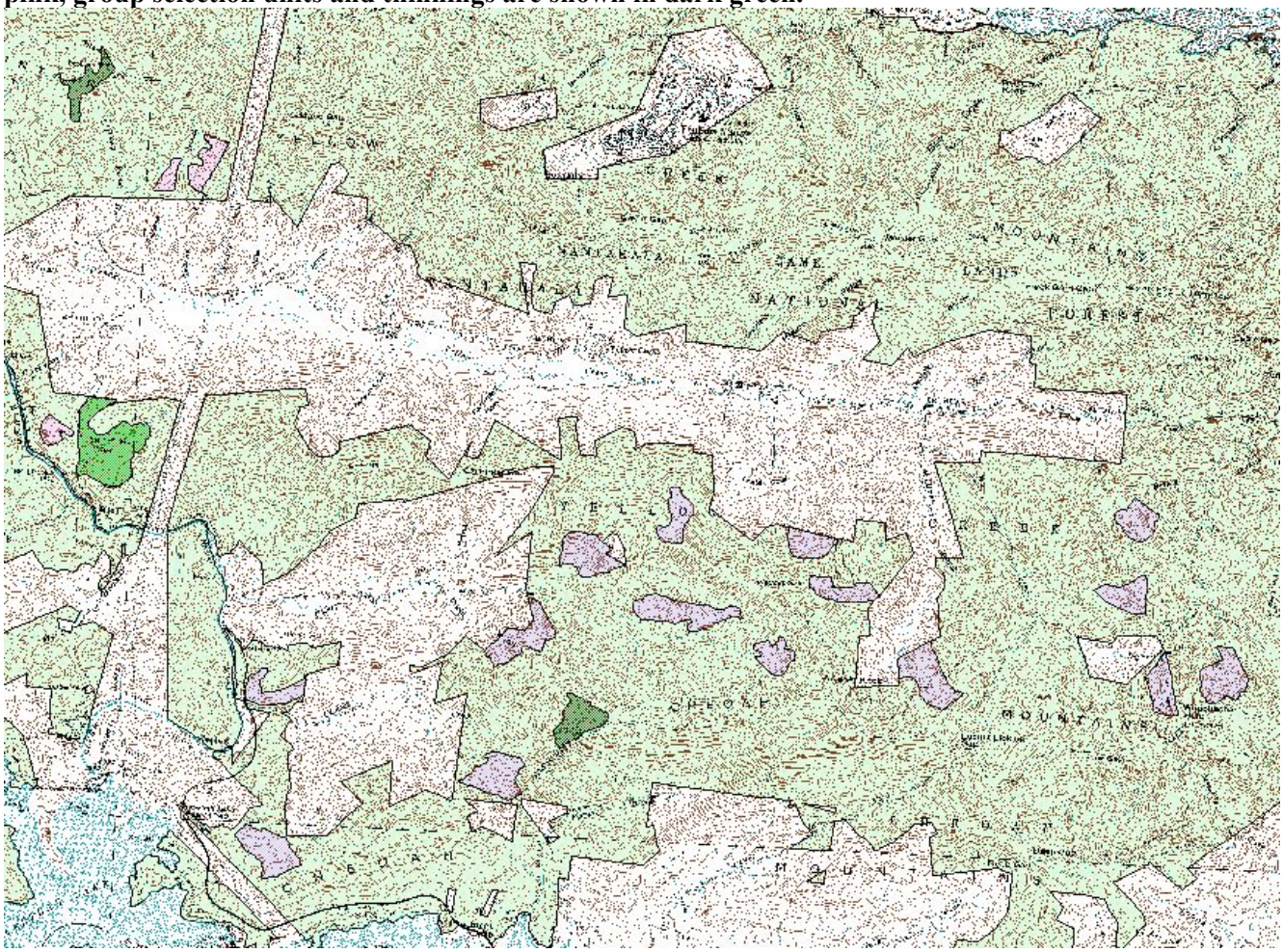
USDI Fish and Wildlife Service
North Carolina Division of Environment and Natural Resources
North Carolina State Historic Preservation Officer
Eastern Band of Cherokee
Morgan Sommerville - Appalachian Trail Conference

APPENDIX A - BIOLOGICAL EVALUATION & BIOLOGICAL REPORTS

BIOLOGICAL EVALUATION - HAZANET TIMBER SALE
CHEOAH RANGER DISTRICT - NANTAHALA NATIONAL FOREST

The preferred alternative would regenerate 427 acres by the 2-age method over fifteen units. Group selection harvest would be done on 72 acres. Forty acres would be slashed, burned, and planted to shortleaf pine. An additional 50 acres would be thinned. Pre-harvest treatments and vine control prior to regeneration harvesting would be conducted on 407 acres. Additional vine control would be conducted on another 214 acres. Timber stand improvement work would be done on 255 acres. Helispots would be developed in stands 35/15, 26/8, 26/14, and 27/4 or 9. These activities would require about three miles of road construction and 0.6 mile of road reconstruction. About 351 acres would be prescribe burned for wildlife habitat improvement. Ten vernal pools would be created for wildlife habitat improvement.*

Figure 1. Project vicinity map. Alternative 3. Two-aged regeneration units are shown in pink, group selection units and thinnings are shown in dark green.



*Slight variations in acreage figures from those described in Chapter 2 are the result of independent acreage calculations and are considered within an acceptable range of variability.

Proposed, endangered, threatened, and sensitive (PETS) species considered in this analysis are those included in the National Forests in North Carolina PETS species list (January, 2002). All PETS species that might occur on the Nantahala National Forest were considered. Potentially affected species were identified from information on habitat relationships, element occurrence records of PETS species as maintained by the North Carolina Natural Heritage Program and field data on the project area.

Duke Rankin, Nantahala National Forest botanist, surveyed these sites and concluded that the project will have no effect on any federally listed or proposed plant species. The preferred alternative will have no effect on any federally listed plant species. Consultation with the U. S. Fish and Wildlife Service is not required. The project may impact individuals of the sensitive species *Euphorbia purpurea, Helianthus glaucophyllus,* and *Scutellaria saxatilis*, but are not likely to cause a loss of viability or a trend to federal listing. The action alternatives will not impact any other sensitive plant species. There will be no cumulative effects on any sensitive plant species from the activities (see attached Botanical Analysis).

Doreen Miller, Nantahala National Forest wildlife biologist, surveyed these sites and concluded that the project is not likely to adversely affect the Indiana bat and would have no effect on any other federally listed or proposed terrestrial animal species

To reduce the likelihood of direct effects to Indiana bats and indirect effects to Indiana bat habitat, this project will comply with the Terms and Conditions in the Biological Opinion of the U. S. Fish and Wildlife Service for the protection of the Indiana bat.

Since the sequence of events that would result in a tree being cut down in which a bat is roosting is very unlikely, direct effects to Indiana bats should not occur. Because there is only a very minor loss of potential Indiana bat habitat in the area impacted, this action will not affect the availability of Indiana bat habitat in the project area.

This project **is not likely to adversely affect** the Indiana bat (*Myotis sodalis)*. The project will have no effect on any other federally proposed or listed terrestrial animal species. The project may impact individuals of the northern bush katydid (*Scudderia septentrionalis*), rock-loving grasshopper (*Trimerotropis saxatilis*), frosted elfin (*Callophrys irus*), Diana fritillary butterfly (*Speyeria diana)*, Santeetlah dusky salamander (*Desmognathus santeetlah*) and southern Appalachian salamander (*Plethodon teyahalee)*, but will not impact their viability across the Forest. This project will not impact any other sensitive species. No cumulative effects on species viability across the Forest will result from this project. Consultation with the U.S. Fish and Wildlife Service **is required** (see attached Wildlife Analysis).

Jason Farmer, Nantahala National Forest fisheries biologist, concluded that the federally listed mussel *Alasmidonta raveneliana* and portions of its critical habitat are located within the project or analysis areas. The USDI Fish and Wildlife Service was contacted.

In accordance with the USDI Fish and Wildlife Service recommendations, the Indiana Bat standards (Amendment 10 to LRMP) will provide the necessary protection for the Appalachian elktoe and its critical habitat. The project is not likely to adversely affect the Appalachian elktoe and will have no effect on any other federally listed aquatic animal species.

Sensitive species *Gomphus consanguis* and *Gomphus viridifrons* may occur within the project area. A *Gomphus sp.* individual (genus in which *Gomphus consanguis* is located) was collected by Pennington & Associates (2002). The habitats for these benthic macroinvertebrate species are common across their range. The implementation of this project may impact or stress individuals, but is not likely to adversely affect the viability of these species across the Forest. No risk to aquatic population viability of the two sensitive species above will occur as a result of this project. The project will have no effect on any other sensitive aquatic animal species (see attached Aquatic Analysis).

Determination of Effect

This project **is not likely to adversely affect** the Indiana bat or the Appalachian Elktoe mussel. The proposed project will have no effect on any other federally proposed or listed species. The project may impact individuals of *Euphorbia purpurea, Helianthus glaucophyllus*, *Scutellaria saxatilis,* northern bush katydid (*Scudderia septentrionalis*), rock-loving grasshopper (*Trimerotropis saxatilis*), frosted elfin (*Callophrys irus*), Diana fritillary butterfly (*Speyeria diana)*, Santeetlah dusky salamander (*Desmognathus santeetlah*), southern Appalachian salamander (*Plethodon teyahalee)*, *Gomphus consanguis,* and *Gomphus viridifrons,* but will not impact their viability across the Forest. The project will have no impact on any other sensitive species. Consultation with the USDI, Fish and Wildlife Service **is required**.

Prepared By:

Doreen L. Miller April 11, 2003
Wildlife Biologist Date
Nantahala National Forest

AQUATIC RESOURCE ANALYSIS (AQUA)

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I. INTRODUCTION

This report documents the findings of an aquatic resource analysis (AQUA) of a proposed timber sale on the Cheoah Ranger District Compartments 25, 29, 30, 31, 33, 34, and 35. The proposed project includes tree harvesting, road construction and reconstruction, site preparation, prescribed burning, vine control using herbicide, wildlife opening rehabilitation, and watershed rehabilitation work. Access to the project areas includes 2.65 miles (Alternative 2) of road construction, or 2.95 miles with Alternative 3. There are 0.6 miles of reconstruction Alternative B and C. Some new culverts (mostly drainage) would be installed and 2 existing culverts would be replaced. A more complete description of the project proposal can be found in the environmental assessment (EA).

The Land and Resource Management Plan (LRMP) for the Nantahala and Pisgah National Forests includes standards and desired future conditions for the Forests, including riparian areas and their aquatic resources. The standards are intended to protect, manage, and enhance riparian and aquatic resources of the Forests. This analysis would focus on the potential effects of the proposed and associated activities on aquatic

resources. Activities that do not have the potential to directly, indirectly, or cumulatively affect aquatic resources or have aquatic resources within or adjacent to them would not be considered in this AQUA. The proposed project was analyzed to determine effects on aquatic proposed, endangered, threatened, and sensitive (PETS) species; forest concern species; and management indicator species (MIS). This analysis also addresses direct, indirect, and cumulative effects of project implementation.

Aquatic Project and Analysis Area

Table 1. LRMP Watershed 23 (Little Tennessee River)

Stream Name	Compartment/Stand	Kilometers in Project Area*	Kilometers in Analysis Area*	DEM Classification **
Cheoah River	25,33,35	3.07	9.56	C Tr
Unnamed Tributary (UT) 1 Cheoah River	25/8,10,18	0.75	0.75	C
Puncheon Camp Branch	25/7,8,10,16,18	1.62	1.85	C
UT 1 Puncheon Camp Branch	25/7,8,16	0.61	0.61	C
UT 2 Puncheon Camp Branch	25/16	0.12	0.12	C
UT 1 Yellow Creek	25/8,21	0.46	1.21	C
Lifting Rock Branch	25/2,3,4,5,15	0.76	1.43	C
UT 1 Lifting Rock Branch	25/3	0.18	0.18	C
UT 2 Lifting Rock Branch	25/3,4,5	1.48	1.48	C
Peterson Branch	25/3,4,15	0.77	1.57	C Tr
UT 1 Peterson Branch	25/3	0.14	0.14	C
UT 2 Peterson Branch	25/3	0.09	0.09	C
Rickman Branch	25/2	1.32	1.32	C
Shuler Creek	26/1	0.47	1.41	C
Turpin Branch	26/1	0.0	0.43	C
UT 1 Turpin Branch	26/1	0.82	1.41	C
Garrison Branch	27/11	0.16	1.67	C
Dummy Branch	28/15	1.52	1.52	C
Big Branch	28/13	1.94	1.94	C
UT 2 Yellow Creek	28/15	0.15	0.15	C
UT 3 Yellow Creek	28/15	0.19	0.19	C
UT 4 Yellow Creek	28/4, 13, 15	0.89	1.60	C
Yellow Creek	29/9,11	3.03	3.03	C Tr
UT 5 Yellow Creek	29/11	0.43	0.43	C
Cody Branch	29/1, 2, 3, 4	3.02	3.34	C
UT 1 Cody Branch	29/1,4	1.22	1.22	C
UT 2 Cody Branch	29/1,5	0.55	0.38	C
UT 3 Cody Branch	29/1	0.34	0.17	C
UT 4 Cody Branch	29/1,11	0.59	1.15	C
UT 5 Cody Branch	29/1	0.68	0.68	C
UT 6 Cody Branch	29/1	0.21	0.21	C
UT 7 Cody Branch	29/1	0.74	0.74	C
UT 8 Cody Branch	29/1	0.27	0.27	C

Bee Creek	30/23	0.33	3.22	C
UT 1 Bee Creek	30/29	0.69	0.69	C
UT 2 Bee Creek	30/13, 24	1.59	1.59	C
Williams Branch	30/9,11,13,15	0.17	2.85	C
UT 1 Williams Branch	30/9	0.30	0.92	C
UT 2 Williams Branch	30/15	0.35	0.16	C
UT 3 Williams Branch	30/15	0.34	0.20	C
UT 4 Williams Branch	30/9	0.89	0.89	C
UT 5 Williams Branch	30/13	0.41	0.41	C
UT 6 Williams Branch	30/11	0.46	0.46	C
UT 6 Yellow Creek	31/8	0.99	0.99	C
UT 7 Yellow Creek	31/5	0.28	0.28	C
UT 8 Yellow Creek	31/1, 2, 4, 5	1.89	3.09	C
Sarvis Branch	33/8	0.86	1.21	C
UT Sarvis Branch	33/8	0.43	0.43	C
UT 2 Cheoah River	33/19	1.22	1.22	C
Cochran Creek	34/9,12,17	2.25	3.54	C
Colvin Branch	34/10,17	0.23	1.17	C
UT 1 Cochran Creek	34/17	0.52	0.52	C
UT 2 Cochran Creek	34/1,3	0.72	0.92	C
UT 3 Cochran Creek	34/17	0.32	0.32	C
UT 4 Cochran Creek	34/9	0.40	0.40	C
UT 5 Cochran Creek	34/17	0.26	0.26	C
UT 6 Cochran Creek	34/17	1.03	1.03	C
UT 7 Cochran Creek	34/9	0.90	0.90	C
UT 8 Cochran Creek	34/17	0.50	0.50	C
UT 9 Cochran Creek	34/9,13	0.48	0.48	C
UT 10 Cochran Creek	34/17	0.26	0.26	C
UT 11 Cochran Creek	34/17	0.27	0.27	C
UT 3 Cheoah River	35/3	0.37	0.37	C
Gladdens Creek	35/7,8,12	1.04	2.87	C
UT 1 Gladdens Creek	35/3	0.33	0.33	C
UT 2 Gladdens Creek	35/13, 15	0.51	1.73	C
UT 3 Gladdens Creek	35/9, 24	2.02	2.02	C
UT 4 Gladdens Creek	35/9	0.74	0.74	C
UT 4 Cheoah River	35/14	0.49	0.73	C

*This analysis addresses project area waters and analysis area waters. Project area waters are defined as those in the area of potential site-specific impacts on aquatic habitat and populations. The analysis area encompasses waters downstream that potentially could be impacted by project activities, in addition to project area waters.

**The "C" classification denotes waters suitable for aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture.

There is limited habitat for fish species within project area waters due to small stream size and restricted flow regimes. Trout do inhabit the project areas of Yellow Creek, Cody Branch, Bee Creek, Williams Branch, Cheoah River, Cochran Creek. Project area waters also provide habitat for macroinvertebrates.

II. AQUATIC SPECIES CONSIDERED AND EVALUATED

National Forests in North Carolina recognize three types of rare species during a NEPA analysis, which are described below. Species meeting these criteria that occur or potentially occur on the Forests are listed in Attachment 1.

A proposed, threatened, or endangered species (T, E, PT, and PE) is a species that has been formally listed or is proposed for listing by the United States Fish and Wildlife Service. These species are included in every AQUA conducted for projects within a watershed where the species is known to, likely to, or may occur. These species are also included in AQUAs for watersheds where the species occurred historically but haven't been found during recent surveys.

A sensitive species (S) is a species appearing on the Regional Forester's Sensitive Species list for the Southern Region. These species may or may not have a Federal or State status, but generally have a global rank of G1, G2, or G3 and a State rank of S1 or S2. These species are included in every AQUA conducted for projects within a watershed where the species is known to, likely to, or may occur.

A Forest concern species (FC) is a species, which National Forests in North Carolina considers to be generally rare, and an important part of the biodiversity across the Forests that do not fall within one of the above categories. These species may or may not have a Federal or State status, and generally have a global rank of G3 or lower and a State rank of S1 or lower. These species are included in every AQUA conducted for projects within a watershed where the species is known to or is likely to occur. The large groups of Forest concern species, which may occur within the aquatic analysis area, but are not known to or are not likely to occur within this area, are addressed collectively as the aquatic insect community.

A management indicator species (MIS) is a species that the National Forests in North Carolina selected for emphasis in planning and would be monitored during Forest plan implementation to assess the effects of management on their conditions and trends and the effects on diversity and population viability of all native and desirable non-native plants and animals.

Thirty-five rare aquatic species have been listed by the NCWRC, USFWS, or NCNHP as occurring or potentially occurring in Graham County. These species are included in Attachment 1 (Rare Species List-Aquatics), which contains habitat descriptions and occurrence information for rare aquatic species
on the Nantahala National Forest. Of the 35 aquatic species included on the list for analysis, 22 were dropped as a likelihood of occurrence based on preferred habitat elements and survey data (Attachment 2).

Therefore, potential effects of the proposed project on two aquatic MIS and 13 rare aquatic species would be analyzed in this report.

Table 2. Known and potential threatened and endangered species, sensitive species, Forest Concern species, and MIS in Graham County that were evaluated for this project (See Attachment 2).

	Species	Type	Brief Habitat Description	Occurrence
Federally Listed Threatened and Endangered Species				
	Alasmidonta raveneliana (Appalachian Elktoe)	Bivalve	Upper Tennessee River drainage	Known to occur in the project area
2002 Region 8 Regional Forester's Sensitive Species List				
	Gomphus consanguis (Cherokee Clubtail)	Dragonfly	Small spring fed streams	May occur in the project area*
	Gomphus viridifrons (Green-faced clubtail)	Dragonfly	Rivers	May occur in the project area*
Forest Concern Species				
	Cryptobranchus alleganiensis (Hellbender)	Amphibian	Rivers and large streams	May occur in the project area
	Ceraclea sp.1 (Lenat's Caddisfly)	Caddisfly	Specifics Unknown	May occur in the project area*
	Gomphus abbreviatus (Spine-crowned Clubtail)	Dragonfly	Rivers	Known to occur in the project or analysis area*
	Gomphus discriptus (Harpoon Clubtail)	Dragonfly	Large streams and rivers	May occur in the project area*
	Gomphus lineatifrons (Splendid Clubtail)	Dragonfly	Rivers	May occur in the project area*
	Gomphus ventricosus (Skillet Clubtail)	Dragonfly	Rivers	May occur in the project area*
	Cordulegaster erronea (Tiger Spiketail)	Dragonfly	Small forested streams	May occur in the project area*
	Gomphus parvidens parvidens (Splendid Clubtail)	Dragonfly	Small spring-fed streams	May occur in the project area*
	Lanthus parvulus (Northern Pygmy Clubtail)	Dragonfly	Small spring-fed streams	May occur in the project area*
	Percina aurantica (Tangerine Darter)	Fish	Large streams and rivers	Known to occur in the project or analysis area‡
Management Indicator Species				
	Oncorhyncus mykiss (Rainbow Trout)	Fish	Cool water streams, rivers and lakes	Known to occur in the project or analysis area‡
	Micropterus dolomieu (Smallmouth Bass)	Fish	Cool water streams, rivers and lakes	Known to occur in the project or analysis area‡

*Pennington & Associates 2001

‡ Loftis, 1993 and 1999 (unpublished data)

Definitions for the various types of likelihood of occurrence are as follows:

"Known to occur" – those species of which there is documentation that the species exists within a specified area, or it was found in the area during surveys.

"Likely to occur" – those species of which there is no documentation of the species occurring in a specified area but are expected to occur based on documentation of very similar habitat to known populations. For purposes of the AQUA, it should be assumed that the species does occur in a specified area until presence/absence of the species is verified.

"May occur" – the species probably occurs in a specified area in the broadest sense. Only very general habitat preferences and species distribution are used to determine if a species may occur. This does not imply their existence in an area, but that their general habitat description is found in the area, so therefore the species may occur.

"Not likely to occur" – Suitable habitat for a species may exist in a specified area, but there is other information known about the area and/or the species to determine that it is not likely to occur. These species are not included in the analysis.

"Does not occur" – exhaustive surveys (existing and ours) have not found the species in the project and/or analysis areas. These species are not included in the analysis.

Management Indicator Species:
A management indicator species (MIS) is a species identified in the Forest Plan that represents a community, assemblage, or special habitat on the Forests. MIS are intended to aid in description of biodiversity and to serve as a mechanism for monitoring population viability across the Forests.

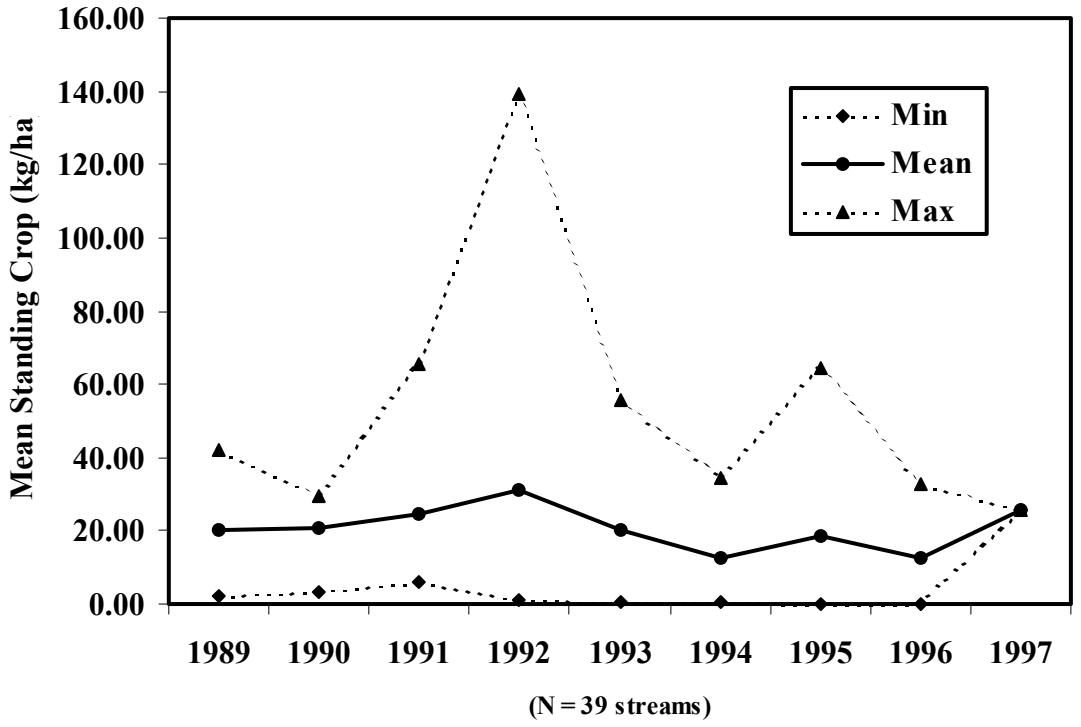
Rainbow trout (*Oncorhynchus mykiss*) has been chosen as an aquatic management indicator species for this project. Rainbow trout were chosen for this project's analysis area because of their presence in the project and/or the analysis areas of Cody Branch, Cochran Creek, Bee Creek, Williams Branch, Yellow Creek and the Cheoah River. Data for rainbow trout on the Nantahala National Forest is reliable and consistent. Smallmouth bass (*Micropterus dolomieu*) was also chosen as an aquatic management indicator species for this project. Smallmouth bass were chosen because they are present in the project waters of the Cheoah River. Smallmouth bass data for the Cheoah River was obtained from the North Carolina Wildlife Resources Agency (Loftis, 1993 and 1999). These data are reliable and sampling techniques were consistent for both years. Aquatic invertebrates were considered for use as management indicators because they are known to occur throughout the aquatic project and analysis areas, but eliminated because of the availability of trend and monitoring data in the project area. Streams that were likely to be affected by the implementation of this project were sampled for aquatic macroinvertebrates. However, only one sample was collected from the analysis area waters, which does not provide trend data. Also, population dynamics of these smaller tributaries are inconsistent with Forest-wide monitoring efforts.

Aquatic MIS population monitoring results

Since 1989, rainbow trout populations in 39 streams across the Nantahala and Pisgah National Forests have been monitored by the USFS and NCWRC. Figure 2 summarizes a preliminary analysis of this data. Rainbow trout mean standing crop has ranged from 12.48 kg/ha to 30.94 kg/ha, with a mean standing crop over this time period of 20.69 kg/ha. Sixty-seven percent of the annual estimates are within one standard deviation of the mean standing crop over the monitoring period (i.e. between 14.80 kg/ha and 26.58 kg/ha). This indicates that there is perhaps not as much variability in rainbow trout populations over time as once thought. Rainbow trout population age-class structure does exhibit considerable variability over time and is discussed below.

Monitoring data shows that fish populations are not static over time, but rather that a range of population levels oscillate around some mean value, with some species or age classes supporting higher standing crops when environmental conditions are suitable or lower standing crops when conditions are adverse. Aquatic community structure is opportunistic in that as standing crops of one species or age class decline, standing crops of other species or age classes increase relative to their habitat requirements and the new habitat available from the declining stock. This give and take has proven to be cyclic, and that in the absence of catastrophic events (e.g. prolonged drought, successive floods, long-term sedimentation), fish communities would exhibit this cyclic pattern.

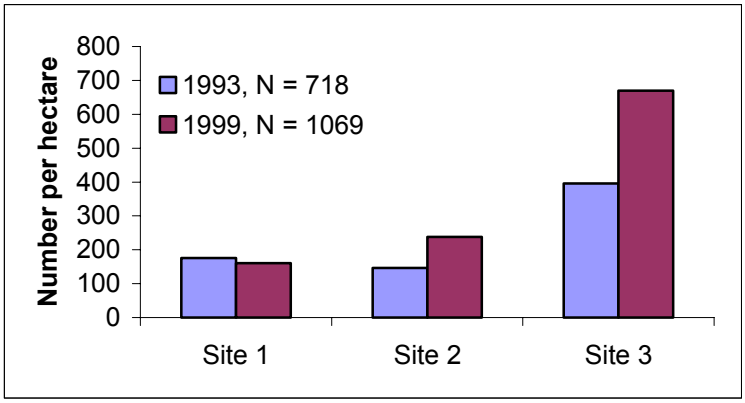
Figure 1. Rainbow trout (*Oncorhynchus mykiss*) population trends across the Nantahala and Pisgah National Forests, 1989-2000.



Smallmouth bass occur throughout the Nantahala and Pisgah National Forests and are harvested throughout; thus, population viability is not a concern. By reviewing species data (TVA, NCWRC, and DENR) from cool and warmwater streams and rivers, numbers and distribution of smallmouth bass on the Nantahala and Pisgah National Forests are sufficient to support viable populations. Taking into account natural fluctuations in populations, smallmouth bass are expected to remain relatively stable in the future.

The Cheoah River smallmouth bass population was sampled in 1993 and in 1999 by the NCWRC. The data show that similar population levels existed at each of the three sites for the two years (Figure 2). These three sample sites were all located within the Hazanet Timber Sale area. The relatively stable numbers of fish per hectare during the two years is indicative of a fairly stable population. There was an increase in the total number of fish per hectare in 1999 at Site 3. Site 3 contained greater numbers of fish during both years. This increase may be associated with improving water quality and habitat as the water moves downstream of Santeetlah Dam. Current dam operations allow very little water to flow past the dam on a daily basis, creating numerous pools downstream of the dam. As more tributaries enter the Cheoah River below the dam, habitat quality improves.

Figure 2. Cheoah River smallmouth bass *Micropterus dolomieu* survey results, 1993 and 1999. Smallmouth bass total abundance is given as numbers of fish per hectare of surface water.



Based on a preliminary analysis of the monitoring data, there appears to be no difference in population dynamics across the Forests. It is important to remember that different streams have the inherent capability to support varying population levels, and that ultimately habitat quality and quantity and environmental variables control the fate of fish

populations. Forest management activities, as well as natural events such as droughts and floods, have the potential to affect part of a fish population (e.g. spawning success may be affected by sedimentation), and that these effects may be long- or short-term, depending on the duration and magnitude of the event. It is possible to lose a year class of rainbow trout or smallmouth bass if spawning habitat is temporarily reduced during a poorly timed culvert installation, as well as during a spring flood. Very rarely does the loss of one-year class affect long-term population viability. The successive loss of year classes, however, can result in long-term declines in fish standing crops. It is important to note that environmental variables, man-induced land uses, or both can cause successive year class failures.

Based on rainbow trout monitoring efforts since 1988, it does not appear that any stream or its populations have suffered long-term effects of land management or of natural forces. A closer look at the data reveals single year-class failures for rainbow trout in one stream or another at some point, but successive year class failures were not found on any stream during the monitoring period.

Smallmouth bass monitoring by NCWRC indicates that no long-term effects of land management have occurred in the Cheoah River. While year-class failures may occasionally occur, these year-class failures do not effect the long-term viability of the population.

ENVIRONMENTAL BASELINE FOR SPECIES EVALUATED

EXISTING CONDITION

Existing Threats to Aquatic Habitat and Populations

Culverts along the Forest Service Roads (438), (439), and (2627), the roads themselves, and existing old roads and skid trails in the project area are the existing threats to the streams and drainages. Impacts from these sources are limited to down slope movement of sediment from road runoff and culvert fills. It is suspected that sediments from these sources are deposited in the natural vegetative filters before they reach areas of perennial water since the roads (FS 438, FS 439, and FS 2627) are closed to all but administrative and fire control traffic (i.e. road disturbance is limited). No culverts in the analysis area were found to inhibit the ability for fish movement and the movement of other aquatic organisms. Southern pine beetle attacks have killed numerous pine stands across the area. These areas have been and are being cut to control the spread of the southern pine beetle. Cutting of these trees, particularly in the riparian areas, is thought to benefit the aquatic system by replacing the pine stands with a mixed hardwood stand. These hardwoods provide a more valuable source of nutrients and large woody dibris for aquatic life than do the pines. A disposal site for anakeista is located adjacent to Sarvis Branch road (FS 2510).

