Environmental Assessment

Gap-based Approach to Oak Regeneration (Femelschlag) Project
Pisgah Ranger District, Pisgah National Forest
Buncombe County, North Carolina
Gap-based Approach to Oak Regeneration Project
Environmental Assessment

Location of Action: Pisgah Ranger District
Pisgah National Forest
Buncombe County, North Carolina

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CHAPTER 1 – PURPOSE AND NEED AND PROPOSED ACTION

1.1. Background

The Gap-Based Approach to Oak Regeneration Research Project (also referred to as the Femelschlag Project) is located in Stand 024 within Compartment 002 of the Pisgah Ranger District, Pisgah National Forest. Located southeast of Beaverdam, NC in Buncombe County, North Carolina, the Analysis Area (AA) comprises 1,243 total acres (which is Compartment 002), of which 145 acres is being considered for active vegetation management. Access is from North Carolina State Roads 3468 (SR 3468) and 3449 (SR 3449). Additional project-level maps of proposed actions are located at the end of this Environmental Assessment (EA).

1.2. Nantahala and Pisgah Forest Plan Direction

This EA tiers (40 CFR 1502.20) to the Final Environmental Impact Statement (FEIS) for the Nantahala & Pisgah National Forest Land and Resource Management Plan (Forest Plan). This EA also incorporates by reference the project record. The project record contains specialist resource reports and other technical documentation used to support the analysis and conclusions in this EA. This EA incorporates by reference the Nantahala and Pisgah Management Indicator Species (MIS) Report. This report along with Monitoring and Evaluation Reports for the National Forests in North Carolina contains the most current information about Nantahala and Pisgah Forest population trends for MIS species.

1.3. Purpose and Need for Action

The Forest Plan describes goals and desired conditions for which the Forest will be managed. The purpose of this project is to meet these Forest Plan goals and desired conditions for the management areas in the Gap-Based Approach to Oak Regeneration Research Project (Femelschlag Research Project) AA.

1. To examine an untested silvicultural system that is based on natural disturbance patterns for its potential to regenerate oak and hickory species on moderate to high productivity sites in the southern Appalachians.
2. To measure the effects of a disturbance-based silvicultural system on other ecosystem components such as wildlife, understory plants, etc.

The research unit is located within MA 3B which emphasizes sustained timber management, a range of age classes and habitat for turkey and other game species.

This project’s research questions relate directly to Forest Goal 6 (Forest Plan, III-2), which identifies the following desired conditions:

A. Diversify silvicultural methods based on research and experimentation,
B. Provide for more natural appearing and diverse forest,
C. Develop regeneration methods based, in part, on natural disturbance patterns, and
D. Restore mast bearing species on suitable sites.
This research is further supported by Forest Goal 9 to incorporate the best science in a continual manner for the benefit of ecosystem management. Goal 9 further recommends that scientists are engaged in resource management making it a “continuing experiment and learning opportunity” (Forest Plan, III-2).

This research and corresponding environmental analysis is also consistent with Nantahala and Pisgah National Forests (NPNFs) Goals 1, 3, 4, 5 (Forest Plan, III-1).

The interdisciplinary team compared the existing condition of the Gap-Based Approach to Oak Regeneration Research Project (Femelschlag) AA to the desired future condition for management areas 3B as described in the Forest Plan. Where existing conditions are found to be outside the desired future condition, management opportunities exist for moving the resources towards the desired future condition.

<table>
<thead>
<tr>
<th>Management Area</th>
<th>Acres in Analysis Area</th>
<th>Management Area General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4A</td>
<td>113</td>
<td>Emphasize visually pleasing scenery. Emphasize non-motorized recreation use. Close most roads to motorized vehicles. Permit timber management modified to emphasize visual quality and wildlife benefits. Permit road construction. Manage habitat of mature forests primarily for bear, and animals requiring similar environments.</td>
</tr>
<tr>
<td>4D</td>
<td>462</td>
<td>Emphasize high quality wildlife habitat particularly for black bear. Emphasize non-motorized recreation use. Close most roads to motorized vehicles. Permit timber production, but modify to emphasize visual quality objectives and wildlife habitat needs. Permit road construction. Base method of harvest on a site-specific analysis. Do not harvest areas larger than 25 acres in size when even-aged regeneration is selected. [Amendment #4] Manage habitat of mature forests primarily for bear, and animals requiring similar environments.</td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td>Riparian Area. Area will be actively managed to protect and enhance, where possible, the distinctive resource values and characteristics dependent on or associated with these systems.</td>
</tr>
</tbody>
</table>

1) There is a need to diversify silvicultural methods based on research and experimentation as well as increase the use of alternative regeneration techniques, including selection methods based, in part, on natural disturbance patterns (Forest Plan, page III-2). This includes conducting research on how supplemental plantings (specifically of northern red oak) respond to various regeneration methods (Forest Plan, page III-37). Regeneration harvests on National Forest lands in North Carolina are conducted primarily using a shelterwood with reserves, or two-aged silvicultural system (National Forests of North Carolina Forest Plan). Although this system regenerates
southern Appalachian hardwood stands, on average to high quality sites (Loftis 1983), the resulting species mixture depends upon the amount and size distribution of advance growth dependent species, including oaks, prior to the final overstory removal (Sander 1972, Loftis 1990b). Although the resultant age-structure of stands treated under these two-aged silvicultural systems represents a minor departure from the predominantly even-aged landscape, this system does not necessarily mimic the age structure and structural complexity common to upland hardwood forests prior to Euro-American settlement.

In the southern Appalachians, where the successful regeneration of desirable tree species on moderate to high quality sites depends on the presence of advance reproduction, the effects of gap creation on the regeneration layer is especially important. While the interior of natural or silviculturally created gaps is largely dominated by seedling and stump sprout origin yellow-poplar (Jenkins and Parker 1994, Berg and Van Lear 2004), advance reproduction of a variety of species near the gap edge environment experiences a substantial increase in the density, survivorship, and growth (Chen et al. 1992, Berg 2004, Bent Creek Experimental Forest, unpublished data). If increased resource availability into the forest matrix following the creation of gaps allows for the development of large advance oak reproduction (along with the development of large advance reproduction of other desirable, persistent strategy species), a system that takes advantage of the presence of this advance oak reproduction, (i.e., an expanding gap system) should work to not only regenerate oak and other advance-growth dependent strategy species, but also create structural and compositional complexity over multiple spatial and temporal scales.

Proposed in this project is a natural disturbance-based approach to regenerating mixed-oak stands in the southern Appalachians. Using information about the natural disturbance regime from a variety of sources (e.g., Lorimer 1980, Runkle 1982, Lorimer 1989, Rentch 2003a,b, McNab et al. 2004) this system, which can be termed an irregular shelterwood, group shelterwood with reserves, Bavarian Femelschlag (Troup 1928, Mathews 1989), will seek to create multi-cohort stands of mixed-species composition that contain a substantial oak component. This femelschlag system will be patterned after natural gap formation processes by expanding the area created around gaps during each entry, as opposed to creating new, independent gaps.

2) **There is a need for intermediate harvest between groups created during selection harvests (Forest Plan, Appendix E-1).** Intermediate commercial thinnings will remove over-mature trees that have a low likelihood of surviving until the next entry into the stand (10 years following the creation of the initial openings) and provide growing space for pole-sized and small sawtimber-sized trees.

3) **There is a need to perform pre-harvest oak shelterwood treatments to ensure survival of advance oak and hickory regeneration (Forest Plan, page III-35-36 #8 & #9).** The stand in the Compartment 002 (which is the Analysis Area) is mature or becoming mature on productive sites that have a large hard mast component that will be lost to soft mast species through harvesting, wildfire, oak decline, weather events, or
attack by non-native species (gypsy moth), unless the understory is manipulated to
develop advanced regeneration of oak and hickory species (Loftis 1990).

4) **There is a need to designate at least 67 additional acres total of small patch old
growth in compartments 002 to meet Forest Plan Old Growth direction (Forest
Plan, page III-27).** There are no designated large or small old growth patches in
Compartment 002 (which is the Analysis Area). There is a need to designate at least 62
acres of small patch old growth in Compartment 002 to meet Forest Plan direction and
standards for providing a network of old growth habitat (Forest Plan, pages III-26 #1
and III-27 #4).

