ENVIRONMENTAL ASSESSMENT

FOR TSALI FOREST HEALTH PROJECT

CHEOAH RANGER DISTRICT

ROBBINSVILLE, NORTH CAROLINA

2001

Lead Agency: Department of Agriculture, US Forest Service, National Forests in North Carolina

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PURPOSE and NEED for the ACTION

Introduction

This Environmental Assessment (EA) discloses the direct, indirect, and cumulative effects of a proposed action and alternative actions for timber harvest, road construction, trail construction, and wildlife habitat improvement within and adjacent to the Tsali Recreation Area. This project, known as the Tsali Forest Health Restoration Project is proposed for compartments 152,153,154,155, and 156 across the Tsali Peninsula for the next several years. The District Ranger or Forest Supervisor will use this information to decide whether or not the Forest Service will proceed with this project, and if so, how to proceed. Other government agencies, groups, individuals, and Forest Service personnel interested and concerned about the potential outcome of this project will also use this publication as a basis for critiquing the various courses of action. Finally, this publication will be used by Forest Service personnel for implementation and monitoring if the decision is made to proceed. This document presents:

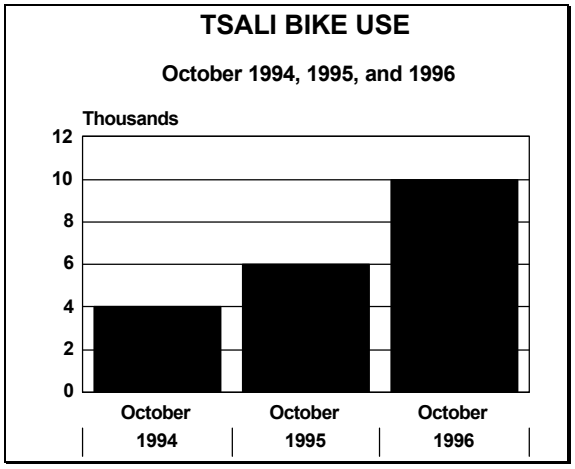
- The proposed action
- Why the action is being proposed (Purpose and Need)
- Analysis of existing conditions
- Project objectives
- Public involvement with the analysis
- Issues associated with the proposed action
- Alternatives considered including the proposed action
- Environmental impacts and analysis

The Proposed Action

The Forest Service is proposing to implement forest management practices on up to 1693 acres in the area known as The Tsali Recreation Area to reduce the impact forest health threats like southern pine beetle, gypsy moth, and the complex disease known as oak decline can and in recent years, have, impacted forest ecosystems at Tsali. The proposed life span of this project is expected to be fiv to seven years and also includes improvements to wildlife habitat and the recreation experience by providing additional habitat for featured wildlife species across the Tsali Area and continue to provide quality recreation experiences to the visitor by constructing addition trails for mountain trail biking, horseback riding, and hiking. Commercial timber sales, pre-commercial timber sales, timber stand improvements, prescribed burning, road construction, road maintenance, road re-construction, and trail construction are being proposed to accomplish this objective. The revenues from commercial timber sales enables the Forest Service to fund at least partially, new trail expansion and wildlife habitat improvements. The Cheoah Ranger District is proposing the following actions within compartments 152,153,154,155, and 156 of the project area.

- Approximately 0.95 miles of skid road and haul road construction
- Approximately 4.4 miles of new trail construction
- Road maintenance on 8.3 miles of existing systems roads (spot gravel and grading on existing roads)
- Commercial thinning across 298 acres
- 2-age regeneration on 111 acres
- Seedlings planted on 111 acres
- Manual/Fire site preparation on 111 Acres
- Pre-harvest treatments to encourage advanced oak regeneration on 114 acres
- Increase grass/forb habitat for wildlife by creating woodland conditions on 67 acres
- Prescribed fire on 869 acres
- Designate 267 acres as old growth

Need for the Proposed Action



The purpose of this project is to implement the direction set forth in the Land and Resource Management Plan (LRMP) 1986-2000 for the Nantahala and Pisgah National Forests (USDA March 1987) as amended. The Tsali Recreation Area is managed for many uses including recreation, wildlife habitat, wood products, and clean water. Hunting, fishing, hiking, horse back riding, and mountain trail biking occur year-round. As the graph in the right hand margin indicates, recreation use, especially mountain trail biking, has increased significantly in recent years. The Tsali area is a nationally known as a first class mountain biking area. The customer survey currently being conducted at Tsali is documenting visitors from all over the country. There are magazine articles touting the high quality trails and diversity of riding experiences available at Tsali. Because Tsali has such a high public recreational use, one of our management goals is to retain and enhance the scenic quality of the area. Catastrophic events can lead to drastic changes in the vegetation and to deteriorated scenic views. Three natural forces have the potential to create this situation at Tsali. Forest health threats such as southern pine beetle, gypsy moth, and oak decline have the potential to impact these benefits by causing forest health problems that can diminish the recreation experience. A healthy forest is constantly changing due to natural forces that include insects and disease and although these forces are a part of forest ecosystems, the rate and direction of change they bring in the forest often create conflicts and raise forest health concerns.

The history of southern pine beetle activity across Tsali is a well documented event that has led to conflicts between the forest visitor and methods used to control the outbreak and salvage beetle killed forest products. Between 1989 and 1994 approximately 75 southern pine beetle (SPB) spots ranging in size from an acre or less to 20 + acres were treated across the Tsali Peninsula (Cheoah Ranger District Files). During these outbreaks, logging and associated logging activities often resulted in trail closures or diminished recreation experiences. Timing is the most critical factor in the successful control of southern pine beetle outbreaks (Swain and Remion ,1980). The degree of success achieved depends on the rapid removal of beetle-infested trees, and the establishment of buffer zones (removal of green uninfested and or infested trees that contribute to limiting the expansion of SPB spots) through commercial salvage and direct control operations. As a result, coordination and notification of trail closures, trail delays, or logging activities is difficult, if not impossible to accomplish.

Although the gypsy moth is not established in the southern Appalachians the consensus is that somewhere between 2005 and 2015 the Nantahala National Forests could begin to be impacted by this insect. In recent years, spring defoliation and mortality of hardwood forest (primarily oak forests) has occurred across thousands of acres in the northeastern United States (Appendix A). Although gypsy moth populations in the northeast are currently at very low levels due to the influence of a fungus responsible for gypsy moth larvae mortality, it is anticipated that gypsy moth populations will once again build to levels responsible for defoliation and mortality across the forest landscape. Once a forest becomes generally infested with gypsy moth, the only proven method to minimize impacts requires aerial application with insecticides. The most appropriate time to implement silviculture treatments to reduce impacts of this insect is 10 to 15 years before a geographical area becomes generally infested. Silviculture options after defoliation and mortality have occurred are often limited to salvage operations.

The complex disease known as oak decline affects thousands of acres in the Southern Appalachian Mountains and has been documented in portions of the oak forest types at Tsali. The disease is caused by a combination of age, stress factors and normally non-aggressive insects and fungi present in the forest ecosystem. As the oaks trees mature, stresses result in the tree becoming susceptible to insects and root disease. The tree's health begins to decline and it eventually dies. Oak decline is part of a "natural" process that is compounded by past land use, loss of species such as the American chestnut followed by replacement with oak species less adapted to the site, and other stress and environmental conditions. Oak decline can be managed by enhancing tree or stand vigor, increasing age classes and species diversity, or reducing the rotation age (the time between regeneration and harvest).

The management approach of the Tsali Forest Health Restoration Project places an emphasis on *proactive* management rather than *reacting* to insect and disease out breaks as they occur. Using this approach, desired future conditions were developed for the forest ecosystems and recreation opportunities at Tsali. Prescribing proven forest management activities to reduce the impact of insects and disease will reduce the potential of conflicts between trail users and salvage logging that follows outbreaks of insects like the southern pine beetle, gypsy moth, and the incidence of the disease known as oak decline. The project is designed to move the existing condition of the project area toward these desired future conditions by tree harvest, access improvements, wildlife habitat improvement, trails expansion, and forest regeneration. The restoration and maintenance of forest health at Tsali will require a long term commitment by the Forest Service and the public. It is beyond the scope of this project to implement the entire future condition at once. Therefore, this

assessment is limited to the development and analysis of alternatives designed to meet as much of this condition as reasonably and economically feasible with tree harvest and associated activities, and to analyze the impacts of these activities on future opportunities. As funding becomes available, other projects will be implemented to meet the entire desired condition. These prospective projects will require separate analyses and public involvement beyond that possible or needed for this project.

Project Objectives

The specific project objectives for this project include:

- Provide for future healthy forest condition by economically regenerating or thinning damaged, sparse, low-quality, mature or overstocked stands to a fully-stocked or optimum growth response level as needed to reduce the risk of southern pine beetle outbreaks, impacts from the gypsy moth, and losses associated with oak decline. Provide this through the following actions:

    - Thinning southern yellow pine stands that exhibit less than .25" radial growth for the last five year period, in order to reduce competition for nutrients, water, and light, and to increase growth rates. This has been shown to make stands less susceptible to attack.

    - Thinning dense mixed pine/hardwood and hardwood/pine stands in order to produce better growing conditions for a diversity of species and age classes.

    - Two-age regeneration of mature southern yellow pine stands that are highly susceptible to southern pine beetle due to their maturity and associated slow growth rate. The regenerated stands (a combination of natural regeneration and planting) are expected to be mixed species stands.

    - Two-age regeneration of older mixed pine/hardwood and hardwood/pine to increase species and age class diversity within the project area. These are stands with evidence of oak decline and poor crown condition where thinning will not produce a favorable response. These stands will regenerate naturally with supplemental planting with the objective of retaining species diversity with a vigorous oak component.

- Improve wildlife habitat. Currently, there are 29 wildlife openings seeded with orchard grass and clover approximately one-half to one acre in size which receive annual maintenance by the Forest Service and/or the North Carolina Wildlife Resources Commission. Logging roads seeded to provide wildlife strips total 4.65 acres. Wildlife openings comprise approximately 25 acres, which is less that 1% of the total area. This condition is below the recommendation set forth in the LRMP for Nantahala National Forests. The desired future condition would be to increase grass/forb conditions to a maximum of 3% . Approximately 100 additional acres of grass/forb conditions need to be created in the project area to meet the direction in the Land and Resource Management Plan, Amendment 5. In addition, there is a need to maintain long term production of hard mast from tree species such as oaks. The following will contribute to improved wildlife habitat conditions:

    - Creating woodland ecosystems with frequent prescribed fire and reducing the density of overstory trees to 40-60 square feet of basal area. This will provide conditions necessary for the production of natural grasses and other herbaceous vegetation that are utilized by wildlife for food and cover. A number of species, including deer and turkey, can benefit from this habitat. Grass/forb habitat is in short supply across the landscape and this will add additional acres toward the overall forest-wide goal.

    - Thinning and regenerating mixed stands to provide better growing conditions for some existing oaks, and to produce young, vigorous oaks that will provide hard mast in the future.

    - To ensure development of oak seedlings and saplings for future hard mast productions, hardwood and hardwood/pine stands will be treated to clear competing vegetation from around existing oak seedlings. The goal is to perpetuate oaks in future stands.

    - Pre-harvest treatments in mixed stands to release advanced oak regeneration would be undertaken to produce future stands with at least as much oak component as is currently present.

- Currently there are 21.9 miles of single track, 6.6 miles of old logging roads used as trails and 9.05 miles of system roads used as trails for a total of approximately 38 miles. The desired future condition would be multiple loops of varying lengths, with a variety of difficulty levels that can meet the needs and skill levels of visitors. To move toward the desired conditions, the proposed action would build additional mile of trail.

Management Direction

The general direction for the proposed action is to implement management activities as directed by the Nantahala and Pisgah Land and Resource Management Plan, Amendment 5, USDA February 1994 (LRMP). Description of these objectives, directions, and standards are given in Chapter III beginning with page III-1. The Plan establishes general management directions for specific areas called "Management Areas". The project area includes Management Areas (MAs) 2A, 4A, 4C, and 18. Management Area allocations (acres in MA) for the proposed project area are displayed in the adjoining table.

More specific direction is given by management area designation and some of the features for the Management Areas for the Tsali project are:

Management Area 2A

- Emphasize visually pleasing scenery
- Emphasize motorized recreation use
- Permit timber production, but modify it to meet visual quality objectives
- Permit road construction
- Manage habitat of mature forests primarily for squirrel, pileated woodpecker, and animals requiring similar environments

Management Area 3B

Although no 3B management area's exist at Tsali, the summary description is provided due to the exception of wildlife management indicator species (MIS) recorded in the LMRP Appendix F, page F1.

- Manage for sustainable supply of timber
- Provide wildlife habitat preferred by wild turkey, small mammals, an other compatible species
- Offer recreation opportunities such as hiking and hunting

Management Area 4A

- Manage for high quality scenery
- Permit timber production, modify to emphasize visual quality and wildlife habitat
- Close most roads to motorized vehicles
- Permit road construction
- Base method of harvest on a site-specific analysis
- Manage habitat of mostly mature forest primarily for black bear (exceptions are shown in LRMP Appendix F-1)

Management Area 4C

- Emphasize visually pleasing scenery
- Emphasize non-motorized recreation use
- Close most roads to motorized vehicles
- Classify land as not suitable for timber production in order to meet visual quality objectives and-wildlife habitat needs, or lands not cost efficient for timber management over the planning horizon
- Manage habitat of older forests primarily for bear, and animals requiring similar environments

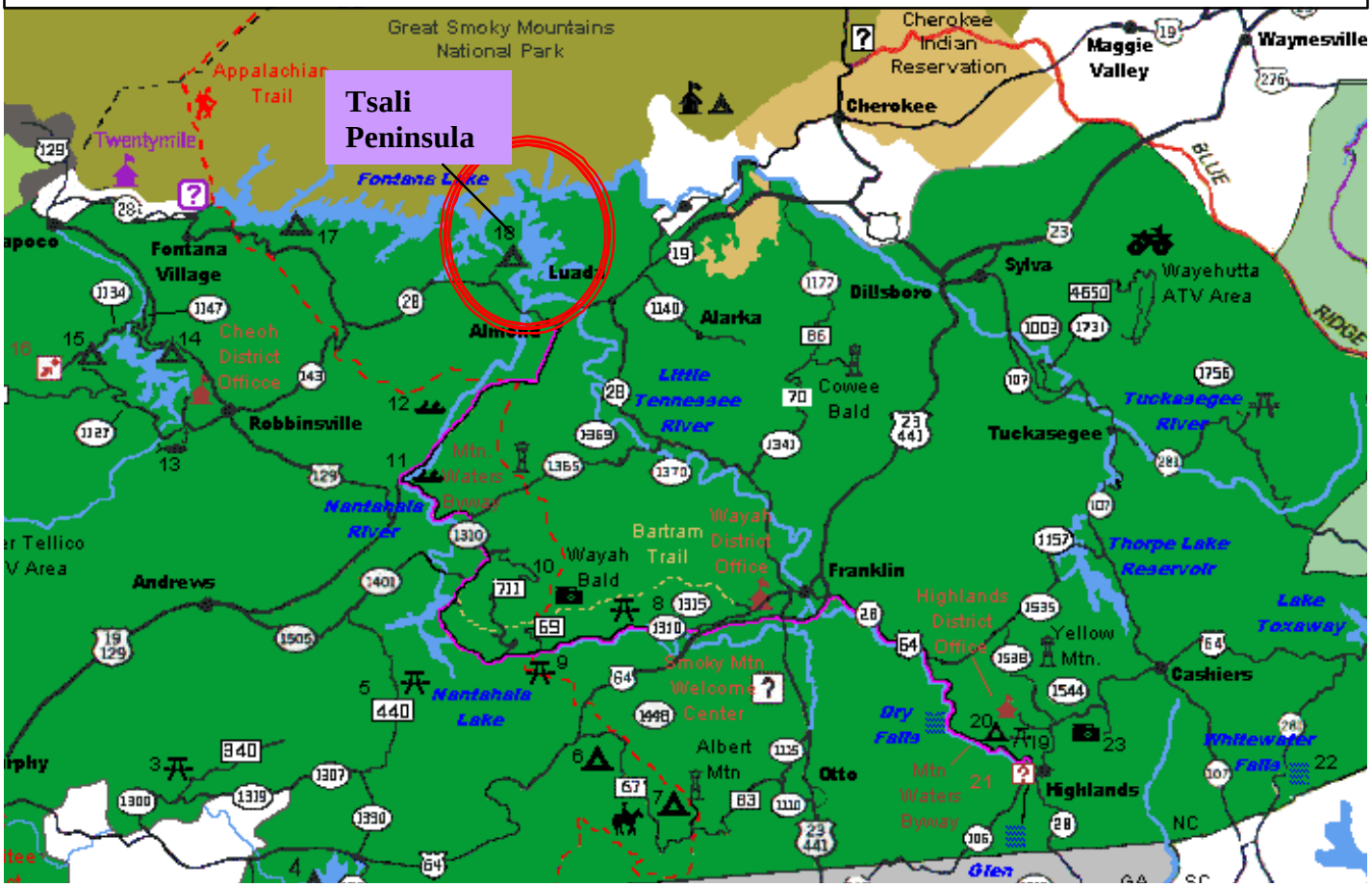
Management Area 18

The Riparian Management Area, embedded in other management areas, consists of the aquatic ecosystem, riparian ecosystem and closely associated plant and animal communities. This area includes at a minimum: perennial streams and perennial water bodies, wetlands, 100-year floodplains and a 100 foot buffer zone on each side of all perennial streams and lakes. The area will be actively managed to protect and enhance, where possible, the distinctive resource values and characteristics dependent on or associated with these systems. For example, timber management can only occur in this area if needed to maintain or enhance riparian habitat values.

The Project Area

Located on the border of Graham and Swain Counties approximately 20 miles from Robbinsville North Carolina, the Tsali Recreation Area is part of the Nantahala National Forest and is managed by the Cheoah Ranger District in Robbinsville. The Tsali Recreation Area is a peninsula created by the impoundment of Fontana Lake in the mid 1940's and is part of the Little Tennessee and Nantahala River

Figure 1. Vicinty Map for Tsali Forest Health Project.



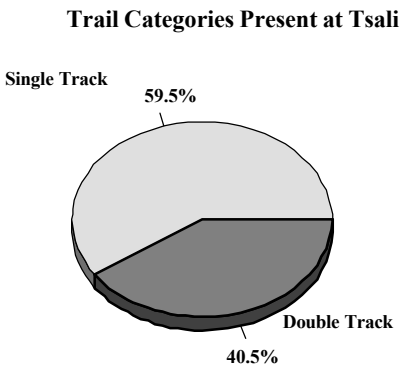
watersheds. The project or analysis area includes 4,254 acres of National Forest lands in the Little Tennessee and Nantahala River watersheds of Graham and Swain Counties. The land is within the Nantahala and Pisgah Land Resource Management Plan (LRMP) Analysis Area 7 in compartments 152, 153, 154,155, and 156. The five compartments are almost exclusively within the Tsali peninsula and surrounded by Fontana Lake. The southeastern boundary by Fontana Lake is adjacent to the confluence of the Nantahala River and the Little Tennessee River, now totally submerged in Fontana Lake. Round Top and Panther Creek delineate the southwestern boundary. North of the area, on the other side of the Lake, is the Great Smoky Mountain National Park. Access to the Tsali Area is via the intersection of State Road 1286 and Highway 28 (see vicinity map page 5). Inside the analysis area, several Forest Service roads and trails provide access (foot, mountain trail bike, and horseback use only) across the peninsula. Management areas include 2A, 4A, and 18. The majority of the proposed activities will occur within management area 4-A.

Existing Conditions

The following sections describe and summarize existing environmental and facility conditions in the proposed project area. Forest conditions such as forest type, forest condition, stocking levels, and age are more completely described in the Continuous Inventory and Stand Conditions (CISC) records located at the Cheoah Ranger District in Robbinsville, North Carolina.

Trails

Currently there is a total of 21.9 miles of single track, 6.6 miles of old logging roads used as trails and 9.05 miles of system roads used as trails for a total of approximately 38 miles. The trail system winds through wooded side-slopes, past streams, then breaks out into old clear cuts with young trees open to views of the lake and nearby ridges. The single-track trail is narrow in places where trees encroach on both sides or along steep side slopes. On busy biking days riders may stop often to allow oncoming bikes to pass in the narrow areas. The double track is old road beds and allows for easy passing. The trail grade is moderate for most of the system with some difficult uphills and fast downhills. The trail system is adequately marked and a map is available, although at times riders are confused by trail junctions. An individual loop takes about 2-3 hours to ride, depending on the rider's experience and conditioning. The desired future condition would be multiple loops of varying lengths, with a variety of difficulty levels that can meet the needs and skill levels of visitors. The size of the trail system will keep up with demand for use and thus will continue to offer an experience where riders have a sense of independence while riding and only meet a few other riders except on busy days. Tsali area may be part of a long distance system of trails if demand for increased miles is shown. The trail setting will continue to offer a mix of hardwood and pine, to open ridge-tops with adequate areas for resting and viewing scenery. The wooded areas will offer some park like settings where tree spacing and low understory allow long views into the forest. Views of the forest from the trails will be attractive and natural appearing. Views of management activities will not dominate the scenery and will be short term in duration. All the trails will be open to hiking, mountain biking, and horse riding on a rotation system or other system that maintains a quality experience and safe trails. Users' experiences and impressions will be solicited through periodic on-site surveys, and monitoring of trail condition and use. Maintenance will be done by FS personnel or volunteer groups. Fees collected for use of the trails will be used to meet visitor needs and maintain the system and facilities.



Transportation System

Current access to the area is via Highway 28 to the intersection of State Road 1286 (Tsali Recreation Area Road). A number of existing Forest Service haul roads have been inventoried and added to the road system with this project. These are:

- FS 2548-Calf Pen Gap-1.6 mi.
- FS 2550-County Line-3.8 mi.
- FS 2550-A-Battle Branch 1.0 mi.
- FS 2550-B-Meadow Branch .60 mi.
- FS 2550-C- Windy Point 1.0 mi.
- FS 2550-D- County Line Extension .40 mi.
- FS 2550-E-Upper Mouse Branch .75 mi.
- FS 2551-Murphy Gap 2.8 mi.
- FS 2552-Town Branch 1.6
- FS 2553-Lemmons Branch 2.5 mi.

Recreation Facilities

There are four separate areas for activities, the campground, a corral area for horses, trailhead parking lot, and boat ramp and parking lot. The 41 campground is a self-service pay facility. It has a small shower/bathhouse, and flush toilets. Shower facilities are not adequate for the number of campsites, and visitors other than paying campers use the showers. The campground fills quickly on weekends with primarily bicyclists. Overflow recreationists camp in dispersed sites, some designated and some not, along the entrance road. There is some evidence of resource damage from high concentration of dispersed camping, especially close to the stream. Horses are not allowed in the campground so the corral area, which is some distance away, is available for overnight use. It is in disrepair and

seldom used because riders want their horses near their campsite. There is a double vault toilet, water spigot, and bike wash station at the trailhead parking. Trail users pay their fee and get information about the trail system at the parking lot. It is often staffed by a Forest Service employee. Parking is adequate for current trail use. The boat ramp has three parking levels that fluctuate with the water level. There are no other improvements at the boat ramp.

Desired future condition would have an expanded campground so most of the overnight recreationists would be accommodated. A group camp area would be available for three or four medium sized groups. The day use parking lot will expand as the trail system expands. Forest Service personnel would be available on site most of the time to give information and help collect fees. Additional facilities at the trailhead parking like cold water showers and shaded sitting areas, would be provided to meet user needs. Visitors drive in along and attractive road with good signing to the various facilities. Facilities are well maintained and accessible to all users.

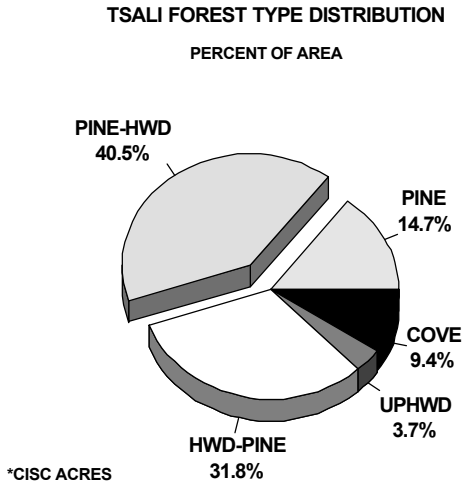
Wildlife Habitat

Approximately 87 per cent of the proposed project area is designated as Management Area 4A. The LRMP for the Nantahala and Pisgah National Forests sets forth the standards and guidelines for wildlife and fish resource management for management area 4 beginning on page III-84. The general standard for Management Area 4 is to manage for wildlife species that "benefit from mostly mature forest conditions" i.e. black bear and associated game and non-game species. The LRMP refers to wildlife species as Management Indicator Species (MIS) that are associated with different management areas (4A, 3B, etc.) and the forest conditions (age, species composition, etc.) that provides habitat for various wildlife species. Exceptions to MIS are located in the LMRP Appendix F, page F1. The need for exceptions to managing habitat for species other than those associated with a given management area, results from several important existing conditions that include habitat improvements, cooperative stocking programs with the North Carolina Wildlife Resources Commission, fragmented National Forest land ownership, and proximity to large acreage's of management areas where primary habitat management is for other species. At Tsali, for example, Compartments 152,153,154,155, and 156 are to be managed primarily for turkey and associated species due to the proximity of the Great Smokies National Park (suitable black bear habitat) and existing forest composition and age class distribution of the forest ecosystem at Tsali.

Currently, there are 29 wildlife openings seeded with orchard grass and clover approximately one-half to one acre in size which receive annual maintenance by the Forest Service and/or the North Carolina Wildlife Resources Commission. Logging roads seeded to provide wildlife strips total 4.65 acres. Wildlife openings comprise approximately 25 acres, which is less that 1% of the total area. This condition is below the recommendation set forth in the LRMP for Nantahala National Forests. The desired future condition would be to relocate a section of Mouse Branch Loop and a section of the Thompson trails away from wildlife openings and roads currently used as bike trails and increase grass/forb conditions to a maximum of 3% . Approximately 100 additional acres of grass/forb conditions need to be created in the project area to meet the direction in the Land and Resource Management Plan, Amendment 5.

The Forest Community

A large percentage of southern yellow pine species occupy the peninsula. This is due in part to the past land use, primarily agriculture integrated with burning. Vegetation is described in the Continuous Inventory of Stand Conditions (CISC) for Compartments 152,153,154,155, and 156, based on the most current forest stand mapping, completed during 1996.. Pine- hardwood and hardwood-pine forest types occur on the drier sites. On the north-to east-facing slopes hardwood forest types dominate, with yellow poplar and other cove hardwood on moist sites. Upland hardwoods and mixed hardwoods occur along mid-slope. The Forest Service supports this species diversity by prescribing forest management activities that promote and maintain this biological diversity. These activities are consistent with the Nantahala National Forest Land Management Plan and are inherent properties of healthy forests.



Elevations within the Tsali peninsula vary from 1700 to 2100 feet above sea level. As such, it is one of the gentler gradient areas located within the Nantahala National Forest. A variant of oak-hickory forest or the lower elevation variant of montane oak forest (Schafale and Weakley 1990, Newell and Peet 1997, Simon 1996) occupies the concave slopes within these lower elevation forests. This community is dominated within the overstory by white oak (Quercus alba), southern red oak (Quercus falcata), scarlet oak (Quercus coccinea), shortleaf pine (Pinus echinata), mockernut hickory (Carya alba), pignut hickory (Carya glabra), red maple (Acer rubrum), black oak (Quercus velutina) or red oak (Quercus rubra). Flowering dogwood (Cornus florida) and American holly (Ilex opaca) are prevalent within the midstory layer. The shrub layer varies in density and is primarily open. On the steeper portions of the landscape with this community type, deciduous members of the heath family are common. These primarily consist of hillside blueberry (Vaccinium pallida) and bear huckleberry (Gaylussacia ursina).

In some of the stands with a greater component of white pine (Pinus strobus), the shrub layer is also denser. Other scattered shrubs includes buffalo-nut (Pyrularia pubera), flame azalea (Rhododendron calendulaceum), horse-sugar (Symplocos tinctoria), Carolina

rose (Rosa carolina) and Carolina holly (Ilex ambigua). Wild hydrangea (Hydrangea arborescens), maple-leaf viburnum (Viburnum acerifolium), and sweet shrub (Calycanthus floridus) are more common where this example occurs adjacent to streams. The herbaceous layer varied greatly across the landscape. Those more xeric examples tended to be less diverse, particularly if the midstory and shrub layer were closed. Species encountered included New York fern (Thelyptris noveboracensis), Pennsylvania sedge (Carex pensylvanica), stiffleaf coreopsis (Coreopsis rigida), moccasin flower (Cypripedium acaule), wood violet (Viola sororia), bellwort (Uvularia puberula), Carex virescens, Curtis goldenrod (Solidago curtisii), clasping aster (Aster patens), Robin's plantain (Erigeron pulchellus), forked witch grass (Dichanthelium dichotomum var. dichotomum), Bosc's witch grass (Dichanthelium bosci), smooth false-foxglove (Aureolaria flava), naked tick-trefoil (Desmodium nudiflorum), downy lobelia (Lobelia puberula), wavy-leaved aster (Aster undulatus), poison ivy (Toxicodendron radicans), Carolina vetch (Vicia caroliniana), hay-scented fern (Dennstaedtia punctilobula), wild lettuce (Lactuca floridana), small-flowered sunflower (Helianthus microcephalus), two-flower melic (Melica mutica), bluegrass (Poa autumnalis), hairy spiderwort (Tradescantia hirsuticaulis), purple-node joe-pye-weed (Eupatorium purpureum), Indian-physic (Porteranthus trifoliatus), cranefly orchid (Tipularia discolor), autumn coralroot (Corallorhiza odontorhiza), little bluestem (Schizachyrium scoparium), bedstraw (Galium pilosum), pinesap (Hypopitys monotropa), summer bluet (Houstonia purpurea), southern harebell (Campanula divaricata), plantain pussy-toes (Antennaria plantaginifolia) and spotted wintergreen (Chimaphila maculata).

Embedded within this type are small shaded rock outcrops. They are similar to montane acidic cliff communities (Schafale and Weakley 1990), although not as well developed as the type example. Characteristic species are alumroot (Heuchera americana), mountain-mint (Pycnanthemum pycnanthemoides), marginal wood fern (Dryopteris marginalis), Campanula divaricata, ebony spleenwort (Asplenium platyneuron), Carex radiata, and Umbillicaria sp. Two unusual species seen on one small outcrop in the northeastern portion of compartment 155 were lanceleaf loosestrife (Lysimachia lanceolata) and Solidago sphacelata. Both of these species tend to be associated with mafic rock.

These oak-hickory communities grade into a poorly developed rich cove forest (Schafale and Weakley 1990), one that represents the lower elevation extreme of this type in the mountains. Dominance in the overstory primarily consists of tulip poplar (Liriodendron tulipifera), with scattered beech (Fagus grandiflora), black birch (Betula lenta), cucumber-tree (Magnolia acuminata) and red maple. Within the open understory wild hydrangea, sweet shrub, spice bush (Lindera benzoin) and strawberry bush (Euonymus americanus) are scattered. Many of the same herbs encountered in the mesic oak-hickory forest are also present within this cove forest. Given that and the generally small size of this community, it is quite difficult where to distinguish between the mesic end of the oak-hickory community and rich cove forest.

Some of those additional herbs encountered within this cove community at Tsali are southern crownbeard (Verbesina occidentalis), Vasey's trillium (Trillium vaseyi), crested iris (Iris cristata), white wood aster (Aster divaricatus), arrow-leaved aster (Aster sagittifolius), skullcap (Scutellaria elliptica), Indian cucumber (Medeola virginiana), blue cohosh (Caulophyllum thalictroides), hay-scented fern (Dennstaedtia punctilobula), wild comfrey (Cynoglossum virginianum), starry campion (Silene stellata), southern lady fern (Athyrium asplenioides), false goat's beard (Astilbe biternata), perfoliate bellwort (Uvularia perfoliata), Carex digitalis, Carex laxiflora, wood-lily (Clintonia umbellulata), jumpseed (Persicaria virginiana), poison ivy, Thalictrum dioicum, mouse-ear chickweed (Stellaria pubera), wild geranium (Geranium maculatum), foamflower (Tiarella cordifolia), doll●s-eye (Actaea pachypoda), interrupted fern (Osmunda claytonia), large-leaved aster (Aster macrophyllus), buttercup (Ranunculus recurvatus), shorthusk grass (Brachyelytrum erectum), wild yam (Dioscorea villosa), black cohosh (Cimicifuga racemosa), broad beech fern (Phegopteris hexagonoptera), maidenhair fern (Adiantum pedatum) rattlesnake fern (Botrychium virginianum), false Solomon's seal (Maianthemum racemosum), wood rush (Luzula acuminata), Christmas fern (Polystichum acrostichoides), wood anemone (Anemone quinquefolia), horsebalm (Collinsonia canadensis), and cane (Arundinaria gigantea). Species present adjacent to streams within this community included green wood orchid (Platanthera clavellata), bugleweed (Lycopus virginicus), blue marsh violet (Viola cucullata), slender toothwort (Cardamine angustata), cinnamon fern (Osmunda cinnamonea), wood-nettle (Laportea canadensis) and turtlehead (Chelone glabra). Past disturbance within these communities is evidenced by the presence of privet (Ligustrum sinense), Japanese honeysuckle (Lonicera japonica), multiflora rose (Rosa multiflora) and Japanese-grass (Microstegium vimineum).

Pine-oak/heath forest (Schafale and Weakley 1990), or xeric evergreen forest (Newell and Peet 1995) is the most dominant community across the landscape in these 5 compartments. It occurs on the relatively broad flat ridgetops and on many of the side slopes, occupying well over half of the landscape. Shortleaf pine (Pinus echinata) is the dominant pine within this community. As such it is similar to some Piedmont vegetation types and most similar to the shortleaf pine communities described in the lower Chattooga River Basin (Simon 1996). Pitch pine is also quite prevalent. Virginia pine (Pinus virginiana) and white pine are scattered also, and probably are indicative of former heavy disturbance prior to pine establishment and subsequent fire exclusion. Common oak species are southern red oak, white oak and scarlet oak. Generally the more exposed examples of this type have a dense shrub layer, this typically dominated by ericaceous species such as mountain laurel, low bush blueberry or bear huckleberry. Scattered herbs within the more closed shrub layer include stiffleaf coreopsis (Coreopsis major var. rigida), wintergreen (Gaultheria procumbens), trailing arbutus (Epigaea repens), rattlesnake orchid (Goodyera pubescens), Dichanthelium commutatum, rattlesnake-weed (Hieracium venosum), bracken fern (Pteridium aquilinum), and whorled loosestrife (Lysimachia quadrifolia). Where this community type has been under a more frequent prescribed burn management, the shrub layer can be quite open, with only scattered occurrences. One shrub that seems to like the more frequent fire is New Jersey tea (Ceanothus americanus).

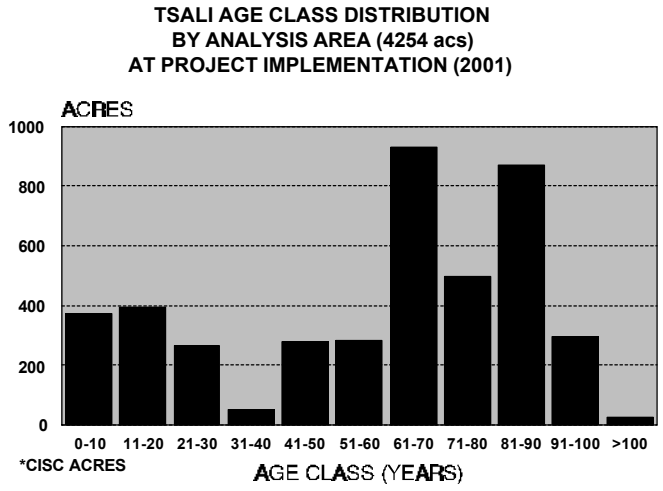
Within these more open areas the herbaceous layer tends to be diverse and includes such species as fragrant goldenrod (Solidago odora), grey goldenrod (Solidago nemoralis), creeping aster (Aster surculosus), little bluestem, Indian grass (Sorghastrum nutans), grass-leaved golden-aster (Pityopsis graminifolia), Maryland golden-aster (Chrysopsis mariana), tick-trefoil (Desmodium laevigatum), hairy lespedeza (Lespedeza hirta), wand lespedeza (L. intermedia), trailing lespedeza (L. repens), rosin-weed (Silphium compositum), hairy angelica (Angelica venenosa), redtop (Tridens flavus), white-haired witch grass (Dichanthelium villolissium), black-eyed susan (Rudbeckia hirta), goat's-rue (Tephrosia virginiana), butterfly pea (Clitoria mariana), late eupatorium (Eupatorium serotinum), sensitive brier (Schrankia microphylla), partridge-pea (Chamaecrista fasiculata), Appalachian sunflower (Helianthus atrorubens), silver plume grass (Saccharum alopecuroideum), and Baptisia tinctoria. One rare species was located within this community, Liatris squarrulosa. Liatris squarrulosa is a forest concern species.

An acidic cove forest inhabits those shallow and moderate slopes adjacent to creeks and tributaries throughout the five compartments (Schafale and Weakley, Newell and Peet 1997). A mixture of black birch (Betula nigra), red maple, Canadian hemlock (Tsuga canadensis) and tulip poplar dominates this community. Great laurel (Rhododendron maximum) and dog-hobble (Leucothoe fontansiana) almost exclusively dominate the understory excluding most herbs. Partridge berry (Mitchella repens), arrowleaf heartleaf (Hexastylis arifolia), striped wintergreen (Chimaphila maculata), Indian cucumber, Indian pipes (Monotropa uniflora), Galax (Galax urceolata), Christmas fern and rattlesnake orchid (Goodyera pubescens) are the most frequently encountered herbs within this community type. A small population of Megaceros aenigmaticus, a regionally sensitive hornwort, was located within an unnamed tributary to Lemons Branch. The majority of the streams investigated was inundated with sediment and did not provide much suitable habitat for aquatic plant species.

One other plant association is present across the five compartments, white pine forests. White pine plantations are present in 15 separate locations across these five compartments. All of these areas have been established during the past 25 years. White pine dominates the overstory here and varies in density. Where the plantation has been established in draws, coves or side slopes, white pine almost exclusively dominates. Along ridgetops and the most xeric slopes, a minor component of either shortleaf pine, pitch pine or various oaks also occur. The shrub layer varies in composition and density. Ericaceous shrubs such as hillside blueberry, mountain laurel, bear huckleberry, deerberry (Vaccinium stamineum) occur in dense patches or are scattered across the stands. Few herbaceous plants occur within these plantations, generally regardless of the shrub density.

Age Class Distribution

The age classes at Tsali are similar to other National Forest lands with one exception. The amount of 0-10 age classes present, or early seral forest types and or conditions found during the inventory of 1996 was atypical of other National Forest Lands across the Nantahala National Forests. This amount recorded during the 1996 inventory (over 600 acres) suggests that in the past 10 to 15 years, major disturbances have occurred. The recent southern pine beetle outbreaks and the storm history for this area are responsible for this unbalance. However, between 1996 and 2001, the amount of forest in the 0-10 year age class present was greatly reduced by forest in the 0-10 year age class growing older - into the 11-20 year old age class. Approximately 75% of the forested area at Tsali is 50 years of age or greater. As these trees age (grow into different age classes), they will become more susceptible to forest insects and diseases.



Forest Health Threats

The alternatives developed for the Tsali Forest Health Restoration Project are the product of over 3 years of analysis, collection of field data, and extensive public scoping. In 1995 the analysis process began when the Cheoah Ranger District, in cooperation with the Forest Health Unit for this region, began to identify and assess forest health threats to the forest ecosystem at Tsali. The PURPOSE AND NEED section of this document presents why this project is being proposed. Seemingly overnight, the Tsali Recreation Area has undergone significant ecological changes directly related to a native insect known as the southern pine beetle. Out breaks of this insect are linked indisputably to the health of our southern yellow pine or mixed hardwood/pine, pine/hardwood forest types common to the forest ecology that occur along the Little Tennessee and lower Nantahala River watersheds.

The Tsali Recreation Area is one of the most popular mountain trail biking areas in the southeast which gives the forest visitor an acute awareness to forest health issues like the southern pine beetle. Individual, values and personal perceptions are responsible for the various definitions used to describe forest health. Mainstream definitions that are applied today are derivatives of personal values and perceptions that generally fall into two broad categories.

I. Utilitarian Perspective---Biotic (living) or abiotic (non living values such as economics) influences do not threaten management objectives now or in future.

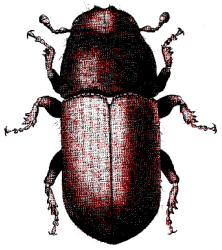
II. Ecosystem Perspective---Forest communities are resistant to catastrophic changes and if these changes occur, have the ability to recover; with an equilibrium existing between supply and demand of resources (sunlight, water, nutrients, and space).These communities will support diverse seral stages (various age groups excluding mature) and stand structures for native species.

These perceptions of forest health are driven by personal intrinsic values and will vary according to these values. Regardless of which perception is held, healthy forests share common attributes that include:

- Resilience to recover from catastrophic events (insects and disease, fire, weather)
- Sustainability of forest products
- Diversity of native species
- Ecological processes(current natural or man related impacts, past influences, and future impacts)

Southern Pine Beetle

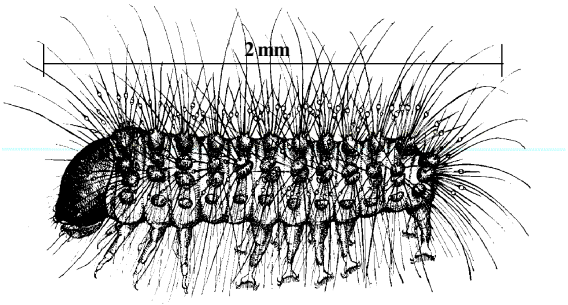
Adult SPB 1/8 inch long



The southern pine beetle, (SPB) is a native insect and the most destructive pest to our pine forest in the southeast. Adults bore through the bark to feed and lay eggs in the living tissue inside the tree. Several hundred beetles may attack a single tree at one time, which can be fatal. A blue-stain fungus, introduced by the beetle, hastens the death of the tree. The Tsali peninsula has a history of SPB outbreaks in those areas dominated by pine species that are declining in health due to slow growth rates. Vigourously growing trees are more able to repel attacks due to higher resin flow than slow growing trees.

Gypsy Moth

Introduced from Europe, the gypsy moth has become one of the most important forest and urban pests in the United States, thriving in the hardwood forests of the east. Currently, the gypsy moth is not established in the southern Appalachians but the consensus is that somewhere between 2005 and 2015 the Nantahala National Forests could begin to be impacted by this insect. In the spring, the caterpillars or larvae hatch from over wintering eggs to feed on the developing leaves of some of the most important tree species, especially oaks, in our forests. The caterpillar or larvae starts its life cycle as a small, benign caterpillar that after 5 or 6 developmental stages, (instars) becomes an aggressive feeder on the leaves of our hardwood forests. This feeding can result in defoliation and as the tree struggles to grow new leaves, becomes stressed and less able to withstand attacks form other insects and diseases. Tree mortality often follows severe or repeated defoliation's.



First instar larvae

Oak Decline

Oak decline is a slow acting disease complex caused by an interaction of environmental factors. Reported occurrences date back over 100 years. During the last 20 years, increases in the incidence of this disease have been documented. Symptoms of oak decline have been observed on over 3 million acres of forestland in 12 states. High incidence of oak mortality and advanced decline symptoms (crown dieback of the dominant and co dominant trees) is associated with forests composed of a high proportion of oak in the overstory, especially red oaks in the older age classes growing on average or low sites. (Oak, Starkey, et.al 1993). Oak trees are first weakened by insects, diseases, or drought, and become stressed. Weak and stressed trees are not able to withstand attacks by insects and diseases that are normally not fatal to the tree and it is usually these older trees growing on less productive sites that are the most affected. Tree mortality occurs after several years of decline.

History And Scoping

During May, 1996, 200 forest plots were established to provide a detailed resource inventory on the Tsali Peninsula. The data collected during the inventory served as an analysis tool to determine the status of forest health risks and hazards associated with the forest ecosystems at Tsali. Risk and hazard ratings were developed to determine the susceptibility and vulnerability of this forest to southern pine beetle, gypsy moth, and oak decline.

Scoping was issued as the Tsali Forest Health Recreation Project on 7/16/97 In May 1997 an interdisciplinary team (ID Team) was selected to complete the Environmental Assessment for this project. Mark Robison, NEPA Forester for Nantahala National Forest, Frank Findley, Recreation Resources Assistant for the Cheoah Ranger District, and Kathy Ludlow, Landscape Architect for National Forest in North Carolina, were assigned to the ID Team by Glenn McConnell, District Ranger. Mark Robison was appointed as Team Leader. Both internal and public scoping was conducted. This included news articles in local papers along with numerous letters sent to persons and organizations, either potentially affected by or interested in the proposal. The list included local residents, timber industry, wildlife groups, special use recreation groups, and state agencies. Several public meetings were held in Graham and Swain Counties to present the proposals and discuss issues and concerns. The proposed project along with the public meetings produced a citizen's action group that actively participated in the analysis process and ultimately helped shape alternatives that minimize impacts to user groups and increase opportunities for additional trails. This group includes commercial bikers, commercial horse outfitters, recreational bikers and horse riders, hunters, local government, local campground owners, boaters, campers, loggers, and the state Wildlife Resources Commission. Many comments, issues, concerns, and responses resulted from these mailings and public meetings. The project file contains the names and addresses of all who were contacted, information sent, public comments, and Forest Service responses. A list of the respondents can be found in appendices at the end of this document.

Direction and "intent" of the National Environmental Policy Act of 1969 (NEPA) are being met by the completion of an EA for this project. The ID Team concluded that it would be reasonable and prudent to proceed with this assessment (EA) to determine if a Finding of No Significant Impact (FONSI) and Decision (DN) could be issued.

Issues by Project Objectives

After reviewing letters, responses, and comments received from several public meetings the ID Team condensed and phrased them as questions. These issues are considered the major factors that drive the environmental analysis. The Tsali Forest Health Restoration Project was designed under the direction of the LRMP as amended to meet the following specific objectives by tree harvest and associated activities. Listed after these objectives are the issues associated with them.

OBJECTIVE: Provide for future healthy forest condition by economically regenerating or thinning damaged, sparse, low-quality, mature or overstocked stands to a fully-stocked or optimum growth response level as needed to reduce the risk of southern pine beetle outbreaks, impacts from the gypsy moth, and losses associated with oak decline. The intent of this objective is to provide continuous timber production from the area and to maintain existing access to the area for cost-efficient long-term resource management.

Issue; Silvicultural Systems: *What type of silviculture systems are planned and how many acres will be affected for each alternative over a given time period?*

Indicators for this issue:

- Acres receiving 2-Age regeneration cutting
- Acres receiving thinning
- Acres committed to creating woodland conditions
- Acres treated to reduce risk/hazard for southern pine beetle, gypsy moth, and oak decline.

Issue; Associated Vegetation Management Activities (manual/chemical site preparation and or pre-harvest stand improvements) necessary to implement silviculture treatments. *What impacts on human and wildlife health would be associated with the silvicultural treatments necessary for meeting the regeneration objectives and stand improvements*?
Indicators for this issue:

- Acres receiving chemical pre-harvest site prep treatment
- Acres receiving manual site prep treatment (including site prerparation burns)
- Acres proposed for prescribed burning for wildlife habitat improvement

Issue: Water Quality: *What would be the potential impacts* of associated activities *(road construction and logging) necessary to implement silviculture treatments to water quality in native fish habitat and other downstream uses due to the proposed activities*?
Indicators for this issue:

- Relative amount of disturbed soil (roads and trail construction, log landings, skid trails)
- Number and type of stream crossings and associated actives within designated riparian areas

Issue: Soils: *How will the soil be affected* by a*ssociated activities(road construction and logging) necessary to implement silviculture treatments?*

Indicators for this issue:

- Miles of skid roads and trails to construct
- Miles of skid road constructed in areas with high erosion potential
- Miles of trail constructed in areas with high erosion potential

Issue: Economics: *What would be the economic consequences of implementing the alternatives?*
Indicators for this issue:

- Benefit to cost ratio

Issue: Cultural Resources: *Would any of the activities(road construction and logging) necessary to implement silviculture treatments impact cultural resources?*

Indicators for this issue:

- Sites impacted by alternative

OBJECTIVE: Improve wildlife habitat by enhancing viability and growth of hard mast bearing trees and increase the amount of grass forb habitat available for wildlife

Issue: Habitat Diversity: *How would the alternatives affect habitat diversity, including grass/forb openings, old forest communitie, and thedevelopment of advanced oak regeneration?*

Indicators for this issue:

- Acres of grass/forb habitat created
- Acres pre-harvest site prep to develop advanced oak regeneration
- Acres designated for old growth restoration

Issue: Proposed, Endangered, Threatened and Sensitive Species (PETS): *What would be the effects on PETS plant, animal, and aquatic species, and their habitat?*

Indicators for this issue:

- Effects determination findings for PETS plants, animals, and aquatic species.

OBJECTIVE: Provide for high quality recreation and scenic experiences for forest visitors by maintaining existing recreation facilities, new trail construction for hiking, horseback riding, and mountain trail bike use

Issue: Recreation: *What impacts will the project have on trail use (hiking, biking, and horseback riding)?*

Indicators for this issue:

- Miles of trail constructed
- Miles of trail impacted by closure, disturbed trail surface or logging traffic during logging and associated activities.

Issue: Visual Quality: *What visual impacts might occur from logging activities, road construction, and site preparation for forest regeneration?*

Indicators for this issue:

- Miles of road constructed within the area
- Acres receiving silvicultural treatment visible from trails or from significant viewpoints

A few issues were considered but identified as not being affected by the proposed project and therefore not needing intensive analysis. These issues were impacts on consumers, civil rights, minority groups, women, prime farmland, and rangeland. Impacts to forest land were considered; there will be no irreversible or irretrievable commitment of resources or unavoidable impacts to forest land outside of those disclosed in the Final Environmental Impact Statement (FEIS) for the Nantahala and Pisgah Land and Resource Management Plan (USDA March 1987) on pages IV-33 and 34.