IV. EVALUATED AQUATIC SPECIES SURVEY INFORMATION

Existing data for aquatic resources within an aquatic analysis area is used to the extent it is relevant to the project proposal. This data exists in two forms: general inventory and monitoring of Forest aquatic resources, and data provided by cooperating resource agencies from aquatic resources on or flowing through the Forest. Both of these sources are accurate back to approximately 1980 and are used regularly in project analyses. Data collected prior to 1980 is used sparingly (mostly as a historical reference). Project-specific surveys are conducted to obtain reliable data where none exists.

Survey data was reviewed to provide information on what species are present in the stream at the time of the survey. The techniques do not sample the entire population, but rather what is present at the sample site. It is possible to miss species due to habitat distribution and natural patchiness of aquatic populations and to equipment efficiency. If there is a reason to believe that a species occurs that was not sampled during the surveys, it is included in the analysis. This may occur with the presence of historic records or suitable habitat and vicinity records.

Project information was obtained from Jim Buckel, US Forest Service (USFS) Forester. Lorie L. Stroup, USFS Fisheries Biologist and Dale Holder, USFS Timber Sales Administrator, conducted aquatic habitat and aquatic insect surveys of the proposed aquatic project and analysis areas on May 22, June 3,6, and 7 of 2002. Yellow Creek, Cody Branch, Bee Creek, Williams Branch, Garrison Branch, and Cochran Creek were surveyed previously by the USFS and NCWRC during the Forest-wide brook trout surveys. The surveys consisted of examining streams within the aquatic project area, noting habitat quality, quantity, and suitability for rare aquatic and management indicator species, as well as existing impacts and their source. Macroinvertebrate information for the Cheoah River was obtained from the Topoco Project FERC report (Pennington & Associates 2002) and from the Virginia Commonwealth University (Rideout 2002; unpublished data). Cheoah River smallmouth bass *Micropterus dolomieu* data were provided by the North Carolina Wildlife Resources Commission (NCWRC) fisheries biologist.

Additional information specifically addressing aquatic PETS species, forest concern species, and MIS was obtained from NCWRC biologists, North Carolina Natural Heritage Program (NCNHP) records, and US Fish and Wildlife Service (USFWS) biologists.

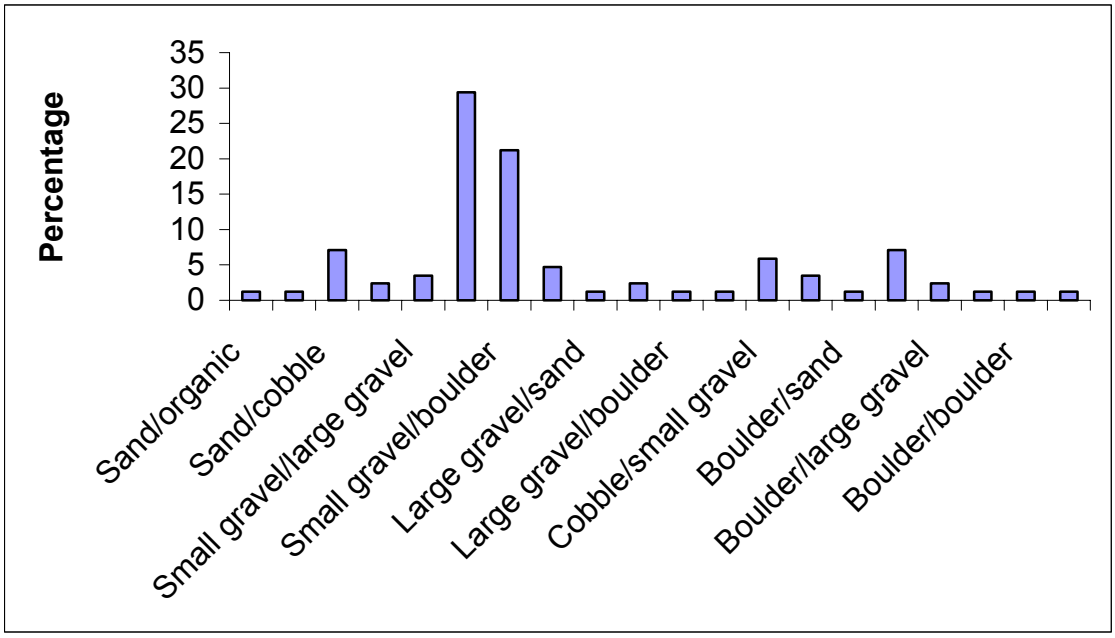
Aquatic Habitat

A complete listing of project area waters is provided in Table 1.

Substrate within the project area waters was evaluated and visually estimated. The 3 primary types of substrate that existed were documented at each macroinvertebrate sample site. This information is valuable for determining the amount of habitat available for PETS species, MIS species as well as any other aquatic organisms. An additional

aquatic habitat survey was conducted on Cochran Creek in 2001 using the Basinwide Visual Estimation Technique (Doloff et al. 1993). The results of this survey are given in Figure 3.

Figure 3. Composition of Cochran Creek substrate in 2001. Percentage of the total samples that consisted of the following habitat types. Dominant and subdominant substrate types were estimated using standard BVET protocols. Eighty-five samples collected.



Bee Creek is adjacent to FS 438A and associated with units 13, 15, 23,24, and 29 in Compartment 30. The average width of Bee Creek is 3 meters to 4 meters and the riparian vegetation consists of rhododendron, hemlock, and mixed hardwoods. The tributary headwaters of Bee Creek are too small to support fish habitat due to restricted size and flow regimes. The substrate within these small streams consisted mainly of gravel (approximately 40%) and sand/silt (25%). The gradient of Bee Creek was approximately 40%, which is a measure of the slope of the stream channel.

Williams Branch has no roads adjacent to it and the stream is associated with units 9, 11, 13, and 15 in Compartment 30. The average width of Williams Branch is 2 meters to 3 meters and the riparian vegetation consists of mixed hardwoods. Williams Branch was sampled for macroinvertebrates and substrate was visually estimated. Substrate within Williams Branch was 10% gravel, 20% sand and silt and 45% cobble.

Lifting Rock Branch is located just below 2-age Unit 9 in Compartment 25. The average width of Lifting Rock Branch is 2 meters and the riparian vegetation consists of birch, yellow poplar, black gum, red maple, and rhododendron. Lifting Rock Branch was sampled for macroinvertebrates and identified to the family level. Substrate within this stream consisted of sand (20%), silt (10%), small gravel (30%), cobble (20%), and large

gravel (20%). The stream gradient was 8%. No fish habitat exists in Lifting Rock Branch.

Sarvis Branch is located within thinning Unit 8 in Compartment 33. The average width of Sarvis Branch is 1.5 meters and the riparian vegetation is made up of yellow poplar, red maple, ironwood, and beech. Substrate within this stream consisted of 50% sand, 10% silt, 10% small gravel, 20% cobble, and 10% large gravel. The gradient was 6%. No fish habitat exists within Sarvis Branch.

Peterson Branch is located in prescribed burn Units 3 and 4 of Compartment 25. The average width of Peterson Branch is 6 meters. The riparian vegetation consists of hemlock, yellow poplar, red maple, rhododendron, and dog hobble. Substrate within Peterson Branch consists of 15% sand, 5% silt, 10% boulder, 20% large gravel, 5% small gravel, 15% cobble, and 30% 6 –12 inch stone. The stream gradient was 12% and no fish habitat exists within Peterson Branch.

Colvin Branch is located in vine control Unit 10 and 2-age/thinning/site-prep Unit 17 of Compartment 34. The average width of Colvin Branch is 3 meters and the riparian vegetation consists of birch, maple, yellow poplar, hickory, spice bush, stripe maple, stingweed, fern, and virginia creeper. Substrate within Colvin Branch consists of 50% bedrock, 15% cobble, 5% sand, 5% silt, 5% organic, 10% 6 – 12 inch stone, and 10% gravel. This stream goes underground in several locations. The stream gradient was 80% and no fish habitat exists within the stream.

UT 4 to the Cheoah River is located in Unit 14 of Compartment 35. The riparian vegetation of UT Gladdens Creek consists of yellow poplar, birch, hickory, hemlock, stripe maple, spice bush, and stingweed. Substrate within this stream consists of 50% 6 – 12 inch stone, 15% bedrock, 15% sand, 10% small gravel, and 10% large gravel. The stream gradient is 25% and there is no fish habitat in this stream.

Aquatic Populations

Aquatic macroinvertebrates were sampled by the USFS in May and June 2002. Sample locations were predetermined based on location of project activity sites. Sites were located downstream of project activity, particularly below proposed culvert reconstruction or construction. Samples were collected by using a surber net in 3 different habitat types within each designated stream reach. These samples were preserved and identified by Fish and Wildlife Associates, Inc. to family. EPT stands for the orders ephemeroptera, plecoptera and trichoptera (commonly called mayfly, stonefly and caddisfly). These orders are commonly used as indicators of water quality due to their sensitivity to pollution. The “somewhat tolerant families” include families from the odonata order (damsel and dragonflies), coleoptera (beetles), and crayfish. Tolerant taxa include crustaceans (isopoda and amphipoda), diptera (true flies), oligochaeta (worms), and planariidae (flatworms).

Table 3. Number of EPT Families Present.

STREAM NAME	EPT FAMILIES (Intolerant Taxa)	Abundance of Somewhat Pollution Tolerant families	Abundance of Pollution Tolerant Taxa
Bee Creek	7	4	1
Williams Branch	8	1	0
Gladdens Creek	8	2	0
Sarvis Branch	4	4	0
Lifting Rock Branch	5	1	0
Peterson Branch	8	2	1
Colvin Branch	5	2	0

Table 4. Families of Macroinvertebrates found in May and June 2002 surveys (USFS).

STREAM NAME	FAMILY
Bee Creek	EPHEMERELLIDAE, HEPTAGENIIDAE, PELTOPERLIDAE, PERLIDAE, PERLODIDAE, HYDROPSYCHIDAE, RHYACOPHILIDAE, GOMPHIDAE, ANTHERICIDAE, TIPULIDAE, SIMULIIDAE, HALIPLIDAE
Williams Branch	HEPTAGENIIDAE, LEPTOPHLEBIIDAE, PERLIDAE, GLOSSOSOMATIDAE, HYDROPSYCHIDAE, LEPIDOSTOMATIDAE, ODONTOCERIDAE, RHYACOPHILIDAE, CORDULEGASTRIDAE, TIPULIDAE
Gladdens Creek	EPHEMERELLIDAE, HEPTAGENIIDAE, LEPTOPHLEBIIDAE, PELTOPERLIDAE, GLOSSOSOMATIDAE, HYDROPSYCHIDAE, LIMNEPHILIDAE, ODONTOCERIDAE, GOMPHIDAE, TIPULIDAE, HALIPLIDAE
Sarvis Branch	EPHEMERELLIDAE, PERLIDAE, HYDROPSYCHIDAE, UENOIDAE, GOMPHIDAE, CURCULIONIDAE, ELMIDAE, LAMPYRIDAE
Lifting Rock Branch	EPHEMERELLIDAE, LEPTOPHLEBIIDAE, PELTOPERLIDAE, PERLIDAE, HYDROPSYCHIDAE, GOMPHIDAE, TIPULIDAE
Peterson Branch	EPHEMERELLIDAE, HEPTAGENIIDAE, LEPTOPHLEBIIDAE, SIPHLONURIDAE, PELTOPERLIDAE, PERLIDAE, HYDROPSYCHIDAE, POLYCENTROPODIDAE, GOMPHIDAE, EUBRIIDAE, SIMULIIDAE
Colvin Branch	HEPTAGENIIDAE, LEPTOPHLEBIIDAE, PELTOPERLIDAE, HYDROPSYCHIDAE, LIMNEPHILIDAE, CORDULEGASTRIDAE, GOMPHIDAE

In addition to the aquatic macroinvertebrate surveys performed by the USFS, Virginia Commonwealth University in Richmond surveyed the Cheoah River downstream of Santeetlah Dam. They found 8 species of adult dragonflies during their study (*Anax junius, Gomphus exilis, Stylogomphus albistylus, Celithemis elisa, Libellula luctuosa,*

Epicordulia princeps, Tetragoneuria cynosura, and *Erythemis simplicicollis*), none of which are on our Regional Forester's Sensitive or Forest Concern lists.

Bee Creek, Williams Branch, Cody Branch, Cochran Creek, and Garrison Branch were all included in the 1995 Brook Trout Surveys conducted by the USFS and the NCWRC. Some of these surveys were conducted down stream of the analysis area but have been included in the analysis to show species distribution within the watershed. The stream channel of Cody Branch is braided above approximately 3100 feet; therefore, little fish habitat exists above this elevation. Additionally, Yellow Creek is listed by the NCWRC as a hatchery supported trout stream.

Table 5. Species data from the 1995 Trout Distribution Surveys (USFS, NCWRC)

STREAM NAME	SPECIES FOUND
Bee Creek	Rainbow Trout
Williams Branch	Rainbow Trout
Cody Branch	Rainbow Trout
Cochran Creek	Rainbow Trout
Garrison Branch	No Fish Collected

Table 6. Species data from Cheoah River Surveys (NCWRC, TVA)

Sample Year	SPECIES FOUND
1981	Smallmouth bass, Rock bass, Northern hogsucker, Whitetail shiner
1993	Rainbow trout, Brown trout, River chub, Warpaint shiner, Whitetail shiner, Northern hogsucker, River redhorse, Flathead catfish, Rock bass, Smallmouth bass, Greenside darter, Greenfin darter, Tangerine darter
1997	Black redhorse, Greenfin darter, Greenside darter, Longnose dace, Mottled sculpin, Northern hogsucker, Rock bass, Rainbow trout, River chub, Smallmouth bass, Central stoneroller, Tennessee shiner, Warpaint shiner, Whitetail shiner
1999	Rainbow trout, River chub, Warpaint shiner, Whitetail shiner, Northern hogsucker, Flathead catfish, Rock bass, Smallmouth bass, Greenside darter, Greenfin darter, Tangerine darter

V. EFFECTS OF PROPOSED MANAGEMENT ACTIONS

Please refer to the Environmental Assessment for a complete list of project issues and a detailed description of each alternative for the Hazanet Project. Mitigation measures would be stated where such actions are necessary to comply with local, State, and Federal environmental regulations. Management recommendations are made to protect or enhance aquatic resources where practical.

Direct Effects

Examples of direct effects of a proposed action on aquatic species include (but are not limited to) things such as crushing individual insects, fish, or redds during stream crossing installation. Such effects are more likely to occur to less mobile aquatic organisms (e.g. aquatic insects, freshwater mussels, and fish eggs and larvae). Whereas, more mobile species such as crayfish, aquatic salamanders, and juvenile and adult fish are often able to escape direct effects by simply leaving the area (emigration).

Examples of direct effects on aquatic habitat include, but are not limited to, things such as changes in the quality, quantity, or diversity of habitat available resulting from sedimentation (or a reduction thereof). It is important to note that effects on aquatic habitats from management activities can be positive or negative, depending on the nature of the proposed actions and site-specific conditions.

Indirect Effects

Examples of indirect effects of a proposed action on aquatic species include (but are not limited to) altered reproductive or foraging success and increased disease as a result of sedimentation, degraded water quality, and altered community structure as a result of migration (see above).

Examples of indirect effects on aquatic habitat include, but are not limited to, things such as changes in the quality, quantity, or diversity of habitat available resulting from changes in riparian vegetation. Specifically, the transport of large woody debris (LWD), an integral component of aquatic habitat diversity, to stream channels is a function of riparian vegetation structure and composition. It is important to note here that the Forest Plan does not allow vegetation management within 100 feet of perennial streams unless it is specifically for the enhancement of riparian values. This standard was designed to allow vegetation along streams to become old and decadent and to serve as a long-term source of LWD to stream channels. However, areas exist across the Forests where vegetation can be managed within designated riparian areas to facilitate LWD transport and serve as a short-term source of habitat improvement.

Cumulative Effects

Cumulative effects on aquatic species and habitat are the integration of any direct or indirect effects discussed above into the existing condition. Most often, we think of cumulative effects as a degradation or improvement of an already impacted situation, but they can also be the first step in the degradation or improvement process. It is important to note that cumulative effects on aquatic habitats and populations from management activities can be positive or negative, depending on the nature of the proposed actions and site-specific conditions.

Threats or Limiting Factors

1. Sedimentation. Sedimentation of aquatic habitats within the project area may occur with the maintenance of existing system roads, the reconstruction of roads and skid trails, and the construction of a new road.

   Sediment loading and turbidity can result in the loss of interstitial habitat within the substrate and cause direct mortality by the crushing or smothering of less mobile organisms such as aquatic invertebrates, fish eggs and juveniles.

2. Anakeesta. Anakeesta formations are known to occur in the project area. If these areas are disturbed and left untreated they have the potential of acidifying project area waters, which can cause direct mortality on aquatic organisms.

3. Incomplete or Unavailable Data. Because of the amount of suitable habitat available across North Carolina and the Southern Appalachian Mountains, a majority of the members of the sensitive and Forest concern aquatic insect community analyzed for this project have been under sampled across North Carolina and their ranges, and therefore are listed with limited distributions. Habitat descriptions for these species, however, indicate that they may be widespread in Mountain Province waters, with several extending their ranges into the Piedmont Province.

Potential Effects of Proposed Alternatives

This discussion assumes that all Forest Service timber sale contract clauses, North Carolina Best Management Practices (BMP), and any other required management practices relating to water quality would be implemented successfully. Should an implemented contract clause or BMP fail during project implementation, immediate corrective action should be taken to lessen impacts to aquatic resources.

Alternative 1 is the no action alternative. The existing condition of aquatic resources has been described above. Natural fluctuations in population stability and habitat quality and quantity would continue.

Alternative 2

ISSUE: Effects of Access on Aquatic Resources

Forest Service (FS) roads 251 and 251C are in good condition and would need no reconstruction.

FS road 2440A would be reconstructed from where it leaves State Route (SR) 1242 to gap (approximately 0.1 mile) to avoid the riparian area of UT 4 Yellow Creek. An old drainage culvert has washed out at Mile Post 0.2, which is causing off-site erosion. This culvert would be replaced and the road would be repaired. FS road 2440 is in good condition; therefore, no construction/reconstruction is needed.

In Compartment 29, 0.4 mile of haul road to Unit 1 would be reconstructed. This reconstruction would include ditching, drainage culvert installation, widening, and surfacing. An additional 0.2 mile of existing skid road accessing Unit 1 would be upgraded to a haul road and 0.3 mile of new road would be constructed to access landings. A temporary road (0.1 mile) would be constructed off of FS road 438A to access Unit 5. FS road 438 has some poorly drained areas near the top of the mountain. One new culvert is planned for this upper section of FS 438 to improve drainage on this road. FS road 438A is in good condition.

In Compartment 30, 0.5 mile of temporary road would be constructed to access Unit 11. A washed out culvert on FS road 439 at the headwaters of UT 2 to Bee Creek would be replaced. FS road 438A is in good condition.

In Compartment 31, 0.8 mile of temporary road would be constructed off of FS road 2627 to access Unit 9. One new drainage culvert would be needed on this road. FS road 2627 is in good condition.

A 0.5 mile system road would be constructed off of FS road 2510 to access Unit 8 in Compartment 33. This construction would require the placement of a new culvert in the Sarvis Branch drainage. The culvert installation in Sarvis Branch would be done during a dry period. Total Suspended Sediments (TSS) would be monitored daily one week prior to culvet installation and one week after installation. If TSS increases are observed, the source would be located and corrective measures would be taken. FS road 2510 would need 0.2 mile of reconstruction. This reconstruction would shift the road up-slope away from the Anakeesta disposal site. Erosion control devices (silt fence or brush barriers) would be placed down-slope of the reconstruction area. Brush barriers or silt fence would also be placed around the Anakeesta disposal site if this area is disked for wildlife plantings and disking would not penetrate the 12 inch cap.

In Compartment 34, 0.6 mile of system road would be constructed off of FS road 2627C to access Unit 9 and Unit 17. One new culvert would be needed in UT 11 to Cochran Creek.

In Compartment 35, 0.25 mile of new system road would be constructed off of SR 129 to access Unit 3. A 0.4 mile temporary road off of FS road 2627 would be constructed to access Unit 14. FS road 2627 is in good condition.

Any culverts that were not listed in the above descriptions are for drainage purposes only and do not involve the project area streams.

DIRECT EFFECTS: Stream channel excavation for culvert installation on FS2440A, FS438, FS439, FS2510 would result in direct mortality to less mobile aquatic organisms (e.g. aquatic insects, freshwater mussels, and fish eggs and larvae) in the immediate vicinity if they are present; whereas, more mobile species such as crayfish, aquatic salamanders, and juvenile and adult fish are often able to escape direct effects by simply

leaving the area. Aquatic organisms will begin to reestablish inside the culvert if the culverts are placed 1/3 of the way down into the substrate. This allows substrate to move into the culvert making it more accessible for movement of aquatic organisms. Project plans for culvert placement and replacement will minimize disturbance from construction activities.

INDIRECT EFFECTS: Sediment loading and turbidity would occur with the installation of culverts. There may also be off-site movement of soil from road construction and reconstruction into project area waters.

Turbidity and sediment loading can cause mortality by injuring and stressing individuals or smothering eggs and juveniles. Available habitat, including the interstitial space within substrate used as spawning and rearing areas, may be covered with sediments. Larger, more mobile aquatic species, such as fish and hellbenders are able to temporarily escape the effects of sedimentation by leaving the disturbed area. Eggs and juveniles may be lost to reduced habitat or suffocation. This can result in the lost or reduced year class strength, which can lead to accelerated population fluctuations and suppressed population levels. These species, overtime, would recolonize areas as habitat conditions improve. Smaller less mobile organisms such as crayfish and aquatic insects may not be able to move to more suitable habitat. Populations of these species may decline locally or be lost through reduced productivity. These may recolonize from reaches of undisturbed streams as conditions improve with site rehabilitation. Implementation of the contract clauses, erosion control precautions, and stream crossing methods described above should minimize sediment effects and accelerate site rehabilitation.

Access may also cross ephemeral streams or spring seeps that feed these streams and others in the project area. If heavy rains occur while these ephemeral crossings are exposed, bare soil can be transported down slope to intermittent and ephemeral stream channels. Temporary stream crossings should be used across ephemeral channels to avoid the potential for sedimentation of down slope aquatic resources. These crossing could include the use of temporary bridges (e.g. simple log stringers or pre-fabricated decking) or culverts, or channel armor (e.g. stone or brush). These crossing should be removed when the skid road or trail is rehabilitated

ISSUE: Effects of Timber Harvest on Aquatic Resources

NC-FPG and the LRMP standards should be applied to the harvest activity. Applications of LRMP standards are intended to meet performance standards of the State regulations. Visible sediment as defined by the State regulations should not occur unless there is a failure of one or more of the applied erosion control practices. Should any practice fail to meet existing regulations, additional practices or the reapplication of existing measures would be implemented as specified by State regulations.

Direct and Indirect Effects of Timber Harvest on Water Quality:

Water Quality: Water quality should not be affected as long as LRMP and NC-FPG standards are followed and timber sale contract clauses are implemented. Stream temperatures would not be affected since adequate shade would be maintained along perennial and intermittent streams. Sediment impacts would be minimized by the application of LRMP standards and NC-FPG compliance; and timber sale contract clauses, erosion control precautions, and stream crossing methods incorporated into the project. Watersheds with new or improved access roads or skid trails might experience a temporary increase in suspended sediment loading, particularly when stream crossings are installed.

Riparian Areas: There is no plan to harvest within the 100 foot riparian of any analysis area stream thus riparian areas would remain in their current state.

ISSUE: Other Activities

EFFECTS OF PRESCRIBED BURNING: There are approximately 467 acres of prescribed burning proposed for the project area with both alternatives. The proposed burn areas are located in Compartment 25 between Lifting Rock Branch and Peterson Branch and an area in the headwaters of Puncheon Camp Branch. Additional burn areas include Units 11, 12, and portions of Unit 1 in Compartment 29. Fire lines would be constructed in the headwaters area of Cody Branch. Existing trails and roads would be used for fire lines. Fire lines in Compartment 33 Unit 11 would consist of SR 129 and SR 1242. This burn area encompasses Sarvis Branch. In Compartment 34, fire lines would be constructed along a ridge top and existing Forest Service roads. Late winter or early spring burns are typically of low intensity. Any burning activity within riparian areas should not be intense enough to destroy riparian vegetation. All fire lines would be constructed with hand tools. If mineral soil is disturbed within riparian areas, it is possible that erosion could occur. Prescribed burn areas are inspected after treatment. Areas of erosion are identified and controlled during inspection to eliminate stream sediment sources. There should be no effect to aquatic resources from this activity.

EFFECTS OF THE USE OF HERBICIDES: It is proposed to use herbicides in compartments 29, 30, 31, 33, 34, and 35 for 2-age regeneration and vine control units. In accordance with the Vegetation Management Final Environmental Impact Statement (VM-FEIS), herbicide spraying would not occur within 30 horizontal feet of water. In accordance with the LRMP, riparian areas are not suitable for timber management; therefore no herbicides would be used within 100 feet of any aquatic resource within these compartments.

Cumulative Effects to Aquatic Resources

Past projects and events within the analysis area of the Hazanet Timber sale include wildfires along the Northwestern portion of Old Roughy (Compartment 35) and an area in the headwaters of Yellow Creek in Compartment 33. Five southern pine beetle suppression projects within the analysis area have been undertaken in recent years. These

areas include portions of Units 5 and 8 in Compartment 33 and Units 1 and 17 in Compartment 35. Approximately 25 acres were cut in 2001 and 2002.

A private trout farm exists in the headwaters of Cody Branch. This trout farm may cause an increase in nutrients and ammonia within Yellow Creek. Santeetlah Dam on the Cheoah River is located within the project area. Current dam operations restrict the flow of the Cheoah River. However, the stream flow and habitat conditions improve below the dam as new tributaries enter the river.

Please refer to the cumulative effects discussion above. It is very unlikely that, given the location and types of management proposed, any effects on aquatic resources would be measurable, and therefore contribute to cumulative effects. There has been a tremendous amount of planning and resource specialist involvement in the planning and design of the units proposed for the Hazanet Timber Sale. Critical aquatic resource areas were dropped from the overall proposal.

There should be no adverse cumulative effects to the analysis area aquatic resources, based on the Project Activity Assumptions included in this analysis.

Alternative 3

Effects to aquatic resources would generally be the same as alternative 2 except in the headwaters of Williams Branch and in the headwaters of UT 6 to Yellow Creek. Both of these streams would have crossings associated with access with alternative 2. However, these crossings would be across the dry channels above the locations where these streams surface. Sediment may temporarily increase in these headwaters as a result of the culvert placement, particulary during storm events. These effects would not occur with alternative 3.

Summary of Effects to Aquatic Resources

Table 7. Summary of potential effects of alternatives, by issue.

Issue	Alternative 1 (No action)	Alternative 2 (Preferred Alternative)	Alternative 3
Effects on T & E species	Existing habitat and population trends continue.	Existing habitat and population trends continue.	Existing habitat and population trends continue.
Effects on Sensitive and Forest Concern Species	No impact to habitat or populations.	May impact individuals. Not likely to adversely affect population viability of Forest.	May impact individuals. Not likely to adversely affect population viability of Forest.
Effects on aquatic MIS	Existing habitat and population trends continue.	May have temporary fluctuations in turbidity but not expected to permanently effect habitat or population viability.	May have temporary fluctuations in turbidity. Not expected to permanently effect habitat or population viability.
Effects on water	No change from	Turbidity and sediment	Turbidity and sediment

quality (Associated with the amount of soil disturbance)	existing condition.	loading would occur at water crossings but should diminish downstream and cease with site rehabilitation.	loading would occur at water crossings but should diminish downstream and cease with site rehabilitation. Fewer crossings associated with 3 thus less effect to overall water quality of area.
Effects of Prescribed Burning	No impact.	No effect on aquatic resources or riparian due to the low intensity of burns within the riparian areas.	No effect on aquatic resources or riparian due to the low intensity of burns within the riparian areas.
Effects on aquatic habitat and populations	Existing habitat and population trends continue.	No long-term, permanent effects expected.	No long-term, permanent effects expected.
Effects to riparian areas	Remain in present state. Aquatic habitat would improve, as riparian areas grow older.	Remain in present state except at stream crossings. Aquatic habitat would improve, as riparian areas grow older.	Remain in present state except at stream crossings. Aquatic habitat would improve, as riparian areas grow older.
Effects of herbicide	No impact	No effect on aquatic resources due to 100-foot buffer on streams.	No effect on aquatic resources due to 100-foot buffer on streams.

VI. CONSULTATION HISTORY

USDI Fish and Wildlife Service was contacted for the Hazanet Timber Sale on the Cheoah Ranger District. Fish and Wildlife recommendations would be followed during implementation of this project to protect the Appalachian Elktoe and its critical habitat. The project would have no effect on the federally listed species Appalachian Elktoe or its critical habitat.

VII. DETERMINATION OF EFFECT

Table 8. Determination of effect of each alternative on the evaluated threatened and endangered, sensitive species and forest concern species.

Species	Alternative 1	Alternative 2	Alternative 3
Federally Threatened and Endangered Species			
Alasmidonta raveneliana	No Effect.	Not likely to adversely affect because the Indiana Bat standards would provide effective protection for the Cheoah River and its tributaries	Not likely to adversely affect because the Indiana Bat standards would provide effective protection for the Cheoah River and its

Species	Alternative 1	Alternative 2	Alternative 3
			tributaries
2002 Region 8 Regional Forester's Sensitive Species List			
Gomphus consanguis	No Impact.	May impact individuals. Would not affect viability across Forest.	May impact individuals. Would not affect viability across Forest.
Gomphus viridifrons	No Impact.	May impact individuals. Would not affect viability across Forest.	May impact individuals. Would not affect viability across Forest.
Forest Concern Species			
Cryptobranchus alleganiensis	No Impact.	May impact individuals. Would not affect viability across Forest.	May impact individuals. Would not affect viability across Forest.
Ceraclea sp. 1	No Impact.	May impact individuals. Would not affect Viability across the Forest.	May impact individuals. Would not affect viability across Forest.
Gomphus abbreviatus	No Impact.	May impact individuals. Would not affect viability across Forest.	May impact individuals. Would not affect viability across Forest.
Gomphus discriptus	*No Impact.*	*May impact individuals. Would not affect viability across Forest.*	*May impact individuals. Would not affect viability across Forest.*
Gomphus lineatifrons	*No Impact.*	*May impact individuals. Would not affect viability across Forest.*	*May impact individuals. Would not affect viability across Forest.*
Gomphus ventricosus	*No Impact.*	*May impact individuals. Would not affect viability across Forest.*	*May impact individuals. Would not affect viability across Forest.*
Cordulegaster erronea	*No Impact.*	*May impact individuals. Would not affect viability across Forest.*	*May impact individuals. Would not affect viability across Forest.*
Gomphus parvidens parvidens	*No Impact.*	*May impact individuals. Would not affect viability across Forest.*	*May impact individuals. Would not affect viability across Forest.*
Lanthus parvulus	*No Impact.*	*May impact individuals. Would not affect viability across Forest.*	*May impact individuals. Would not affect viability across Forest.*
Percina aurantica	*No Impact.*	*May impact individuals. Would not affect viability across Forest.*	*May impact individuals. Would not affect viability across Forest.*

Management Indicator Species			
Oncorhynchus mykiss	No Impact.	Not likely to affect adults. The off-site movement of soil may affect less mobile eggs and juveniles.	Not likely to affect adults. The off-site movement of soil may affect less mobile eggs and juveniles.
Micropterus dolomieu	No Impact.	Not likely to affect adults. The off-site movement of soil may affect less mobile eggs and juveniles.	Not likely to affect adults. The off-site movement of soil may affect less mobile eggs and juveniles.