5) **There is a need to reduce the abundance of undesirable species (e.g., red maple) and
retain desired species (oaks and hickories) through site preparation and seedling
release (Forest Plan, pages III-36-37).** Following the creation of group openings,
harvested groups Compartment 002, Stand 24 will be site prepared using handtools and
herbicide followed by a seedling release treatment 1 to 2 years after site preparation using
herbicide to treat sprout clumps (oak and hickory sprout clumps will not be treated).

6) **There is a need to control and manage non-native invasive species in the analysis
area (Forest Plan, page III-52).** Chinese silver grass (*Miscanthus sinensis*), Japanese
stiltgrass (*Miscanthus sinensis*), and oriental bittersweet (*Celastrus orbiculatus*) are
present in Compartment 002 (which is the Analysis Area). Treatment of non-native
invasives will be needed prior to and following vegetation management activities to
control the spread of these invasive species.

7) **There is a need to add roads to the Forest Road system and reconstruct Forest
Roads 5005 and 5011 to provide access for timber management (Forest Plan, page
III-76 #1. a and b.).** The project area Compartment 02 Stand 24 is accessible by
National Forest System Roads 5005 (Beaverdam) and 5011 (Harriet Cove) but, access
through the 145 acre stand to implement the harvest, site preparation, tree planting and
follow up treatments are not accessible with the current Forest Road system so adding 3
existing un-authorized roads (Green Top Road 0.5 miles, Long Gap Road 1.75 miles and
Sheep Rock Road 1.1 miles) are needed to provide long term access. The addition of
these existing roads to the Forest Road system will meet Forest Plan direction and
standards to 1.a. “Plan the road system to progressively access all lands suitable for
timber production”. Forest System roads 5005 and 5011 will be reconstructed to replace
undersized culverts and reshape existing broad based dips.

A travel analysis has been prepared to analyze the necessary transportation system in the
project area. The analysis has been completed pursuant to Forest Service Manual (FSM)
7709.55, Chapter 20, and is available on-line at: [http://www.fs.usda.gov/nfsnc](http://www.fs.usda.gov/nfsnc).
1.4. Proposed Action – Alternative B

The Proposed Action (Alternative B) was developed to specifically meet the goals and objectives outlined in the Purpose and Need. Maps of the proposal are located at the end of the EA.

Tables 1 and 2 summarize vegetation management activities planned under Alternative B, including intermediate treatments (both precommercial and commercial) and regeneration treatments.

**Table 1. Proposed Vegetation Management Activities - Alternative B in the Femelschlag Research Project**

<table>
<thead>
<tr>
<th>Compartment</th>
<th>Stand</th>
<th>Management area</th>
<th>Logging system</th>
<th>Site index (ft; oak, base-age 50)</th>
<th>Acres</th>
<th>Temp road (approx. miles)</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>002 024</td>
<td>3B</td>
<td>Rubber tired skidder</td>
<td>96 ft.</td>
<td>109</td>
<td></td>
<td>0</td>
<td>Commercial thinning</td>
</tr>
<tr>
<td>002 024</td>
<td>3B</td>
<td>Rubber tired skidder</td>
<td>36</td>
<td>0</td>
<td></td>
<td>Femelschlag (group selection, irregular shelterwood)</td>
<td></td>
</tr>
<tr>
<td><strong>Total treated, MA 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>145</strong></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total treated, AA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>145</strong></td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

To implement this research, the 145 acres encompassed by Stand 024 in Compartment 002 would be divided into six units between 15 and 25 acres in size. Twenty five percent of the acreage in units 1 through 3 will be regenerated using gaps approximately 0.25 acres in size dispersed across the units. Similarly, 25% of the acreage in units 4 through 6 would be regenerated using gaps approximately 1.0 acre in size dispersed across the units. During the initial gap installation, commercial thinning would occur throughout the remaining 145 acres not included in gaps (approximately 109 acres). Commercial thinning will reduce stand density and favor pole to small sawtimber sized trees of desirable species as well as capture mortality of trees that may not survive until the next entry of a selection system (e.g., 10 year cutting cycle).

Every ten years for the next 30 years after the creation of the initial gaps, another 25 percent of the acreage contained in units 1 through 6 would be cut using their respective experimental gap size. The area cut during each entry would be concentrated adjacent to initial gaps taking advantage of advanced oak regeneration development. The intent is to establish four or more distinct age-classes within a prescribed rotation.

In the larger openings, leave trees constituting approximately 10-20 ft²/acre of basal area will be distributed non-uniformly in the openings. Preferred leave trees include mast bearing species. These ‘legacy’ trees will serve as a future source of downed woody debris and provide for wildlife habitat.

Precommercial treatments, which will include the pre-harvest oak shelterwood treatment, are proposed on 109 acres of the 145 acres encompassed by Stand 024 (Table 2). Pre-harvest oak shelterwood treatments are designed to increase the competitiveness of advanced, natural oak regeneration. This treatment includes non-commercially removing shade tolerant species (and
their shade) from the understory and lower canopy of mature stands using chemicals and/or mechanical means. Stand improvement activities include the use of hand tools and herbicides of triclopyr, amine and ester formulations applied with cut surface and streamline application methods to release crop trees. These treatments are all designed to promote the development and regeneration of desirable (e.g., oak) species.

Table 2. Femelschlag Research Project Precommercial Treatments – Alternative B

<table>
<thead>
<tr>
<th>Pre-harvest oak shelterwood</th>
<th>Compart</th>
<th>Stand</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>002</td>
<td>024</td>
<td>109</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>109</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supplemental planting of northern red oak</th>
<th>Compart</th>
<th>Stand</th>
<th>Acres</th>
<th>Estimated planting density</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>002</td>
<td>024</td>
<td>4</td>
<td>200 seedlings/acre</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Site preparation and release activities</th>
<th>Compart</th>
<th>Stand</th>
<th>Acres</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>002</td>
<td>024</td>
<td>36</td>
<td>Hand tools and herbicide</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>36</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 2 – ISSUES AND ALTERNATIVES

2.1. Public Involvement

The proposal was provided to 105 members of the public and other agencies for comment during the scoping period that was initiated on December 19, 2012.

2.2. Issues

Issues are defined as a point of discussion, debate, or dispute about environmental effects. Issues are used to develop alternatives, mitigation measures, or analyze environmental effects. No issues were identified either through public scoping and/or interdisciplinary team discussion.

2.3. Range of Alternatives

The range of alternatives developed and analyzed by the interdisciplinary team (IDT) was driven by the purpose and need of the proposal (Chapter 1), and by the issues identified through scoping. The only exception is the No Action Alternative, which is analyzed as a baseline alternative with which to compare effects of the action alternatives.

2.4. Alternatives Considered in Detail

Two alternatives were considered in detail by the IDT; Alternative A – No Action and Alternative B – Proposed Action. Project design features for activities in the action alternatives are also described in this chapter.

Alternative A – No Action

Under this alternative no new activities would be implemented—existing conditions would remain. The no action alternative serves as the environmental baseline for analysis of effects.

Alternative B – Proposed Action

Chapter 1 gives a detailed description of Alternative B, the Proposed Action.
2.5. Alternatives Considered but Eliminated from Detailed Study

Pursuant to 40 CFR 1502.14(a), two alternatives were considered but eliminated from detailed study:

**Alternative 1**

Alternative 1 proposed to use manual methods and not herbicides as the sole method for controlling/managing competing vegetation in TSI stands. This alternative was eliminated from detailed study because manual methods for treating competing vegetation for site preparation are not as cost effective or efficient as herbicide use to meet desired objectives. Part of the purpose and need of the proposal is to control and manage competing vegetation in regeneration and TSI stands.

**Alternative 2**

A separate alternative to address climate change was not analyzed in detail because the project already includes many actions for improving resiliency of NFS lands to impacts from climate change, including: treating overgrown forests to make them less vulnerable to intense wildfire, pathogens and insect attack and protecting infrastructure by modifying or relocating roads, culverts, trails, and campsites to minimize erosion and sedimentation.

2.6. Project Design Features and Monitoring Common to Action Alternatives

The following project design features have been developed to ensure there would be no adverse effects/impacts to TES and other species in the activity areas:

1. To mitigate the possible loss of potential eastern small-footed bat roosting and nesting trees, it is recommended that snags and cavity trees be retained where safety is not a concern.