Issues, Opportunities, and Concerns Outside the Scope of the Analysis

During the scoping process public meetings, and discussion generated through meetings of the Citizens Advisory Committee, issues, opportunities and concerns were gathered that are considered to be outside the analysis of this project. Some of these issues such as increased information transfer and research addressing recreational development and sustainability, have improved or are underway. A questionnaire developed by the USDA Forest Service research unit in Athens, Georgia (Bowker and English 1998), is currently being presented to various user groups at Tsali. The questionnaire has a two-year life-span that when complete, will become a planning variable for the resources at Tsali. A copy of the questionnaire is on file at the Cheoah Ranger District in Robbinsville, North Carolina. The issues, concerns and opportunities considered outside the scope for this analysis are presented by category and include:

Recreation: The important recreational resource and growing popularity of this area is recognized and the majority of comments received relate to the trail system and new development. They are:

- Opportunity to increase communication and information transfer between USFS and biking community
- Opportunity for a comprehensive study addressing recreational development and what level of development Tsali and surrounding National Forest will sustain
- Concerns about increasing conflicts between horseback trail use and mountain trail bike use

Wildlife: Comments and issues regarding wildlife are directed towards increasing conflicts among the diverse user groups at Tsali and are:

- Issue that logging roads converted to "linear wildlife openings" should remain closed to bicycle, horseback riding, and hiking
- Concerns related to the Impacts of heavy recreation use on wildlife populations, especially during spring and summer months
- Concerns over increasing conflicts between hunters and other recreational users

Socioeconomic: More enduring, and inherently more complex are the issues and concerns related to how this project affects socioeconomic issues. For example, which contributes more to the local economy, logging or recreation activities? How is the recreation "experience" measured economically? What role does the multiplier affect play when considering economics of recreation compared to logging? The issues and concerns received during the comment period and publics meetings are:

- Support for multiple use management---"There is enough for everyone"
- Local government contradicts claims that recreation contributes more to the local economy that logging, especially in counties like Graham and Swain where large land holdings by the government negatively impact municipal operations due to a small tax base
- Mountain trail biking has practically eliminated horseback riding--"The trails were originally built for horse use"

The Alternatives Considered --- Including Those Dropped from Detailed Analysis

Introduction

Five alternatives were formulated to provide a range of choices regarding the need for the proposed project. They represent clear choices between various uses of the natural resources in the project area. Alternatives are described in two sections: alternatives considered but dropped from detailed analysis, and alternatives considered in detail. Alternative descriptions are presented in this section. The interdisciplinary team representing various resources and uses of the Forest, such as timber, wildlife, botanical , water, and recreation, considered the following important elements when the developed the alternatives for this analysis:

- The laws, regulations and policies that govern land development on National Forests
- The goals, objectives, and desired future conditions for the project area as outlined in the Nantahala National Forest Plan
- Comments, suggestions, and recommendations received or made by interested individuals or groups during the scoping process.
- Comments suggestion, and recommendations made by the Users Group for Tsali Recreation Area

Through the scoping process and development of alternatives, 7 public meetings were held to solicit input from various publics. After the second public meeting, a Tsali Users Group formed to discuss issues, and develop or refine alternatives. This group includes representation from the mountain trail bike community, local outfitters for horseback riding, county government, loggers, foresters, wildlife biologists, botanist, and sportsmen (hunters and fishermen). This group reviewed alternatives and associated issues developed by the ID team that relate to the project.

The Tsali Forest Health Project is a challenging project that has undergone extensive analysis. The original scoping document sent out 7-16-97 stated the objectives of this project as forest health restoration, wildlife habitat improvement, and providing a quality recreation experience for a variety of user groups. These objectives have and continue to be the impetus for this project. The Existing Conditions section of this analysis provides a graphical summary of the age class distribution for the entire analysis area (4,254 acres). The large amounts of early successional forest conditions are the direct result of southern pine beetle activity and over a decade of catastrophic weather events (wind, drought, and snow or ice damage). These events are natural occurrences that over time, vary in their frequency and ultimately, shape future forest composition and structure. These disturbances produce “new forests” that are defined by the LRMP for the Pisgah and Nantahala National Forest as forest conditions or early seral conditions that are 0 to 10 years of age. These “new forests” may occur whether management activities (such as direct control methods for SPB) are applied or not.

The numerous Analysis Areas across the Nantahala National Forest (the Tsali Forest Health Project occurs within Analysis Area 7) are imbedded with smaller areas known as Management Areas and Compartments. The LRMP establishes general management directions for specific areas referred to as “Analysis Areas”, "Management Areas", and “Compartments”. Each of these areas has directives and guidelines that determine management objectives. At Tsali, the predominant Management Area is 4A, that according to the LRMP, limits early successional forest types by Analysis Area, Management Area, and Compartment, to 10 %. This means that for the entire analysis area, (4,254 acres) or 425 acres (4,254 x .10) are allowed to be in the early seral stage at any point in time. This 10% applies to the individual Management Areas and Compartments as well as the entire Analysis Area. The application of this standard to the Management Areas 4A and 2A shows that up to 403 acres are allowed to be in early successional forest types (3691 acs in 4A + 342 acs in 2A = .10 x 4033 acs). Management Areas 4A and 2A are combined because they both have the same 10 percent early seral forest type or condition restriction. Early seral forest types for individual compartments are limited to 10 percent of the area within each compartment.

The following tables illustrate the effect of past disturbances on the 0 -10 age classes present at Tsali and represents existing conditions present for the proposed implementation date for the Tsali Project (2001).

***Alternative I No Action* -- Existing Conditions for Early Seral Stages of Forest Conditions By Analysis Area, Management Area, and Compartment**

	Effects By Year (> 10% violates LRMP)				
	2001	2002	2003	2004	2005
Analysis Area (4,254 acs)	9%	8%	7%	6%	5%
Management Area (4,033 acs)	9%	8%	7%	6%	5%
Compartment					
152 (890 acs)	4%	4%	4%	4%	0%
153 (1164 acs)	14%	14%	11%	10%	10%
154 (743 acs)	14%	10%	10%	10%	8%
155 (777 acs)	13%	7%	7%	3%	3%
156 (680 acs)	7%	6%	6%	6%	6%

The table below illustrates what effect proposed silviculture treatments in Alternative III will have on early seral forest types or conditions. In this alternative, silviculture treatments will increase the amount of early successional forest types in the short term, especially for Compartments 153 and 154. The main objective of this alternative is to only treat those areas that exhibit a high hazard rating for southern pine beetle, gypsy moth, and oak decline. As with all the action alternatives a major issue with this alternative is to accomplish these forest health objectives in the shortest time period possible to minimize conflicts with recreation use.

***Alternative III*--Effects on Early Seral Forest Conditions By Analysis Area, Management Area, and Compartment**

	Effects By Year (> 10% violates LRMP)				
	2001	2002	2003	2004	2005
Analysis Area (4,254 acs)	10%	11%	10%	9%	5%
Management Area (4,033 acs)	11%	12%	11%	10%	10%
Compartment					
152 (890 acs)	8%	8%	8%	3%	<3%
153 (1164 acs)	16%	15%	14%	14%	8%
154 (743 acs)	10%	14%	16%	14%	14%
155 (777 acs)	7%	10%	7%	3%	3%
156 (680 acs)	7%	6%	6%	6%	6%

In Alternative IV, the number of acres regenerated in Compartment 153 is reduced to address issues related to the amount of early seral forest types or conditions that result from silviculture treatments. The table below summarizes how proposed treatments for this alternative impact early seral forest types or conditions.

***Alternative IV*--Effects on Early Seral Forest Conditions By Analysis Area, Management Area, and Compartment**

	Effects By Year (> 10% violates LRMP)				
	2001	2002	2003	2004	2005
Analysis Area (4,254 acs)	10%	9%	8%	7%	<7%
Management Area (4,033 acs)	10%	10%	9%	9%	<9%
Compartment					
152 (890 acs)	8%	8%	8%	3%	<3%
153 (1164 acs)	15%	13%	12%	12%	12%
154 (743 acs)	No regeneration proposed for this compartment in Alternative IV				
155 (777 acs)	No regeneration proposed for this compartment in Alternative IV				
156 (680 acs)	No regeneration proposed for this compartment in Alternative IV				

***Alternative V The Preferred Alternative*--Effects on Early Seral Forest Conditions By Analysis Area, Management Area, and Compartment**

	Effects By Year (> 10% violates LRMP)				
	2001	2002	2003	2004	2005
Analysis Area (4,254 acs)	10%	9%	8%	8%	8%
Management Area (4,033 acs)	11% (9%)	10%	9%	8%	8%
Compartment					
152 (890 acs)	8%	8%	8%	3%	≤3%
153 (1164 acs)	No regeneration harvests are proposed in this compartment				
154 (743 acs)	10%	10%	10%	8%	10%
155 (777 acs)	7%	7%	3%	6%	≤6%
156 (680 acs)	No regeneration harvests are proposed in this compartment				

Alternatives Considered – Including Those Dropped From Detailed Analysis

Alternative I---No Action Alternative

The goal of this alternative is to maintain the area's natural condition and uses. Current guidelines such as trail maintenance, emergency pest suppression, timber salvage efforts, and recreation activities will continue. This alternative provides a baseline to compare the effects of the action alternatives.

Alternative II--Commercial Sales Excluded

Considered but dropped from detailed analysis

The goal of this alternative is to address the forest health issues at Tsali through non-commercial forest management activities. This alternative is an pro-active approach that will address the threats to forest health on the Tsali peninsula. The proposed management activities will be accomplished by excluding commercial logging. Trees will be felled and left in place. The citizens group working on the Tsali project was not in favor of pursuing this alternative since it would not allow for additional trail development as an off-shoot of commercial timber harvest activities. Skid road and trails, and haul roads used in timber removal are cost effective ways of providing access routes that can be developed into recreation trails. This alternative does not allow for that. Also, it is likely that some number of felled trees would fall across existing trails, which would necessitate additional expense for trail clearing. The numerous dead and down trees would detract from the scenic qualities immediately adjacent to some trails. In addition, an opportunity would be lost to provide wood products to a timber dependent community.

	Year Proposed				
	2000	2001	2002	2003	2004
Timber volume that would be harvested (mbf)	0	0	0	0	0
Management activities proposed					
• 2 age regeneration method (acres)	58	76	14	0	0
• Thinning (acres)	82	159	0	0	0
• Woodlands created (acres)	0	0	0	0	0
• Manual/Chemical pre-harvest site prep (acres)	35	0	15	0	0
• Prescribed fire other than site preparation (acres)	100	209	0	0	0
• Prescribed fire for site preparation (acres)	0	58	76	14	0
	---	---	---	---	---
Logging Methods					
Acres planted with pine seedlings	0	0	58	90	0
Miles of road to construct	0	0	0	0	0
• Skid road	0	0	0	0	0
• System	0	0	0		
				0	0
Miles of road maintenance	0	0	0		
Miles of trail to construct				0	0
• Single track	0	0	0	0	0
• Double Track	0	0	0		
				0	0
Acres of grass forb habitat created for wildlife	0	0	0		
Acres of old growth forest set aside	267				

Alternative III

The goal of this alternative is to meet the objectives and desired future conditions of the project through commercial timber sales in those areas identified as having the highest risk and or hazard rating for southern pine beetle, gypsy moth, and oak decline. This alternative is designed to accomplish project goals and objectives in the shortest time period possible (3 years). Minimizing conflicts between trail users and logging activities was a major issue in formulating this alternative. This alternative is similar to the previous alternative except that commercial harvesting, , road construction, and some wildlife habitat improvement will occur. Some of the features of this alternative include:

	Year Proposed				
	2001	2002	2003	2004	2005
Timber volume that would be harvested (mbf)	230.8	327.6	30.0	0	0
Management activities proposed					
• 2 age regeneration method (acres)	55	76	14	0	0
• Thinning (acres)	85	159	0	0	0
• Woodlands created (acres)	0	0	0	0	0
• Chemical pre-harvest site prep (acres)	35	0	15	0	0
• Prescribed fire other than site preparation (acres)	100	209	0	0	0
• Prescribed fire for site preparation (acres)	0	55	76	14	0
Logging Methods	Tractor	Tractor	Tractor	---	---
Acres planted with pine seedlings	0	0	55	90	0
Miles of road to construct					
• Skid road	0.95	0	0	0	0
• System	0	0	0	0	0
Miles of road maintenance	2.5	4.5	2.0	0	0
Miles of trail to construct					
• Single track	0	0	0	0	0
• Double Track	0	0	0	0	0
Acres of grass/forb habitat created for wildlife	1.5	0	0	0	0
Acres of old growth forest set aside	267	0	0	0	0

Alternative IV

The goal of this alternative is to meet the objectives and desired future conditions for a healthy forest at Tsali, improve wildlife habitat, and to provide for high quality recreation and scenic experiences for forest visitors. Alternative IV was designed to treat only those areas with a high risk/hazard rating for southern pine beetle, gypsy moth, and oak decline in the shortest period possible to reduce conflicts between recreation use and logging activities. Creating woodland conditions, to increase the amount of grass/forb habitat for wildlife is introduced in this alternative. Creating new trails for hiking, horseback riding, and mountain trail bikes is considered in this alternative to enhance recreation opportunities and where possible, reduce the impact of trail use and available grass/forb openings for wildlife. Relocating and constructing future trails away from existing and planned grass/forb openings for wildlife will reduce the amount of disturbance to wildlife. Some of the features of this alternative include:

	Year Proposed				
	2001	2002	2003	2004	2005
Timber volume that would be harvested (mbf)	217.2	326.8	189.6	0	0
Management activities proposed					
• 2 age regeneration method (acres)	41	18	0	0	0
• Thinning (acres)	82	166	86	0	0
• Woodlands created (acres)	17	44	42	0	0
• Chemical pre-harvest site prep (acres)	24	55	0	0	0
• Prescribed fire other than site preparation (acres)	100	59	85	0	0
• Prescribed fire for site preparation (acres)	0	59	0	0	0
Logging Methods	Tractor	Tractor	Tractor	---	---
Acres planted with pine seedlings	0	0	59	0	0
Miles of road to construct					
• Skid road	0.95	0	0	0	0
• System	0	0	0	0	0
Miles of road maintenance	2.5	4.5	2.0	0	0
Miles of trail to construct					
• Single track	2.2	1.1	0	0	0
• Double Track	1.1	0	0	0	0
Acres of grass for habitat created for wildlife	17	44	42	0	0
Acres of old growth set aside	267	0	0	0	0

Alternative V -- The Preferred or Proposed Alternative

The goal of this alternative is to meet the objectives and desired future conditions for a healthy forest at Tsali, improve wildlife habitat, and to provide for high quality recreation and scenic experiences for forest visitors. Similar to Alternative IV, woodland conditions are proposed to achieve wildlife objectives. The addition of new trails is also considered in this alternative. This alternative is designed to treat those areas with high and moderate risk/hazard ratings for southern pine beetle, gypsy moth, and oak decline in the shortest time period possible with the least amount of impact to trail users. Like Alternative IV, creating woodlands and additional trail construction is proposed here to enhance recreation experiences and mitigate wildlife issues. Silviculture methods such as pre-harvest treatments to promote oak regeneration are prescribed here to address wildlife habitat and visual quality issues. The total acreage treated in this alternative is greater than Alternatives III and IV. This is due primarily to the amount of prescribed burning being proposed (869 acres). The forest types at Tsali have a long history of fire dating back to early native American periods. The forest ecosystem itself is adapted to a fire ecology that includes some southern yellow pine species that are dependent upon fire for regeneration (e.g. pitch pine). Some of the features of this alternative include:

The action alternatives for this project include a timeframe (2001,2002, etc) for the proposed treatments. Due to weather, un-forseen conflicts with trail bike construction, logging, and associated logging activities, some variation in the schedule of events can be expected.

	Year Proposed					
	2001	2002	2003	2004	2005	2006
Timber volume that would be harvested (mbf)	326.0	51.75	296.70	181.80	119.25	
Management activities proposed						
• 2 age regeneration method (acres)	56	0	0	26	35	
• Thinning (acres)	52	20	198	28	0	
• Woodlands created (acres)	0	0	20	47	0	
• Chemical pre-harvest site prep (acres)	76	38	0	0	0	
• Prescribed fire other than site preparation (acres)	323	208	338	0	0	
• Prescribed fire for site preparation (acres)	0	56			26	35
Logging Methods	Tractor	Tractor	Tractor	Tractor	Tractor	
Acres planted with pine seedlings	0	0	56	26	35	
Miles of skid road to construct						
• Skid Road	0.50	0	0	0	0	
• Haul Road	0.45	0	0	0	0	
Miles of road maintenance	1.3	2.0	3.0	1.0	1.0	
Miles of trail to construct						
• Single track	2.2	1.1	0	0	0	
• Double Track	1.1		0	0	0	
Acres of grass/forb created for wildlife habitat	0.60	0	20	47	0	
Acres set aside for old growth	267	0	0	0	0	

Mitigating Measures Common to All Action Alternatives

The Forest wide standards and guidelines and specified direction for Management Areas 2,3,4, and 18 as detailed in the LRMP for Nantahala and Pisgah National Forests are incorporated by reference in this document unless other wise noted. Additional standards, guidelines, and mitigating measures that provide specific direction originate from the Tsali Recreation Area Planning Document (McConnell and Findley 1995). The objectives of this document are to define the desired future condition for the area's resources and uses; to establish guidelines for implementing the Forest Plan and for coordinating resource activities; and to prioritize management activities in the near future. Management requirements, mitigation measures, and monitoring would be applied to meet the needs of one or more resource values.

Guidelines for Road Management and Use

- All roads will be Traffic Service Level D (TSL D). TSL D roads are low standard roads with only intermittent use.
- Permanent drainage structures will be installed and maintained.
- Most roads will be native surfaced.
- Spot gravel will be used through drainage structures, steep slopes, and other problem areas such as wet or soft spots.
- Roads will be managed as closed to motor vehicles unless open for specific management purposes.

Those not identified on the enclosed maps as trail opportunities will be managed as wildlife strips and placed on the system. Following use all roads will be seeded to a wildlife mixture. Road construction within the trail corridor (30 feet on either side of trail) will use the following techniques to minimize impacts on aesthetics:

- When possible, trees will be cut instead of pushed up.
- If cutting is not possible, root wads will be placed at base
- Clearing limits will be minimized and not extend past cut or fill slopes.
- Slope cut banks to enable quick re-vegetation.
- Location will be field verified with representatives from recreation, wildlife, and timber shops.
- Re-seeding will occur within 7 days of disturbance.

Use of Roads for Timber Harvest Also Used as Trails

Timber sale contracts will be written to minimize damage to roadbeds, by limiting or halting road use during wet weather conditions and by requiring user to prevent or repair any damage caused by his/her operations. Areas subject to rutting will be graveled. If large (3") stone is used, it will be covered with fine (ABC) gravel for surfacing.

Waterbars/dips will be maintained. Where reasonable, trails will be temporarily routed around sale area. Otherwise, they will be closed for short periods to ensure user safety when felling or skidding trees near the trail. Closure decisions will be made after consultation with the District Recreation, Wildlife and Timber staff and after public notification. Informational signing will explain the reason for reroutes or closures.

Use of Roads Used as Trails Which Have the Appearance of Single Track

- Clearing limits will be minimized.
- If road is widened, banks will be sloped to facilitate re-vegetation.
- If road banks are currently eroding, they will be sloped during road use period and re-vegetated. If banks are stable, do not disturb.
- Trees will be cut flush with ground level instead of being pushed out of the way.
- Coordinate decision to reopen road with District wildlife, recreation and timber staff.
- Sign road to explain reasons behind opening of road.

Timber Management

Planned timber harvests will be designed to meet visual concerns from trails, campground, boat launching area, roads, and Fontana Lake. The identified Visual Quality Objective for MA 2A and 4A is retention in the foreground or sensitivity level 1 areas and partial retention for all other distance zones and sensitivity levels. The VQO's for these management areas are to manage so that activities are not a dominant feature in the landscape. For foreground situations (retention VQO) the activity should not be noticeable after one growing season. In this project area retention VQO will include all areas seen from the trail, roads, and lake.

Management Within Trail Corridor

The trail corridor is designated as 30 feet on each side of the trail. The trail itself is either designated as single track or double track. A single track trail is defined as a trail that is not located on a road. A double track trail is one located on a road. Any activities within this corridor will be coordinated between Recreation, Timber, and Wildlife staff.

The timber within this corridor will be managed primarily as a continuous forest canopy. Planned activities may include thinning and stand improvement to make stands more resistant to insects and disease.

Natural openings created by blowdown, southern pine beetle (SPB) attacks, or other agents, may occur. Salvage operations along trail may occur, depending upon threat to adjoining stands, accessibility, value, user safety and impact on recreational experience. Activities such as site preparation for regeneration may include slashing damaged stems, lopping slash to lay within 2 feet of the ground, prescribe burning, and planting.

Slash treatments following logging will be to completely remove logging slash from corridor, and then lop slash to lay within 2 feet of the ground for another 20 feet.

If trail through area being logged is open, signs will be placed on the trail to notify users, and debris blocking trail tread created by treatments will be removed immediately.

Both road construction and landings along roads used as trails are discouraged and will be permitted only if no alternative is available. Landings will not be permitted in trail corridor of singletrack trails. No roads will be constructed with 30 feet of the trail. If crossing or leaving the trails with a new road, construct it perpendicular to the trail, cut trees down instead of pushing with dozer, and place root wads at toe of fill outside corridor. Road construction within trail corridor will be limited. Landings may be allowed along roads used as trails if no feasible alternative is available. Landings will not be permitted in trail corridor of singletrack trails. No roads will be constructed within 30 feet of the trail. Clearing limits will be restricted to what is needed for excavation. Cut banks will be sloped, and cuts banks and fills seeded within 7 days.

If outside the seeding season, disturbed areas will be mulched and then seeded at the earliest date feasible at the start of the next seeding season. All new road locations will be field verified with representatives from the Recreation, Timber, and Wildlife staff.

When reopening roads that are being used for trails, restrict clearing limits to the minimum width necessary for the management activity. If cut banks are vegetated do not disturb unless necessary to obtain adequate width. If cut banks are disturbed, slope banks to facilitate re-vegetation. Cut trees in roadway instead of pushing over with equipment.

Road management will consist of limiting haul when roadway is subject to rutting. Gravel may be applied to minimize rutting and extend logging periods. If coarse gravel is used, fine gravel will be placed over the coarse gravel for trail maintenance. Dips and outlet ditches will be maintained for proper drainage during and following harvest. Dips and outlet ditches will be inspected and maintained annually.

When logging traffic is using roads open to trail users, roads will be signed that logging is in process. Notice of logging activity will be posted on bulletin board at trailhead prior to beginning harvest..

In addition to the above standards, guidelines, and mitigating measures set forth in the Tsali Recreation Planning document the following measures will apply to all action alternatives.

Visual Quality

Follow the direction for visual quality in Appendix G of the Nantahala/Pisgah Land Resource Management Plan Amendment 5. In addition, leave flowering woody species and hemlocks in regeneration areas where practicable. In 2 –age regeneration areas, leave a denser basal area adjacent the trail corridor to further buffer the view from the trail. Shape units to have a natural appearance and feathered edges. Mark trees away form view from the trail. Consult with forest landscape architect for other site-specific recommendations as projects are designed..

Water Quality

Comply with the forest practices guidelines and standards found in the North Carolina Forest Practices Guidelines Related to Water Quality. Manage streamed protection zones of 100 feet horizontal distance either side of perennial streams and 15 feet either side of intermittent streams to maintain stream temperatures, protect channel stability, prevent soil movement into streams and protect riparian ecosystems. Re-vegetate all disturbed soil promptly with seeding mixtures appropriate to the specific season; re-vegetate 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.

Wildlife Habitat

Leave up to ten well-formed dogwood, serviceberry and other soft-mast producers per acre during site preparation if available; do not treat grapevines. Leave at least one 1/2 acre clump of potential den trees per 20 acre regeneration harvest opening if not found in adjacent stands. Protect all active den trees; leave an average of two 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.

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.

Prescribed Burning

Prepare a burning plan, including smoke management guidelines, prior to prescribed burning; conduct a post-burn evaluation following treatment. Conduct prescribed burns 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. 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.

Treatment Descriptions

Alternative III

*About 145 acres committed to two-aged regeneration by harvest, leaving 10 to 20 square feet of residual basal area per acre in well-formed sawtimber and poletimber trees, to be carried at least to mid-rotation (40 to 60 years). Units 5, and 6, (approximately 28 acres) will be regenerated naturally to upland hardwoods, with site preparation by chainsaw slashing, followed by streamline application of a 17% solution of Garlon 4 (triclopyr) herbicide in mineral oil to undesirable sprout clump regeneration after the first growing season. Units 2,8,13,17,20 (approximately 117 acres) will be regenerated artificially by planting shortleaf on 15 x 15 spacing.

About 244 acres will be commercially thinned to promote growth and reduce impacts of southern pine beetle

About 50 acres committed to chemical pre-harvest site preparation to promote advanced regeneration of oak and other species by thinline spraying or injecting the herbicide Triclopyr (Garlon 3a and/or Garlon 4). Approximately 1.0 lbs. per acre of active ingredient will be applied or injected to stems over one-foot in height and less than 6 inches in diameter. Target species include: red maple, sourwood, silverbell, and black gum.

Year Proposed	Proposed Treatments	Treatment Units	Acres or Miles
2001	2 Age	2,5,6	55 acs
	Thinning	1,7,9	85 acs
	Chemical pre-harvest site preparation	4,10	35 acs
	Prescribed burning	3	100 acs
2002	2 Age	8,13,17	76 acs
	Thinning	11,14,15	159 acs
	Chemical pre-harvest site preparation	---	0 acs
	Manual and/or Fire site preparation	2,5,6	55 acs
	Prescribed burning	12,19,18	209 acs
2003	2 Age	20	14 acs
	Thinning	---	0 acs
	Chemical pre-harvest site preparation	16	15 acs
	Manual and/or Fire Site preparation	8,13,17,	76 acs
	Prescribed burning	---	0 acs
	Plant pine seedlings	2	27 acs
2004	2 Age	---	0 acs
	Thinning	---	0 acs
	Chemical pre-harvest site preparation	---	0 acs
	Manual and/or /Fire Site preparation	20	14 acs
	Prescribed burning	---	0 acs
	Plant pine seedlings	8,13,17,20	90 acs

About 309 acres are proposed for prescribed fire to reduce fuel loads and promote herbaceous plants for wildlife. These acreage's do not include prescribed fire to accomplish site preparation. Roads, trails, and natural boundaries will be utilized to minimize the amount of handline construction.

About 117 acres are proposed for site preparation by slashing down (chainsaw) unmerchantable stems less than 6 inches followed by mid to late summer prescribed fire. These burns are designed to reduce logging slash, reduce competitive sprouts, improve planting conditions, and increases seedling survival

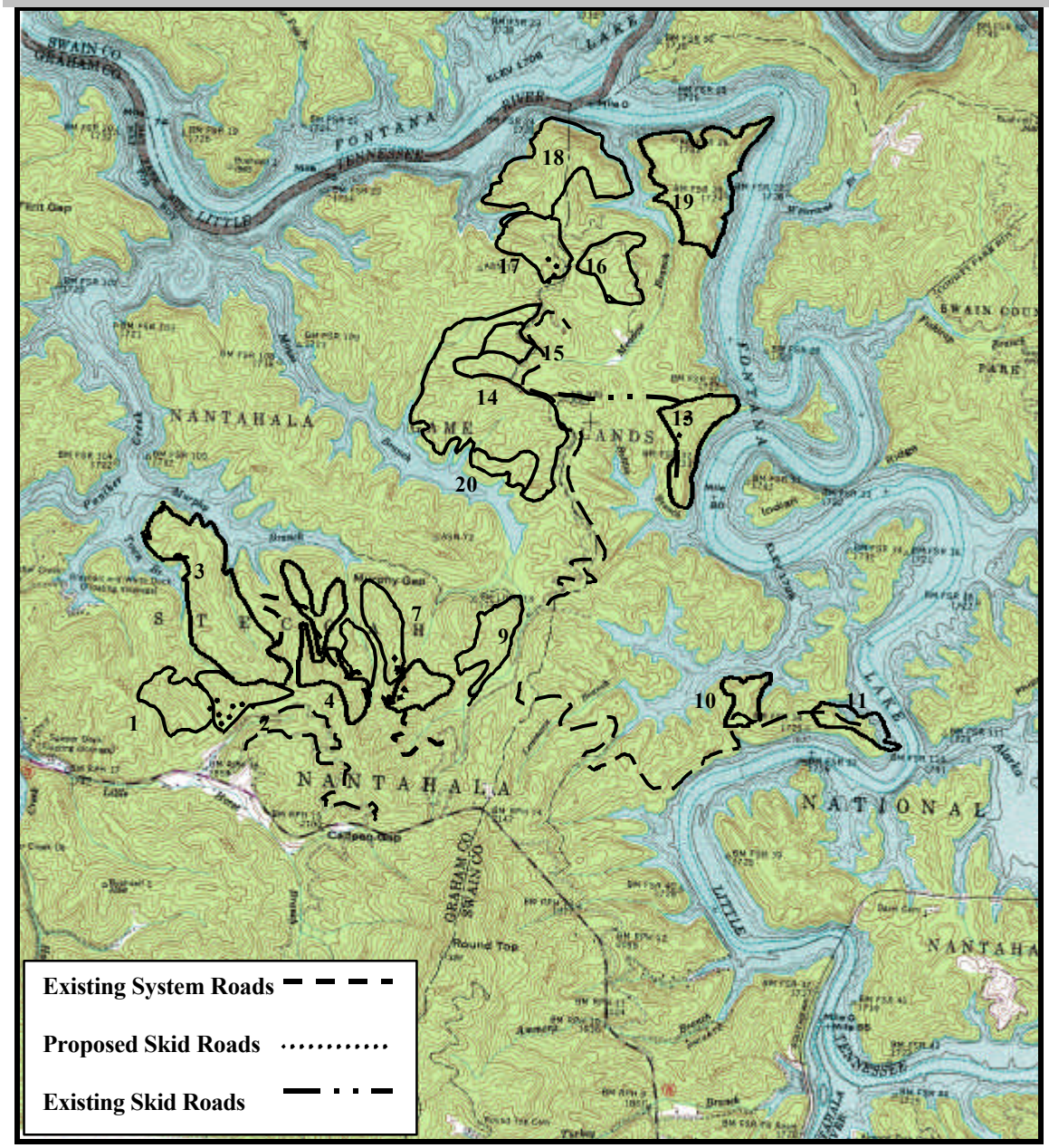
About 117 acres are proposed for planting shortleaf pine on 15 x 15 spacing. These plantings will follow manual and prescribed burn site preparation.

* See Treatment map for Alternative III on following page.

ALTERNATIVE III TREATMENT MAP

Not to Scale

Unit	Acs	Proposed Treatments	Unit	Acs	Proposed Treatments	Unit	Acs	Proposed Treatment
	30	Thin	9	30	Thin	17	28	2 Age
	27	2 Age	10	11	Pre-harvest	18	85	Burn
	100	Burn	11	14	Thin	19	92	Burn
	24	Pre-harvest	*12	32	Burn	20	14	2 Age
	17	2 Age	13	30	2 Age			
	11	2 Age	14	130	Thin			
	25	Thin	15	15	Thin			
	18	2 Age	16	15	Pre-harvest			



Alternative IV

*About 59 acres committed to two-aged regeneration by harvest, leaving 10 to 20 square feet of residual basal area per acre in well-formed sawtimber and poletimber trees, to be carried at least to mid-rotation (40 to 60 years)
About 103 acres will be committed to creating woodland like forest ecosystems to increase grass/forb habitat for wildlife.

About 334 acres will be commercially thinned to promote growth and reduce impacts of southern pine beetle.

About 79 acres committed to chemical pre-harvest site preparation to promote advanced regeneration of oak and other species by thinline spraying or injecting the herbicide Triclopyr (Garlon 3a and/or Garlon 4). Approximately 1.0 lbs. per acre of active ingredient will be applied or injected to stems over one-foot in height and less than 6 inches in diameter. Target species include: red maple, sourwood, silverbell, and black gum.

**About 4.4 miles of new trail for horseback, mountain trail bike, and hiking will be constructed to meet demands and mitigate wildlife issues.

About 241 acres are proposed for prescribed fire to reduce fuel loads and promote herbaceous plants for wildlife. These acreage's do not include prescribed fire to accomplish site preparation. Roads, trails, and natural boundaries will be utilized to minimize the amount of handline construction.

Year Proposed	Proposed Treatments	Treatment Units	Acres or Miles
2001	2 Age	1,6	41 acs
	Thinning	2,7,9	82 acs
	Create Woodlands	5	17 acs
	Chemical pre-harvest site preparation	4	24 acs
	**Trail construction	Sections 1,2,3,4	3.3 mi.
	Prescribed burning	3	100 acs
2002	2 Age	8	18 acs
	Thinning	14,15,22,23	166 acs
	Create Woodland	11,13	44 acs
	Chemical pre-harvest site preparation	10,21	55 acs
	Manual and/or Fire site preparation	1,6,8	59 acs
	Trail Construction	Section 5	1.1 mi.
	Prescribed burning	12	56 acs
2003	2 Age	---	0 acs
	Thinning	16,19,20	86 acs
	Create Woodlands	17,24	42 acs
	Chemical pre-harvest site preparation	---	0 acs
	Site preparation via fire	---	0 acs
	Trail Construction	---	0 mi.
	Prescribed burning	18	85 acs
	Plant pine seedlings	1,6,8	59 acs

About 59 acres are proposed for site preparation by slashing down (chainsaw) unmerchantable stems less than 6 inches followed by mid to late summer prescribed fire. These burns are designed to reduce logging slash, reduce competitive sprouts, improve planting conditions, and increase seedling survival

About 59 acres are proposed for planting shortleaf pine on 15 x 15 spacing. These plantings will follow manual and prescribed burn site preparation.

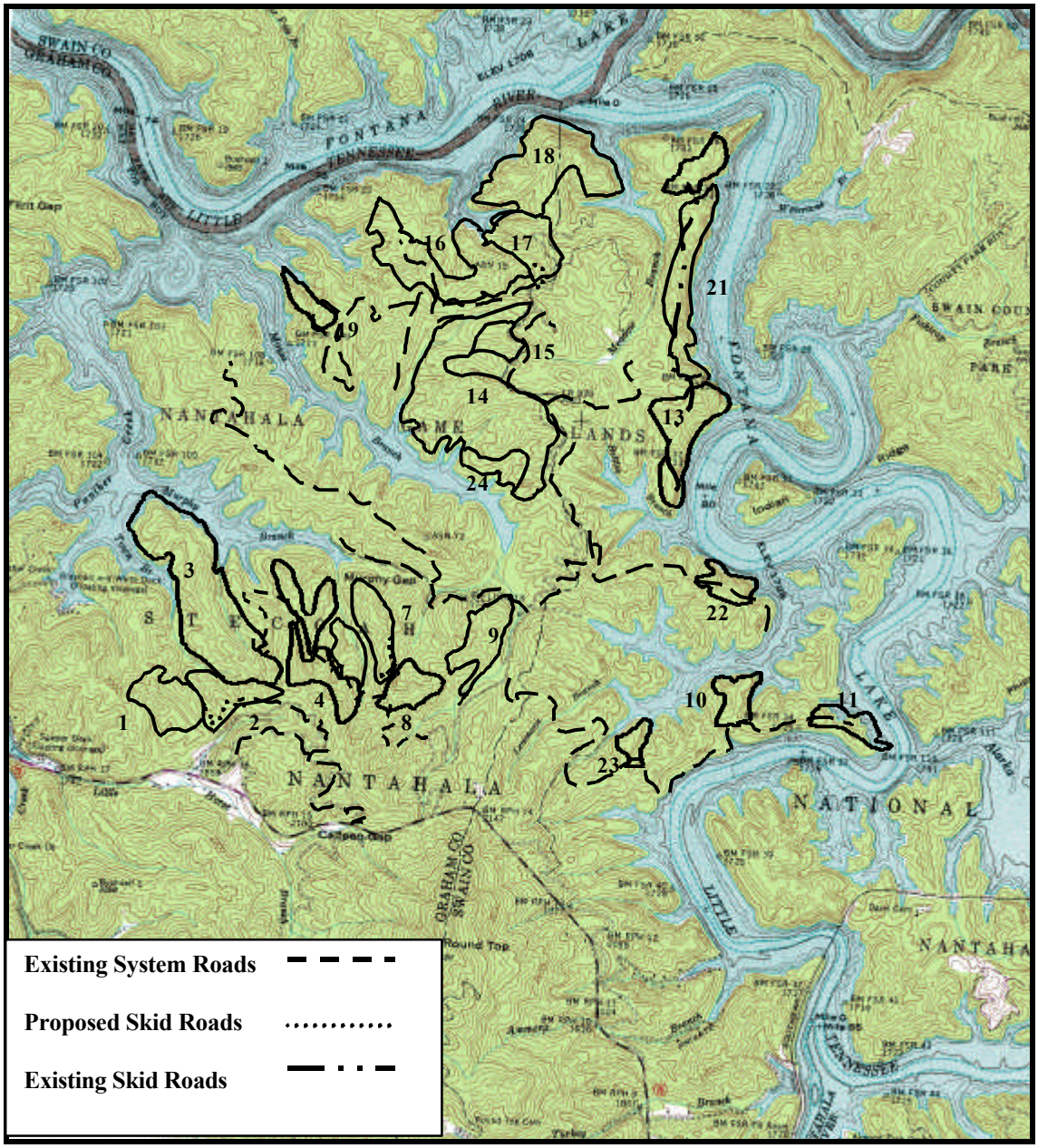
*See Treatment Map for Alternative IV on following page.

** See Proposed Trail Construction Map for Alternative IV.

ALTERNATIVE IV TREATMENT MAP

Not to Scale

Unit	Acs	Proposed Treatments	Unit	Acs	Proposed Treatments	Unit	Acs	Proposed Treatment
	30	2 Age	9	30	Thin	17	28	Woodland
	27	Thin	10	11	Pre-harvest	18	85	Burn
	100	Burn	11	14	Woodland	19	11	Thin
	24	Pre-harvest	*12	32	Burn	20	13	Thin
	17	Woodland	13	30	Woodland	21	27	Pre-harvest
	11	2 Age	14	130	Thin	22	11	Thin
	25	Thin	15	15	Thin	23	10	Thin
	18	2 Age	16	62	Thin	24	14	Woodland



Alternative V

Year Proposed	Proposed Treatments	Treatment Units	Acres or Miles
2001	2 Age	1,3,32	56 acs
	Thinning	2,4,6,8	52 acs
	Chemical pre-harvest site preparation	5,7	76 acs
	Trail construction	Sections 1,2,3,4	3.3 mi.
	Prescribed burning	Burn Units 1,5,9	323 acs
2002	Thinning	12,15,16,19	20 acs
	Chemical pre-harvest site preparation	9,10,18	38 acs
	Manual/Fire site preparation	1,3,32	56 acs
	Trail Construction	Section 5	1.1 mi.
	Prescribed burning	Burn Units 3,10,11	208 acs
2003	Create Woodland	20	20 acs
	Thinning	13,22	198 acs
	Chemical pre-harvest site preparation	---	0 acs
	Prescribed burning	Burn Units 2,4,6,7,8	338 acs
	Plant pine seedlings	1,3,32	56 acs
2004	2 Age	11,21	26 acs
	Thinning	25,28,29,30,31	28 acs
	Create Woodland	26,27	47 acs
	Chemical pre-harvest site preparation	---	0 acs
	Manual/Fire site preparation	11, 21	26 acs
	Prescribed burning	---	0 acs
	Plant pine seedlings	11,21	26 acs
2005	2 Age	14,17,23,24	35 acs
	Manual/Fire site preparation	14,17,23,24	35 acs
	Plant pine seedlings	14,17	21 acs
	Plant pine seedlings	23,24	14 acs

The schedule of events represents the strategy for accomplishing this alternative and every effort will be made to adhere to these commitments. However, due to budgets, weather, and unforeseen conflicts that may arise through administration of trail construction and logging contracts, some variance in this schedule can be expected.

*About 117 acres committed to two-aged regenration by harvest, leaving 10 to 20 square feet of residual basal area per acre in well-formed sawtimber and poletimber trees, to be carried at least to mid-rotation (40 to 60 years).

About 67 acres will be committed to creating woodland like forest ecosystems to increase grass/forb habitat for wildlife.

About 298 acres will be commercially thinned to promote growth and reduce impacts of southern pine beetle.

About 114 acres committed to chemical pre-harvest site preparation to promote advanced regeneration of oak and other species by thinline spraying or injecting the herbicide Triclopyr (Garlon 3a and/or Garlon 4) Approximately 1.0 lbs. per acre of active ingredient will be applied or injected to stems over one-foot in height and less than 6 inches in diameter. Target species include: red maple, sourwood, silverbell, and black gum.

**About 4.4 miles of new trail for horseback, mountain trail bike, and hiking will be constructed to meet recreation objectives and mitigate wildlife issues.

***About 869 acres are proposed for prescribed fire to reduce fuel loads and promote herbaceous plants for wildlife. These acreage's do not include prescribed fire to accomplish site preparation. Roads, trails, and natural boundaries will be utilized to minimize the amount of handline construction.

About 111 acres are proposed for site preparation by slashing down (chainsaw) unmerchantable stems less than 6 inches followed by mid to late summer prescribed fire. These burns are designed to reduce logging slash, reduce competitive sprouts, improve planting conditions, promote diversity, and increase seedling survival. About 111 acres are proposed for planting shortleaf pine on 15 x 15 spacing following manual and prescribed burn site preparation. Release of shortleaf pine and advanced oak regeneration (4.5 ft tall and greater than 1.5 inches in diameter) using Garlon 3a and or Garlon 4 will occur between 1 and 3 years after planting if needed.

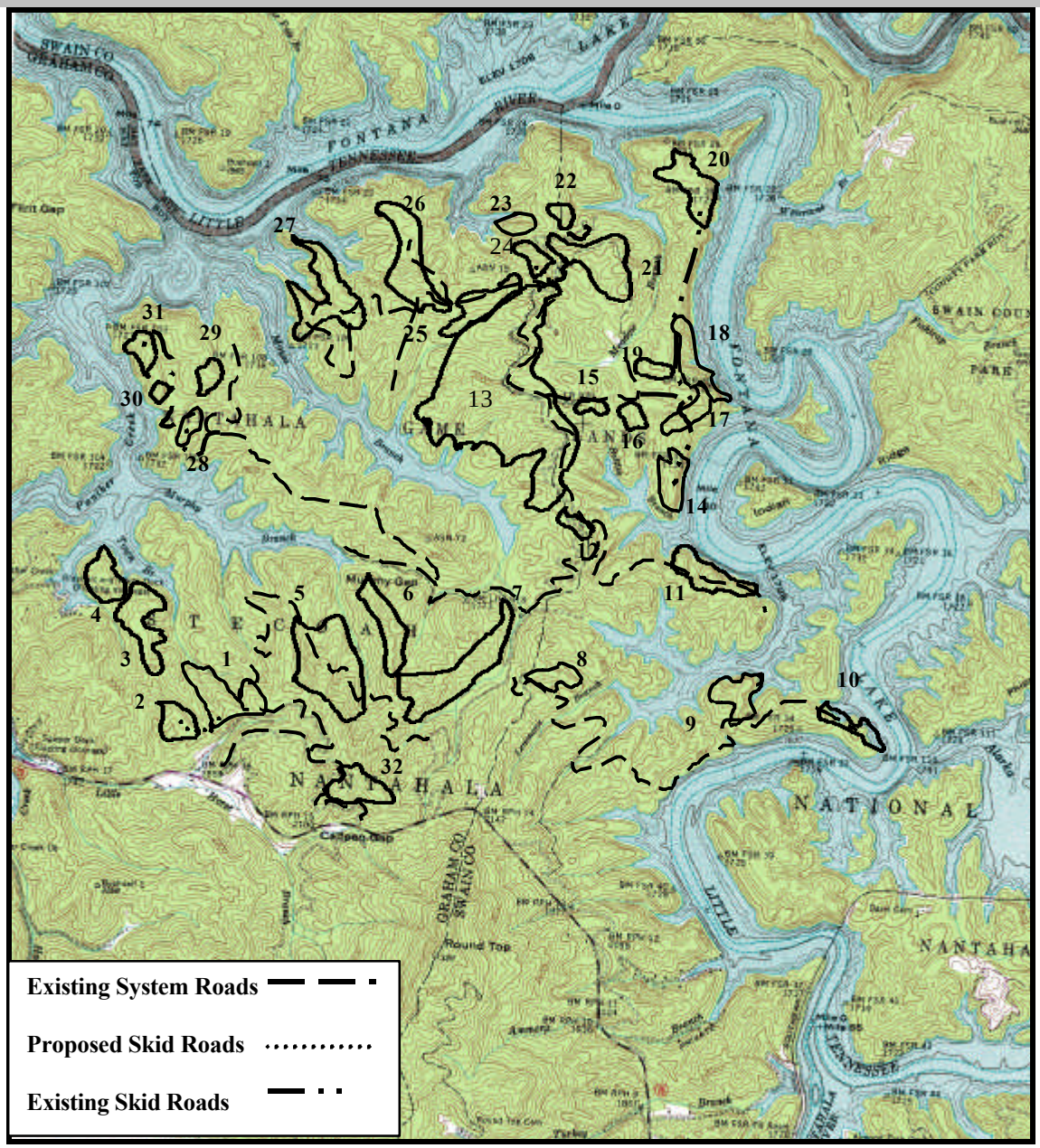
* See Proposed Treatment Map for Alternative V on page 29.