The federally listed mussel *Alasmidonta raveneliana* and portions of its critical habitat are located within the project or analysis areas. The USDI Fish and Wildlife Service was contacted. In accordance with the USDI Fish and Wildlife Service recommendations, the Indiana Bat standards (Amendment 10 to LRMP) would provide the necessary protection for the Appalachian elktoe and its critical habitat. No effect to aquatic population viability of any species including Federally listed, Sensitive, Forest Concern and MIS across the Forest would occur as a result of the Hazanet Timber project.

Sensitive species *Gomphus consanguis* and *Gomphus viridifrons* may occur within the project area. The implementation of this project may impact or stress individuals but not likely to adversely affect viability of the species across the Forest. A *Gomphus sp.* individual (genus in which *Gomphus consanguis* is located) was collected by Pennington & Associates (2002). No *Ophiogomphus edmundo, Macromia margarita, Ophiogomphus howei, Etheostoma vulneratum, Percina squamata,* or *Seratella spiculosa* were found in the surveys (Pennington & Associates 2002; and Ridout 2002, unpublished data). However, since the habitat for these individuals is present within the analysis area, they were included in this report. The habitats for these benthic macroinvertebrate species are common across their range. No risk to aquatic population viability of the sensitive species above would occur as a result of this project.

Forest concern species *Cryptobranchus alleganiensis, Ceraclea sp. 1, Gomphus abbreviatus, Gomphus descriptus, Gomphus lineatifrons, Gomphus ventricosus, Cordulegaster erronea, Gomphus parvidens parvidens, Lanthus parvulus, and Percina aurantica* may occur within the project area. *Gomphus abbreviatus* and *Percina aurantica* are the only Forest concern species that were verified as occurring in the project area. Members of the genus *Ceraclea, Cordulegaster,* and *Lanthus* were found in the project area surveys (Pennington & Associates 2002; and Ridout 2002, unpublished data), which increases the likelihood of occurrence within the analysis area. This project may impact individuals but will not likely adversely affect the viability of any of the above species across the Forest. Habitats for the benthic macroinvertebrate species are common across their range. No risk to aquatic population viability of these Forest Concern species will occur as a result of this project.

Management Indicator Species (MIS) *Oncorhynchus mykiss* are known to occur within the analysis area of Bee Creek, Wouldiams Creek, Cochran Creek, Cody Creek, Yellow Creek, and the Cheoah River. *Micropterus dolomieu* are known to occur in the Cheoah River. There is no plan to harvest within the riparian areas. There would be off site movement of soil with the stream crossings associated with this project. This off-site movement of soil may cause temporary fluctuations in turbidity in project area waters. Members of MIS would not be adversely affected. No risk to aquatic population viability would occur as a result of this project.

VIII. MITIGATION MEASURES & MANAGEMENT RECOMMENDATIONS

No mitigation measures are necessary.

Management recommendations, while not legally required, are actions that, when implemented, would result in improved resource condition or minimize potential effects.

1. **Skid road layout should avoid stream crossings and paralleling perennial channels within designated riparian areas.**

2. **Landings and skid trails should be vegetated as soon as possible after use to avoid off-site soil movement.**

3. **According to Forest Practice Guidelines, no log landings shall be placed within the 100-foot riparian area of any perennial stream.**

4. **Temporary roads (if needed) should be constructed to avoid runoff into area streams. In addition, silt fence, straw bales, or brush barriers should be placed along the length of the road where it parallels or crosses a stream as needed to control runoff and stream sedimentation.**

IX. LIST OF PREPARERS

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XI. DATA SOURCES AND SURVEY PROTOCOL

Table 10 lists survey methods used for aquatic resource parameters and references to descriptions of the methods. All data used in this AQUA (existing or project-specific) was collected using an appropriate survey method. Full citations of listed references can be found in the references section of this document.

Table 10.

Parameter	**Method**	**Reference**
Fish populations (streams)	backpack electrofishing	Murphy and Willis 1996
		Schreck and Moyle 1990
		SD-AFS 1992
	visual (snorkel)	Dolloff et al. 1993
		Hankin and Reeves 1988
Fish populations (rivers)	IBI	Karr et al. 1986
		Lyons 1992
	boat electrofishing	Murphy and Willis 1996
		Schreck and Moyle 1990
	visual (snorkel, SCUBA)	Murphy and Willis 1996
		Schreck and Moyle 1990
Fish populations (ponds,	nets/traps	Murphy and Willis 1996
reservoirs, rivers)		Schreck and Moyle 1990
Aquatic insects and crayfish	net samplers (Surber,	Brigham et al. 1982
	kick, drift)	Hauer and Resh 1996
		Hawkins et al. 1998
		Hobbs 1972
		Merritt et al. 1996
		Rosenburg and Resh 1993
		USEPA 1989
Freshwater mussels	visual (snorkel, SCUBA)	Athearn 1969
		Cummings et al. 1993
Aquatic salamanders	backpack electrofishing	Williams and Hocutt 1981
	visual (snorkel, SCUBA)	Williams and Hocutt 1981
Habitat	BVET	Dolloff et al. 1993
		Hankin and Reeves 1988
		Harrelson et al. 1994
Substrate composition	pebble count	Bevenger and King 1995

Attachment 1

RARE SPECIES LIST - AQUATICS

NANTAHALA NATIONAL FOREST

UPDATED 1/2/02

THREATENED AND ENDANGERED SPECIES

TYPE	SCIENTIFIC NAME	COMMON NAME	HABITAT/DISTRIBUTION	NC STATUS	USFWS STATUS	NC RANK	GLOBAL RANK
BIVALVE	*Alasmidonta raveneliana*	Appalachian Elktoe	Little Tennessee River drainage and Tuckaseegee River; Nolichucky River	E	E	S1	G1
BIVALVE	*Pegias fabula*	Littlewing Pearlymussel	Lower Little Tennessee River; historic record from Valley River, Cherokee Co.	E	E	S1	G1
FISH	*Cyprinella monacha*	Spotfin Chub	Little TN River; French Broad River system	T	T	S1	G2

SENSITIVE SPECIES (BASED ON 7/96 REGION 8 LIST)

TYPE	SCIENTIFIC NAME	COMMON NAME	HABITAT/DISTRIBUTION	NC STATUS	USFWS STATUS	NC RANK	GLOBAL RANK
BIVALVE	*Fusconaia barnesiana*	Tennessee Pigtoe	Lower Little TN River and Hiwassee River	E		S1	G2G3
BIVALVE	*Lasmigona holstonia*	Tennessee Heelsplitter	Small to large streams in Cherokee Co., historic record; Mills River	E	FSC	S1	G2G3
BIVALVE	*Villosa iris*	Rainbow	Little TN and Hiwassee Rivers, Martin and Brasstown Creeks; French Broad River	SC		S1	G5
CRUSTACEAN	*Cambarus georgiae*	Little Tennessee Crayfish	Streams in Little TN River, Macon Co.	SR		S1S2	G1
CRUSTACEAN	*Cambarus parrishi*	Hiwassee Headwaters Crayfish	Streams in Hiwassee River drainage	SR	FSC	S1?	G1
CRUSTACEAN	*Cambarus reburrus*	French Broad Crayfish	Tributary to Horsepasture River, Transylvania Co.; upper French Broad River	W2	FSC	S3	G3
DRAGONFLY	*Gomphus consanguis*	Cherokee Clubtail	Small spring-fed streams	SR	FSC	S1	G2G3
DRAGONFLY	*Gomphus viridifrons*	Green-faced Clubtail	Rivers	SR		S1S3	G3
DRAGONFLY	*Macromia margarita*	Mountain River Cruiser	Rivers, Macon, Swain, Transylvania Co.; Caldwell Co.	SR	FSC	S1S2	G2G3
DRAGONFLY	*Ophiogomphus edmundo*	Edmunds Snaketail	Blue Ridge escarpment streams	SR	FSC	S1?	G1
DRAGONFLY	*Ophiogomphus howei*	Pygmy Snaketail	Rivers	SR	FSC	S1?	G3
FISH	*Etheostoma vulneratum*	Wounded Darter	Large streams and rivers, Little TN River system, Jackson, Macon, Swain Co.	SC		S2	G3
FISH	*Percina squamata*	Olive Darter	Higher gradient upland rivers, Tennessee River system, Cherokee, Jackson, Macon, Swain Co.	SC	FSC	S2	G2
MAYFLY	*Seratella spiculosa*	Spicilose Seratellan Mayfly	Mountain streams	SR	FSC	SH	GH

FOREST CONCERN SPECIES

TYPE	SCIENTIFIC NAME	COMMON NAME	HABITAT/DISTRIBUTION	NC STATUS	USFWS STATUS	NC RANK	GLOBAL RANK
AMPHIBIAN	*Cryptobranchus alleganiensis*	Hellbender	Rivers and large streams, Tennessee and Savannah River systems	SC	FSC	S3	G4
BIVALVE	*Alasmidonta viridis*	Slippershell Mussel	Little Tennessee River, Swain Co.	E		S1	G4G5
BIVALVE	*Elliptio dilatata*	Spike	Little TN and Hiwassee Rivers, Cherokee Co.;	SC		S1	G5

			New River				
BIVALVE	*Lampsilis fasciola*	Wavy-rayed Lampmussel	Little TN River; French Broad and Pigeon Rivers historic records	SC		S1	G4
BIVALVE	*Pleurobema oviforme*	Tennessee Clubshell	Little TN and Hiwassee drainages, Cherokee Co.	SR	FSC	S1?	G3
BIVALVE	*Villosa vanuxemensis*	Mountain Creekshell	Hiwassee River system, Cherokee Co.; French Broad River system	T		S1	G4
CADDISFLY	*Agapetus jocassee*	A Caddisfly	Lake Jocassee catchment, Transylvania Co.; Davidson River drainage	SR	FSC	SR	G?
CADDISFLY	*Ceraclea sp. 1*	Lenat's Caddisfly	Specifics unknown	SR	FSC	S?	G?
CADDISFLY	*Helicopsyche paralimnella*	A Caddisfly	Fires Cr, ?Co. and Bearwallow Cr, Transylvania Co.; SW mountains of NC	SR	FSC	S2	G?
CADDISFLY	*Hydropsyche carolina*	A Caddisfly	Whitewater River, Macon Co.	SR		S1	G?
CADDISFLY	*Hydroptila englishi*	A Caddisfly	Lake Jocassee catchment, Transylvania Co.	SR	FSC	SR	G?
CADDISFLY	*Rhyacophila amicus*	A Caddisfly	Cullasaja River, Macon Co.; Whiterock Cr, Spainhour Cr, North Toe River, Deep Cr, Oconoluftee River	SR		S2	G?
CADDISFLY	*Rhyacophila melita*	A Caddisfly	Tusquitee Cr, Clay Co.; Oconoluftee River, South Toe River, Palmer Cr	SR		S2	G?
CADDISFLY	*Rhyacophila vibox*	A Caddisfly	Whiteoak Cr, Macon Co	SR		S1S2	G?
CADDISFLY	*Wormaldia thyria*	A Caddisfly	Specifics unknown	SR		SR	G3?
CRUSTACEAN	*Cambarus chaugaensis*	Oconee Stream Crayfish	Streams in Savannah River drainage, Jackson, Macon, and Transylvania Co.; SC and GA	SR		S1S2	G2
CRUSTACEAN	*Cambarus hiwasseensis*	Hiwassee Crayfish	Streams in Hiwassee River drainage	W2	FSC	S3?	G3
CRUSTACEAN	*Cymocythere clavata*	Oconee Crayfish Ostracod	Symbiotic on crayfish in mountain streams and rivers in Savannah River system, Transylvania Co.; French Broad River system	SR	FSC	S2?	G?
CRUSTACEAN	*Dactylocythere prinsi*	Whitewater Crayfish Ostracod	Symbiotic on crayfish, streams in Savannah River drainage, Jackson Co.; possibly in SC and GA	SR	FSC	S1	G?
CRUSTACEAN	*Skistodiaptomus carolinensis*	Carolina Skistodiaptomus	Lake Ravenel, Macon Co.	SR	FSC	S1?	G?
CRUSTACEAN	*Waltoncythere acuta*	Transylvania Crayfish Ostracod	Symbiotic on crayfish in high gradient rivers and streams, Transylvania Co.; likely occurs in SC	SR	FSC	S2?	G?
DRAGONFLY	*Aeshna tuberculifera*	Black-tipped Darner	Boggy or marshy ponds	SR		S1?	G4
DRAGONFLY	*Cordulegaster erronea*	Tiger Spiketail	Small forested streams	SR		S2S3	G4
DRAGONFLY	*Gomphus abbreviatus*	Spine-crowned Clubtail	Rivers; also found in Piedmont Province	SR		S2S3	G3G4
DRAGONFLY	*Gomphus descriptus*	Harpoon Clubtail	Large streams and rivers	SR		S1S3	G4
DRAGONFLY	*Gomphus lineatifrons*	Splendid Clubtail	Rivers; also found in Piedmont Province	SR		S2S3	G4
DRAGONFLY	*Gomphus parvidens parvidens*	Piedmont Clubtail	Small spring-fed streams	SR		S2S3	G4T?
DRAGONFLY	*Gomphus ventricosus*	Skillet Clubtail	Rivers	SR		S2?	G3
DRAGONFLY	*Lanthus parvulus*	Northern Pygmy Clubtail	Small spring-fed streams	SR		SR	G3G4
DRAGONFLY	*Ophiogomphus aspersus*	Brook Snaketail	Rapids of rivers and streams	SR		S1?	G3G4
DRAGONFLY	*Ophiogomphus mainensis*	Maine Snaketail	Rapids of rivers and streams	SR		S1S3	G4
DRAGONFLY	*Stylurus amnicola*	Riverine Clubtail	Rivers; also found in Piedmont and Coastal Provinces	SR		S2S3	G3G4
DRAGONFLY	*Stylurus scudderi*	Zebra Clubtail	Streams & rivers	SR		S3?	G3G4
DRAGONFLY	*Sympetrum obtrusum*	White-faced Meadowfly	Boggy or marshy ponds and lakes	SR		S1S3	G5

FISH	*Clinostomus, sp 1*	Smoky Dace	Little TN River drainage, Jackson and Macon Co.	SC	S2	G2Q
FISH	*Cottus carolinae*	Banded Sculpin	Hiwassee River system; French Broad River system	T	S1	G5
FISH	*Etheostoma inscriptum*	Turquoise Darter	Large streams in Savannah River system	SC	S1	G4
FISH	*Hybopsis rubrifrons*	Rosyface Chub	Savannah River system; Transylvania Co.	T	S1	G4
FISH	*Lampetra appendix*	American Brook Lamprey	Hiwassee River system; French Broad River system	T	S1	G4
FISH	*Luxilis chrysocephalus*	Striped Shiner	Reported in Little TN River system, Macon Co.; Cane River system	T	S1	G5
FISH	*Micropterus coosae*	Redeye Bass	Savannah River system; Transylvania and Jackson Co.	SR	S1	G5
FISH	*Moxostoma sp 1*	Sicklefin Redhorse	Little TN and Hiwassee River drainages	SR FSC	S1S2	G2G3Q
FISH	*Notropis lutipinnis*	Yellowfin Shiner	Savannah and Little TN River systems, Jackson and Transylvania Co.; Broad River system	SC	S3	G4Q
FISH	*Noturus flavus*	Stonecat	Warmwater streams and rivers, Little TN River drainage, Swain Co.; Nolichucky and French Broad River systems	E	S1	G5
FISH	*Percina aurantica*	Tangerine Darter	Large streams and rivers; TN River system	W2	S3	G3G4
FISH	*Percina caprodes*	Logperch	Streams, rivers, reservoirs in TN River system; New River drainage	T	S1	G5
FISH	*Stizostedion canadense*	Sauger	Large streams, rivers, reservoirs in Hiwassee River system, Cherokee Co.; French Broad River system	SR*	S2	G5
GASTROPOD	*Goniobasis interrupta*	Knotty Elimia	Hiwassee River and tributaries, Cherokee Co.	E FSC	S1	G?
GASTROPOD	*Leptoxis virgata*	Smooth Mudalia	Hiwassee River, report possibly in error	SR FSC	SU	G2
MAYFLY	*Barbaetis benfieldi*	Benfield's Bearded Small Minnow Mayfly	Caney Fork, Jackson Co.; Jacob Fork (Burke Co.), French Broad River (Transylvania Co.); may be undersampled	SR	S1	G2G3
STONEFLY	*Megaleuctra williamsae*	William's Rare Winter Stonefly	UT Cullasaja River, Macon Co. and Mull Cr, Jackson Co.; Cove Cr (Haywood Co.); possibly undersampled; semi-aquatic	SR	S1	G2
STONEFLY	*Shipsa rotunda*	A Stonefly	Mountain, Piedmont, and Coastal Province streams	SR	S2S3	G?
STONEFLY	*Zapada chila*	A stonefly	Small streams; Beech Flat Prong (Swain Co.), Ashe Co.; may be undersampled	SR	S1S2	G?

ATTACHMENT 2

Rare Species Analysis For: **Hazanet**
Analysis Date: 4/11/03

Known and Potentially Occurring* Rare Aquatic Species
Graham County, North Carolina

TYPE	SCIENTIFIC NAME	STATUS	LIKELIHOOD OF OCCURRENCE WITHIN AQUATIC ANALYSIS AREA
AMPHIBIAN	*Cryptobranchus alleganiensis*	FC	May occur (1)
BIVALVE	*Alasmidonta raveneliana*	E	Known to occur (1,3)
CADDISFLY	*Ceraclea sp. 1*	FC	May occur (1,4)
CADDISFLY	*Helicopsyche paralimnella*	FC	Not likely to occur (1,4)
CADDISFLY	*Wormaldia thyria*	FC	Not likely to occur (1,4)
DRAGONFLY	*Aeshna tuberculifera*	FC	Not likely to occur (1,5)
DRAGONFLY	*Cordulegaster erronea*	FC	May occur (1,4)
DRAGONFLY	*Gomphus abbreviatus*	FC	May occur (1,4)
DRAGONFLY	*Gomphus consanguis*	S	May occur (1,4)
DRAGONFLY	*Gomphus descriptus*	FC	May occur (1,4)
DRAGONFLY	*Gomphus lineatifrons*	FC	May occur (1,4)
DRAGONFLY	*Gomphus parvidens parvidens*	FC	May occur (1,4)
DRAGONFLY	*Gomphus ventricosus*	FC	May occur (1,4)
DRAGONFLY	*Gomphus viridifrons*	S	May occur (1,4)
DRAGONFLY	*Lanthus parvulus*	FC	May occur (1,4)
DRAGONFLY	*Macromia margarita*	S	Not likely to occur (1,4)
DRAGONFLY	*Ophiogomphus aspersus*	FC	Not likely to occur (1,4)
DRAGONFLY	*Ophiogomphus edmundo*	S	Not likely to occur (1,4)
DRAGONFLY	*Ophiogomphus howei*	S	Not likely to occur (1,4)
DRAGONFLY	*Ophiogomphus mainensis*	FC	Not likely to occur (1,4)
DRAGONFLY	*Stylurus amnicola*	FC	Not likely to occur (1,4)
DRAGONFLY	*Stylurus scudderi*	FC	Not likely to occur (1,4)
DRAGONFLY	*Sympetrum obtrusum*	FC	Not likely to occur (1,5)
FISH	*Clinostomus sp. 1*	FC	Not likely to occur (1,4)
FISH	*Etheostoma vulneratum*	S	Not likely to occur (1,4)
FISH	*Luxilis chrysocephalus*	FC	Not likely to occur (1,4)
FISH	*Moxostoma sp. 1*	FC	Not likely to occur (1,4)
FISH	*Notropis lutipinnis*	FC	Not likely to occur (1,4)
FISH	*Noturus flavus*	FC	Not likely to occur (1,4)
FISH	*Percina aurantica*	FC	Known to occur (1)
FISH	*Percina caprodes*	FC	Not likely to occur (1,4)
FISH	*Percina squamata*	S	Not likely to occur (1,4)
MAYFLY	*Seratella spiculosa*	S	Not likely to occur (1,4)
STONEFLY	*Shipsa rotunda*	FC	Not likely to occur (1,4)
STONEFLY	*Zapada chila*	FC	Not likely to occur (1,4)

* Based on known distributions and presence of suitable habitat.

EVALUATION CRITERIA:

1 = Recent survey data within or downstream the aquatic analysis area (<5 yrs old)
2 = Historical survey data within or downstream the aquatic analysis area (>5 yrs old)
3 = Vicinity records (within or downstream the analysis area, not necessarily within project area)
4 = Suitable habitat present, but no vicinity records
5 = No suitable habitat present or vicinity records within analysis area, but species may be present in county
6 = Extirpated species listed for river system

BOTANICAL RESOURCE REPORT

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ABSTRACT

Action Alternatives 2 and 3 of the Hazanet Timber Sale, would have no effect on any federally-listed plant species (Table 1). Consultation with the U. S. Fish and Wildlife Service is not required. The action alternatives may impact individuals of the sensitive species *Euphorbia purpurea*, *Helianthus glaucophyllus* and *Scutellaria saxatilis*, but are not likely to cause a trend to federal listing or a loss of viability. The action alternatives would not impact any other sensitive species. Because the action alternatives would have no effect on any threatened or endangered species, and is unlikely to seriously impact any sensitive species, no mitigation is recommended for this project.

Table 1: Determination of effect of each alternative on the evaluated threatened and endangered species and sensitive species.

Species	Alternative 1	Alternative 2	Alternative 3
Federally Threatened and Endangered Species			
Spiraea virginiana	no effect	no effect	no effect
2002 Region 8 Regional Forester's Sensitive Species List			
Euphorbia purpurea	no impact	may impact individuals but not likely to cause a trend to federal listing or a loss of viability	may impact individuals but not likely to cause a trend to federal listing or a loss of viability
Helianthus glaucophyllus	no impact	may impact individuals but not likely to cause a trend to federal listing or a loss of viability	may impact individuals but not likely to cause a trend to federal listing or a loss of viability
Hydrothyria venosa	no impact	no impact	no impact
Megaceros aenigmaticus	no impact	no impact	no impact
Scutellaria saxatilis	no impact	may impact individuals but not likely to cause a trend to federal listing or a loss of viability	may impact individuals but not likely to cause a trend to federal listing or a loss of viability

I. INTRODUCTION

Nantahala National Forest has proposed a timber sale in compartments 25, 29, 30, 31, 33, 34 and 35 of the Cheoah Ranger District. The proposed project area is located from 4 to 6 miles north northwest of the town of Robbinsville in central Graham County, North Carolina. The seven compartments extend primarily along the upper slopes of the Cheoah and Yellow Creek Mountains, from the Cheoah River to Wauchecha Bald. In general, the soils are developed from biotite gneiss with locally abundant quartz and aluminum silicates. Islands of amphibolite rock are scattered across this more abundant biotite gneiss group. Elevations within the proposed project area range from 1800 to 3600 feet.

The proposal includes three alternatives. Alternative One is no action. Alternative Two consists of 18 harvest stands. Harvest procedures include two-age timber harvest (349 total acres in 10 stands plus portions of two stands), thinning (99 total acres in three stands plus portions of two stands), and group selection (53 net acres in groups would be harvested from 213 total acres in three stands). Three stands (40 total acres) would be slashed, burned and planted with yellow pine as a control measure for southern pine beetle. Four areas, comprised of 13 stands totaling 351 acres, would undergo prescribed burning for wildlife. Approximately 749 acres in 27 additional stands would undergo some form of preharvest treatments or timber stand improvement. These would involve 3.35 miles or road construction and 0.6 miles of reconstruction. Four helispots would be constructed, and eleven vernal ponds would be constructed as wildlife habitat.

Alternative Three consists of 18 harvest stands. Harvest procedures include two-age timber harvest (430 acres in 15 stands), thinning (51 acres in two stands), and group selection (18 net acres in groups harvested from one, 72 acre stand). Three stands (40 total acres) would be slashed, burned and planted with yellow pine as a control measure for southern pine beetle. Four stands, comprised of 13 stands totaling 351 acres, would undergo prescribed burning for wildlife. Approximately 616 acres in 24 additional stands would undergo some form of preharvest treatments or timber stand improvement. These would involve 2.95 miles of road construction and 0.6 miles of reconstruction. Four helispots would be constructed, and eleven vernal ponds would be constructed as wildlife habitat.

II. SPECIES CONSIDERED AND SPECIES EVALUATED

Seven federally-endangered, seven federally-threatened, 149 sensitive, and 252 forest concern plant species are either known to occur, or may occur, on the Nantahala and Pisgah National Forests. Regional sensitive species are believed to have viability concerns throughout their range and generally exhibit a global rank of G1, G2 or G3 (Table 2). The regional sensitive list was updated on January 1, 2002. Forest concern plant species are more common on a global basis (G4 or G5), but grow at the periphery of their range in North Carolina or disjunct from their main range. This list of 415 tracked species includes species known from the mountains of North Carolina only from

historical records (> 20 yr since last observed), and records from both private and public lands.

Table 2: Definitions used by the Biological and Conservation Datasystem [BCD]. The Biological and Conservation Datasystem [BCD] is the central information management system used by state heritage programs to track and rank rare species. Each species receives a priority rank at both the global and state levels. The criteria for each ranking is as follows:

S1 or G1	Critically imperiled with fewer than six viable occurrences either within the state [S-rank] or throughout its range [G-rank]. Generally, this denotes species with fewer than 1000 individuals or communities covering fewer than 2000 acres.
S2 or G2	Imperiled with six to 20 occurrences either within the state [S-rank] or throughout its range [G-rank]. This rank generally denotes species with 1000 - 3000 individuals or communities covering 2000 - 10,000 acres.
S3 or G3	Either very rare or exhibiting localized distribution, with 20 - 100 occurrences either within the state [S-rank] or throughout its range [G-rank]. This rank generally denotes species with 3000 - 10,000 individuals or communities covering 10,000 - 50,000 acres.
S4 or G4	Widespread, abundant and apparently secure, with 100 to 1000 occurrences either within the state [S-rank] or throughout its range [G-rank]. This rank does not denote any necessary range of individuals or acreage.
S5 or G5	Demonstrably secure to ineradicable, with more than 1000 occurrences either within the state [S-rank] or throughout its range [G-rank]. This rank does not denote any necessary range of individuals or acreage.

As a first filter from the larger list, a query of the Biological Conservation Database was made for documented occurrences of tracked species in Graham County. Forty-three (43) tracked plant species occur in Graham County (Attachment 1). Two of these species are federally-listed, 24 are sensitive species, and 17 are species of forest concern. The two federally-listed species are the endangered rock gnome lichen (*Gymnoderma lineare*) and the threatened Virginia meadow-sweet (*Spiraea virginiana*).

The species surviving the initial filter were filtered a second time using their primary habitats. Due to the large area of the proposed sale, and therefore the large number of potential habitats within the boundaries of the sale, however, the habitat filter excluded only five species from the analysis: *Glyceria nubigena*, found in high elevation seeps, *Lilium canadense* spp. *editorum* and *Platanthera flava* var. *herbiola*, found in bogs,

Rhododendron cumberlandense, found in high elevation balds, and *Spiraea virginiana*, found in the scour zone of large rivers.

In addition to the county and habitat filters, tracked species underwent a proximity analysis to identify species located within one air mile of the project area. Existing species records in the Biological Conservation Database were mapped using Arcview, and the distance between the project area and the location of a tracked species measured.

III. ENVIRONMENTAL BASELINE FOR SPECIES EVALUATED

(1) Existing Condition

The mesic, concave slopes of the project area generally support a Rich Cove Forest community type, especially on calcareous soils at lower elevations (Schafale and Weakley 1990). The canopy of these forests is typically dominated by *Liriodendron tulipifera,* but also contains tree species such as *Quercus rubra, Tilia americana, Aesculus flava*, *Betula lenta, Fraxinus americana*, *Acer rubrum* and *Prunus serotina*. Subcanopy species include *Halesia carolina, Amelanchier arborea* and *Cornus florida*. The shrub layer is often open. Common shrubs include *Hydrangea arborescens*, *Cornus alternifolia*, *Lindera benzoin, Cornus alternifolia* and *Pyrularia pubera.* The herbaceous layer exhibits both high cover and high diversity. Common herbs include A*diantum pedatum, Aruncus dioicus, Actaea racemosa, Carex digitalis, Caulophyllum thalictroides*, *Clintonia umbellulata*, *Collinsonia canadensis, Desmodium glutinosum, Dryopteris marginalis, D. intermedia, Galium latifolium, Geranium maculatum*, *Goodyera pubescens, Hepatica acutiloba*, *Houstonia purpurea, Iris cristata, Lysimachia quadrifolia, Medeola virginiana, Mitchella repens, Orchis spectabilis, Oxalis grandis, Parthenocissus quinquefolia, Polygonatum biflorum, Polystichum acrostichoides, Sanguinaria canadensis, Thalictrum dioicum*, *Thelypteris noveboracensis, Tiarella cordifolia, Toxicodendron radicans, Trillium erectum*, *T. vaseyi*, *Sanguinaria canadensis, Smilax herbacea, Uvularia perfoliata, U. sessilifolia, Veratrum parviflorum*, *Viola canadensis* and *V. pubescens.* Drier sites exhibit correspondingly lower cover and diversity.

The cove landform on non-circumneutral soils generally supports an Acidic Cove Forest community type (Schafale and Weakley 1990). The canopy is dominated primarily by *Tsuga canadensis,* but also contains tree species such as *Liriodendron tulipifera*, *Betula lenta* and *Acer rubrum*. *Acer pennsylvanicum* and *Nyssa sylvatica* are common subcanopy trees. *Rhododendron maximum* strongly dominates the shrub layer, often forming dense, impenetrable thickets. Herbaceous cover is usually low, and often limited to deciduous patches between the evergreen shrubs. Common herbs include *Arisaema triphyllum, Clintonia umbellulata, Dryopteris marginalis, D. spinulosa, Geranium maculatum, Luzula acuminata, Medeola virginiana, Melampyrum lineare, Polystichum acrostichoides, Mainthemum racemosum = Smilacina racemosa,* and *Viola blanda.*

Lower and more convex slopes across the project area generally support a montane Oak - Hickory Forest community type (Schafale and Weakley 1990). This community type is

dominated by oak species, primarily *Quercus rubra* var. *borealis,* but also *Quercus alba*, *Quercus montana* and *Carya glabra,* with scattered individuals of *Liriodendron tulipifera* and *Acer rubrum*. *Ilex opaca* is also present at lower elevations. Shrub density varies. A few examples of the type exhibit high cover by *Gaylussacia ursina*. Most of examples of this community type, however, exhibit low shrub cover. These examples exhibit the highest herbaceous cover and diversity. Common herbs include *Aster patens, A. retroflexus, Botrychium virginianum, Carex communis, Carex digitalis, C. pensylvanica, C. virescens, Coreopsis major, Desmodium nudiflorum, Dichanthelium boscii, Prosartes lanuginosa = Disporum lanuginosum, Eupatorium purpureum, Galium latifolium, Helianthus microcephalus, Luzula bulbosa, Lysimachia quadrifolia, Medeola virginiana, Poa autumnalis, Prenanthes altissima, Solidago curtisii, Mainthemum racemosum = Smilacina racemosa, Stellaria pubera, Thelypteris noveboracensis, Toxicodendron radicans, Uvularia sessilifolia,* and *Viola pubescens*.