2. Trees accidentally felled across stream channels (that prevent or block stream flow) would be lifted (when possible) away from the water. If this is not possible, each tree would be pulled away from the water where it fell and temporary decking would be used to support the weight of the tree as it is pulled across the channel. These removals would be perpendicular to the stream channel whenever possible to minimize stream bank disturbance. Bare soil would be seeded and mulched if native vegetation does not start to recolonize the area by the time timber removal from the unit is complete.

3. Skid roads would avoid stream crossings and parallel perennial channels within designated riparian areas.

4. Landings and skid trails would be vegetated as soon as possible after use to avoid off-site soil movement.
5. Temporary roads would be constructed to avoid runoff into area streams. In addition, silt fence, straw bales, or brush barriers would be placed along the length of the road where it parallels or crosses a stream, as needed to control runoff and stream sedimentation.

6. Where feasible, stream crossings would be designed so that they allow for continuity of habitat for all aquatic organisms.

7. To mitigate the possible effect of invasive plant species, all known populations of *Miscanthus sinensis*, *Rosa multiflora*, *Celastrus orbiculatus*, *Microstegium vimineum*, and *Ligustrum sinense/vulgare* should be treated prior to disturbance activities. Populations of *Miscanthus sinensis*, *Microstegium vimineum* and *Celastrus orbiculatus* were found along existing forest roads. Control of these invasive species is most easily and effectively done by the use of herbicide (Glyphosate). It will be necessary to treat these populations several times to ensure successful control.

8. It is recommended that native plants be utilized in roadside erosion control plans.

9. Northern long-eared bat, *Myotis septentrionalis*, has been proposed to be listed as Federally Endangered. Project design features will incorporate any direction given to the Nantahala and Pisgah National Forests by the Fish and Wildlife Service into our documentation and project implementation (as appropriate).

**Monitoring**

1. National objectives include reducing impacts from non-native invasive species and improving the effectiveness of treating selected invasive species on the Nation’s forests and grasslands. NNIS treatments have been underway for two years under the Nantahala/Pisgah NNIS EA. Survey areas would be established in the form on permanent research plots established by the USDA FS, SRS-RWU-4157 (Bent Creek Experimental Forest) staff to monitor control efforts throughout the length of this project. A post-treatment evaluation report would be completed with the purpose of monitoring effectiveness of treatments. Follow-up herbicide treatments would occur should monitoring determine necessity. A 10 year period would be used for evaluating non-native invasive species.

2.7. **Summary Comparison of Actions by Alternative**

The following table (Table 3) summarizes management activities for each of the alternatives considered in detail:

**Table 3. Comparison of Alternatives**

<table>
<thead>
<tr>
<th>Proposed Activity</th>
<th>Alt A</th>
<th>Alt B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Access Management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add 0.9 miles of Sheep Rock Rd (current non-system road) with an RMO of D1</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Add 0.50 miles of Green Top Rd (current non-system road) with an RMO of D1</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Add 1.1 miles of Long Gap Rd (current non-system road) with an RMO of D1</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Temporary roads developed (miles)</td>
<td>0</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Wildlife Resources &amp; Vegetation Management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial thinning (acres)</td>
<td>0</td>
<td>109</td>
</tr>
<tr>
<td>Regeneration via selection (acres)</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>Proposed Activity</td>
<td>Alt A</td>
<td>Alt B</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Pre-harvest oak shelterwood using herbicide and hand tools</td>
<td>0</td>
<td>109</td>
</tr>
<tr>
<td>Supplemental planting of northern red oak (trees/ acres)</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Stand improvement</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td><strong>Old Growth Resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small patch old growth designated (acres)</td>
<td>0</td>
<td>67</td>
</tr>
</tbody>
</table>
CHAPTER 3 – ENVIRONMENTAL EFFECTS

The following table (Table 4) displays past, present, and reasonably foreseeable future actions within the Femelschlag Project analysis area (AA) that would be accounted for in cumulative effects, as appropriate, by resource analysis and could have a cumulative effect in the AA:

Table 4. Past, present, and reasonably foreseeable future actions within the Femelschlag Project AA

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recreation/Special Uses/ Roads</td>
<td>Hiking, biking, fishing and hunting occur in the area. The Blue Ridge Parkway (National Park Service) forms the extreme southern boundary of the AA and receives millions of visitors each year.</td>
</tr>
<tr>
<td>Aquatic improvement</td>
<td>Installation of new culverts on perennial stream crossing and one culvert on a ephemeral stream crossing as well as replacement of undersized culverts along Harriet Cove Road and removal of 2004 storm slide debris.</td>
</tr>
<tr>
<td>Control of non-native plant species</td>
<td>Control of Oriental bittersweet (<em>Celastrus orbiculatus</em>) is ongoing, with work being conducted under the Non-Native Invasive Plant Control Project (Nantahala and Pisgah National Forests Non-Native Invasive Plant Environmental Assessment (EA)).</td>
</tr>
</tbody>
</table>

3.1 Hydrology and Aquatic Habitat

This analysis addresses activity area waters and analysis area (AA) waters. Activity area waters are defined as those in the area of potential site-specific impacts to aquatic habitat and populations. The AA encompasses waters downstream that potentially could be impacted by project activities, in addition to treatment area waters. The hydrologic analysis area (AA) is the Beaverdam Creek drainage within the 1,243 acres of Compartment 002. The AA is larger than the activity areas – see Definitions section of Biological Evaluation (BE), Appendix A for aquatic analysis area boundary. Additional analysis on aquatic habitat is disclosed in Appendix A [BE]; Section 3.6 [Threatened, Endangered, Sensitive (TES), and Forest Concern (FC) Species] and; Section 3.7 [Management Indicator Species (MIS)], of this document. Additional information on aquatic resources can also be found in the aquatic resource report, which is part of the project record.

Project information was obtained from Ted Oprean, U.S. Forest Service (USFS) Forester; Brady Dodd, USFS Hydrologist; and Lorie Stroup, USFS Fisheries Biologist. Additional information specifically addressing aquatic management indicator species (MIS) was obtained from North Carolina Wildlife Resources Commission (NCWRC) biologists, North Carolina Natural Heritage Program (NCNHP) records, North Carolina Department of Environment and Natural Resources (NCDENR) Division of Water Quality aquatic biologists, and US Fish and Wildlife Service (USFWS) biologists.
3.1.1. Existing Condition

The proposal is within the Beaverdam Creek drainage of the South Hominy Creek Sub-Watershed (6th level hydrologic unit). The hydrologic analysis area (AA) is the Beaverdam Creek drainage downstream to its confluence with Hominy Creek. Historically, the Beaverdam Creek drainage was heavily logged near the turn of the century. Early logging activities required many roads and skid trails to be developed on the landscape. These activities likely exposed soil and increased compaction within the watershed, and thus increased sources of sediment and rates of storm water runoff. Since main travel routes were constructed predominantly in the relatively flat valley bottoms, adverse impacts to adjacent stream channels was likely heavy during and within the first 5 to 10 years after construction when logging occurred. Following the clearing of land, farming in valley bottoms occurred as the Beaverdam Creek drainage was settled. Both farming and valley bottom roads caused stream reaches to be straightened from their natural meander pattern. As a result, in-stream erosion increased and aquatic habitat quality degraded. These conditions persist today in much of the watershed with additional impacts occurring from land development.

Presently the headwater areas of the eastern portion of the watershed are predominantly forested lands managed by the U.S. Forest Service. Previously, during the 1800s, parts of the watershed were in private ownership where subsistence agriculture was practiced, which included woodland grazing by domestic livestock and timber utilization. Farming has been eliminated, but the legacy of early settlement and logging practices are still present on portions of the landscape. Several small unnamed tributaries to the larger Beaverdam Creek have stream reaches that show signs of channel instability, evidenced by excessive stream bed and bank erosion. Another stream reach showing evidence of channel instability is an unnamed tributary to Beaverdam Creek outside of the project area that has been impacted by farming and logging in the past.

In the headwaters of the Beaverdam Creek drainage, on National Forest System (NFS) lands only, there are approximately 14 miles of both system and non-system closed road. Roads can act as conduits for delivery of more water and sediment to the channel than it has naturally received, and thus roads can influence channel stability and water quality. The roads on NFS lands are predominantly stable due to well-vegetated surfaces, with the exception of road/stream crossings where culverts have plugged and stream flow has eroded the road fill material.