** See Proposed Trail Construction Map on page for Alternatives IV and V.

*** See Proposed Prescribed Burning Map for Alternative V on following pages.

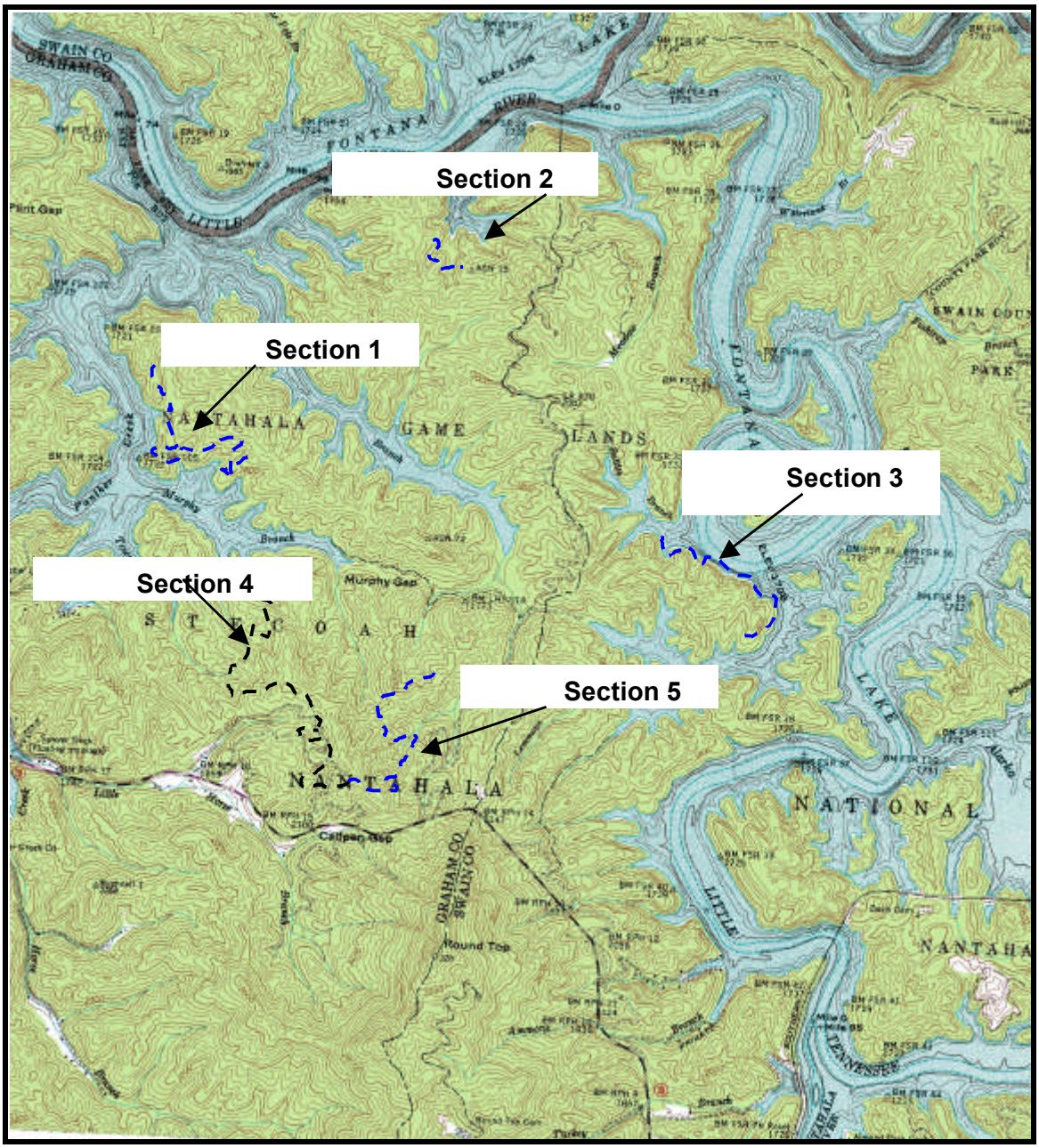
ALTERNATIVE V TREATMENT MAP

Unit	Acs	Proposed Treatment	Unit	Acs	Proposed Treatment	Unit	Acs	Proposed Treatment	Unit	Acs	Proposed Treatment
1	17	2 Age	9	11	Pre-harvest	17	8	2 Age	25	11	Thin
2	11	Thin	10	10	Pre-harvest	18	17	Pre-harvest	26	25	Woodland
3	25	2 Age	11	11	2 Age	19	5	Thin	27	22	Woodland
4	13	Thin	12	6	Thin	20	20	Woodland	28-31	17	Thin
5	40	Pre-harvest	13	192	Thin	21	15	2 Age	32	14	2 Age
6	21	Thin	14	13	2 Age	22	6	Thin			
7	36	Pre-harvest	15	4	Thin	23	6	2 Age			
8	7	Thin	16	5	Thin	24	8	2 Age			



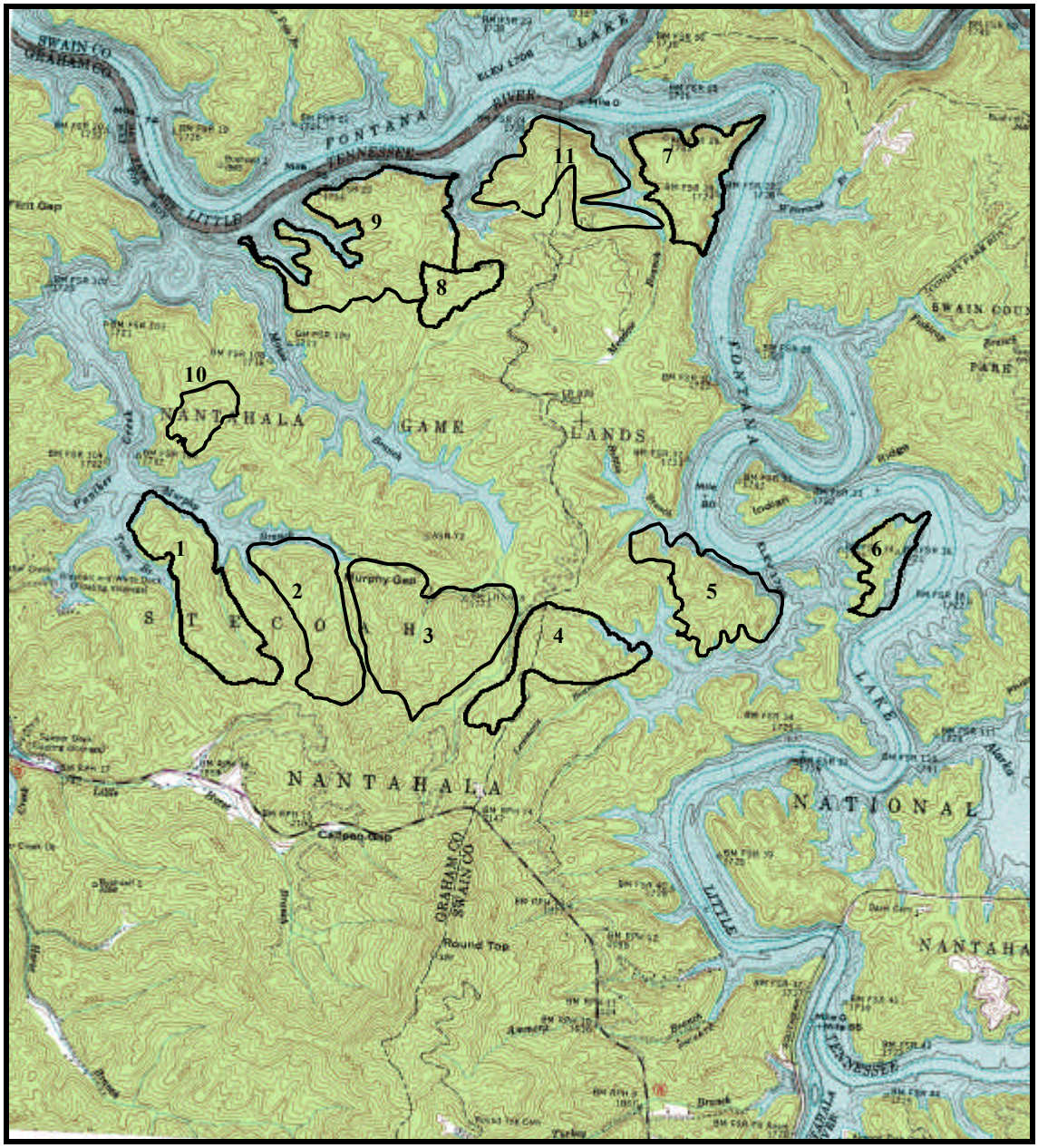
PROPOSED TRAIL CONSTRUCTION ALTERNATIVES IV AND V

Section Number	*Trail Type to be Constructed*	*Length in Miles*	*Year Proposed*
1	Single Track	1.1	2001
2	Single Track	.15	2001
3	Single Track	.95	2001
4	Double Track	1.1	2001
5	Single Track	1.1	2002



PRESCRIBED FIRE OTHER THAN SITE PREP FOR ALTERNATIVE V
Not to Scale

Burn Unit	Acres
1	100
2	100
3	95
4	74
5	73
6	36
7	100
8	28
9	150
10	28
11	85



OLD GROWTH DESIGNATIONS FOR EACH ACTION ALTERNATIVE					
Compartment	**Stand Number (CISC)**	**Acres**	**Forest Type**	**Age (Average)**	**Unit Number**
152 & 153	24,27, & 13	107	Oak Pine	62	1
154	14	54	Pine Oak	81	3
155	1/2/3	50	Oak Pine	68	4
156	1	56	Oak Pine	83	5

Features Common to the Action Alternatives (III, IV, and V)

Old Growth Designation

Old Growth Designations by Compartment and Stand			
Compartment Number	**Stand Number(s)**	**Age**	**Acres**
152 and 153	13,24,27	62 (average)	107
154	14	81	54
155	1,2,3	73	50
156	1	83	56
			Total: 267 acs

In this project area, approximately 4,033 acres are classified as suitable for timber management (MAs 2A and 4A,) and 221 acres (MA's 4C) classified as unsuitable. Of the total 4,254 acres, 267 acres (6 percent) have been designated for management as old growth. Old growth designations are made in compartments 152,153,154,155,156. Compartments 152 and 153 are combined to provide a 100 contiguous acre block of old growth. In compartment 153, old growth is underrepresented by 15 acres. The LRMP specifies 50 acres of old growth identified as "small patch" to be set aside for each compartment within a given analysis area. Due to the history of southern pine beetle activity at Tsali, small patches of old growth, as defined by the LRMP, are limited in Compartment 153 (50 acres per compartment). The designations for old growth for this project supports desired future conditions for old growth areas (specific site characteristics, elevation gradients, and forest landscapes found in the Southern Appalachians). This designation does not differ among alternatives. Old growth designations are shown on the following page, Proposals for Old Growth Designation Map. Stands selected for long term old growth management were based on the following analysis.

Old Growth Analysis

One of the objectives of the Land and Resources Management Plan for the Pisgah and Nantahala National Forest is to allocate a network of large, medium and small patches dispersed across the Forest for long term old growth management. Stands selected across the analysis area should be representative of the forest types, soils, elevations and aspects found there, should include areas with unique species diversity and should consist of those stands currently with or that have the highest potential for old growth attributes. Generally the stands selected should be greater than 80 years of age. Few stands seen throughout the analysis area currently have old growth characteristics such as large tree size, numerous snags, various sizes of dead and downed trees in various stages of decay, heterogeneity within the vertical structure and little evidence of human disturbance.

The analysis area encompasses the following five compartments; 152,153,154,155,156. An elevation change from around 1700 feet to 3200 feet occurs across US Forest Service land in this analysis area from Fontana Lake surrounding most of Tsali peninsula to Round Top southeast of NC 28 at Calfpen Gap.

Thirty-two large patches, each consisting of at least 2500 contiguous acres, were designated across the Pisgah and Nantahala Forests. Potential areas are identified in Appendix L of the LRMP amendment. As a starting point for large patch designation, the current CISC database was queried for forest type representation within the respective administrative watersheds. From discussions between Nantahala and Pisgah National Forest silviculturists and botanists, old growth groups were developed by grouping CISC forest types based on similar vegetation and rates of natural disturbance. Two separate administrative watersheds are delineated across the five compartments within the Tsali peninsula. Compartment 152, 153 and 154, all within Graham County, are included in administrative watershed 10, while compartments 155 and 156, both within Swain County are in administrative watershed 14. Portions of five large patches, 5, 6, 7, 8 & 10, occur within these two watersheds.

Administrative watershed 10, consisting of 22,381 acres, encompasses the middle Little Tennessee River drainage from the Swain and Graham County line in the east from Fontana Lake and Cheoah Bald west to Stecoah Bald, Wauchecha Bald and to the western edge of Fontana Lake at the dam. The large patch (# 5) within this area of the Forest is the Cheoah Bald & Sassafras Gap patch on the southeastern-facing slopes of the Nantahala Gorge. This patch also includes some of the north-facing and east-facing forests along the Appalachian Trail from Grassy Gap to Stecoah Gap. It is these later forests that are within administrative watershed 10. Table 1 shows the representation of the old growth groups present in this watershed. One Thousand eight hundred and forty-four of these acres are within the confines of the Cheoah Bald large patch and provide the minimum 5% contiguous medium patch (1120 acres) for this watershed.

Of the seven old growth groups represented within the administrative watershed, five are represented within the upper elevation communities selected for the medium patch, which is embedded within the Cheoah Bald large patch (Table 1). Only one of these five groups is underrepresented, that is the xeric pine and pine-oak forest. Those old growth groups present within the watershed but not represented within this medium patch are dry-mesic oak-pine forest and northern pine forest.

OLD GROWTH GROUPS	WATERSHED 10	LARGE PATCH
NORTHERN HARDWOOD FOREST	01%	13%
MIXED MESOPHYTIC FOREST	31%	30%
DRY-MESIC OAK FOREST	26%	46%
DRY OAK FOREST	7%	9%
XERIC PINE & PINE-OAK FOREST	10%	1%
DRY & DRY-MESIC OAK-PINE FOREST	17%	---
NORTHERN PINE FOREST	8%	---

Table 1. Old growth representation within the Little Tennessee Watershed.

Northern pine forest, occurring within the analysis area dispersed across the peninsula, represents an artificially regenerated white pine plantation. All of the white pine stands within the five compartments have been planted within the last 25 years. Only within the steeper slopes and walls of gorges are white pine dominated communities believed to be persistent natural communities (Schafale & Weakley 1990). Within the analysis area these conditions were not seen. No attempt was made to incorporate this old growth group within the small patches for individual compartments.

Within these three compartments no area was observed with high quality old growth characteristics. The majority of the area shows signs of relatively recent human disturbance. Selections were made to represent the one pine-oak old growth group not represented in the medium patch for this watershed. This dry-mesic oak-pine forest old growth type was selected within all three compartments within this watershed. Two mixed pine-oak stands were selected from compartments 152 and 153 that are adjacent to each other, thus making a contiguous 107-acre small patch. A 72-acre stand (27) was selected in compartment 152 while a 35-acre stand was selected from compartment 153. As such, the 35 acres in compartment 153 do not meet the minimum 50-acre small patch size. However, this area was selected since it is adjacent to the selected area in compartment 152 and is one of the older stands within this compartment.

Within compartment 154, a 54-acre shortleaf pine community was selected in the extreme northern portion of the compartment in order to connect to the small patch selected for compartment 155. This community is aged at 81 years according to the continuous inventory of stand conditions (CISC) database. Compartment 155 is within watershed 14. Administrative watershed 14, consisting of 12,939 acres administered by the National Forests in North Carolina, encompasses the lower Nantahala River drainage extends from Hickory Knob east to Wine Spring Bald on its southern boundary. The Nantahala Mountains delineate the eastern boundary form Cooper Ridge Bald to Wesser Bald north to the Nantahala River and Fontana Lake. The southeast-facing slopes of the Nantahala Gorge delineate the western boundary of this watershed. Table 2 shows the representation of the old growth groups present in this watershed.

Portions of five separate old growth patches are included within this watershed. Only one, large patch # 6 on the north-facing slopes of the Nantahala Gorge, is completely enclosed within this watershed. Other patches includes the portion of the Cheoah Bald patch within the Nantahala Gorge, the southern portion of the Hickory Knob patch (# 7), the extreme western edge of the Copper Ridge patch (# 8), and the western half of the Wesser Bald and Dehart Bald patch (# 8). Large Patch # 6, consisting of 2522 contiguous acres, in the Nantahala Gorge satisfies the minimum requirements (1607 acres) for a medium old growth patch within this watershed. In addition, the 2016 acres selected for large patch # 7 within compartments 51 and 52 in the Wayah Ranger District also satisfies the medium patch requirements for this watershed.

Of the eight old growth groups represented within the administrative watershed, all are represented within the five separate selected old growth areas (Table 2). Most of the groups represented within the selected old growth areas are remarkably similar to the representation seen across the watershed. Only one of these groups, hemlock hardwood forest, is barely represented within the large patch old growth selected areas. This old growth group is not abundant across the entire watershed. There are no stands of this type to select for the small patch designation within compartments 155 and 156. The stands selected within compartment 155 were chosen in order to make a larger patch with those stands selected from compartment 154. Stands 1 & 3 and small portions of 2 were selected to make up the 50 acres. This area is aged at 73 years old and has a diversity of habitat ranging from pine-oak/heath on the ridge to mesic oak-hickory on the steeper east-facing slopes which grades to an rich and acidic cove forest in the steep draw on that face. The southeastern portion of compartment 156 was selected for the final small patch area. This was stand 1, consisting of a 56 acre mixed pine-oak forest aged at 83 years.

OLD GROWTH GROUPS	WATERSHED 14	LARGE PATCH
NORTHERN HARDWOOD FOREST	4%	2%
HEMLOCK-HARDWOOD FOREST	1%	trace
MIXED MESOPHYTIC FOREST	23%	23%
DRY-MESIC OAK FOREST	41%	38%
DRY OAK FOREST	16%	24%
XERIC PINE & PINE-OAK FOREST	4%	5%
DRY & DRY-MESIC OAK-PINE FOREST	6%	7%
NORTHERN PINE FOREST	2%	1%

Table 2. Old growth representation within the Lower Nantahala River Watershed.

Representation of the various old growth groups within the two large old growth patches that occur within watershed 16 is shown above in Table 2.

Two old growth types present within the watershed are not represented within those designated large patches. One unrepresented old growth group was northern pine forest, which as stated previously is not believed to represent a natural community within this portion of the Forest. Dry-mesic oak-pine forest was also unrepresented, but only represents a trace amount (18 acres) within this watershed. This stand is located within compartment 100, just west of those stands selected for large patch 9 within this watershed. While this community type is not rare across the forest, it is rare within the watershed and should be looked at for incorporation within small patch designation when this compartment has stands selected.

The acreage selected for large patch 11 also satisfies the requirements for small patch designation within compartment 111. Any further designation in the other compartments within the Shooting Creek watershed will be completed when a project is implemented there.

Silviculture Methods and Associated Vegetative Treatments

Alternatives III, IV, and V all propose two-age regeneration harvest. This is a silvicultural system in which some overstory trees are retained longer than 20% of the rotation (Smith 1962), in order to maintain two separate age classes. This may be desired for aesthetic reasons or for continuous mast production (Beck 1987), or to maintain components of species (various oak species) that may be lost or reduced in the regenerated stand due to competition. The residual overstory trees could be harvested at mid-rotation, perpetuating the two-aged condition, or carried with the regenerated stand to full rotation, as in deferment cutting (Smith, Lawson, and Miller 1989). The two-age regeneration method prescribed for the Tsali project will favor the white oak species as the residual overstory.. There are several advantages to this, the most obvious being continuity of hard mast production. The two-age regeneration method will achieve regeneration objectives while protecting scenic quality. It also would allow for the regeneration of oak species, especially with the presence of advanced oak regeneration (4 to 5 feet tall). This condition does exist in certain stands but several stands proposed for regeneration will rely on burning, low origin sprouts, and release to promote the oak species. As mentioned previously, the white oak component across the project area comprises approximately 20 percent of the total tree species present. If regenerated today without chemical release or burning, white oak would only be 3 percent of the total of the regenerated stand. This prediction is based on a model constructed by Dr. David Loftis at the Bent Creek Experimental Forest and has been very reliable in the prediction of future forest composition based on relative competetiveness among various species. While most of the regeneration would come from coppice sprouting, some oak regeneration can be expected from those seedlings greater than four and ½ feet in height and from some of the smaller seedlings (2-4 feet high) that have well developed root systems.

Alternatives III, IV, and V all propose free thinnings as a method to increase growth rates and reduce impacts of southern pine beetle gypsy moth, and oak decline. Free thinnings can be described as a combination of thinning practices (thinning from above and below) where trees selected for removal are based on crown position and crown condition. Trees in the dominant and co-dominant position are selected for removal based on existing conditions (age, number of trees/acre, presence of poor or declining crowns) in any given unit or forest stand. There is a probability that thinning can temporarily predispose forest stands to insects and diseases or exacerbate existing conditions. For example, thinning in physiological mature upland oak stands where decline evidence is present will often increase the incidence of decline due to stress from logging activities. Thinning in immature stands provides the opportunity to pre-salvage anticipated losses of individual trees that exhibit poor crown conditions, lack of vigor, or presence of insects and disease.

Alternatives IV and V also introduce the concept of woodlands. A woodland is described as a “park like” area in appearances with 40 to 60 square feet of basal area per acre where frequent fire (2 or 3 year intervals) is used to promote various native grasses and herbaceous shrubs and plants. Today, woodlands are common in the longleaf pine forest of the south and at one time were a part of the forests in the Southern Appalachians. Native Americans used fire frequently to make it easier to travel through the woods and encourage the growth of berries and herbs for their own use, and “to stimulate young growth favored by game” (Shands 1993). In all units where woodlands are proposed, tree harvest will be used to reduce the basal area to a range between 40 to 60 per acre. This residual -(February) or early spring (March) burns every 3 years will occur to create and maintain woodland conditions. Regeneration would be deferred for the life of the woodland due to the frequency of fire that prevents its development. As previously discussed, woodlands are not a new concept to the forests of the Southern Appalachians. In Alternative V, the preferred alternative, 3 woodlands are being proposed to create grass/forb conditions for wildlife and retain a residual overstory. If Alternative V is implemented, part of the proposal is to include monitoring plots to determine what residual basal area accompanied by frequent burning, is most conducive to establishing grass forb conditions.

Alternatives III, IV, and V all contain manual vegetation management treatments. Most of these, including commercial logging, and follow-up site preparation activities, would involve the use of chainsaws and other cutting tools; therefore, there would be a risk of injury to workers involved. Manual vegetation management treatments would cause some disturbance and displacement of some wildlife during all proposed activities. These effects would be minor in nature and short term in duration. The goal of manual release is to insure and adequate stocking level of yellow pine species. The preferred species composition for the project area is a mixed stand of pine/hardwood or hardwood/pine.

Alternatives III, IV, and V in this project include use of the herbicide Triclopyr, in the ester form (in solution with mineral oil and limonene) for pre-harvest treatments and release of advanced oak regeneration and occasionally shortleaf and other yellow pine species. Again, the desired future conditions are mixed stands with sustainable oak and pine component. The management prescription is to specifically favor white oak sprouts or seedlings when the opportunity exists. The combination of site prep burning and chemical release should produce mixed pine hardwood or mixed hardwood pine stands. Oak regeneration will occur as either sprouts or seedlings and will be favored as crop trees even over shortleaf when the chemical release occurs. The major oak species of concern is the white oak and the goal is to regenerate at least at much as is in place now.

Estimated occupational and environmental exposures to Triclopyr herbicide in humans by dermal, oral, and inhalation routes are considerably less than levels at which toxic effects have been observed in experimental animals. Triclopyr has not been shown to be toxic or to have reproductive, teratogenic, or mutagenic effects at exposures well in excess of those to which forest workers, visitors, and animals would be exposed through normal use (USDA agriculture Handbook Number 633, “Pesticide Background

Statements", Volume I. Herbicides). The Risk Assessment (Appendix A of the Appalachian Mountain Vegetation Management FEIS) indicates that no member of the public, including sensitive individuals, should be affected by use of Triclopyr or limonene at typical or maximum exposure scenarios. The Risk Assessment also indicates a low level of risk to workers applying these chemicals in the manner specified at either typical or maximum exposure scenarios. There would be a risk in the accident scenario from direct contact through spillage or accidental spray onto workers. This risk can be mitigated by the use of personal protective equipment and/or by immediate washing in the event of accidental exposure. (See FEIS, Vegetation Management in the Appalachian Mountains, Volume I, page IV-15 through IV-21.) Therefore, the use of Triclopyr herbicides in the proposed actions would not pose a significant risk to human health. Mitigating measures described in the ALTERNATIVES CONSIDERED section of this assessment would reduce or eliminate potential risks to human health from herbicide use. Based on the rapid microbial degradation of Triclopyr in soil (reported half-lives of 30-56 days), the rapid photodegradation in water (half-life as short as l0 hours; probably similar photodegradation on exposed surfaces), and the direct stem application methods proposed, there is not a significant risk of ground or surface water contamination resulting from proper use of Triclopyr. This is supported by water monitoring studies performed on similar sites and soil series, including tests directly beneath two Garlon 4 application sites on the Wayah Ranger District in 1985 which failed to detect Triclopyr at the 0.1 parts per billion level during peak flow events following treatments. (See Wayah Ranger District file 2510 - WATERSHED SURVEYS & PLANS - Herbicide Water Monitoring.)

No adverse effects to wildlife would be expected from herbicide use. Triclopyr and limonene applied at typical rates pose less risk than allowed under the EPA standard for wildlife and aquatic animals not listed as threatened or endangered (FEIS, Vegetation Management in the Appalachian Mountains, Volume I, page IV-75 and tables 8-10 and 8-14 of Appendix A). The ester formulation of Triclopyr (Garlon 4) is known to be highly toxic to rainbow trout and bluegill (LC 50 = .74 and .87 ppm, respectively). However, compliance with label direction and VMAM standards would prevent negative impacts on the streams near areas treated with herbicides; there would be no measurable effect on the aquatic system within the project area. The only risk of adverse effects to the aquatic system would be from accidental herbicide spillage directly into water.

Prescribed Burning

The prescribed burning being proposed should provide many benefits for the project area. The site preparation burning, which is in addition to the acres proposed for wildlife burns, will reduce the amount of competing vegetation for the short leaf pine seedlings as well as the oak seedlings that originate from seed or sprouts. This is especially true on the less productive sites where the oak species are established and can compete with other species when chemical release occurs sometime in a five-year period after harvest. Chemical release involves targeting those oak species (especially white oak for this project) that are free to grow and eliminate or reduce the amount of competition for nutrients between the oaks and various other species of hardwoods and softwoods. Red maple, sourwood, sassafras, various yellow pine species, and blackgum are some of the species that will be competing with the various oak species present across the project area.

The prescribed burning proposed in Alternatives III, IV, and V of this project would have unavoidable short-term impacts on air quality. Gas emissions produced during prescribed burning which are considered pollutants by EPA include carbon monoxide, hydrocarbons, nitrogen and sulfur oxides, and photochemical oxidants. Typical emission levels of these pollutants would not be high enough to pose a risk of adverse effects on human health. Emissions would be reduced by burning during proper fuel moisture and weather conditions (dry fine fuels; moist soil, duff, and large fuels; clear days; steady winds; low to moderate relative humidity) so that flaming combustion would be maximized and smoldering combustion minimized (FEIS, Vegetation Management, pages IV-122 through IV-128).

Prescribed burning would also produce 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 emissions can also be greatly reduced by burning under conditions that enhance flaming and reduce smoldering. The effects of particulate matter on smoke-sensitive areas can be lessened by burning when atmospheric conditions are conducive to smoke dispersion. For all prescribed burning activities in Alternatives III, IV, and V of this project, all method-specific mitigating measures in the Vegetation Management ROD would be followed.

Road Construction and Road Maintainence

- There will be no new system roads built in this project and skid/haul construction is less that one mile for each alternative. The system roads in place have been maintained at a level that will support logging activities. The gentle slopes where logging is planned reduces the need for skid road construction. The following existing system roads will be used to harvest forest products.
- FS 2548-Calf Pen Gap-1.6 mi.

- FS 2550-County Line-3.8 mi.
- FS 2550-A-Battle Branch 1.0 mi.
- FS 2550-B-Meadow Branch .60 mi.
- FS 2550-C- Windy Point 1.0 mi.
- FS 2550-D- County Line Extension .40 mi.
- FS 2550-E-Upper Mouse Branch .75 mi.
- FS 2551-Murphy Gap 2.8 mi.
- FS 2552-Town Branch 1.6
- FS 2553-Lemmons Branch 2.5 mi.

SUMMARY COMPARISON CHART OF EFFECTS OF THE ALTERNATIVES

.	The Issues and the Alternatives Compared			
Issues and Indicators for Alternatives				
	Alternative I - No Action	Alternative III	Alternative IV	**Alternative V- Preferred**
Silvicultural Systems and Regeneration Methods				
– Acres receiving 2 Age regeneration cutting	0	145	59	**117**
– Acres receiving thinning	0	244	334	**298**
– Acres committed to creating woodland conditions	0	0	103	**67**
– Acres Treated to reduce risk/hazard to southern pine beetle, gypsy moth, and oak decline	0	389	496	**482**
Associated Vegetation Management				
– Acres receiving chemical pre-harvest site prep treatment	0	50	79	**114**
– Acres receiving manual site prep treatment (including site preparation burns)	0	145	59	**117**
– Acres proposed for prescribed burning for wildlife habitat improvement	0	309	241	**869**
Water Quality				
– Relative amount of disturbed soil	None			
– Number and type of stream crossings and associated activities within riparian areas				
Soils				
– Miles of skid/haul roads and trails to construct	0	.95	5.35	**5.35**
– Skid roads construted in areas with high erosion potential	0	0	0	**0**
– Miles of trail constructed in areas with high erosion potential	0	0	.72	**.72**
Economics				
– Benefit to Cost Ratio (ratio > 1.0 indicates revenues exceed costs	0.00	1.04	1.17	1.24
Cultural Resources				
– Impacts to sites elegible for inclusion in the National Register of Historic Places	None	None	None	**None**
Wildlife Habitat Diversity				
– Acres of grass/forb created	0	1.5	103	**67**
– Acres pre-harvest site prep to develop advanced oak regeneration	0	50	79	**114**
– Acres designated for old growth	0	267	267	**267**

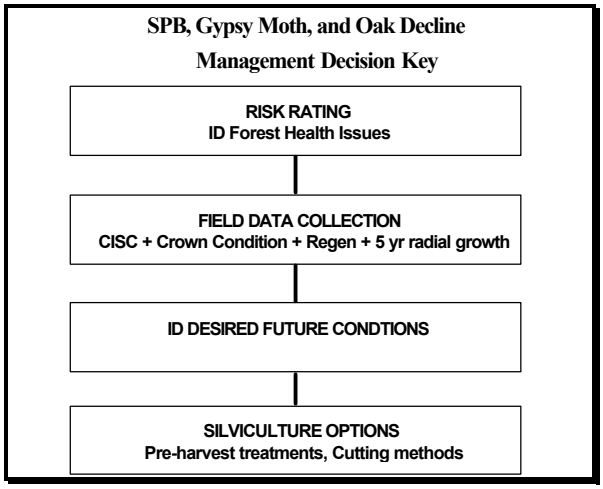
.	The Issues and the Alternatives Compared			
Issues and Indicators for Alternatives				
	Alternative I - No Action	Alternative III	Alternative IV	**Alternative V- Preferred**
Proposed, Endangered, Threatened and Sensitive Species (PETS)				
– Effects to evaluated Threatened and Endangered Species	No effect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect
– Effects to evaluated Sensitive Species	No effect	May impact individuals of four species	May impact individuals of four species	May impact individuals of four species
Recreation--Impacts on Trail Use				
– Miles of Trail constructed	0	0	4.4	**4.4**
– Miles of trail impacted due to logging activities including closure and disturbance	0	6.5	7.5	**7.64**
Visual Quality				
– Miles of road constructed within the area	0	.95	5.35	**4.76**
– Acres receiving regeneration cutting, thinning, site preparation, or pre-harvest site preparation visible along trails or from significant viewpoints		439	551	**587**

Environmental Impacts and Analysis

This section forms the scientific and analytic basis for the alternative comparisons in the previous section. The analysis approach applied includes the assessment of forest health impacts (risk and hazard determinations) as an integral part of the analysis process which ultimately, forms the alternatives. Analysis of present forest conditions across the project area determines whether forest health threats exist and are the genesis of forest health restoration.

The environmental impacts (or effects) described here include both beneficial and detrimental impacts. Environmental impacts 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 impacts are analyzed using references from various literature and reports which are incorporated as an integral part of this environmental assessment. They are listed in the References Cited section.

Risk and Hazard



One of the major objectives of the Tsali Forest Health Restoration project is to identify the risks and hazards of southern pine beetle (SPB), gypsy moth and oak decline to the Tsali forest ecosystem. In 1996, data collected at 200 forest plots across the project area identified existing forest health risks and hazards. Risk is associated with species composition and susceptibility. For example, southern yellow pine species are susceptible or at risk to SPB outbreaks. Likewise, the oak species are at risk or susceptible to oak decline and gypsy moth because these trees are the primary host for this particular insect and disease. The extent to which a forest is dominated by trees favored by particular insects or diseases determines its relative susceptibility.

Hazard or vulnerability, is related to the forest health of individual trees or groups of trees (forest stands). Individual trees within forest stands that exhibit symptoms of declining health (slow growth rates, poor crown conditions, presence of other insects and diseases) have a high hazard rating or are more vulnerable to forest insects and diseases. The decision key in the right hand margin outlines the process necessary before Silviculture treatments can be applied to produce desired future conditions. Silviculture options and treatments are directly related to and depend on the upper hierarchy of this decision key. After forest health risks are identified by analysis of the Continuous Inventory of Stand Conditions data (CISC), field data is collected that is used to validate CISC conditions and determine vulnerability (hazard). Regeneration data is collected to predict what the future forest will look like if silviculture treatments include regeneration harvests and natural regeneration. Silviculture options like pre-harvest treatments to promote oak regeneration, 2 aged regeneration in declining upland oak stands or mature overstocked pine stands, and thinning to stimulate growth in pine forests are implemented to achieve desired future conditions. An example of how CISC data is applied to determine risk (susceptibility) and hazard (vulnerability) to forest stands for gypsy moth is presented in the left hand margin. The GMV or Gypsy Moth Vulnerability, is related to existing forest conditions as reported by CISC. As the table indicates, risk or susceptibility is predetermined by forest type. Condition classes are surrogates for actual field data (crown condition) that is collected to determine vulnerability. Condition classes that directly relate to either a healthy or damaged category are reported in CISC as:

- Condition Class 2: damaged poletimber
- Condition Class 5: sparse poletimber
- Condition Class 6: sparse sawtimber
- Condition Class 7: low quality poletimber
- Condition Class 8: low quality sawtimber

Stands recorded in CISC with a Condition Class of 2,5,6,7, or 8 often are verified during field examinations (crown condition assessments) as being vulnerable to gypsy moth defoliation's and are likely to show various stages of oak decline.

CISC ATTRIBUTES THAT DETERMINE GYPSY MOTH VULNERABILITY

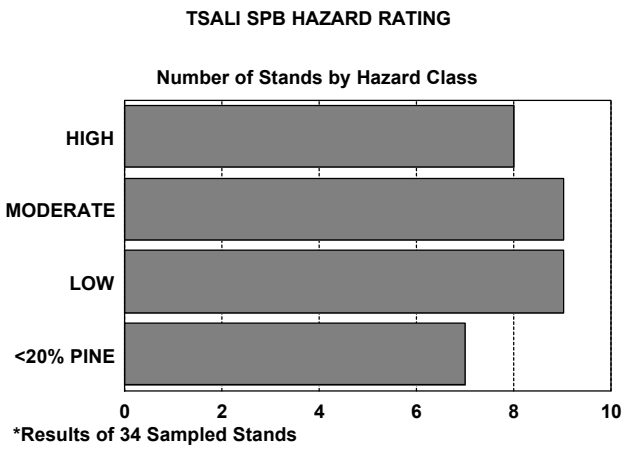
*GMV	FOREST TYPE	CONDITION CLASS	SIZE	**SI/AGE
None	Pine	All	All	All
	Cove Hardwood	All	All	All
Low	Pine/ Hardwood	All	All	All
	Hardwood/Pine	Healthy	Pole-Saw	>1.0
Moderate	Hardwood/Pine	All	Pole-Saw	<1.0
	Upland Hardwood	Healthy	Pole-Saw	>1.0
High	Upland Hardwood	Damaged	Pole-Saw	>1.0
	Upland Hardwood	Healthy	Pole-Saw	<1.0
Extreme	Upland Hardwood	Damaged	Pole-Saw	<1.0

* GMV: Gypsy Moth Vulnerability

** Site Index / Over Age: As this ratio approaches 1, forest stands or trees begin to reach physiologic maturity and become more vulnerable to insects and disease.

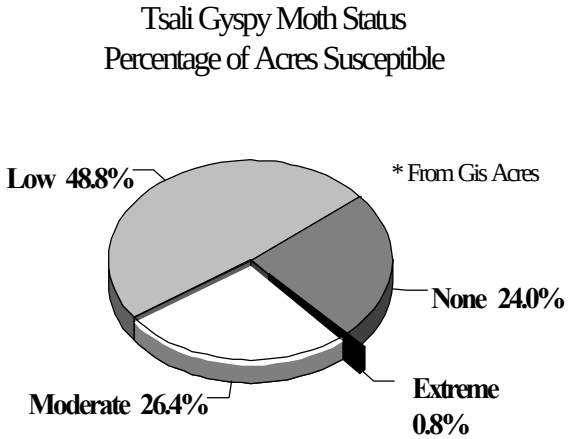
Summary of Field Data

Present forest conditions as determined by field data collected in 1996, and risk / hazard rating models for southern pine beetle, gypsy moth, and oak decline, demonstrate that forest health threats with potential significant impact are present across the Tsali Peninsula(see appendix x Risk and Hazard Rating Maps). In most cases, model predictions using CISC data of risk and hazard were validated in the field. The field data collected was necessary to identify where on the landscape or in individual stands do these hazards exist. These areas are identified in the Alternatives Considered in Detail as candidates for silviculture treatments such as thinnings, pre-harvest treatments, and 2 age shelterwood cutting units that will reduce impacts and lessen the severity of southern pine beetle outbreaks, future gypsy moth infestations, and the incidence of oak decline.



To demonstrate how the SPB rating system is applied, 24 stands across the Tsali peninsula were sampled during May 1996 and 10 stands in August of 1997. Susceptibility or risk, was pre-determined because of the presence of southern yellow pine species in these stands. Of the 34 stands sampled, 17 stands, or 50 % are vulnerable to southern pine beetle (sum of moderate and high categories). These are expressed as treatment units on the unit map for each alternative. The key forest health indicator collected in the field and used to hazard rate or determine vulnerability is the measurement of the past 5 year's radial growth measured in tenths of inches. Historically, dense pine stands and slow tree growth are frequently associated with southern pine beetle outbreaks(Remion & Swain 1965). This data is then entered into the Modified Mountain Risk Rating for SPB (Hedden 1983) to determine the appropriate hazard or vulnerability class. (See appendix B for table and model equations used to determine SPB hazard categories). Rating a stand's vulnerability (hazard) to SPB attack provides information that can be used to identify current or future hazard conditions that could impact pine forests. For this project, stands were hazard rated and evaluated for silviculture treatments that will reduce the likely hood of outbreaks. Silviculture treatments selected for individual cutting units within stands (thinnings, and 2 age regeneration cuts) are based on current stand conditions (age, 5 yr. radial growth rates, and site quality). For example, thinnings are being proposed in areas that will respond to the treatment by stimulating radial growth.(typically 35 to 60 years old on moderate to good growing sites). Thinnings can occur and are applied at ages older than 60 but the growth response lessens as age increases. Since the tree's natural defense against southern pine beetle relies on vigorous growth and sap or pitch production to physically "pitch out" boring beetles as they enter the tree through the bark, thinning in older stands is less effective. Thinnings however can be prescribed in older pine forest to remove individual trees that are physiologically mature, meet visual objectives, as pre-salvage/sanitation operations, economic considerations, and conformity to the LRMP.

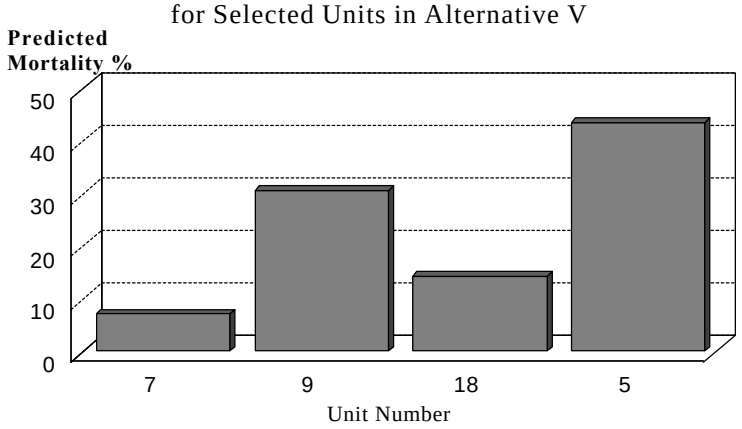
Approximately 27 % of the upland hardwoods (the sum of moderate and extreme ratings) are susceptible or at risk to gypsy moth. Susceptibility relates specifically to species composition of the forest. Continuous Stand and Inventory Conditions(CISC) data was entered into the Gypsy Moth Risk Rating Model (Oak, Robison et.al; 1996) to produce the pie chart in the margin.. CISC attributes such as forest type, condition class (damaged and sparse category) and site index over age are the variables applied to the model to risk rate (determine susceptibility) the upland forest types at Tsali. These risk categories represent areas (stands) across the landscape within the project area. The next step in the Management Decision Key is the field validation of these results and simultaneously collecting field data The next step in the Management Decision Key is the field validation of these results and simultaneously collecting field data (crown condition) used to create vulnerability (hazard) ratings. Assessing crown condition in dominant and co-dominant trees involves observing the amount of dead or dying portions in the upper level of the crowns. Symptoms of poor crown condition are dieback that progresses from the top down and from the outside in (Oak, 1994). Crown condition categories and Crown Class Codes for this project are presented in the following table.



Code	Description	Crown Mortality %
0	Healthy	0
10	Trace	1-10%
1	Moderate	11-33%
2	Severe	>33%
4	-	Dead in present year
5	-	Dead in previous year

Crown condition assessments by stand for the Tsali Project are on file at the Cheoah Ranger District and are summarized as percentage of trees with poor crowns (sum of moderate and severe mortality categories). Treatment unit maps in the Alternatives Considered in Detail section reflect where on the landscape (within the stand) these conditions occur. As Gansner and Herrick reported in 1984, oak trees with poor crown conditions have an 86 percent probability of mortality following severe gypsy moth defoliation, while other species with poor crowns have 62 percent probability.

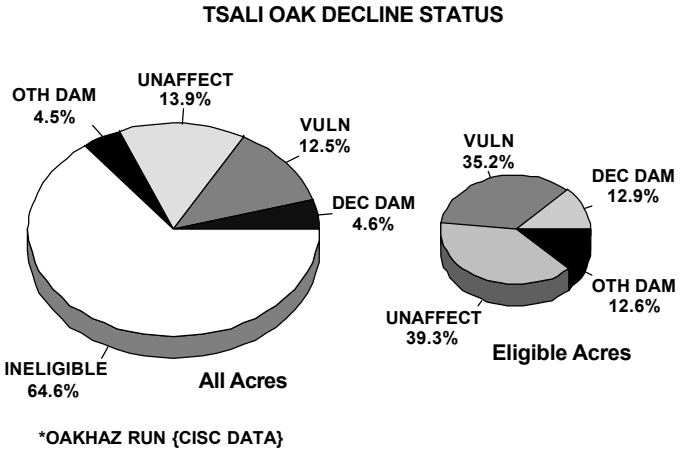
Predicted Mortality from Gypsy Moth Based On Crown Condition and Amount of Host Type Present for Selected Units in Alternative V



* Pre-harvest silviculture treatments proposed for Alternative V

Stand or individual tree mortality to gypsy moth is defined as the probability of damage occurring in the stand or tree given that defoliation has occurred. The definition of damage can be quite broad: everything from tree mortality to loss of mast production to decreased water quality form increased nitrogen export (Gottschalk 1991). Although this broad definition of vulnerability is being accepted, most past work and mortality predictions for this project use tree mortality as the major guide. Forest health indicators such as crown condition that can be measured in the field or modeled using existing data such as CISC, determine the hazard rating or vulnerability and are used to model or predict mortality given the presence of gypsy moth.. Crown condition is used as an indicator of forest health to determine the health of individual trees or forest stands. Forest stands or individual trees that exhibit symptoms of declining forest health (slow growth rate and poor crown condition) are less likely to survive insect attacks and other natural stress inducing factors such as drought and catastrophic climatic events. For example, Units 5,7,9, and 18 of Alternative V have a high incidence of declining crown condition (various stages of oak decline) that were observed during the data collection process in May of 1996. Gansner and Herrick's model for predicted mortality demonstrates the potential impact of future gypsy moth outbreaks in these units (see graph in right hand margin). The dominant and co-dominant upland hardwood (oak and hickory) trees in the upper forest canopy are beginning to show or in some cases (unit 5), exhibit advanced signs of declining crown conditions. Since the presence of advanced regeneration seedlings is critical to the successful regeneration of most hardwoods in the east (especially oak spp.), pre -harvest stand improvements that encourage advanced oak regeneration are proposed for these units.

Two approaches were used to risk rate the forest types most likely to experience oak decline in the project area. The large pie chart expresses the area in percent that is vulnerable, already in a decline state, or ineligible/unaffected for the entire analysis area. The small chart considers only eligible acres (hardwood/pine mixtures and upland hardwood stands). Many of the same CISC attributes (damaged, sparse, and low quality) used to evaluate potential impacts of gypsy also apply to the model used to risk rate for oak decline The vulnerable and decline damage percentages total 48 % for the smaller chart. This means that (according to the model) 35 % of the eligible acres are vulnerable to oak decline and approximately 13% are presently experiencing some degree of decline. During the field survey, various stages of oak decline were observed in units 5,7,9, and 18 in Alternative 5. The crown condition guide used to predict mortality for future gypsy moth outbreaks was also applied to determine the incidence of oak decline.



Soil Test Results

During the inventory in May of 1996, 81 soil samples were collected across the Tsali Peninsula. These samples were sent to the Agronomic Division of the North Carolina Department of Agriculture (NCDA) for analysis. The Agronomic Division of the NCDA works to increase crop productivity, promote responsible land management and protect the environment. To achieve those ends, the Division provides diagnostic and advisory services for all North Carolina citizens and works closely with educational institutions, agribusiness, and various state and federal agencies.

NCDA soils test evaluate 22 factors. The following includes a brief descriptions of the factors along with soil analysis results from the Tsali project area that relates to each factor. The first seven factors (soil class, % humic matter (HM%), weight/volume (W/V), cation exchange capacity(CEC), % base saturation (%BS), exchangeable acidity (Ac), and hydrogen ion concentration (pH), all influence the amount of plant nutrients and soil amendments (lime) necessary to support growth. The other fifteen are:

- Phosphorous Index (P-I) major plant nutrient
- Potassium Index (K-I) major plant nutrient
- Calcium % (Ca%) major plant nutrient
- Magnesium % (Mg%) micro plant nutrient
- Manganese Index (Mn-I, the actual Manganese Index) minor plant nutrient, can be toxic at certain levels.
- Manganese Availability Index 1 (Mn-AI 1 applies to first crop to be grown) primarily used for double cropping
- Manganese Availability Index 2 (Mn-AI 2 applies to the second crop to be grown) primarily used for double cropping
- Zinc Index (Zn-I)
- Zinc Availability Index (Zn-AI) availability of zinc based on soil class, Zn-AI for mineral soils (the soil class at Tsali) = Zn-I
- Copper Index (Cu-I) gauges the sufficiency or toxicity of this element.
- Sulfur Index (S-I) Prediction of plant available sulfur.
- Nitrate nitrogen (NO_3-N), Ammonium nitrogen (NH_4-N), Boron (B), and soluble salt (SS),, not measured for this project, applies primarily to row crop agriculture.

Relationship Between Soil Test Indices and Yield

The soil test results for Tsali reports phosphorous (P), potassium (K), manganese (Mn), sulfur (S), zinc (Z), and copper (Cu), as indices. application.. The table below summarizes the index range as determined by NCDA and includes average values and rankings from soil test results at Tsali. The critical quantitative value of each nutrient is assigned and index of 25. Values of 25 or below indicated low

Relationship Between Soil Test Index and Yield

Crop Yield in Response to Nutrient Application

Index Range	Nutrient Status	P	K	Mn	Zn	Cu
0 - 10	Very Low	* High **(1.62)**	High	High	High	High
11 - 25	Low	High	High	High	High	High
26 - 50	Medium	Med/Low	*Med/Low **(43.3)**	None	* None **(44.5)**	* None **(48.9)**
51 - 100	High	None	Low/None	None	None	None
100+	Very High	None	None	* None **(333.3)**	None	None

*** (Index value number) Average nutrient index values for 81 soil samples at Tsali**

soil fertility, high fertilizer requirement, and potentially dramatic yield increase in response to fertilization. Values from 26 to 50 indicate medium fertility, those above 50, high fertility, and values above 100 are considered excessive and show no response to fertilizer.

The quantity of each nutrient required by different crops may vary greatly and the index provides a common scale for judging nutrient supply and balance in the soil.

The soil analysis results and index ranges are recommendations made by NCDA that supports the establishment and growth of a mixed pine and hardwood forest typical to the forest ecosystem at Tsali. General liming and fertilizing across the forest landscape is not considered economical at this time and the impact to the forest ecosystem is not conclusive. The growth of a tree with a particular genetic makeup is a function of age and many site factors. Among the environmental components are temperature, moisture supply, radiant energy, composition of the atmosphere and soil air, biotic factors, and soil physical and chemical properties. Soil physical properties and soil water have been long considered of primary importance to site productivity and in more recent years the importance of chemical properties has become better understood and appreciated. Not only are soil acidity, cation exchange capacity, and nutrient availability of significance to tree growth, but they can be of overriding importance on some sites. For example, soil acidity appears to have little direct effect on tree growth, for most trees grow quite will over a wide range of reactions. However, acidity can have tremendous indirect influence on growth and development through its effect on nutrient availability, microbial activity, and the existence of toxic compounds. It can also give an indication of the % base saturation of a soil. In a similar fashion, it can be said that cation exchange capacity is of little direct importance to forest development. However, the capacity of a soil to retain nutrients in an available form against the leaching action of percolating waters can be of great significance to tree nutrition. In fact, nutrient availability has received little attention in forest soils because of the apparent ability of some forest trees to grow well on impoverished soils.

It is well recognized now that the annual uptake of nutrients by forest trees is comparatively large, but that trees make very good use of the nutrients available through efficient recycling and deep soil exploitation, enabling them to survive on relatively infertile soils. Nevertheless, as the intensity of forest management increases, the demands placed on the soil for nutrients will greatly increase. (William L. Pritchett, Properties and Management of Forest Soils 1979).

The application of the soil test results at Tsali will be primarily to quantify the amount of plant nutrients and soil amendments (lime) to establish various grass covers on disturbed areas (log landings, skid trails and skid roads). It is also possible that these recommendations will apply to the proposed woodlands to insure that various native grasses are successfully established in these areas. A copy of the complete soil analysis on file at the Cheoah Ranger District in Robbinsville, North Carolina.

Soil Class: Soils belong to one of three classes based on % humic matter (HM%), and weight per volume ration (W/V), mineral (min), mineral organic(M-O), or organic (ORG). Plants can tolerate more acidity in organic soils that in mineral soils because organic soils contain less aluminum (an element that can increase the acidity). Therefore soil class exerts considerable influence on lime recommendations. The application of agriculture limestone is the preferred method for decreasing soil acidity and improving growing conditions.

Soil Classification at Tsali: Mineral

% Humic Matter: A measure of the portion of organic matter that has decomposed to form humic and other acids. HM% represents the portion of organic matter that is chemically reactive. This value affects determinations of lime and herbicide rates.

% Humic Matter at Tsali: Considered to be generally low for undisturbed forest soils**;** an indication of predominately warm sites.

Weight per Volume Ratio: The W/V ratio is a good indicator of soil texture. Very sandy soils for example, often weigh more than $1.5 g/cm^3$, while silt and clay loams near $1.0 g/cm^3$.

*Soil Texture based on W/V ratio at Tsali**:*** Fine, loamy, mixed.

Cation Exchange Capacity (CEC): CEC indicates the extent to which a soil can hold and exchange basic cations (plant nutrients) such as calcium, magnesium and potassium as well as hydrogen, aluminum, iron and manganese. A high CEC is desirable because it makes leaching of plant nutrients (due to water percolation) less likely and maintenance of high reserve quantities more likely. The CEC will vary as pH varies and as organic matter fluctuates through addition or decomposition. For example, a low CEC is often and indicator of acidic soils.

CEC at Tsali: Low, ranges from 2.0 to 9.4; and indication of highly weathered soils and past land use (primarily intensive agriculture without soil amendments or improvements)

Percent Base Saturation (%BS): The portion of the CEC that is occupied primarily by plant nutrients such as calcium**,** magnesium, and potassium. A high base saturation reduces soil acidity level and increases the supply of other plant nutrients. Therefore, high BS% values are favorable for plant growth.

Percent Base Saturation at Tsali: Ranges from low teens to 85 which indicates that past intensive agriculture (probably row cropping) was practiced on certain areas across the Tsali peninsula. About 62% of the samples have %BS less than 35 % and 38% of the samples have %BS or greater that 35%..

Exchangeable Acidity (Ac): A quantitative measurement of the portion of the CEC occupied by acidity factors such as hydrogen and aluminum. The amount of acidity increases in soils as pH decreases. (See following discussion of pH).

Hydrogen Ion Concentration: An index of the active acidity in a soil at an instant in time. Soil pH values range from 3 to 8 on a scale of 1 to 14. The lower the number or pH, the more acidic a soil is. An extremely low pH or acidic soil interferes with plant nutrient uptake and can even cause root damage.

Hydrogen Ion Concentration (pH) at Tsali:

Soils at Tsali are predominately acidic soils. This means that less nutrients are available for plant growth and that soil amendments such as lime will be required to insure good growing conditions, especially for grasses planted in disturbed areas (log landings, skid trails, and skid roads).

pH Rating	pH Range	% of Samples in Range
Extremely Acid	3.5 to 4.4	5%
Very Strongly Acid	4.5 to 5.0	73%
Strongly Acid	5.1 to 5.5	18%
Moderately Acid	5.6 to 6.0	4%

Effects by Alternative

The environmental impacts (or effects) described here include both beneficial and detrimental impacts. Environmental impacts 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 impacts are analyzed using references from various literature and reports which are incorporated as an integral part of this environmental assessment. They are listed in the References Cited section. Environmental impacts for each alternative are presented using the objectives and issues listed in the Specific Project Objectives and Issues section

OBJECTIVE: Provide for a Future Healthy Forest Condition

Issue: Silvicultural Systems and Regeneration Methods

Alternative I:

This alternative would allow vegetation to continue in its current state. No poorly-stocked, poor quality, damaged, or over stocked stands would be treated, foregoing the opportunity to return them to a healthy condition. Growth rates would decrease in older stands, with the potential for increased occurrence and impacts from southern pine beetle outbreaks, future gypsy moth infestations, and oak decline. Over time, there would be a loss of early successional vegetative types, as regeneration cuts from past treatments achieve canopy closure and develop into stands of immature poles. Shade tolerant species would continue to reproduce under closed forest canopies (FEIS page E-3).