On sharper convex slopes, the montane Oak-Hickory Forest community may grade into a Chestnut Oak-Scarlet Oak Forest community type, dominated primarily by *Quercus coccinea* and *Quercus montana,* with scattered individuals of *Quercus velutina*, *Acer rubrum* and *Nyssa sylvatica* (Schafale and Weakley 1990). *Robinia pseudoacacia* can be common along roads, and pitch pine (*Pinus rigida*) can be found in the most xeric examples of the type. The canopy is typically broken, exhibiting 50 – 70% cover, and facilitating the development of a dense shrub layer, often approaching 100% cover. Common shrubs include *Kalmia latifolia*, *Gaylussacia ursina*, *G. baccata* and *Vaccinium pallidum*. These shrubs often form large, monoclonal patches. Understory plants are usually confined to small, open patches without shrub cover. As a result, herbaceous diversity is poor. Frequent herbs include *Chimaphilia maculata*, *Coreopsis major,* several *Dichanthelium* species, *Epigaea repens*, *Hypopitys monotropa, Hypoxis hirsuta*, *Melampyrum lineare, Pteridium aquilinum* and *Uvularia puberula*.

At higher elevations, especially on concave, north-facing slopes, the Rich Cove Forest may grade into a Northern Hardwood Forest community type (Schafale and Weakley 1990). Dominance in the overstory varies among *Betula alleghaniensis*, *Aesculus flava*, *Tilia americana* and *Fagus grandifolia*, although *Prunus serotina*, *Tsuga canadensis*, *Quercus rubra* var. *borealis* and *Acer saccharum* are also frequent. This community type exhibits an open understory, including small trees such as *Acer pensylvanica*, and shrubs such as *Hydrangea arborescens* and *Cornus alternifolia*. The herbaceous layer exhibits high cover, but less diversity than the Rich Cove Forest community. Common herbs in Northern Hardwoods Forest include *Actaea pachypoda*, *Ageratina altissima*, *Aster chlorolepsis*, *Aster macrophyllus*, *Cimicifuga americana*, *Claytonia caroliniana*, *Collinsonia canadensis*, *Dicentra cucullaria*, *Dryopteris intermedia, Erythronium umbilicatum*, *Laportea canadensis*, *Panax trifolius*, *Prenanthes roanensis*, *Stachys lanata*, *Trillium erectum*, and *Viola canadensis.*

Small rock outcrops are present across the project area, usually embedded within both the Rich Cove Forest community type and the montane Oak-Hickory Forest community type. These are typically herbaceous communities dominated by species such as *Heuchera villosa, Saxifraga michauxi, Carex debilis, Poa autumnalis, Dryopteris marginalis,*

Smilacina racemosa, and *Asplenium montanum,* and non-vascular species such as *Polytrichum commune* and *Atrichum angustatum.*

(2) Cumulative Condition

The landscape within the seven compartments consists of an elevational segregation of public and private land. The lower elevations (generally below 3000 feet) are privately owned, and consist primarily of small, private home lots. As a result, these private lands provide little suitable habitat for federally listed, sensitive or forest concern plant species. Although some private lands adjacent to the proposed timber sale contain mature forest, the more extensive lands under federal ownership provide the best management conditions for maintaining rare plant species within the area.

Additional projects in the area include the East Buffalo Dumpster expansion, and portions of the proposed Cornsilk Timber Sale. Neither of the projects would negatively impact the species analyzed for the Hazanet project.

IV. EVALUATED SPECIES SURVEY INFORMATION

The following species were identified during the proximity search of existing occurrence records:

[1] *Spiraea virginiana* [federally threatened]. Six populations along the Cheoah River, adjacent to the western edge of the proposed timber sale.

[2] *Aconitum reclinatum* [forest sensitive]. One population in the upper Bee Creek area, approximately 0.5 miles northeast of the boundary of the proposed sale at Locust Licklog Gap. Gary Kauffman has examined the specimen from this location, and concluded it is actually a white form of the normally blue-flowered *Aconitum uncinatum* (Gary Kauffman, personal communication).

[3] *Euphorbia purpurea* [forest sensitive]. One population south of the Wauchecha Bald area, approximately 0.5 miles south of the boundary of the proposed sale.

[4] *Carex purpurifera* [forest concern]. One population north of the headwaters of Lifting Rock Branch, approximately 0.5 miles north of the boundary of the proposed sale.

[5] *Trientalis borealis* [forest concern]. One population in the upper Bee Creek area, approximately 0.5 miles northeast of the boundary of the proposed sale at Locust Licklog Gap. This is the same location as the *Aconitum reclinatum* record.

Surveys for endangered, threatened, sensitive, and forest concern species suspected of growing within the proposed Hazanet timber sale were conducted between 1998 and 2001 by Gary Kauffman, Allen Smith and Karin Heimen, and in July, 2002, by Wilson Rankin. Field survey methods consisted of a timed meander with intensity increased in the most diverse areas, and conducted until no new species or microhabitats were detected (Goff *et al.* 1982).

No federally endangered or threatened plant species was located during the field survey. Three sensitive plant species, *Euphorbia purpurea*, *Megaceros aenigmaticus* and *Scutellaria saxatilis*, were located in the harvest areas (Table 3). Wilson Rankin found a small population of *Euphorbia purpurea* in Stand 34-17A. Gary Kauffman found five populations of *Megaceros aenigmaticus* in and near the project area: one population in Stand 31-1, two populations downstream of the prescribed burn stand in Compartment 29, one population downstream of Stand 30-9A, and one population downstream of Stands 30-23 and 29-1 in the Cody Branch watershed. Gary Kauffman also found five populations of *Scutellaria saxatilis* in and near the project area. Two populations were located inside proposed harvest stands, one inside Stand 31-9, and one inside the portion of Stand 34-17B common to both action alternatives. Two additional populations on National Forest land were located adjacent to proposed harvest stands, one adjacent to Stand 31-9, and one adjacent to the Action Alternative 2 configuration of Stand 34-17B. The fifth population of *Scutellaria saxatilis* was located on private land adjacent to Stand 31-9.

Table 3. Federally-listed plant species and sensitive plant species known to occur in the proposed Hazanet project area.

Species	Type	Brief Habitat Description	Occurrence
Federally Listed Plant Species			
None Located	N/A	N/A	Not known to occur
2002 Region 8 Regional Forester's Sensitive Plant Species List			
Euphorbia purpurea	Herb	Rich Cove Forest, Mesic Oak-Hickory Forest	Known to occur in the activity area
Scutellaria saxatilis	Herb	Rich Cove Forest	Known to occur in the activity area
Megaceros aenigmaticus	Lichen	Streams	Known to occur in the activity area

Three forest concern plant species, *Calamagrostis porteri, Carex hitchcockiana* and *Carex leptonervia,* were also located in the project area (Table 4). Gary Kauffman found one population of *Calamagrostis porteri* adjacent to Stand 35-9C. Gary Kauffman found a population of *Carex hitchcockiana* in the portion of Stand 34-17B common to both action alternatives. Gary Kauffman also found three populations of *Carex leptonervia*: one in the portion of Stand 34-17B common to both action alternatives, one in Stand 30-23, and one adjacent to northwestern portion of the Action Alternative 2 configuration of Stand 34-17B (Gary Kauffman, personal communication).

Table 4. Forest Concern plant species known to occur in the proposed Hazanet project area.

Species	Type	Brief Habitat Description	Occurrence
Calamagrostis porteri	Herb	Rich Cove Forest, Oak-Hickory Forest, Roadside Edge	Known to occur in the activity area
Carex hitchcockiana	Herb	Rich Cove Forest, Mesic Oak-Hickory Forest	Known to occur in the activity area
Carex leptonervia	Herb	Rich Cove Forest, Mesic Oak-Hickory Forest	Known to occur in the activity area

Populations of four additional species considered rare at the time of the field survey -- *Cardamine flagellaris*, *Carex manhartii, Panax trifolius* and *Prosartes maculata* -- were located in the project area by Gary Kauffman. All three of the species, however, have since been dropped from the sensitive or forest concern lists, and would not be analyzed in this report.

V. EFFECTS OF PROPOSED MANAGEMENT ACTION

(1) Endangered, Threatened, Sensitive and Forest Concern Plant Species

(A) Threatened Species

Spiraea virginiana

Spiraea virginiana, the Virginia meadow-sweet, is a tall shrub with upright, arching branches. The small, white flowers are produced in showy, flat-topped clusters during June and July. The leaves are generally elliptical, with varying number of teeth, and glaucous undersides. Technically, this species is distinguished from other members of the genus by the flat-topped inflorescence in combination with the elliptical, glaucous leaves (Radford, *et al.* 1986). In the field, the tall arching stems growing in the scour zone of large, rocky rivers is diagnostic.

Spiraea virginiana is most common in the central Appalachian Mountains, with populations in the Cumberland Plateau, the Blue Ridge physiographic region, and the Ohio River drainage. All states with populations except Alabama and Louisiana consider the species imperiled (Figure 1). Current populations stretch from Ohio to Georgia and Tennessee, with an historic record from Pennsylvania. In North Carolina, *Spiraea virginiana* occurs in five counties in the western portion of the state, with an historic record from Buncombe County. Two populations occur on National Forest lands: one in the Nolichucky River Gorge of the Pisgah National Forest, and one in the Cheoah River of the Nantahala National Forest.

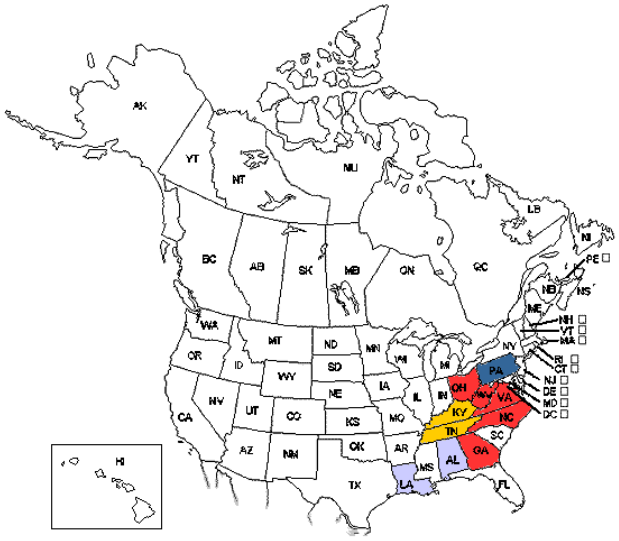

Figure 1: Range map for *Spiraea virginiana*, where blue is SX (presumed extirpated), red is S1 (critically imperiled), orange is S2 (imperiled), and periwinkle is SR (reported; Natureserve 2002).

Spiraea virginiana is considered a G2/S1 species (6 - 20 global populations). The species is listed as federally-threatened due to the small number of populations in combination with the large number of threats. Potential threats to the species include changes in site hydrology due to impoundment, direct mortality from recreational activities, competition from exotic species, roadside maintenance in highway corridors, and natural processes such as flooding and herbivory.

Spiraea virginiana grows in rocky bars at the edge of rivers and along the scour zones of high-gradient mountain streams. It would also grow between boulders and in alluvial sands if the sites are seasonally saturated. Plants are usually found along rivers with dynamic flooding regimes, primarily in geologically-active areas characterized by erosion, deposition, and slumping. Associated plants may include *Alnus serrulata*, *Clematis viorna*, *Cornus amomum*, *Impatiens capensis*, *Physocarpus opulifolius*, *Platanus occidentalis*, *Salix* spp., *Sambucus canadensis* and *Verbesina alternifolia*. Although *Spiraea virginiana* may flower profusely, sexual reproduction is rare, and most reproduction occurs through clonal growth. Populations are generally stable and readily recover from natural disturbance given proper habitat. As a result, conservation efforts for this species focus on maintaining the natural hydrology of the site and removing competing species, especially exotics. New *Spiraea* plants are easily produced by rooting stems, and populations can be readily restored by transplanting rhizomes. In addition, manual cross-pollination from different clones would produce viable seed.

Spiraea virginiana is included is this report due to the proximity analysis. Neither *Spiraea virginiana* nor its habitat was located in any of the proposed timber stands. Because *Spiraea* is a large plant with well-defined habitat requirements, it is unlikely to be overlooked in the field. The only populations on the National Forest occur outside the boundaries of the timber sale. As a result, it is highly unlikely the species would be damaged through indirect effects.

Alternative 1 (No Action)

The current populations of *Spiraea virginiana* along the Cheoah River are threatened by competition from exotic plants and recreational use by fishermen. No action may allow these habitats to undergo further degradation.

Action Alternative 2

Spiraea virginiana was not located in any of the proposed harvest stands. Neither the number of stands nor their management prescriptions would affect any populations of this species.

Action Alternative 3

Spiraea virginiana was not located in any of the proposed harvest stands. Neither the number of stands nor their management prescriptions would affect any populations of this species.

(B) Sensitive Species

Euphorbia purpurea

Euphorbia purpurea, the glade spurge, is a robust herb 3-4 feet in height. Although the flowers are inconspicuous, large, yellow bracts form cups beneath the flowers, creating a bright display. All members of the genus are characterized by milky sap. In the southern Appalachians, *Euphorbia purpurea* can be distinguished from other species of *Euphorbia* by its large, entire leaves 4-6 inches in length, with a prominent mid-vein. *Euphorbia purpurea* ranges from New Jersey, Pennsylvania and Ohio south to Virginia and the mountains of North Carolina (Weakley1998). All states in its range track the glade spurge as a rare species (Figure 2). Twenty-one populations have been documented in western North Carolina. Seven populations occur in the Nantahala and Pisgah National Forests, and five occur on the Blue Ridge Parkway (NCNHP database and Gary Kauffman, personal communication). In addition, three historic populations occurred on federal lands, one in Great Smoky Mountains National Park, and two on the Nantahala National Forest.

Euphorbia purpurea grows in both mesic rich cove forest and drier montane oak forest (Gleason and Cronquist 1991). In Virginia, most of the larger populations occur in partially open areas where woody cover is inhibited (Porter and Wieboldt 1991). In Ohio, glade spurge has been located within glades and partially open oak woods that have undergone recent prescribed burns (Gary Kauffman, personal communication).

A small population of 3-4 plants was growing in a former skid trail within a rich cove forest community in Stand 34-17A.

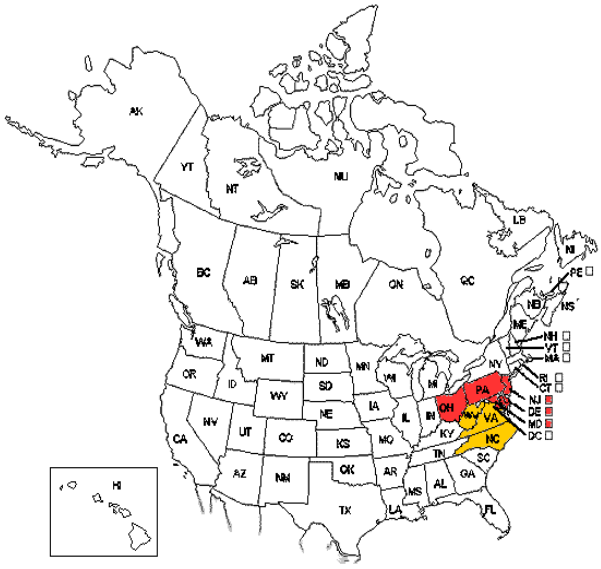

Figure 2: Range map for *Euphorbia purpurea*, where red is S1 (critically imperiled) and orange is S2 or S2S (imperiled; Natureserve 2002).

Alternative 1 (No Action)

Euphorbia purpurea apparently grows well beneath a closed canopy. Not harvesting the trees would maintain the closed canopy, and probably produce little to no effect upon the species. The population should remain close to its current size.

Action Alternative 2

This alternative proposes a two-age harvest in Stand 34-17A. Direct effects from the selection and thinning harvests could result in the death of individual plants from both the construction of skid roads as well as the skidding of the logs. Indirect effects would result from the change in light and humidity at the forest floor. Because *Euphorbia purpurea* is most often associated with the closed canopy conditions of mature forest, any dramatic opening of the forest through harvest may degrade the habitat and negatively effect populations of *Euphorbia purpurea*.

In so far as *Euphorbia purpurea* responds positively to disturbance, however, harvest may improve the habitat for the species. For example, a large population of *Euphorbia purpurea* occurs in the Deep Gap area of Graham County. The surrounding forest community was heavily thinned during the Shepherd Creek timber sale. Two years later, the site contained a vigorous population of *Euphorbia purpurea* (Gary Kauffman, personal communication).

Action Alternative 3

This alternative proposes the same harvest procedures as Action Alternative 2. Direct and indirect effects would be the same as Action Alternative 2.

Effect of Fire

The perennating tissue of *Euphorbia purpurea* is a thick rhizome growing several inches beneath the surface of the soil. Prescribed fire should not be hot enough to damage this rhizome (Porter and Wieboldt 1994). Two forms of fire may, however, damage species. First, an extremely hot fire implemented during a long dry period could potentially burn through the upper layers of the soil and damage the rhizomes of the plants. Second, *Euphorbia purpurea* sprouts early in the spring; a fire late in the spring season may burn the above-ground sprouts. In general, however, fire should improve habitat for the species by opening the mid-story of the canopy.

Cumulative Effect

The Shepherd Creek Timber Sale effected one population of *Euphorbia purpurea*, but the population remains vigorous (Gary Kauffman, personal communication). The proposed County Line Timber Sale may effect two large populations of *Euphorbia purpurea*, but the proposed management procedures are thinnings unlikely to severely degrade the habitat of the species. The National Forests contains six *Euphorbia purpurea* populations that are currently undisturbed and unlikely to be actively managed in the foreseeable future. As a result, there should be no cumulative affect or loss of viability across the National Forest for this species.

Helianthus glaucophyllus

Helianthus glaucophyllus, the white-leaf sunflower, is a tall, rhizomatous perennial in the aster family. The flowers resemble yellow daisies, with yellow petals surrounding dark centers. Technically, this species is distinguished from other sunflowers by the presence of small flower heads, broad leaves with long petioles, and the absence of glands on the undersides of the leaves (Cronquist 1980). In the field, the glaucous undersides of the broad leaves give the plants a distinctive, whitish appearance. The species is a narrow southern Appalachian endemic occurring in northwestern South Carolina, western North Carolina, and eastern Tennessee (Cronquist 1980, Weakley 2000; Figure 3). In North Carolina, *Helianthus glaucophyllus* occurs in twelve counties, with historical records in three additional counties (Amoroso 2002, Gary Kauffman, personal communication). The species was formerly considered rare by the North Carolina Natural Heritage Program, but was downgraded to the watch list when the species had been located at 75 different sites (Alan Weakley, personal communication). Nantahala National Forest contains at least 60 populations. Given the number of populations in North Carolina alone, *Helianthus glaucophyllus* is probably a G4 plant (>100 populations).

Helianthus glaucophyllus generally flowers only in canopy gaps or along roadside edges (Weakley 2000). It is typically more common in open areas such as recent canopy gaps, burn areas that partially opened the canopy, and roadside edges (Gary Kauffman, personal communication). As a result, disturbance may benefit *Helianthus glaucophyllus* by opening the canopy and allowing additional light to the forest floor.

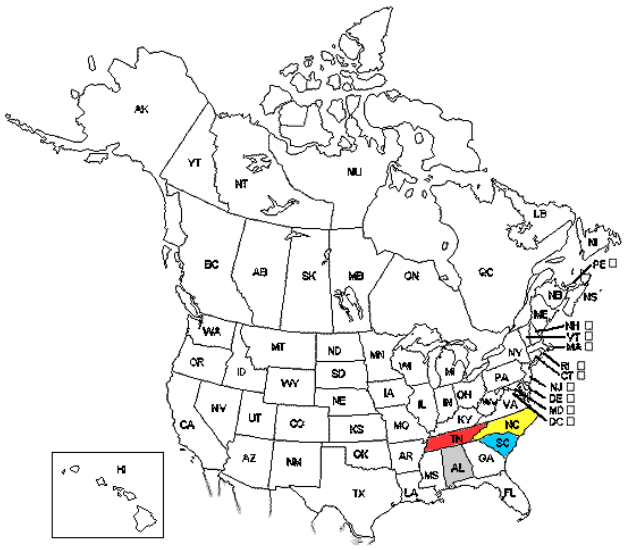

Figure 3: Range map for *Helianthus glaucophyllus*, where red is S1 (critically imperiled), yellow is S3 (vulnerable), blue is S? (unranked), and gray is SH (possibly extirpated; Natureserve 2002).

Gary Kauffman found *Helianthus glaucophyllus* on private land adjacent to Stand 31-9. It was not located in any of the proposed harvest stands. Because it frequently occurs in disturbed habitats throughout the national forest, however, *Helianthus glaucophyllus* may be present in disturbed habitats in the proposed activity area.

Alternative 1 (No Action)

Helianthus glaucophyllus is most often associated with disturbed and open habitats. In the absence of disturbance, habitat for this species may decrease.

Action Alternative 2

Helianthus glaucophyllus was not located in any of the proposed harvest stands. Neither the number of harvest stands nor their management prescriptions would affect any populations of this species. Because *Helianthus glaucophyllus* is most often associated with disturbed and open habitats, disturbance associated with timber management may improve habitat for this species.

Action Alternative 3

Helianthus glaucophyllus was not located within any of the proposed timber stands. Neither the number of harvest stands nor their management prescriptions would affect any populations of this species. Because *Helianthus glaucophyllus* is most often associated with disturbed and open habitats, disturbance associated with timber management may improve habitat for this species.

Effect of Fire

The effects of fire on *Heilanthus glaucophyllus* are unknown. The genus *Helianthus* can be common in fire ecosystems such as prairies, and often responds to prescribed fire by increasing productivity. In addition, the edge habitats characteristic of this species are unlikely to carry a hot fire that would potentially damage the long, subterranean rhizomes of the species. It seems unlikely that prescribed fire would negatively impact *Heilanthus glaucophyllus*.

Cumulative Effect

Because *Helianthus glaucophyllus* has not been formally tracked by the National Forests in North Carolina for the last 10 years, it is not known how many projects have impacted the species. Since 1997, the species has been located in at least six activity areas: three timber harvests, two proposed burn sites, and one road-widening project. Due to the large number of populations in the southern Appalachians and the Nantahala National Forest, however, there are no viability concerns for *Helianthus glaucophyllus* across the National Forest.

Hydrothyria venosa

Hydrothyria venosa, the waterfan, is an aquatic lichen with a gelatinized thallus that resembles brown algae. It is generally found attached to partially-submerged rocks on the edge of swiftly flowing, steep gradient streams. This species has two general ranges of distribution, the Pacific Northwest and a narrow portion of the southern Appalachians, including western North Carolina and eastern Tennessee (Brodo, *et al.* 2001). Within the last seven years, *Hydrothyria* has been located in eleven North Carolina counties, including Cherokee, Graham, Jackson, Swain, Macon and Transylvania (Amoroso 2002). Currently, Nantahala National Forest contains over 65 records for this species.

Hydrothyria may be sensitive to increased sedimentation. Sediments in solution may act as an abrasive that can shear the thallus from the rock face. Alternately, sediments may cover the thallus, blocking sunlight and therefore preventing photosynthesis.

Because *Hydrothyria* is small, brown, and grows under water in dense shade, it can be readily overlooked, and may be more common than indicated by the field survey. On the other hand, the lichen is virtually confined to free-flowing streams. Under the current forest plan, timber management is not allowed in these environments. As a result, the proposed harvest is unlikely to impact these populations except at stream crossings, where road construction may increase sedimentation directly downstream.

Hydrothyria venosa was not located in the project area during the field surveys. It is included in this report due to the proximity analysis.

Alternative 1 (No Action)

Hydrothyria venosa often grows in undisturbed streams surrounded by dense thickets of rhododendron. As a result, it is potentially one of the most tolerant and successionally stable species in the National Forest. In the absence of disturbance, populations should remain fairly stable.

Action Alternative 2

Hydrothyria venosa was located by Gary Kauffman in streams on National Forest lands below Stand 34-17B. It was not, however, located within any of the proposed harvest stands. Given the proper implementation of erosion controls, as specified in the forest plan, neither the number of harvest stands nor their management prescriptions would effect any populations of this species.

Action Alternative 3

Hydrothyria venosa was located by Gary Kauffman in streams on National Forest lands near Stand 30-9A. It was not, however, located within any of the proposed harvest stands. Given the proper implementation of erosion controls, as specified in the forest plan, neither the number of harvest stands nor their management prescriptions would effect any populations of this species.

Effect of Fire

Prescribed fire is unlikely to penetrate the moist, dense rhododendron stands that typically characterize the stream corridors that shelter populations of *Hydrothyria*. As a result, cool-season fire should not severely impact this species. Fire may, however, indirectly impact *Hydrothyria* by reducing the dense riparian vegetation characteristic of acidic cove communities.

Cumulative Effect

Two projects on the Tusquitee Ranger District (the Ritz Easement and Bates Creek Road Closure) include stream crossings that may impact populations of *Hydrothyria venosa*. In addition, *Hydrothyria venosa* has been located in the general area of the proposed Ray Branch Timber Sale on the Wayah Ranger District. Due to the large number of populations in on the Nantahala National Forest, however, there are no viability concerns for *Hydrothyria venosa* across the National Forest.

Megaceros aenigmaticus

Megaceros aenigmaticus, the Tusquitee hornwort, is a dark green, thalloid hornwort with erose margins (Hicks 1992, Schuster 1992). *Megaceros* forms green, irregular patches on shaded rocks in small streams. Technically, hornworts are determined by the presence of a single, large blue-green chloroplast in the center of each cell. Compared to other members of the group, *Megaceros* forms much larger plants. *Megaceros* is a narrow

southern Appalachian endemic occurring in nine counties in North Carolina and Tennessee. It extends from the Tellico River in eastern Tennessee east to Burningtown Falls, northwest of Franklin, and south to Pounding Mill Creek, northeast of Shooting Creek, NC. Between 30 and 35 populations have been found on the Nantahala National Forest (Gary Kauffman, personal communication). In addition, large populations of *Megaceros* occur in the waters of the Joyce Kilmer/Slickrock Wilderness and Santeetlah Creek, which form the center of its distribution. *Megaceros* is also common in the streams draining into Nantahala Lake. Globally, the species is ranked G2/G3. It is ranked S2/S3 in North Carolina, and S1/S2 in Tennessee (Natureserve 2001).

Megaceros grows on shaded rocks and boulders in small streams. These streams are characterized by shallow depths (usually less than 3 inches), infrequent flooding, and low sediment loads. This species suffers from at least two threats. First, increased sediment load and water flow may either dislodge the plants, increasing direct mortality, or bury them, decreasing photosynthesis and therefore indirect mortality. Second, decreased forest cover may increase light intensity and decrease humidity levels surrounding the stream, decreasing the depth of the water and facilitating the growth of competing species.

Alternative 1 (No Action)

Megaceros aenigmaticus often grows in undisturbed streams surrounded by dense thickets of rhododendron. As a result, it is potentially one of the most tolerant and successionally stable species in the National Forest. In the absence of disturbance, populations should remain fairly stable.

Action Alternative 2

This alternative proposes two-age harvests in Stands 29-1, 30-23 and 31-1, and a prescribed burn in Compartment 29. *Megaceros aenigmaticus* occurs within the boundaries of Stand 31-1, and downstream of the other stands. Because *Megaceros* grows only in streams, timber management would have no direct effects upon this species.

Indirect effects include sedimentation from stream crossings and improper erosion controls. In addition, loss of forest cover could increase stream flow, potentially impacting *Megaceros* by increasing the scouring action of the water. This effect, however, should be minimal because the increase in water flow should occur primarily during the spring and summer. This period usually exhibits the lowest seasonal flow, and should be within the normal annual fluctuation within this drainage (Richard Burns, USFS hydrologist, personal communication, to Gary Kauffman).

Given the proper implementation of erosion controls, as specified in the forest plan, neither the number of harvest stands nor their management prescriptions would effect any populations of this species.

Action Alternative 3

In regards to *Megaceros aenigmaticus*, this alternative proposes the same as management activities as Action Alternative 2, except Stand 31-1 is excluded. Stand 31-1 was the only proposed harvest stand in which *Megaceros* was located. As a result, Action Alternative 3 should exhibit no direct effects on *Megaceros aenigmaticus*.

This alternative also proposes a two-age treatment for Stand 30-9A. A small population of *Megaceros* is located downstream of this stand, in the headwaters of Williams Branch. As a result, this alternative may increase indirect effects on populations of *Megaceros aenigmaticus* compared to Action Alternative 2. These indirect effects include sedimentation from stream crossings and improper erosion controls. In addition, loss of forest cover could increase stream flow, potentially impacting *Megaceros* by increasing the scouring action of the water. This effect, however, should be minimal because the increase in water flow should occur primarily during the spring and summer. This period usually exhibits the lowest seasonal flow, and should be within the normal annual fluctuation within this drainage (Richard Burns, USFS hydrologist, personal communication, to Gary Kauffman).

Given the proper implementation of erosion controls, as specified in the forest plan, neither the number of harvest stands nor their management prescriptions would effect any populations of this species.

Effects of Fire

Because *Megaceros* is confined to permanent streams, direct impacts from prescribed burning are highly unlikely. In addition, the dense stands of rosebay (*Rhododendron maximum*) characteristic of *Megaceros aenigmaticus* habitat are difficult to burn, and a cool-season fire should not severely impact the riparian vegetation when rosebay is present (Gary Kauffman, personal communication). Fire may, however, indirectly impact *Megaceros* populations by reducing the dense riparian vegetation characteristic of acidic cove communities. In addition to the fire effects, fire line construction may increase sedimentation in the streams.

Cumulative Effect

Four recent timber sales on the Wayah and Cheoah Ranger Districts included road construction that could potentially impact populations of *Megaceros aenigmaticus* through sedimentation. In addition, at least one road improvement project in the past year, and two proposed road improvement projects in the current year, may impact populations of *Megaceros aenigmaticus*. None of these projects should impact *Megaceros aenigmaticus* populations, however, if erosion control measures are properly implemented. In addition, Nanthala National Forest contains 20 - 25 populations with no potential impacts from proposed projects. As a result, there are no viability concerns for *Megaceros aenigmaticus* across the National Forest.

Scutellaria saxatilis

Scutellaria saxatilis, the rock skullcap, is small, woodland herb in the mint family. The flowers are blue, approximately one half inch in length, and displayed on one side of a long, thin raceme. All skullcaps have a small, curved crest on the top of the calyx, resembling the crest of a medieval helmet. *Scutellaria saxatilis* is distinguished from other members of the genus by terminal, one-sided racemes in combination with cordate leaf bases (Cronquist 1980). *Scutellaria saxatilis* is widely distributed across eastern North America, ranging from the Ohio valley south to Georgia, Alabama and Arkansas (Cronquist 1980, Weakley 2000). Most of the states in its range consider *Scutellaria saxatilis* rare (Figure 4). In North Carolina, *Scutellaria saxatilis* occurs in five counties in the southern Appalachians and western Piedmont, plus one historic record (1893) from Watauga County. Nantahala and Pisgah National Forests contain at least four populations of the species. *Scutellaria saxatilis* is considered a G3/S1 species.

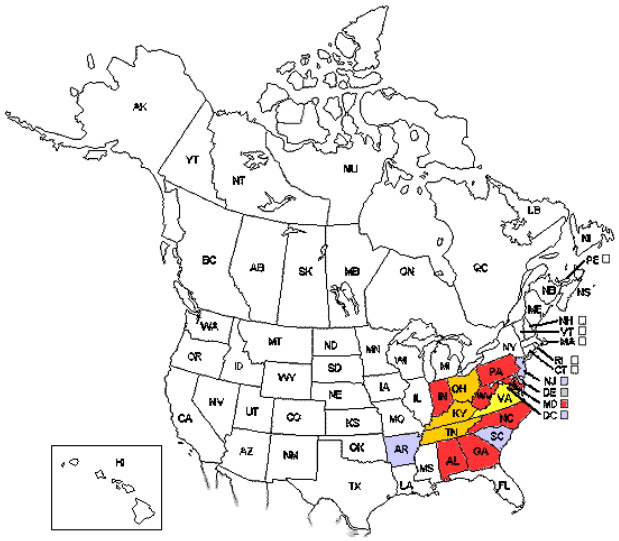

Figure 4: Range map for *Scutellaria saxatilis*, where red is S1 (critically imperiled), orange is S2 (imperiled), yellow is S3 (vulnerable), and periwinkle is SR (reported; Natureserve 2002).