Protected water uses were designated by the State of North Carolina, Department of Environment and Natural Resources for all state waters, including those in the Beaverdam Creek drainage. These are inclusive of the following: aquatic life propagation and maintenance of biological integrity, wildlife, secondary recreation (swimming on an infrequent basis), agriculture, and water supply for drinking, culinary, or food processing. In addition to these protected water uses, water quality in Hominy Creek is to be maintained and protected to sustain and allow for trout propagation and survival of stocked trout on a year-round basis.

Beaverdam Creek is not listed as "water quality limited" by the N.C. Department of Environment and Natural Resources, Division of Water Quality as of the latest 303(d) listing of stream channels impaired from meeting State water quality standards. Therefore, all protected water uses are currently identified as "supported" at some level.
Substrate within activity area waters (Table 5) was evaluated and visually estimated. The three primary types of substrate that exist were documented at each macroinvertebrate sample site. This information is valuable for determining the amount of habitat available for proposed endangered, threatened, and sensitive (PETS) species, MIS, as well as other aquatic organisms. A map of the unnamed tributary (UT) streams in the activity areas is located at the end of the chapter.

Fish habitat exists within the aquatic biological AA and activity areas of Beaverdam Creek. There is limited habitat for fish species within other activity area waters due to small stream size and restricted flow regimes. Activity area waters provide habitat for macroinvertebrates.

### Table 5. Forest plan watershed 27 (Beaverdam Creek).

<table>
<thead>
<tr>
<th>Stream name</th>
<th>Compartment-stand</th>
<th>Miles in activity areas</th>
<th>Miles in analysis area</th>
<th>DEM classification*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaverdam Branch</td>
<td>002-024</td>
<td>0</td>
<td>21.8</td>
<td>C</td>
</tr>
<tr>
<td>UT1</td>
<td>002-024</td>
<td>0.77</td>
<td>2.3</td>
<td>C</td>
</tr>
<tr>
<td>UT2</td>
<td>002-024</td>
<td>1.5</td>
<td>2.5</td>
<td>C</td>
</tr>
<tr>
<td>UT3</td>
<td>002-024</td>
<td>0.23</td>
<td>2.1</td>
<td>C</td>
</tr>
</tbody>
</table>

*UT denotes unnamed tributary; **The NC Department of Environmental Management (DEM) designates classifications and water quality standards known as "Classifications and Water Quality Standards Applicable to the Surface Waters and Wetlands of North Carolina." The "C" classification denotes waters suitable for aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture.

**Beaverdam Creek**

Beaverdam Creek is located within the Analysis Area, and lies to the south of the Activity Area. Forest Service Roads 5005 and 5011 cross Beaverdam Creek. Tributaries to Beaverdam Creek in the project area include Jesse Branch, UT1, UT2, and UT3, which are unnamed (Table 3-2). Each UT to Beaverdam Creek was not surveyed for aquatic habitat and organisms. The unnamed tributaries are characterized by higher gradients and restricted flow regimes.

**Jesse Branch**

Jesse Branch is included in the analysis area because it flows into Beaverdam Creek, within the activity area. Culverts along FSR5005 and FSR5011, the roads themselves, and existing old roads and skid trails in the activity areas are the existing threats to streams and drainages. According to USFS Hydrologist, Brady Dodd, historical land slide activity has caused some degradation of water quality due to sedimentation. Impacts from these sources are limited to down slope movement of sediment from road runoff and culvert fills. It is suspected that sediments from these sources are deposited in the natural vegetative filters before they reach areas of perennial water since both of the roads (FSRs 5096 and 485) are closed to all vehicle traffic except for administrative and fire control traffic (i.e. road disturbance is limited).
3.1.2. Direct, Indirect, and Cumulative Effects on Hydrology

Direct and indirect effects to stream channels were analyzed at specific stream reaches within the Beaverdam Creek drainage. Cumulative Watershed Effects would be analyzed at the outlet of Beaverdam Creek into Hominy Creek, approximately a 7th level hydrologic unit. Below this point, it is assumed that if any effects from the proposed activities did occur, they would be masked or diluted to the point that ties with potential site disturbance would not be apparent. As a result, the effects analysis for road impacts to water quality does not extend below this location.

3.1.2a. Alternative A - No Action
Existing trends would persist with changes occurring naturally. It is likely that currently unstable stream reaches would continue on a slow trend of recovery interrupted and set back by storm runoff events that would continue to erode stream channels and unstable road crossings. Thus, erosion and sedimentation from roads and streams would remain above pre-disturbance levels.

3.1.2b. Alternative B - Proposed Action

Direct Effects
Alternative B is not likely to increase long-term sediment loading to stream channels from the proposed road. Although road reconstruction and in-stream structure placement have the potential to deliver sediment to streams during and just after construction, it is expected that current sediment loading to streams would decrease because of this work since sites of erosion would be stabilized. Therefore, Alternative B would decrease sediment.

Alternative B would reconstruct and add 2.47 miles of existing roads to the existing system road network. Another 1.75 miles of Forest System Road would be reconstructed. Under Alternative B, approximately 0.6 miles of existing temporary road would be re-constructed. Since all proposed road work (system and temporary) is located well above all stream inception points (springs and seeps), there is not likely to be connectivity of new roads to streams. Although the reconstructed road(s) would increase surface runoff because of an increase in ground compaction and potentially intercept sub-surface flow, the implementation of road construction BMPs would mitigate potential water and sediment transport to downstream channels. Best Management Practices for road re-construction and temporary road construction include out-sloped roads with broad based dips to frequently shed water off the road and where ditch lines are necessary, adequately spaced ditch relief culverts would be placed to avoid concentrating runoff.

All constructed temporary roads would be maintained as linear wildlife openings following the timber sale. Since the road prism would remain on the landscape, modification of hydrologic processes, e.g., runoff and erosion would remain. Effects would be mostly mitigated by out-sloping the road, thus eliminating the need for an inboard ditch line and relief culverts, a heavy growth of grass, and very infrequent vehicle traffic. The short-term road density in the Beaverdam Branch drainage would slightly increase due to the reconstruction of the temporary road near Yellow Gap, but due to the location and design of the road the increase in drainage density would not have an effect on the hydrologic and sediment regimes.
The proposed reconstruction of 4.08 miles of road in the hydrologic AA has the potential to increase sediment inputs to streams, predominantly during the replacement of culverts. During the replacement of road crossings, BMPs would be implemented to minimize increases in turbidity and sedimentation. Thus, it is anticipated that the accomplishment of this work would have small increases in sediment loading to the stream channels based on effective implementation of BMPs. Also, the proposed reconstruction would have a long-term (beyond one-year) benefit to the current sediment yields in all affected drainages since existing chronic sources of sediment would be notably reduced.

**Cumulative Effects**

This alternative would allow current direct and indirect effects to continue and thus would continue to contribute to cumulative effects. Sediment produced from the erosion of unstable stream reaches and road sections would continue to add to the degradation of water quality and aquatic habitat in Beaverdam Creek and Hominy Creek. The current trend of residential development within the drainage has the likelihood of changing both the hydrologic and sediment regime of Beaverdam Creek because of an increase in ground compaction in the drainage and subsequent runoff.

Proposed actions to improve hydrologic conditions in the area: 1) replacement of undersized culverts currently located along Harriet Cove Rd. (FSR 5011); (2) removal of storm slide material (from a 2004 storm) from the ford on Harriet Cove Rd. (FSR 5011); and (3) installation of new culverts along perennial and ephemeral stream crossings on Long Gap Road and Green Top Road, respectively. These actions are expected to have long-term benefits to hydrologic resources by reducing sediment potential and improving hydrologic functioning. There are no other known foreseeable actions in the activity areas that could adversely affect hydrologic functions.