Alternative III

Units selected for pine, pine/hardwood/hardwood/pine, and cove hardwoods/upland hardwoods are summarized below. Mixed forest types are common across the project area and a forest stand or treatment unit classified or typed as pine/hardwood means that 51-69% of the dominant and co-dominant crowns are pine species mixed with various species of cove and upland hardwoods. Units in which 51-69% of the dominant and co-dominant crowns are hardwoods are typed as hardwood/pine. Cove and upland hardwood forest types occur when at least 70% of the dominant and co-dominant crowns are hardwoods. As the name suggested, cove hardwoods (e.g. yellow poplar, northern red oak, basswood) typically occupy the moist cove areas and can be mixed with species like white oak, black oak, chestnut oak, scarlet oak, and hickory that occupy the drier areas.

Alternative III Summary of Units Selected for Management by Forest Type

	Pine	***Pine/Hardwood**	****Hardwood/Pine**	*****Cove&Upland Hardwood**
Units	13,14,20,30,	2,7,9,11,15,17	1,8,10,16	4,5,6
Total Acres	174	139	74	52

* 51-69% of dominant and co-dominant crowns are pine species.
**51-69% of dominant and co-dominant crowns are hardwood species
***70% of the dominant and co-dominant crowns are hardwoods.

Two-aged regeneration on 145 acres (3% of the project area) and thinnings across 244 acres (6%) between 2001 and 2003 would increase the amount of early successional vegetation to a level that exceeds plan standards for the 0 - 10 year age class.

Twenty-eight acres of poorly stocked, low-quality, and/or damaged stands which are affected by oak decline (units 5,6) would be regenerated via 2 Age shelterwood to fully-stocked stands, with oak components that are decline-free due to their physiological immaturity (Oak, Starkey and Dabney 1988). Manual site preparation followed by direct stem herbicide treatment with Triclopyr to treat aggressive red maple, sourwood, silverbell, and black gum sprouts would occur the following growing season. Both of these units have sufficient stocking to facilitate 2-age shelterwood harvest.

However, due to the presence of oak decline (advanced in some cases); residual stems especially the red oaks, left in the overstory, will not survive to mid rotation (40 to 60 years) of the regenerated stand. There is a high probability that stress from logging activities, accompanied with the presence of decline, will result in a further reduction of hard mast production (acorns) and that maintenance of hard mast producing species, especially the oaks, can not be accomplished.

117 acres (units 2,8,13,17,20) of mixed forest types (pine, pine-hardwood, and hardwood-pine) will be regenerated via 2 age irregular shelterwood method leaving 10 to 20 square feet of residual basal area per acre in well-formed sawtimber and poletimber trees, to be carried at least to mid-rotation (40 to 60 years). Forest conditions in these units can be characterized as mature stands with evidence of oak decline (units 2 and 8) and a high hazard rating for southern pine beetle due to slow growth rates and species composition. If available, hard mast producing trees especially the oaks, will be priority candidates to carry into mid rotation to support mast

production. Manual site preparation followed by late summer prescribed burns to facilitate planting and reduce competitive sprouts is prescribed for these units. Regeneration will occur by planting shortleaf pine seedlings on 15 x 15 spacing to promote the develop of a mixed pine/upland hardwood forest types.

Free thinnings based on crown condition, crown position , and hazard ratings across 244 acres (units 2,7,9,11,14, and 15) to promote growth and reduce the number of trees susceptible to southern pine beetle, gypsy moth, and oak decline. After thinning residual basal areas will range between 55 to 90 square feet per acre depending on stand density, age, and forest conditions. Units 7, 9, and 11 are mixed pine/hardwood forest types with pine represented at least 51% of the total basal area. The hardwood component of these units will benefit from thinning by removing those trees in the dominant and co-dominant position that have poor crowns. Increased growth and vigor (reduces vulnerability) of the residual sawtimber and poletimber hardwood species will occur. Growth response to free thinnings in units 7,14, and 15 will reduce the vulnerability to southern pine beetle, improve species composition and quality for residual trees in these units.

Alternative IV

Two-aged regeneration on 59 acres (1% of the project area) and thinnings across 334 acres (9%) between 1999 and 2001 are proposed for this alternative. Approximately 103 acres (2%) are proposed to create woodland conditions. Units selected for pine, pine/hardwood/hardwood/pine, and cove hardwood/upland hardwoods are summarized in the following table.

Alternative IV Summary of Units Selected for Management by Forest Type

	Pine	***Pine/Hardwood**	****Hardwood/Pine**	*****Cove&Upland Hardwood**
Units	13,14,15,23,24	2,7,9,11,16,19	1,5,8,10,17,20,22	4,6,21
Total Acres	199	169	128	65

* 51-69% of dominant and co-dominant crowns are pine species
**51-69% of dominant and co-dominant crowns are hardwood species
***70% of the dominant and co-dominant crowns are hardwoods

59 acres units (1, 6, and 8) are proposed for regeneration by 2 age shelterwood leaving 10 to 20 square feet of residual basal area per acre in well-formed sawtimber and poletimber trees, to be carried at least to mid-rotation (40 to 60 years). Unit 2 is a mature pine-hardwood forest type with evidence of oak decline in the hardwood component. The pine component has a moderate hazard rating for southern pine beetle due to slow growth rates and amount of host type (pine spp.) present. Manual site preparation followed by mid to late summer site preparation burning is being proposed. Shortleaf pine seedlings will be planted on 15' x 15' spacing following these treatments. The treatments and effects for units 6 and 8 would be the same as in Alternative III.

103 acres (units 5,11,13,17, and 24) are being proposed as opportunities to create woodland conditions to increase grass/forb habitat for wildlife. A woodland is described as a "park like" area in appearances with 25 to 35 trees per acre where frequent fire (2 or 3 year intervals) is used to promote various native grasses and herbaceous shrubs and plants. Today, woodlands are common in the longleaf pine forest of the south and at one time were a part of the forests in the Southern Appalachians. Native Americans used fire frequently to make it easier to travel through the woods and encourage the growth of berries and herbs for their own use, and "to stimulate young growth favored by game" (Cronin 1983, Williams 1989). In all units where woodlands are proposed, tree harvest will be used to reduce the basal area to a range between 25 and 35 trees per acre. This residual basal area will be well formed sawtimber and poletimber trees(if available). Once the desired basal area is achieved, late winter (February) or early spring (March) burns every 3 years will occur to create and maintain woodland conditions. Regeneration would be deferred for the life of the woodland due to the frequency of fire that prevents it's establishment.

Unit 5 is an upland oak forest type and the effects of creating a woodland here includes a reduction of the hardwood component and consequently, a reduction in hard mast production due to the intolerance of most hardwood species to fire. Units 11, 13,17, and 24 are pine, pine-hardwood, or hardwood-pine forest types The pine component of these units is more tolerant to fire due to thick outer bark. Again, overtime a net loss of the hardwood component is expected in the pine-hardwood(unit 11) and hardwood pine (unit 17) due to the use of fire.

Free thinnings based on crown condition, crown position , and hazard ratings across 361 acres (units 1,7, 9, 14,15,16,19,20, ,22, and 23) to promote growth and reduce the number of trees susceptible to southern pine beetle, gypsy moth, and oak decline. After thinning residual basal areas will range between 55 to 90 square feet per acre depending on stand density, age, and forest conditions Treatments and effects in units 7, 9, 14, and 15 would be the same as in Alternative III. Growth response in units 16,19,20, 22, and 23 will be limited due to the age (65+ years old). Thinnings are proposed for these units to meet either visual quality objectives or as pre-salvage/sanitation efforts. Pre-salvage/sanitation treatments are prescribed to remove those trees that are physiologically mature and are more vulnerable to southern pine beetle, gypsy moth, and oak decline.

Alternative V

Two-aged regeneration on 117 acres (3% of the project area) and thinnings across 363 acres (9%) between 2001 and 2005 are proposed for this alternative. Approximately 67 acres (2%) are proposed to create woodland conditions. Units selected for pine, pine/hardwood/hardwood/pine, and cove hardwood/upland hardwood management are summarized in the margin.

Alternative V Summary of Units Selected for Management by Forest Type

	Pine	***Pine/Hardwood**	****Hardwood/Pine**	*****Cove &Upland Hardwood**
Units	13,14,15,16, 17	2,3,6,7,8,10,12,22 ,23,24,25,26,27,2 8,29,30,31,32	1,4,9,11,19,20,21	5,18
Total Acres	222	269	135	57

* 51-69% of dominant and co-dominant crowns are pine species
**51-69% of dominant and co-dominant crowns are hardwood species
***70% of the dominant and co-dominant crowns are hardwoods

Two-aged shelterwood harvest would be an appropriate regeneration treatment for units 1,3,11,14,17,21,23,24, and 32 (111 acres) These units all have sufficient quality growing stock to facilitate commercial harvest while leaving a residual overstory between 10 and 25 trees per acre.

Favoring well formed oaks and other hard mast producers with good crowns as residual trees will maintain hardwood components and continuous mast production in these units.

Reduced susceptibility to southern pine beetle, gypsy moth, and oak decline will be accomplished due to a reduction of host type and the condition of the residual trees (will formed oaks with good crowns). Manual site preparation followed by mid to late summer site preparation burning that will improve planting conditions and increase species diversity is being proposed. Shortleaf pine seedlings will be planted on 15' x 15' spacing following these treatments.

67 acres, (units 20, 26, and 27) are being proposed as opportunities to create woodland conditions to increase grass/forb habitat for wildlife. Units 20 and 26 are a mixed upland oak/pine forest type. Unit 27 is a mixed pine/oak forest type. The treatments and effects for these units would be the same (a net reduction in the hardwood component over time due to intolerance of fire) as in the mixed upland oak/pine and pine/oak forest types in Alternative IV where woodlands are proposed. These areas however, are somewhat isolated from the trail systems and the access road is closed to all but foot travel. Wildlife will benefit from the native grasses and shrubs encourage by the frequent use of fire and will be less likely to be disturbed due to trail traffic or other human contact.

Free thinnings based on crown condition, crown position , and hazard ratings across 298 acres (units 2,4,5,6,8,12,13 15,16,19, 22, 25,28,29,30, and 31) to promote growth and reduce the number of trees susceptible to southern pine beetle, gypsy moth, and oak decline. After thinning residual basal areas will range between 55 and 90 square feet per acre depending on stand density, age, and forest conditions. Growth response in units 16,19,20, 22, and 23 will be limited due to the age (65+ years old). Thinnings are proposed for these units to meet either visual quality objectives or as pre-salvage/sanitation efforts. Pre-salvage/sanitation treatments are prescribed to remove those trees that are physiologically mature and are more vulnerable to southern pine beetle, gypsy moth, and oak decline.

Issue: Associated Vegetation Management

Alternative III

Vegetative management treatments (site preparation burns, manual chainsaw slashing , and pre-harvest treatments with herbicides are proposed in Alternatives III for the purpose of silvicultural and wildlife habitat management. All treatments would use one or a combination of manual, prescribed fire, or herbicide methods. The amounts and proposed time period each treatment are described in the ALTERNATIVES CONSIDERED IN DETAIL section of this assessment.

Fifty acres (units 4, 10, and 16) are committed to pre-harvest treatments to encourage regeneration among oak spp.. Black gum, sourwood, red maple, and silverbell trees up to 6 inches in diameter will be injected or stream line sprayed with Garlon 3a and/or Garlon 4 (the herbicide Triclopyr). This treatment will reduce competition and improve growing conditions for existing oak regeneration (trees 2+ feet tall and greater that 1.5 inches in diameter) to ensure that advanced oak regeneration is present when these units are regenerated in the future.

Manual site preparation followed by site preparation burning will occur across 117 (units 2,5,6,8,13,17, and 20) acres of mixed pine and hardwood forest types to encourage this species diversity.

Prescribed burning in units 3,12,18, and 19 would reduce ericaceous shrub density (evergreen shrubs), increase the amount and diversity of herbaceous and woody vegetation in these stands, and improve conditions for the development of tree reproduction in advance of future regeneration of these stands.

In general, herbicides are more effective in treating undesirable vegetation because they kill both the tops and the roots of treated stems, preventing resprouting. Manual cutting or fire kills the tops, but not the below-ground portions of the plants. Most hardwood species re-sprout vigorously following topkill by either cutting or fire.

If re-sprout growth is desired, then manual and/or prescribed fire methods are most effective. If manual methods are used, cutting must be done as low to the ground as possible to provide for sprouts of low origin. Prescribed fire provides for the lowest origin sprouts (at or below ground line) and therefore best stem quality of sprout re-growth and is the least expensive method to use. A combination of manual and prescribed fire methods has proven to be a very effective method of regenerating stands selected for mixed pine-hardwood management (Abercrombie and Sims 1986; Phillips and Abercrombie 1987).

Alternative IV

Vegetative management treatments (site preparation burns, manual chainsaw slashing , and pre-harvest treatments with herbicides are proposed in Alternatives IV for the purpose of Silvicultural and wildlife habitat management. All treatments would use one or a combination of manual, prescribed fire, or herbicide methods. The amounts and proposed time period for each treatment are described in the ALTERNATIVES CONSIDERED IN DETAIL section of this assessment.

79 acres (units 4, 10, and 21) are committed to pre-harvest treatments to encourage regeneration among oak spp.. Black gum, sourwood, red maple, and silverbell trees up to 6 inches in diameter will be injected or stream line sprayed with Garlon 3a and/or Garlon 4 (the herbicide Triclopyr). The treatments and effects for these units would be the same as in Alternative III, except that more acres would be treated in Alt. IV.

Manual site preparation followed by site preparation burning will occur across 59 acres (units 1,6, and 8) acres of mixed pine and hardwood forest types to encourage this species diversity and facilitate reforestation (planting pine seedlings).

The treatments and effects for the proposed prescribed burning in units 3,12, and 18, would be the same as in Alternative III, except that fewer acres would be treated in Alt IV.

In general, herbicides are more effective in treating undesirable vegetation because they kill both the tops and the roots of treated stems, preventing resprouting. Manual cutting or fire kills the tops, but not the below-ground portions of the plants. Most hardwood species re-sprout vigorously following topkill by either cutting or fire.

If re-sprout growth is desired, then manual and/or prescribed fire methods are most effective. If manual methods are used, cutting must be done as low to the ground as possible to provide for sprouts of low origin. Prescribed fire provides for the lowest origin sprouts (at or below ground line) and therefore best stem quality of sprout re-growth and is the least expensive method to use. A combination of manual and prescribed fire methods has proven to be a very effective method of regenerating stands selected for mixed pine-hardwood management (Abercrombie and Sims 1986; Phillips and Abercrombie 1987).

Atlernative V

Vegetative management treatments (site preparation burns, manual chainsaw slashing , and pre-harvest treatments with herbicides are proposed in Alternatives V for the purpose of silvicultural and wildlife habitat management. All treatments would use one or a combination of manual, prescribed fire, or herbicide methods. The amounts and proposed time period each treatment are described in the ALTERNATIVES CONSIDERED IN DETAIL section of this assessment.

114 acres (units 5,7,9,10, and 18) are committed to pre-harvest treatments to encourage regeneration among oak spp.. Black gum, sourwood, red maple, and silverbell trees up to 6 inches in diameter will be injected or stream line sprayed with Garlon 3a and/or Garlon 4 (the herbicide Triclopyr). The treatments and effects for these units would be the same as in Alternative III & IV except that more acres would be treated than in Alts. II & IV.

Manual site preparation followed by site preparation burning will occur across 117 acres (units 1,3,11,14,17,21,23,24, and 32) of mixed pine and hardwood forest types to encourage this species diversity and facilitate reforestation (planting pine seedlings). The treatment and effects for these activities are the same as in Alternative III, with more acres being treated than in Alt. IV.

The treatments and effects for the proposed prescribed burning in units 1,2,3,4,5,6,7,8,9,10, and 11 (869 acres) would be the same as in Alternative III and IV, except that more acres would be treated in this alternative than in III or IV.

Cummulative Effects

Cumulative effects are effects that result from the incremental impact of the proposed action plus other past, present, and reasonably foreseeable future actions, regardless of which agency or persons undertake such actions. Naturally occurring events may be considered as well. Effects are evaluated using landscape level analyses as well as site-specific analysis. For the Tsali Project, land-use and projects on adjacent areas are considered to the extent they are known. Also, disturbances that occurred in the recent past will be discussed.

Past Actions and Events - Activities that have occurred in the past in the analysis area include timber harvesting, site preparation, prescribed burning, and planting of new stands on National Forest system lands. These activities have also occurred within the last ten years in the area to the west known as Meetinghouse (Compartments 132 thru 136) and the area to the south known as Horse Branch (Compartments 149, 150 and 151) The analysis area is surrounded by federal land and is bounded on the North by Fontana Lake and the Great Smoky Mountains National Park, and to the east by Fontana Lake and the Wayah Ranger District (Compartments 1 through 6). Much of the same forest types present in the analysis area are also found in the surrounding areas where similar growing conditions exist (drier sites). On private lands, past practices include conversion of forested lands to agricultural crop-production, timber harvesting, road construction, and residential development. In the past fifteen years, the Tsali Peninsula, along with those areas adjacent to or adjoining have experienced several natural events that directly affect forest structure, age, and to some extent, forest species composition. Out breaks of southern pine beetle, wind, and storm damage are documented events that are direct causal agents of change in the aforementioned forest attributes. The natural pine and pine hardwood forest types that occupy these areas are changing to hardwood pine or hardwood forest types. The abundance of early seral forest conditions, or stands considered to be in regeneration across the analysis area are a direct result of these events. Early seral forest conditions are best visualized as stands without a canopy of large trees and in various stages of regeneration. The term age class distribution refers to the amount expressed as acres or percentage, of the various age classes present within watersheds or analysis areas. Usually, age classes are divided into ten year increments (e.g. 0-10 years old or early seral forest conditions) and are determined from data maintained in the Continuous Inventory of Stand Conditions (CISC database) The effects of each alternative on age class distribution and forest structure are discussed in the Alternatives Considered section of this document.

Age Class Distribution - National Forest Lands adjoining or adjacent to Tsali have approximately 8% of the total area represented by trees that are 10 years old or less. .

Present Actions/Events -. Commercial timber sales, pre-commercial timber sales, timber stand improvements, seedling planting, prescribed burning, road construction, road maintenance, road re-construction, and trail construction are being proposed within the analysis area. Without question the timber sales will contribute to the amount of early seral forest conditions present in the analysis area as well as the areas that bound the Tsali Peninsula. This impact is short term and is necessary to accomplish one of objectives of the project (forest health restoration). As previously mentioned, the pine and pine hardwood forest types are changing to hardwood and hardwood pine forest types due to natural events. . This is most obvious along the northern shoreline of Fontana Lake within the boundary of the Great Smoky Mountains National Park. Forest management practices such as fire, timber harvesting, and planting have not occurred and the once dominant pine and pine hardwood forests found on the drier sites are now mostly low quality hardwood forests. To some degree, the same trend is occurring across the Tsali Peninsula. The silviculture methods proposed are proven forest management activities that will result in mixed pine hardwood, or hardwood pine forest types that occur naturally in this area on the drier sites. The frequent burning schedule proposed would help support this effort since southern yellow species are well adapted to fire. Some species such as pitch pine and table mountain pine depend on fire for regeneration. The wide spacing being proposed for pine seedlings (15' x 15') will ensure a mixed pine hardwood or hardwood pine forest type. Ultimately seedling survival, natural seeding, and other associated factors will determine whether the forest type is considered pine hardwood, or hardwood pine. The thinning proposed in the analysis area will lessen the impacts of insects and disease by promoting vigorous growing trees. There are no other timber sales presently occurring in the analysis area. On private land, there is some agricultural-crop production, grazing of livestock, and residential development. Currently, Highway 28, within the analysis area, is being widened from two lanes to four that will result in a net loss of approximately 30 acres of forested land within the area. . Extensive road reconstruction and new construction is occurring with large cuts and fills. This is primarily in compartments 152, 153, and 156 within the analysis area. These cuts and fills have and are being planted with various grasses and tree species considered beneficial to wildlife.

The natural forest types of pine hardwood and hardwood pine that occur on the drier sites are being replaced by various species of hardwoods. This is due in part to lack of fire, storm events, and insect outbreaks.

The Lemmons Branch Boat Ramp project is planned to begin sometime in the summer of 2001. This project is located in Compartment 156 of the analysis area. Approximately 1.4 miles of road will be reconstructed to two lane paved road standards recognized by the North Carolina Department of Transportation. Due to the extra width of a two lane road, there will be more cut and fill slopes which will be planted to a wildlife seed mixture. As an additional mitigation measure, the acreage assumed lost from the Lemmons Branch Road will be replaced in nearby similar situations (one lane skid roads) and will be reseeded and maintained to provide for the loss of

any grass/forb habitat. In these ways, the amount of grass/forb habitat will be increased through the implementation. There will be a loss of approximately 10 acres of forested land.

Future Actions - The Wayah Ranger District is currently planning a timber sale to the east of the area and across Fontana Lake (Compartments 1,2,3,4,5,and 6). One of major objectives of this project is forest health restoration. The same loss of natural forest types is occurring in this area as well and is attributed to natural events. Many of the activities listed above are also being proposed for this project. There is a 1000 acre private development just underway east of the project area across Fontana Lake. Much of the natural forest types are or will be replaced by ornamentals and other more desirable shade trees common to developments. The yellow pine species over time will gradually be replaced by those species desirable to homeowners.

Issue: Soils

Soil Characteristics: The soils of the Tsali Peninsula Area are derived from metasedimentary rocks such as phyllite, slate, quartzite, and thinly bedded metasandstone. Three dominate soil classifications are recognized in this proposal and they occur as the Brasstown/Junaluska complex, the Junaluska/Tsali complex, and the Spivey/Whiteoak complex. The Brasstown/Junaluska and the Junaluska/Tsali soils occur on the landscape along side slopes and ridge tops. The Spivey/Whiteoak soil are associated with coves and drainageways. Tsali soils have a depth of less that 20" from bedrock and are some of the poorest soils in the area. Brasstown/Junaluska soils have fine sandy loam surface textures and 18-35% clay in the subsoil. Junaluska, which 20-40" deep, occurs in complexes with the deeper Brasstown soils and with the shallow Tsali soils. There is no prime farmland or significant floodplains or wetlands within the project area.

An attribute of soil characteristics is the erosion potential of the three soil classifications at Tsali. The potential for off site soil movement following disturbances such as road construction, is related to the severity of slope. For the three major soil classifications at Tsali erosion potential or the erodability factor is experessed in terms of low, moderate, and high. The erodability factor for slopes ranging from 0 to 30 per-cent is considered to be low A moderate rating is assigned to those areas with slopes ranging from 30 to 50 percent. Slopes greater than 50 percent are considered to have a high erosion potential following disturbance.

These soils and their complexes, are the most common low elevations soils in the metasedimentary geology and are generally found on all aspects below 3000' MSL. The Spivey/Whiteoak soils are dark surfaced and are the most productive soils in the project area.

Alternative I: No action -- As considered here, not action means that no road construction/reconstruction, timber harvest, wildlife habitat improvement**,** or associated activities would occur in the project planning area as a result of this proposal.

Alternative III: This alternative would have approximately .95 miles of skid road construction. Total area disturbed by road construction is approximately 3 acres. The roads constructed for this alternative will not exceed slopes greater than 20 percent or occur on slopes greater than fifty percent. The erosion potential for this alternative is low to moderate. This area would be considered out of general forest production but serving as linear wildlife openings during periods between compartment entries. Roads would be disked, fertilized, and seeded to prevent soil erosion and to restore soil productivity. Most non-road soil disturbances would be short-term and, with little or none of the excavation inherent to roading, and therefore would be generally less intrusive. With the exception of some log landings and openings, which may requires grading and shaping (no deep excavation), there would be little direct displacement of soil materials. There would be some potential for short - term erosion on log landings and skid trails. Soil compaction from ground skidders, log trucks, and other vehicular traffic will occur at long landings and along skid trails. Log landings and skid trails would be seeded to prevent erosion and restore soil productivity.

Alternative IV: This alternative would have approximately .95 miles of skid road construction and 3.3 miles of new trail constructed (single track) The 1.1 miles of double track trail planned for this project will be along existing system roads. No construction will actually occur along this road (Calf Pen Gap Road FS# 2548) other than ordinary maintenance required to facilitate logging equipment and future trail bike use. The effects and treatments for road construction and associated activities in this alternative are the same as alternative III. The proposed single track construction will result in compaction and some degree of erosion in the short and long term because construction will occur across slopes greater than 50 percent. In section 3 and 5, approximately one-half of the new trail construction will occur on slopes greater than 50 percent. These negative effects can be mitigated by constructing water bars, limiting trail construction to grades less than 30%, and performing scheduled trail maintenance as needed. This alternative would have more risk of soil compaction than Alternatives III or V especially along the newly constructed bike trails.

Alternative V: This alternative would have approximately .5 miles of skid road , and .45 miles of haul road construction. There would be no new system roads. No construction will actually occur along this road (Calf Pen Gap Road FS# 2548) other than ordinary maintenance required to facilitate logging equipment and future trail bike use. The effects and treatments for road construction and associated activities in this alternative are reduced because there will be less skid road construction. Skid road construction will occur on those slopes between 0 and 50 percent. Therefore, the erosion potential for this alternative is considered low to moderate. Again,

the proposed single track construction will result in compaction and some degree of erosion in the short and long term. These negative effects can be mitigated by constructing water bars, limiting trail construction to grades less than 30%, and performing scheduled trail maintenance as needed.

Fire Effects: Prescribed burning is proposed in Alternatives III, IV, and V of this project. The potential impacts of prescribed fire on soil productivity depend on the intensity of the fire. If slash burning is done under improper 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 (Van Lear and Waldroop 1989) and (FEIS, Vegetation Management, Appendix B).

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 (see Wayah Ranger District Prescribed Fire Plan post-burn evaluations, 1980-1993). Even an intense slash burn done when duff, soil, and larger fuels are moist will seldom be severe. The moderate burns performed during these moisture conditions do not affect soil structure. Most litter and some duff may be consumed, but soil organic matter is little affected.

Soil biota may be reduced, but recover quickly. Some nitrogen may be lost from burned areas through volatilization and leaching, but burning may also result in enhanced availability of nitrogen as well as inputs from nitrogen-fixing leguminous species which rapidly colonize burned areas. Long-term nitrogen budgets would be neutral. Other soil nutrients are little affected (VanLear and Waldroop, 1989) and (FEIS, Vegetation Management, pages IV-89 through IV-96 and Appendix B). There would be some mortality of small animals resulting from prescribed burning.

VanLear and Danielovich (1988) found that site preparation did not significantly increase soil movement on steep slopes in the southern Appalachians. 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 re-growth, which provided quick cover and protection of the soil. Van Lear and Kapeluckz (1989) found that low severity burns did not increase soil movement on slopes that ranged from 21-41 percent. Mineral soil was only exposed on fifteen percent of the burned area. This left sufficient forest floor and a thick mat of fine to medium roots to protect the surface of the mineral soil. Losses of available phosphorous and exchangeable cations on eroded sediments from the burned plots were too low to cause concern about possible effects on soil productivity. In Macon County, North Carolina, a prescribed burn study was conducted by Coweeta Hydrologic Laboratory. The burning was planned and conducted on the Wayah Ranger District of the Nantahala National Forest using the Nantahala-Pisgah LRMP Standards and Guidelines. Three 10 acre sites were burned under prescription on slopes that ranged from 35 to 45 percent. Sites were on the Cowee-Evard soil series that are classified as fine-loamy, mixed, mesic typic Hapludults. Swift, Elliott, Ottmar and Vihnanek (1993) found there were only minor and very localized movements of burned plant matter and soil observed throughout all sites. The fibrous humus layer was charred on the surface but one third or more remained unburned. Even where elevated large woody material was consumed, the forest floor below remained intact. Sediment did move from some localized patches of exposed soil but was trapped within a short distance by residual forest floor debris. Dry ravel and mass failure were never observed on any of the sites.

Herbs, tree seedlings, stump sprouts and grasses appeared as early as 19 days after the burns. First season vegetation covered 23% of the surface. Intact forest floor and woody debris covered an additional 62% at the end of the first growing season. Soil moisture was measured over pretreatment months as well as after the burns. Soil moisture tended to be lower in the upper slope plots and higher in the plots that were near the heads of ephemeral channels. These differences were unaffected by the burning treatments.

Direct, Indirect and Cumulative Effects Common to All Action Alternatives

The greatest potential for erosion in the project area is the road construction needed to access harvest areas. All road construction would be designed and built to LRMP standards and guidelines, and to the North Carolina Forest Practices Guidelines Related to Water Quality. These guidelines prevent erosion and stream sedimentation. The direct effects would be some soil erosion during road construction. This erosion would be from roadbeds that would be dedicated to serve that area in the future. The indirect effects may be localized short-term impacts to water quality during construction activities, such as an increase in sediment on the day crossings are installed. However, the proposed activities should have no adverse impacts or cumulative effects on water uses downstream of the project area. Stream sedimentation from old roadbeds should decrease as drainage structures and surfacing on existing roads are brought up to current standards.

Studies conducted by Coweeta Hydrologic Laboratory on the same soil families and slope percents as in the project area show the major source of erosion from forest practices is not from harvest cuts or thinnings, but from poor road design, location, and construction (Douglass 1975; Douglass and Swank 1975; Swift 1984; Ursic and Douglass 1975). Studies conducted elsewhere in the Southern Appalachians have shown similar results (Browning 1980). In addition, studies conducted both at Coweeta, and in the Willis Cove area of Macon County, have outlined the design criteria needed to minimize soil erosion and stream sedimentation (Swift 1984; Douglass 1975). Such design standards include brush barriers, silt fences, surfacing, filter strip width, immediate seeding and/or mulching of cut and fill slopes, and broadbased ("Coweeta") dips to control roadbed runoff. These criteria were used to develop both the LRMP road

location, design and construction standards, and The North Carolina Forest Practices Guidelines Related to Water Quality (North Carolina BMPs).

Adherence to Land and Resource Management Plan Standards and Guidelines and North Carolina Forest Practice Guidelines Related to Water Quality would protect water quality in all action alternatives.

Issue: Water Quality and Aquatic Resources

This report documents the findings of an aquatic resource analysis (AQUA) of a proposed forest health project. 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 will focus on the potential effects of the proposed forest health project and associated activities which would be most likely to affect aquatic resources. 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.

Existing Condition

Aquatic habitat

The proposed project is within LRMP watersheds 10 (Fontana Lake) and 14 (lower Nantahala River). Project area waters include the impounded finger of Panther Creek, Town Branch, Murphy Branch, Mouse Branch, Meadow Branch, Battles Branch, Lemmons Branch, unnamed tributaries to these streams, unnamed tributaries to Little Horse Branch, Fontana Reservoir, and unnamed tributaries to Fontana Reservoir. Analysis area waters include project area waters downstream into the main channel of the Fontana Reservoir.

The North Carolina Division of Environmental Management (NCDEM) has classified waters within the analysis area as follows. Panther Creek is classified as C Tr from source to Fontana Lake. Fontana Lake is classified as B. Town Branch, Murphy Branch, Mouse Branch, Meadow Branch, Battles Branch, and Little Horse Branch are classified as C. Lemmons Branch is classified as B. Class C waters are suitable for aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture. Tr denotes waters suitable for natural propagation and maintenance of stocked trout. Class B waters are suitable for primary recreation and other usage specified by the "C" classification.

Aquatic Species

Table 2. Species list for Panther Creek (Bonner 1981).

Common Name	**Scientific Name**
Rainbow trout	***Oncorhynchus mykiss***
Northern hog sucker	*Hypentelium nigricans*
Longnose dace	*Rhinichthys cartaractae*
Unidentified Sculpin species	*Cottus sp.*
Central stoneroller	*Campostoma anomalum*
Rosyside dace	*Clinostomus funduloides*

Table 3. Fontana Reservoir Species List (TVA 2000).

Gizzard shad	*Dorosoma cepedianum*
Rainbow trout	*Oncorhynchus mykiss*
Muskellunge	*Esox masquinongy*
Goldfish	*Carassius aurantus*
Common carp	*Cyprinus carpio*
Whitetail shiner	*Notropis galacturus*
Silver shiner	*Notropis photogenis*
Spotfin shiner	*Notropis spilopterus*
Silver redhorse	*Moxostoma anisurum*
River redhorse	*Moxostoma carinatum*
Black redhorse	*Moxostoma duquesnei*
Golden redhorse	*Moxostoma erythrurum*
Shorthead redhorse	*Moxostoma macrolepidotum*
Channel catfish	*Ictalurus punctatus*
Flathead catfish	*Pylodictis olivaris*
White bass	*Morone chrysops*
Rock bass	*Ambloplites rupestris*

Green sunfish	*Lepomis cyanellus*
Bluegill	*Lepomis macrochirus*
Smallmouth bass	*Micropterus dolomieui*
Largemouth bass	*Micropterus salmoides*
White crappie	*Pomoxis annularis*
Black crappie	*Pomoxis nigromaculatus*
Tangerine darter	*Percina aurantiaca*
Walleye	*Stizostedion vitreum*

IV. EVALUATED SPECIES SURVEY INFORMATION

PREVIOUS SURVEY INFORMATION

Table 4. Previous Surveys

Stream Name:	Fontana Reservoir
Type:	Watershed index inventory and monitoring
Date:	1993-2000
Agency:	TVA

Stream Name:	Fontana Reservoir
Type:	Reservoir population composition monitoring (electrofishing & gill netting)
Date:	1996-2000
Agency:	NCWRC, USFS

Stream Name:	Panther Creek
Type:	NCWRC Survey
Date:	1981
Agency:	NCWRC

Stream Name:	Panther Creek
Type:	Brook Trout Surveys
Date:	1995
Agency:	USFS, NCWRC

Stream Name:	Mouse Branch
Type:	Brook Trout Surveys
Date:	1995
Agency:	USFS, NCWRC

NEW SURVEYS CONDUCTED

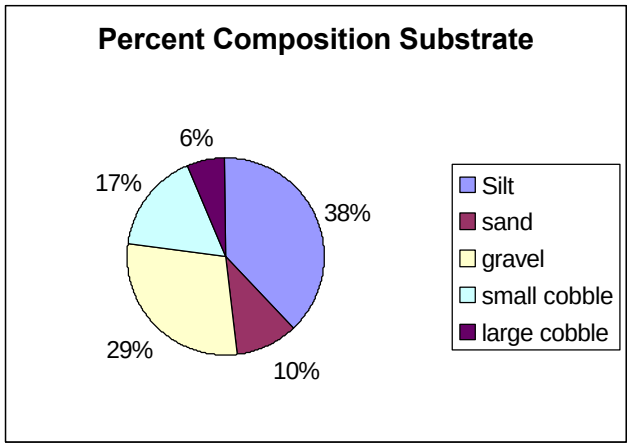
Jeanne Riley, former Nantahala Fisheries Biologist, visited the activity area in November 1997. Project information was obtained from Mark Robison, US Forest Service (USFS) NEPA Forester. Lorie Lewis, Nantahala National Forest Fisheries Biologist and Kelly Howell, Pisgah National Forest Fisheries Biologist obtained site-specific data from area streams in March 2000. Sample sites were chosen according to the amount of disturbance of the area around or within streams.

Additional information specifically addressing aquatic PETS species, forest concern species, and MIS was obtained from North Carolina Wildlife Resources Commission (NCWRC) biologists, North Carolina Natural Heritage Program (NCNHP) records, and US Fish and Wildlife Service (USFWS) biologists. An analysis of risk to aquatic resources was performed using reference materials, field observations, and project maps.

Survey site: Unnamed tributary to Mouse Branch

Reason for site location: This site was chosen because it is parallel to the prehaul and maintenance road 2552 and 2552A.

Figure 2. UT Mouse Branch substrate survey results.



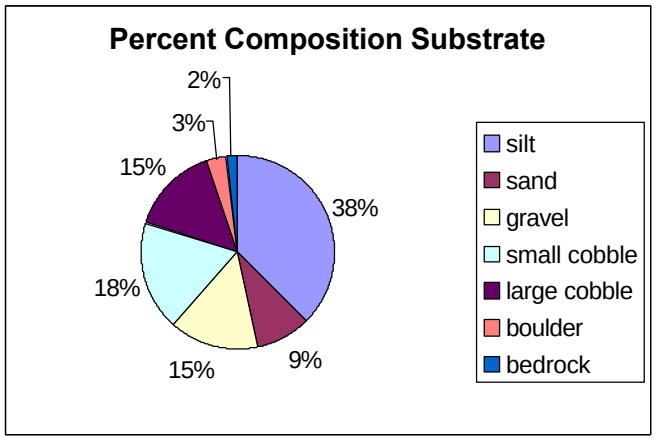
**Habitat survey based on 100-meter reference section of stream.

This section of the stream has a low gradient of about 2-3% and is primarily riffle habitat. Average width is 1.9 meters and average depth is 2.55 inches. Large woody debris is very small with hemlock and rhododendron within the immediate riparian area. This section of the UT to Mouse Branch was historically used as a streambed. NO fish habitat exists in the immediate project area of UT Mouse Branch. Caddis, stone and mayflies as well as snails were present during the survey.

Survey site: Meadow Branch

Reason for site location: This site was chosen because it is parallel to the prehaul and maintenance road 2550C and surveyed to ensure there is no freshwater mussel habitat within the project area.

Figure 3. Meadow Branch substrate survey results.

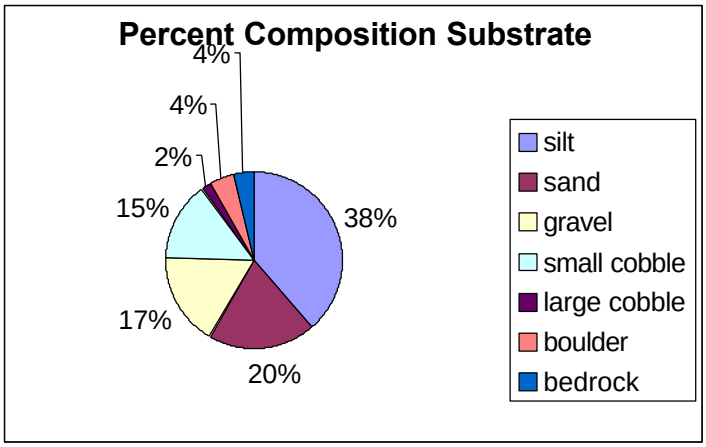


No mussel habitat was found within Meadow Branch. A surber sample was taken and observed for 30 minutes. Stone, caddis, snail and oligocheates were found within the macroinvertebrate sample. Salamanders were also picked up in the sample as well. The gradient of the sample section of Meadow Branch was only 4% relative to its location to the reservoir. The average width is 3.06 meters and the average depth is 7.8 inches. Cut banks and deep pools indicate there is fish habitat present within the survey section of Meadow Branch. The Pool to Riffle ratio here is 40% pool habitat and 60% riffle.

Survey site: Another Unnamed tributary to Mouse Branch

Reason for site location: This site was chosen because this is a proposed area for a skid access with alternatives III and IV.

Figure 4. Another Unnamed tributary to Mouse Branch substrate survey results.



A surber sample was taken and observed for 30 minutes. Stone, may, caddisflies and snails were present within the macroinvertebrate sample. The gradient of the survey section was approximately 4%. The average width was 2.71 meters and average depth was 7.3 inches. There is a bike trial parallel to the survey section within the riparian which may explain the high amount of silt within the substrate composition. This trail is however in good working condition and there is herbaceous material between the trail and the stream.

Survey site: Unnamed Tributary to Murphy Branch
Reason for site location: Adjacent to proposed prehaul maintenance and newly constructed road.
This tributary was small with very little flow. Rocks were examined for macroinvertebrates. Snails and caddis and stoneflies were observed. NO fish habitat was present within the survey section of UT Murphy Branch.

EFFECTS OF PROPOSED MANAGEMENT ACTION

THREAT OR LIMITING FACTORS

Sedimentation may occur with the building of the new road, trail and access area. Sediment loading and turbidity can cause mortality by injuring and stressing aquatic individuals or smothering fish eggs and larvae. These effects are more likely to impact less mobile organisms, such as aquatic insects and fish eggs and larvae.

Loss of interstitial space within the substrate due to sedimentation can affect fish spawning habitats. The disturbance resulting in sedimentation may cause a temporary loss of this habitat but is unlikely to affect fish community stability.

INCOMPLETE OR UNAVAILABLE DATA

The majority of the members of the forest concern aquatic insect community type analyzed for this project has been under sampled and therefore is listed with limited distributions. However, the habitat descriptions of these species and the sensitive aquatic insects indicate they may be widespread in Mountain Province waters and some of these also occur in the Piedmont Province.

Discussion of alternatives:

Alternative I is the no action alternative. This alternative will have no impact on water quality since no land or riparian area will be disturbed. The aquatic community will remain in the present state or continue any current population trends.

Alternative II excluded commercial sale of timber. The alternative was considered, but dropped from detailed analysis. Please refer to the Environmental Assessment for detail of this alternative.

Alternative III.

Direct and Indirect effects of Access on Water Quality: There will be 9.0 miles of road prehaul maintenance and reconstruction on FS 2548 (Little Horse Branch, Panther Creek, and Town Branch drainages), 2552 (Murphy Branch drainage), 2552A (Mouse Branch drainage), 2550 (Meadow Branch, Mouse Branch, and Fontana Reservoir drainages), 2550A (Battles Branch and Fontana Reservoir

drainages), 2550B (Battles Branch and Meadow Branch drainages), 2550C (Meadows Branch and Fontana Reservoir drainages) over a three year period. There will be no widening associated with this activity. Trees and brush will be removed from the existing roadbeds and the road surface will be graded. There is no anticipated culvert replacement in project area streams. Drainage culverts will be installed in areas where needed. There will be a total of 0.95 miles of skid road construction from FS 2552 to access Stand 7, from FS 2548 to access Stand 1, and from FS 2550 to access Stand 17. These roads will be constructed during the first year of the project. There are no stream crossings associated with the skid road construction. Soil disturbance will occur with skid trails. Harvest stands include 1 and 2 (Little Horse Branch and Town Branch drainages) accessed by FS 2552A; 11 (Fontana Reservoir drainage) accessed by FS 2553; 13 (Battles Branch and Fontana Reservoir drainages) accessed by FS 2550B; 14, 15, and 20 (Mouse Branch drainage) accessed by FS 2550; and 17 (Fontana Reservoir drainage) accessed by FS 2550D.

Geological formations high in iron sulfide are located on Tsali Peninsula, according to the Geological Maps of Cherokee, Graham, and Swain counties, NC composed by the NC Geological Society. These areas pose a high-risk hazard for stream acidity and aquatic populations. Road prehaul maintenance and reconstruction as described above should not expose rock. Drainage culverts will not be placed where rock is encountered on roadbeds. Skid road construction is located in these areas, but there are no water resources associated with the construction. **If sulfidic material is encountered, it must be hauled off site and encapsulated with lime rock away from water resources.**

Turbidity and sediment loading will occur at water crossings from prehaul maintenance and reconstruction and possibly from skid roads and trails. These effects will be evident at and immediately below the crossings, but should diminish with downstream flow and cease with site rehabilitation. Access may also cross ephemeral streams or spring seeps that feed these streams and others in the project area. Timber sale contract clauses, erosion control precautions, and temporary stream crossing methods should be implemented into this project to avoid impacts to the aquatic resources.

No haul road construction or reconstruction should occur outside the normal seeding season of April 1 to September 30 without the consent of Forest Service officials (Timber Sale Contract Clause R8-CT6.62 or similar 9T clause; and Timber Management and Forest Engineer letter "Road Construction Outside the Seeding Season" dated 11/18/93). District personnel should coordinate with the Forest Hydrologist or a Fisheries Biologist when activities are associated with riparian areas. This will facilitate success of erosion control measures and reduce the chance of sediment reaching the stream channels. In addition, staked hay bales and brush barriers should be placed along the length of the road prior to soil disturbance where it is within 100 feet of perennial and 15 feet of intermittent streams. These should be maintained until revegetation occurs (Timber Sale Contract Clause R8-CT6.62 or similar 9T clause). Additional measures will be implemented if the above erosion control measures fail. Specifically, this applies to all roads within riparian areas and those, which cross water. This includes all project area roads and skid roads discussed above. All disturbed roadbeds will be revegetated and closed to traffic as the activity in the area is completed.

There is no anticipated culvert replacement in project area streams. In the event of the failure of an existing culvert during road use, the following should apply to the culvert replacement. Culvert placement should be at stream grade to assure fish passage, which will also allow movement of other aquatic species. Water crossings will be seeded and mulched the same day construction occurs (Timber sale contract clause R8-CT6.62 or similar 9T clause) as an immediate site rehabilitation measure to improve water quality conditions for aquatic life. Stone should be placed on stream approaches and crossings prior to road use.

There are no stream crossings on skid trails with this project. USFS personnel will mark location of skid roads and trails. They should be located outside riparian areas and a distance from ephemerals and springs so that water does not channel into them. Existing skid roads and trails located within the 100-foot perennial riparian area and 15-foot intermittent shade area (50 foot streamside management zone) will not be used without a site evaluation to determine possible effects to the aquatic system (Timber Sale Contract Clause R8-CT6.5 or similar 9T clause). Springs should not be covered with soil, but crossed with decking surge stone. Skid trails should be vegetated as soon as possible after use to avoid off-site soil movement (Timber Sale Contract Clause R8-CT6.601 or similar 9T clause).

Direct and Indirect Effects of Access on the Aquatic Community: As discussed above, access reconstruction and skidding activities have the potential of contributing sediments into 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 the 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 and suffocation. This can result in a lost or reduced year class strength, which can lead to accelerated population fluctuations and suppressed population levels.

Cumulative Effects on the Aquatic Community: These species, over time, will recolonize areas as habitat conditions improve. Smaller, less mobile species, 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 upstream and downstream reaches of undisturbed stream as conditions improve with site rehabilitation. Movement to more suitable areas may influence community dynamics by increasing competition for food and suitable habitats. Aquatic community structure could become dominated by species

which are less specialized and can adapt to varying conditions; replacing resident species. Resident species that require more specialized habitats, such as mussels, may occur at reduced densities and could be extirpated. Also, those species that naturally exist at low densities or are generally rare may be locally eliminated from the aquatic community. Aquatic populations, which are already stressed as a result of past or ongoing habitat degradation, may be further suppressed or lost. The degree of impact on the aquatic community depends on the extent and duration of riparian disturbance and the time period it takes for site rehabilitation. **Implementation of contract clauses, erosion control precautions, and stream crossing methods described above should minimize sediment effects and accelerate site rehabilitation.**

The extent of riparian disturbance should be minimal with this project. There is no haul road construction and the skid road construction is located away from water resources and riparian areas. Haul road maintenance and reconstruction will cross streams and off-site soil movement from skid trails is possible. It is expected with this project that adult hellbenders and fish will be able to move to less turbid waters during project activities. Hellbender and fish eggs and juveniles may be lost to sedimentation below stream crossings and for the distance that any sediments are carried.

Alternative IV

Direct and Indirect Effects of Access to Water Quality: Under this alternative road prehaul maintenance and reconstruction and skid road construction remain the same as that in Alternative III. The number and acreage of stands to be harvested increase: therefore soil disturbance from skid trails will increase. Additional stands include 10 and 23 (Fontana Reservoir drainage) accessed by FS 2553; 22 (Fontana Reservoir drainage) assessed by FS 2550E; and 19 (Fontana Reservoir drainage) accessed by FS 2550C; 16 (Fontana Reservoir drainage) accessed by FS 2550E; and 19 (Fontana Reservoir drainage) accessed by 2550. Potential for effects to the aquatic resource increase with increased in soil disturbance in Alternative IV as compared to Alternative III.

Direct and Indirect Effects of Access on the Aquatic Community: See alternative III.

Cumulative Effects of Access on the Aquatic Community: See alternative III.

Alternative V

Direct and Indirect Effects of Access of Water Quality: Under alternative V, some stands are dropped, some added, and some divided into smaller stands or expanded. Road prehaul maintenance and reconstruction decreases to 8.3 miles with the exclusion of seven stands. This occurs on a section of FS 2552 (Murphy Branch drainage) and FS 2553 (Fontana Reservoir drainage). FS 2552A (Mouse Branch drainage) will not be used as access. An additional road will be used as access in this alternative. FS 2551 (Murphy Branch and Panther Creek drainages) will access stands 28, 29, 30 and 31. There is no prehaul maintenance or reconstruction proposed for this road. Skid road construction off of FS 2552 (Murphy Branch drainage) will be replaced with a skid trail. Skid road construction from FS2548; 11 (Fontana Reservoir drainage) accessed by FS2550A; 15 and 16 (Battles Branch drainage) accessed by FS 2550 E; 12 and 27 (Mouse Branch drainage) accessed by FS 2550; and 28, 29, 30 and 31 (Murphy Branch and Panther Creek drainages) accessed by FS 2551. Potential effects to the aquatic resource increase with increased soil disturbance in Alternative V as compared to Alternative III but approximately the same as Alternative IV.

Direct and Indirect Effects of Access on the Aquatic Community: See Alternative III.

Cumulative Effects on Aquatic Community: See Alternative III.

Table 5b. Effects of the alternatives by issue.

Issue	Alternative I	Alternative III	Alternative IV	Alternative V
Effects to T & E species	No Effect	No Effect	No Effect	No Effect
Effects to Sensitive and Species of Forest Concern	No Effect. Aquatic habitat will remain same.	May impact individuals in Table 5a.	May impact individuals in Table 5a.	May impact individuals in Table 5a.
Effects to Water Quality (Associated with the amount of soil disturbance)	Remain the same.	Turbidity and sediment loading will occur at water crossings but should diminish downstream and cease with site rehabilitation.	Potential effects to water quality increase due to the increased amount of soil disturbance with this alternative.	Potential effects to water quality increase due to the increased amount of soil disturbance with this alternative.