The natural history of *Scutellaria saxatilis* is poorly understood. The NatureServe (2002) website, for example, does not list a refereed publication for this species. *Scutellaria saxatilis* is a woodland species, potentially confined to areas of unbroken canopy. Two small populations in Great Smoky Mountains National Park have responded positively to shrub and subcanopy clearing (Karen Rock, personal communication). Severe canopy disturbance, however, may alter the herbaceous microenvironment sufficiently to negatively impact the species. In addition, exotic competitors such as Japanese honeysuckle (*Lonicera japonica*) and stilt grass (*Microstegium vimineum*) may pose significant threats, especially following mild canopy disturbance.

Alternative 1 (No action)

Scutellaria saxatilis is most often associated with closed canopy conditions. In the absence of disturbance, habitat for this species should remain unchanged.

Action Alternative 2

This alternative proposes a two-age harvest in Stand 31-9 and a group selection in Stand 34-17B. Direct effects, produced by activities such as building the skid road and skidding the logs, could impact the *Scutellaria* populations in Stands 31-9 and 34-17B, and result in the death of individual plants. Indirect effects could result from the change in light and humidity at the forest floor. Because *Scutellaria saxatilis* is most often associated with the closed canopy conditions of mature forest, any dramatic opening of the forest may degrade the habitat and negatively impact populations of *Scutellaria saxatilis*. There is no evidence to suggest *Scutellaria saxatilis* responds positively to the extensive canopy disturbance characteristic of two-age harvests.

Populations of *Scutellaria saxatilis* adjacent to two-age harvests may respond positively to indirect effects such as the increased light in the margins of the harvests. This positive response would be short-lived, however, as the margins of the harvest stands fill with competing tree and shrub species.

Action Alternative 3

This alternative excludes the population of *Scutellaria saxatilis* in Stand 31-9 from the proposed harvest treatments. The population in Stand 34-17B, however, remains inside a group selection harvest. Direct effects, produced by activities such as building the skid road and skidding the logs, could impact this population, and result in the death of individual plants. Indirect effects could result from the change in light and humidity at the forest floor. Because *Scutellaria saxatilis* is most often associated with the closed canopy conditions of mature forest, any dramatic opening of the forest may degrade the habitat and negatively impact populations of *Scutellaria saxatilis*. There is no evidence to suggest *Scutellaria saxatilis* responds positively to the extensive canopy disturbance characteristic of two-age harvests.

Populations of *Scutellaria saxatilis* adjacent to two-age harvests may respond positively to indirect effects such as the increased light in the margins of the harvests. This positive response would be short-lived, however, as the margins of the harvest stands fill with competing tree and shrub species.

Effects of Fire

The effects of fire on this species are unknown. Because *Scutellaria saxatilis* responds positively to shrub and subcanopy clearing, however, prescribed fire that eliminates the shrub layer of the forest should improve the habitat for this species.

Cumulative Effect

No other populations have been recently disturbed by Forest Service activities.

(C) Forest Concern Species

Calamagrostis porteri

Calamagrostis porteri, Porter's reedgrass, is a tall, rhizomatous perennial in the grass family. It is distinguished from other members of the genus by the bent awn at the tip of the florets, and relatively short hairs inside the florets (Weakley 2000). In the field, the dense, spiny panicle, tinged with purple, is often distinctive. *Calamagrostis porteri* ranges from New York and the Ohio valley, through the mid-Atlantic states, and west to the Mississippi valley. It reaches its southern extent in the Appalachian mountains of Georgia. Eight states consider the species rare (Figure 5). Populations in Missouri and Arkansas are disjunct from the main range (Weakley 2000), and probably should be considered rare as well. In North Carolina, *Calamagrostis porteri* grows in six western counties, with one historical record (1981) in Transylvania County. Nantahala National Forest contains at least four populations. *Calamagrostis porteri* is considered an S1/G4 species.

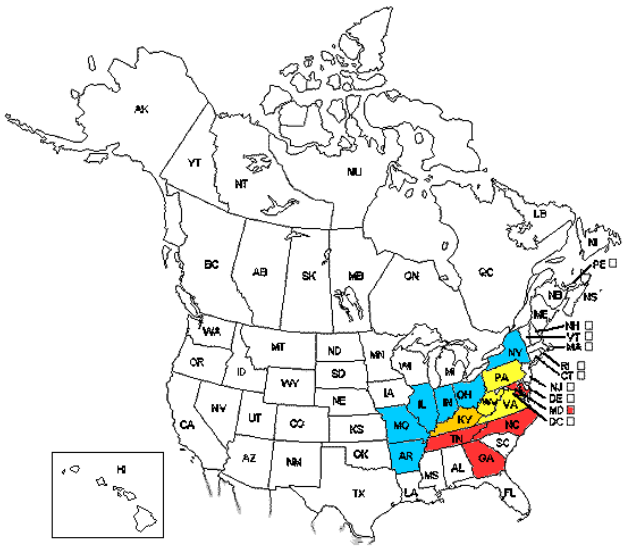

Figure 5: The range of *Calamagrostis porteri* by state, where red is S1 (critically imperiled), orange is S2 or S2S3 (imperiled), yellow is S3 (vulnerable), and blue is S? (unranked; Naturserve 2002)

Calamagrostis porteri grows in oak-hickory forests and along forests edges, often in association with mild canopy disturbance, and typically at mid- to high elevation. As a result, mild canopy disturbance such as thinning may benefit this species.

Alternative 1 (No Action)

Calamagrostis porteri is most often associated with recently disturbed forest communities. In the absence of canopy disturbance, habitat for this species may decrease.

Action Alternative 2

Calamagrostis porteri was not located in any of the proposed harvest stands. Because it forms large patches of ramets visible throughout the growing season, it is unlikely to be overlooked during the field survey. As a result, it is unlikely that populations of Calamagrostis porteri grow in any of the harvest stands. Neither the number of harvest stands nor their management prescriptions would affect any populations of this species.

Because *Calamagrostis porteri* is most often associated with recently disturbed forest communities, disturbance associated with timber management may improve habitat for this species, especially moderate levels of canopy disturbance such as thinning and group selection.

Action Alternative 3

Calamagrostis porteri was not located in any of the proposed harvest stands. Because it forms large patches of ramets visible throughout the growing season, it is unlikely to be overlooked during the field survey. As a result, it is unlikely that populations of Calamagrostis porteri grow in any of the harvest stands. Neither the number of harvest stands nor their management prescriptions would affect any populations of this species.

Because *Calamagrostis porteri* is most often associated with recently disturbed forest communities, disturbance associated with timber management may improve habitat for this species, especially moderate levels of canopy disturbance such as thinning and group selection.

Effects of Fire

The effects of fire on this species are unknown. Because *Calamagrostis porteri* appears to respond positively moderate disturbance of the overstory, any treatment that reduces midstory canopy should improve the habitat for this species.

Cumulative Effect

No other populations of *Calamagrostis porteri* have been recently disturbed by Forest Service activities. In addition, the species may respond positively to disturbance. Even if this is not the case, *Calamagrostis porteri* is fairly common in the project area, and occurs in several locations that would not undergo harvest. As a result, there are no viability concerns for this species in either the project area, or across the National Forest.

Carex hitchcockiana

Carex hitchcockiana, Hitchcock's sedge, is a short, woodland herb in the sedge family. The species is distinguished from other members of the genus by the impressed nerves on the obovate, tapered perigynia in combination with small, bristly hairs on the leaf sheaths. *Carex hitchcockiana* characteristically grows on circumneutral substrates, frequently on rocky outcrops and boulders in or near the streams of rich cove forests (Gary Kauffman, personal communication). The species is widespread throughout eastern and central North America, ranging from the Great Lakes region through the mid-Atlantic region, and as far west as the Great Plains of Nebraska, Kansas and Oklahoma. It reaches the southern extent of its range in the southern Appalachians. Eleven states consider *Carex hitchcockiana* rare, including North Carolina (Figure 6). In North Carolina, the species occurs in four western counties: Buncomb, Graham, Jackson and Macon (Amoroso 2002). The Pisgah and Nantahala National Forests contain at least four populations.

No data exist regarding the natural history of *Carex hitchcockiana*, or its response to disturbance. Gary Kauffman found *Carex hitchcockiana* gowing in the portion of Stand 34-17B common to both action alternatives.

Alternative 1 (No Action)

Carex hitchcockiana is most often associated with closed canopy conditions. In the absence of disturbance, populations of this species should remain unchanged.

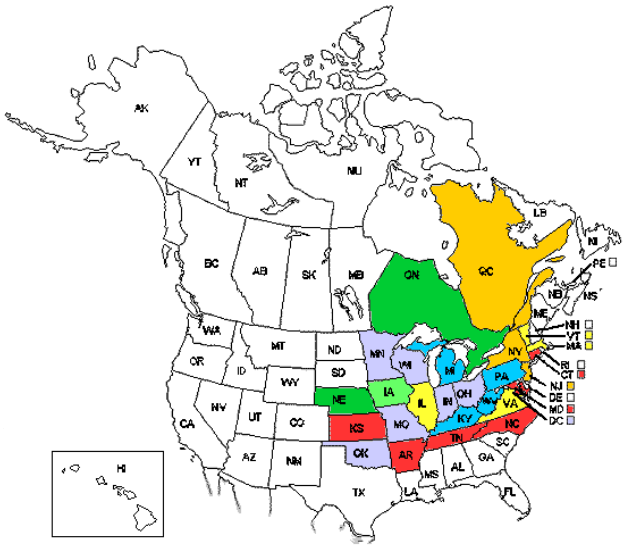

Figure 6: The range of *Carex hitchcockiana* by state, where red is S1 (critically imperiled), orange is S2 (imperiled), yellow is S3 (vulnerable), light green is S4 (apparently secure), dark green is S5 (secure), periwinkle is SR (reported from the state), and blue is S? (unranked; NatureServe 2002).

Alternative 2

This alternative proposes a group selection harvest in Stand 34-17B. Direct effects, produced by activities such as building the skid roads and skidding the logs, could impact *Carex hitchcockiana* populations, and result in the death of individual plants.

Indirect effects would result from the change in light and humidity at the forest floor. *Carex hitchcockiana* is most often associated with rocky outcrops in riparian communities. Compared to forest communities on deep soils, rocky outcrops often have thin soils that are unable to buffer the drier conditions associated with removal of the canopy. As a result, plants growing on rocks exposed by timber management are much more likely to suffer negative impacts than plants growing in adjacent communities. In addition, species adapted to the low light levels characteristic of riparian communities may be unable to adjust to higher light levels, especially in drier conditions. As a result, the indirect effects of timber management may be more detrimental for this species than the direct effects, and mitigation measures may be necessary to ensure the continued existence of the population in Stand 34-17B.

In North Carolina, *Carex hitchcockiana* is apparently confined to rich, undisturbed cove forests. A two-age or group selection harvest may alter the environment of the forest community surrounding the *Carex hitchcockiana* population sufficiently to extirpate the population. *Carex hitchcockiana* reaches the southern extent of its range in Graham County, North Carolina (Gary Kauffman, personal communication). Four populations grow in North Carolina, and the population in Stand 34-17B is separated from the next closest population by over 30 air miles. As a result, the Graham County population represents an isolated stand on the extreme edge of the species' range. Should the population become extirpated, it seems unlikely it could be re-established from neighboring populations. *Carex hitchcockiana* is also relatively rare in North Carolina, and the loss of even a single population may diminish the viability of the species across the national forest.

Action Alternative 3

This alternative proposes a two-age harvest in Stand 34-17B. In regards to *Carex hitchcockiana*, this treatment is essentially the same as Action Alternative 2. As a result, direct and indirect effects for this species should be the same as Action Alternative 2.

Effects of Fire

The effects of fire on this species are unknown. *Carex hitchcockiana* is most often found on rocky outcrops in riparian communities. These outcrops are characterized by high relative humidity and the absence of fuel. As a result, these habitats are unlikely to support a ground fire. Prescribed fire is unlikely to directly affect this species.

Cumulative Effect

No other populations have been recently disturbed by Forest Service activities.

Carex leptonervia

Carex leptonervia, the smooth wood sedge, is a short, woodland herb in the sedge family. The species belongs to a subgenus of common woodland sedges (Laxiflorae) that can be difficult to separate in the field. In the past, for example, *Carex leptonervia* has been considered a variety of both *Carex blanda* and *Carex laxiflora*, two common species in the Laxiflorae. In general, sedges in the Laxiflorae are dark-green, tufted perennials with cylindrical, erect spikes. The anterior spike is staminate, the lower spikes pistillate, and the pistillate bracts form an elongated sheath around the stem. *Carex leptonervia* is distinguished from other members of the subgenus by the absence of pronounced nerves on the perigynia. The species is widespread throughout eastern and North America, ranging from the upper Great Lakes region through the mid-Atlantic region, and west to the Mississippi River. It reaches the southern extent of its range in the southern Appalachians. It is common throughout most of its range, including parts of New York, Vermont, Maine, Michigan, Pennsylvania, Minnesota and Ohio. Eight states, however, consider *Carex leptonervia* rare including North Carolina (Figure 7). In North Carolina, the species occurs in four western counties: Buncomb, Graham, Jackson and Macon (Amoroso 2002). The Pisgah and Nantahala National Forests contain at least four populations.

Carex leptonervia occupies a diverse set of woodland habitats, often colonizing disturbed areas with damp or muck soils. In the Appalachians, it is commonly associated with damp, high elevation communities such as northern hardwood forests, coniferous forests, woodland seeps, or disturbance corridors such as abandoned roads. Because it is often found in disturbed habitats, *Carex leptonervia* probably responds favorably to moderate canopy disturbance.

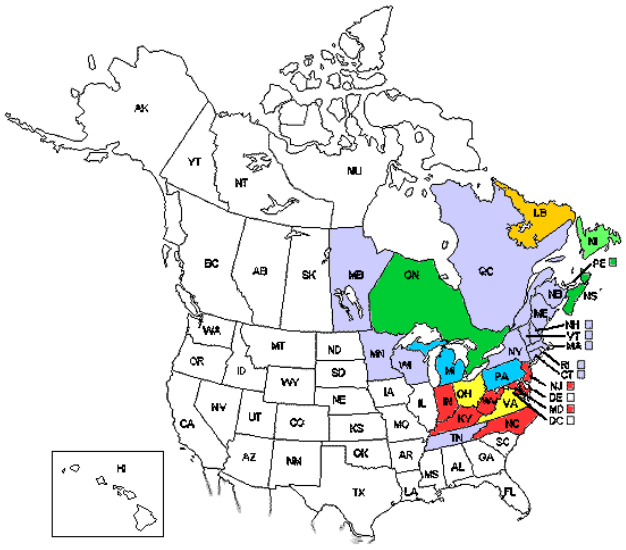

Figure 7: The range of *Carex leptonervia* by state, where red is S1 (critically imperiled), orange is S2 (imperiled), yellow is S3 (vulnerable), light green is S4 (apparently secure), dark green is S5 (secure), periwinkle is SR (reported from the state), and blue is S? (unranked; NatureServe 2002).

Gary Kauffman found *Carex leptonervia* at three locations in the project area. Two populations were associated with Stand 17-34B. One of these populations was located inside the boundaries of the stand, in portion of the stand common to both action alternatives. The second population was located outside the stand, near the western edge of the Action Alternative 2 configuration of the stand. A third population was located inside the boundaries of Stand 30-23.

Alternative 1 (No Action)

Carex leptonervia is often associated with disturbed habitats. In the absence of disturbance, habitat for this species may decrease.

Action Alternative 2

This alternative proposes a two-age harvest in Stand 30-23, and a group selection in Stand 34-17B. Direct effects, produced by activities such as building the skid roads and skidding the logs, could impact *Carex leptonervia* populations, and result in the death of individual plants. On the other hand, *Carex leptonervia* is often associated with moderate levels of canopy disturbance. Moderate disturbance, such as thinning and group selection, could improve habitat for this species by opening the canopy.

Indirect effects would result from the change in light and humidity at the forest floor. Although *Carex leptonervia* is often associated with canopy disturbance, it is also associated with wet soils. Timber management would increase amount of light reaching the soil surface, potentially decreasing soil moisture and negatively impacting the species. Two-age harvest would also produce a regeneration phase of thick saplings, increasing woody competition, and potentially eliminating populations of *Carex leptonervia*. Mild disturbance, on the other hand, may positively effect the species, especially if the disturbance occurs over existing populations on deep, wet soils such as seeps. It may be possible to mitigate, to some degree, the potential negative effects of two-age harvest by thinning the canopy over *Carex leptonervia* populations adjacent to the harvest sites.

Action Alternative 3

This alternative proposes the same harvest treatment over the population of *Carex leptonervia* in Stand 30-23, and excludes the population next to Stand 34-17B. In regards to *Carex leptonervia*, this alternative proposes essentially the same harvest treatment as Alternative 2, and would therefore produce the same affects as Alternative 2.

Effects of Fire

The effects of fire on this species are unknown. Because *Carex leptonervia* appears to respond positively moderate disturbance of the overstory, any treatment that reduces midstory canopy should improve the habitat for this species. In addition, it is unlikely that the wet soils in which Carex leptonervia often grows would support a hot fire. In general, it seems unlikely that prescribed fire would negatively affect this species.

Cumulative Effect

No other populations have been recently disturbed by Forest Service activities.

Carex purpurifera

Carex purpurifera, the purple sedge, is a tufted woodland herb in the sedge family. The species belongs to a subgenus of common woodland sedges (Laxiflorae) that can be difficult to separate in the field. In general, sedges in the Laxiflorae are dark-green, tufted perennials with cylindrical, erect spikes. The anterior spike is staminate, the lower spikes pistillate, and the pistillate bracts form an elongated sheath around the stem. *Carex purpurifera* is distinguished in the field by its flame-red base, glaucous lower stem, pistillate spikes with 7 to 11 scattered perigynia, and long-peduncled, staminate spike (Weakley 2000, Gleason & Cronquist 1991). It ranges from western Virginia and southern Ohio into Kentucky and Tennessee, and south into northern Georgia and Alabama, with recent discoveries in North Carolina. Although most common in Tennessee and Kentucky, all states that contain *Carex purpurifera* consider the species rare (Figure 8). Prior to 1987, the range of *Carex purpurifera* within North Carolina was uncertain because the species had not been separated from *Carex manhartii* (Bryson et. al. 1987). During the past seven years, all historical records in North Carolina have been resurveyed, and *Carex manhartii* appears to be more common in North Carolina than *Carex purpurifera* (Gary Kauffman, personal communication). Eleven *Carex purpurifera* populations are currently known within North Carolina, all but one of which occur on the Nantahala National Forest. Five populations occur in or near the Nantahala River Gorge. In North Carolina, *Carex purpurifera* is considered an S1/G4 species.

Carex purpurifera occurs in rich cove and montane oak-hickory community types. It frequently grows on soils derived from mafic rock. This species may benefit from partial canopy removal (Kral 1983), and small populations in the Cable Cove area appear to respond positively to canopy disturbance. The long-term response of the species to disturbance, however, is unknown. It occurs in forest communities with basal areas ranging from 40 to 100 sq. ft. per acre (Gary Kauffman, personal communication).

Carex purpurifera was not located in the project area during the field surveys. It is included in this report due to the proximity analysis.

Alternative 1 (No-Action)

Carex purpurifera is most often associated with closed canopy conditions. In the absence of disturbance, habitat for this species should remain unchanged.

Action Alternative 2

Carex purpurifera was not located in any of the proposed timber stands. Neither the number of timber stands nor their management prescriptions would affect any populations of this species. Based on the populations at Cable Cove, some canopy

disturbance may benefit this species, should populations occur within a harvest stand. The effects of two-age management on this species, however, are unknown.

Action Alternative 3

Carex purpurifera was not located in any of the proposed timber stands. Neither the number of timber stands nor their management prescriptions would affect any populations of this species. Based on the populations at Cable Cove, some canopy disturbance may benefit this species, should populations occur within a harvest stand. The effects of two-age management on this species, however, are unknown.

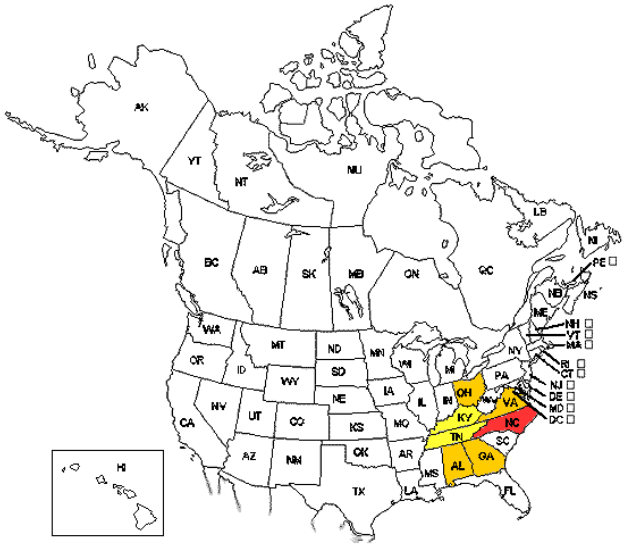

Figure 8: The range of *Carex purpurifera* by state, where red is S1 (critically imperiled), orange is S2 or S2S3 (imperiled), and yellow is S3 (vulnerable; Natureserve 2002).

Effects of Fire

The effects of fire on this species are unknown.

Cumulative Effects

For *Carex purpurifera*, four other timber sales have documented populations within the proposed activity areas (Gary Kauffman, personal communication). Three occur in the Cheoah Ranger District, the fourth in the Tusquitee Ranger District. All but one decision excluded activities surrounding the affected populations of *Carex purpurifera*. The other activity thinned around a portion of the *Carex purpurifera* population. This population appeared robust one year after the treatment (Gary Kauffman, personal communication). As a result, there should be no cumulative loss of viability for *Carex purpurifera* across the Forest with implementation of the action alternatives.

Trientalis borealis

Trientalis borealis, the northern starflower, is a short, woodland herb in the primrose family. The white, solitary flowers are borne at the top of the plant on a slender stalk, and typically contain seven petals (Weakley 2000). The leaves are displayed in a single whorl in the middle of the plant. *Trientalis borealis* is widespread and common throughout the northeast and midwest regions of the United States, the subartic region of Canada, and the west coast of North America. It reaches the southern extent of its range in the Appalachians of Georgia. A northern species widespread in the mountains of Virginia, *Trientalis borealis* was first located in North Carolina in 1988 (Weakley 2000, Dellinger 1989). Six states consider it rare, including North Carolina (Figure 9). In North Carolina, *Trientalis borealis* occurs in three western counties: Graham, Cherokee and Haywood (Amoroso 2002). Nantahala National Forest contains at least two populations.

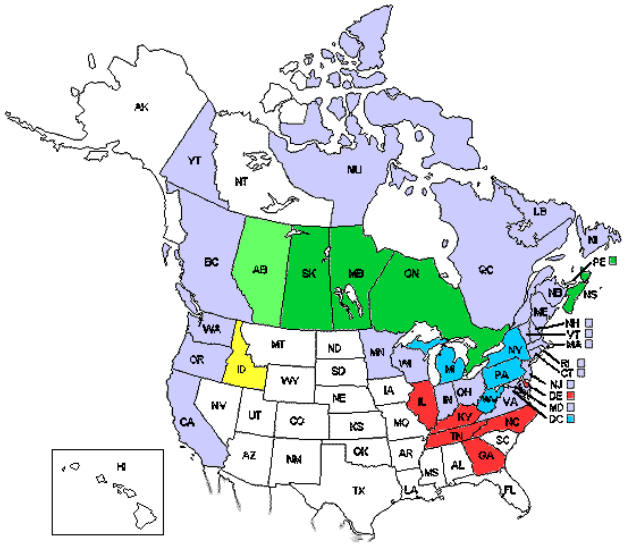

Figure 9: The range of *Trientalis borealis* by state, where red is S1 (critically imperiled), yellow is S3 (vulnerable), light green is S4 (apparently secure), dark green is S5 (secure), periwinkle is SR (reported from the state), and blue is S? (unranked; NatureServe 2002).

Trientalis borealis characteristically grows in northern hardwood and rich cove forests, often in second growth communities (Weakley 2000). As a result, canopy disturbance may benefit this species.

Trientalis borealis was not located in the project area during the field surveys. It is included in this report due to the proximity analysis.

Alternative 1 (No Action)

In so far as the species depends upon canopy openings, mild disturbance may benefit the species. In the absence of disturbance, the habitat for this species may diminish.

Action Alternative 2

Trientalis borealis was not located in any of the proposed timber stands. Neither the number of timber stands nor their management prescriptions would affect any populations of this species. Some canopy disturbance may benefit this species, should populations occur within a harvest stand. The effects of two-age management on this species, however, are unknown.

Action Alternative 3

Trientalis borealis was not located in any of the proposed timber stands. Neither the number of timber stands nor their management prescriptions would affect any populations of this species. Some canopy disturbance may benefit this species, should populations occur within a harvest stand. The effects of two-age management on this species, however, are unknown.

Effects of Fire

The effects of fire on this species are unknown.

Cumulative Effect

No other populations have been recently disturbed by Forest Service activities.

(2) Biodiversity & Old Growth

No rare communities are located within the proposed activity areas.

The proposed Hazanet project area lies in Administrative Watershed 9, which encompasses the lower drainage of the Cheoah River, from Wauchecha Bald, Santeetlah Dam and Saddle Tree Gap north to Fontana Lake. This 50,286 acre watershed contains 25,663 acres of National Forest land.

The Land and Resource Management Plan (LRMP) requires the National Forest to designate old growth restoration forest. Designated old growth areas on the Nantahala and Pisgah National Forests currently encompass 205,081 acres (Table 5). These designations can be placed into one of three categories, based on areal extent: large patches, medium patches, and small patches. Large patches contain at least 2500 contiguous acres, and are distributed according to administrative watersheds. Thirty-four large patches, totaling 178,000 acres, have been designated across the National Forest. The large patch in Watershed 9 is the Joyce Kilmer/Slick Rock Wilderness.

In watersheds containing at least 2500 acres of national forest land, but without the contiguous old growth forest necessary for a large patch, the forest plan requires the designation of a medium patch. The medium patch must contain a minimum of five percent of the national forest land in the watershed. Thirteen medium patches, totaling

13,100 acres, have been designated across the National Forest. Because it contains a portion of a large patch, no medium patch is required in Watershed 9.

In each compartment containing at least 250 acres of national forest land, but without a large or medium patch, the forest plan requires the designation of a small patch. Small patches must be at least 50 acres or five percent of the acreage in the compartment. Approximately 300 small-sized patches, totaling 13,800 acres, have been designated by compartment across the National Forest. Small patches must be designated prior to any ground-disturbing activities in the compartment. To meet LRMP direction for small-sized patches, the Hazanet project proposes that seven stands be designated as small-sized, old growth patches, as listed below.

By compartment, the following stands are proposed for designation as small patches of old growth forest:

Compartment 25. One stand, approximately 74 years old, encompassing 53 acres of yellow pine - oak forest in Stand 18. The stand is adjacent to Highway 129, and would protect visual resources in the Cheoah River corridor.

Compartment 26. One stand, approximately 108 years old, encompassing 52 acres of oak - hickory forest in Stand 1. The stand is the oldest timber in the compartment. It occupies a south-facing, high elevation cove on the western edge of the compartment.

Compartment 27. Two stands (50 total acres), ranging in age from 58 to 88 years: eleven acres of yellow pine - oak forest in Stand 10, and 39 acres of oak - hickory forest in Stand 11. The stands occupy the ridge and south-facing slopes of Walker Gap on the northern edge of the compartment, and would partially protect the Appalachian Trail corridor.

Compartment 28. Three stands (53 total acres), ranging in age from 65 to 90 years: 24 acres of oak - hickory forest in Stand 4, thirteen acres of oak - hickory forest in Stand 5, and sixteen acres of rich cove forest in Stand 13. The stands occupy the ridge and south-facing slopes of High Top on the northern edge of the compartment, and would partially protect the Appalachian Trail corridor.

Compartment 29. One stand, approximately 73 years old, encompassing 102 acres of oak - hickory forest in Stand 11. The stand occupies the ridge from Yellow Creek Gap to Cody Gap, and would partially protect the Appalachian Trail corridor.

Compartment 30. One stand, approximately 75 years old, encompassing 60 acres of acidic cove forest in Stand 3. The stand occupies the east-facing slope above Bee Creek. It is one of the few old growth stands at low elevation in the timber sale, and is the only small patch designation in the Hazanet proposal that protects acidic cove forest.

Table 5: **Proposed old growth acreage in small patches in the Hazanet Project, compared to total acreage in the National Forest, and previously designated old growth on the National Forest.**

Ecological Zone	Total NF Acres	Percent of NF Acres	Total NF Old Growth Acres	Percent Old Growth Acres	Water-shed 09 NF Acres	Percent of NF Acres	Pro-posed Old Growth Acres	Percent Old Growth Acres
Spruce Fir Forest	14788	2%	6075	3%	0	0%	0	0%
Rich Cove Forest	107524	11%	25201	12%	3882	15%	16	2%
Acidic Cove Forest	174566	17%	37632	19%	7159	31%	60	9%
Shortleaf Pine - Oak Heath	10193	1%	787	0%	6	0%	64	10%
Xeric Pine - Oak Heath	167550	17%	46320	23%	8069	31%	60	9%
Chestnut Oak Heath	8605	1%	1337	1%	2	0%	0	0%
High Elevation Red Oak Forest	40571	4%	15153	7%	67	0%	0	0%
Northern Hardwood Forest	52093	5%	18685	9%	585	2%	0	0%
Dry-Mesic Oak-Hickory Forest	21766	2%	4044	2%	8	0%	0	0%
White Pine - Oak Heath	17620	2%	2092	1%	41	0%	0	0%
Mesic Oak-Hickory	283340	28%	43682	21%	5844	23%	464	70%
Other Community Types	127873	11%	2320	1%	0	0%	0	0%
Total	103053		205081		25663		664	

Compartment 31. One stand, approximately 88 years old, encompassing 50 acres of oak - hickory forest in Stand 4. The stand occupies the north-facing slope above Foster Cove, and lies adjacent to Stand 7, Compartment 34. Stand 4 contains the largest contiguous block of old growth timber in the compartment.

Compartment 32. Three stands, ranging in age from 52 to 122 years old: 52 acres of oak - hickory forest in Stand 3, five acres of oak - hickory forest in Stand 4, and 20 acres of oak - hickory forest in Stand 5. Stand 3 occupies the north-facing slope of Cochran Peak, and contains some of the oldest timber in the compartment. Stand 4 lies adjacent to Stand 1, Compartment 33, and contains some of the oldest timber in the compartment. Stand 5 occupies the north-facing slope of Cochran Peak and lies adjacent to Stand 3.