3.1.3. Direct, Indirect, and Cumulative Effects on Aquatic Habitat

The following table (Table 6) summarizes expected effects on the aquatic resource:

<table>
<thead>
<tr>
<th>Issue</th>
<th>Alternative A</th>
<th>Alternative B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effects on aquatic management indicator species</td>
<td>Existing habitat and population trends continue.</td>
<td>Exiting habitat would improve with watershed enhancement and stream bank stability at crossings. Population trends continue.</td>
</tr>
<tr>
<td>Effects on water quality (associated with the amount of soil disturbance)</td>
<td>Slight risk of degradation from undesignated connector trails.</td>
<td>Turbidity and sediment loading may increase slightly during culvert installation and implementation of watershed project. It should diminish downstream and end with site rehabilitation.</td>
</tr>
<tr>
<td>Effects on aquatic habitat and populations</td>
<td>Existing habitat and population trends continue.</td>
<td>May temporarily affect aquatic habitat in Beaverdam Creek and tributaries during restoration, but would improve over time.</td>
</tr>
<tr>
<td>Effects to riparian areas</td>
<td>Remain in present state. Aquatic habitat would</td>
<td>Remain in present state except at stream crossings. Aquatic habitat would improve with time through</td>
</tr>
</tbody>
</table>
### Issue Table

<table>
<thead>
<tr>
<th>Issue</th>
<th>Alternative A</th>
<th>Alternative B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>improve with aging riparian areas.</td>
<td>increased amount of large woody debris in streams.</td>
</tr>
<tr>
<td>Effects of herbicide</td>
<td>No treatment would likely result in the replacement of some native riparian species with exotics.</td>
<td>No impact because no treatment would occur within 30 feet of streams.</td>
</tr>
</tbody>
</table>

#### 3.1.3a. Alternative A

Implementation of Alternative A would perpetuate the existing condition described above. Aquatic habitat quality, quantity, and populations would continue in their natural dynamic patterns. There would be no impacts upon the 10 Forest Concern species.

#### 3.1.3b. Alternative B

**Direct and Indirect Effects**

Access to the proposed units would involve the reconstruction of 4.22 miles of road (2.47 being added to the system roads) and the re-construction of 0.6 miles of existing temporary road as well as the development of skid trails and log landings.

All drainage ways in the project area were examined for the occurrence of surface water during the fall season of 2012, a year of slightly below average precipitation. Drainages with surface water, or an indication of the likely presence of subsurface water, were classified following Forest guidelines as perennial or intermittent. Three unnamed perennial streams were identified in the project area. Perennial streams can support a permanent assemblage of aquatic organisms including invertebrates, reptiles, amphibians, and fish. Intermittent streams occurred at the upper end of each perennial stream and as the drainage from a springhead at the base of a steep slope that joins a perennial stream near the lower boundary of the project area. Intermittent streams may flow during only a portion of the year and their flow may stop in dry summers. These streams have a strong bed and bank structure, receive both surface and subsurface flow, and support limited biological assemblages. Both perennial and intermittent streams have strong, well defined bed and bank structures. Ephemeral drainages were not identified. Within the Activity Area, a total of 4,563 feet of streams were classified as perennial and 1,229 feet were classified as intermittent. Both perennial and intermittent streams were mapped by GPS methods and their locations verified for accuracy of delineation by overlaying on a 1:24,000 scale topographic map. Except for one area, all drainages were linear, V-shaped features with steep channel bottoms ranging from under 20 to over 60 percent gradient. Planar channel bottoms were mostly narrow, from 2 to 10 feet wide, and consisted primarily of exposed bedrock and boulders ranging from 6 to 36 inches diameter. Water in perennial streams typically formed a continuous surface that was restricted to a narrow path up to 12 inches in width. Water in streams classified as intermittent was most visible on bedrock as a thin film less than 0.1 inch in depth and in small pools where channel of alluvial materials were less steep. Riparian zones, identified by saturated soils, vegetation, and channel features, were typically restricted to the planar bottoms of the channels where alluvial materials had collected. Edges of riparian zones of both perennial and
intermittent streams were typically sharply delineated by the steep slope of the adjacent dry-land bank. Stream channels were typically devoid of vegetation, except for an occasional clump of sedge, hydrangea shrub, or red maple sapling.

Riparian areas were identified and mapped as zones 30 feet (horizontal measure) or more in width on either side of the center of perennial streams and 15 feet (horizontal measure) or more in width on either side of the center of intermittent streams. Short lengths of ephemeral streams are present in the project area, but are uncommon due to the location of the project on upper slope positions with small watersheds. Ephemeral streams usually flow only for several days after a major rain event, receive only small subsurface flow, and have weak to moderate bed and bank structure. These factors form conditions that make survival difficult for aquatic organisms.

One areal feature of alluvial materials was identified in the low-gradient confluence of two perennial streams. This large area of approximately 0.5-acre consisted primarily of a network of surface and subsurface channels in alluvium deposited from high-rainfall storms that caused debris avalanches, which were now stable. The area was characterized by mounds from numerous crayfish burrows. There are no new stream crossings associated with this alternative; however, there are some culverts that would be replaced with larger, better hydrologically functioning pipes. The sizes for these pipes have been determined using the Forest Culvert Sizing Protocol which considers species present and need for passage of aquatic organisms. The replacement of the drive through ford crossing in Beaverdam Creek was considered during the preliminary development of this project. However, after further field evaluation of harmful effects on aquatic resources and assessment of cost resulted in a decision to defer replacement of the drive through ford until it could be financed as part of a larger timber sale.

Cumulative Effects
Since the implementation of this alternative would not have adverse direct and indirect effects on the existing sediment regime, this alternative would not have measurable cumulative effects on lower Beaverdam Creek or Hominy Creek. This alternative would improve current direct and indirect effects of sedimentation produced from the erosion of unstable stream reaches and road sections in the Beaverdam Branch drainage. Residential development activities, including road construction, are currently occurring to the west and north of the Beaverdam Creek area (Biltmore Lake area). These developments are likely to create notable changes in the flow and sediment runoff from the affected drainages because of an increase in compacted area. Since the Femelschlag proposal would not contribute to the current trend in water resource degradation associated with residential development within the drainage, the proposal would not have adverse effects on the private land developments or private residences. Extensive agricultural fields utilized for production of annual crops, primarily tomatoes, border Beaverdam Creek below the project area, from Upper and Lower Beaverdam Loop Roads downstream to Enka Lake Road. Aquatic effects resulting from agricultural activities on these lands, such as cultivation, fertilization, pesticides and soil erosion, are below the project area and are not included in this assessment.

Herbicides are proposed under Alternative B to control non-native invasive plants and as part of timber stand improvement activities and site preparation in the harvest area. In accordance with the Vegetation Management Final Environmental Impact Statement (VM-FEIS), herbicide spraying would not occur within 30 horizontal feet of water unless the herbicide has been approved for aquatic applications. Field applications of herbicides where stream buffers have
been maintained have resulted in concentrations of these herbicides in streams below the lethal concentration – generally concentrations ≤ 0.0072 ppm in the adjacent streams (Durkin, 2003a; Durkin, 2003b; and Durkin and Follansbee, 2004). Furthermore, these herbicides degrade into nontoxic compounds in approximately 65 days (VM-FEIS). The 30 foot buffers would prevent the Estimated Environmental Concentrations of glyphosate or triclopyr from reaching the LC50 (Lethal Concentration at which 50% of the organisms suffer mortality) for any aquatic species (VM-FEIS) because the herbicides would not enter the streams in any measurable quantity. Treatment area streams would be protected by a 30 foot buffer (minimum) which would prevent the concentrations of these herbicides from accumulating within the treatment area streams in measurable quantities.

### 3.2 Soil/Geology Resources

#### 3.2.1. Existing Condition

The following table (Table 7) displays soil map units within the project area and their characteristics the proposal may affect.