Issue	Alternative I	Alternative III	Alternative IV	Alternative V
Direct and Indirect Effects of Timber Harvest on Water Quality	No Effect.	No Effect as long as LRMP and NC-FPG standards is followed and timber sale clauses are implemented.	No Effect as long as LRMP and NC-FPG standards are followed and timber sale clauses are implemented	No Effect as long as LRMP and NC-FPG standards are followed and timber sale clauses are implemented
Effects to Riparian Areas	Remain in Present State.	No proposal to harvest within 100' riparian. Remain in Present State.	No proposal to harvest within 100' riparian. Remain in Present State.	No proposal to harvest within 100' riparian. Remain in Present State.
Effects of Prescribed Burning on Aquatic Resources.	No Effect.	No Effect. Riparian areas are not intensely burnt. Fire lines constructed with hand tools.	No Effect. Riparian areas are not intensely burnt. Fire lines constructed with hand tools	No Effect. Riparian areas are not intensely burnt. Fire lines constructed with hand tools
Effects of Site Preparation	No Effect.	No Effect. No plan for manual or herbicidal removal of vegetation within Riparian areas.	No Effect. No plan for manual or herbicidal removal of vegetation within Riparian areas	No Effect. No plan for manual or herbicidal removal of vegetation within Riparian areas
Effects of Planting on Aquatic Resources	No Effect.	No Effect. Activity outside riparian.	No Effect. Activity outside of Riparian.	No Effect. Activity outside of riparian.
Effects of Trail Construction on Aquatic Resources.	No Effect.	No new trails proposed.	May effect. See "Effects of Trail…" below.	May effect. See "Effects of Trail…" below.

Effects of Trail Construction on Aquatic Resources: Bicycle and horse trail construction is proposed under Alternatives IV and V. FS 2548 will be reconstructed for use as a double track trail. New construction of two single-track trails from FS 2548 will connect to FS 2552 and FS 2552A to form a loop and connector to FS 2551. The reconstruction and construction (2.28 miles) of these trails will be located away from water resources. A section of single-track trail (0.15 miles) on FS 38 will be relocated to close out a stream crossing (unnamed tributary to Fontana Reservoir). Trail relocation of FS 38 will improve water quality conditions in the unnamed tributary to Fontana Reservoir. New single-track trail (1.1 miles) will be constructed downhill of Fs 2550A to avoid timber access activities. There are no stream crossings associated with this trail. Relocation of a single-track trail (1.14 miles) will be constructed downhill FS 2551 to avoid timber access activities. A stream crossing (unnamed tributary to Panther Creek) will be spanned with a bridge. The bridge will be located where off trail use is discouraged and barriers will be installed to deter traffic from the stream. The bridge will span the stream across the cannel and onto the approaches for a distance that will protect stream bank integrity. There should be no stream bank or channel excavation. The gradient of the approaches will be broken to allow sediments to runoff the trail before it crosses the stream. Decking should be placed tightly together to decrease sediment input. If these methods are implemented, there should be no negative cumulative effects to the aquatic resource. This new trail construction has the potential for contributing sediments into the stream. Short-term direct and indirect effects to aquatic species from construction to the stream bank may occur. No cumulative effects are expected from the trail construction**.**

Cumulative Effects for Implementation of Project

Recent past USFS projects on the Tsali Peninsula include the Tsali Pine Beetle Salvage in 1993, Tsali Parking Lot Expansion in 1994, Tsali Boat Ramp Parking Expansion in 1995, and Trail Construction in 1995 and 1998. The Tsali Pine Beetle Salvage was implemented under a Salvage Programmatic Biological Evaluation that restricted road use to existing roadbeds with no reconstruction. Mitigation measures were implemented with both of the parking lot projects to ensure that sediments did not reach Fontana Reservoir. New trail reconstruction has been located away form water resources. There are proposal s to replace stream fords with bridges and relocated trails away from streams. These projects will improve aquatic habitat in the streams associated with trail use. The Tsali Forest Health Project may have short-term direct and indirect effects on aquatic species as discussed below in the determination of effect section of this document.

CONSULTATION HISTORY

No consultation with the US Fish and Wildlife is necessary.

DETERMINATION OF EFFECT

Table 6. Determination of effect of each alternative on the evaluated threatened and endangered, sensitive species and forest concern species.

Species	Alternative I.	Alternative III.	Alternative IV.	Alternative V.
Federally Threatened and Endangered Species				
There are no T&E Species in the project area				
1996 Region 8 Regional Forester's Sensitive Species List				
Gomphus consanguis	D/I/C: No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Ophiogomphus edmundo	D/I/C: No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Serratella spiculosa	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Forest Concern Species				
Cryptobranchus alleganiensis	No Effect.	D/I/C: CODE 1	D/I/C: CODE 1	D/I/C: CODE 1
Clinostomus, sp. 1	No Effect.	D/I/C: CODE 1	D/I/C: CODE 1	D/I/C: CODE 1
Notropis lutipinnis	No Effect.	D/I/C: CODE 1	D/I/C: CODE 1	D/I/C: CODE 1
Percina caprodes	No Effect.	D/I/C: CODE 1	D/I/C: CODE 1	D/I/C: CODE 1
Ceraclea sp. 1	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Helicopsyche paralimnella	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Wormaldia thyria	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Cordulegaster erronea	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Gomphus parvidens parvidens	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Stylurus scudderi	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Ophiogomphus aspersus	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Ophiogomphus mainensis	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Sympetrum obtrusum	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Barbaetis benfieldi	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Megaleuctra williamsae	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2
Shipsa rotunda	No Effect.	D/I/C: CODE 2	D/I/C: CODE 2	D/I/C: CODE 2

D/I: Direct and Indirect Effect

C: Cumulative Effects

CODE 1: May effect eggs or juveniles. Will not affect viability across the Forest.

CODE 2: May impact individuals. Will not affect viability across the Forest.

CODE 3: Habitat capability will remain the same.

No risk to aquatic population viability of any species including MIS, Forest Concern and Sensitive Species across the Forest will occur as a result of this project.

Sensitive species *Gomphus consanguis, Ophiogomphus edmundo* and *Seratella spiculosa* may occur within the project area. The implementation of this project may impact or stress individuals but not likely to adversely affect the species. No Odonates (including *Gomphus* and *Ophiogomphus*) species were found during the project surveys. Caddisfly larvae were picked up in the sampling efforts but not identified to species. The habitats for these benthic macroinvertebrate species are common across their range. No risk to aquatic population viability of the sensitive species above will occur as a result of this project.

Forest concern species *Cryptobranchus alleganiensis, Clinostomus, sp. 1, Notropis lutipinnis, Percina caprodes, Ceraclea sp. 1, Helicopsyche paralimnella, Wormaldia thyria, Cordulegaster erronea, Gomphus parvidens parvidens, Ophiogomphus aspersus, Ophiogomphus mainensis, Sympetrum obtrusum, Barbaetis benfieldi, Megaleuctra williamsae,* and *Shipsa rotunda* may occur within the project area. No fish were found in the project area surveys however fish habitat does exist downstream of activities where these fish species may occur. The fish species are mobile organisms and will elude sedimented areas of the stream, however eggs and juveniles may be affected by the implementation of this project. No odonates (including *Cordulegaster erronea*, *Gomphus parvidens parvidens*, *Ophiogomphus* species and *Sympetrum obtrusum*) were found in the project area surveys. This project will not likely adversely affect any of the above species. 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.

MITIGATION MEASURES / MANAGEMENT RECOMMENDATIONS

No mitigation measures are recommended.

Wildlife Resources

OBJECTIVE: Wildlife Habitat Improvement

Issue: Wildlife Habitat Diversity

compartments, eastern wild turkey is an emphasis species, which increases the objective for grass-forb habitat to 3% of the project area, or 128 acres.

	0-10yrs.	10-20	20-40	40-80	80-100	100+	TOTAL
Yellow pine types	10	2	2	19	1		43%
White pine types	2	4	3	0	0	0	9%
Upland hardwood	1		<1	24	10	<1	36%
Cove hardwoods			1	10	<1		12%

acres are on good sites with a site index of 70 or above. Open road density is 0.23 miles per square mile.

SPECIES CONSIDERED AND SPECIES EVALUATED

Proposed, endangered, threatened, and sensitive (PETS) species considered in this analysis are those included in the National Forests in North Carolina PETS species list. All 27 PETS terrestrial animal species that might occur on the Nantahala National Forest were considered (see Attachment 1). This list includes species that have been proposed as additions to the Forest's sensitive species list and are under review by the Regional Forester. 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.

Management area 4A direction is to provide habitat conditions for black bear, eastern wild turkey, pileated woodpecker, golden-crowned kinglet, bats, white-breasted nuthatch, and gray squirrel. There is no suitable habitat in the project area for golden-crowned kinglets. Bats were not considered because the special habitat they represent, caves, are not present in the project area.

Table 2. Known and potential proposed, endangered and threatened species, sensitive species, forest concern species, and MIS evaluated for this project.

Species	Type	Habitat description	Likelihood of occurrence
Federally Proposed, Endangered and Threatened Species			
Indiana bat	mammal	roosts in caves and hollow trees	may occur
1996 Region 8 Regional Forester's Sensitive Species			
Diana fritillary butterfly	butterfly	deciduous and pine woodlands near streams	likely to occur
Glossy supercoil	snail	leaf litter on wooded hillsides and ravines	may occur
S. Appalachian salamander	amphibian	moist forests at all elevations	likely to occur
		Management Indicator Species	
White-breasted nuthatch	bird	open hardwoods, cavities; < 5000 feet	may occur
Pileated woodpecker	bird	deciduous forests, with large snags	may occur
Eastern wild turkey	bird	hard mast, soft mast, grass/forb	likely to occur
Black bear	mammal	hard mast, soft mast, dens	may occur
Gray squirrel	mammal	mature hardwoods, hard mast, cavities	likely to occur

ENVIRONMENTAL BASELINE FOR SPECIES EVALUATED

The area has a significant amount of early successional habitat and younger age classes. Species that benefit from this habitat include black bear, eastern wild turkey, white-tailed deer, and ruffed grouse, which find tender browse, fruit and hiding cover in dense young stands. This condition is partly the result of recent salvage activities following southern pine beetle damage. Half of this amount has been created within the last four years. Additional early successional habitat may benefit some species such as ruffed grouse, prairie warblers and other early successional associates. With no action in the project area, approximately 9% of the analysis area will be in early successional habitat. Standards in the Forest Land and Resource Management Plan (FLRMP) specify that no more than 10% of each compartment and MA 4A be in early successional habitat (0-10 years old) at any one time.

Populations of eastern wild turkey are limited by the availability of grass-forb habitat for young broods. Wild turkey is an emphasis species in this area. This habitat component occurs on less than 0.8% of the project area. An amount equal to 3% of the area, or 128 acres, would provide desirable conditions for wild turkey. At least 103 additional acres of grass- forb habitat should be created, preferably by thinning and burning some gentle slopes.

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 will benefit wildlife. The hard mast capability model provides a numerical description of the project area incorporating both age-class and forest-type diversity. Stands of mature upland hardwoods receive the highest rating. Mixed stands of oak/pine or pine/oak rate somewhat lower, followed by cove hardwoods, white pine, then yellow pine. This area rates below the desired condition of 150 lbs per acre due to the number of acres of pure shortleaf pine. Special efforts should be made to regenerate and/or retain hard mast producing trees in project areas such as this.

Although upland hardwoods comprise a majority of the older age classes (47% versus 39% pine types), only 46 acres of upland hardwoods and no cove hardwoods have been regenerated within the last 20 years. It is possible that gypsy moth may affect the area in the future. Healthy trees are more likely to withstand attacks by this pest. Stand improvement thinnings of mature upland hardwoods would increase the vigor of the remaining trees and make them less susceptible to the effects of gypsy moth. Regenerating these stands to a young, vigorous condition would also reduce the threat of gypsy moth. Regeneration of a variety of hard mast producing species should be the focus of timber management activities in this area to prevent a decline in hard mast production.

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 0.25 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 higher levels of disturbance, greater hunting pressure, and enforcement of hunting regulations is more difficult. At 0.23 miles per square mile, the desired condition for 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 may prevent any new trees from becoming established. The desired condition is to provide high quality riparian areas by reducing rhododendron coverage where necessary and establishing young hardwood trees.

Habitat capability for wildlife is maximized when habitat objectives for all management indicator species are met across the planning area.

EVALUATED SPECIES SURVEY INFORMATION

Previous Survey Information – None

New Surveys or Inventories Conducted –

The impacted areas were surveyed for the presence of special habitats (such as bog turtle habitat, boulderfields, caves or mines) that could be adversely affected by project activities. None were located. The terrestrial snail fauna was sampled in each area proposed for regeneration harvesting to determine the possible occurrence of rare molluscs. These sites were surveyed because canopy removal may adversely affect the habitat of these species. No sensitive species were collected.

Species For Which Inventories Not Conducted and Justification -

Inventories were not conducted for the Indiana bat (Myotis sodalis). 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.

Inventories were not conducted for the Diana fritillary butterfly (Speyeria diana) or the southern Appalachian salamander (Plethodon teyahalee). The Diana fritillary butterfly 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. Although no specific surveys have been conducted, the frequency with which this species has been encountered indicates that it is much more abundant than previously thought. It can be assumed that this species is likely to occur in the project area and that individuals may be adversely affected by project activities. Since the species utilizes nectar plants found in openings, it is possible that ground disturbance will improve habitat for this species. 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 southern Appalachian salamander 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.

EFFECTS OF PROPOSED MANAGEMENT ACTION

ISSUE – Proposed, Endangered, Threatened, Sensitive, Forest Concern and MIS species:

Direct effects:

Road-building, harvesting and prescribed burns proposed in all of 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. While large and more mobile animals may escape harm; insects, arachnids, molluscs, amphibians, reptiles and bird nests are likely to be affected.

Indirect effects:

Proposed, Endangered and Threatened Species

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. Previously, North Carolina was not considered likely to provide either significant wintering habitat or maternal roosting habitat. 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.

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.

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 will be implemented when the stand is marked for sale.

Calculation of the habitat suitability index resulted in a 1.53% change from the baseline.

Based on the very 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 will 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 small amount of harvesting, the area will 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 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. Consultation with the U.S. Fish and Wildlife Service **is required**.

Sensitive Species

Three sensitive species could possibly occur in the project area. Stands of possible PETS species habitat were surveyed in March and May of 1997 and in May of 2001. 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 I - No Action

This alternative will have no impact on any PETS species.

Alternatives III, IV, And V

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

The Diana fritillary butterfly is often found feeding on plants such as joe-pye-weed, ironweed, and butterflyweed along roadsides through mature forest, particularly coves. This project is not likely to adversely affect its habitat. With any alternative, less than 15% of the project area would be in early successional habitat (0-10 years) at any time. Nearly 75% of the area would be older than 40 years. Opening of the canopy in regeneration units and ground disturbance along roadsides would result in an increase in nectar plants, which seed into disturbed areas. The net result may be an increase in suitable habitat. This project may result in beneficial impacts to this species.

The Appalachian salamander may also occur in project activity areas. The effect from prescribed burning is short-term. The effect from regeneration harvesting is more impacting because of the openings in the canopy, but this will occur in only in a small part of the project area. Much suitable habitat will remain. Habitat may be temporarily decreased where ground litter is disturbed and/or insolation increases from removal of canopy trees. Project activities will 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.

Management Indicator Species

Direction for MA 4A is to provide some suitable habitat for forest interior dependant species. The three action alternatives will create a small amount of additional early successional habitat. Better quality forest interior habitat would be provided in the Forest Interior Breeding Bird Habitat Areas distributed across the Forest.

The current open road density in the project area is 0.23 miles per square mile. This density meets habitat objectives for black bear of less than 0.25 miles per square mile. Open road density will not change in any alternative.

The 5% per compartment of designated old growth is meant to provide denning sites for black bear. Most of the designated acres are in oak types, which should provide potential den trees. Bike trails pass through or along most of these areas, which may prevent use of the trees by black bears, which require freedom from disturbance for denning.

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

Indirect Effects Common to all Action Alternatives

The new regeneration areas, woodlands, thinnings, and prescribed burns created by this proposal will result in a significant amount of disturbance across the landscape. Over 1500 acres would be affected by all project activities over the next five years. Common animals will readily recover in areas disturbed by thinnings and prescribed burns.

White-breasted nuthatches are associated with open deciduous forests, decaying woodlands, forest edges, and park-like habitats. This species is associated with mature forests and would be adversely affected by activities that remove the overstory, thereby making the habitat unsuitable. The main effect of the action alternatives on white-breasted nuthatch is due to the loss of large mature trees and dead and decaying trees, and increase in open woodlands and park-like habitats through thinning and prescribed burning. Effects of the alternatives on white-breasted nuthatches were estimated according to the change in mature deciduous stands (see Table 3a).

Across the Forest, habitat for this species has increased in recent years with the decreasing amount of regeneration activities. Young stands that were regenerated several years ago have matured into suitable habitat. Currently, there are approximately 689,000 acres of suitable habitat on the Forest. Ten years ago, there were about 672,000 acres. Long-term Breeding Bird Survey data from the past thirty-five years indicate a significant increase of 1.9% across the U.S. for the nuthatch. Trends for North Carolina were positive, but not statistically significant. White-breasted nuthatch was detected on all 10 BBS routes that include some parts of the Nantahala and Pisgah National Forests. Based on these survey routes, nuthatch populations appear variable.

Pileated woodpeckers are associated with dense, old forests with large trees and secondary growth consisting of a mix of hardwood and coniferous trees. This species is associated with mature forests and would be adversely affected by activities that remove the overstory, thereby making the habitat unsuitable. The main effect of the action alternatives on pileated woodpeckers is due to the loss

of large, mature trees and dead and decaying trees. Effects of the alternatives on pileated woodpeckers were estimated according to the change in mature deciduous or mixed oak/pine or pine/oak stands (see Table 3a).

Across the Forest, habitat for this species has increased in recent years with the decreasing amount of regeneration activities. Young stands that were regenerated several years ago have matured into suitable habitat. Currently, there are approximately 722,000 acres of suitable habitat on the Forest. Ten years ago, there were about 705,000 acres. Long-term Breeding Bird Survey data from the past thirty-five years indicate that the pileated woodpecker is doing well. BBS data indicate significant population increases of +0.98% for the period 1966-1998 for the entire USA. For that same time period, a significant upward trend of +1.8% was also evident in North Carolina. The pileated woodpecker was detected on all 10 BBS routes that include some parts of the Nantahala and Pisgah National Forests.

Eastern wild turkeys require large areas moderately free from the disturbance of motorized vehicles and intensive timber harvesting. This area is already subject to large amounts of disturbance due to heavy recreational use. 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 will be provided by the action alternatives, except for a short term effect on hard mast capability. Some early successional habitat and grass/forb brood habitat that is created along bike trails may not be utilized due to disturbance.

This species utilizes a variety of habitat types and benefits from a diverse forest landscape. The creation of new regeneration areas and the pine-oak woodlands will 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.

Effects of the alternatives on wild turkey habitat were estimated according to the availability of four habitat components; grass-forb habitat, 4-10 year old regeneration, hard mast availability from the Stone and Brodie (1986) habitat capability model for black bears, and the open road density (see Table 3a). Grass-forb habitat and regeneration are treated as somewhat compensatory, with grass-forb habitat considered as greater in importance. The grass-forb/regeneration component is rated twice as important as hard mast availibility, and the open road density is rated half as important. An index was calculated separately for the northern section (Compartments 154 and 155) and the southern section of the project area, projecting the conditions that would be present five years after project implementation. In general, an index of greater than 0.6 would represent good habitat, a rating of 0.4 to 0.6 would represent fair habitat, and a rating of less than 0.4 would indicate poor habitat.

Across the Forest, wild turkey populations have also increased due to factors other than habitat management. . Record harvests have been reported for the last four consecutive years, both statewide and in the Western Region. In the Western Region, the 2000 reported spring gobbler harvest of 3,137 birds represents a 29% increase over the 1999 reported spring gobbler harvest of 2,428 birds. 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 will increasingly constrain population levels.

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 will increase as the amount of area in regeneration increases, resulting in greater rates of mortality. This area is already subject to large amounts of disturbance due to the heavy recreational use. The main effect of these alternatives on black bear habitat would be the increase in bike trails, resulting in more human disturbance in that area. If black bears utilize the designated old growth areas for denning, they may be disturbed by bike trails passing too close to suitable den trees.

This species utilizes a variety of habitat types and benefits from a diverse forest landscape. The creation of new regeneration areas and the pine-oak woodlands will 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.

Effects of the alternatives on black bear habitat were estimated using a habitat capability model for black bears in the southern Appalachian Mountains (Stone and Brody, 1986). Components of the model include estimates of summer food availability, fall food availability, suitable den sites and open road density (see Table 3a). The food components are based on forest types and age classes present in the analysis area, projecting the conditions that would be present five years after project implementation. The fall food availability (hard mast capability) is rated twice as important as summer food in calculating a total food component. The denning

component is based on the number of trees greater than 36" present, with more than 13 trees per square mile being optimal. In the absense of a complete inventory, it was assumed that there are few trees of this size in this project area. The minimum value for this component 0.5 was used. The low open road density of 0.23 miles per square mile results in a maximum value of 1.0 for this component. The final index is a value between 0 and 1 representing the minimum of the food, road density and denning habitat components.

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. Mountain population models, based on age structure and reproductive information collected by NCWRC personnel, indicate that populations have grown considerably over the last decade. Models are most accurate at predicting populations up to 2-3 years prior to the last year for which we have age and reproductive data. Therefore, we can be confident in a population increase experienced from 1980-1996. These models indicate the system of regulations, enforcement, and sanctuaries in place in the region should be effective in protecting females and in maintaining a viable mountain population despite increasing harvests.

Gray squirrels require mature hardwood forests, with abundant ground cover and dense canopy. This species is associated with mature forests and would be adversely affected by activities that remove the overstory, thereby making the habitat unsuitable. The species relies heavily on hard mast, primarily oak and hickory, and uses fallen trees found in mature and overmature forests. Tree cavities found in these mature forests are important for denning and for ground cover. The main effect of the action alternatives on gray squirrels is due to the potential effect on hard mast production and the loss of large, mature trees and dead and decaying trees. Effects of the alternatives on gray squirrels were estimated according to the change in mature deciduous or mixed oak/pine stands (see Table 3a).

Across the Forest, habitat for this species has stayed about the same in recent years, even with the decreasing amount of regeneration activities. Young stands that were regenerated several years ago have matured into suitable habitat, but about an equal number have been regenerated. Currently, there are approximately 723,000 acres of suitable habitat on the Forest.

Table 3a. Summary of indirect effects of each alternative on the evaluated proposed, endangered and threatened species, sensitive species, forest concern species, and MIS.

Species	*0Alternative 1*	*1Alternative III*	*2Alternative IV*	*3Alternative V*
Federally Proposed, Endangered and Threatened Species				
Indiana bat	no effect	insignificant	insignificant	insignificant
1996 Region 8 Regional Forester's Sensitive Species				
Diana fritillary butterfly	no impacts	beneficial	beneficial	beneficial
Glossy supercoil	no impacts	no impacts	no impacts	no impacts
S. Appalachian salamander	no impacts	- 145 acres	- 162 acres	- 162 acres
Management Indicator Species				
White-breasted nuthatch	no change	- 28 acres	- 28 acres	no change
Pileated woodpecker	no change	- 101 acres	- 118 acres	- 116 acres
Eastern wild turkey - grass/forb	2.1%	2.1%	6.9%	7.0%
(northern section) - regeneration	0%	4.8%	0%	4.1%
- hard mast	0.51	0.50	0.50	0.48
- open road den	0	0	0	0
- index	0.36	0.43	0.51	0.56
- rating	poor	fair	fair	fair

Eastern wild turkey - grass/forb	2.3%	2.3%	4.0%	2.3%
(southern section) - regeneration	0%	4.0%	3.2%	3.1%
- hard mast	0.54	0.52	0.52	0.52
- open road den	0.61	0.61	0.61	0.61
- index	0.36	0.41	0.46	0.40
- rating	poor	fair	fair	fair
Black bear - soft mast	0.42	0.42	0.42	0.42
- hard mast	0.53	0.51	0.51	0.50
- denning	0.50	0.50	0.50	0.50
- open road den	0.23	0.23	0.23	0.23
- index	0.49	0.48	0.48	0.47
Gray squirrel	no change	- 46 acres	- 104 acres	- 136 acres

ISSUE – Habitat Diversity

Alternative I - No Action

This will result in the maintenance of early successional habitat in the project area over the short term. Two hundred forty-one acres have been regenerated within the last five years. By the year 2001, there will still be 383 acres (9%) of this habitat component in the project area. Southern pine beetle damage may result in salvage activities that create additional early successional habitat. If no salvage activities occur, there will be 6% in early successional habitat remaining by the year 2004. Grass-forb habitat will remain at current levels. In ten years, stands aged greater than 90 years will increase to 21% of the project area. Most of these acres are in shortleaf pine/oak and white oak/black oak/yellow pine stands. There will be 191 acres aged at greater than 100 years. The 111 acres of shortleaf pine/oak will have reached the rotation age appropriate to this management area of 100 years for yellow pine. The other 80 acres will not have reached the rotation age of 120 acres for hardwoods.

Hard mast production would be expected to increase as some younger trees begin mast production and older trees increase in size. Other factors being equal, trees of larger diameter produce more acorns than trees of smaller diameter (NCFES Technical Brief, March 1994). Peak production in northern red oak is at about 20 inches dbh, while white oak peaks at about 26 inches dbh. These species show a decline in mast production after this point, other species (such as chestnut oak and scarlet oak) do not. Hard mast production in this area is dominated by white oaks between fifty and ninety years of age. While red oaks may decline in the near future, white oaks are long-lived species that could be expected to increase in mast production with time. The coefficients used in the calculation of hard mast production do not account for declines due to age or oak decline.

Alternative III

The regeneration areas will be created in 2001, 2002, and 2003. Most of the acres cut would be hard mast producing stands, including 55 acres of shortleaf pine/oak and 18 acres of white oak/black oak/yellow pine. Twenty-eight acres of hardwoods will be regenerated in compartment 153. The leave basal areas in the regeneration areas will be 20-30 square feet per acre. Depending on marking guidelines, some mast would be provided by leave trees in the 2-age regeneration units. Mast production would be reduced to 106 lbs/acre. This effect can be mitigated by emphasizing the retention of healthy oaks of different species and hickories.

The prescription for the thinnings is to remove trees that exhibit poor crown condition, insect/storm damage, and hold co-dominant or intermediate positions in the canopy. Since the retention of oaks is emphasized in the marking guidelines, this may result in an increase in mast production by increasing the health, vigor and growth rate of the remaining trees.

While the oak component may be reduced in some units, the primary effect on hard mast production will be determined by how well oaks are favored in the 244 acres of thinnings. The chemical preharvest treatment will enhance the future oak component. With the development of a younger and more vigorous hardwood component, hard mast production should increase over time.

This alternative would have more regeneration than the other two alternatives (see below) and less chemical preharvest site preparation. Prescribed burning for wildlife habitat improvement would be slightly more than in Alternative 4 and much less than in Alternative 5. There would be no pine-oak woodlands to benefit eastern wild turkey. There would be slightly less adverse effect on hard mast production, since fewer acres dominated by oak and more acres dominated by pine would be regenerated.

The effects would be similar to that described for Alternative 5, except there would be no pine-oak woodlands and much less chemical preharvest treatment to enhance the future oak component.

Alternative IV

The regeneration areas will be created in 2001 and 2002. Most of the acres cut would be hard mast producing stands, including 30 acres of shortleaf pine/oak and 18 acres of white oak/black oak/yellow pine. No hardwood types will be regenerated. The 103 acres of pine-oak woodland will be created in stands of white oak/black oak/yellow pine, shortleaf pine and cove hardwoods. The leave basal areas in the woodlands will be 40-60 square feet per acre, and the leave basal areas in the regeneration areas will be 20-30 square feet per acre. Depending on marking guidelines, some mast would be provided by leave trees in the 2-age regeneration units and more in the woodlands. Mast production would be reduced to 107 lbs/acre. This effect will be mitigated by emphasizing the retention of healthy oaks of different species and hickories. Only the largest trees are likely to withstand the repeated burning prescribed for the woodlands. For that reason, they should be retained.

The prescription for the thinnings is to remove trees that exhibit poor crown condition, insect/storm damage, and hold co-dominant or intermediate positions in the canopy. Since the retention of oaks is emphasized in the marking guidelines, this may result in an increase in mast production by increasing the health, vigor and growth rate of the remaining trees.

While the oak component may be reduced in some units, the primary effect on hard mast production will be determined by how well oaks are favored in the 334 acres of thinnings. The chemical preharvest treatment will enhance the future oak component. With the development of a younger and more vigorous hardwood component, hard mast production should increase over time.

One hundred three acres of grass-forb habitat will be created in the pine-oak woodlands through frequent burning. This would result in 3% of the area in grass-forb habitat, which would meet habitat objectives for eastern wild turkey. Bike trails skirt the edges of some of these areas, partially impacting their value as bugging areas for wild turkey broods. The disturbance effect would not be as great on animals such as bear, adult turkey and deer, which may utilize these areas for diurnal grazing.

This alternative would have less regeneration than the other two alternatives (see below) and less prescribed burning for wildlife habitat improvement. Chemical preharvest site preparation would be conducted on more acres than Alternative 3 and less acres than Alternative 5. There would be more pine-oak woodlands than in Alternative 5 to benefit eastern wild turkey and they would be well dispersed across the project area. There would be less adverse effect on hard mast production, since fewer acres dominated by oak and more acres dominated by pine and cove hardwoods would be regenerated or put into pine-oak woodland.

The effects would be similar to that described for Alternative 5, except there would be more pine-oak woodlands, but less chemical preharvest treatment to enhance the future oak component.

Alternative V

The regeneration areas will be created in 2001, 2004, and 2005. Most of the acres cut would be hard mast producing stands, including 53 acres of shortleaf pine/oak and 43 acres of white oak/black oak/yellow pine. No hardwood types will be regenerated. The 73 acres of pine-oak woodland will also be created in stands of white oak/black oak/yellow pine. The leave basal areas in the woodlands will be 40-60 square feet per acre, and the leave basal areas in the regeneration areas will be 20-30 square feet per acre. Depending on marking guidelines, some mast would be provided by leave trees in the 2-age regeneration units and more in the woodlands. Mast production would be reduced to 105 lbs/acre. This effect will be mitigated by emphasizing the retention of healthy oaks of different species and hickories. Only the largest trees are likely to withstand the repeated burning prescribed for the woodlands. For that reason, they should be retained.

The prescription for the thinnings is to remove trees that exhibit poor crown condition, insect/storm damage, and hold co-dominant or intermediate positions in the canopy. Since the retention of oaks is emphasized in the marking guidelines, this may result in an increase in mast production by increasing the health, vigor and growth rate of the remaining trees.

While the oak component may be reduced in some units, the primory effect on hard mast production will be determined by how well oaks are favored in the 363 acres of thinnings. The chemical preharvest treatment will enhance the future oak component. With the development of a younger and more vigorous hardwood component, hard mast production should increase over time.

Seventy-three acres of grass-forb habitat will be created in the pine-oak woodlands through frequent burning. This would result in 2.3% of the area in grass-forb habitat, which would almost meet habitat objectives for eastern wild turkey. Bike trails skirt the edges of these areas, partially impacting their value as bugging areas for wild turkey broods. The disturbance effect would not be as great on animals such as bear, adult turkey and deer, which may utilize these areas for diurnal grazing.

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. This includes the effect of the recent salvage activities on the current age-class distribution. There are no other timber sales presently occurring in the analysis area. 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.

The Lemmons Branch boat ramp is a project currently under construction in the project area. This will result in 1.4 miles of new road construction and increase the existing open road density to 0.47 miles per square mile. The existing wildlife openings that will be impacted by this project are scheduled to be replaced by equivalent habitat.

Table 3b. Effects of the alternatives by issue.

Species	*Alternative 1*	*Alternative III*	*Alternative IV*	*Alternative V*
Federally listed species	no effect	not likely to adversely	not likely to adversely	not likely to adversely
Sensitive species	no impacts	may impact individuals*	may impact individuals	may impact individuals
MIS	various	various	various	various
Habitat diversity	adverse	beneficial	beneficial	beneficial

*may impact individuals but not likely to cause a trend to federal listing or a loss of viability

VI. CONSULTATION HISTORY (if any)

The U.S. Fish and Wildlife Service has concurred with the determination that this project is not likely to adversely affect the Indiana bat (see letter dated October 23, 2000).

VII. DETERMINATION OF EFFECT

Table 4. Determination of effect of each alternative on the evaluated proposed, endangered and threatened species, and sensitive species.

Species	*Alternative 1*	*Alternative III*	*Alternative IV*	*Alternative V*
Federally Proposed, Endangered and Threatened Species				
Indiana bat	no effect	not likely to adversely affect	not likely to adversely affect	not likely to adversely affect
1996 Region 8 Regional Forester's Sensitive Species				
Diana fritillary butterfly	no impacts	may impact individuals*	may impact individuals	may impact individuals
Glossy supercoil	no impacts	no impacts	no impacts	no impacts
S. Appalachian salamander	no impacts	may impact individuals	may impact individuals	may impact individuals

*may impact individuals but not likely to cause a trend to federal listing or a loss of viability

This project will have no effect on any federally proposed or listed terrestrial animal species. The project may impact individuals of the Diana fritillary butterfly (*Speyeria diana)* and the 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.

Botanical Resources

Issue: Effects on Proposed, Endangered, Threatened, or Sensitive plant species and Other Vegetation

PETS and Forest Concern Species Considered

There are 409 PETS and forest concern plant species known to occur or suspected as occurring on the Nantahala and Pisgah National Forest. Many of these species have a clearly definable range within North Carolina. As a first filter from the larger list, a query of the Biological Conservation Database was made for Graham and Swain Counties. There are 102 currently tracked rare plant species known to occur within either Graham or Swain County (see attachment 1). These recent or historical occurrences are represented from both public and private land ownership. Two of these species are federally listed, 45 are regional sensitive species (with viability concerns throughout the region as determined by a global rank of G3 or T3 or lower or a national rank of N3 or lower) and 55 are forest concern species. These forest concern species are either at the periphery of their range here in North Carolina or disjunct from their main range.

All but 28 of these species were dropped from further consideration because there was no suitable habitat for those excluded species within the proposed activity area and the analysis area, which included the surrounding compartments (Attachment 1). A large number of these excluded species are associated with humid, rocky conditions typically found in grottoes and spray cliff communities in gorges, with high elevation grassy openings, with high elevation rocky summits, with other mid and high elevation forests, or with bogs; all of which are found in other portions of either Graham or Swain County. Some species with a well-known distribution in North Carolina, such as *Rugelia nudicaulis*, which is only known within the Great Smoky Mountain National Park, were excluded from any further consideration as occurring within the proposed project area.

This second filtered list was derived only after conducting field analysis within the five compartments. It also incorporates range data of rare plant species known to occur within adjacent areas to the Tsali compartments. Three sensitive and two forest concern species have been found nearby, within 1 to 2 aerial miles, the analysis area. The three sensitive species are butternut (*Juglans cinera*), Blue Ridge bindweed (*Calystegia catesbiana var. sericata*), and southern nodding Trillium (*Trillium rugelii*). The forest concern plant species are goldenseal (*Hydrastis canadensis*) and Huger's carrion-flower (*Smilax hugeri*).

Based on field surveys, no proposed, endangered or threatened plant species were located. One sensitive plant species, *Megaceros aenigmaticus*, was located on the boundary of one of the proposed activity areas. One forest concern plant species, Earle's blazing star (*Liatris squarrulosa*) was located within the proposed activity area.

Table 1. Known and potential threatened and endangered plant species, sensitive plant species, and forest concern plant species evaluated for the Tsali project.

	Species	Type	Brief Habitat Description	Occurrence
1996 Region 8 Regional Forester's Sensitive Species List				
	Megaceros aenigmaticus	Hornwort	on bedrock in streams	known to occur in the activity area
Forest Concern Species				
	Liatris squarrulosa (Earle's blazing star)	Herb	open woods primarily in soils derived from mafic rock	known to occur in the activity area

EVALUATED SPECIES SURVEY INFORMATION

Previous botanical surveys have been undertaken in a small portion of the analysis area in 1994 while analyzing pine beetle spot salvage areas. These surveys were primarily in compartments 154 and 155. An additional survey was completed in late winter and early spring of 1995 for redesigned bike trails in compartment 153 and 155.

Surveys for suitable habitat for PETS and Forest concern plant species suspected of being within the Tsali forest health project activity areas were conducted in the summer and fall of 1997, and during different times of the growing season of 1998. Gary Kauffman, Nantahala NF botanist and George Hernandez, former Nantahala NF ecologist surveyed the area, concentrating in the proposed activity areas. Field survey methodology consisted of a timed meander with intensity increased in the most diverse areas and conducted until no new species or microhabitat was detected (Goff, Dawson & Rochow 1982).

EFFECTS OF PROPOSED MANAGEMENT ACTION

Sensitive Plant Species Effects

Megaceros aenigmaticus

Megaceros aenigmaticus is a large dark green thalloid hornwort with erose margins (Hicks 1992, Schuster 1992). It 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, NC and south to Pounding Mill Creek near Shooting Creek, NC. Based on recent survey work across this area, 30-35 populations, depending on definition and extent of the population, are known to occur in the Nantahala National Forest (Marie Hicks & Jame Amoroso 1997, personal observations). Large populations of this species occur in the waters of the Joyce Kilmer/Slickrock Wilderness and in the waters of Santeetlah Creek, which is the center of distribution for this species. This species has also been found to be quite common in the streams draining into Nantahala Lake. The global rank for this hornwort is G2G3. It is ranked as an S2S3 species within the state of North Carolina, and as a S1S2 species within Tennessee (Natureserve 2001, Amoroso 1999).

This hornwort prefers shaded rocks and boulders in small streams with a water depth of 1-2 inches that are infrequently flooded and have low sediment loads. *Megaceros aenigmaticus* is believed to prefer cool non-turbid waters (Natureserve 2001). Two primary threats appear to create risk for this species. Increased sediment load and water flow, as a result of disturbance within the watershed upstream of the occurrence, either dislodges or buries the plants, smothering them under dirt and debris. Some small stream tributaries in watersheds where *Megaceros aenigmaticus* was located did not have any individuals even though nearby similar size streams had thriving populations (Marie Hicks & Jame Amoroso 1997). Also, canopy removal would increase light at the microsite and could potentially change the humidity levels surrounding the population to the point that this liverwort could no longer exist at that particular location.

Alternative 1

This no-action alternative would have no activities that could potentially impact the small *Megaceros aenigmaticus* population found in a tributary to Lemmons Branch. *Megaceros aenigmaticus* was only located in this east-flowing tributary in the Tsali area. The population should remain the same size as at present.

Alternatives 3 & 4

These action alternatives will have the same effect on the *Megaceros aenigmaticus* population as the no-action alternative. There is no proposed road construction or reconstruction across the tributary where this species was seen. There is no planned prescribed fire adjacent to the stream with the hornwort population. Thus there will be no direct or indirect affect to this species from the Tsali Forest Health proposal for these 2 alternatives. Given the small amount of suitable habitat for this species within the stream reach where it occurs, this population probably will remain close to the same size as it presently is.

Alternative 5

This alternative does not propose any timber activities with associated roading that could potentially affect the population of *Megaceros aenigmaticus* in the Lemmons Branch tributary. However it does propose a prescribed burn on the south-facing slopes of the tributary. The tributary will serve as a fire break for the prescribed burn.

The species will not be directly affected by the proposed fire since there will be only be fireline construction next to the stream where it starts. This location is relatively gentle and should not result in sedimentation into the stream. *Megaceros aenigmaticus* could be indirectly affected with a change in the surrounding tree or shrub canopy. However this is highly unlikely since this portion of the landscape is more protected with higher relative humidities, which should result in a less intense fire. The prescription for the burn is designed for the mixed pine-oak community on the surrounding ridge. Typically a fire will be designed to back down to the natural firebreak along the stream. Thus there should be a low intensity fire by the time it gets to the stream. This should result in no affect to the midstory and canopy trees surrounding the stream.

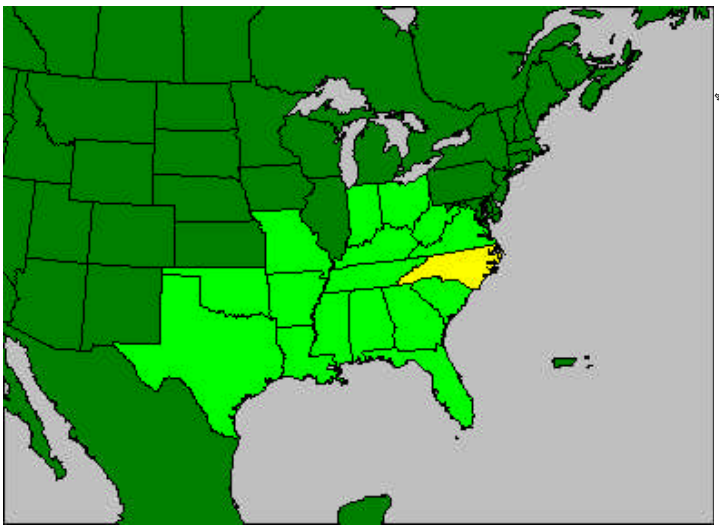
For *Megaceros aenigmaticus*, there are seven other timber sales with associated roading, which may impact a portion of the populations seen if severe sedimentation results. These other timber sales occur within the Wayah Ranger District and the Cheoah Ranger District. An upcoming timber project, the Upper Fontana project, located just east of the Tsali area, will not affect this

hornwort. It was not located there. Three additional projects, a horse trail, two road improvements, and a road easement across USFS land may impact four other populations. These populations are located on the Wayah, Tusquitee and Cheoah Ranger Districts. And another population may no longer be in federal ownership if the Thrash exchange is implemented as presently proposed. None of the six timber sales and the four other road and trail projects that could potentially affect *Megaceros aenigmaticus* occurs within the Tsali area. None of these projects are anticipated to result in the loss of this species from the immediate areas provided proper installation of erosion control measures is implemented. Twenty to twenty-five other populations occur on federal land across the range of this species within North Carolina with no known or anticipated impact from any upcoming project.

Forest Concern Plant Species Effects

Liatris squarrulosa

Liatris squarrulosa, Earle's blazing star, is a member of the aster family that is distinguished by larger flowering heads, with a barbed pappus, squarrose bracts and consisting of 14-25 individual flowers (Cronquist 1980). This species is distributed (see figure 1a & 1b) from southern Ohio and western Virginia south to coastal South Carolina and northern Florida, west to southern Missouri, Arkansas, and Louisiana (Cronquist 1980, Gleason & Cronquist 1991, Strasbaugh & Core 1978). It is infrequently encountered in Tennessee and South Carolina in the southern Appalachians (Wofford 1989). It has been recorded from 11 counties in North Carolina, ranging from the Sandhills to the Mountains, although primarily is known within the Piedmont (Amoroso, 1997). It is primarily known from the Piedmont of Tennessee and South Carolina also (USDA, NRCS 2001). This is the only known occurrence in the National Forests in North Carolina, and represents one of two recent sighting in the mountains. Typically it is found in xeric open woods or diabase glades (Amoroso 1997, Gleason & Cronquist 1991). This species is believed to be associated with mafic-rock influenced soils. The global rank for this blazing star is G4G5. It is ranked as an S2 species within the state of North Carolina, and as a S1S2 species within Tennessee (Natureserve 2001, Amoroso 1999).



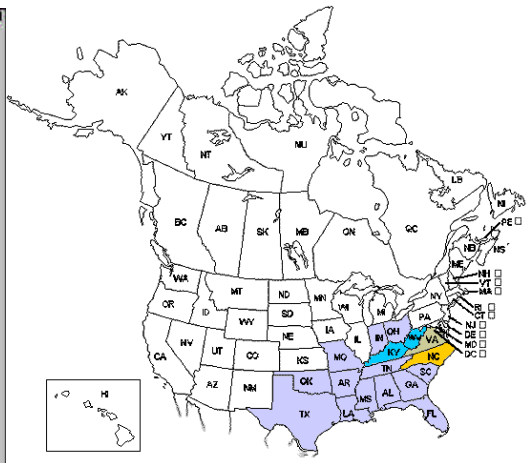


Figure 1a. *Liatris squarrulosa* range map (yellow highlight denotes formally tracked by the state, light green denotes presence in the state). Kartesz 1999. Figure 1b. *Liatris squarrulosa* state range map by S rank (orange is S2 —imperiled, light blue is SR—reported, dark blue is S? —unranked). Natureserve 2001.

Alternative 1

With the no-action alternative, there will be no prescribed burns adjacent to the Earle's blazing star population. *Liatris* species require open or partially open conditions to bloom. They typically are associated with glades, rock outcrops, bogs or prairies throughout the east or southeast. A thorough search of the surrounding forest did not yield any more individuals of this species. It was only seen in one spot in the project area. The present population should remain where it is with standard maintenance. It is doubtful that the population will have any potential for expansion with the no-action alternative.

Alternative 3,4 & 5
Each of these action alternatives is proposing a prescribed burn within the older adjacent forested area by the *Liatris squarrulosa* population. The existing trail to this population should serve as an adequate fireline break. However, one measure should be taken to ensure no adverse effects if there is any need to expand the fireline construction beyond the existing trail:

1) Prior to any burn the blazing star population should be clearly delineated by the Nantahala National Forest Botanist to avoid any fireline construction in addition to the existing bike trial near it.

With proper delineation of the small site and avoidance of the population, there should be no direct effect to this *Liatris squarrulosa* population from the fireline construction. This may not be the case with the fire depending on the timing of the burn. The fire could top-kill either emerging or growing vegetation. The negative direct effect that might result will be short term and should not result in the death of any individuals. Many *Liatris* species are adapted to fire maintained open woodlands or grasslands. The thick perenneating corm below the litter layer should allow for resprouting of individuals following the fire. Herbaceous species that do not have reproductive organs in the litter layer should resprout following a fire (Flinn & Wein 1977). Additionally, if this burn is implemented early enough in the season, those individuals of this late –blooming species will be dormant and will not be affected by the burn.

The proposed burn adjacent to the *Liatris squarrulosa* site may improve habitat for this species if it removes some of the midstory canopy in a nearby older forest and if it creates canopy gaps in adjacent young forest. However, this burn may not be effective enough to improve and open habitat. If the Tsali area was a formerly frequently burned landscape, varying fire intensities occurred across the landscape. Higher intensity fires on the ridgetops and upper slopes would have created more open forested sites. It is probable within these sites that *Liatris squarrulosa* persisted. Given its feathery pappus attached to their lightweight achenes, it may be that this species was dispersed across the landscape to more open recently burned ridgetops. Certain associated species were located with the *Liatris squarrulosa* population. The increased burning in other locations across the Tsali area with all action alternatives may improve habitat for this species provided seed is either already present within the seed bank or is able to migrate to the area. The assemblage of associated species at the *Liatris squarrulosa* site were also seen near Murphy Gap and on the ridges above Meadow Branch. These would be high priority areas to check for this species following some fire management. These may be appropriate sites for reintroducing this species with seed collected from the project area site. Monitoring of this population should be initiated prior to and following the prescribed burn management.

There are no other *Liatris squarrulosa* populations known on the Nantahala or Pisgah National Forests. Thus there will be no cumulative effects to this species from the proposed prescribed burn associated with the Tsali project.

Plant Management Indicator Species Effects

The following discussion refers to the effect to the biological communities from the proposed alternatives. The plant MIS species were selected to represent these communities and can be analyzed by tracking the effects to each respective community. A listing of the respective plant MIS species for each community is listed in Volume 1 of the environmental impact statement Land and Resource Management Plan for the Nantahala and Pisgah National Forests on pages III-48 to III-52.

COVE FORESTS

Cove forests include both rich cove and acidic cove forests. Both community types occur in portions of the proposed activity areas.

Acidic Cove Forest Community

Within the Tsali area (5 compartments) there are about 260 acres of acidic cove forest. None of the action alternatives are proposing any timber project within this habitat. Each action alternative is proposing prescribed burns across some acidic cove forest. Alternative 3 proposes prescribed fire across 309 acres, alternative 4 across 241 acres, and alternative 5 across 869 acres. Alternative 5 will potentially impact more acidic cove forest than either alternative 3 or 4. However, these acidic cove communities, all typically surrounding the riparian zone, should not be impacted since the high relative humidity and the constantly damp Rhododendron leaf litter underneath the dense *Rhododendron maximum* thicket present will typically prohibit any fire activity. Typically these communities act as firebreaks.

Rich Cove Forest Community

Within the Tsali area there are about 160 acres of rich cove forest. The action alternatives differ in the intensity of timber harvest activities. Alternative 3 proposes a 2-age shelterwood harvest across 28 acres. There is no timber harvest proposed in the rich cove forest for either alternative 4 or the preferred alternative, alternative 5. A preharvest oak treatment is proposed for each action alternative. These differ in the acres affected; alternative 3 is proposing the activity across 24 acres, alternative 4 across 54 acres and alternative 5 across 57 acres. A woodland for wildlife benefit is also proposed on 7 acres of rich cove forest for alternative 4. The

timber treatments in the two action alternatives is not expected to result in a change in community type of the rich cove forest, although it will result in a dramatic shift in species composition in the short term. It may result in greater abundance of fast growing tree species, such as tulip poplar. On the other hand, the woodland creation may result in a permanent shift in this community type given the frequent use of fire. The prescription for the woodland is to promote a mixed grass forb understory.

Each action alternative is proposing prescribed burns across some rich cove forest. These cove communities are included in the prescribed burns to prescribe some larger landscape burns. As such, the proposed fire across the rich cove acres is expected to be low intensity, primarily a leaf litter fire, given the higher humidities present within this community type. Alternate 5 is proposing burns across the greatest amount of acreage.

Cumulative Effect: About 420 rich and acidic cove acres are dispersed across the 5 compartments primarily restricted to protected east and north-facing slopes. Within the last 20 years, 16 acres of cove habitat have been harvested. This represents about 3% of the cove habitat present in this area of the forest. The forest average during the last 10 year period was to harvest slightly less than 2% of both rich and acidic cove forest. Only Alternative 3 proposes any harvesting in rich coves.

Oak & Oak-hickory Forest

Within the Tsali area, this broad grouping is composed of 3 separate plant communities, mesic oak-hickory forest, dry mesic oak-hickory forest, and chestnut oak/heath forest. The first two types occur in the portions of the action alternatives.

Mesic Oak-Hickory

There are about 200 acres of mesic oak-hickory forest within the Tsali area. The preferred alternative is proposing a 2-age shelterwood harvest across 10 acres of this community type while alternative 4 is proposing this action across 11 acres. The other action alternative is not proposing any harvest activities.
A woodland is being proposed across 10 acres of mesic oak-hickory habitat for alternative 4. The acreage affected by the proposed burn varies from the greatest amount with alternative 5, the least amount with alternative 4, and an intermediate amount in alternative 3. No other actions are proposed within this plant community type.