Compartment 33. Two stands, ranging in age from 97 to 117 years: 48 acres of oak - hickory forest in Stand 1, and 19 acres of oak - hickory forest in Stand 18. Stand 1 occupies the north-facing slope of Cochran Ridge in the northwest corner of the compartment, and contains the oldest timber in the compartment. Stand 18 also occupies the north-facing slope of Cochran Ridge, and lies adjacent to Stand 1.
Compartment 34. One stand, approximately 93 years old, encompassing 62 acres of oak - hickory forest in Stand 7. The stand occupies the south-facing slope of the ridge above Cochran Creek, and lies adjacent to Stand 4, Compartment 31. Although Stand 7 does not contain the oldest timber in the compartment, it contains old growth timber that, in combination with Stand 4, Compartment 31, forms a 102 acre patch across the top of the ridge.

Compartment 35. Two stands, both approximately 73 years old: 36 acres of xeric (pitch) pine - oak forest in Stand 7, and 22 acres of oak - hickory forest in Stand 8. The two stands occupy a south-facing slope in the upper drainage of Gladdens Creek. Stand 7 would protect pitch pine - oak forest, an unusual community type in the analysis area. Stand 8 is necessary to meet the LRMP direction for the minimum size of small patches.

The proportion of old growth communities in designated patches was compared to the proportion of forest communities in the both the National Forest as a whole and the proportion of forest communities in Watershed 9 (Table 5). Four ecological zones (spruce-fir forest, northern hardwoods forest, xeric pine-oak and oak heath, and high elevation red oak forest) are over-represented in the current old growth designation -- meaning, they occupy a substantially greater percentage of the designated old growth patches than they occupy on the National Forest as a whole. Two zones (mesic oak-hickory forest and shortleaf pine-oak heath) have been under-represented in the current old growth designation. To offset some of these discrepancies, the Hazanet project proposes to designation a relatively high percentage of mesic oak-hickory and a relatively small percentage of xeric pine-oak forest as small patches of old growth forest.

(3) Effects of Fire

The natural incidence of fire in the southern Appalachians is poorly understood (Barden and Woods 1974). Historical evidence of fires in the early twentieth century indicates that large fires were more common during below-average precipitation years (Harmon 1982). Rainfall dampens the leaf litter and diminishes the spread of fire if a lightning strike should ignite the vegetation. These lightning sets do occasionally smolder in hollow trees, however, and reignite the surrounding litter once it dries (Martin 1991). This was the mechanism behind two recent lightning strike fires in the Great Smokies Mountains National Park and Pisgah National Forest. In addition to natural fire, Native Americans and early European settlers frequently set fires (Williams 1998, Harmon 1984, Barden and Woods 1973). A study of fossil pollen and charcoal by Delcourt and Delcourt (1998) concluded fires set by prehistoric Native American increased the percentage of oak and chestnut in forest communities

Based on survey work and the ecological zone models, most of the proposed burn area is dominated by some form of oak forest. Fire appears to be especially important in forest communities dominated by oak and hickory. Various researchers believe oaks need recurrent fire for their long-term stability and regeneration (Lorimer 1985, Abrams 1992). Oak and oak-hickory communities do not regenerate exclusively by tree fall gap disturbance patterns (Peet and Christensen 1987). Fire may have a beneficial influence on oaks by reducing competition from fire-sensitive species (Lorimer 1985).

Fire disturbance may also play a direct role in selecting against mesic hardwoods. Communities across the Chattooga River watershed appear to be changing from oak dominance to more shade tolerant red maple, black birch and blackgum (Bratton and Meier 1998). Historical records and analysis of current canopy trees of old growth forest indicate fire was a dominant force in the watershed during early European settlement (Meir and Bratton 1996). Since the time of fire suppression in the Great Smoky Mountain National Park, however, *Quercus montana* has experienced poor regeneration (Harrod, *et al.* 1998).

As a result, oak-hickory forests communities are probably fire dependent, and would change composition unless managed with prescribed burning. Given the uncertain role of fire in the landscape, any fire management scheme should be monitored to determine the effects of fire on community structure and composition.

The proposed burn area may impact acidic cove forest at lower elevation. The higher humidity in these communities, combined with the backing movement of the fire off the surrounding ridges, should result in a patchy ground fire. Fire impacts should be minimal within the heavy evergreen shrub layer of the acidic cove forest. A previous stand-replacement fire in the Wine Spring area, designed to regenerate a declining pine-oak/heath community, resulted in a mosaic of fire intensities (Vose, *et al.* 1997). Only a low-intensity litter fire was carried in the cove forest along the south facing draws of Indian Camp Branch, and the fire did not carry across much of the northwest-facing slope with heavy *Rhododendron maximum* cover (Gary Kauffman, personal observation). The acidic cove community surrounding the riparian zone should be impacted the least of any

community because high relative humidity and constantly damp *Rhododendron* leaf litter should quickly extinguish any fire.

(4) Invasive Plant species

Exotic introduced species are a problem throughout the southern Appalachians (Bowen 1996), and a major ecological problem worldwide (Williamson 1996). A list of the most invasive species within the Pisgah and Nantahala National Forest lands includes the following plant species: *Pueraria lobata, Rosa multiflora, Microstegium vimineum, Ligustrum sinense, Lonicera japonica, Miscanthus sinensis, Celastrus orbiculata, Spiraea japonica, Ailanthus altissima, Paulownia tomentosa, Dioscorea oppositifolia, and Albizia julbrissin*. While other exotic species, such as *Vinca minor* or *Hedera helix*, are also widely dispersed in the Forest, they are not as invasive as the listed species, and therefore have less of an impact on plant communities.

In many cases, exotic plants hold a competitive edge over native plants because their natural enemies present in their native lands are not present here. The most invasive species are capable of dispersing rapidly and producing copious numbers of propagules. They also have the potential to overtake native vegetation, particularly in areas of recent disturbance. Ground disturbance and increased light conditions to the forest floor that results from timber harvest, road construction and reconstruction contribute to more suitable acreage for invasive exotic species.

Preliminary occurrence data for some invasive exotic species have been recently compiled from field survey notes on the Nantahala and Pisgah National Forest. Over 1050 communities were analyzed on the Nantahala and 220 on the Pisgah National Forest. *Microstegium vimineum* was present on 16% of the Nantahala sites and 12% of the Pisgah sites. A second invasive species, *Lonicera japonica*, was present on 12% of the Nantahala sites and 10% of the Pisgah sites. Both species occur frequently in mesic sites, although *Lonicera japonica* has a greater tolerance for drier sites. The species were most frequent on sites below 2500 feet in elevation.

Although fire is often used to reduce the influence of invasive plant species, fire may increase certain species adapted to fire regimes. For example, a fire study in the Great Smoky Mountains National Park has detected an increase in *Paulownia tomentosa* in some burned areas (Gary Kauffman, personal communication). In addition, surveys conducted during 2001 in the Steels Creek area and across the Linville rim in Burke County have detected a profusion of *Paulownia tomentosa* seedlings since a wildfire swept across the area in the fall of 2000. For some of these sites the closest mature *Paulownia* tree was one mile away. *Paulownia* trees, while not in the Hazanet proposed activities areas, are present along Highway 129, and their small, and their light seeds could be blown into the proposed activity areas.

In the project area, the most invasive species are *Microstegium vimineum* and *Lonicera japonica*. *Microstegium vimineum* is common on old logging roads in mesic sites.

Lonicera japonica can be common is edge habitats and disturbed forest communities. The proposed harvest activities would most likely result in an increase in *Lonicera japonica* and *Microstegium vimineum* in the short term. With increasing development of small tracts in the lower elevations of the project area, both species should increase in the surrounding landscape. It is not known how long these species would persist following harvest and the closure of the overstory canopy.

The no-action alternative is less likely to facilitate the spread exotic species in the forested areas than either of the action alternatives. Both action alternatives consist of relatively small harvest areas (< 40 acres), a management technique that maximizes edge habitat in proportion to the total area of the harvest. Alternative 3 would create approximately 26.1 miles of edge habitat in forested communities, while Alternative 2 would create approximately 27.5 miles of edge habitat. Alternative 3 would also involve the construction or reconstruction of approximately 1.95 miles of system road and 1.6 miles of temporary road. Alternative 2 would involve the construction or reconstruction of approximately 1.95 miles of system road and 2.3 miles of temporary road. As a result, the Alternative 3 would create approximately 5% less forest edge habitat and approximately 30% less road edge habitat than Alternative 2.

VI. CONSULTATION HISTORY

No federally listed plant species was found in the proposed activity area. No suitable habitat for these species was located in the proposed activity area. Consultation with the US Fish & Wildlife Service is not necessary.

VII. DETERMINATION OF EFFECT

The two action alternatives of the Hazanet Timber Sale would have no effect on any federally-listed plant species (Table 6). Consultation with the U. S. Fish and Wildlife Service is not required.

The action alternatives may impact individuals of the sensitive species *Euphorbia purpurea, Helianthus glaucophyllus* and *Scutellaria saxatilis*, but are not likely to cause a loss of viability or a trend to federal listing. The action alternatives would not impact any other sensitive plant species. There would be no cumulative effects on any sensitive plant species from the activities associated with the action alternatives.

The action alternatives may negatively impact individuals of the forest concern species *Carex hitchcockiana* and *Carex leptonervia*, but would not affect the viability of any of these species across the National Forest (Table 7), providing the mitigation measure listed in Section VIII is implemented. The action alternatives would not impact any other forest concern plant species. There would be no cumulative effects on any forest concern plant species from the activities associated with the action alternatives.

VIII. MITIGATION MEASURES

1. Exclude an area of approximately one acre along an unnamed tributary of Cochran Creek containing the population of *Carex hitchcockiana* in Stand 34-17B from the two-age and group selection harvests.

Table 6: Determination of effect of each alternative on the evaluated threatened and endangered species and sensitive species.

Species	Alternative 1	Alternative 2	Alternative 3
Federally Threatened and Endangered Species			
Spiraea virginiana	no effect	no effect	no effect
2002 Region 8 Regional Forester's Sensitive Species List			
Euphorbia purpurea	no impact	may impact individuals but not likely to cause a trend to federal listing or a loss of viability	may impact individuals but not likely to cause a trend to federal listing or a loss of viability
Helianthus glaucophyllus	no impact	may impact individuals but not likely to cause a trend to federal listing or a loss of viability	may impact individuals but not likely to cause a trend to federal listing or a loss of viability
Hydrothyria venosa	no impact	no impact	no impact
Megaceros aenigmaticus	no impact	no impact	no impact
Scutellaria saxatilis	no impact	may impact individuals but not likely to cause a trend to federal listing or a loss of viability	may impact individuals but not likely to cause a trend to federal listing or a loss of viability

Table 7. Determination of effect of each alternative on the evaluated forest concern plant species.

Species	Alternative 1	Alternative 2	Alternative 3
Nantahala National Forest Species of Forest Concern			
Calamagrostis porteri	no impact	no impact	no impact
Carex hitchcockiana	no impact	may impact individuals but not likely to cause a trend to federal listing or a loss of viability	may impact individuals but not likely to cause a trend to federal listing or a loss of viability
Carex leptonervia	no impact	may impact individuals but not likely to cause a trend to federal listing or a loss of viability	may impact individuals but not likely to cause a trend to federal listing or a loss of viability
Carex purpurifera	no impact	no impact	no impact
Trientalis borealis	no impact	no impact	no impact

IX. LIST OF PREPARERS

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Date:

March 14, 2003

WILDLIFE RESOURCE REPORT

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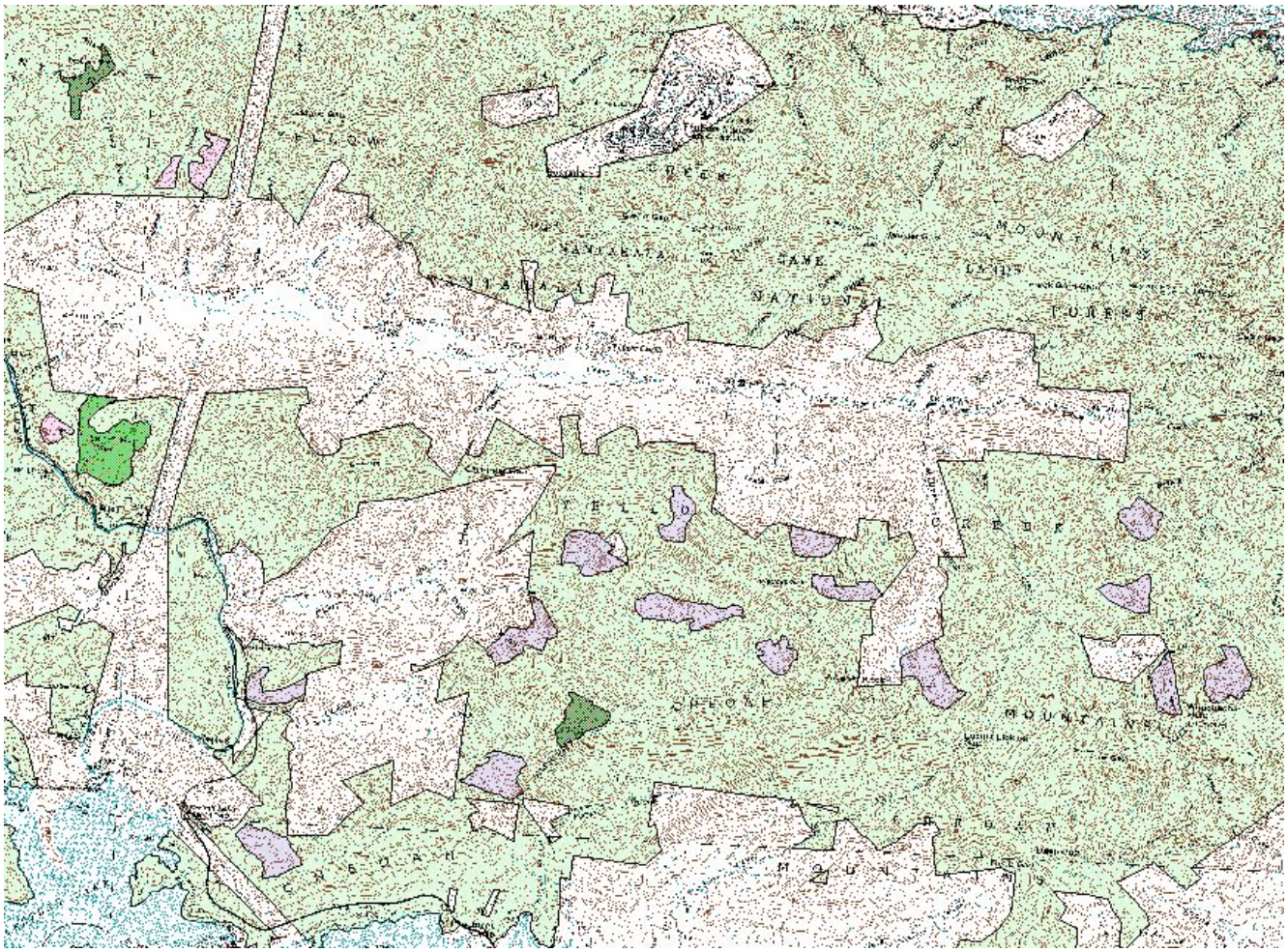
1. TERRESTRIAL WILDLIFE COMMUNITY LEVEL EVALUATION

1.1 Existing Condition

The proposed project is a timber sale and associated activities in the Cheoah Mountains of Graham County, between the town of Tuskeegee and Lake Santeetlah. The analysis area for this project includes compartments 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, and 35. About 60% of the area (7,574 acres) is National Forest land. The lower elevations along Yellow Creek, Cochran Creek and Gladdens Creek are privately owned. The National Forest land is predominantly cove hardwoods (3303 acres), and upland hardwoods (1861 acres), with smaller amounts of white pine, hardwood/pine and pine/hardwood forest types. Most of the white pine dominated stands are in the lower elevation areas at the western end.

Figure 1. Project vicinity map. Alternative 3. Two-aged regeneration units are shown in pink, group selection units and thinnings are shown in dark green.



The project area is south of the Great Smoky Mountains National Park and east of the Joyce Kilmer/Slickrock Wilderness Area. Potential barriers to animal movement into or out of the area include Yellow Creek to the north, the town of Tuskeegee to the east, the town of Robbinsville to the south, and U.S. 129 and the Cheoah River to the west. Large, mobile land animals, such as black bear, may access the area from the north through the relatively isolated forest in the vicinity of the Appalachian Trail at Yellow Creek Gap.

The area has a very limited amount of early successional habitat and younger age classes. Openings are needed to provide age-class diversity in this area and improve habitat quality for wildlife. Species that would benefit from the creation of openings include black bear, eastern wild turkey, white-tailed deer, and ruffed grouse, which find tender browse, fruit and hiding cover in dense young stands. Neotropical migratory birds such as chestnut-sided and golden-winged warblers also breed in these regeneration openings. There are few young stands of upland hardwoods and almost no young stands of cove hardwoods. Regenerating cove stands would benefit the area and have less effect on hard mast production. Regenerating upland hardwood stands would provide for future hard mast production. Standards in the Forest Land and Resource Management Plan

(FLRMP) specify that no more than 10% of MA 4A and 15% of MA 3B be in early successional habitat (0-10 years old) at any one time.

Early successional habitat is currently lacking in eight of the 11 compartments, and would soon be lacking in the other three. Grass-forb brood habitat is lacking. Hard mast production may be limited in the four compartments (25, 26, 33, 35) with a significant component of white pine dominated forest types. In particular, about 50% of compartment 33 is dominated by white pine. There are no upland hardwood stands younger than 40 years in these compartments. It would be beneficial to emphasize the regeneration of hard mast-producing hardwoods in these areas to benefit wildlife. Both of the main access roads are closed year-round, so the open road density is very low across the project area.

Compartments 26, 27, and 28 to the north are in the Yellow Creek Mountains. The area is dominated by upland hardwoods (99%), with a few areas of pitch pine and white pine. This area is in MA 4C and has no young stands less than 20 years. This is designated to provide a portion of a Forest Interior Breeding Bird Habitat Area, described in the Forest Plan.

Compartments 29 and 30 to the east are in the Cheoah Mountains. This includes the higher elevations of the project area near Wauchecha Bald. The area is dominated by cove hardwoods (53%), with 29% in upland hardwoods and a small amount of northern hardwoods (5%). There is 239 acres in 0 to 20 year old stands, which is about 11% of the area.

Compartments 31, 32 and 34 are in the central section, which is dominated by cove hardwoods (61%). There are 137 acres of 10 to 20 year old stands, which is about 9% of the area.

Compartments 25, 33 and 35 to the west are at lower elevations along the Cheoah River. This area has a much larger pine component (52% of the area is pine dominated forest types) than the other areas. About 21% of the area is dominated by upland hardwoods, and 27% by cove hardwoods. There are 421 acres in 0 to 20 year old stands, which is about 19% of the area.

Populations of eastern wild turkey are limited by the availability of grass-forb habitat for young broods. In most of the project area compartments, wild turkey is a management indicator species. The desired density of grass-forb habitat is at least 3% in these areas.

Many species of wildlife in the southern Appalachians are dependent on hard mast production, with populations rising and falling in relation to good and poor mast years. Forest management that provides a diversity and abundance of hard mast producing trees would benefit wildlife. The hard mast capability model provides a numerical description of the project area incorporating both age-class and forest-type diversity. Areas dominated by mature upland hardwoods would receive a higher rating. Areas dominated by cove hardwoods and pines would rate lower. Mixed stands rate in the middle. Special

efforts should be made to regenerate and/or retain hard mast producing trees in areas rated at less than 150 lbs per acre.

Old growth is most beneficial to wildlife when it contains large diameter den trees that are not subject to human disturbance. Designated old growth should be well distributed and located on good sites that are not easily accessible to humans. Standards in the FLRMP specify that the density of open roads should be less than 0.50 miles per square mile in MA 3B and less than 0.25 miles per square mile in MA 4A. Limiting the density of open roads is meant to provide areas free from disturbance of motorized vehicles for species such as black bear and eastern wild turkey. In areas of high open road density, these species are subjected to greater hunting pressure than desired, and enforcement of hunting regulations is more difficult. With no open roads in the project area, the desired condition for
eastern wild turkey and black bear habitat is being met in this area.

Riparian areas should provide large diameter den trees and small trees for wildlife food and cover. Where these trees are lacking, extensive rhododendron coverage can prevent any new trees from becoming established. The desired condition is to provide high quality riparian areas by reducing rhododendron coverage where needed and establishing young hardwood trees.

Alternatives

Alternative 1 would result in no action.

Alternative 2 would regenerate 349 acres by the 2-age method over twelve units. Group selection harvest would be done on 213 acres. Forty acres would be slashed, burned, and planted shortleaf pine. An additional 99 acres would be thinned. Pre-harvest treatments and vine control prior to regeneration harvesting would be conducted on 562 acres. Additional vine control would be conducted on another 254 acres. Timber stand improvement work would be done on 260 acres. Helispots would be developed in stands 35/15, 26/8, 26/14, and 27/4 or 9. These activities would require about three miles of road construction and 0.6 mile of road reconstruction. About 351 acres would be prescribe burned for wildlife habitat improvement. Ten vernal pools would be created for wildlife habitat improvement.

Alternative 3 would regenerate 427 acres by the 2-age method over fifteen units. Group selection harvest would be done on 72 acres. Forty acres would be slashed, burned, and planted to shortleaf pine. An additional 50 acres would be thinned. Pre-harvest treatments and vine control prior to regeneration harvesting would be conducted on 407 acres. Additional vine control would be conducted on another 214 acres. Timber stand improvement work would be done on 255 acres. Helispots would be developed in stands 35/15, 26/8, 26/14, and 27/4 or 9. These activities would require about three miles of road construction and 0.6 mile of road reconstruction. About 351 acres would be prescribe burned for wildlife habitat improvement. Ten vernal pools would be created for wildlife habitat improvement.

1.2 Effects of alternatives

Management Indicator Species

Most of the project area is designated as management area 3B (MA 3B), where forest-wide direction is to provide habitat conditions for species such as eastern wild turkey, ruffed grouse, white-tailed deer, and travel corridors and foraging habitat for black bear. Standards for MA 3B are to provide at least 5% and no more than 15% in early successional habitat, and a minimum of 0.5% and a desired density of 3% in permanent grass-forb openings. A significant portion of the area is in MA 4C, (not suitable for timber management), where direction is to emphasize visual quality in all activities.

Table 1. Known and potential management indicator species evaluated for this project.

Eastern wild turkey (*Melagris gallapavo*)	bird	hard mast, soft mast, grass/forb	likely to occur
Ruffed grouse (*Bonasa umbellatus*)	bird	hardwood saplings	likely to occur
White-tailed deer (*Odocoileus virginianus*)	mammal	hard mast, browse, grass/clover	may occur
Black bear (*Ursus americanus*)	mammal	hard mast, soft mast, dens	may occur

Forest interior dependent species would find some suitable habitat in the project area. The landscape as a whole is about 86% forested, and a relatively small amount of edge habitat would be created by management activities. The best quality forest interior habitat is provided by the Forest Interior Breeding Bird Habitat Areas distributed across the Forest. One of these habitat areas includes compartments 26, 27 and 28, on the north side of the project area. The criteria for this area is stands must be greater than 40 years old, with a minimum basal area of 60 square feet, breaks in the canopy cannot exceed 100 feet, and all portions of the area should be greater than ½ mile in width.

This habitat area (which includes portions of compartments 23, 24, and 119) currently provides only 1908 acres that meet the criteria for forest interior habitat. The desired acreage is for a contiguous 2500 a. patch. The proposal to create helispots in stands 26/8, 26/14, and 27/4 or 9 would further reduce the size of this Forest Interior Breeding Bird Habitat Area by creating openings in the canopy greater than 100 feet in diameter. Due to the location of these openings, the resulting Habitat Area would be about 1044 acres in size.

Other than stream crossings, riparian areas would not be affected in any alternative. None of the activity areas are within the 100 ft. riparian management area.

Direct and Indirect effects**:**

The current open road density in the project area is 0 miles of open road per square mile. This density meets habitat objectives for eastern wild turkey and black bear. Open road density would not change in any alternative.

The existing barriers to animal movement across the landscape would not be affected by the action alternatives. The most likely movement corridor at Yellow Creek Gap would not be affected. Existing regeneration areas would be replaced with new areas in the action alternatives. Only the no action alternative would result in a significant change in habitat conditions.

The action alternatives are likely to result in direct mortality of wildlife. Direct effects from crushing are possible for any alternative that uses heavy equipment for ground disturbing activities. Road building and harvesting activities would undoubtedly result in direct mortality of some species. While large animals may escape harm, insects, arachnids, molluscs, amphibians, reptiles and bird nests would be affected. About 424 acres may eventually be affected by all project activities, but this is only about 13% of the analysis area. These common animals would readily reoccupy disturbed areas, if the habitat remains suitable. Other animals, such as salamanders, require moist conditions and may initially disappear from regenerated stands, but would return quickly once the litter has reformed.

As long as project activities do not result in direct mortality of very rare species or a loss of specialized habitats, there would not be a significant decline in populations of any species in the analysis area. Effects to rare species and specialized habitats are addressed in another section of this report.

Regeneration activities would result in some new habitat for early-successional associates and less habitat for mature forest associates. The creation of new regeneration areas would provide some suitable habitat for neotropical migratory birds of management concern, such as the chestnut-sided warbler and the golden-winged warbler. These areas would also provide soft mast for use by bear, deer, turkey, and other species. When this habitat is provided on private lands it is often not utilized due to human disturbance.

Eastern wild turkeys require large areas moderately free from the disturbance of motorized vehicles and intensive timber harvesting. The main effect of these alternatives on wild turkey would be due to the potential effect on hard mast production and the increase in grass-forb habitat. Desired habitat conditions are; open road density less than 0.5 miles per square mile over 5 square miles, 20 acres of grass/forb brood habitat per square mile, early successional habitat more than 5%, but less than 15% per square mile, and a minimum of 150 pounds per acre of hard mast production per square mile. These desired habitat conditions would be provided by the action alternatives, due to the creation of new regeneration and grass/forb habitat.

This species utilizes a variety of habitat types and benefits from a diverse forest landscape. The creation of new regeneration areas would provide new early successional habitats to replace the stands that are maturing into young pole timber stands. Across the

Forest, habitat for this species has declined in recent years with the decreasing amount of regeneration activities. Although some brushy areas are created from the loss of mature pine trees due to the southern pine beetle, and some habitat may be created from prescribed burns and wildfire, this probably does not compensate for the lack of active management.

Across the Forest, wild turkey populations have also increased due to factors other than habitat management. The dramatic population growth of the eastern wild turkey in recent years is due to the restocking programs of the North Carolina Wildlife Resources Commission. This species is just now occupying the available habitat. As populations increase, the lack of active management across the Forest would increasingly constrain population levels.

Ruffed Grouse is strongly associated with mid-successional (5 to 20 years) forest habitats characterized by thick, shrubby growth. Ruffed grouse often uses downed woody debris of various sizes for drumming. The creation of new regeneration areas would provide new early successional habitats to replace the stands that are maturing into young pole timber stands. The availability of grass/forb habitat on seeded roads improves the quality of the existing habitat. Four prescribed burns are proposed for wildlife habitat improvement, totaling 345 acres. This may also improve grouse habitat by stimulating shrubby growth. In addition to the timber harvest units, grapevine control is proposed for 469 acres. Grape slicks would be left at the rate of one acres for every 25 acres treated in order to limit the adverse effect of this activity on ruffed grouse habitat.

Across the Forest, habitat for this species has increased recently as previously cut stands entered the suitable age classes. With the decreasing level of timber harvest, habitat for this species would be greatly reduced in the near future. There are few young stands available to replace existing habitat.

White-tailed Deer is associated with both early successional habitat and hard-mast production. The species uses stems and leaves of woody and herbaceous green plants, fungi and fruits. Deer require hard mast for reproductive success and subsequent fawn survival. Grass/forb plantings can help to buffer the effects of poor mast crop. The creation of new regeneration areas would provide new early successional habitats to replace the stands that are maturing into young pole timber stands. Hard mast production may be limited in the four compartments (25, 26, 33, 35) with a significant component of white pine dominated forest types. In particular, about 50% of compartment 33 is dominated by white pine. There are no upland hardwood stands younger than 40 years in these compartments. It would be beneficial to emphasize the regeneration of hard mast-producing hardwoods in these areas to benefit wildlife.

Across the Forest, white-tailed deer populations are stable to slightly increasing. While hard mast capability has increased in recent years, the amount of early successional habitat has declined. Grass/forb planting have probably not increased significantly. Within the range of deer densities and overstory conditions that exist on public lands in

the Southern Appalachians, timber harvesting is not likely to significantly improve the nutritional quality of the winter diet of deer.

Black bears require large areas free from disturbances of motorized vehicles, frequent human activity, and intensive timber harvesting. Bears in much of the eastern United States depend on hard mast for the energy needed for reproduction and hibernation. A bears' home range would increase as the amount of area in regeneration increases, resulting in greater rates of mortality. This species utilizes a variety of habitat types and benefits from a diverse forest landscape. The creation of new regeneration areas would provide new early successional habitats to replace the stands that are maturing into young pole timber stands. Across the Forest, habitat for this species has declined in recent years with the decreasing amount of regeneration activities. Although some brushy areas are created from the loss of mature pine trees due to the southern pine beetle, and some habitat may be created from prescribed burns and wildfire, this probably does not compensate for the lack of active management.

Across the Forest, black bear populations have increased due to factors other than habitat management, probably due to the benefits of the state black bear sanctuary system. As young bears migrate from these protected areas, they increasing occupy habitats with little or no hunting pressure, allowing the population to increase further.

Table 2. Indirect affects of each alternative on the evaluated management indicator species.

Eastern wild turkey	adverse	beneficial	beneficial
Ruffed grouse	adverse	beneficial	beneficial
White-tailed deer	adverse	beneficial	beneficial
Black bear	adverse	beneficial	beneficial

Habitat Diversity

Alternative 1 - No Action

Alternative 1 would result in no change in early successional habitat in the short term. Grass-forb habitat would remain at current levels.

Alternative 2

This would result in the creation of new early successional habitat in seven of eleven compartments. Standards for MA 3B to provide at least 5% and no more than 15% in early successional habitat would be met in four compartments. The additional early successional habitat created would be beneficial to many species of wildlife. The 221 acres created in compartments 29, 30, 31, and 34 should provide suitable habitat for

golden-winged warblers in the future. Grouped by area, none of the northern portion, about 6% of the eastern portion, about 10% of the central portion, and about 9% of the western portion along the Cheoah River would be in early successional habitat. Though at low levels, this habitat would be fairly well distributed across the project area. (The northern section is in management area 4C, which is categorized as unsuitable for timber production.)

Eighteen additional acres of grass/forb habitat would be created on roads and log landings in compartments 29, 30, 31, 33, 34, and 35. To meet objectives for grass/forb habitat, many more acres would need to be created. Some additional acreage may be created as a result of the prescribed burns.

Stands 25/2, 25/15, and 33/11 would be planted in shortleaf pine. There is already a significant component of white pine in these compartments.

Alternative 3

This would result in the creation of new early successional habitat in seven of eleven compartments. Standards for MA 3B to provide at least 5% and no more than 15% in early successional habitat would be met in six compartments. The additional early successional habitat created would be beneficial to many species of wildlife. The 335 acres created in compartments 29, 30, 31, and 34 should provide suitable habitat for golden-winged warblers in the future. Grouped by area, none of the northern portion, about 9% of the eastern portion, about 11% of the central portion, and about 8% of the western portion along the Cheoah River would be in early successional habitat. Though at low levels, this habitat would be fairly well distributed across the project area. (The northern section is in management area 4C, which is categorized as unsuitable for timber production.)

Eighteen additional acres of grass/forb habitat would be created on roads and log landings in compartments 29, 31, 33, 34, and 35. To meet objectives for grass/forb habitat, many more acres would need to be created. Some additional acreage may be created as a result of the prescribed burns.