**Table 7. Comparison of soil map units.**

<table>
<thead>
<tr>
<th>Map Unit Name</th>
<th>Soil Map Symbol</th>
<th>Avg. Slope Percent</th>
<th>Acreage potentially impacted within project area</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tate</td>
<td>121D</td>
<td>15-30</td>
<td>1.0</td>
<td>These moderately steep, very deep, well drained soils are on high stream terraces, benches, fans, and coves. They formed in colluvium and alluvium weathered form granite, gneiss, and schist. They have a loamy surface layer and subsoil. A large amount of gravels and cobbles are present. Permeability is moderate and shrink-swell potential is low. Seasonal high water table is below 6.0 feet.</td>
</tr>
<tr>
<td>Toecane-Tusquitee</td>
<td>181E</td>
<td>30-50</td>
<td>30.9</td>
<td>This map unit consists of steep Greenlee soils and Tusquitee soils on coves, benches, and fans. These soils formed in colluvium from granite, gneiss, and schist. Greenlee soils are along drainage ways and Tusquitee soils are in crowned areas. Both soils are very deep and well drained. They have a loamy surface layer and subsoil. A large amount of gravel, cobbles, and stones are present throughout these soils. Many stones are scattered over the surface. Permeability is moderately rapid and shrink-swell potential is low. Seasonal high water table is below 6.0 feet.</td>
</tr>
<tr>
<td>Edneyville-Chestnut</td>
<td>803D,E,F</td>
<td>15-95</td>
<td>84.8</td>
<td>This map unit consists of moderately steep Edneyville soils and Chestnut soils on uplands. These soils formed in residuum weathered from granite, schist, and gneiss. Edneyville soils are very deep and well drained. They have a loamy surface layer with a large amount of gravel and a loamy subsoil. Occasional stones are scattered over the surface. Permeability is moderately rapid and shrink-swell potential is low. Seasonal high water table is below 6.0 feet. Chestnut</td>
</tr>
<tr>
<td>Map Unit Name</td>
<td>Soil Map Symbol</td>
<td>Avg. Slope Percent</td>
<td>Acreage potentially impacted within project area</td>
<td>Characteristics</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------</td>
<td>-------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ashe-Cleveland-Rock outcrop</td>
<td>804 D,E,F</td>
<td>15-95</td>
<td>4.8</td>
<td>This map unit consists of moderately steep Ashe soils, Cleveland soils and Rock outcrops on uplands. These soils formed in residuum from granite, schist, and gneiss. Ashe soils are moderately deep and somewhat excessively drained. They have a gravelly sandy loamy surface layer and subsoil. They are adjacent to rock outcrops on narrow ridges on narrow ridges and south- to west-facing side slopes. Occasional stones are scattered over the surface. Hard bedrock is within a depth of 20 to 40 inches. Permeability is moderate and shrink-swell potential is low. Seasonal high water table is below 6.0 feet. Cleveland soils are shallow and excessively drained. They have a gravelly sandy loam surface layer and subsoil. They are adjacent to rock outcrops on spur ridges and south- to west-facing side slopes. Occasional stones are scattered over the surface. Hard bedrock is within a depth of 10 to 20 inches. Permeability is moderate and shrink-swell potential is low. Seasonal high water table is below 6.0 feet. Rock outcrop consists of small areas where bedrock or loose stones cover more than 90 percent of the surface. It occurs in small areas on steep slopes and its total acreage is small.</td>
</tr>
<tr>
<td>Porters-Unaka</td>
<td>841D,E,F</td>
<td>15-95</td>
<td>23.3</td>
<td>This map unit consists of steep Porters soils and Unaka soils on uplands. They formed in residuum weathered from granite, schist, and gneiss. Porters soils are deep and well drained. They have a loamy surface layer and subsoil. Occasional stones are scattered over the surface. Hard bedrock is within a depth of 40 to 60 inches. Permeability is moderately rapid and shrink-swell potential is low. Seasonal high water table is below 6.0 feet. Unaka soils are moderately deep and well drained. They have a loamy surface layer and subsoil. Occasional stones are scattered over the surface. Hard bedrock is within a depth of 20 to 40 inches. Permeability is moderate and shrink-swell potential is low. Seasonal high water table is below 6.0 feet.</td>
</tr>
</tbody>
</table>

1 - Soil mapping unit information taken from USDA Natural Resource Conservation Service reports. These reports are based on information collected in the field by soil scientists.
3.2.2. Direct, Indirect, and Cumulative Effects

Detailed below are the direct, indirect, and cumulative effects of the two Alternatives outlined in this EA.

3.2.2a. Alternative A - No action

Under this alternative, there would be no adverse direct, indirect, or cumulative effects to soils resources, as no ground disturbing actions are proposed. There are no known foreseeable actions in the activity areas that could adversely affect soils.

3.2.2b. Alternative B – Proposed Action

Direct and Indirect Effects
The Forest Plan provides direction to minimize soil damage by designing all facilities to prevent damage; constructing and maintaining all facilities to prevent substantial soil movement; and exposing the minimum amount of soil practicable at any given time during project implementation (Forest Plan, page III-42). The action alternatives propose ground disturbing actions on five general soil map units with various amounts of intensity as disclosed in the previous table.

There are no long-term adverse effects to the soil resource in the Beaverdam Creek area as a result of the action alternatives because the action alternatives have been designed to minimize soil disturbance by adhering to Forest Plan direction and standards; implementing established Best Management Practices (BMPs); and ensuring soil protection clauses from the timber sale contract are adequately implemented. Specific protection measures include restricting the operation of skidding equipment to slopes less than 40%, avoiding wet areas, along with the small size of the openings and their close proximity to the existing road system will minimize soil compaction and erosion within the project area.

Mechanical operations, particularly road reconstruction, have the potential to have the greatest impact on soil productivity by increasing soil compaction and erosion. Increased soil movement, however, would be temporary. In both the thinning and regeneration operations, increased soil movement may occur for approximately two years post-treatment after which time erosion levels would be expected to return to pre-disturbance levels. Harvesting restrictions and protections measures described above (e.g., implementation of BMPs), however, would limit erosion and compaction effects to only minor levels.

Cumulative Effects

The action alternatives are not expected to have adverse cumulative effects because the direct and indirect effects of each alternative on the soils resource would not be cumulatively added to past harvest actions since there has been no harvest-related activity in the Beaverdam area for almost 24 years. About 162 acres have been regenerated between 1970 and 1990 and about 28 acres have been thinned. Each harvested stand has since reforested and is not contributing adverse cumulative effects to the soils resource.

Road construction and reconstruction activities to various standards in the Beaverdam Creek area have occurred since 1970. As part of earlier resource management activities (e.g., harvest and
thinning activities in between 1970 and 1990), portions of the road network were reconstructed with specified gradient, drainage, surface material and vegetative cover in the Beaverdam Creek area for classification as permanent "system" roads. System roads are generally considered as stabilized and contribute only minor sources of sediments to streams, which may result from unusual storm events where debris plugs culverts and causes road overflow. Many of the other roads are unclassified and have since grown in; none are open to motorized vehicles. There should be no adverse cumulative effects to the soils resource as a result of the existing road network and the proposed road activity due to implementation of Forest Plan standards, BMPs, and implementation of timber sale clauses.

In addition, residential development activities, including road construction, are currently occurring to the west and north of the Beaverdam Creek area (Biltmore Lake area). These developments are likely to create notable changes in the flow and sediment runoff from the affected drainages because of an increase in compacted area. The potential cumulative effects of the proposal in relation to these two developments are expected to be minimal and immeasurable.

In terms of the direct, indirect, and cumulative effects of Alternative B on nutrient cycling, an initial surge of available plant nutrients is likely to occur as the vegetative canopy is opened. The increase in soil moisture, surface soil temperatures, and organic debris would produce ideal conditions for accelerated organic matter decomposition and increased soil biotic activity. This in turn would result in an increased availability of nutrients in the upper part of the soil profile. The existing root systems on-site, along with new plant germinations are expected to take advantage of the increased availability of nutrients and moisture, and a surge of growth would occur. Possible losses of nutrients to groundwater through leaching and through volitization are expected to be offset by additions of nutrient rich leafy material and small woody debris left on-site after harvest, plus additions by the atmosphere and precipitation. Thus there would be no major direct, indirect, or cumulative effects on nutrient cycling, either through nutrient removal or nutrient leaching as a result of the proposal.

The stands identified to be managed under group selection under this EA would receive recurring treatment every 10 years under Alternative B. Treatments are expected to be similar to those proposed by Alternative B under this EA, and are thus not expected to cause long-term adverse impacts to soils and productivity. Use of herbicides for timber stand improvement treatments and site preparation are not expected to have measurable adverse effects on soils due to proper application as per Material Safety Data Sheets, product labels, risk assessments, mitigation measures contained in the Vegetation Management in the Appalachian Mountains Final Environmental Impact Statement, and standards and guidelines from the Forest Plan. There are no other known foreseeable actions in the activity areas that could adversely affect soils.