The proposed burning should result in an increase in natural regeneration of oak and hickories within this community type. This may not be the case with the proposed harvest units in alternatives 5 and 4. Oaks often regenerate poorly after timber harvest. The presence of vigorous advanced regeneration is essential for producing good stands of oaks after timber harvest (Clark et. al. 1971). There have been no specific projects completed in these 2-age units, either through preharvest oak regeneration or with prescribed fire, to ensure quality oak regeneration in place at the time of the harvest.

Cumulative Effect: Within the last 10 years about 50 acres of mesic oak-hickory forest were regenerated across the 5 compartments of the Tsali project area. During the same time period, approximately 7,300 acres of mesic oak-hickory forest were harvested. The harvest during the previous 10 years at Tsali represents about 25% of the total mesic oak-hickory forest while the forest percent is around 3% of the this type.

Dry Mesic-Oak Hickory

Between 25-29% of the analysis area consists of dry mesic oak-hickory forest. As analyzed here, this broad community type could have a significant co-dominant class of yellow pine, primarily shortleaf pine. Various activities are being proposed within this community type (see table). All three have 2-age shelterwood harvests proposed. They vary from 48 acres in alternative 4 to 33 acres in alternative 5 to 18 acres in alternative 3. All of these units will be artificially regenerated with a shortleaf planting. Thinnings are also proposed in this community type within each action alternative varying from a maximum of 30 acres in alternative 3 to 18 acres in alternative 5. The creation of a woodland for wildlife benefit is proposed within this community type in alternatives 5 and alternative 4. Ninety-three acres are proposed for treatment in alternative 5 and 28 acres are proposed in alternative 4. Preharvest oak treatments are proposed within each alternative varying from 25 and 26 acres in alternatives 4 and 3 respectively to 11 acres in alternative 5. As previously stated, the acreage affected by the proposed burn varies from the greatest amount with alternative 5, the least amount with alternative 4, and an intermediate amount in alternative 3.

The proposed burning and the preharvest oak treatments should result in an increase in natural regeneration of oak and hickories within this community type. This may not be the case with the proposed harvest units in alternatives 5 and 4. The prescription for the 2-age shelterwood harvest areas would remove those oak species that have poorly formed crowns and would be susceptible to oak decline while favoring any healthy oaks for the residual canopy. The current average amount of oaks within oak-pine types is 47% oak, which is represented by 27.5% white oak. The prescription will reduce the amount of oaks in these types of stands. The estimate of hard mast production for the Tsali area is reduced from the existing condition to 106 lbs. per acre with this action alternative. Ensuring the retention of healthy oaks, in particular white oak, the most dominant oak present within the Tsali area, can mitigate this effect.

In addition, all these stands are scheduled for shortleaf pine plantings. There will be less regeneration of oak species than currently present within these harvest units. Oaks often regenerate poorly after timber harvest. The presence of vigorous advanced regeneration is essential for producing good stands of oaks after timber harvest (Clark et. al. 1971, Seymour 1982). There have been no specific projects completed in these 2-age units, either through preharvest oak regeneration or with prescribed fire, to ensure quality white oak regeneration in place at the time of the harvest. Oak regeneration can be estimated based on a model developed by Dave Loftis (1992), USFS researcher at the Bent Creek Experimental Forest. The model relies on the competitive edge of those species with seedlings in the understory at least 4 and ½ feet in height or 1 and ½ inch girth at the time of the regeneration harvest. Within the regenerated oak-pine units after 10 years, the oak component is estimated at 22% with white oak representing 4% of the total.

Cumulative Effect: Within the last 10 years 23 acres of dry mesic oak hickory forest were regenerated, while at the same time about 450 acres of this community type were regenerated across the forest. The Tsali harvest represents slightly less than 2% of the total present there while the Forest average represents slightly more than 2% of the total dry-mesic oak-hickory forest.

Pine and Mixed Forests

Xeric yellow pine forests

Xeric yellow pine forest occurs typically on steep facing xeric slopes and uncommonly at lower elevations like the Tsali area. About 100 acres of pitch pine dominated forest (pine-oak/heath) occurs within the 5 compartments of the analysis area. A thinning harvest is proposed in two of the action alternatives. Action 5 proposes to thin 11 acres while alternative 4 proposes to thin 62 acres. All three action alternatives will have prescribed fire across this forest type. The proposed actions should not result in any change to this community type. The burning should help to maintain this fire dependent community.

During the past 10 years, none of the pitch pine dominated habitat has been harvested within the Tsali area. Across the Forest, less than 2% has been harvested during that same time period.

Yellow Pine low elevation community

As previously stated, southern mountain pine-oak forest (Schafale 2000), a low elevation variant of pine-oak/heath forest (Schafale and Weakley 1990), and low mountain pine forest (Schafale 2000) are the two dominant plant community types present in the analysis area. Both occur on the relatively broad flat ridgetops and on many of the side slopes. Shortleaf pine is the dominant pine within both of these communities. They can vary in the amount of oak within them.

Southern Mountain pine-oak forest

About 27% of the analysis area, or around 1025 acres, consists of this shortleaf pine-oak forest. Alternatives 3 and 5 have 2-age shelterwood harvests proposed within this community type. This harvest is proposed across 55 acres in alternative 3 and 53 acres in alternative 5. Both of these alternatives are proposing artificially regeneration with a shortleaf planting following the harvest Thinnings are also proposed in this community type within each action alternative varying little from 69 acres in alternative 3 to 62 acres in alternative 4. The creation of a woodland for wildlife benefit is proposed across 14 acres within this community type in alternative 4. Preharvest oak treatments are proposed for the preferred alternative across 46 acres of this type. The acreage affected by the proposed burn varies from the greatest amount with alternative 5, the least amount with alternative 4, and an intermediate amount in alternative 3.

As with the oak-pine communities, the proposed burning and the preharvest oak treatments should result in an increase in natural regeneration of oak and hickories within this community type. As discussed in the oak-pine communities, the amount of the oak component following the regeneration harvests probably will be less than the current percentages. In pine-oak types in the Tsali area, the existing oak component is 37%, with white oak representing close to 11%. The proposed prescription and the lack of any pretreatment, either by herbicide or fire, is anticipated to reduce the amount of oaks in these types of stands. Based on Loftis's model, there is anticipated to be a some reduction in the oak component to 31% following the regeneration harvest. The white oak component following harvest would be reduced to around 3%.

Southern Pine Forest

About 450 acres consists of shortleaf pine forest within the Tsali area. Alternatives 3 and 5 have 2-age shelterwood harvests proposed within this community type. This harvest is proposed across 44 acres in alternative 3 and 21 acres in alternative 5. Both of these alternatives are proposing artificially regeneration with a shortleaf planting following the harvest Thinnings are also proposed in this community type within each action alternative varying from 130 acres in alternative 3 to 201 acres in alternative 5. The acreage affected by the proposed burn varies from the greatest amount with alternative 5, the least amount with alternative 4, and an intermediate amount in alternative 3. The proposed actions should not result in any change to this low elevation community type. The prescribed burning should help to maintain this fire dependent community.

Within the last 10 years about 20% of the low elevation yellow pine forest was regenerated in the Tsali area while during the same time about 4% of this type was regenerated across the Nantahala and Pisgah National Forests.

White Pine-Oak Forest

About 400 acres consists of white pine and white pine-oak forest within the Tsali area. This community type within the Tsali area is derived from conversion of former upland stands to white pine or white pine-oak forest. All the white pine forest within the Tsali area is less than 30 years of age. A thinning of 15 acres is proposed in alternatives 3 and 4. The proposed actions should not result in any change to this community type.

Within the last 20 years about 40% of this type was planted within the Tsali area. White pine dominated stands consist of about 9.5% of the Tsali acreage while consisting of 5.5% of the acreage in the 5 compartments to the east of this area. As a result of the conversion, oaks are not as dominant in the landscape as in the compartments to the east.

Other Communities

Shaded rock outcrops

Shaded rock outcrops primarily occur within rich cove forest, high elevation red oak forest, northern hardwood forest, mesic oak-hickory forest, and acidic cove forest across the Nantahala and Pisgah National Forests. Within lower elevation sites like the Tsali area the greatest likelihood of occurrence is within acidic and rich cove forest. Planned activities within these acres include 2-age regeneration harvest, pre-harvest oak treatment, woodland creation and prescribed fire. Of these activities the greatest impact to the overstory canopy would be the 2-age regeneration harvest. Alternative 3 has a 2-age regeneration harvest across 28 acres within a rich cove forest. There would also be an impact to the overstory from the woodland creation. This activity is only proposed for action alternative 4, where shaded rock outcrops could occur across 7 acres with a rich cove forest.

There should be little impact to the amount of light reaching the shaded rock outcrops from the preharvest oak treatments proposed across cove forest within all three action alternatives. All three alternatives vary in the amount of proposed burning. Fire intensity tends to be less severe within rich cove forest given the greater humidities present. Typical fire activity within these habitats is a leaf litter fire. The burning probably will not directly affect this habitat since any fire intensity will be slowed by the surrounding rock where this species occurs.

As previously stated, cove habitats have the greatest incidence of harboring shaded rock outcrops. Cove habitats are limited within the Tsali area. About 420 rich and acidic cove acres are dispersed across the 5 compartments primarily restricted to protected east and north-facing slopes. Within the last 20 years, only 16 acres of this habitat have been cut. These habitats have been infrequently harvested across the surrounding low elevation forests in the Tsali area. Seventeen acres of cove hardwoods have been harvested during the past 10 years across the adjacent 14 compartments. Fifty-five acres of cove hardwoods were harvested during the late 80's and 19 acres in the early 80's. Some cove hardwood habitat is being proposed for harvest within the Upper Fontana project to the east of the Tsali area.

Seeps

The potential for seeps across the landscape within the Nantahala and Pisgah National Forests is primarily embedded in northern hardwood and rich cove forest communities. They occur in flatter portions of stream channels where there are gaps in the shrub layer or the understory is already open. Within the Tsali area, the highest probability of occurrence is within rich cove forest. Impacts to seeps can result from road construction or reconstruction or dramatically opening the canopy. The activities from the proposed action alternatives would be the same as shaded rock outcrops, except for the burning in the acidic cove forest. However, neither action alternative is anticipated to impact this habitat since any significant seep located within the activity area will be within the riparian zone where no activities are being proposed.

As stated above for the shaded rock outcrops, few cove acres have been impacted within the Tsali area and the surrounding areas during the past 20 years. Recently, a seep was impacted with the current construction of the Lemmons Branch road in the Tsali area.

Effects to Community Types from the Prescribed Burns

Woodlands

This creation of woodlands is designed to reduce the midstory canopy and heavily thin the overstory component. The objective is to enhance any existing grass and forb component. These areas are desired to provide a different grass/forb component in the landscape

compared to the traditional planted wildlife opening. Structurally this would consist of an open overstory canopy with a scattered shrub layer and a dense herbaceous component. Visually this would yield a park-like community. Ecologically, it may be more appropriate to refer to this community as a woodland since this refers to open stands of trees with crowns not usually touching, forming 25-60% cover (Grossman et. al. 1998)

Structurally it is unknown how the pre-Columbian landscape was constituted, but it was almost certainly influenced by the use of fire. While there are historical accounts of open forested landscapes in the Mountains, the area in the Tsali peninsula is more reminiscent of the Piedmont given the dominant yellow pine component. There are historical accounts of early explorers detailing the open landscape in the Piedmont of the Southeast, referring to it as "prairies", "savannas", "plains" or "old fields" (Barden 1997). Within the western foothills of the Great Smoky Mountains National Park, old growth shortleaf pine forests have a dispersed layer of large older pines with a 40-80 year old component of white pine and various hardwoods, including many fire-intolerant species (personal observation). These pine and pine-oak communities prior to fire suppression should be the models for these woodlands. Within the Tsali peninsula various open forests occur with an existing basal area of 40-60 square feet that have high diversity of herbaceous species. In order to mimic the park-like effect of these historical woodlands, those largest fire tolerant trees, the oaks and pines, should remain as the residual canopy within the "savanna" areas.

Depending on the type of forest, the herbaceous component will vary in its grass or forb component. Little bluestem, Indian grass, silver plume grass and red top tend to be the dominant grasses within open xeric forests at Tsali. Various members of the aster and legume family tend to be prevalent in this open forest and should increase with this management. These tend to be Maryland golden-aster, grass-leaved golden aster, fragrant goldenrod, creeping aster, Appalachian sunflower, tick-trefoil, hairy lespedeza, rosin-weed, black-eyed susan, goat's-rue, butterfly pea, late eupatorium, sensitive brier, partridge-pea, Appalachian sunflower and *Baptisia tinctoria*.

Fire return intervals of 10-12 years have been determined for *Pinus rigida* and *Pinus pungens*-dominated forests in the Great Smokies National Park before 1940, when fire suppression was actively implemented (Harmon 1982). This rate is believed to be similar across other xeric ridges and exposed slopes in the Southern Appalachians (Cecil Frost, North Carolina Plant Protection Program director, personal communication). It is unknown how frequent fire needs to return to the landscape within this area to achieve the greatest herbaceous diversity. The understory of the woodland will vary depending on fire frequency. With a fire return frequency greater than 5 years, the shrub layer and woody sapling layer will probably become well developed to the detriment of the herbaceous layer. It is anticipated that these areas will have to be burned on a 3-year rotation in order to create and maintain high herbaceous diversity. A permanent monitoring design should be implemented within portions of these woodland management areas to determine the need for recurrent fire and to document structural and compositional changes.

PRESCRIBED BURNS

Information is incomplete on the natural occurrence of fire in the southern Appalachians (Barden and Woods 1974). Rainfall, accompanied with lightning, typically dampens the leaf litter and prohibits any spread of fire if an ignition results from the lightning. However, these lightning sets do occasionally smolder in hollow trees, and reignite the surrounding litter once it dries (Martin 1991). This is the scenario of two lightning strike fires that occurred this year in late Spring and Summer in the Great Smokies Mountains National Park and the Pisgah National Forest. Historical evidence of fires in the early twentieth century indicates that large fires were more common during below-average precipitation years (Harmon 1982). In addition to the occasional natural fire, native Americans and early European settlers frequently set fires (Williams 1998, Harmon 1984, Barden and Woods 1973). Generally these fires were ignited in the late Fall and early Spring and resulted in a different effect on the landscape. A study of fossil pollen and charcoal by Delcourt and Delcourt (1998) indicates that prehistoric Native American use of fire resulted in increases in oak and chestnut. No matter what the previous disturbance mechanism, it is likely that the present composition of oak-hickory or montane oak forest will change unless prescribed fire is actively used as a management tool. Given the uncertainly of fire changing this community, and its major abundance across the Nantahala National Forest, it is hoped that these fires will be monitored with community sampling to determine changes in both structure and species composition.

The proposed burn sites are primarily covered with pine-oak/heath or with montane oak forest. Yellow pines in the southern Appalachians are shade intolerant (Illick and Aughanbaugh 1930). They require exposed mineral soil for optimal seed germination and successful recruitment (Ledwig and Little 1979). As a result they are unstable and require recurrent fire to successfully regenerate (White 1987, Williams 1998). Recurrent use of fire within these communities should help to maintain a more open understory thus increasing the diversity of the herbaceous flora. Those species preferring more open conditions, including *Liatris squarrulosa* may increase with the proposed burns.

Oaks and oak-hickory forest do not regenerate exclusively by tree fall gap disturbance patterns (Peet and Christensen 1987). Various researchers believe oaks need recurrent fire for their long-term stability and regeneration (Lorimer 1985, Abrams 1992). Fire may have a beneficial influence on oaks by reducing competition from more fire-sensitive tree species in the sapling layer (Lorimer, 1985). Fire reduces the amount of litter under a stand, which, according to Lorimer, may discourage rodent predation of acorns. Fire may indirectly influence rodent populations as well, by reducing available nest sites and food availability. Fire disturbance can play a role in selecting

against thin barked mesic hardwoods. In montane oak forests sampled in Shining Rock Wilderness, saplings of *Acer rubrum* and *Halesia caroliniana* suggest dominance in the future canopy by these thin barked species with oak species diminishing (Newell and Peet 1996). An old growth white pine-mixed oak community is being largely replaced in younger age classes by shade tolerant later successional species such as *Acer rubrum* (Abrams, Orwig and Demeo 1995). The authors believe that this old growth oak-pine stand was maintained during the 18th and 19th century by periodic fire, which has not occurred within this community after 1900. Communities across the Chattooga River watershed appear to be changing from oak dominance to more shade tolerant red maple, black birch and blackgum (Meir and Bratton 1996). Historical records and current canopy trees of surveyed old growth within the watershed indicate that fire was a dominant force on the landscape during early European settlement (Meir and Bratton 1996). Since the time of fire suppression in the Great Smoky Mountain National Park, *Quercus montana* is experiencing poor regeneration (Harrod, White and Harmon 1998).

The small patch old growth areas selected for compartments 152, 153, 154 and 155 are located in two 100-acre patches and are proposed for a prescribed burn. This burn management should be compatible with old growth conditions within these communities. As previously discussed the fire is necessary to maintain these pine and pine-oak communities and could replicate the spacing of dispersed older trees as seen in an old growth area of these types in the western portion of the Great Smoky Mountain National Park. Within the last year, the Park has implemented two separate burns on old growth shortleaf pine sites in order to reduce the midstory and shrub layer. This management has been implemented with initiation of a monitoring program to determine the floristic and structural effects of the burn. It is recommended that some of the proposed burn areas here at Tsali peninsula also have permanent plots established in order to detect changes form the burn management.

The proposed burns also will have some cove hardwood forest along the lower concave slopes of the activity area. It is anticipated that higher humidities there will only result in a leaf litter fire. A landscape stand-replacement fire designed to regenerate a declining pine-oak/heath community in the Wine Spring area in the Wayah Ranger District resulted in a mosaic of fire intensities (Vose et al. 1997). The burn was designed to take advantage of natural firebreaks, here consisting of streams. A low-intensity litter fire was only 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 (personal observation). Those portions of the landscape in Tsali with an acidic cove community surrounding the riparian zone within the proposed burns should be impacted the least of any community since high relative humidity and constantly damp *Rhododendron* leaf litter will quickly extinguish any fire.

DETERMINATION OF EFFECT

Table 5. Determination of effect of each alternative on the evaluated federally listed plant species, sensitive plant species, forest concern plant species, and the MIS plant species.

Species	Alt. 1	Alt. 3	Alt. 4	Alt. 5
Federally Threatened and Endangered Species				
None	Not applicable	Not applicable	Not applicable	Not applicable
1996 Region 8 Regional Forester's Sensitive Species List				
Megaceros aenigmaticus	No impact	No impact	No impact	No impact, marginally slightly higher risk than alternatives 3&4
Forest Concern Species				
Liatris squarrulosa	No impact	Potential beneficial impact, mitigation measure	Potential beneficial impact, mitigation measure	Potential beneficial impact , mitigation measure

The proposed activities associated with this project in the Tsali Recreation Area in the Cheoah Ranger District will have no effect on any Federally listed or proposed plant species. For all sensitive plant species, there will be no impact from the activities associated with this forest health project.

With the increase in fire management and provided efforts are taken to avoid any fireline construction across the *Liatris squarrulosa* population, this project may beneficially impact this forest concern species for all action alternatives. For all other forest concern plant species, there will be no impact from the activities associated with this project from any action alternative.

MITIGATION MEASURES

With implementation of the planned burns for all three action alternatives, the following mitigation measure is necessary to ensure the continued existence of the *Liatris squarrulosa* population

1) Prior to any burn the blazing star population should be clearly delineated by the Nantahala National Forest Botanist to avoid any fireline construction beyond the existing bike trial near it.

Recreation Resources

OBJECTIVE*: provide for high quality recreation and scenic experiences for forest visitors by maintaining existing recreation facilities, and new trail construction for hiking, horseback riding, and mountain trail bike use.*

Issue: Recreation - What impact will logging and associated activities have on trail use?

Alternative I - No Action. There will be no impact on the recreation experience or the trail use because no logging activities are planned.

Cumulative effects Alternative I: If a catastrophic event occurs in the future that requires clean-up and removal of logs and logging

trail system mileage thus enhancing the recreation experience.

Cumulative effects Alternatives III, IV & V: All three alternatives have some short term effects that decrease the recreational

the desired VQO.

Cumulative Effects Alt. I - In the future if a catastrophic event occurs that requires clearcutting to salvage the timber this would have a

construction, it has the least impact on the scenery.

Alternative IV - Road construction is .95 miles. An estimated 551 acres are seen from trails within or along side units. These units are primarily thinnings, woodlands and burns. Four viewpoints fall within units. After some initial disturbance the woodlands and to a certain extent, the thinnings, will help create a diversity of experience along the trails, permitting pleasing views into the forest. Although the number of impacted acres and miles of road construction are higher than alternative III the activities are less visually disturbing and will meet the scenery needs and objectives.

Alternative V - Skid Road construction planned in this alternative is approximately .36 miles. An estimated 587 acres are seen from trails within or along side units. These units are primarily thinnings, woodlands, and pre-harvest site preparation. After some initial disturbance the woodlands and to a certain extent, the thinnings, will help create a diversity of experience along the trails, permitting pleasing views into the forest. Prescribed burns other than site prep impact almost all of Thompson Loop trail and half of Left Loop. Number of impacted areas and miles of road construction are similar to alternative IV, although areas impacted by prescribed burning are three to four times greater. In the short term this alternative will meet the scenery needs and objectives to a lesser degree than the other alternatives because of the high number of disturbed areas.

Cumulative Effects Alternatives III, IV & V - All three alternatives will have some short term effects that decrease the scenic quality. Long term the scenery will be enhanced through planned activities that create stable healthy stands with a reduced risk of catastrophic events.

Cumulative Effects: The changes that would be seen on National Forest lands would be in addition to other timber harvests and logging roads currently visible from the viewpoints analyzed. Over time (5 years or more), the existing and new harvest areas would be noticeable primarily because of the change in the height and density of the new vegetation compared to the surrounding forest. To some viewers the resulting variety would be pleasing. To others who prefer a more homogeneous appearing forest, the resulting variety may not be acceptable.

Issue: Cultural Resources

Alternatives III, IV, and V. Ground disturbing activities such as road, skid trail, and log landing construction would have the greatest potential for impacts to cultural resources. Sites discovered during the ongoing survey would be protected by mitigating measures appropriated to the level of significance.

The heritage resource base of the Nantahala National Forest includes a rich and diverse range of both prehistoric (before AD 1500) and historic (after the advent of written record and European contact) artifacts and sites. These include: historic cabins, trails, mines, logging camps, railroad grades, homesteads, mills, original highway grades, historic Forest Service structures including lookout towers, guard stations, camps, administrative centers, Civilian Conservation Corps (CCC) era campgrounds, roads and buildings, prehistoric campsites, villages, graves, quarries, trails, rock shelters, and Native American religious and traditional sites.

The North Carolina State Historic Preservation Office (SHPO), Office of State Archeology, has records of 410 sites in Graham County and 284 sites in Swain County. These totals include sites recorded on National Forest land and non-Forest lands in the counties as of June, 1999. The majority of these sites are found on Forest lands recorded mostly during compliance related surveys prior to land disturbing, altering; exchanging projects, timber sales, recreation development, and other projects or activities. Archeological sites in this area are found on a variety of landforms conforming mostly to coves, gaps, ridgetops, knolls and ridgetops.

The construction of Fontana Dam and lake by the Tennessee Valley Authority (TVA) in 1941-1945 is an integral part of the history of this region and of the Tsali Forest Health Analysis area. The construction of Fontana Lake resulted in the inundation of approximately 10,670 acres of land, including portions of the Little Tennessee, Nantahala, and Tuckasegee rivers and numerous tributaries. The project resulted in the relocation of 1,311 families. Most of the area acquired by TVA for the Fontana Project was not inundated but consisted of areas on the north and south shores of the lake for which access was to be cut off by lake construction. Many remnants of pre-Fontana lifeways have been recorded on Forest Service lands south of Lake Fontana including homestead and farmstead remains, roads, highways, mills, and cemeteries.

Effects to heritage resources can result from a number of activities. In Alternatives III-IV, ground disturbing activities such as road, skid trail, and log landing construction would have the greatest potential for impacts to heritage resources. Other potential impacts may occur from trail building or fireline construction for prescribed burning activities. The greater the planned impact acreage, the greater expected impacts to heritage resources. This increases the need for more acreage to be inventoried prior to disturbing activities in order to take into account effects on heritage resources and allow the Advisory Council on Historic Preservation to comment on an undertaking as required by Federal preservation laws, regulations and policies.

Alternative I and II: would have no impact on heritage resources

Alternative III and IV and V: Prior to field work, the project area was rated by the Forest Service. The project activity acres were rated, varying from low to high likelihood for containing archeological sites. Two archeological sites were discovered during the project surveys. Both sites are rated Class III and are not considered eligible for listing in the National Register of Historic Places. A previously documented site is within the proposed activity area. The site will require preservation by avoidance. During project activity, it is recommended that the site be monitored by an archeologist or heritage resource technician. On March 5, 2001, a copy of the site forms and the report was sent to North Carolina State Historic Preservation Officer for review and comment.

Issue: Economics

Existing Condition: The Cheoah Ranger District currently sells between five and 7 million board feet of sawtimber and related wood products annually to private wood industries in Graham and surrounding counties. These products include high quality hardwood sawtimber, some lower grade sawtimber, firewood and chipwood for manufacturing processes such as paper production and wood energy production.

This analysis was performed using the Quick-Silver software (Vasievich 1999) which is designed to compare the economic performance of competing projects or alternatives. Quick-Silver analyzes cost and benefit flows for a wide variety of investments or operations. Discounted cash flow techniques are used to compute criteria or measures of economic performance for each management investment alternative. The table below represents the financial analysis performed for this project. The cost and benefit figures used to compile this analysis are located in the project file on the Cheoah Ranger District in Robbinsville, North Carolina.

	Alternative I (Control)	Alternative III	Alternative IV	Alternative V
B/C Ratio	0.00	1.04	1.17	1.24
Present Net Value ($)	-$37,000.00	$3,200.39	$16,448.22	$25,168.35
PV-Benefits ($)	$0.00	$89,068.43	$112,522.95	$128,448.38
PV-Costs ($)	-$37,000.00	-$85,868.04	-$96,074.73	-$103,280.03

Economic Criteria

Benefit to Cost Ratio: The ratio of the discounted benefits to the discounted costs. A B/C ration greater than one indicates revenues greater than costs.

Present Net Value: The value of all benefits discounted at the specified rate to the beginning of the investment period.

Present Value of Benefits: The value of all benefits discounted at the specified rate to the beginning of the investment period.

Present Value of Costs: The value of all costs discounted at the specified rate to the beginning of the investment period.

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II. AGENCIES AND PERSONS CONSULTED

A number of agencies and persons have been consulted and asked to provide their comments and concerns during the project planning period. The initial project scoping document was mailed on 8-01-97.

Alan Duff, Smoky Mountains Hiking Club
Alex Bergman
Andrew George
Andrews Walter
Barry Midgette, SA Chapter, Ruffed Grouse Society
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Bill Thomas, North Carolina Sierra Club
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Bureau of Indian Affairs
Burt Kornegay
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Chrys Baggett, Clearinghouse--State of North Carolina
Chuck Ramsey, Asheville Blue Ridge Bicycle Club
Dan Pittillo, Bartram Trail Society
Danny Childers, Nantahala Chapter of National Wild Turkey Federation
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Nathaniel H. Axtell, Appalachian Voice
Norma Ivey, Western North Carolina Alliance
Paul Carlson
Payson Kennedy, Nantahala Outdoor Center
Planning Staff, National Forest's in North Carolina
Randy Denman
Ray Harbin
Ray Payne, Smoky Mountains Hiking Club
Scott Burns
Shirley Crisp
Southern Appalachian Forest Coalition
Southern Environmental Law Center
Stephen Novak
Steve Henson, Multiple Use Council
Steven P. Hall, NCDEHNR, Division of Parks and Recreation
Sue Fugate
Tom Strode, Forest Watch
United States Fish and Wildlife Service
United States Forest Service, Tellico Plains Ranger District
W. W. Kerr
Wayne Swank, Coweeta Hydrologic Laboratory
Wilderness Society

Several public meetings were held concerning this proposal. The following summarizes these meetings and includes a list of attendants.

The first meeting occurred on 6-17-97 at the Nantahala Outdoor Center in Almond, North Carolina. Mark Robison, NEPA Forester for National Forest in North Carolina, presented a slide program related to forest health issues at Tsali and explained the purpose of the project. Attendees included:

Craig Plocica
Gary McIntosh, Nantahala Outdoor Center
Jim Parham,Nantahala Bike Club
Ken Howle, Nantahala Outdoor Center
Mark Singleton
Par Reid

The second meeting occurred on 12-05-97. Mark Robison presented a slide program and posters relating to forest health issues at Tsali and the Southern Appalachians. Attendees included:

Andrew Judson
Bob Dellinger
Bob Geyer, Blue Ridge Bike Club
Chuck Ramsey, Blue Ridge Bike Club
Danny Childers, Nantahala Chapter of National Wild Turkey Federation
Dave Panebaker, Great Smoky Mountains National Park
David Allen, North Carolina Wildlife Resources Commission
Doreen Miller, United States Forest Service
Frank Findley, United States Forest Service
Gary Kauffman, United States Forest Service
Gary McIntosh, Nantahala Outdoor Center
Glenn McConnell, United States Forest Service
Hal Markham
Jamie Bridges
Jim Parham, Nantahala Bike Club
Joe Bonnette, United States Forest Service
Joe Livingston
Joffrey Brooks, North Carolina Wildlife Resources Commission
Kathy Ludlow, United States Forest Service
Ken Howle, Nantahala Outdoor Center
Kent Cranford, Nantahala Bike Club

Kit Dehart, Logger
Krista Bender
Larry Norman, Nantahala Bike Club
Laurie Mclaren, Nantahala Bike Club
Leonard Harwood, Trout Unlimited
Lois Phlegar
Mary Danals
Paula Reed, Nantahala Bike Club
Roy Payne, Smoky Mountain Hiking Club
Russell Childers, Nantahala Chapter of National Wild Turkey Federation
Russell Kelly, Nantahala Bike Club
Steve Henson, Multiple Use Council
Tracy Williams

After the second meeting, the need to organize a citizens advisory group for this project was recognized. Dale Wiggins, County Commissioner for Graham County, initiated and organized this effort. Four meetings were held with this group on various dates to discuss the proposed alternatives, issues, and concerns. Meeting notes and summaries are on file at the Cheoah Ranger District in Robbinsville, North Carolina. The meetings were facilitated by the Mountain Dispute Settlement Center in Bryson City, North Carolina. Various groups were present at these meetings and include:

Boaters/Boat Launch Operators
Congressman Taylor's Office
County Governments (Graham and Swain)
Economic Development Representatives
Fisherman
Horseback Riders--Private and Commercial

Hunters
Loggers and Timber Industry
Mountain Bikers--Private and Commercial
Multiple Use Council Representative
Wildlife Resource Commission

Dale Wiggins Graham County Commissioners
Dalton Adams
Danny Childers, Nantahala Chapter of National Wild Turkey Federation
David Allen, North Carolina Resources Commission
Floyd Griffin
Janet Smith, Nantahala Outdoor Center
Jim Parham
Joffrey Brooks, North Carolina Resources Commission
Judy Edwards, District Representative for Congressman Charles Taylor
Ken Howle Nantahala Outdoor Center
Lynn Cody Graham County Commissioner

III. INTERDISCIPLINARY PLANNING TEAM

The following interdisciplinary planning team directed the environmental analysis process for this project:

Mark E. Robison, NEPA Forester
Frank Findley, Other Resource Assistant, Cheoah Ranger District
Gary Kauffman-Botanist
Doreen Miller -Wildlife Biologist
Jeannie Riley - Fisheries Biologist

IV. CONSULTANTS TO THE INTERDISCIPLINARY TEAM

The following people provided natural resource and technical data, analysis, and comments during the planning process:

Bill Sites, Pathologist, United States Forest Service
Dale Holder, Forest Technician, United States Forest Service
Dale Wiggins Graham County Commissioners
Dalton Adams
Dan Manning, Soil Scientist, United States Forest Service
Danny Childers, Nantahala Chapter of National Wild Turkey Federation
David Allen, North Carolina Resources Commission
E. Hugh Lane, Silviculture Technician, United States Forest Service
Ed Yockey, GIS Specialist, United States Forest Service
Floyd Griffin
Gina Anderson, Forest Technician, United States Forest Service
Glenn McConnell, District Ranger, United States Forest Service
James Compton, Biological Technician, United States Forest Service
Janet Smith, Nantahala Outdoor Center
Jill Bassett, Archeologist, United States Forest Service
Jim Buckel, Timber Management Assistant, United States Forest Service
Jim Parham
Joe Bonnette, Silviculturist, United States Forest Service
Joffrey Brooks, North Carolina Resources Commission
Judy Edwards, District Representative for Congressman Charles Taylor
Ken Howle Nantahala Outdoor Center
Laney Cutshaw, Fire Management Officer, United States Forest Service
Lloyd Hedrick, Forest Technician, United States Forest Service
Lynn Cody Graham County Commissioner
North Carolina Department of Transportation
Pat and Pete Vander Wende
Pat Reid
Patrick J. Barry, Entomologist, United States Forest Service
Ralph Hooper
Rick Wike
Robin Suggs, Graham County Planning Department
Rod McClanahan, Wildlife Biologist, United States Forest Service
Roger Smoker, Forest Technician, United States Forest Service
Roy Bailey, Smokey Mountain Marina
Shirley Crisp
Steve Covington, United States Forest Service
Steve Henson, Multiple Use Council
Steve Oak, Pathologist, United States Forest Service
Steve Simon, Ecologist, United States Forest Service
Swain County Government
Terry Boyte, Appalachian Packing and Riding
Terry Eller, Forest Technician United States Forest Service
Tim Solesbee, Forest Technician, United States Forest Service
Tracy Williams, Peppertree-Fontana Resort
Walter Hooper, Logger

Appendix A

GYPSY MOTH

Life Cycle

The gypsy moth is a member of the order Lepidoptera (butterflies and moths), family Lymantriidae. The gypsy moth has one generation per year. Larvae (caterpillars) begin emerging from egg masses in April or early May. Newly hatched larvae are less than 2 mm long and have long, lateral hairs. If the weather is unfavorable or cold (below 40^{O} F or 4^{O} C), they remain on or near the egg mass for several days. When conditions improve, the larvae leave the egg mass and climb trees in response to daylight, trailing silken threads. When larvae reach the top branches or branch ends, they do not feed. Some drop on the silken threads and are then dispersed by wind. Some of these larvae maybe carried for long distances by the wind, but most are distributed within relatively local areas. If the larvae land on favorable host plants they feed voraciously and grow rapidly. As they increase in size, the quantity of foliage eaten per day increases. Approximately 70 percent of all foliage eaten is consumed during the last instar. This is usually about mid-June, and it is at this time when defoliation becomes most evident. Male larvae usually pass through five instars (larval stages) and females through six. Each instar lasts 4 to 10 days, depending on environmental conditions during each stage of development. During the first three instars, the larvae alternate feeding and resting during the day. After the larvae molt to the fourth instar, they feed at night and rest in protected locations during the day. At dusk, the larvae again climb the trees to feed. Larvae usually complete their development by late June. They again seek sheltered areas and pupate for about 2 weeks. In dense populations, clumps of pupae can be found at the base of branches, in bark fissures, or attached to the bark surface.

The adult male moth is dark brown and has many dark bands across the forewings. The female moth is nearly white and has very dark bands across the forewings. Because their bodies are weighted down with eggs, females do not fly. Instead, they crawl short distances from the place where they emerged and release a potent sex attractant (pheromone) to attract male moths. Soon after mating the female deposits her eggs in a single mass and dies. The eggs are covered by a dense coating of hairs sloughed from the abdomen of the female moth. The egg mass may contain from 75 to 1,000 eggs. The number of eggs is an indication of the population vigor (Campbell 1966), with smaller egg masses indicating a stressed population. Egg masses are buff colored when first laid, but may bleach out in the winter months when exposed to direct sunlight and weathering. Within 4 to 6 weeks the embryos develop into larvae that overwinter in the eggs and hatch the following spring.

Hosts

Gypsy moth larvae feed on a large number of host trees, shrubs, and vines. Preferred hosts include all oak species, sweetgum, apple, beech, birch, basswood, and willow. Intermediately favored hosts include maple, hickory, black cherry, elm, sassafras, all pine species, eastern hemlock, and blackgum. Least preferred hosts include ash, yellow-poplar, red cedar, sycamore, dogwood, American holly, and black locust (Clement 1917). Late instar larvae can feed upon tree species that younger larvae normally would not, such as hemlocks, pines, and spruces. This usually occurs when high populations have defoliated the favored tree species and larvae migrate to adjacent trees to finish their development.

IMPACTS

The Tree

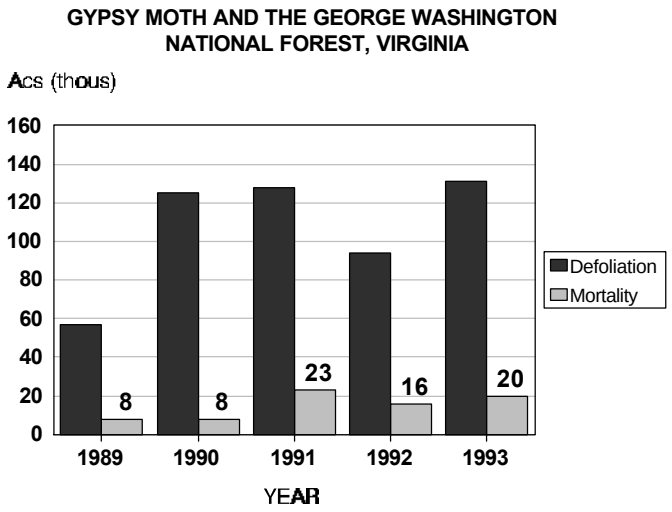
Defoliation by the gypsy moth can result in growth loss, crown dieback, and tree mortality. The gypsy moth defoliates trees in the spring. Spring defoliation is more harmful to the tree's well being than fall defoliation, because the trees defoliated in the spring will refoliate, thereby depleting energy reserves. The amount of foliage that must be removed to trigger refoliation is not known because it is difficult to estimate exact percentages of defoliation. Different tree species also vary in their response to similar defoliation levels. Artificial defoliation studies show that when 50 percent of the foliage is removed refoliation will sometimes occur. When greater than 75 percent of the foliage is removed, refoliation will always occur, unless it is a late-season defoliation (Wargo 1978).

Refoliation gives the tree the photosynthetic ability to produce food, however, the process uses up starch reserves to maintain its living tissues until the new leaves are formed and produce more food. Growing conditions at time of refoliation are different from the spring, the days are shorter and hotter; the time left to replenish starch reserves needed for next spring is cut short. A tree that is defoliated and refoliates in the same season will begin the next season with lowered food reserves, less productive leaves, and mineral imbalances. The end result is that the tree is weaker and more susceptible to attack by other insects and pathogens. Hardwood trees that are healthy can tolerate several years of defoliation before dieback begins. Hardwoods that are already suffering under some stress, such as drought or

crowding, do not tolerate defoliation as well. It is usually the weak or unhealthy tree that dies or loses much of its crown from branch dieback after one season of defoliation (Campbell and Valentine 1972).

The Forest

It can take several years from the time when the gypsy moth first invades an area to the time that it causes noticeable damage. Eventually, populations reach levels where defoliation can be severe. The first outbreak is usually the worst and most devastating to the forest. A certain amount of mortality can be expected following severe defoliation. The exact amount depends on a number of factors other than the gypsy moth, such as species composition, stand age and vigor, and other environmental factors. As a general rule, gypsy moth infestations result in mortality losses of less than 15 percent of total basal area. Losses of 15 to 35 percent are not uncommon, and occasionally levels greater than 50 percent are reported (Gansner and others 1987). Over time, the composition of the forest will change to favor those species less preferred by the gypsy moth. This will undoubtedly result in a reduction in the oak component and an increase in less susceptible species such as maple. However, oak will still be a component of the resulting forest.



Timber Resource

Quimby (1981) reported that forest stands in Pennsylvania that sustained defoliation of 60 percent or more, showed that the cumulative mortality rate for a 10 year period averaged 20 percent. Losses in timber value averaged $16 per acre, or less than $2 per acre per year.

In a study in the Pocono Mountain Region of northeastern Pennsylvania, cumulative mortality of trees 3 inches in dbh and larger associated with an outbreak during the early 1970's averaged 13 percent mortality over a 5-year period. Losses in timber value averaged $14 per acre; less than $3 per acre per year.

Overall growth in timber volume and value would have been greater without gypsy moths, but this study showed that only 10 percent of the stands lost more than $30 per acre. Many of the trees that died were small and of low grade. Oak species were the most effected. Significant losses in timber volume and value occurred during the early years of infestation but most of them were offset by growth in later years. The majority of the stands have more volume and value now than they had before the infestation (Gansner and others 1983).

Wildlife

Wildlife species are affected by gypsy moths in many ways, but primarily through changes in habitat. Many of the changes in forest vegetation are favorable to many species of wildlife, so the consequences of defoliation by gypsy moth are not entirely negative. The extensive growth of understory herbs, shrubs, and grasses produces an abundant supply of food and cover for many wildlife species. Some species will obviously decline in numbers, but other species will be enhanced. The implication of this is that forest wildlife populations, like the forest, will be altered, perhaps significantly but will continue to survive. A diversity of habitat will yield a diverse nongame bird community and subsequently produce a more resistant forest to defoliation by the gypsy moth (Cooper and others 1987).

Many wildlife species supplement their diet with acorns, so a loss of this resource reduces the capacity of an area to support some species, especially the gray squirrel. Defoliation can have direct and indirect effects on mast production. Direct defoliation effects on acorn production during years of greater than 50 percent defoliation can come from three sources: direct consumption of flowers, abortion of immature acorns due to low carbohydrate supply, and lack of flower bud initiation. These effects are generally short-lived, having residual effects for only 1 or 2 years after defoliation ended.

As mentioned above defoliation can lead to crown dieback and poor vigor, and shifts in species composition. These effects can reduce viable seed for regeneration and wildlife food. Estimates on the impact of mortality on stand-level acorn production following an outbreak show that considerable mortality (60 percent of oak basal area) must occur before significant reductions in acorn production

occurs. This result is due to mortality occurring primarily in intermediate and suppressed trees that are not heavy mast producers (Gottschalk 1989).

Overstory mortality increases available moisture, nutrients, and light penetration within the forest resulting in an increase in herbaceous growth and soft mast. The extensive growth of understory herbs, shrubs, and grasses produces an abundant supply of food and cover for many more wildlife species. The increased vertical stratification of the foliage in the forest benefits many species of birds. In addition, unsalvaged dead trees create more snags for cavity-nesting animals, and limbs and boles that fall to the forest floor provide additional cover or shelter for small mammals and other ground-dwelling animals.

Appendix B

SOUTHERN PINE BEETLE RISK/HAZARD RATING MODEL USED FOR TSALI ANALYSIS

Description: Mountain risk is based upon discriminant analysis of data representing site, stand, and tree characteristics associated with southern pine beetle activity in the mountains of the eastern United States. The system is easily applied using the discriminant analysis equation or working directly from the table. The analysis at Tsali relied upon both approaches.

Inputs: Data collected during field survey at Tsali included the following information**:**

1. Proportion of pine (shortleaf, pitch, or Virginia pine) in the stand or proposed treatment unit

2. Radial growth in the last 5 years (inches)

Risk estimates were developed by entering the above information into the following equation:

Score = -1.980 - 3.97 (PPS) + 2.14(RG)

where

PPS = proportion of pine (shortleaf, pitch, or Virginia)
RG = *ln (radial growth in the last 5 years (inches) x 25.4

Outputs: A rating class is determined from the score as follows:

Score	**Risk Class**
> 0.40	Low
0.40 to - 0.56	Medium
< - 0.56	High

* ln = the natural log of the 5 year radial growth.