Stands 25/2, 25/15, and 33/11 would be planted in shortleaf pine. There is already a significant component of white pine in these compartments.

Table 3. Acres of each compartment in grass/forb habitat and the 0 - 10 year old age-class.

	Total acres	Grass/forb	**Alt 1** (0-10)	**Alt 2** (0-10)	**Alt 3** (0-10)
Compartment 25	753	1.9 (<1%)	0	29 (4%)	29 (4%)
Compartment 26	507	0	0	0	0
Compartment 27	647	0	0	0	0

Compartment.28	585	0	0	0	0
Compartment.29	1049	2.9 (<1%)	33 (3%)	92 (9%)	112 (11%)
Compartment.30	1226	4.2 (<1%)	0	52 (4%)	84 (7%)
Compartment 31	383	2.4 (1%)	0	13 (3%)	42 (11%)
Compartment 32	251	0	0	0	0
Compartment.33	720	0	44 (6%)	67 (9%)	66 (9%)
Compartment.34	905	9.3 (1%)	0	141 (16%)	130 (14%)
Compartment 35	786	7.2 (1%)	0	98 (12%)	92 (12%)

Cumulative effects:

The effects of past practices are displayed in the current existing condition described above. On private lands, past practices include conversion of forested lands to agricultural crop-production, timber harvesting, etc. The cumulative effect on mast production and projected age-class distributions are discussed under each proposed alternative. The effects of these projects are included in the age class distribution listed for the analysis area above. There are no other timber sales actively being planned in the analysis area at this time. If additional projects are proposed in the future, cumulative effects would be evaluated at that time.

2. TERRESTRIAL WILDLIFE TES EVALUATION: SPECIES LEVEL EVALUATION

2.1 Species Evaluated and Rationale

Proposed, endangered, threatened, and sensitive (PETS) species considered in this analysis are those included in the National Forests in North Carolina PETS species list (January, 2002). All 30 PETS terrestrial animal species that might occur on the Nantahala National Forest were considered (see Attachment 1). Potentially affected species were identified from information on habitat relationships, element occurrence records of PETS animals as maintained by the North Carolina Natural Heritage Program and field data on the project area.

Table 4. Known and potential proposed, endangered, and threatened species, sensitive species, and forest concern species evaluated for this project.

Species	Type	Habitat description	Likelihood of occurrence
Federally Proposed, Endangered, and Threatened Species			
Indiana bat (*Myotis sodalis*)	mammal	roosts in caves and hollow trees	may occur
2002 Region 8 Regional Forester's Sensitive Species			
Northern bush katydid (*Scudderia septentrionalis*)	insect	treetops at edges of broadleaved forest	may occur
Rock-loving grasshopper (*Trimerotropis saxatilis*)	insect	lichen covered rock outcrops	may occur
Frosted elfin (*Callophrys irus*)	butterfly	open woods and borders, in dry situations	may occur
Diana fritillary butterfly (*Speyeria diana*)	butterfly	deciduous and pine woodlands	may occur
Glossy supercoil (*Paravitrea placentula*)	snail	leaf litter on wooded hillsides and ravines	may occur
Santeetlah dusky salamander (*D. santeetlah*)	amphib.	stream headwaters and seepage areas	known to occur
Junaluska salamander (*Eurycea junaluska*)	amphib.	wider portions of streams below 2395’	known to occur
S. appalachian salamander (*Plethodon teyahalee*)	amphib.	moist forests at all elevations	known to occur
Southern water shrew (*Sorex palustris puntulatus)*	mammal	small streams 12-15' wide above 3000'	may occur
Forest Concern Species			
Tawny crescent butterfly (*Phyciodes batesii ma*.)	butterfly	dry hillsides, upland pastures	known to occur
Queen crater (*Appalachina chilhoweensis*)_	snail	leaf litter in deciduous forests	may occur
Pink glyph (*Glyphyalinia pentadelphia*)	snail	moist leaves in upland woods	may occur

Ramp cove supercoil (*Paravitrea lacteodens*)	snail	leaf litter in mesic coves	known to occur
Open supercoil (*Paravitrea placentula)*	snail	leaf litter on hillsides and ravines	known to occur
Cerulean warbler (*Dendroica cerulea*)	bird	large trees on steep slopes	known to occur

2.2 Existing Condition

The Santeetlah dusky salamander is known to occur at one location on the eastern edge of the project area near Yellow Creek Gap. It has also been collected from sites immediately to the south.

The Junaluska salamander is known to occur in the Cheoah River, which is the western boundary of the project area.

The southern Appalachian salamander is known to occur near Big Spring on the eastern end of the project area.

The ramp cove supercoil is an endemic known only from the vicinity of Tuskeegee in Graham County. This record is the type specimen and paratypes collected by H.E. Sargent in 1899. There is an additional unconfirmed record near Murphy in Cherokee county.

The open supercoil has been recorded from one location in Graham County; it is a pre-1945 record from "Tuskeegee Mountain between the heads of Tuskegee and Yellow Creeks". The only other site in North Carolina is also from Graham County, "along the Cheoah River near the junction of Yellow Creek".

The Cerulean warbler was known to occur at two locations along F.S. 438 on the eastern end of the project area and at several locations just to the north of the project area near Cable Gap.

New Surveys or Inventories Conducted –

The project area was evaluated as suitable habitat for PETS species. Impacted areas were surveyed for the presence of special habitats (such as wetlands, boulderfields, caves or mines) that could be adversely affected by project activities. No special habitats were located.

The terrestrial snail fauna was sampled in each area proposed for regeneration harvesting in April of 2001 to determine the possible occurrence of rare molluscs. These sites were surveyed because canopy removal may adversely affect the habitat of these species. The animals collected were identified by John Slapcincsky, senior biologist, Florida Museum of Natural History, University of Florida. The pink glyph, *Glyphyalinia pentadelphia*,

was collected from unit 17B. The queen crater, *Appalachina chilhoweensis*, was collected from four locations in compartment 29: Unit 29/3, Unit 29/5, near Unit 29/1A, and in a 10-15 year old clearcut nearby.

Breeding bird surveys were conducted in May of 1999, 2000 and 2001. A special emphasis was placed on determining whether Cerulean warblers occur in any activity areas. Cerulean warblers were located at additional sites in the project area. No other rare species were detected and no special habitats for any other sensitive species were located.

Species For Which Inventories Not Conducted and Justification -

Inventories were not conducted for the Indiana bat, katydid, grasshopper, two butterflies, or the southern water shrew. These six species were considered as potentially occurring within the project area. Inventories were also not conducted for the Santeetlah dusky salamander, the Junaluska salamander, or the southern Appalachian salamander, since these species are already known to occur in the project area.

For the Indiana bat (*Myotis sodalis*), potentially suitable summer roosting and foraging habitat does exist within the project area, however, this project would comply with the "Terms and Conditions" in the biological opinion of the U.S. Fish and Wildlife Service for the protection of the Indiana bat on the Nantahala and Pisgah National Forests.

The northern bush katydid (*Scudderia septentrionalis*), and rock-loving grasshopper (*Trimerotropis saxatilis*) utilize habitats that are common across the Forest. Although individuals may be impacted if they are present, the project would not affect the availability of suitable habitat across the Forest.

The frosted elfin (*Callophrys irus*) occurs in open woods and borders in dry situations. Little of this habitat would be affected. Although individuals may be impacted if they are present, the project would not affect the availability of suitable habitat across the Forest. This habitat is common across the Forest.

The Diana fritillary butterfly *(Speyeria diana)* has been found at more than 34 different locations in and near the National Forest in the last five years. The species is widely distributed and occurs in different forest types, but seems to prefer roadsides through cove forests. The frequency with which this species has been encountered indicates that it is much more abundant than previously thought. Small-scale disturbances are unlikely to affect the availability of suitable habitat. The main threat to this species would be from the large-scale use of insecticides.

The Santeetlah dusky salamander (*Desmognathus santeetlah)* is known to occur in stream headwaters and seepage areas of hardwood, cove hardwood and spruce-fir forests in the Great Smoky, Unicoi, Cheoah and Great Balsam Mountains of North Carolina and Tennessee. There are 11 records from the National Forest, 10 from Graham county and one from Cherokee county. The extent of the species range on the Forest is not well established, but it generally occurs in moist forests above 3000'. Direct effects to this species are possible from any activity that impacts seepage areas and other suitable

habitat. With the implementation of Forest-wide standards to protect riparian areas, adverse effects to this species should be minor and temporary, in most cases.

The Junaluska salamander (*Eurycea junaluska)* is known to occur in Tululah, Snowbird and Santeetlah creeks and in the Cheoah River in Graham county. It occurs in wider, base-level portions of streams with sluggish side pools, below 2395' elevation. Direct effects to this species are possible from any activity that degrades the water quality of suitable sites or uses heavy equipment or disturbs the soil in the riparian areas alongside suitable habitat. Activities at some distance from suitable habitat which degrade water quality may also adversely affect this species.

The southern Appalachian salamander *(Plethodon teyahalee)* is found in moist forests in the southwestern mountains at all elevations. The Biological Conservation Database of the North Carolina Natural Heritage Program has records from 12 locations in western North Carolina, eight of which are on the Nantahala. It is thought to be fairly common across Graham, Swain, Cherokee, Clay and Macon counties. Dr. Richard Highton's collection at the Smithsonian lists 1007 records for this species from 10 counties at elevations from 1160 feet to 6000 feet. This includes 267 records on the National Forest, distributed across the same 10 counties and four ranger districts. Direct effects to this species are possible from any activity that uses heavy equipment or disturbs the soil. Since the species is widely distributed, potentially occupying nearly a half million acres of National Forest land, current management is unlikely to affect the availability of suitable habitat.

The Appalachian water shrew *(Sorex palustris punctulatus)* is known to occur on small first order streams up to 12-15' wide, with rhododendron cover across Macon, Swain and Clay counties. Nine sites have been recorded on the Nantahala, most of these being recent records from Macon county from Dr. Joshua Laerm and his students surveying small mammal populations. The species is thought to be widespread, but occurs in low densities and is difficult to capture. Direct effects to this species are possible from any activity that degrades water quality or disturbs the riparian area. With the implementation of Forest-wide standards to protect riparian areas, adverse effects to this species should be minor and temporary, in most cases.

2.3 Effects of alternatives by species

Direct and Indirect effects**:**

Proposed, Endangered and Threatened Species

Indiana Bat

On July 25, 1999, two Indiana bats were captured in a mist-net located in the upper Santeetlah Creek drainage in Graham County, North Carolina. Monitoring of the roost tree documented use by 28 bats. Given the species communal roosting habits, it is probable that all 28 bats were Indiana bats. Most of the cave sites and cavelike habitats available in western North Carolina do not provide suitable conditions for significant wintering habitat for Indiana bats. Thus, North Carolina was not considered likely to

provide either significant wintering habitat or maternal roosting habitat. The capture of a reproductively active female Indiana bat in Graham County provides new information on the status and distribution of this species in North Carolina. At present, this is the southernmost known Indiana bat maternity colony. It is possible that other Indiana bat maternity colonies occur on the Forest, as well as individual roosting males. Direct effects may occur between April 15 and October 15 if a tree that a bat is roosting in is cut. Indirect effects may also occur to potential Indiana bat roosting and foraging habitat.

This project may impact a maximum of 589 acres of suitable habitat. To reduce the likelihood of direct effects to Indiana bats and indirect effects to Indiana bat habitat, this project would comply with the Terms and Conditions in the Biological Opinion of the U. S. Fish and Wildlife Service for the protection of the Indiana bat.

This includes retention of standing trees with more than 25% exfoliating bark, shellbark, shagbark and bitternut hickories, snags, hollow, den, and cavity trees, trees in buffer zones along intermittent and perennial streams, and shade trees adjacent to some of the large snags. These measures would be implemented when the stands are marked for sale.

Calculation of the habitat suitability index resulted in a 2% change from the baseline.

Based on the small number of currently suitable or potential roost trees that would be affected, effects on the bat population would be unlikely, and would not reach the scale where an adverse affect or actual take occurs. The sequence of events that would result in a tree being cut down in which a bat is roosting is unlikely.

Removing a small number of trees would not make the area unsuitable as summer habitat for Indiana bats. Indiana bats are known to use highly altered and fragmented landscapes. They may respond positively to habitat disturbance, particularly where forests are even-aged and closed-canopied. A diverse landscape may benefit Indiana bats, as long as sufficient mature forest and numbers of quality roost trees are provided. Given the amount of harvesting, the area would still provide vast numbers of roost trees and potentially suitable habitat for Indiana bats.

Since the sequence of events that would result in a tree being cut down in which a bat is roosting is very unlikely, direct effects to Indiana bats should not occur. Because there is only a very minor loss of potential Indiana bat habitat in the area impacted, this action would not affect the availability of Indiana bat habitat in the project area. This project **is not likely to adversely affect** the Indiana bat.

Sensitive Species

Species-specific effects are described below by alternative. Recommendations are based on best available information and include direct and indirect effects to PETS species off site or on private land.

Alternative 1 - No Action

This alternative would have no impact on any PETS species.

Alternatives 2 and 3

The northern bush katydid (*Scudderia septentrionalis*), and rock-loving grasshopper (*Trimerotropis saxatilis*) utilize habitats that are common across the Forest. Although individuals may be impacted if they are present, the project would not affect the availability of suitable habitat across the Forest.

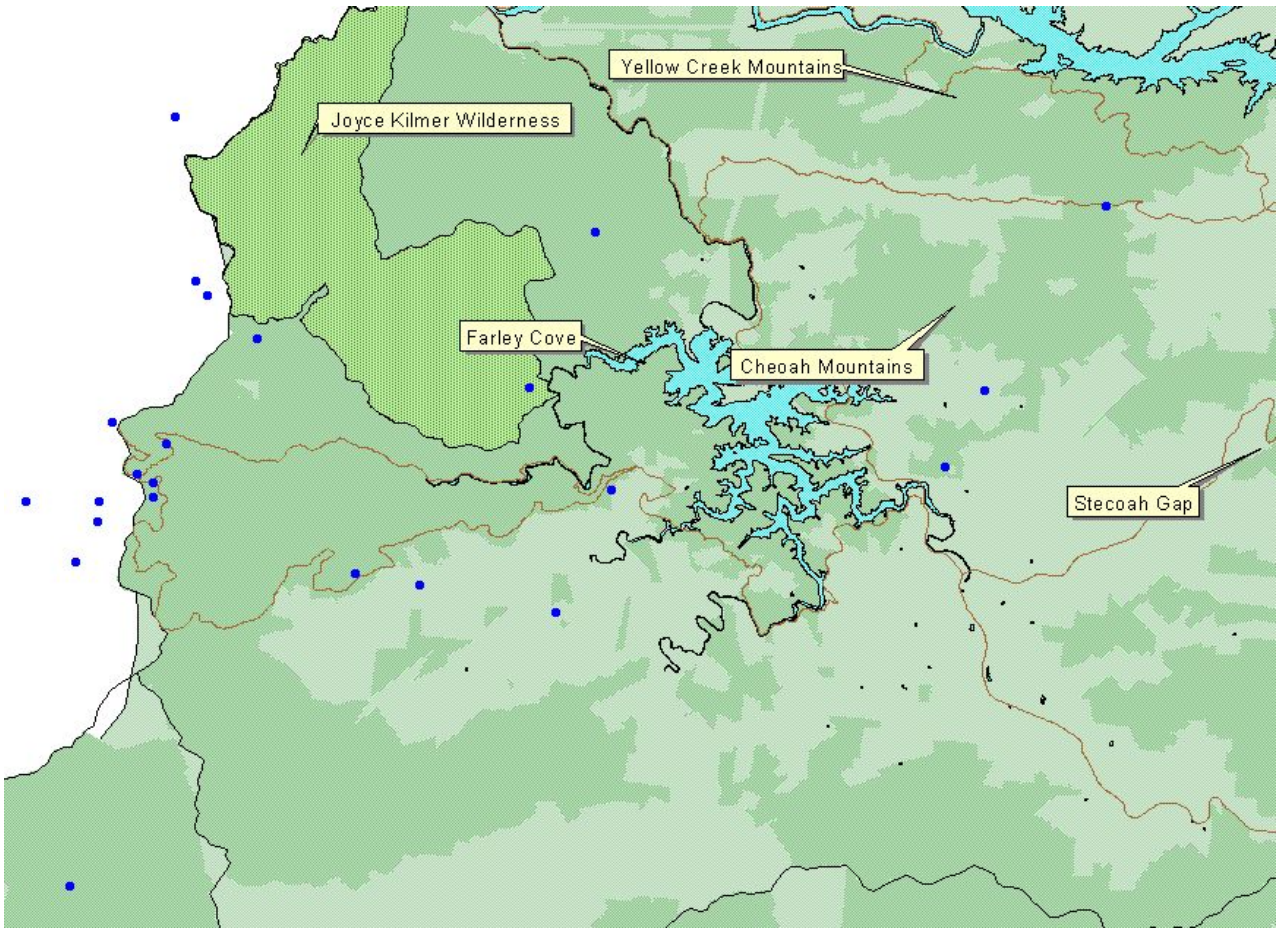
Little of the habitat for the frosted elfin (*Callophrys irus*) would be affected. Although individuals may be impacted, the project would not affect the availability of suitable habitat across the Forest.

The Diana fritillary butterfly *(Speyeria diana*) may occur in the project area and individuals may be adversely affected by project activities. Since the species utilizes nectar plants found in openings, it is possible that ground disturbance would improve habitat for this species.

The glossy supercoil (*Paravitrea placentula*) was not located in the units surveyed. There would be no impacts to this species.

The Santeetlah dusky salamander (Desmognathus santeetlah) may occur in stream headwaters and seepage areas in hardwood and cove hardwood forests at elevations above 3000' throughout the Cheoah Mountains. Although there is only one existing record in the project area, the species may occur at suitable sites throughout.

Figure 2. Santeetlah dusky salamander records in and adjacent to Graham County, North Carolina.



Loss of habitat may occur from road construction across riparian areas. This may occur in sections of new road construction proposed for stands 29/1, 34/9 and 35/14. With the implementation of Forest-wide standards to protect riparian areas, the majority of habitat in the project area would be protected. This project is not expected to adversely affect the availability of suitable habitat in the project area or across the Forest.

The Junaluska salamander (*Eurycea junaluska*) is known to occur in the Cheoah River, which forms the western boundary of the project area. New road construction proposed to access stands 33/8, 35/3 and 35/14 is a potential source of sedimentation into occupied habitat. With the implementation of Forest-wide standards to protect riparian areas, adverse effects to this species should be minor and temporary. This project would have no impacts on the Junaluska salamander.

The southern Appalachian salamander (*Plethodon teyahalee)* may occur in project activity areas. There may be a substantial effect from regeneration harvesting because of the openings in the canopy, but this would occur in only in a small part of the project area. Much suitable habitat would remain. Habitat may be temporarily decreased where ground litter is disturbed and/or insolation increases from removal of canopy trees.

Project activities would not significantly affect the availability of suitable habitat in this area. This project may impact individuals of this species, but is not likely to cause a trend to federal listing or a loss of viability.

Forest plan standards that limit the amount of regeneration allowed in any compartment, management area and analysis area prevent any cumulative effects to this species.

The Appalachian water shrew *(Sorex palustris punctulatus)* may occur within project activity areas. With the implementation of Forest-wide standards to protect riparian areas, adverse effects to this species should be minor and temporary. This project would have no impacts on the Appalachian water shrew.

Forest Concern Species

The tawny crescent butterfly (*Phyciodes batesii maconensis*) is known from seven counties in western North Carolina, Buncombe, Haywood, Jackson, Macon, Graham, Clay, and Swain. It occurs on dry hillsides and upland pastures. The host plants are Aster undulates and Andropogon sp. It has been recorded from three locations in the project area, none of which are in activity areas. Since the species utilizes nectar plants found in openings, it is possible that ground disturbance would improve habitat for this species. There is unlikely to be any adverse effects to this species from the proposed project.

The queen crater (*Appalachina chilhoweensis*) is known from Graham, Haywood, Madison and Swain counties. It was collected from two activity areas and from two locations outside of the activity areas, including a 10-15 year old clearcut. The presence of this species within a previous regeneration unit indicates that removing the canopy does not make the area completely unsuitable for an extended period of time. Populations may have been reduced, but apparently some individuals survived the harvest. It is unlikely that a species with such limited mobility was extirpated from the site and then reoccupied it recently.

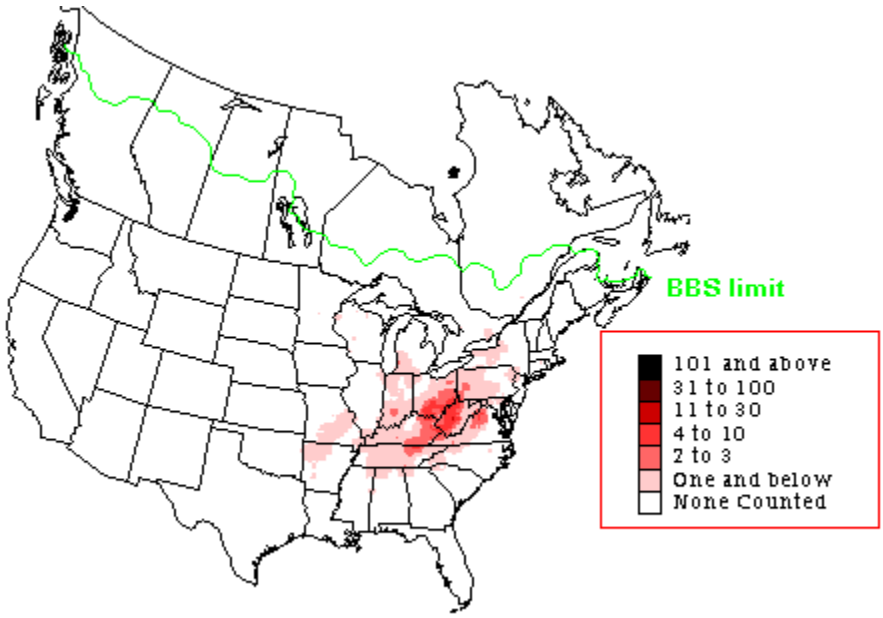
Individuals of the queen crater occurring within Units 29/3 and 29/5 may be adversely affected by harvesting activities, but this unlikely to significantly affect populations in the project area or across the Forest. Habitat within the unit may be limited for a period of time. Individuals and habitat outside the unit would not be affected. Potential adverse effects would be minimized if additional canopy were retained in the vicinity of the collection site.

The pink glyph, *Glyphyalinia pentadelphia*, is known from five counties in North Carolina; Cherokee, Clay, Graham, Macon, and Swain. There are seventeen records from these counties from a variety of forest types and elevations. Populations of this species in Unit 17B may be adversely affected immediately after the stand is harvested due to drying of the leaf litter. The proper habitat conditions would be reestablished as the stand matures. This is not likely to adversely affect populations of this species in the project area or across the Forest.

The ramp cove supercoil (*Paravitrea lacteodens*) and the open supercoil (*Paravitrea placentula)* were not located in the units surveyed. There would be no impacts to these species.

The Cerulean warbler (*Dendroica cerulea*) is of conservation concern throughout its range. North American Breeding Bird Survey (BBS) data on the Cerulean warbler indicate a significant population decline in eastern North America, which is most pronounced in the core of the breeding range. The U. S. D. I. Fish and Wildlife Service lists the Cerulean warbler as a "Species of Concern". Partners-in-Flight ranks the Cerulean warbler as one of the top ten priority neo-tropical migratory bird species of conservation concern in the southern Blue Ridge.

Figure 3. Range map of the Cerulean warbler.



In North Carolina the distribution is very spotty, most of the birds are in the mountains, in northern Graham County, along the Blue Ridge Parkway in Buncombe County, and in the White Oak and Warrior Mountains in Polk County. A few birds occur in riparian habitats along the Roanoke River in the coastal plain. In the mountains, this species is associated with steep terrain, mixed mesophytic (cove) forest, canopy gaps, a rich well-developed herbaceous layer, and high vertical vegetative diversity. Timber management activities potentially affect Cerulean warbler habitat by changing the structure of the vegetation.

The Cerulean warbler is consistently associated with stands that have a high percentage of relatively few, but very large ("super emergent") trees, less canopy cover but with complex structure (Nicholson unpubl. data). Often tulip poplars and white oaks make up a high percentage of stocking in cove hardwood stands occupied by Cerulean warblers (Partners in Flight Bird Conservation Plan for the Southern Blue Ridge, Physiographic

Area 23, p. 42). Habitat objectives are to support 5000 cerulean warbler pairs in mature cove forests.

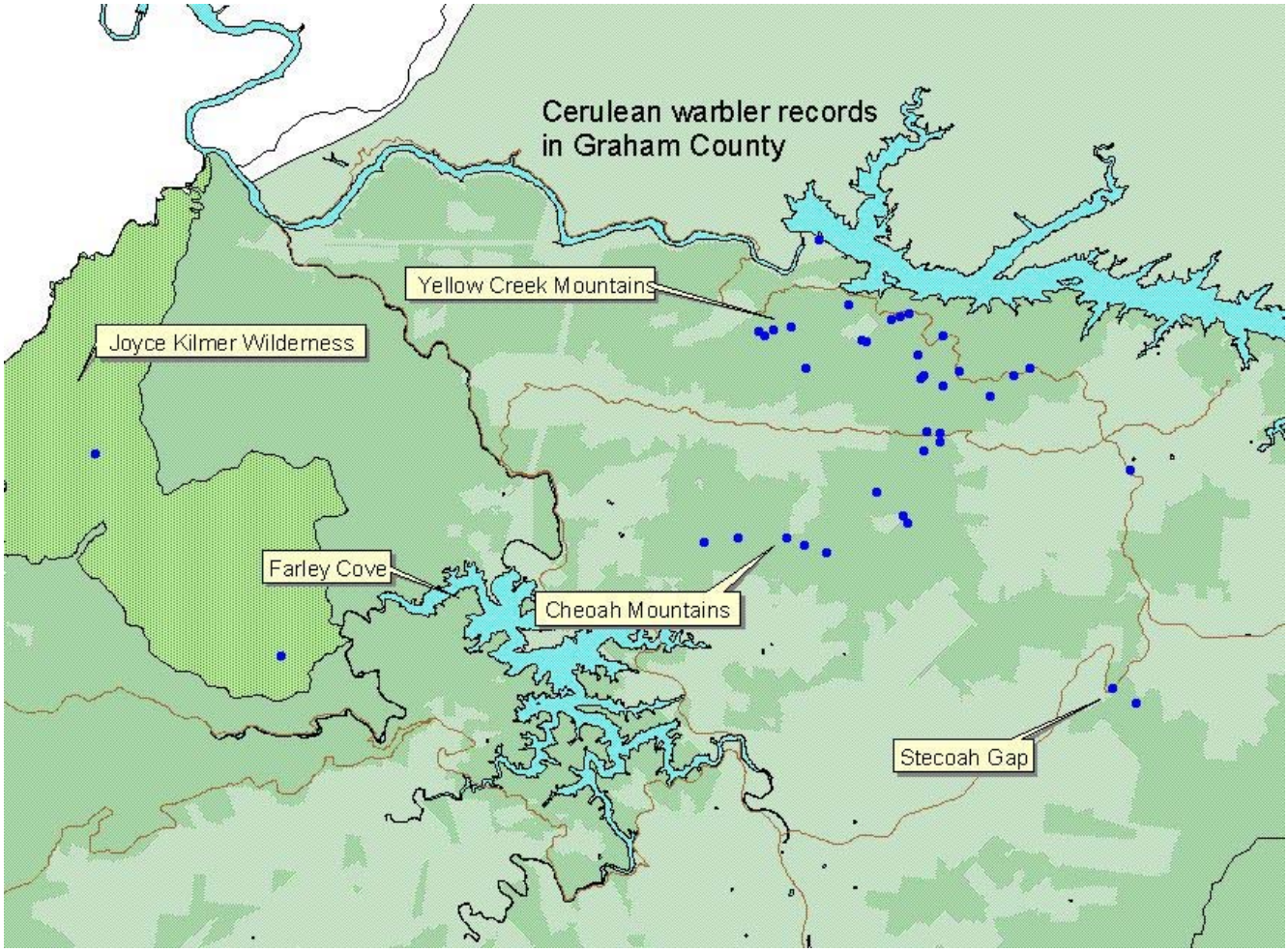
The North Carolina Natural Heritage Program ranks the breeding population of the Cerulean warbler in North Carolina as an S2; which means a species with extant populations numbering between six and twenty which is considered imperiled because of rarity or because of some factor(s) making it very vulnerable to extirpation.

The Cerulean Warbler Atlas Project lists 109 breeding pairs in North Carolina, mostly along the Blue Ridge Parkway in Buncombe County, with just 12 birds recorded from Graham County. Tennessee reports a large number of birds (1210), but these are mostly from the Cumberland Mountains northwest of Knoxville with just a few reported from the Blue Ridge Mountains. There are only 22 breeding pairs listed for Georgia, from Union County. Virginia reports 152 birds, with 20 of these on the Clinch Ranger District in extreme western Virginia. This totals about 100 breeding pairs in the southern Blue Ridge in North Carolina, Tennessee and Georgia.

Until 1994, the Cerulean warbler was known from just nine locations on the Nantahala and Pisgah National Forests. Most of these sites were in Graham County, between the town of Tuskegee and Fontana Village. The two other extant sites on the Forest supported a few birds in Clay and McDowell counties. In 1994, breeding bird surveys conducted in preparation for a timber sale in the Hickory Knob area in Macon County located three birds on territory. (Surveys done during the last five years have not relocated the birds at this site.)

Between 1994 and 1998, surveys recorded an additional 30 individuals in the Cheoah and Yellow Creek Mountains of Graham County, including the Hazanet Project area. These birds were all found within areas already known to support Cerulean warblers. A total of 45 birds on territory have now been documented between Stecoah Gap and Fontana Village, an area encompassing about 40 square miles. During the last seven years, extensive surveys have been conducted for Cerulean warblers in all areas of suitable habitat where timber harvesting or other significant impacts to the vegetation were proposed. Despite this effort, no new occupied territories were documented in any additional areas of the Forest. During the 2002 season, a single bird was recorded from the Farley Cove area west of Santeetlah Lake. This site fills a gap between known sites east of the lake in the Cheoah Mountains and previous records in the Joyce Kilmer/Slickrock Wilderness Area.

Figure 4. Cerulean warbler records in Graham County, North Carolina.