3.3 Wildlife Habitat

3.3.1. Existing Condition
The project area is dominated by mature Montane Oak Forest with smaller areas of mature Chestnut Oak Forest and Acidic Cove Forest (Schafale and Weakley 1990). Elevation is <3500
ft and no high-elevation forest types occur within the either the Analysis or Activity Area. The Gap-Based Approach to Oak Regeneration Project occurs within the Pisgah and Nantahala Land and Resources Plan (LRMP) watershed #27, a part of the French Broad River. An unnamed tributary to Jesse Branch and some smaller unnamed streams are included in the project area. The available aquatic habitat is considered shallow, slow-moving perennial and intermittent streams that flow through the area which provide aquatic habitat and a small amount of depositional wetland habitat along the streamside.

3.3.2. Direct, Indirect, and Cumulative Effects

3.3.2a. Alternative A - No Action
There would be no direct effects to wildlife under Alternative A because no actions would occur.

3.3.2b. Alternative B – Proposed Action

Direct and Indirect Effects
Approximately 36 acres (timber harvest) of early successional habitat would be created under Alternative B. Harvests involve creation of small gaps that will leave much of the forest matrix intact and create small young-forest patches that could benefit some of TE, S, or FC species. Further, a minimum 15 ft (for intermittent streams) or 30 ft (for perennial streams) buffer will be retained along streams, so that effects on water quality or stream conditions will be negligible. The open habitat conditions created via group selection are expected to last approximately 10 years after harvesting. As the stands age and basal area increases in the harvested units, the stands will still be suitable for a variety of non-game and game species including woodland warblers, white-tailed deer, eastern wild turkey, ruffed grouse, and black bear. In addition to the creation of early successional habitat via timber harvesting, the commercial thinning operations proposed under Alternative B may further improve wildlife habitat quality via increase forage production (Beck, 1983).

An additional 62 acres of old growth habitat are proposed under Alternatives B. This habitat would benefit wildlife species that require large contiguous acres of mature forest conditions, such as ovenbird, black bear, and woodpecker.

Selection of Alternative B would help to maintain the long-term desired vegetative composition of early and mid-successional habitat types for associated wildlife species and Forests Plan projected goals for vegetation accomplishments.

A wide variety of wildlife species thrive in early successional habitats and depend on early successional habitat for all or a part of their yearly nutritional requirements. Implementation of the proposed action would help to maintain the early successional forest type across the analysis area and the Forest, while providing beneficial effects for these species.

Wildlife species such as ruffed grouse, white-tailed deer, eastern wild turkey, and black bear have a high recreational appeal both for wildlife viewing and as game species. Implementation of Alternative B would provide beneficial effects by moving approximately 36 acres of mature
forest into the younger age-class. The proposed harvesting activities would provide a more balanced age-class distribution within the analysis area.

Use of herbicides for stand improvement treatments and site preparation are not expected to have measurable adverse effects on wildlife due to proper application as per Material Safety Data Sheets, product labels, risk assessments, mitigation measures contained in the Vegetation Management in the Appalachian Mountains Final Environmental Impact Statement, and standards and guidelines from the Forest Plan. Herbicide treatments for TSI and site preparation are selective treatments, meaning they would be applied directly to the stems or stumps of undesirable trees, therefore, direct contact with wildlife would not be likely to occur.

**Cumulative Effects**
Within the proposed activity area, past activities include: Beaverdam (1988-1990) and the Beaverdam C-2 (1974-1975) timber sales. The cumulative effects of past management activities likely benefited early successional game and non-game species in the short term but that early successional habitat is no longer present in the analysis area.
3.4 Botanical

3.4.1. Existing Condition
The botanical analysis area (Botanical Analysis Area) or “boundary of effects” used for this proposal is defined as: the total area within the proposed unit (treatment area) or known element occurrence (EO) of any threatened, endangered, sensitive (TES), or Forest Concern (FC) plant species. The Botanical Analysis Area consists of approximately 145 acres. All potential effects (direct, indirect and cumulative) to botanical resources in the Botanical Analysis Area were analyzed using this “boundary”.

The Gap-Based Approach to Oak Regeneration Project Area encompasses three natural communities: (1) Chestnut Oak Forest, (2) Montane Oak Forest, and (3) Acidic Cove. These communities grade into each other throughout the site. These communities are described in detail by Schafale and Weakley in Classification of the Natural Communities of North Carolina publication and are not described here.

Many lower- to mid-elevation forests were farmed then logged near the turn of the last century. Additional areas were logged more recently. As a result, the forested communities of the Gap-Based Approach to Oak Regeneration Botanical Analysis Area are comprised of stands of second or third growth forests. Even so, the existing forest represents a relatively diverse group of communities and plant species. The Montane Oak-Hickory, Chestnut Oak and Acidic Cove Forests are common throughout the Pisgah National Forest and southern Appalachians. The herbaceous diversity within this community is often very low. In general, these mid-elevation communities contain much less habitat for TES or FC plant species. No vascular T.& E. S. or FC. plant species are known to be present within the community of the Botanical Analysis Area.

3.4.2. Direct, Indirect, and Cumulative Effects

3.4.2a. Alternative A – No Action
Alternative A would result in no direct effects to individual plants and plant communities within the botanical analysis area.

3.4.2b. Alternative B – Proposed Action

Direct and Indirect Effects
Plant species would be directly affected by treatment activities through exposure to logging activities such as moving heavy equipment, skidding logs, and road construction that damage individual plants.

Indirect effects to plants include those resulting from a modified habitat. Indirect effects of timber removal include an initial increase in light, temperature, reduction in humidity, and a decrease in soil surface moisture. These effects may have a positive effect or negative effect depending upon the particular plant species. Some weedy (i.e., ruderal) plants as well as those associated with young forest habitats, such as Rubus, are expected to increase in the activity area (Greenberg et al., 2007). Other plant species may be negatively affected by the competition of these woody species. The long-term effect of rotational logging practices on the general plant...
communities is poorly understood. There is some evidence that the repopulation of some herbaceous plant species in mixed mesophytic communities may take more than a hundred years after logging. Most species are expected to recover faster than that because of various biologic factors such as growth rate, dispersal, and current species distribution.

The approximate acreage by natural community within the botanical analysis area is displayed in Table 8 below. Most of the proposed activities would occur in communities what are common in the southern Appalachians; Chestnut-Oak Forest or Mesic Forest Communities/Mesic Oak-Hickory.

<table>
<thead>
<tr>
<th>Habitat or Natural Community</th>
<th>Infestation Potential</th>
<th>Alternative A</th>
<th>Alternative B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary Roads</td>
<td>High</td>
<td>None</td>
<td>0.6 miles</td>
</tr>
<tr>
<td>Acidic Cove Forest</td>
<td>High</td>
<td>None</td>
<td>3 acres</td>
</tr>
<tr>
<td>Montane Oak-Hickory Forest</td>
<td>Low</td>
<td>None</td>
<td>142 acres</td>
</tr>
</tbody>
</table>

**Cumulative Effects**

Past actions in the Femelschlag Analysis Area include the Beaverdam C-2 (1974-1975) and Beaverdam (1988-1990) timber sales. These activities included regeneration harvests and forest thinning operations. These activities resulted in short-term creation of early successional habitat and an increase in understory species diversity (Greenberg et al., 2007), but do not appear to have directly affected, in the long-term, the composition of natural plant communities in either the Project or Botanical Analysis Area.

**3.5 Non-native Invasive Plants**

**3.5.1. Existing Condition**

A list of 17 high priority invasive plant species across the Nantahala and Pisgah National Forests has been developed from both botanical surveys completed during the past 15 years and non-native invasive plant (NNIP) species inventories that were conducted in 2002-2003 across selected watersheds within the Nantahala and Pisgah NFs (Table 9). Thousands of acres are known to have some outbreaks of these 17 species; however, the exact infested acreage within the Nantahala and Pisgah NFs is unknown and changes annually. Most of the 17 species identified and listed in Table 9 are prevalent across the region and are continuing to spread, actively impacting biodiversity. NNIP inventories conducted in 2002-2003 recorded spot occurrences of one or more of the 17 species on over 70% of plots along roadsides within the Nantahala and Pisgah NFs. These species were assigned a relative priority for treatment based on their known impacts to rare species and communities, their ability to rapidly spread, and their ability to persist in the forest. These species have been identified as the highest priority NNIP species on the Nantahala and Pisgah NFs at the present time, but the list will be updated as needed, based on new information regarding species’ spread and infestation characteristics. Surveys for invasive species were conducted within the proposed Gap-Based Approach to Oak Regeneration activity area and around roads to the activity areas in 2012. Four NNIP species are known within the Gap-Based Approach to Oak Regeneration Botanical Analysis Area (Table 9).
Table 9. List of medium and high priority NNIP species on the Nantahala/Pisgah National Forests and their presence/absence in the Gap-Based Approach to Oak Regeneration Analysis Area.