Estimates of southern pine beetle risk and hazard was also determined by using rough pine stocking and radial growth categories presented in the following table. **Five year radial growth values range from 0.2 inches to 0.8 inches**

Pine Stocking (%)	**Risk/Hazard Classes**			
	0.2 in	**0.4 in**	**0.6 in**	**0.8 in**
20	Low	Low	Low	Low
40	Med	Low	Low	Low
60	High	Low	Low	Low
80	High	Med	Low	Low
100	High	High	Med	Low

Genereral Reference: Hedden 1983

Appendix C

Financial Analysis

Quick-Silver Investment Analysis

Forest: Cheoah Ranger District Nantal
Analyst: Mark Robison
File: TSALIFORESTHEALTH.QSP
Title: TsaliProject

Project Notes

Mark E. Robison
United States Forest Servie
Robbinsville, North Carolina 28771

Parameters

File: TSALIFORESTHEALTH.QSP
DataPath: C:
Project Desc: Project EA - June 2001

Start Year:	2001	**Last Modified:**	07/09/2001
Transactions:	28	**Discount Rate:**	4.00
Alternatives:	4	**Inflation Rate:**	2.00
Partners:	1		
Calculate Tax:	False	**Tax Rate:**	28.00
		CapGains Rate:	20.00

Partners

USFS	Default Partner

Alternatives

Alternative I (C	No Action
Alternative III	Harvest 389 acres
Alternative IV	Harvest 512 acres
Alternative V	Harvest 476 Acres

Forest: Cheoah Ranger District Nantahala Natio
Analyst: Mark Robison
File: TSALIFORESTHEALTH.QSP
Project: TsaliProject

Mark E. Robison
United States Forest Servie
Robbinsville, North Carolina 28771

Alternative: Alternative I (Control

COST	*Partner*	*Type*	*Year(s)*	*Quantity*	*Value*	*Rate(%)*	*Base*
Environmental Analysis (Planning)	USFS	One time	0	65.00 days	$240.00	0.00	2001
Heritage Resource Survey (Monitoring/Inventory)	USFS	One time	0	7.00 days	$250.00	0.00	2001
NEPA Analysis (Planning)	USFS	One time	0	60.00 days	$240.00	0.00	2001
Scenery Analysis (Monitoring/Inventory)	USFS	One time	0	2.00 days	$250.00	0.00	2001
Silvicultural exams (Timber management)	USFS	One time	0	300.00 acres	$10.00	0.00	2001
TES survey (Monitoring/Inventory)	USFS	One time	0	7.00 days	$250.00	0.00	2001

Alternative: Alternative III

COST	*Partner*	*Type*	*Year(s)*	*Quantity*	*Value*	*Rate(%)*	*Base*
Commercial thinning sale (Timber sales)	USFS	One time	0	244.00 MBf	$5.00	0.00	2000
Cruise/mark (Timber sales)	USFS	One time	0	389.00 acres	$30.00	0.00	2000
Environmental Analysis (Planning)	USFS	One time	0	65.00 days	$240.00	0.00	2001
Hand plant conifers (Timber management)	USFS	One time	0	117.00 acres	$44.00	3.00	2001
Heritage Resouce Survey (Monitoring/Inventory)	USFS	One time	0	7.00 days	$250.00	0.00	2001
NEPA Analysis (Planning)	USFS	One time	0	60.00 days	$240.00	0.00	2001
Prescribed burning (Timber management)	USFS	One time	0	117.00 acres	$28.00	0.00	2001
Road gravel (Roads)	USFS	One time	0	1.00 miles	$1,200.00	0.00	2001
Road maint, level 5 (Roads)	USFS	One time	0	9.00 miles	$500.00	0.00	2001
Road rehab./closure (Roads)	USFS	One time	0	1.00 miles	$1,500.00	0.00	2001
Sale administration (Timber sales)	USFS	One time	0	588.00 MBF	$8.00	0.00	2000
Scenery Analysis (Monitoring/Inventory)	USFS	One time	0	2.00 days	$250.00	0.00	2001
Seedling costs (Timber management)	USFS	One time	0	14.00 thousar	$40.00	0.00	1998
Shelterwood sale (Timber sales)	USFS	One time	0	344.00 MBf	$5.00	0.00	1998
Silvicultural exams (Timber management)	USFS	One time	0	300.00 acres	$10.00	0.00	2001
Stocking survey (Timber management)	USFS	One time	0	117.00 acres	$5.00	0.00	2001
Survival survey (Timber management)	USFS	One time	0	117.00 acres	$5.00	0.00	2000
Temp road construction (Roads)	USFS	One time	0	1.00 miles	$2,800.00	0.00	2001
TES survey (Monitoring/Inventory)	USFS	One time	0	7.00 days	$250.00	0.00	2001

Forest: Cheoah Ranger District Nantahala Natio
Analyst: Mark Robison
File: TSALIFORESTHEALTH.QSP
Project: TsaliProject

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Alternative: Alternative III

COST	*Partner*	***Type***	***Year(s)***	***Quantity***	***Value***	***Rate(%)***	***Base***
Timber stand improvement (Timber management)	USFS	One time	0	50.00 acres	$65.00	0.00	2000
Visuals - Lop & Scatter (Recreation)	USFS	One time	0	3.00 acres	$350.00	0.00	2001

BENEFIT	*Partner*	***Type***	***Year(s)***	***Quantity***	***Value***	***Rate(%)***	***Base***
Low grade hdwd. sawtimber (Timber-NC)	USFS	One time	1	41.00 MBf	$15.00	0.00	2001
Mixed hardwood pulpwood (Timber-NC)	USFS	One time	1	203.00 CCF	$3.00	0.00	1998
Mixed Oak&Hrwd. Sawtimber (Timber - NC)	USFS	One time	1	41.00 MBf	$188.00	0.00	2001
NRO, black oak sawtimber (Timber-NC)	USFS	One time	1	18.00 MBf	$309.00	0.00	2001
Softwood pulpwood (Timber-NC)	USFS	One time	1	321.00 CCF	$8.00	0.00	2000
White, chestnut oak sawtimAlternative III (Timbe	USFS	One time	1	24.00 MBf	$94.00	0.00	2000
Yellow pine sawtimber (Timber-NC)	USFS	One time	1	177.00 MBf	$132.00	0.00	2001

Alternative: Alternative IV

COST	*Partner*	***Type***	***Year(s)***	***Quantity***	***Value***	***Rate(%)***	***Base***
2 Age Regeneration (Timber sales)	USFS	One time	0	426.00 acres	$5.00	0.00	2001
Commercial thinning sale (Timber sales)	USFS	One time	0	350.00 MBf	$5.00	0.00	2000
Cruise/mark (Timber sales)	USFS	One time	0	409.00 acres	$30.00	0.00	2000
Environmental Analysis (Planning)	USFS	One time	0	65.00 days	$240.00	0.00	1998
Hand plant conifers (Timber management)	USFS	One time	0	59.00 acres	$44.00	0.00	2000
Heritage Resouce Survey (Monitoring/Inventory)	USFS	One time	0	7.00 days	$250.00	0.00	2001
NEPA Analysis (Planning)	USFS	One time	0	60.00 days	$240.00	0.00	2001
Prescribed burning (Timber management)	USFS	One time	0	59.00 acres	$28.00	0.00	1999
Road gravel (Roads)	USFS	One time	0	1.00 miles	$1,200.00	0.00	2000
Road maint, level 5 (Roads)	USFS	One time	0	8.50 miles	$500.00	0.00	2000
Road rehab./closure (Roads)	USFS	One time	0	1.00 miles	$1,500.00	0.00	2000
Sale administration (Timber sales)	USFS	One time	0	734.00 MBF	$8.00	0.00	2000
Scenery Analysis (Monitoring/Inventory)	USFS	One time	0	2.00 days	$250.00	0.00	2001
Seedling costs (Timber management)	USFS	One time	0	8.00 thousanc	$40.00	0.00	1998

Forest: Cheoah Ranger District Nantahala Natio
Analyst: Mark Robison
File: TSALIFORESTHEALTH.QSP
Project: TsaliProject

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Alternative: Alternative IV

COST	*Partner*	***Type***	***Year(s)***	***Quantity***	***Value***	***Rate(%)***	***Base***
Silvicultural exams (Timber management)	USFS	One time	0	300.00 acres	$10.00	0.00	2000
Stocking survey (Timber management)	USFS	One time	0	59.00 acres	$5.00	0.00	2001
Survival survey (Timber management)	USFS	One time	0	59.00 acres	$5.00	0.00	1998
Temp road construction (Roads)	USFS	One time	0	1.00 miles	$2,800.00	0.00	2001
TES survey (Monitoring/Inventory)	USFS	One time	0	7.00 days	$250.00	0.00	2001
Timber stand improvement (Timber management)	USFS	One time	0	79.00 acres	$65.00	0.00	2000
Visuals--Lop&Scatter (Recreation)	USFS	One time	0	2.00 acres	$350.00	0.00	2001

BENEFIT	*Partner*	***Type***	***Year(s)***	***Quantity***	***Value***	***Rate(%)***	***Base***
Low grade hdwd. sawtimber (Timber-NC)	USFS	One time	1	51.00 MBf	$15.00	0.00	2000
Mixed hardwood pulpwood (Timber-NC)	USFS	One time	1	160.00 CCF	$3.00	0.00	1998
Mixed Oak&Hrwd. Sawtimber (Timber - NC)	USFS	One time	1	81.00 MBf	$188.00	0.00	2001
Softwood pulpwood (Timber - NC)	USFS	One time	1	400.00 CCF	$8.00	0.00	2000
White, chestnut oak sawtimAlternative IV (Timbe	USFS	One time	1	22.00 MBf	$94.00	0.00	2000
Yellow Pine Sawtimber (Timber - NC)	USFS	One time	1	257.00 MBf	$132.00	0.00	2000

Alternative: Alternative V

COST	*Partner*	***Type***	***Year(s)***	***Quantity***	***Value***	***Rate(%)***	***Base***
Commercial thinning sale (Timber sales)	USFS	One time	0	298.00 MBf	$5.00	0.00	2000
Cruise/mark (Timber sales)	USFS	One time	0	409.00 acres	$30.00	0.00	2000
Environmental Analysis (Planning)	USFS	One time	0	65.00 days	$240.00	0.00	1998
Hand plant conifers (Timber management)	USFS	One time	0	111.00 acres	$44.00	3.00	2000
Heritage Resouce Survey (Monitoring/Inventory)	USFS	One time	0	7.00 days	$250.00	0.00	2001
NEPA Analysis (Planning)	USFS	One time	0	60.00 days	$240.00	0.00	2001
Prescribed burning (Timber management)	USFS	One time	0	111.00 acres	$28.00	0.00	2000
Road gravel (Roads)	USFS	One time	0	1.00 miles	$1,200.00	0.00	1998
Road maint, level 5 (Roads)	USFS	One time	0	9.00 miles	$500.00	0.00	1998
Road Rehab./Closure (Roads)	USFS	One time	0	0.50 miles	$1,500.00	0.00	2001

Forest: Cheoah Ranger District Nantahala Natio
Analyst: Mark Robison
File: TSALIFORESTHEALTH.QSP
Project: TsaliProject

Mark E. Robison
United States Forest Servie
Robbinsville, North Carolina 28771

Alternative: Alternative V

COST	*Partner*	***Type***	***Year(s)***	***Quantity***	***Value***	***Rate(%)***	***Base***
Sale administration (Timber sales)	USFS	One time	0	976.00 MBF	$8.00	0.00	2000
Scenery Analysis (Monitoring/Inventory)	USFS	One time	0	2.00 days	$250.00	0.00	2001
Seedling costs (Timber management)	USFS	One time	0	18.00 thousar	$40.00	0.00	1998
Shelterwood sale (Timber sales)	USFS	One time	0	537.00 MBf	$5.00	0.00	2001
Silvicultural exams (Timber management)	USFS	One time	0	300.00 acres	$10.00	0.00	1998
Stocking survey (Timber management)	USFS	One time	0	111.00 acres	$5.00	0.00	2001
Survival survey (Timber management)	USFS	One time	0	111.00 acres	$5.00	0.00	2001
Temp road construction (Roads)	USFS	One time	0	0.50 miles	$2,800.00	0.00	2001
TES survey (Monitoring/Inventory)	USFS	One time	0	7.00 days	$250.00	0.00	2001
Timber stand improvement (Timber management)	USFS	One time	0	114.00 acres	$65.00	0.00	2000
Visuals--Lop&Scatter (Recreation)	USFS	One time	0	4.00 acres	$350.00	0.00	2001

BENEFIT	*Partner*	***Type***	***Year(s)***	***Quantity***	***Value***	***Rate(%)***	***Base***
Softwood pulpwood (Timber - NC)	USFS	One time	0	532.00 CCF	$8.00	0.00	2000
Low grade hrwd. sawtimber (Timber - NC)	USFS	One time	1	59.00 MBf	$15.00	0.00	2001
Mixed hardwood pulpwood (Timber-NC)	USFS	One time	1	267.00 CCF	$3.00	0.00	1998
Mixed Oak&Hrwd. Sawtimber (Timber - NC)	USFS	One time	1	98.00 MBf	$188.00	0.00	2001
NRO,black oak sawtimber (Timber - NC)	USFS	One time	1	20.00 MBf	$309.00	0.00	2001
White, chestnut oak sawtimAlternative V (Timber	USFS	One time	1	29.00 MBf	$94.00	0.00	1998
Yellow Pine Sawtimber (Timber - NC)	USFS	One time	1	332.00 MBf	$132.00	0.00	2001

Forest: Cheoah Ranger District Nantahala National Forest
Analyst: Mark Robison
File: TSALIFORESTHEALTH.QSP

Mark E. Robison
United States Forest Servie
Robbinsville, North Carolina 28771

All Partners

Discount Rate %: 4.0000

	ernative I (Conti	Alternative III	Alternative IV	Alternative V
B/C Ratio	0.00	1.04	1.17	1.24
Cash Flows (number)	6	30	30	30
Composite Rate of Return (percent)	NA	7.88	21.81	29.34
Internal Rate of Return (percent)	NA	12.67	43.71	60.98
Investment Length (years)	0	1	1	1
Net Annual Equivalent ($)	NA	$3,328.41	$17,106.15	$26,175.08
Present Net Value ($)	-$37,000.00	$3,200.39	$16,448.22	$25,168.35
PV-Benefits ($)	$0.00	$89,068.43	$112,522.95	$128,448.38
PV-Costs ($)	-$37,000.00	-$85,868.04	-$96,074.73	-$103,280.03

USFS

Discount Rate %: 4.0000

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Appendix D
Definitions, Methodologies, and Terms Common to all Alternatives

2-Aged Shelterwood: A variant of the Shelterwood Method in which some or all of the shelter trees are retained, well beyond the normal period of retention, to attain goals other that regeneration (e.g., wildlife and aesthetics). The resulting stand may be 2-aged or tend towards an uneven-aged condition as a consequence of both and extended period of regeneration establishment and the retention of reserve trees that may represent on or more age classes.

1. A optional preparatory harvest to enhance conditions for seed production
2. A removal harvest to release established regeneration from competition with the overwood; harvesting may be done uniformly throughout the stand, in groups, patches, or strips.

Advanced Growth/Regeneration: Seedlings or saplings that develop naturally or by treatments and are present in the understory.

Age Class: A distinct aggregation of trees originating from a single natural event or regeneration activity, or a grouping of trees, e.g., 10 year age class, as used in inventory or management.

1. An establishment harvest to prepare the seed bed and to create a new age class

Artificial Regeneration: An age class created by direct seeding or by planting seedlings or cuttings.

Birthday (or regeneration period): The time between the initial regeneration cutting and the successful establishment of a new age class by natural means, planting, or direct seeding.

Burning, Prescribed: The application of fire, usually under existing stands and under specified conditions or weather and fuel moisture, in order to attain silvicultural or other management objectives.

– Clearcutting: A method of regenerating and even-aged stand in which a new age class develops in a fully exposed microclimate after removal, in a single cutting, of all trees in the previous stand. Regeneration is from natural seeding direct seeding, planted seedlings, and/or advance reproduction. Harvesting may be done in groups or patches or in strips.

Co-dominant--Trees with crowns forming the general level of the main canopy in even-age groups of trees, receiving full light from above and comparatively little from the sides.

Composition, Stand: The proportion of each tree species in a stand expressed as a percentage of either the total number, basal area, or volume of all tree species in the stand.

Crown Class: A class of tree based on crown position relative to the crowns of adjacent trees.

Crown Condition: Assessing crown condition in dominant and co-dominant trees involves observing the amount of dead or dying portions in the upper level of the crowns. Symptoms of poor crown condition are dieback that progresses from the top down and from the outside in (Oak, 1994).

Crown: The part of a tree or woody plant bearing live branches and foliage.

Dominant--Trees with crowns extending above the general level of the main canopy of even-aged groups of trees, receiving full light from above and partly from the sides..

Even-Aged Methods of Regeneration: The following terminology applies to those methods designed to create and single age class.

Even-Aged Stand: A stand of trees containing a single age class in which the range of tree ages is usually less than 20 percent of the rotation.

Hazard (Vulnerability): Relates to forest health of individual trees or groups of tress (forest stands). Individual trees or groups of trees that exhibit symptoms of declining health (slow growth rates, poor crown conditions, presence of other insects and diseases) have a high hazard rating or are more vulnerable to the effects of insects and disease.

Intermediate Treatments: A collective term for any treatment designed to enhance growth, quality, vigor, and composition of the stand after establishment of regeneration and prior to final harvest.

Intermediate--Trees with crowns extending into the lower portion of the main canopy of even-aged groups of trees, but shorter in height than the co-dominants. They receive little direct light from above and none from the sides.

Mixed Stand: A stand in which there is a mixture of tree species (e.g. pine-hardwood, hardwood-pine)

Natural Regeneration: An age class created from natural seeding, sprouting, suckering, or layering.

Overstory Removal: The cutting of trees comprising the upper canopy layer in order to release trees from other vegetation in an understory.

Overtopped or Suppressed--Trees of varying levels of vigor that have their crowns completely covered by the crowns of one or more neighboring trees.

Pre-commercial Thinning (PCT): A thinning that does not yield trees of commercial value, usually designed to improve tree spacing and enhance growth.

Pre-harvest Site Preparation/Stand Improvement: An intermediate treatment made to improve the composition, structure, condition, health, and growth of even aged or uneven aged stands.

Pure Stands: A stand composed of essentially a single tree species.

Riparian Areas: Areas with distinctive resource values and characteristics that are composed of aquatic and riparian ecosystems, 100-year floodplains and wetlands. They also include all upland areas with a horizontal distance of approximately 100 feet from the edge of perennial streams or other perennial water bodies.

Risk (Susceptibility): Risk is associated with species composition and susceptibility. For example, southern yellow pine tree species are susceptible or at risk to southern pine beetle outbreaks. Likewise, the oak species are at risk or susceptible to oak decline and gypsy moth.

Woodland Ecosystem: An open park like forest with an abundance of grasses, forbs, and herbaceous plants that are created and maintained by regular, scheduled prescribed burns.

Regeneration (Reproduction) Method: A cutting method by which a new age class is created. The major methods are Clearcutting, Seed-Tree, Shelterwood, Selection, and Coppice for even age management.

– Seed-Tree: An even-aged regeneration method in which a new age class develops from seedlings that germinate in fully exposed microenvironments after removal of all the previous stand except a small number of trees left to provide seed. Seed trees are removed after regeneration is established.

– Shelterwood: A method of regeneration and even-aged stand in which a new age class develops beneath the partially shaped micro-environment provided by the residual trees. The sequence of treatments that include three distinct types of cuttings

Silviculture System: A planned process whereby a stand is tended, harvested, and re-established. The system name is based on the number of age classes (see even-age and two-aged), and or the regeneration method used (Shelterwood, 2-Aged Shelterwood, or Thinning)

Site Preparation: The preparation of the ground surface prior to reforestation. Various treatments are applied as needed to control vegetation that will interfere with the establishment of the new crop of trees or to expose the mineral soil sufficiently for the establishment of the species to be reproduced.

Stand Density: A quantitative, absolute measure of tree occupancy per unit of land area in such terms as numbers of trees, basal area, or volume.

Stand Improvement: A term comprising all intermediate cuttings made to improve the composition, structure, condition, health, and growth of even-aged, two-aged, or uneven aged stands.

Stand: A contiguous group of trees sufficiently uniform in age class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit. For example:

Stocking: An indication of growing space occupancy relative to a pre-established standard. Common indices of stocking are based on percent occupancy, basal area, relative density, and crown competition factor.

Thinning: A cutting made to reduce stand density or trees primarily to improve growth, enhance forest health, or to recover potential mortality.

Two-Aged Methods of Regeneration: The following terminology applies to methods designed to develop and maintain a forest stand with two distinct age classes.

Appendix E

Swain & Graham County Rare Plant Species

NATIONAL FOREST	SPECIES FORM	COMMON NAME OAR	FOREST POPS
Sensitive	Abies fraseri Vascular plant	Fraser Fir 4	30+
14	Aconitum reclinatum Forest concern F1	Trailing Wolfsbane Vascular plant 4	
Possible Sensitive	Acrobolbus ciliatus Liverwort	A Liverwort 4	00
01	Agalinis decemloba Forest concern F1	Piedmont Gerardia Vascular plant 3	
01	Anastrophyllum saxicola Forest concern F2	Liverwort	A Liverwort 4
Sensitive	Aneura sharpii Liverwort	A Liverwort 4	03
01	Arabis patens Forest concern F1	Spreading Rockcress Vascular plant 4	
04	Bartramidula wilsonii Sensitive	Dwarf Apple Moss Moss	4
Sensitive	Bazzania nudicaulis Liverwort	A Liverwort 4	01
01	Berberis canadensis Forest concern F3	American Barberry Vascular plant 3	
Moonwort Vascular plant	Botrychium matricariifolium 00 4	Possible concern	Daisy-leaf
Shorthusk Vascular plant	Brachyelytrum septentrionale 26 4	Forest concern F3	Northern

	Bryoxiphium norvegicum	Sword Moss	01	
Sensitive	Moss	4		
	Buchnera americana	American Bluehearts		
00	Possible concern	Vascular plant	3	
	Buckleya distichophylla		Piratebush	
08	Sensitive	Vascular plant	4	
	Cardamine clematitis	Mountain Bittercress		
04	Sensitive	Vascular plant	4	
	Cardamine flagellifera	Appalachian Bittercress		
60+	Sensitive	Vascular plant	3	
	Carex cristatella	Small-crested Sedge		
00	Possible concern	Vascular plant	4	
	Carex leptonervia	A Wood Sedge	14	
Forest concern F3	Vascular plant	4		
	Carex manhartii	Manhart's Sedge	60	
Sensitive	Vascular plant	3		
	Carex misera	Miserable Sedge	14	
Sensitive	Vascular plant	4		
	Carex projecta	Neeklace Sedge	05	
Forest concern F3	Vascular plant	3		
	Carex purpurifera	Purple Sedge	02	
Forest concern F1	Vascular plant	4		
	Carex ruthii	Ruth's Sedge	60+	
Sensitive	Vascular plant	4		
	Carex trisperma	Three-seeded Sedge		
01	Forest concern F3	Vascular plant	4	
	Chiloscyphus appalachianus		A Liverwort	
03	Forest concern F2	Liverwort	4	
	Cirriphyllum piliferum	A Moss	02	
Forest concern F3	Moss	4		
	Corydalis micrantha ssp. micrantha		Slender	

Corydalis	01	Forest concern F2	
Vascular plant	4		
	Cystopteris tennesseensis		Tennessee
Bladder-fern	02	Forest concern F3	
Vascular plant	4		
	Dicentra eximia	Bleeding Heart	16
Forest concern F3	Vascular plant	4	
	Dichodontium pellucidum		A Moss
06	Forest concern F3	Moss	4
	Diplophyllum obtusatum	A Liverwort	01
Sensitive	Liverwort	4	
	Entodon compressus	Ftattened Entodon	
01	Forest concern F2	Moss	4
	Entodon sullivantii	Sullivant's Entodon	
07	Forest concern F1	Moss	4
	Eupatorium godfreyanum	Godfrey's Throughwort	
00	Possible concern	Vascular plant	3
	Euphorbia purpurea	Glade Spurge	06
Sensitive	Vascular plant	3	
	Geum aleppicum	Yellow Avens	01
Forest concern F2	Vascular plant	4	
	Glyceria nubigena	Smoky Mountain Mannagrass	
02	Sensitive	Vascular plant	4
	Gymnoderma lineare	Rock Gnome Lichen	
18	Endangered	Lichen	4
	Helianthus glaucophyllus		Whiteleaf
Sunflower	75+	Sensitive	Vascular
plant	4		
	Hydrastis canadensis	Goldenseal	08
Forest concern F1	Vascular plant	3	
	Hydrothyria venosa	An Aquatic Lichen	
60	Sensitive	Lichen	3

	Hygrohypnum closteri	Closter's Brook-hypnum	
00	Possible concern	Moss	4
	Hypericum graveolens	Mountain St. John's-wort	
20+	Sensitive	Vascular plant	4
	Hypericum mitchellianum		Mitchell's
St. John's-wort	20+	Sensitive	Vascular
plant	4		
	Ilex collina	Long-stalked Holly	
00	Possible Sensitive	Vascular plant	4
	Juglans cinerea	Butternut	11
Forest concern F3	Vascular plant	3	
	Leptodontium excelsum	Grandfather Mountain	
01	Sensitive	Moss	4
		Leptodontium	
	Leptodontium flexifolium		Pale-margined
Leptodontium	01	Forest concern F3	
Moss	4		
	Liatris squarrulosa	Earle's Blazing Star	
01	Forest concern F1	Vascular plant	1
	Lilium philadelphicum var. philadelphicum		
Wood Lily	01	Forest concern F2	
Vascular plant	4		
	Liparis loeselii	Fen Orchid	01
Possible concern	Vascular plant	4	
	Lonicera canadensis	American Fly-honeysuckle	
10	Forest concern F3	Vascular plant	4
	Macrocoma sullivantii	Sullivant's Manned-moss	
11	Forest concern F3	Moss	3
	Marsupella funckii	A Liverwort	00
Possible concern	Liverwort	3	
	Megaceros aenigmaticus	A Hornwort	20
Sensitive	Hornwort	2	
	Milium effusum	Millet-grass	00
Possible concern	Vascular plant	3	
	Monotropsis odorata	Sweet Pinesap	06

Sensitive Vascular plant 3

Nardia scalaris ssp. scalaris A Liverwort
00 Possible concern Liverwort 4

Orthodontium pellucens Translucent Orthodontium
01 Sensitive Moss 4

Panax trifolius Dwarf Ginseng 26
Forest concern F3 Vascular plant 3

Phegopteris connectilis Northern
Beech Fern 07 Forest concern F2
Vascular plant 4

Plagiochila austinii A Liverwort 04
Sensitive Liverwort 4

Plagiochila corniculata A Liverwort
02 Sensitive Liverwort 4

Plagiochila echinata A Liverwort 03
Sensitive Liverwort 4

Plagiochila sharpii A Liverwort 07
Sensitive Liverwort 4

Plagiochila sullivantii var. sullvantii
A Liverwort 07 Sensitive Liverwort
4

Plagiomnium carolinianum Carolina
Star-moss 02 Sensitive Moss
4

Platanthera flava var. herbiola Northern
Green Orchid 02 Forest concern F3
Vascular plant 4

Platanthera peramoena Purple Fringeless Orchid
02 Forest concern F1 Vascular plant 4

Poa palustris Swamp Bluegrass 02
Forest concern F3 Vascular plant 4

Porella wataugensis A Liverwort 02
Sensitive Liverwort 4

	Prenanthes roanensis	Roan Rattlesnakeroot	
31	Sensitive	Vascular plant	4
	Radula voluta	A Liverwort	00
Possible Sensitive	Liverwort	4	
	Rhododendron cumberlandense		Cumberland
Azalea	04	Sensitive	Vascular
plant	4		
	Riccardia jugata	A Liverwort	00
Possible Sensitive	Liverwort	3	
	Robinia hispida var fertilis		Fruitful
Locust	03	Sensitive	Vascular
plant	4		
	Rubus idaeus ssp. strigosus		Red Raspberry
	03	Forest concern F2	
Vascular plant	4		
	Rugelia nudicaulis	Rugel's Ragwort	00
Posible Sensitive	Vascular plant	4	
	Saxifraga careyana	Carey's Saxifrage	
20+	Sensitive	Vascular plant	3
	Saxifraga caroliniana	Carolina Saxifrage	
07	Sensitive	Vascular plant	4
	Schlotheimia lancifolia		Highlands
Moss	01	Sensitive	Moss
4			
	Scopelophila ligulata	Copper Moss	01
Forest concern F3	Moss	4	
	Scutellaria saxatilis	Rock Skullcap	03
Forest concern F3	Vascular plant	4	
	Silene ovata	Mountain Catchfly	
15	Sensitive	Vascular plant	3
	Sphenolobopsis pearsonii		A Liverwort
01	Sensitive	Liverwort	4
	Spiraea virginiana	Virginia Spiraea	
02	Threatened	Vascular plant	4

	Stachys clingmanii	Clingman's Hedge-nettle		
01	Sensitive	Vascular plant	4	
	Synandra hispidula	Synandra		00
Possible concern	Vascular plant	3		
	Thaspium pinnatifidum	Mountain Thaspium		
02	Forest concern F2	Vascular plant	4	
	Trichomanes petersii	Dwarf Filmy-fern		
05	Forest concern F3	Vascular plant	4	
	Trientalis borealis	Starflower		02
Forest concern F2	Vascular plant	4		
	Trillium flexipes	Bent White Trillium		
00	Possible concern	Vascular plant	3	
	Trillium rugelii	Southern Nodding Trillium		
15	Sensitive	Vascular plant	3	
	Trillium simile	Sweet White Trillium		
04	Sensitive	Vascular plant	3	
	Tsuga caroliniana	Carolina Hemlock		
60+	Sensitive	Vascular plant	4	
	Vaccinium hirsutum	Hairy Blueberry		25
Sensitive	Vascular plant	3		

FOREST POPS - population numbers documented on the Forest; NATIONAL FOREST - rare plant status on National Forests in NC:
threatened & endangered = federally listed species, sensitive = USFS region 8 listed species, Forest concern F1 = species rare in NC
and generally rare across their entire range, Forest concern F2 = species rare in NC and geographically separated (disjunct) from their
main range, Forest concern F3 = species rare in NC and at the periphery of their geographical range, Possible = those species with
documented occurrences near the Forest, but not presently known to occur in the Forest;
OAR - Occurrence analysis results: 1 = species present in the activity area based on NC Heritage Program records and recent surveys,
2 = species present in the analysis area but not located in the activity area, 3 = suitable habitat may exist in the analysis area,
4 = suitable habitat does not exist in the analysis area.

APPENDIX F

NANTAHALA NATIONAL FOREST
PROPOSED, ENDANGERED, THREATENED, AND SENSITIVE
TERRESTRIAL ANIMAL SPECIES
(27 SPECIES)

*	Common Name	Scientific Name	U.S.	N.C.	NCNHP
Endangered and Threatened Species					
2	Spruce-fir moss spider	Microhexura montivaga	E	SR	G1 S1
	in moss and liverwort mats on rock and boulders in high elevation spruce-fir forest; Avery/Caldwell, Swain; no records on Forest				
2	Noonday globe	Mesodon clarki nantahala	T	T	G2T1?S1
	cool, wet areas under vegetation and leaf litter; Nantahala Gorge only				
2	Peregrine falcon	Falco peregrinus	E/SA	E	G4S1BS2N
	large vertical rock cliffs with ledges for nesting w/adequate bird prey; only Whiteside Mtn.; sensitive to disturbance				
2	Bald eagle	Haliaeetus leucocephalus	T	E	G4S2BS2N
	nests in large, open grown trees near lakes and rivers				
2	Virginia big-eared bat	Corynorhinus townsendii vir.	E	E	G4T2S1
	roosts in caves and rarely in mines, especially in limestone areas; 0 N				
2	Car. n. flying squirrel	Glaucomys sabrinus coloratus	E	E	G5T1S1
	mature spruce-fir and northern hardwoods above 4,000 feet; Unicoi & Balsam Mtns.; effects of mgt. activities				
2	Indiana bat	Myotis sodalis	E	E	G2SUBSZN
	roosts in caves, hollow trees, under loose bark of trees in riparian areas and uplands; effects to caves, riparian foraging habitat; 1 N				
Sensitive Species					
2	A ground beetle	Trechus balsamensis	-	SR	G1?S1?
	Waterrock Knob; Plott Balsam Mountains; only one locality; endemic; 0 N				
2	A ground beetle	Trechus luculentus luculentus	-	SR	G2T2S2?
	riparian; leaves and wet gravel beside small streams; mountains of southwestern N C; Clay, Graham, Macon, and Swain; 6 N				
2	A ground beetle	Trechus luculentus unicoi	-	SR	G2T2?S2?
	beneath rocks and moss in wet ravines and near seeps and springs above 3000';				

apparently endemic to the Unicoi mountains of Graham county; 4 N

2 A ground beetle Trechus rosenbergii - SR G1?S1?
in mat of spruce and fir needles piled against wet, vertical, rock faces;
Waterrock Knob and Richland Balsam, Jackson and Haywood co. 0 N

1 Diana frit. butterfly Speyeria diana - SR G3 S3
mature deciduous and pine woodlands near streams below 4000';
nectaring on joe-pye-weed, ironweed, butterflyweed; Cherokee, Clay, Graham, Macon

2 Milne's euchlaena Euchlaena milnei - SR GU S1S3
unknown

2 Mary Alice's sm-h fly Eulonchus marialiciae - SR G1G3S1S3
nectaring on Rubus at high elevations; GSMNP and Blue Ridge Parkway, Rough Butt Bald, Swain county, endemic to North Carolina; 0 N

2 Lost Nant. cave spider Nesticus cooperi C2 SR G1?S1
Blowing Springs and Lost Nant. Cave; Swain; effects to cave interiors

2 A nesticid spider Nesticus sheari - SR G2?S2?
on ground in moist or rich forests; apparently endemic to Graham county

1 A nesticid spider Nesticus silvanus - SR G2?S2?
habitat not indicated; apparently endemic to southern mountains of NC

2 Black mantleslug Pallifera hemphilli - SC G3 S2
high elevation forests, mainly spruce-fir; Jackson, Swain counties

2 Glossy supercoil Paravitrea placentula - SC G3 S2
leaf litter on wooded hillsides and ravines, Mitchell, Swain counties

2 Santeetlah dusky sal. Desmognathus santeetlah - SR G3QS2S3
stream headwaters and seepage areas; s.w. mtns.; hardwood, cove hardwood and spruce-fir; Great Smoky, Unicoi and Great Balsam mtns; 1 N

2 Junaluska salamander Eurycea junaluska C2 SC G2QS2
wider portions of streams below 2395'; Tululah and Santeetlah creeks, Cheoah River and tributaries; effects to riparian, water quality; 3 N

2 Tellico salamander Plethodon aureolus - SR G2G3QS2
hardwood forests in Unicoi Mountains with fallen logs, leaf litter and organic soil; far western Cherokee and Graham counties; 5 N

1 So. Appala. salamander Plethodon teyahalee - W3 G3QS3
moist forests, in southwestern mountains at all elevations; most records from Graham and Cherokee counties; also Clay, Macon, and Swain

2 Bog turtle Clemmys muhlenbergii T/SA T G3 S2
sunlit, marshy meadows, bogs, wet pastures, seepages; tributaries to Nantahala and L. Tennessee rivers; effects on hydrology, woody growth

2 Southern rock vole Microtus chrotorrhinus car. C2 SC G5T3S2
rocky areas in spruce-fir, n. hwds and grassy balds, above 3200'; Plott Balsams - GSMNP, Roan & Mt. Mitchell; effect of isolation of pops.; 0 N

2 E. small-footed myotis Myotis leibii leibii C2 SC G3SUBS2N
hemlock forests, rock crevices, caves, mines or buildings; possibly

throughout; effects to roost sites and surroundings

2 Southern water shrew Sorex palustris punctulatus C2 SC G5T3S2
streambanks 12-15' wide w/rhododendron cover in n. hardwood or spruce-fir forests above 3000'; Clay, Macon, Swain; effects to water quality

*Occurrence Criteria
1 - Potentially suitable habitat; may occur
2 - Lack of suitable habitat or outside the known or expected range
E, T, SC, SR - listed as endangered, threatened, special concern or significantly rare.
C2 - previously a candidate for federal listing

APPENDIX G
Aquatics PETS LIST
Nantahala National Forest
Updated 10/29/97

Threatened and Endangered Species

Type	Scientific Name	Common Name	NC Status	USFWS Status	NC Rank	Global Rank	Habitat/Distribution
Bivalve	Alasmidonta raveneliana	Appalachian Elktoe	E	E	S1	G1	Little Tennesse Rivere drainage and lower Tuckasseegee River
Bivalve	Pegias fabula	Littlewing Pearlymussel	E	E	S1	G1	lower Little Tennessee River
FIsh	Cyprinella monacha	Spotfin Chub	T	T	S1	G2	lower Little Tennessee River

Sensitive Species (Based on 7/96 USFS Region 8 List)

Bivalve	Fusconaia barnesiana	Tennessee Pigtoe	E		S1	G2G3	lower Little Tennessee River in NC
Bivalve	Lasmigona holstonia	Tennessee Heelsplitter	E	FSC	S1	G2G3	Small to large streams in Cherokee County, historical record
Bivalve	Villosa iris	Alabama Rainbow	SC		S1	G4	Little Tennessee and Hiwassee Rivers
Crustacean	Cambarus georgiae	Little TN Crayfish	SR		S1?	G1	streams in upper Little TN River drainage, upstream Franklin, NC
Crustacean	Cambarus parrishi	Parrish Crayfish	SR	FSC	S1?	G1	headwaters of Hiwassee River, Clay Co.
Crustacean	Cambarus reburrus	French Broad Crayfish	SR	FSC	S3	G3	Savannah River system, Transylvania Co.
Dragonfly	Gomphus consanguis	Cherokee Clubtail	SR	FSC	S1	G2G3	small spring-fed streams
Dragonfly	Gomphus viridifrons	Green-faced Clubtail	SR		S1S3	G3	rivers
Dragonfly	Macromia margarita	Margaret's River Cruiser	SR	FSC	S1S2	G2G3	rivers
Dragonfly	Ophiogomphus edmundo	Edmund's Snaketail	SR	FSC	S1?	G1	Blue Ridge escarpment streams
Dragonfly	Ophiogomphus howei	Pygmy Snaketail	SR	FSC	S1?	G3	rivers
Fish	Etheostoma vulneratum	Wounded Darter	SC		S2	G3	medium to large rivers, TN River system
Fish	Percina squamata	Olive Darter	SC	FSC	S2S3	G3	higher gradient upland rivers, TN River system

Forest Concern Species

Amphibian	Crypotobranchus allenganiensis	Hellbender	SC	FSC	S3	G4	Tennessee and Savannah River systems
Bivalve	Alasmidonta viridis	Slippershell Mussel	E		S1	G4	Little Tennessee River
Bivalve	Elliptio dilatata	Spike	SC		S1	G5	Little Tennessee River
Bivalve	Lampsilis fasciola	Wavy-rayed Lampmussel	SC		S1	G4	Little Tennessee River
Bivalve	Villosa vanuxemensis	Mountain Creekshell	T		S1	G4	Hiwassee River system
Caddisfly	Agapetus jocassee	A Caddisfly	SR	FSC	S?	G?	Lake Jocassee catchment, Transylvania Co.
Caddisfly	Helicopsyche paralimnella	A Caddisfly	SR	FSC	S2	G?	Lake Jocassee catchment, Transylvania Co.

Caddisfly	Hydropsyche carolina	A Caddisfly	SR		S1	G?	Whitewater River, Transylvania Co.
Caddisfly	Hydroptila englishi	A Caddisfly	SR	FSC	SR	G?	Lake Jocassee catchment, Transylvania Co.
Caddisfly	Rhyacophila amicis	A Caddisfly	SR		S2	G?	Cullasaja River, Macon Co.
Caddisfly	Rhyacophila melita	A Caddisfly	SR		S2	G?	Tusquitee Creek, Clay Co.
Caddisfly	Rhyacophila vibox	A Caddisfly	SR		S1S2	G?	Whiteoak Creek, Macon Co.
Crustacean	Cambarus hiwasseensis	Hiwassee Crayfish	SR	FSC	S3?	G4G5	streams in Hiwassee River system
Crustacean	Cymocythere clavata	Oconee Crayfish Ostracod	SR	FSC	S2?	G?	streams and rivers in Savannah River system, Transylvania Co.
Crustacean	Dactylocythere prinsi	Whitewater Crayfish Ostracod	SR	FSC	S1	G?	streams in Savannah River system, Jackson Co.
Crustacean	Skistodiaptomus carolinensis	Carolina Skistodiaptomus	SR	FSC	S1?	G?	Lake Ravenel in Macon Co.
Crustacean	Waltoncythere acuta	Trans. Crayfish Ostracod	SR	FSC	S2?	G?	streams and rivers, Transylvania Co.
Dragonfly	Aeshna tuberculifera	Black-tipped Darner	SR		S1?	G4	boggy areas and marshy ponds
Dragonfly	Cordulegaster erronea	Tiger Spiketail	SR		S2S3	G4	small forested streams
Dragonfly	Gomphus abbreviatus	Spine-crowned Clubtail	SR		S2S3	G3G4	rivers
Dragonfly	Gomphus descriptus	Harpoon Clubtail	SR		S1S3	G4	large streams and rivers
Dragonfly	Gomphus lineatifrons	Splendid Clubtail	SR		S2S3	G4	rivers
Dragonfly	Gomphus parvidens parvidens	Piedmont Clubtail	SR		S2S3	G4T?Q	small spring-fed streams
Dragonfly	Gomphus ventricosus	Skillet Clubtail	SR		S2?	G3	rivers
Dragonfly	Lanthus parvulus	Zorro Clubtail	SR		SR	G3G4	small spring-fed streams
Dragonfly	Ophiogomphus aspersus	Brook Snaketail	SR		S1?	G3G4	rapids of rivers and streams
Dragonfly	Ophiogomphus mainensis	Twin-horned Snaketail	SR		S1S3	G3G4	rapids of rivers and streams
Dragonfly	Stylurus amnicola	Riverine Clubtail	SR		S2S3	G3G4	rivers
Dragonfly	Stylurus scudderi	Zebra Clubtail	SR		S3?	G3	streams and rivers
Dragonfly	Sympetrum obtrusum	White-faced Meadowfly	SR		S1S3	G5	boggy or marshy ponds and lakes
Fish	Clinostomus, new species	Smoky Dace	SC		S2	G2Q	Little TN river drainage
Fish	Etheostoma inscriptum	Turquoise Darter	SC		S1	G4	large streams in Savannah River system
Fish	Micropterus coosae	Redeye Bass	SR		S1	G5	Savannah River system
Fish	Moxostoma, new species 1	Sicklefin Redhorse	SR		S1S2	G?	Little TN and Hiwassee Rivers
Fish	Notropis lutipinnis	Yellowfin Shiner	SC		S3	G4Q	Savannah and Little TN river systems
Fish	Notropis rubescens	Rosyface Chub	T		S1	G4	Savannah River System
Fish	Noturus flavus	Stonecat	E		S1	G5	warmwater streams and rivers, TN River system
Fish	Percina aurantiaca	Tangerine Darter	SR		S3	G3G4	large streams and rivers, TN River system
Fish	Percina caprodes	Logperch	T		S1	G5	streams, rivers, reservoirs in TN River system
Fish	Stizostedion canadense	Sauger	SR		S2	G5	large streams, rivers, reservoirs in Hiwassee River system
Gastropod	Goniobasis interrupta	Knotty Elimia	E	FSC	S1	G?(G1)	Hiwassee River and tributaries
Gastropod	Leptoxis virgata	Smooth Mudalia	SR	FSC	SU	G2	Hiwassee River and tributaries
Mayfly	Barbaetis benfieldi	A Mayfly	SR		S1	G?	Caney Fork, Jackson Co.
Stonefly	Megaleuctra williamsi	A Stonefly	SR		S1	G?	Cullasaja River, Macon Co.
Stonefly	Shipsa rotunda	A Stonefly	SR		S2S3	G?	mountain streams

Appendix H

Management Indicator Species Habitat Evaluation

Tsali Forest Health Project

INTRODUCTION

An assessment of habitat changes linked to management indicator species(MIS) is documented in this section. The assessment provides a checkpoint of project level activities, the change in habitat used by MIS, and the likely contribution to forestwide trends.

PROCESS

The amount of habitat changed by the project is checked for consistency with the Forest Plan and the recent trends in activities. If any inconsistencies are uncovered, then further investigation should be made to determine effects on MIS. However, if the project activities are consistent with recent trends, then effects of habitat changes to MIS should remain constant.

To process and document the information efficiently, a series of tables are used as follows.

1) **Tables MIS-1** and **MIS-2** are reproductions of the biological communities and special habitats examined in the forest plan (Plan EIS, III-48 to III-52) and the associated MIS.
2) **Table MIS-3 and MIS-4** list the biological communities and special habitats, along with forestwide estimates and the estimated change in habitat by the activities in the preferred alternative
3) **Table MIS-5** reverses the previous tables to show each species and the habitats they are indicating. Also, an estimate of their population trend is shown. More information about MIS habitats and population trends is documented in the MIS Assessment, a document continuously updated with information.

The process focuses on the effects of the preferred alternative for MIS, in the similar way that Biological Evaluations focus on effects of the preferred alternative for threatened, endanagered, and sensitive species. It provides another checkpoint for the decisionmaker to be aware of project level effects.

Table MIS-1. Biological communities and associated MIS (using Plan EIS, Table III-8).

Biological Community	MIS
Fraser fir forests	Fraser fir, golden-crowned kinglet, Carolina northern flying squirrel
Red Spruce/fraser fir forests	Golden crowned kinglet, Carolina northern flying squirrel, solitary vireo
Grassy and heath balds	Mountain oat-grass, Catawba rhododendron
Northern hardwood forests	Carolina northern flying squirrel, twisted stalk, solitary (blue-headed) vireo
Carolina hemlock bluff forests	Golden-crowned kinglet, Carolina hemlock
Cove forests	Ginseng, black cherry, buckeye, basswood, solitary (blue-headed) vireo
Oak and oak/hickory forests	Red oak, white oak, hickories
White pine forests	White pine (natural community only)
Yellow pine mid-successional communities	Pine warbler (low elevational shortleaf/Virginia pine)
Xeric yellow pine forests	Pine warbler (pine/oak/heath low elevation habitats) pitch pine, table mountain pine, turkey beard, mid-successional)
Reservoirs	Index of biotic integrity, largemouth bass, bluegill
Forested seep wetlands	Golden saxifrage, umbrella leaf, mountain lettuce
Bogs	*Sphagnum spp.*
Mountain ponds and ephemeral pools	Spotted salamander (vernal pools)
Barrens and glades	Prairie dropseed, slender wheatgrass
Shaded rock outcrops and cliffs	Green salamander (granitic gneiss rock outcrops with crevices and mesic conditions), Jordan's salamander, alumroots, saxifrages
Open rock outcrops and cliffs	Raven, peregrine falcon, Biltmore sedge, wretched sedge, mountain oat-grass
Caves	Bats (all cave-using species)
Alluvial forests	Two-lined salamander (mid-late successional stages), raccoon (all forest types), mink
Coldwater streams	Brook, brown, and rainbow trout; sculpin, blacknose dace
Coolwater streams	Smallmouth bass, white sucker, moxostoma spp., index of biotic integrity
Warmwater streams	Index of biotic integrity, smallmouth bass, freshwater mussels, spotfin chub

Table MIS-2 Special Habitats and associated MIS (using Plan EIS, Table III-9).

Special Habitat	MIS
Old Forest Communities (100+ years old)	Black bear (dens, low levels of disturbance), bats (roosting and foraging habitats in mature forests), pileated woodpecker (cavities, foraging habitat), lung lichens
Early successional (0-10 years old)	White-tailed deer (all communities and elevations), eastern wild turkey (all communities), ruffed grouse (early and mid-successional all communities) rabbits, rufous-sided (eastern) towhee, bobcat, field sparrow (brushy, riparian thickets)
Early successional (11-20)	Rufous-sided (eastern) towhee, ruffed grouse (early and mid-successional all communities)
Soft mast producing species	Wild grape (*vitus spp.)*, cedar waxwing (all communities soft mast)
Hard mast-producing species (>40 yrs)	Black bear, wild turkey, gray squirrel, white-tailed deer
Cove forests	Ginseng, black cherry, buckeye, basswood, solitary (blue-headed) vireo
Mixed pine/hardwood forest types (successional stage and hard mast)	Black bear, eastern wild turkey, gray squirrel, white-tailed deer
Contiguous areas with low disturbance (< 1 mile open travelway/4 square miles	Black bear (all communities)
Contiguous areas with moderate disturbance levels (<1 mile open travelway/2 square miles)	Eastern wild turkey (all communities)
Large contiguous forest areas	Ovenbird (in breeding range, moderately productive sites), northern parula warbler (in breeding range, requires cover and riparian habitats) veery, solitary (blue-headed) vireo
Permanent grass/forb openings	Eastern wild turkey, eastern meadowlark, rabbit
Den trees (>36” dbh)	Black bear (large dens)
Snags and dens (>22” dbh)	Pileated woodpecker, raccoon (moderate sized dens)
Small snags and dens	Gray squirrel, white-breasted nuthatch, yellow-bellied sapsucker (breeding populations)
Downed woody debris – all sizes (foraging and cover habitats)	Black bear (all communities), pileated woodpecker, ruffed grouse (down logs for drumming),Jordan’s salamanders

Table MIS-3 Biological communities, forestwide estimates, and expected changes resulting from the preferred alternative.

Biological Community	Forestwide Estimate	*Estimated Changes*
Fraser fir forests	See below	None Affected
Red Spruce/Fraser fir forests	14,700 ac	None Affected
Grassy and heath balds	18 occurrences	None Affected
Northern hardwood forests	52,000 ac	None Affected
Carolina hemlock bluff forests	6 occurrences	None Affected
Cove forests	Rich= 107,500 ac Acidic= 174,500 ac Cove(other) =2,800ac	There may be a shift to more oak individuals in the upper slopes of the rich cove communities proposed for preharvest oak treatment (57 acres). The prescribed burning is not anticipated to affect either the rich cove or acidic cove forest in the proposed burn areas.
Oak and oak/hickory forests	High El R.Oak: 40,500 ac Mesic Oak/H: 283,340 ac Dry Mesic Oak/H: 21,7000ac	Proposed harvest units in 2-age regeneration (43 acres) and the thinning (18 acres) anticipated to result in a reduced oak component. The proposed burning and the preharvest oak treatments (11 acres) should result in an increase in natural regeneration of oak and hickories within this community type in the long term.
White pine forests	WP/Oak : 17,600 ac	Not affected by the preferred alternative
Yellow pine mid-successional communities	13,400 ac	Pine-oak habitat is anticipated to have a reduction in the oak component following the 2-age regeneration (53 acres) and the thinning (64 acres) harvest. Preharvest oak treatment on 46 acres and the extensive burning should help to maintain the oak component in the long term.
Xeric yellow pine forests	17,400 ac	Prescribed fire and thinning harvest will not result in any change to this community. The burning will maintain this fire dependent community.
Reservoirs	36,000 ac	This habitat is located in the project area, but not affected by activities in the preferred alternative
Forested seep wetlands	22,000 ac (high prob)	Seeps within the analysis area occur within the protected riparian zone, not affected
Bogs	10 occurrances	None Affected
Mountain ponds and ephemeral pools	27 ponds/pools (22 ac) 9 Beaver Ponds (3 ac)	No mountain ponds affected; Ephemeral pools may be affected

Biological Community	Forestwide Estimate	*Estimated Changes*
Barrens and glades	1 occurrance (300ac)	None Affected
Shaded rock outcrops and cliffs	66,282 acres (high probability)	Possible impact from preharvest oak treatment and prescribed fire. These impacts on modifying the amount of light reaching the rock surface expected to be minimal.
Open rock outcrops and cliffs	141 occurrances (800 ac)	None Affected
Caves		None Affected
Alluvial forests	21,000 ac Alluvial Forest 55,000 ac other floodprone areas	Not Affected by preferred alternative
Coldwater streams	5,060 mi	This habitat is located in the project area, but not affected by activities in the preferred alternative
Coolwater streams	400 mi	None Affected
Warmwater streams	210 mi.	None Affected

Table MIS-4 Special Habitats, Forestwide estimates and changes of the preferred alternative.

Special Habitat	Forestwide Estimate	Estimated Changes
Old Forest Communities (100+ years old)	171,000 ac	None
Early successional (0-10 years old)	26,800 ac (yr 2000) 2040 ac (5 yr av) downward trend	Increase of 117 acres
Early successional (11-20)	46,290 ac (yr 2000) Peak of upward trend	None
Soft mast producing species	High Probability 5,800 ac downward trend	Increase of 117 acres by 2005
Hard mast-producing species (>40 yrs)	681,000 ac increasing trend	Decrease of 136 acres
Mixed pine/hardwood forest types (successional stage and hard mast)	52,521 increasing trend	Regeneration of 53 acres
Contiguous areas with low disturbance (< 1 mile open travelway/4 square miles	160,832 ac	None
Contiguous areas with moderate disturbance levels (<1 mile open travelway/2 square miles)	576,240 ac	None
Large contiguous forest areas	38 Patches (302,000 ac)	None
Permanent grass/forb openings	3,000 ac	No permanent grass/forb; but 67 acres Of woodland habitat
Den trees (>36" dbh)	See below	None affected
Snags and dens (>22" dbh)	See below	None affected
Small snags and dens	Ave. at 80 yr. Cove= 4/ac Upland=3/ac Pine-2/ac	None affected
Down Woody Material	***High Accumulation*** Small wood: 18,000 Large wood: 386,000	***High Accumulation*** Small wood: Increase on 553 acres

	Low Accumulation approx: 600,000	

DISCUSSION

Cove forest. This project should continue the recent upward trend of timber stand improvement (preharvest oak treatment) in cove hardwoods, thus favoring oak species.

Oak Hickory Forest. About 3 percent of the oak hickory forests in the project area will be regenerated; this follows the forest average. Due to the artificial regeneration of shortleaf pines in this type, there will be fewer oaks but those remaining will be higher quality. The preharvest oak treatments (11 acres) is consistent with the upward trend in timber stand improvement. The increase in prescribed fire within oak-hickory forest in the Tsali area should favor oaks and a richer understory.

Yellow Pine Mid Successional Communities. Mid successional yellow pine and pine-oak habitat is anticipated to have a reduction in the oak component in the short term from 2 age regeneration, however there should be a increase in this component for the long term. This project should not result in any trend changes to those species associated with this habitat.

Xeric Yellow Pine. The prescribed fire and thinning harvest in the xeric pine habitat should create a localized upward trend in species dependent on pitch pine-oak/heath habitat. This project will help to reverse the Forest downward trend in species associated with this habitat.

Shaded Rock Outcrops. Impacts to the overstory canopy surrounding shaded rock outcrops are fewer during the past 10-year period. The thinnings and 2-age regeneration activities are expected to leave enough canopy such that the habitat provided by shaded rock outcrops would not be irretrievably damaged. This area has low probability of outcrops occurring; only one rock outcrop was observed during field surveys.

Mountain Ponds and Ephemeral Pools. No mountain ponds would be affected by the project. Ephemeral pools, such as water in road ruts, would be affected by activity. The vegetation treatments are temporary; ephemeral pools along roadways would become re-established and useable habitat immediately following the activity. Recreation activity, such as mountain biking through ephemeral pools, is persistent and could make pools unusable for habitat. With the amount of recreational use in the Tsali area, it is anticipated that damage to pools in roadways has already occurred, thus any additional damage caused by this project would be incidental.

Early Successional Habitat. This project would contribute early successional habitat (ESS) habitat of 177 acres, which is about 6 percent of the forestwide average over the last 5 years. Other projects throughout the forest will contribute to ESS habitat, and cumulatively, they would be near the forestwide average. However, in 2001 there have been fewer than expected projects and the downward trend over the past 5 years is likely to continue.

Soft mast. Soft mast producing species have declined across the Forest since 1990 and 1980, adversely affecting the availability of this habitat for associated species. This project will create some new habitat, but in combination with other current vegetation management activities, this will not be sufficient to reverse this downward trend.

Hard Mast. Hard-mast producing species greater than 40 years old have increased across the Forest since 1990 and 1980, as younger stands have matured into this age-class. This project, along with other similar projects, will cumulatively reduce the amount of this habitat available, up to the forest annual average of cove and upland forests regeneration (approx 1600 average ac/ year). However, this reduction has little

effect on the total availability of hard mast and is not likely to change the trend of increasing hard mast availablility.

Mixed pine/hardwood forest. Mixed pine/hardwood forest types have declined across the Forest since 1990 and 1980. This project will regenerate this habitat back to the same type, which will not affect the total amount of this forest type across the Forest.

Down woody material. Down woody material has increased across the Forest since 1990 and 1980, due to the aging of the Forest and the effects of hurricanes, windstorms, and the southern pine beetle. This project will increase the amount of small diameter down woody material on the forest floor. The trend for down woody material in larger size classes will continue to increase, specifically in the Tsali area due to recent southern pine beetle attacks.