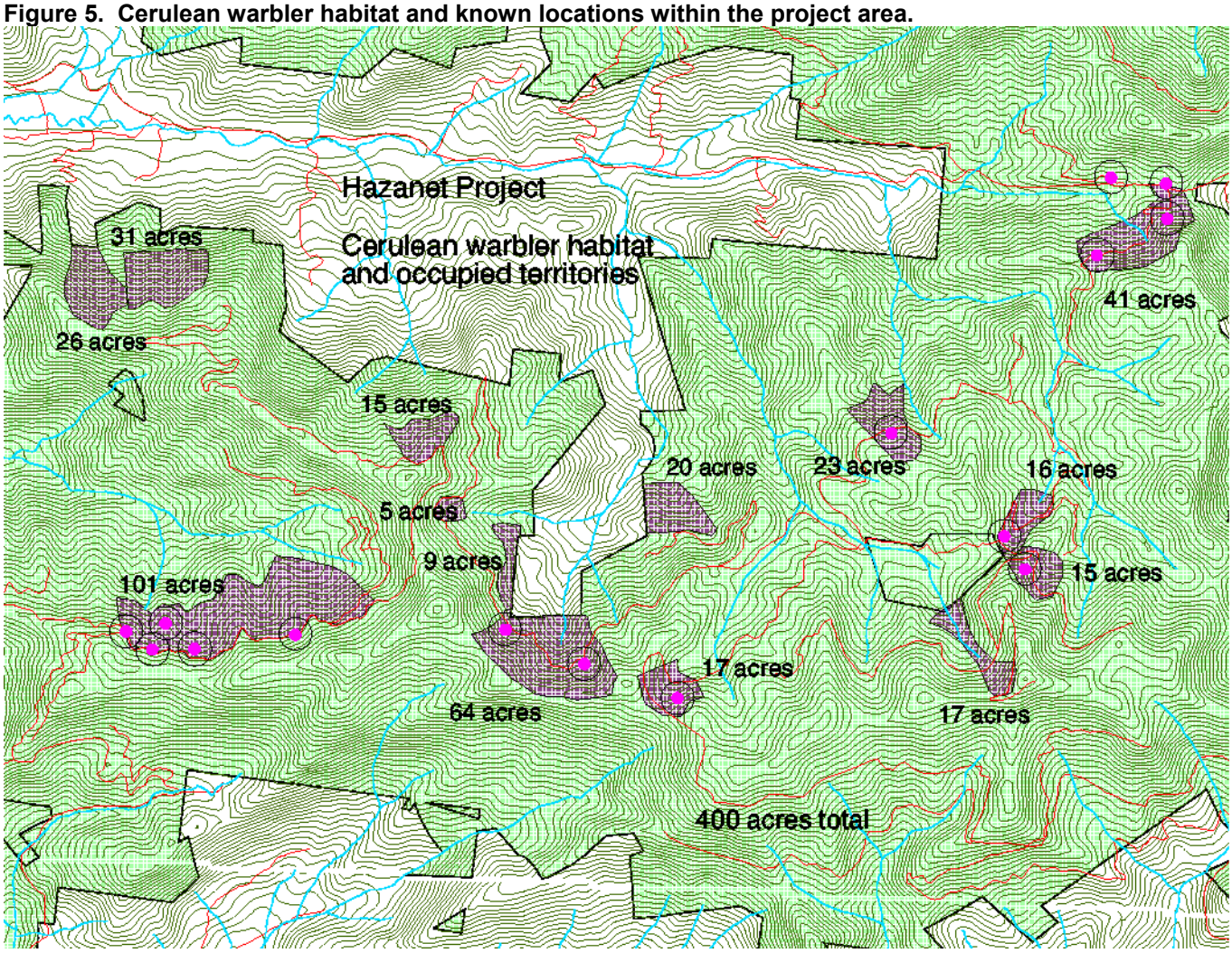
The planning team for the revision of the Forest Plans for the Southern Appalachian National Forests lists the Cerulean warbler as a forest interior/area sensitive, mid-late successional, deciduous forest associate. The susceptibility of birds to fragmentation effects depends on the condition of the surrounding landscape. In a highly fragmented area, forest interior/area sensitive species would be subjected to increased rates of nest parasitism by cowbirds and predation by crows, jays, and various mammals. They recommend that where this species is a concern, fragmentation effects be evaluated at a landscape scale of approximately 75,000 acres. They suggest that if more than 80 percent of this landscape is forested, fragmentation effects would not be significant.

The planning team also recommends specific management for Cerulean warblers on a landscape level as well as for specific stands. The desired age class distribution of mixed mesophytic forest is for at least 70% of the landscape to be greater than 80 years of age with a maximum of 5% of the area in grass/forb and early successional habitat. Management that may be compatible with Cerulean warbler habitat includes thinning down to a basal area of 60 square feet per acre, while leaving the largest trees present on the site, and group selections of 0.10 to 0.25 acre.

In this 7,574 a. analysis area, each stand proposed for treatment was evaluated for suitability as Cerulean warbler habitat. Stands were compared with known occupied habitat in this area and at other sites in Graham County and the Nantahala National Forest in making this determination. Stands dominated by white pine or rhododendron, xeric stands, and young stands lacking any large trees were not considered suitable. This resulted in about 400 acres (5% of the total area) estimated to provide potentially suitable habitat for Cerulean warblers. This habitat is located in Compartments 29, 30, 31, and 34, which are dominated by cove hardwoods. This includes parts of compartment 29, stands 1, 3, 7, 8, and 11; compartment 30, stands 9, 10, 11, 16, 23, and 26; compartment 31, stands 1, 7, 8, 9, and 10; and compartment 34, stand 17. (See Figure 2.)

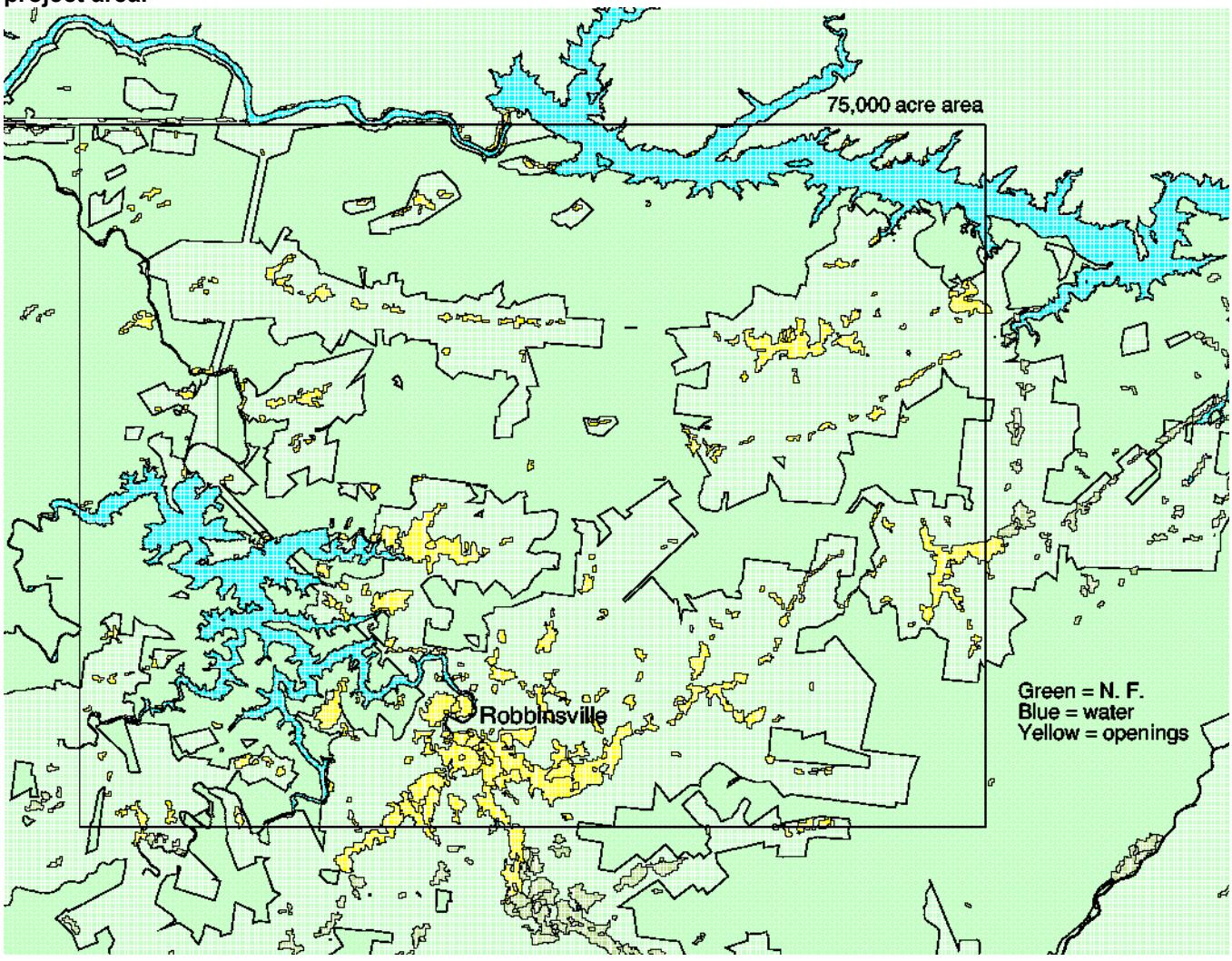
The 400 acres is classified as about 74% cove hardwoods and 19% northern hardwoods. Within this habitat, surveys conducted during the last three years have located a total of 13 birds on territory. All of the birds were located in association with a break in the forest canopy, either adjacent to an open paved state road, a narrow gravel Forest Service road, or a significant canopy gap due to wind throw.

Figure 5. Cerulean warbler habitat and known locations within the project area.



A landscape scale analysis determined that fragmentation effects are probably not an issue, as the surrounding 75,000 acres is about 86% forested. (Information on openings on private land includes non-forest cover types estimated from Landsat data for the Southern Appalachian Assessment. See Figure 3.) The Southern Appalachian Assessment completed a landscape-level habitat suitability analysis for species that are area-sensitive and associated with mid- to late-successional deciduous forest. The Blue Ridge Mountains were determined to be 84% forested. More significant edge effects can be expected in highly fragmented landscapes.

Figure 6. Distribution of openings in an otherwise forested landscape surrounding the project area.



<u>Alternative 1</u> - No Action

This alternative would result in no additional openings being created in the project area. The habitat would remain in its current condition in the near future.

Alternative 2

This alternative would create twelve new 2-aged regeneration openings (totaling 251 acres) in Compartments 29, 30, 31 and 34, which is about 7% of this area. Group selection would be done on 141 acres, with 14 of these acres regenerated. An additional 23 acres would be thinned.

The areas identified as suitable habitat for Cerulean warblers would be treated according to the management recommendations of the planning team for the Southern Appalachian National Forests. These restrictions include the stands identified as suitable habitat, even if birds have not been located there during surveys. These include:

5) No timber harvesting would occur within a 300 ft. buffer around known occurrences.
6) Retain at least 60 square feet of basal area in harvested stands, with leave trees consisting of the largest and tallest dominant canopy trees.
7) Group selection openings would be no larger than 0.5 acres, with groups comprising no more than 10 percent of the stand. Groups would be no closer than 300 feet. Thinning between groups would retain at least 60 square feet of basal area, with leave trees consisting of the largest and tallest dominant canopy trees.
8) Roads constructed or reconstructed within or adjacent to suitable habitat would be built to minimum road width standards and areas subject to day lighting (cutting trees alongside the road to increase the light level on the roadbed, thus providing a drier surface) would retain a minimum of 60 square feet of basal area.

Of the 400 acres identified as suitable habitat, 43 acres would be thinned. Small group openings would be created on another 103 acres, with thinning between the groups. The current basal area of these stands is between 100 and 130 square feet per acre. Thinning from below would remove intermediate and suppressed trees and reduce the basal area to about 80 square feet. This would alter the structure of the vegetation on about a third of the suitable acres. Since all of the Cerulean warblers found in the project area have been adjacent to canopy gaps, creating these small openings may improve the habitat. Thinning in between would break up the canopy and increase the structural diversity of the rest of the stand. Over time, growth would be concentrated on the residual larger trees. This may also improve the habitat. Pre-harvest treatments, timber stand improvements and other treatments involving vine control would be conducted on 673 acres in compartments 29, 30, 31 and 34, which is about 19% of the total acreage in those compartments. This would include about 150 of the acres identified as suitable habitat. One half acre of grape vine slicks would be left per 20 acres.

Alternative 3

This alternative would exclude the areas identified as suitable habitat for Cerulean warblers from any timber harvesting. Twelve new 2-aged regeneration openings (totaling 335 acres) would be created in Compartments 29, 30, 31 and 34, which is about 9% of this area. Some of these openings are quite close to areas identified as suitable habitat, but are generally on higher and drier upland hardwood sites. While not directly treating the habitat, this alternative would create additional openings in the general area occupied by the Ceruleans. The edges of these openings, adjacent to mature cove hardwood stands, may be attractive to Cerulean warblers in the near future. Pre-harvest treatments, timber stand improvements and other treatments involving vine control would be conducted on 514 acres in compartments 29, 30, 31 and 34, which is about 14% of the total acreage in those compartments. This would include about 155 of the 400 acres identified as suitable habitat.

Cumulative effects:

A project that is being implemented now is the reconstruction of the Wauchecha Bald road. This project would directly impact the habitat of a known occupied breeding territory. Impacts to the vegetation are limited to five feet from the top of the cut bank and five feet from the edge of the road on the downhill side. This would increase the size of the canopy gap in this area, but would result in limited impacts to the structure of this site. The project is being constructed outside the normal breeding season of April 15 to July 1, to prevent adverse effects to the Cerulean warbler.

Watch List Species

The **golden-winged warbler**, *Vermivora chrysoptera*, while not a Forest Concern species, is of management concern due to the significance of the population found in this area. It is also ranked as a priority neotropical migratory bird species by the USDI - Fish and Wildlife Service. North American Breeding Bird Survey (BBS) data indicate a significant population decline in eastern North America. Concern regarding the status of this species in surrounding states led to an interest in documenting its status in North Carolina.

Since 1995, golden-winged warblers identified during the course of other bird surveys on the Nantahala National Forest have been recorded. Birds have been located at 60 sites in Graham, Cherokee, Clay, and Macon counties. Nearly all of these birds were on the edge of 10 to 15 year old clearcuts between 3000 and 4000 feet elevation. A few were found using wildlife openings. Golden-winged warblers nest on or near the ground in grasses and herbaceous cover. Dr. David Buehler from the University of Tennessee and his students conducted an intensive study of this species in the Hazanet analysis area and located 30 breeding pairs; a significant population. Some effort to locate golden-winged warblers on the Forest is likely to locate many more breeding pairs associated with these young stands.

The information collected indicates that this species is fairly common across the Nantahala at the present time. However, the reduction in timber harvesting that has

occurred in the last five years means that the habitat that is currently available would not be replaced in the near future. In the absence of other significant disturbance events, the amount of suitable habitat available for this species would decline, both in the short and long term.

The planning team for the revision of the Forest Plans for the Southern Appalachian National Forests lists this species as a high elevation, early successional habitat associate. They suggest that habitat can be created on upland sites through burning and/or logging. Sites of 10 to 15 ha, which can support six pairs, may be close to optimum. The Partners in Flight Southern Blue Ridge Bird Conservation Plan recommends increasing the amount of early successional, shrub-scrub habitat in high-elevation hardwoods, Appalachian oak, and southern yellow pine in part to benefit this species.

About 240 acres in 11 to 30 year old stands are dominated by upland or cove hardwoods and may provide suitable habitat for golden-winged warblers. Another 260 acres were regenerated in 1992, mostly in compartments 29 and 30, on the eastern side of the project area. The rest of the project area is lacking in early successional habitat. There are no new regeneration areas to provide habitat for golden-winged warblers as these existing sites decline. Regenerating some stands of upland hardwoods or mixed pine-hardwoods would provide replacement habitat for this species in the future. The drier sites proposed in Alternative 3 are preferred since they would retain the habitat longer. The proposed prescribed burning may also improve habitat for this species.

Table 5. Indirect effects of each alternative on the evaluated proposed, endangered, and threatened species, sensitive species, and forest concern species.

Species	Alternative 1	Alternative 2	Alternative 3
Federally Proposed, Endangered, and Threatened Species			
Indiana bat	No effect	Not likely to adversely affect	Not likely to adversely affect
2002 Region 8 Regional Forester's Sensitive Species			
Northern bush katydid	No impacts	May impact*	May impact
Rock-loving grasshopper	No impacts	May impact	May impact
Frosted elfin	No impacts	May impact	May impac
Diana fritillary butterfly	No impacts	May impact	May impact
Glossy supercoil	No impacts	No impacts	No impacts
Santeetlah dusky salamander	No impacts	May impact	May impact

Junaluska salamander	No impacts	No impacts	No impacts
Southern Appalachian salamander	No impacts	May impact	May impact
Southern water shrew	No impacts	No impacts	No impacts
Forest Concern Species			
Tawny crescent butterfly	No impacts	May impact	May impact
Queen crater	No impacts	May impact	May impact
Pink glyph	No impacts	May impact	May impact
Ramp cove supercoil	No impacts	No impacts	No impacts
Open supercoil	No impacts	No impacts	No impacts
Cerulean warbler	No impacts	May impact	May impact

*May impact = may impact individuals but not likely to cause a trend to federal listing or a loss of viability

2.4 Consultation History (if any)

None.

2.5 Determination of Effect

Table 6. Determination of effect of each alternative on the evaluated proposed, endangered, and threatened species, and sensitive species.

Species	Alternative 1	Alternative 2	Alternative 3
Federally Proposed, Endangered, and Threatened Species			
Indiana bat	No effect	Not likely to adversely affect	Not likely to adversely affect
2002 Region 8 Regional Forester's Sensitive Species			
Northern bush katydid	No impacts	May impact *	May impact
Rock-loving grasshopper	No impacts	May impact	May impact

Frosted elfin	No impacts	May impact	May impact
Diana fritillary butterfly	No impacts	May impact	May impact
Glossy supercoil	No impacts	May impact	May impact
Santeetlah dusky salamander	No impacts	May impact	May impact
Junaluska salamander	No impacts	No impacts	No impacts
Southern Appalachian salamander	No impacts	May impact	May impact
Southern water shrew	No impacts	No impacts	No impacts

*May impact = may impact individuals but not likely to cause a trend to federal listing or a loss of viability

This project **is not likely to adversely affect** the Indiana bat (*Myotis sodalis*). The project would have no effect on any other federally proposed or listed terrestrial animal species. The project may impact individuals of the northern bush katydid (*Scudderia septentrionalis*), rock-loving grasshopper (*Trimerotropis saxatilis*), frosted elfin (*Callophrys irus*), Diana fritillary butterfly (*Speyeria diana)*, Santeetlah dusky salamander (*Desmognathus santeetlah*) and the southern Appalachian salamander (*Plethodon teyahalee)*, but would not impact their viability across the Forest. This project would not impact any other sensitive species. No cumulative effects on species viability across the Forest would result from this project. Consultation with the U.S. Fish and Wildlife Service **is required**.

2.6 Mitigation Measures and Management Recommendations

None

2.7 List of Preparers

Doreen Miller

Attachment 1. Proposed, endangered, threatened, sensitive and management indicator species considered.

Species	Type	Habitat description	Likelihood of occurrence
Federally Threatened and Endangered Species			
Noonday globe	snail	restricted to the Nantahala Gorge	no; outside the range
Bog turtle	reptile	sunlit, marshy meadows, bogs, wet pastures	no; lacks suitable habitat
Bald eagle	bird	nests in large, open grown trees near lakes	no; nests are unlikely
Carolina n. flying squirrel	mammal	spruce-fir and northern hardwoods above 4000'	no; lacks suitable habitat
Indiana bat	mammal	roosts in caves and hollow trees	yes
2001 Region 8 Regional Forester's Sensitive Species			
Cicindela ancocisconensis	beetle	high elevation forests; > 4000’	no; elevation is < 4000’
Trechus luculentus unicoi	beetle	rocks and moss in wet ravines in w. Graham county	no; outside the range
Divergent melanoplus	insect	glades and balds, 1800 – 1417’; Jackson county	no; outside the range
Serrulate melanoplus	insect	valleys and lower slopes, e. Graham county	no; outside the range
Northern bush katydid	insect	in the treetops at the edges of broadleaved forests	yes
Rock-loving grasshopper	insect	lichen-covered rock outcrops	yes
Frosted elfin	butterfly	open woods and borders, usually in dry situations	yes
Diana fritillary butterfly	butterfly	deciduous and pine woodlands near streams	yes
Fraser fir angle	moth	spruce-fir forests with fraser fir	no; lacks suitable habitat
Lost Nanatahala cave spider	spider	Blowing Springs and Lost Nantahala Cave	no; outside the range
Nesticus sheari	spider	boulderfields in moist or rich forests; Graham co.	no; outside the range
Nesticus silvanus	spider	boulderfields in moist or rich forests	no; outside the range
Black mantleslug	snail	high elevation forests; mainly spruce-fir	no; lacks suitable habitat
Glossy supercoil	snail	leaf litter on wooded hillsides and ravines	yes
Santeetlah dusky salamander	amphibian	stream headwaters and seepage areas	yes

Junaluska salamander	amphibian	wider portions of streams below 2395' elevation	yes
Tellico salamander	amphibian	hardwood forests in Unicoi Mountains	no; outside the range
S. Appalachian salamander	amphibian	moist forests at all elevations	yes
Peregrine falcon	bird	large vertical rock cliffs	no; lacks suitable habitat
Migrant loggerhead shrike	bird	fields and pastures	no; lacks suitable habitat
App. Bewick's wren	bird	woodland borders or openings at high elevations	no; lacks suitable habitat
Rafinesque's big-eared bat	mammal	old buildings, caves, mines, bridges	no; lacks suitable habitat
Southern rock vole	mammal	rocky areas in spruce-fir, n. hwds and balds	no; lacks suitable habitat
E. small-footed bat	mammal	hemlock forests, rock crevices, caves, mines	no; lacks suitable habitat
Southern water shrew	mammal	small streams up to 12-15' wide above 3000'	yes
		Management Indicator Species	
Green salamander	amphibian	suitable rocks in cove hardwoods, upland pine	no; no suitable habitat
Jordan's salamander	amphibian	shaded rocks, general forest	yes
Spotted salamander	amphibian	vernal pools in hardwood and mixed forest	possible
Blue-ridge two-lined	amphibian	springs, seepages, mesic forests	yes
Golden-crowned kinglet	bird	spruce-fir sawtimber	no; no spruce-fir forest
Veery	bird	moist deciduous and mixed forests with much	yes
		understory, > 3500 feet elevation	
Solitary vireo	bird	mixed, spruce-fir, hemlock, and white pine	yes
		>3500 feet elevation	
Parula warbler	bird	hardwood & hemlock/hardwood	yes
		particularly along streams	
Ovenbird	bird	decidous or mixed, dry forests with much	yes
		understory, avoids edges, <5000 feet elevation	
Rufous-sided Towhee	bird	brushy fields and thickets	yes
White-breasted nuthatch	bird	open hardwoods, cavities; < 5000 feet	yes
Cedar waxwing	bird	open, mature conifers	yes

Pine warbler	bird	mature yellow pine stands	yes
Field sparrow	bird	grassy areas of 5 acres or more	no; no suitable habitat
Meadowlark	bird	grassy areas of 3 acres or more	yes
Y-bellied sapsucker	bird	deciduous forests near openings with cavities	no; elevation < 4000 feet
		>4000 feet elevation	
Pileated woodpecker	bird	deciduous forests, with large snags	yes
Ruffed grouse	bird	hardwood saplings	yes
Eastern wild turkey	bird	hard mast, soft mast, grass/forb	yes
Peregrine falcon	bird	exposed cliff habitats	no; lacks suitable habitat
Raven	bird	cliffs other than peregrine sites	no; lacks suitable habitat
Raccoon	bird	dens, acorns in non-aquatic habitats, fruit	yes
Bats in caves	mammal	caves	no; lacks suitable habitat
Carolina NFS	mammal	spruce-fir and northern hardwoods > 4500 feet	no; lacks suitable habitat
Black bear	mammal	hard mast, soft mast, dens	yes
White-tailed deer	mammal	hard mast, browse, grass/clover	yes
Rabbit	mammal	grassy areas of 5 acres or more	yes
Gray squirrel	mammal	mature hardwoods, hard mast, cavities	yes
Bobcat	mammal	grassy/brushy areas	yes
Mink	mammal	forested wetlands	yes

APPENDIX B – MANAGEMENT INDICATOR SPECIES HABITAT EVALUATION. Estimates of forest-wide acreage, and expected effects resulting from the preferred alternative.

Special Habitats	***Estimate of Forest-wide Acreage***	***Estimated Management Effects***
Old growth communities (>100 yr)	171,000 ac Forest trend: increasing	No communities affected.
Early successional communities (0-10 yr)	26,800 ac (yr 2000) 2040 ac (5 yr average) Forest trend: decreasing	The two-age harvests [349 acres in 10 stands and parts of 2 stands] and group harvests [h] should increase the amount of early successional habitats.
Early successional communities (11-20 yr)	46,290 ac (yr 2000) Forest trend: increasing	No communities affected.
Soft mast-producing species	13,144 ac (yr 2000; highest potential for soft mast-producing species, however, on only 5,650 ac) Forest trend: decreasing	The two-age harvests [376 total acres in 13 stands] and group harvests [across 213 acres in 3 stands] should increase the amount of early successional habitats associated with soft mast-producing species.
Hard mast-producing species (>40 yr)	681,000 ac Forest trend: increasing	The two-age harvests [376 total acres in 13 stands] and group harvests [182 acres in 3 stands] should decrease the number of mature, hard-masting trees [primarily oaks and hickories].
Mixed pine/hardwood forest (successional communities with hard-mast species	52,521 ac Forest trend: increasing	No communities affected.
Contiguous areas with low disturbance (< 1 mile open travelway/4 square miles	160,832 ac	No communities affected.
Contiguous areas with moderate disturbance levels (<1 mile open travelway/2 square miles)	576,240 ac	No communities affected.
Large contiguous forest areas	38 Patches (302,000 ac)	No communities affected.
Permanent grass/forb openings	3,000 ac	No communities affected.
Den trees (>36” dbh)	See below	None effected.

Snags and dens (>22" dbh)	See below	None effected.
Small snags and dens	Average in 80 yr community: Cove: 4/ac Upland: 3/ac Pine: 2/ac	The two age harvests [376 total acres in 13 stands] and group harvests [182 acres in 3 stands] may decease the number of small snags and dens in the harvest stands.
Down Woody Material	**High Accumulation** Small wood: 18,000 ac Large wood: 386,000 ac **Low Accumulation:** approximately 600,000 ac	**High Accumulation/Small wood: increased on all management stands [1616 total acres in 65 stands, excluding prescribed fire stands].**

Discussion

Cove communities. Cove forest communities comprise 63% of the proposed harvest. Cove forest communities, however, comprise 30% of the National Forest. As a result, the harvest would reverse the 20 year trend of undercutting cove forest communities [on a percentage basis] compared to oak and oak/hickory communities. MIS species associated with cove forest communities may exhibit a decline in response to harvest.

Oak/hickory communities. Oak and oak/hickory communities comprise 32% of the proposed harvest. Oak and oak/hickory communities, however, comprise 38% of the National Forest. As a result, the harvest would slightly undercut oak/oak hickory forest on a percentage basis, reversing the modest [2% over 20 yr] but general decline of oak and oak/hickory forest communities across the National Forest. MIS species associated with oak-hickory forest may exhibit a slight, relative increase. In addition, the proposed burn stands should encourage oak and hickory reproduction, improving the health of these communities.

White pine communities. Twenty-five acres of white pine forest would undergo two-age harvest. Following the harvest, however, white pine should continue to dominate the community, both in the canopy as well as the regeneration layers. As a result, this harvest should not affect the amount of white pine communities on the National Forest.

Yellow pine communities. Thirty-nine acres of yellow pine forest would be harvested to control southern pine beetle.

APPENDIX C
APPROPRIATENESS OF HARVEST METHODS

Regeneration methods were discussed at length in Appendix E of the FEIS for the Forest Plan, and on pages E1-E2 in Amendment 5 of the Forest Plan. Choices include shelterwood cutting and clearcutting (even-aged management system), two-age (two-aged system), and group selection (uneven-aged system). At this time, single-tree selection is not being considered as appropriate in meeting long-term regeneration needs to sustain productive stands of desirable tree species except in northern hardwood (beech-birch-sugar maple) or hemlock stands. Thinning and sanitation cutting may also occur, but they are intermediate treatments not meant to establish regeneration.

Regeneration using the **group selection** method is appropriate in upland hardwood, cove hardwood, or mixed hardwood/pine stands where slopes are gentle enough to allow ground skidding of timber (logging costs are relatively low) and where there is enough volume and value in the stands to make selection cutting operable. Group selection is not appropriate in very small stands, on slopes greater than 40% where cable logging is required, where timber volume or value is low, or in stands where insect or disease hazards are high and widespread. It is also not appropriate where partial cutting and leaving a white pine seed source would result in conversion of mixed pine/hardwood stands to almost pure pine stands, if the accompanying long-term loss of mast production would be detrimental to local wildlife populations. This method would provide for the establishment and long term growth and development of intermediate and shade intolerant species.

In the **two-age** regeneration method the stand is partially cut, similar to shelterwood except that overstory removal is deferred indefinitely or until another two-age cut can be done. It is appropriate in upland hardwood, cove hardwood, or mixed hardwood/pine stands. In order to ensure growth and development of a new age class, the amount and size of the residual basal area becomes very important. To provide for regeneration of the desired tree species, enough light must be available over a period of time for the newly developing stand. Basal area of leave trees should not exceed 20-30 sq ft/acre fifteen years after harvest so they would not hinder further growth and development of the new stand. The type of leave trees retained would depend on site-specific objectives. The two-age method is appropriate in operable stands on slopes less than 40% whenever there are enough leave trees that would live to be a part of the stand for 50-100 years into the future. Two-age could be appropriate to meet objectives other than timber production, e.g. if continuous acorn production is needed within a stand, or if den trees are scarce, or if aesthetics is a consideration. Two-age would be appropriate on slopes greater than 40% if timber value is high enough to offset increased costs of selective logging with cable systems, and if visual concerns or wildlife habitat objectives cannot be met by clearcutting. Two-age is not appropriate in stands where leaving an overstory would make the stands inoperable. This method would provide for the establishment and long term growth and development of intermediate and shade intolerant species.

The following tables describe factors determining appropriateness of regeneration methods for each stand:

ALTERNATIVE 2

STAND#	TWO-AGE REGEN	GROUP SELECTION REGEN	LOGGING SYSTEM	APPROPRIATENESS FACTORS
29-1	33		CABLE	Forest type, steepness
29-5	26		CABLE	Forest type, steepness
30-13	27		SKIDDER	Forest type, stand configuration
30-23	23		SKIDDER	Forest type, stand configuration
31-1	12		CABLE	Forest type, steepness
34-3	32		HELICOPTER	Forest type, steepness
34-4	24		CABLE	Forest type, steepness
34-9	40		CABLE & SKIDDER	Forest type, steepness
34-17A	34		HELICOPTER	Forest type, steepness
35-3	25		SKIDDER	Forest type, stand configuration
35-9B	38		HELICOPTER	Forest type, steepness
35-14	35		CABLE	Forest type, steepness
30-11		32/8NET	SKIDDER	Forest type, steepness, stand configuration
33-8		72/18NET	SKIDDER	Forest type, steepness, stand configuration
34-17B		109/27NET	SKIDDER	Forest type, steepness, stand configuration

ALTERNATIVE 3

STAND #	TWO-AGE REGEN	GROUP SELECTION REGEN	LOGGING SYSTEM	APPROPRIATENESS DETERMINATION
29-1	33		CABLE	Forest type, steepness
29-3	23		SKIDDER	Forest type, stand configuration
29-5	26		CABLE	Forest type, steepness
30-9A	21		CABLE & SKIDDER	Forest type, stand configuration
30-13	36		CABLE & SKIDDER	Forest type, stand configuration
30-23	23		SKIDDER	Forest type, stand configuration
31-1B	20		CABLE	Forest type, steepness
31-6	29		SKIDDER	
34-3	32		HELICOPTER	Forest type, steepness
34-9	40		SKIDDER	Forest type, stand configuration
34-17A	34		HELICOPTER	Forest type, steepness
34-17B	15		CABLE & SKIDDER	Forest type, stand configuration
35-3	25		SKIDDER	Forest type, stand configuration
35-9B	38		SKIDDER & HELICOPTER	Forest type, stand configuration
35-14	35		CABLE	Forest type, steepness
33-8		72/18NET	SKIDDER	Forest type, steepness, stand configuration

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