EVALUATION

First, many of the biological communities and special habitats in the project area are not affected by activities in the preferred alternative. Second, the habitat changes cited above are consistent with the Nantahala/Pisgah Forest Plan; most of the habitat changes are needed to accomplish the multiple use goals of the plan. Finally, the cumulative effect of this project, along with other similar projects, would change habitats in amounts close to forestwide averages of the recent past. Therefore, population trends of MIS related to habitat changes on the forest would continue as cited in the most recent update of the MIS assessment.

Appendix I
RESPONSE TO COMMENTS
TSALI PROJECT
CHEOAH RANGER DISTRICT

KEY INTEREST: Forest Health

1) Comment: If the southern pine beetle is such a problem, why plant more pine trees?

Reply: The natural forest ecosystem at Tsali includes southern yellow pine species mixed with various species of hardwoods common to the southern Appalachians. Outbreaks of southern pine beetle are often attributed to slow growth rates in predominately pure or nearly pure pine stands.

Pine seedlings planted would be on a 15 by 15 spacing. The objective is to produce mixed hardwood/pine, or pine/hardwood stands with this spacing which is resistant to southern pine beetle infestation. Prior to planting, prescribed burning will occur which also increases the amount of hardwood diversity in mixed stands. The wide spacing gives the opportunity for hardwoods to compete and grow alongside the pine seedlings. When canopy closure occurs (somewhere around age 10 to 15 years old), the future forest will be a mixed hardwood/pine or pine/hardwood forest.

2) Comment: The project will likely improve the overall health of the forest and reduce the threat of a potentially more drastic event and the subsequent change in vegetation and scenic views.

Reply: This statement is the major objective of this project. By taking a proactive approach rather than reacting to insects and disease as they occur will in the end, produce the desired future conditions at Tsali.

3) Comment: We question the need to justify this project based on a perceived threat from gypsy moths.

Reply: The potential for damage by gypsy moth are based on years of study regarding susceptibility and vulnerability and what role defoliation plays in tree mortality. The forest types at Tsali are susceptible and vulnerable to defoliation from this insect.

At present, gypsy moth populations in the northeast are experiencing drastic declines due to the fungus entomophagia maimaiga. In June and July of 1989, *E. maimaiga* was first discovered in seven contigious northeast states. Extensive disease outbreaks were observed in increasing populations of gypsy moth in all of these states. Undoubtedly, these outbreaks with accompanying high mortality rates, prevented defoliation and subsequent damage to the oak component of the forest. However, *E.maimaiga* does not occur in all areas where the gypsy moth occurs, especially in those areas more recently colonized by the gypsy moth (Hajek et.al. 1990). This fungus is prevalent in low to high-density gypsy moth populations, causing up to 100% mortality of late stage larvae. *E.maimaiga* is highly variable, and as yet, unpredictable in reducing gypsy moth populations. Although gypsy moth is a non-native insect to this country, most scientists believe that it is and will continue to be an influence to our hardwood forests here in the east. Only time will tell to what degree and what frequency *E.*

maimaiga will influence gypsy moth populations. The fungus **could** play a major role in the natural control of gypsy moth, especially in years where environmental conditions are favorable for the fungus. We are unaware of any agencies or scientists that are ready to say gypsy moth is no longer a significant influence to our hardwood forests. Many of the forest types at Tsali are vulnerable to gypsy moth due to their declining health. The health of our oak forests at Tsali is primarily related to the loss of the American chestnut years ago and the exclusion of fire. Many species such as oak replaced the chestnuts and unfortunately, the oaks are now growing on sites that are not the best to support healthy oak trees. Therefore, these trees, after a certain age begin to decline and are vulnerable to events such as defoliation. The Forest Service will continue to perpetuate young vigorous growing upland oak stands to minimize the risk of insects and disease and provide food for various species of wildlife.

4) Comment: We do not feel that any special, proactive silvicultural methods are required, at least with respect to this particular forest pest.

Reply: Silviculture treatments for are more effective if performed 10 to 15 years ahead of infestations. The forest has had time to recover from logging stress and is more likely to survive defoliation. To reduce the impact of gypsy moth, those oak trees in poor health are marked for removal. No one can or is ready to say when and if gypsy moth will be established in Western North Carolina. The fungus entomophagia maimaiga **could** play a major role in the natural control of gypsy moth, especially in years with a wet spring. We are unaware of any agencies or scientists that are ready to say gypsy moth is no longer a significant influence to our hardwood forests.

5) Comment: The Forest Service generally contends that trees are somehow wasted when they die. If the trees die, they need to be allowed to fulfill their function and be recycled back into the ecosystem. The no-action alternative needs to consider these values.

Reply: The EA for this project does not address whether trees are wasted or not when they die. We do, however, point out the large-scale mortality that can and has happened in the past due to forest health threats, in particular, the southern pine beetle. The Forest Service is aware of the natural processes involved with "recycling" within ecosystems. We are also aware that it is the rate and amount of change the " recycling"processes bring about, that raises forest health concerns. The intense recreation and wildlife use at Tsali makes a hands off approach inappropriate. To ignore current ecological conditions that promote unhealthy forest and ultimately interfere with the recreation experience at Tsali is not consistent with sound forest management processes.

6) Comment: The analysis needs to disclose how many standing and fallen dead trees would there be in a healthy natural forest of this size and the status of this habitat component. The analysis needs to disclose the effects of the proposal on this important habitat.

Reply: The current guidelines require that all dead trees or snags be left during tree harvest operations. Down dead trees are generally left on site. The commenter does not specify what is a healthy forest. Many definitions and opinions exist that describe a healthy forest. A couple of definitions that seem to fit to some degree almost all concerned are:

> *Utilitarian Perspective---Biotic (living) or abiotic (non living values such as economics) influences do not threaten management objectives now or in future.*

Ecosystem Perspective---Forest communities are resistant to catastrophic changes and if these changes occur, have the ability to recover; with an equilibrium existing between supply and demand of resources (sunlight, water, nutrients, and space). These communities will support diverse seral stages (various age groups excluding mature) and stand structures for native species.

A complete agreement or consensus of the above perspectives is not necessary to determine that the Forest Service endeavors to support both of these definitions. If the Forest Service ignores the utilitarian perspective, and relies only on the ecosystem perspective, the rate and amount of change often present with the hands off approach, conflicts with management objectives, current use, and raises forest health concerns. Such is the case at Tsali. To ignore forest health issues and the catastrophic change they can and have created in the past ignores the current recreation use at Tsali. With proper forest management including logging and fire, the forest ecosystem can continue to support those species adapted to the ecological sites that exist across the peninsula.

7) Comment: The issue of the effects the project will have on other stands in times of high wind needs to be addressed. The analysis needs to address if the opening will funnel the wind to other trees that will result in blow down. By the same token, the analysis needs to address if the trees left standing can survive high winds.

Reply: High winds are something that cannot be predicted or prevented. All we can do is not plan large regeneration cuts for a ridge that leaves the adjoining stands vulnerable. The size of regeneration openings is regulated by NFMA and the Forest Plan. In the Management Prescription, the upper limit is 25 acres. In this project, no regeneration cuts are over 25 acres. Based on the experience of the foresters on this Forest, regeneration cuts have not resulted in extensive blow down of trees in adjacent stands. Sometimes the some leave trees left in a regeneration stand succumb to blow down. The majority of leave trees remain standing and shed seed to reforest the stands where they are left. By the time a stand is of an age where we look at it for a regeneration possibility, there is already some mortality and blow down present. This is a natural part of succession.

8) Comment: The Forest Service must resurvey this area, as well and ascertain whether the beetle presents a high risk, or is merely puffery to justify this timber sale.

Reply: The data collected for this project has, to say the least, been extensive. Working models that rate the susceptibility and vulnerability of insects and disease to the forest types present at Tsali were applied. The model used to predict southern pine beetle susceptibility has, as of January 13, 2000, been 86 % accurate. In other words, 86% of the stands rated as moderate to high for southern pine beetle susceptibility are currently infested with southern pine beetle. An aerial survey was conducted in 2000 to determine the extent of active southern pine beetle infestation on the Cheoah Ranger District. As of August 31, 2001, over 90% of stands rated as susceptible are infested. Even stands that were rated lower in susceptibility are being infected due to the extreme high concentration of the insect.

KEY INTEREST: Recreation

9) Comment: It seems unnecessarily risky to promote hunting in the same place you promote hiking, horseback riding, and mountain biking.

Reply: National Forest Land is managed by law for multiple uses. The North Carolina Department of Natural Resources, Fish and Game Division, enforces hunting regulations and issue licensees.

10) Comment: The meager investment in trail construction seems inconsistent with the disproportionately heavy use of the area by mountain bikers and horseback riders.

Reply: The focus of this project is three-fold: address forest health issues, address the need for additional grass/forb habitat, and provide some additional miles of trails. We anticipate investments in additional trails, beyond those proposed in this project, may be made in the future. A product of the scoping and analysis process for Tsali is a questionnaire that was developed specifically for Tsali by researchers from The University of Georgia to answer questions regarding the amount and types of trails desirable in the long term. The Forest Service feels it would be prudent to first examine results from the questionnaire before proposing additional trails beyond those in this project.

11) Comment: I would want to see less timber cut and more of the proceeds devoted to trail construction and maintenance.

Reply: One of the objectives of this project is to prescribe those forest management practices that will reduce the impact of insects and disease across the area. The idea here is to lessen the impact, therefore, lessen the amount of maintenance and unscheduled interruptions to recreation use due to salvage logging. It is important to remember that since mountain trail biking has become so popular at Tsali, the Forest Service has:

Constructed 18 additional miles of trail
Added bathrooms
Constructed a bike washing station
Constructed a new parking lot
Made physical improvements to existing infrastructure

12) Comment: We continue to be concerned with the effects of the proposed increases in trail miles in Tsali and throughout the National Forests in North Carolina.

Reply: Recreational use of the Forest is rapidly increasing, particularly in non-traditional uses such as mountain biking. Conflicts with other recreational users are inevitable.

13) Comment: Bike and horse trails create conflicts with other forest users, degrades grass/forb and other terrestrial wildlife habitats, degrades water quality, destroys riparian vegetation, as well as disturbance factors associated with human activity.

Reply: Adverse effects to wildlife habitats and water quality can be minimized with proper management. Disturbance factors and conflicts with other forest users are inevitable with increasing

recreational use. This project proposes an increase in grass/forb habitat with maintenance of that component over time.

14) Comment: Adequate trail maintenance associated with heavy use appears to be beyond the current budgets and capabilities of most ranger districts throughout the national forests.

Reply: Unfortunately this is true in many cases and is due in part to the lack of funding Congress appropriates each year for trails and recreation. Many user groups volunteer to help maintain trails and support a user fee specifically for trail maintenance. Also, Tsali is a Recreation Fee Demonstration site and collects fees from users that go directly to support maintenance of the site.

15) Comment: We are also concerned that no provision for "hunter use" was provided in the EA. We recommend the closure of certain areas to biking and other recreational activities during portions of the hunting season to avoid conflicts between the various user groups.

Reply: That option could minimize conflicts between recreational users; however, national forest lands are managed for multiple uses.

KEY INTEREST: Wildlife

16) Comment: For all state and Federal threatened and endangered (including candidate species), sensitive species, species of concern, and rare species the analysis needs to:

Describe the desired future condition (habitat quality, quantity, and configuration needed to support the desired population levels.

Disclose any known or suspected limiting factors.

Define suitable habitat and the status the of the habitat in the project area for the species.

List management recommendations that would remove or mitigate any adverse effects.

Reply: The Biological Evaluation and WILDA. BOTA, and AQUA evaluate the potential effects to populations and individuals of appropriately selected species and whether or not such impacts are likely to result in loss of viability across the forest. Required mitigations (if any) are also stated. Factors considered relevant by the specialist doing each report are considered in the analysis.

17) Comment :In most areas of the National Forests, managers are failing to meet the grass/forb requirements outlined in the Land and Resource Management Plan.

Reply: One objective is to maintain existing grass/forb habitat. Due to limited funding, maintaining status quo has been difficult. This proposal will establish additional grass/forb areas with the project boundaries.

18) Comment: Although the plan proposed creation of "savannas" to mitigate for grass/forb habitat loss, we are concerned that funding for the continuous prescribed burning required for this activity may not be available in future years.

Reply: That is correct. Funding for the planned prescribed burning is not assured However, there is currently increased funding available under the National Fire Plan.

19) Comment: The impact of cowbird parasitism and predation on forest interior birds should be prominently considered.

Reply: The most recent information indicates that cowbird parasitism and predation are not likely to be a problem in landscapes that are primarily forested (greater than 75%).

20) Comment: The analysis needs to consider the degree to which the alternatives would impede the movement and dispersal of closed-canopy forest wildlife species between stands and larger regions. The analysis should present and quantify the degree of fragmentation within the project area that has already taken place and those that will occur as a result of the various alternatives. These patterns need to be compared to the historical patterns that existed prior to human disturbance

Reply: It is unclear which species you consider "closed-canopy forest wildlife species". The project area is surrounded by the waters of Fontana Lake and Highway 28. These are the major factors that would "fragment" the landscape for species restricted to forested habitats. The timber harvest and regeneration that is proposed will maintain the same pattern on the landscape that exists now. These temporary openings do not produce the same fragmentation effects as permanent openings, such as highway right-of-ways and agricultural fields. The historical pattern of this particular landscape prior to human disturbance is unknown.

21) Comment:

Analysis needs to be conducted and presented to show the range of potential impacts for the following variables:

total amount and distribution of late-successional and mature forest habitat.
total amount and distribution of important wildlife habitats now uncommon due to past human activity.
total amount and percentage of forest habitat compromised by edge effects.
size distribution of habitat patches by seral stand and forest type.
forest patch perimeter to edge ratio.
amount and distribution of roadless area within and adjacent to the planning area.
degree of connectivity between both individual forest stands and larger habitat blocks.
degree of structural contrast between habitat patches.
population viability analysis for species or feeding guilds most prone to fragmentation effects

Reply : The variables considered relevant to the habitat analysis for this particular project are considered in the WILDA, BOTA and AQUA. These include the amount of grass/forb habitat, age class distribution, open road density, hard mast production, old growth, riparian areas, turbidity and sedimentation in streams, and impacts to understory vegetation. There is no roadless area at Tsali and "roadless" is not considered an issue for this project.

22) Comment: An alternative to manage this area for forest interior species (by changing its management prescription if needed) must be considered. Projects that reduce the fragmentation of the area should be considered.

Reply: Forest interior species and fragmentation effects are analyzed in the Forest Plan. The project area is not designated as an area designed to maximize habitat for forest interior species or minimize fragmentation effects. Other areas of Nantahala National Forest have been deemed more suitable for providing forest interior conditions, and have been designated for that use.

23) Comment: The analysis must cumulatively consider whether interior species can escape extinction if the project area is not protected. The issue of how forest interior species such as the wood thrush can maintain a minimum viable population without protecting this area needs to be addressed.

Reply: Forest interior species and fragmentation effects are analyzed in the Forest Plan. The project area is not designated as an area designed to maximize habitat for forest interior species or minimize fragmentation effects.

24) Comment: The population trends of threatened, endangered, sensitive species, and need to be disclosed for the Ranger District, Forest, and Region. These trends of threats to these species in each Ranger District, Forest, and Region needs to be disclosed.

Reply: Information regarding these species is contained within the Biological Evaluation and associated special reports.

25) Comment: The analysis needs to disclose and consider all the monitoring data that has been conducted in the project area. If there has been no monitoring done in the project area, the Forest Service should not be proposing any projects until it obtains monitoring data for the area.

Reply: Numerous data have been collected for the Tsali area through surveys and monitoring reviews. An integrated resource review of the area was conducted in 1994. Since then many specialized resource inventories and surveys have been conducted. Some of these are discussed in the EA, WILDA, BOTA, and AQUA.

26) Comment: The Forest Service failed to consider impacts to the Appalachian elktoe, which occurs throughout the Little Tennessee drainage. The EA fails to indicate if surveys for the elktoe were performed. Consultation with the USFWS under Section 7 of the ESA is required for this species. Failure to consult will result in litigation under the ESA.

Reply: Habitat for the Appalachian elktoe is generally considered to be fast flowing streams, creeks and rivers. The presence of the Appalachain elktoe was not discovered in the streams and creeks within the project area that drain into Fontana Lake.

27) Comment: The viability of several aquatic Management Indicator Species will be impacted, in violation of the NFMA. Eggs and juveniles will be killed by sediment, and the cumulative impacts of these losses are ignored. The Forest Service cannot undertake this project if viability will be decreased.

Reply: The effect on aquatic resources is discussed in the Environmental Assessment under the Environmental Impacts Section (Water Quality and Aquatic Resources). There are no species where viability will be impacted.

KEY INTEREST: Planning/Process

28) Comment: Logging is an inappropriate use of public forests and is contrary to the public interest. The analysis needs to address the need for the timber sale.

Reply: The primary purpose for this project is forest health. The timber sale is a tool to accomplish the forest health objectives. As an agency of the federal government, the USDA Forest Service responds to Federal Law. Congress has identified that one role of the national forest system is to produce and provide trees for the consumptive use of the citizens of the United States. For instance, the Organic Administration Act, June 4, 1897, states," No national forest shall be established, except to improve and protect the forest within the boundaries…and to furnish a continuous supply of timber for the use and necessities of citizens of the United States". The Weeks Law, March 1, 1911, under which most of the Eastern National Forest System lands have been assigned states, "The Secretary of Agriculture is hereby authorized and directed to…purchase such forested…lands within the watersheds of navigable streams…necessary…for the production of timber…"Also the National Forest Management Act, October 2,1976, states, "…the Secretary of Agriculture, may sell…trees, portions of trees, or forest products located on National Forest System lands."

Clearly, Congress has determined that producing and selling trees for timber is an appropriate use of public (National Forest) land and is in the public interest.

29) Comment: We wish to raise the issue that all laws that apply to the project need to be followed.

Reply: The Decision Notice for the project discusses compliance with various laws applicable to the project.

30) Comment: The Forest Service must disclose site-specific monitoring data, which demonstrates that there is a need for the sale. The need analysis must also address why natural processes will not create enough early successional habitat.

Reply: As the Purpose and Need Section clearly state this is a forest health project rather than a timber project. Timber products being removed clearly fit into the multiple use policy of the Forest Service.

The Forest Service has collected data on over 200 plots across the Tsali Peninsula. The field data collected shows that there is a need for vegetative manipulation to reduce the threat of insects and disease that have and are at this moment conflicting with management objectives and use of the area. The analysis area for this project is undergoing a southern pine beetle outbreak at this time and it is anticipated that the outbreak will continue and intensify. The stands ranked at high risk during the collection of the field data are being attacked first.

The Purpose and Need section states what the objectives are for this project. The vast majority of users for this area recreate on the trail systems and the Forest Service shared data results and worked closely with them regarding alternative developments that would least impact the trail system. The current southern pine beetle outbreak is not a first for this area. There is evidence of serious infestations that go back to 1939. The Forest Service acquired much of the analysis area from Tennessee Valley Authority and Whiting Manufacturing Company in 1947 and 1948 respectively. The use of this area has changed over time. In 1947 or 1948, mountain trail biking was not occurring and what horse travel still in use was not for pleasure. The Forest Service acquired worn out farmland that was eroding and very little pine type was left due to the southern pine beetle and wild fire.

The natural processes underway today at Tsali, can indeed create an abundance of early sucessional habitat. These processes would create too much at one time. Proactive management activities can have the effect of spacing out creation of early successional habitat and lessening the possible impacts of gypsy moth and oak decline, thus providing more consistent conditions for wildlife and recreationists. Trail use could be less satisfactory and wildlife habitat for some of management indicator species would be reduced if large amounts of early successional habitat occur at one time as a result of insect and disease assault.

31) Comment: The project needs to be considered within a landscape context.

Reply: Landscape analysis was performed during completion of the Land and Resource Management Plan, Nanatahala and Pisgah National Forests, Amendment 5. This project tiers to the forest plan.

32) Comment: The alternatives considered do not represent a range. Water quality impacts, PETS species impacts, road construction impacts, associated vegetation management, and the effects of erosion are identical for all alternatives. The Forest Service dropped consideration of a non-commercial alternatives, despite repeated requests for such an alternative. Such an alternative would prove that the Forest Service's economic analysis is biased toward timber extraction.

Reply: The range of alternatives was developed from scoping and the range of possible desired future conditions for the area. A non-commercial alternative was considered but dropped from detailed analysis since it is not considered a practical alternative. It foregoes the opportunity to provide wood products that could help support the local communities, and it could negatively affect the scenery since felled trees would be left in place.

33) Comment: We specifically request consideration of an alternative that would utilize available funds for this project to support the ecological restoration component of this sale by itself, without completing the commercial sale component.

Reply: This alternative was discussed in the EA under "Considered but dropped from detailed analysis". A non-commercial alternative was considered but dropped from detailed analysis since it is not considered a practical alternative. It foregoes the opportunity to provide wood products that could help support the local communities, and it could negatively affect the scenery since felled trees would be left in place.

34) Comment: Cumulative impacts analysis is incomplete and conclusory. The Forest Service cannot conclude that this project will have no cumulative impacts if it cannot quantify the impacts from past projects.

Reply: Cumulative impacts analysis has been supplemented.

35) Comment: The Forest Service is creating more early successional habitat with this sale, despite the lack of a shortage. This must be disclosed and analyzed.

Reply: In the EA, the Alternatives Considered section fully discloses the amount of early successional age class.

The objectives and desired future conditions are to lessen the impact of forest insects and disease. Currently, the project area is experiencing an outbreak of southern pine beetle (SPB). If the outbreak continues it is projected that much more of the forest will be in an early seral stage due to SPB than the logging proposed in the Preferred Alternative, Alternative V. The reduction in the impact of this insect to the pine forest at Tsali is one of the major objectives of the project. It is an ecosystem restoration project. The value and volume of wood products that are proposed to be harvested from Tsali are not high value products. The Forest Service used models to predict what stands were vulnerable to southern pine beetle. In the Purpose and Need Section of the EA, the Forest Service points out clearly why we feel that a proactive approach to insects and disease is the appropriate course of action. The heavy use of this area by mountain trail bikers and forest health threats like southern pine beetle have had in the past, strongly suggest that a proactive approach is much more desirable, cost efficient, and promotes forest health more than reacting to insects and disease as they occur.

KEY INTEREST: Biodiversity

36) Comment: The issue of biodiversity and forest fragmentation needs to be considered.

Reply: Diversity of species, age classes and forest types are discussed in the biological analyses. The issue of forest fragmentation is primarily discussed in the Forest Plan as a forest-wide issue. This issue is dealt with in the Forest Plan by providing a network of forest interior patches and old growth patches across the landscape, connected by predominantly mature forest. This supports biodiversity and mitigates potential effects of fragmentation.

37) Comment: The degree to which this area provides a biological corridor and its value should be considered. Sampling effect and minimum area requirements of all species should be addressed.

Reply: The project area is surrounded by the waters of Fontana Lake and Highway 28. It is not likely to serve as a biological corridor for species restricted to forested habitats. It is unclear what sampling effect you are referring to. Home range sizes of various management indicator species are considered in the wildlife effects analysis.

38) Comment: The analysis must define and measure biodiversity both in terms of the existing condition and the condition that would result if each of the alternatives is implemented. The analysis must consider the vulnerability, reduction from historical abundance, and the regional importance of all species in the project area.

Reply: The wildlife, botanical, and aquatic analyses evaluate the potential effects to appropriately selected species and habitat elements, which are elements of biodiversity.

39) Comment: The analysis needs to evaluate the existing condition of biodiversity, and compare it with the natural range of variability.

Reply: The wildlife, botanical, and aquatic analyses evaluate the potential effects to appropriately selected species and habitat elements, which are elements of biodiversity. No requirement exists to compare the existing condition in a project area with some supposed "natural range of variability."

KEY INTEREST: Botany

40) Comment: The issue of the impacts to herbaceous understory needs to be addressed. Research indicates herbaceous understories never recover from logging.

Reply: The EA discusses and discloses the issues related to herbaceous cover.

41) Comment: To adequately consider the impacts of the project on biodiversity at the landscape scale, the following analysis must be conducted for all of the alternatives:

- **size distribution of habitat patches for all community types and forest seral stages.**
- **patch size diversity index.**
- **degree of connectivity maintained between habitat patches at various scales, particularly between those patches that are now uncommon in the landscape.**
- **vegetation mosaic patterns.**
- **cumulative effects at scale of watershed and regional ecosystem.**
- **comparison of landscape patterns created by development to those created by natural disturbance regimes for all the above variables.**
- **maintenance of uncommon or unique landscape elements (eg. rare plant communities, natural ecotones, undistributed vegetation along environmental gradients, etc.)**

Reply: Many of these issues are raised earlier. The Commenter does not indicate how these impacts are related to the site-specific project. Effects from proposed actions and the alternatives are discussed

in the Environmental Effects section of the EA. The extent of analysis you request is excessive given the scope and scale of the project.

42) Comment: The analysis needs to consider the cumulative and site specific effects of logging on biodiversity.

Reply: Effects from proposed actions and the alternatives are discussed in the Environmental Effects section of the EA. The data collected in May of 1996 and CISC data show which vegetation types and ages occur within the project area. Erosion is addressed in the water and soil resources section of the Environmental Effects section of the EA. The Forest Plan identifies standards and guides for wildlife habitat, vegetation manipulation, special areas and other resources with the intention of protection, maintaining and restoring the entire array of diverse natural communities and their successional stages, which are and have been a part of the project area. Techniques prescribed for vegetation management are those, which mimic natural processes (prescribed burning/wildfire age harvest/wind storm/insects and diseases, etc.) By insuring that actions proposed in the project follow Forest Plans standards and guides, and disclosing what the effects are, the communities, which support genetic, community and species diversity will be maintained.

43) Comment: All old growth opportunities should be evaluated independently of potential timber stands. Opportunities must be based on both type and structural characteristics. Any stand that meets either or both characteristics should be designated as old growth. Riparian areas deserve priority for inclusion in old growth designations for watershed protection and wildlife benefits.

Reply: This issue is discussed in the section of the EA titled Old Growth Designation.

44) Comment: Herbicide use will kill many non-target species and harm humans as well.

Reply: Alternatives III, IV, and V in this project include use of the herbicide Triclopyr, in the ester form (in solution with mineral oil and limonene) for pre-harvest treatments and release of 3 to 4 year old shortleaf pine seedlings. Direct application to target species using the thinline method will reduce or eliminate the effects to non-target species. Estimated occupational and environmental exposures to Triclopyr herbicide in humans by dermal, oral, and inhalation routes are considerably less than levels at which toxic effects have been observed in experimental animals. Triclopyr has not been shown to be toxic or to have reproductive, teratogenic, or mutagenic effects at exposures well in excess of those to which forest workers, visitors, and animals would be exposed through normal use (USDA agriculture Handbook Number 633, "Pesticide Background Statements", Volume I. Herbicides). The Risk Assessment (Appendix A of the Appalachian Mountain Vegetation Management FEIS) indicates that no member of the public, including sensitive individuals, should be affected by use of Triclopyr or limonene at typical or maximum exposure scenarios. The Risk Assessment also indicates a low level of risk to workers applying these chemicals in the manner specified at either typical or maximum exposure scenarios. There would be a risk in the accident scenario from direct contact through spillage or accidental spray onto workers. This risk can be mitigated by the use of personal protective equipment and/or by immediate washing in the event of accidental exposure. (See FEIS, Vegetation Management in the Appalachian Mountains, Volume I, page IV-15 through IV-21.) Therefore, the use of Triclopyr herbicides in the proposed actions would not pose a significant risk to human health. Mitigating

measures described in the ALTERNATIVES CONSIDERED section of this assessment would reduce or eliminate potential risks to human health from herbicide use.

45) Comment: Old growth analysis is faulty and disgraceful. Only 6% of the area is managed for old growth. This will not maintain viable populations of old-growth dependent native species.

Reply: The Old Growth Analysis and discussion is presented in the Existing Conditions section of the EA. Old growth designation meets Forest Plan Standards and Guidelines.

KEY INTEREST: Roads

46) Comment: The analysis needs to consider the impacts of logging roads (both providing feeding areas and a source of calcium for cowbirds) on forest interior species.

Reply: Current information indicates that narrow logging roads do not provide feeding areas for cowbirds**.**

47) Comment: The issue of impacts of roads needs to be addressed. The analysis needs to address the impacts from fragmentation and isolation of species with an aversion to roads.

Reply: Current information indicates that narrow logging roads do not cause fragmentation effects for many vertebrate species. The analysis addresses the needs of appropriately selected species and impacts of the proposed actions.

48) Comment: The analysis needs to determine if there are any roads in the project area that are not included in the Forest Transportation Plan inventory. If any roads are not in the inventory, they need to be permanently closed to motorized travel by using permanent physical obstructions and by ripping, recontouring, and revegetating the roadbed and prism.

Reply: All roads within the project area are currently on the Cheoah Road System and the large amount of management area 4A (3691 acs or ~86%) limits or prohibits motorized travel.

49) Comment: The Forest Service needs to determine if the number of open roads in the project areas exceeds forest plan standards. If the standards are exceeded, the roads need to be permanently closed. If any road in the project area is already subject to a closure order, a site inspection needs to be conducted to determine if motorized use of the road is occurring. If such use is occurring, the Forest Service needs to block the traffic with physical barriers and ripping, recontouring, and revegetating the road. Law enforcement must be employed to ensure appropriate compliance.

Reply: Open road density is discussed and analyzed in the Effects by Alternative section (wildlife analysis). From this analysis it is clear that the Forest Service is not in violation. Site inspections occur weekly at Tsali and the area is self policed by the users (Mountain Trail Bike Patrol.)

50) Comment: The analysis needs to disclose the conditions and weight limits of all the roads and bridges that will be used to haul trees to the main roads. The analysis needs to disclose if any of these roads or bridges will need to be upgraded or repaired in order to carry out this project.

Reply: There are no bridges within the project area. The logging roads in place at Tsali are designed for heavy logging equipment. A list of the transportation system for this project is on page I-6 in the Environmental Assessment. These are all system roads and will require minor blading to smooth roadbed and removal of vegetation that has grown up in the road or along road banks that will obstruct travel. In addition, wear and tear on Forest Service roads attributed to logging is accounted for in the timber appraisal and is a cost paid by a timber purchaser at the time a particular unit is opened for operation.

51) Comment: The analysis also needs to disclose the amount of damage the logging trucks will do to existing roads and bridges, and the cumulative direct and indirect effects the transportation of logs will have on local residents and landowners.

Reply: The system roads at the project area are used heavily for trail bike use. During the life of the timber sale, purchaser will be required to maintain road conditions equal to current conditions. This includes spot gravel and minor grading for surface maintenance. There are no bridges within the project area. Forest Service road 2550,-County Line Road is -3.8 miles long. At the end of this road, there is an inclusion of private property. There are no residents on this property and no activities are planned that will require a right-of-way agreement.

52) Comment: Before carrying out the project, the Forest Service needs to obtain baseline data for all MIS species, forest interior birds, and reptiles and amphibians. This needs to be done with field surveys. Survey methodologies must be disclosed. An adequate monitoring plan also needs to be in place. The Forest Service needs to conduct plant and animal surveys in all seasons.

Reply: Management Indicator Species (MIS) are used at the Forest Plan level as a surrogate for analyzing how well the diversity of plant and animal communities is maintained across the planning area. The usefulness of MIS is in the overall context of the management plan, where habitat for certain species is highlighted in some management areas, and other species habitat is highlighted in other parts of the forest. In this way diversity is provided across the landscape. The MIS selected for analysis for this project are discussed in the various specialists' reports (AQUA, BOTA, WILDA). A variety of information sources are used to ascertain information on the status of MIS species and habitats. Field surveys are useful for some species but not for others.

53) Comment: The analysis needs to disclose all the site-specific data that is being used for this project. For all the data, the analysis should reveal when it was gathered, who gathered it (including their qualifications), and the methodologies used.

Reply: As mentioned in the environmental assessment, all the data that is summarized in the document is available to the public. The files are located at Cheoah Ranger District in Robbinsville, North Carolina. Please see appendices for a list of consultants and those involved with the project.

54) Comment: The EA lumps together road closures and disturbance from road construction, and finds no effects. This is completely inappropriate. Road closures are not the same as construction and timber sales. They must be analyzed separately.

Reply: Road closures are not discussed in the EA. Portions of the trail may or may not have to be closed during the logging process. These closures will be short term (1 to 5 days) and appropriate signage will be in place to notify users of closure or alternate routes.

Comment: The Forest Service claims that open road density is .23 mi/sqmi, but does not state what the actual road density is, including closed roads. Closed roads still provide access for illegal poaching and ORV use, but the Forest Service ignores these illegal uses despite being foreseeable. Road density analysis must be completed.

Reply: Our analysis shows that closed roads have much less impact on wildlife than open roads. Standards in the FLRMP specify that the density of open roads should be 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 higher levels of disturbance, greater hunting pressure, and enforcement of hunting regulations is more difficult. At 0.23 miles per square mile, the desired condition for black bear habitat is being met in this area.

KEY INTEREST: Soils

56) Comment: The issues of carbon holding capacity and increased nitrates need to be addressed.

Reply: This issue is outside the scope of this environmental analysis. Regulations by the Council of Environmental Quality state, "NEPA documents must concentrate on issues that are truly significant to the action in question, rather than amassing needless detail." For project-level analysis, issues must be site-specific to the project. The context of the project analysis should focus on the locale rather that in the world as a whole (CEQ regs 1508.27(a)).

57) Comment: The issues of the impacts to soil and water quality needs to be addressed. The effects of soil compaction and vegetation/nutrient removal must be considered. The analysis needs to address the impacts of decreased water quality due to increasing rates of soil erosion and mass wasting events. The effects of sedimentation, nutrient removal, and increased temperatures resulting from logging must be considered. The analysis needs to address the cumulative impacts on aquatic communities, including fisheries.

Reply: Effects of harvest on soil and water is discussed in the Environmental Effects section of the EA.

58) Comment: The issue of mercury contamination needs to be considered. Soil heating and mineralization may release mercury from the soil; this issue must be analyzed.

Reply: The research we have access to do not show heavy metal increases to due to prescribed fire or burning. The parent material of the soil in this are is sandstone. Heavy metals are not a problem given this lithology.

59) Comment: The issue of nutritional value of the plants growing in the resulting openings needs to be addressed.

Reply: Please read the section of Chapter III in the EA, "Soil Test Results" for information on plant nutrients in the soil.

60) Comment: Soil pH is in the 3-8 range, but the Forest Service fails to analyze what effect increased acidity will have. Soil disturbance will release hydrogen ions, and effect aquatic and terrestrial species, but the Forest Service ignores these impacts. This is illegal.

Reply
It is the results of the soil analysis that the pH range was determined. Please read the section of the EA "Soil Test Results".

KEY INTEREST: Water Quality

61) Comment: The analysis needs to identify all site-specific "Best Management Practices" for controlling non-point source pollution. The analysis needs to identify and consider any water quality monitoring done to demonstrate the adequacy of the best management practices.

Reply: Studies conducted by Coweeta Hydrologic Laboratory on the same soil families and slope percents as in the project area show the major source of erosion from forest practices is not from harvest cuts or thinnings, but from poor road design, location, and construction (Douglass 1975; Douglass and Swank 1975; Swift 1984; Ursic and Douglass 1975). Studies conducted elsewhere in the Southern Appalachians have shown similar results (Browning 1980). In addition, studies conducted both at Coweeta, and in the Willis Cove area of Macon County, have outlined the design criteria needed to minimize soil erosion and stream sedimentation (Swift 1984; Douglass 1975). Such design standards include brush barriers, silt fences, surfacing, filter strip width, immediate seeding and/or mulching of cut and fill slopes, and broadbased ("Coweeta") dips to control roadbed runoff. These criteria were used to develop the LRMP road location, design and construction standards, and The North Carolina Forest Practices Guidelines Related to Water Quality (North Carolina BMPs).

Adherence to Land and Resource Management Plan Standards and Guidelines and North Carolina Forest Practice Guidelines Related to Water Quality would protect water quality in all action alternatives. Other measures can be found in the Mitigating Measures Common to All Alternatives Section.

62) Comment: The analysis must also consider groundwater and subsurface water flow.

Reply: The LRMP developed for the Pisgah and Nantahala National Forests clearly identifies the BMP's used to mitigate effects to ground water. These BMP's are designed to protect both ground water and sub surface water flows.

63) Comment: The issues of all cumulative threats to water quality, including logging, illegal dumping, oil and gas leasing, wildlife openings upstream of the project area must be addressed. The analysis needs to identify all these threats. The analysis needs to identify and protect all riparian areas, wetlands, and floodplains.

Reply: The Forest Service has no specific knowledge of oil and gas leasing. The EA plainly states in the Environmental Impacts section those steps necessary to protect riparian areas. There are no designated wetlands within the project area.

64) Comment: The Forest Service continues to claim that Best Management Practices will protect water quality. This claim does not relieve the Forest Service of their duty to protect water quality and fisheries. The standard, blind and complete reliance by the Forest Service on best management practices to comply with state water quality standards was officially rejected by the Ninth Circuit over ten years ago.

Reply: Forest Service timber harvesting projects comply with the NC-FPG which provides an exemption to the State's Sediment Pollution Control Act of 1973 as amended in 1989. The North Carolina Department and Environment and Natural Resources latest water quality assessments of creeks and rivers that enters Fontana Lake were given "Excellent" and "Good" ratings based on both 1994 and 1999 benthic macroinvertebrate monitoring. There has been virtually no change in the ratings from the two monitoring years. Such findings reflect the overall health of watersheds and creeks that surrounds Fontana Lake. This indicates water quality and fisheries are being protected.

65) Comment: There is no good evidence that the application of BMPs can reduce the impacts of logging and road construction at the watershed scale to a level safe for at-risk aquatic species especially in light of existing conditions of imperiled aquatic invertebrates and habitats. (7f)

Reply: Compliance with the NC-FPG, which includes preventing visible sediment from reaching stream channels. If no sediment reaches the channel, there should be no cumulative effects which will degrade the watershed from the sediment standpoint.

66) Comment: The authors recommend that projects scheduled for degraded watershed should not proceed until the Forest Service can demonstrate that conditions have recovered to optimum levels. The Forest Service cannot be allowed to continue in its quest to log degraded watersheds containing imperiled aquatic species without fully disclosing why its BMPs have consistently failed in the past, and how the BMPs have been beneficially modified to provide sufficient protection for this proposed project.

Reply: Watersheds within the scope of the Tsali project are not considered to be "degraded" from a hydrologic perspective. There are no waters identified as being "degraded" within the Tsali project area. The North Carolina Department and Environment and Natural Resources latest water quality assessments of creeks and rivers that enters Fontana Lake were given "Excellent" and "Good" ratings based on both 1994 and 1999 benthic macroinvertebrate monitoring. There has been virtually no change in the ratings from the two monitoring years. Such findings reflect the overall health of watersheds and creeks that surrounds Fontana Lake.

67) Comment: Timber harvest in close proximity to Little Tennessee River and immediate tributaries is likely to raise stream temperatures in the subwatershed, for several reasons. Studies indicate that logging-related sediment deposition can increase width-depth ratios in stream channels, causing water temperatures to increase even if there is no shade loss. Increased sedimentation reduces pool volumes, and may additionally impact deep pools, which serve as temperature refuge for fish.

Reply: Compliance with the NC-FPG includes preventing visible sediment from reaching stream channels. If no sediment reaches the channel, there should be no cumulative effects which will degrade the watershed from the sediment standpoint.

68) Comment: The only water quality indicator, found on page II-19, is purely procedural with no actual monitoring of water involved. This is completely inadequate. Monitoring must occur on site, not just in offices far away.

Reply: The analysis has been updated and different water quality indicators are now listed in the table you refer to.

KEY INTEREST: Aquatic Resources

69) Comment: The effects to reptile and amphibian populations needs to be evaluated. Baseline data needs to be gathered for the entire project area. A monitoring plan needs to be developed. Research indicates logging devastates salamander populations.

Reply: The EA adequately discusses the effects to appropriately selected MIS and PETS. The only reptile or amphibian selected for analysis is the southern Appalachian salamander, for which impacts are disclosed. Research also indicates that if salmander populations do decline after logging, it is a short period of time before populations begin to build again.

70) Comment: The analysis needs to address the status of native fisheries and mussels and streams habitat quality compared with historic conditions in the project area.

Reply: The EA discusses impacts to aquatic resources to the degree appropriate to the scope and scale of the project.

KEY INTEREST: Economic Analysis

71) Comment: The indirect effect of the unfair government competition triggering poor private forest management needs to be analyzed.

Reply: The national forest acreage in Graham County is approximately 58.6 percent of the total land area. The local wood using and processing industry is dependent upon the national forests for raw material. There is no intention to unfairly compete or trigger poor private land management.

72) Comment: The analysis needs to consider how this timber sale will promote waste of wood and fiber.

Reply: This Forest Health Project will not promote waste of wood and fiber. As documented in the "Need for the Proposed Action", the project is to improve the health of the Tsali Peninsula. This is prevention of later more serious problems, which could conceivably be more wasteful.

73) Comment: The issue of exports needs to be considered. An alternative of banning exports needs to be considered.

Reply: Banning of exports requires an act of Congress. This is outside the scope of this proposal.

74) Comment: The impacts of recreation need to be considered. The Forest Service should consider how the project, including the cumulative impact of other logging operations, will pay the Deciding Officer's and other Forest Service employee's salaries and other administrative overhead. The no-action alternative needs to disclose its impact on Forest Service employment levels.

Reply: Salary expenses are fixed costs and would not vary by project. Employment levels would not vary by project alternative.

75) Comment: The Forest Service must utilize a professional economist trained in efficiency analysis and economic impact analysis. The federal government has, in its possession, tools of economic analysis that enable project planners to estimate both adverse economic impacts as well as ecosystems values, and incorporate these estimates into EAs and EISs so that realistic comparisons between economic benefits of the various alternatives can be completed. Incorporation of such costs and benefits is essential to fulfill the Forest Service's primary duty in management of Forest Service lands, namely to maximize the net public benefits.

Reply: The Forest Service employs professional economists in the Southern Region who provide training and program direction to the forest level personnel. The National Forests in North Carolina has utilized computer software such as TSPAS and Quicksilver in the analysis of the benefits and costs of project alternatives. The training of field personnel is on going. Maximization of net public benefits requires incorporation of the value of non-market products with those that have value in the marketplace. Net public benefits are usually expressed qualitatively rather than quantitatively.

76) Comment: We specifically request that the adverse external economic costs of logging in the Tsali Project area, as well as ecosystems service values of standing or otherwise intact forests be estimated in the final EA for the Tsali Forest Restoration Project using the latest quantitative techniques available.

Reply: Economic costs such as the change in values associated with opening up intact forests can only be expressed qualitatively rather than quantitatively. To incorporate these into an EA would require value judgments which may or may not have universal acceptance. Arguments can be made for and against the ecosystem service values of standing or intact forests.

77) Comment: The economic analysis only considers timber values, without any calculation of recreation, aesthetic or spiritual values. The Tsali timber sale area is used heavily by recreationalists, with numerous dispersed camping sites. The EA must include in its economic analysis the net present value of recreational value within the sale area and the opportunity cost of logging these areas. The Forest Service must state explicitly and numerically what the economic impact on recreation, tourism, and aesthetics will be from this sale, including opportunity costs and losses to recreation.

Reply: Neither MUSY, RPA, or NFMA require that net public benefits be assessed at the project level. The economic analysis in the EA is a financial analysis of the costs and benefits of the timber sale.

78) Comment: NFMA and RPA required detailed analysis of the following economic impacts: The US Forest Service incorrectly assumes that logging the Tsali timber sale area is of economic benefit to the local residents yet this assumption is incorrect and a no-cut alternative would be the best economic option for the community and region. Tourism is a major industry in the area.

Reply: Neither MUSY, RPA, or NFMA require that net public benefits be assessed at the project level. The economic analysis in the EA is a financial analysis of the costs and benefits of the timber sale. Timber sales, in general, have a large impact on the economy of Graham and Swain counties where the unemployment rates are generally higher than that of the state of North Carolina or nationally. In November, Graham County had an unemployment rate of 7.4 percent and Swain County had a rate of 11.0 percent as compared to the North Carolina rate of 3.1 percent and the national rate of 4.1 percent. A large percentage of the workforce is employed in wood processing sectors. The calculation of net present value for each alternative would be necessary before any determination could be made as to which alternative best benefited the local economy. It is agreed that tourism is important to the economy of both counties.

79) Comment: In the case of the Tsali timber sale, the net earnings reduction of recreational use must be valued into the economic impact of this decision.

Reply: The economic analysis in the EA is a financial analysis of the costs and benefits of the timber sale. Economic impacts (employment and income) are examined at the Forest Plan level of decision making.

80) Comment: The economic analysis in the EA is extremely short-sighted and does not represent all the cost inputs.

Reply: The benefit to cost ratio of each alternative has been calculated and is disclosed in the EA. And assumes costs needed to implement the decision to be made.

81) Comment: Another economic cost to be included is the cost timber extraction activities impose, through their manipulation of environmental resources, on others who are uninvolved in the activities and have no direct market links with the timber industry.

Reply: The Land and Resource Plan (LRMP) for the Nantahala and Pisgah National Forests considered the externalities associated with the harvest of timber. These included both the benefits and costs to those not directly involved in the timber harvesting process. The allowable sale quantity determined to

be feasible under the plan far exceeds the amount of timber that has been harvested since the LRMP was signed. This project is in compliance with the Plan and no further analysis of external costs or benefits is required.

82) Comment: The Tsali timber sale is clearly not economically sound and represents an unfair burden upon the taxpayer.

Reply: The benefit to cost ratio is positive for all three action alternatives. Commercial timber sales generate tax revenues as well as revenues for use by county school systems.

KEY INTEREST: Silviculture

83) Comment: The Forest Service needs to fully develop and consider uneven-aged management alternatives.

Reply: As stated on page E-1 of the Land and Resource Management Plan, Amendment 5, silviculture methods such as selection cutting are less likely to occur in southern yellow pine forest. The main reason this method is not recommended is the silvics of the yellow pine species. Most if not all are extremely intolerant of shade and therefore reproduction of these forest types would over time, become impossible with uneven aged selection. The mixed pine/hardwood and hardwood pine types do in some cases qualify as uneven aged forest. This is especially true where natural or man made openings result in the smaller diameter trees that will satisfy the reverse "J" shaped size distribution curve. The uneven age condition occurs frequently where oak/hickory forest types are off site and are mixed with the southern yellow pine species that coinhabit the same sites are and are more suited to the poorer sites.

KEY INTEREST: Prescribed Burning

840 Comment: The issue of impacts of prescribed burning must be considered. This practice must be reevaluated, and the following variables addressed: air quality degradation, soil heating, and loss of organic matter, loss of nitrogen, erosion, and sedimentation.

Reply: The effects of prescribed fire on soil productivity depend on the intensity of the fire. If slash burning is done under improper 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 (Van Lear and Waldroop 1989) and (FEIS, Vegetation Management, Appendix B).

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 (see Wayah Ranger District Prescribed Fire Plan post-burn evaluations, 1980-1993). Even an intense slash burn done when duff, soil, and larger fuels are moist will seldom be severe. The moderate burns performed during these moisture conditions do not affect soil structure. Most litter and some duff may be consumed, but soil organic matter is little affected.

Soil biota may be reduced, but recover quickly. Some nitrogen may be lost from burned areas through volatilization and leaching, but burning may also result in enhanced availability of nitrogen as well as

inputs from nitrogen-fixing leguminous species which rapidly colonize burned areas. Long-term nitrogen budgets would be neutral. Other soil nutrients are little affected (VanLear and Waldroop, 1989) and (FEIS, Vegetation Management, pages IV-89 through IV-96 and Appendix B). There would be some mortality of small animals resulting from prescribed burning.

VanLear and Danielovich (1988) found that site preparation did not significantly increase soil movement on steep slopes in the southern Appalachians. 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 re-growth, which provided quick cover and protection of the soil. Van Lear and Kapeluckz (1989) found that low severity burns did not increase soil movement on slopes that ranged from 21-41 percent. Mineral soil was only exposed on fifteen percent of the burned area. This left sufficient forest floor and a thick mat of fine to medium roots to protect the surface of the mineral soil. Losses of available phosphorous and exchangeable cations on eroded sediments from the burned plots were too low to cause concern about possible effects on soil productivity. In Macon County, North Carolina, a prescribed burn study was conducted by Coweeta Hydrologic Laboratory. The burning was planned and conducted on the Wayah Ranger District of the Nantahala National Forest using the Nantahala-Pisgah LRMP Standards and Guidelines. Three 10-acre sites were burned under prescription on slopes that ranged from 35 to 45 percent. Sites were on the Cowee-Evard soil series that are classified as fine-loamy, mixed, mesic typic Hapludults. Swift, Elliott, Ottmar and Vihnanek (1993) found there were only minor and very localized movements of burned plant matter and soil observed throughout all sites. The fibrous humus layer was charred on the surface but one third or more remained unburned. Even where elevated large woody material was consumed, the forest floor below remained intact. Sediment did move from some localized patches of exposed soil but was trapped within a short distance by residual forest floor debris. Dry ravel and mass failure were never observed on any of the sites.

Herbs, tree seedlings, stump sprouts and grasses appeared as early as 19 days after the burns. First season vegetation covered 23% of the surface. Intact forest floor and woody debris covered an additional 62% at the end of the first growing season. Soil moisture was measured over pretreatment months as well as after the burns. Soil moisture tended to be lower in the upper slope plots and higher in the plots that were near the heads of ephemeral channels. These differences were unaffected by the burning treatments.

The prescribed burning proposed in Alternatives III, IV, and V of this project would have unavoidable short-term impacts on air quality. Gas emissions produced during prescribed burning which are considered to be pollutants by EPA include carbon monoxide, hydrocarbons, nitrogen and sulfur oxides, and photochemical oxidants. Typical emission levels of these pollutants would not be high enough to pose a risk of adverse effects on human health. Emissions would be reduced by burning during proper fuel moisture and weather conditions (dry fine fuels; moist soil, duff, and large fuels; clear days; steady winds; low to moderate relative humidity) so that flaming combustion would be maximized, and smoldering combustion minimized (FEIS, Vegetation Management, pages IV-122 through IV-128).

Prescribed burning would also produce 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 emissions can also

be greatly reduced by burning under conditions that enhance flaming and reduce smoldering. Burning when atmospheric conditions are conducive to smoke dispersion can lessen the effects of particulate matter on smoke-sensitive areas. For all prescribed burning activities in Alternatives III, IV, and V of this project, all method-specific mitigating measures in the Vegetation Management ROD would be followed.