<table>
<thead>
<tr>
<th>Species</th>
<th>Forest Treatment Priority</th>
<th>Occurrence in the Gap-Based Approach to Oak Regeneration Botanical AA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Celastrus orbiculatus</td>
<td>High</td>
<td>Seen in the analysis area</td>
</tr>
<tr>
<td>Oriental bittersweet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paulownia tomentosa</td>
<td>High</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Princess tree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spiraea japonica</td>
<td>High</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Japanese meadowsweet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polygonum cuspidatum</td>
<td>High</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Japanese knotweed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microstegium vimineum</td>
<td>High</td>
<td>Generally infested along roads, riparian/ mesic forests etc.</td>
</tr>
<tr>
<td>Japanese stiltgrass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ligustrum sinense/vulgare</td>
<td>High</td>
<td>Seen in the analysis area</td>
</tr>
<tr>
<td>Chinese/European privet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscanthus sinensis</td>
<td>High</td>
<td>Spotty occurrences</td>
</tr>
<tr>
<td>Chinese silver grass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosa multiflora</td>
<td>High</td>
<td>Seen in the analysis area</td>
</tr>
<tr>
<td>Multiflora rose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elaeagnus umbellate/pungens</td>
<td>High</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Autumn/Thorny olive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lonicera japonica</td>
<td>Medium</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Japanese honeysuckle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alliaria petiolata</td>
<td>Medium</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Garlic mustard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centaurea petiolata</td>
<td>Medium</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Spotted knapweed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tussilago farfara</td>
<td>Medium</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Coltsfoot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albizia julibrissin</td>
<td>Medium</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Silk-tree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ailanthus altissima</td>
<td>Medium</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Tree of heaven</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pueraria montana var. lobata</td>
<td>Medium</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Kudzu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dioscorea oppositifolia</td>
<td>Medium</td>
<td>Not seen in the analysis area</td>
</tr>
<tr>
<td>Chinese yam</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.5.2. Direct, Indirect, and Cumulative Effects

3.5.2a. Alternative A – No Action
Under the no-action alternative there would be no potential increase in non-native invasive plant species as a result of ground disturbing actions associated with harvesting, because none would occur. Current treatment of NNIP in the Activity Area is ongoing and being conducted under Non-Native Invasive Plant Control Project (Nantahala and Pisgah National Forests Non-Native Invasive Plant Environmental Assessment (EA)). The continuation of the ongoing treatment of non-native invasive plant species in the Activity Area would occur within the context of forest-wide treatment priorities under Alternative A.

3.5.2b. Alternative B – Proposed Action

Direct and Indirect Effects
It is expected that there would be a temporary increase of ruderal (weedy) species of plants within the Activity Area, many of which may be NNIP. These species are often prevalent during
the early stages of stand development and decrease over time. This is particularly true near constructed roads and log landings. Small populations of NNIP species exist along FS roads. NNIP species would be expected to expand their populations in these areas.

Alternative B would produce habitat (Table 8) that is highly favorable to some of the NNIP species listed in Table 9. The risk of NNIP infestation would be mitigated by the proposed design feature for control of NNIP species which includes treatment of NNIP prior to ground disturbing activities. NNIP may persist in areas with continual disturbance. For example, a maintained road shoulder or wildlife field often has persistent NNIP species. These areas are often maintained in an early successional state for wildlife or human benefit. Therefore, it is expected that this proposal could slightly increase the persistence of NNIPs in the Analysis Area. To mitigate this effect, it is recommended that populations of *Celastrus orbiculatus*, *Microstegium vimineum* and *Rosa multifora* near proposed activity areas or along FS roads leading to a proposed activity be treated and native plants be utilized in roadside erosion control plantings. These treatments should be monitored and retreated, if necessary.

It is recognized that erosion control is the primary goal of seeding areas and some non-native plant species may be highly beneficial to accomplish these goals. However, all the goals of erosion control and encouragement of native plant species may be met by planting native plant species or a suitable mixture of native and non-native mixture of species

The NNIP plant *Microstegium vimineum* is well established along roads of the botanical Analysis Area that control by any currently known method is impractical. It is not known what affect, if any, this proposal will have on the populations of *Microstegium vimineum* within the botanical Analysis Area.

### 3.6 Threatened, Endangered, and Sensitive Species

This section summarizes the effects that the proposed activities may have on threatened and endangered (T&E); Regional Forester’s sensitive (S); and Forest Concern (FC) aquatic, wildlife, and botanical species—see Appendix A, Biological Evaluation (BE), and individual biologic reports located in the project record for more complete disclosure of surveys, habitat, species, and effects/impacts analyses.

#### 3.6.1. Existing Condition

There are no federally-listed (threatened or endangered) terrestrial wildlife or aquatic species likely or known to occur in the Gap-Based Approach to Oak Regeneration Project Area. Northern long-eared bat, *Myotis septentrionalis*, has been proposed to be listed as Federally Endangered. Project design features will incorporate any direction given to the Nantahala and Pisgah National Forests by the Fish and Wildlife Service into our documentation and project implementation (as appropriate). There are, however, four sensitive terrestrial wildlife species and one sensitive aquatic species either likely to occur or are known to occur in the Gap-Based Approach to Oak Regeneration Project Area. These sensitive species were further analyzed for effects (see Table 10).
Table 10. Federally Proposed and Sensitive wildlife and aquatic species with known occurrences or likely to occur in the Gap-Based Approach to Oak Regeneration analysis area.

<table>
<thead>
<tr>
<th>Life form</th>
<th>Species</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>Myotis septentrionalis,</td>
<td>Northern long-eared bat</td>
</tr>
<tr>
<td>Mammal</td>
<td>Myotis leibii</td>
<td>Eastern small-footed myotis*</td>
</tr>
<tr>
<td>Butterfly</td>
<td>Calophrus irus</td>
<td>Frosted elfin*</td>
</tr>
<tr>
<td>Butterfly</td>
<td>Speyeria diana</td>
<td>Diana fritillary*</td>
</tr>
<tr>
<td>Katydid</td>
<td>Scudderia septentrionalis</td>
<td>Northern bush katydid*</td>
</tr>
<tr>
<td>Crayfish</td>
<td>Cambarrus reburrus</td>
<td>French Broad crayfish*</td>
</tr>
</tbody>
</table>

There are no federally-listed (threatened or endangered) or regionally-sensitive rare plant species known or likely to occur within the botanical analysis area. Therefore, there no plant species are considered in this biological evaluation. Further discussion of the species selection and evaluation process can be found in the Femelschlag Botanical Report and Environmental Assessment.

3.6.2. Direct, Indirect, and Cumulative Effects on Federally Listed and Sensitive Species

3.6.2a. Alternative A – No Action

There would be no effect/impact to any threatened, endangered, or sensitive species under Alternative A as no actions are proposed and current conditions would be maintained. There are no other known activities within the Gap-Based Approach to Oak Regeneration Analysis Area that could be added to the existing condition to cause adverse effects to TES species.

3.6.2b. Alternative B – Proposed Action

Direct and Indirect Effects

Eastern small-footed bat (*Myotis lebii lebii*) roosts in hollow trees or rock outcrops during the summer. This species was not captured during 2009-2010 mist-netting efforts at Bent Creek Experimental Forest adjacent to the activity area (S. Loeb, *pers. comm*). However, bats move around the landscape and there is abundant habitat for these species within the project area. If they occur within the project area these species are unlikely to be adversely affected, as adults are mobile and can avoid logging activities. Young forest habitat created in small gaps by this project may benefit these species by providing suitable foraging habitat ([Loeb and O’Keefe 2011](#)) and greater flying insect abundance.

Habitats and host plants for both the frosted elfin and Diana fritillary are described in Appendix 1b. These butterfly species may occur within the project area. Any activities that crush plants with egg masses or caterpillars of these species could kill individuals. Also, Diana fritillary eggs or overwintering caterpillars could be destroyed with any ground-disturbing activity. Proposed harvests of small gaps would create open and edge conditions that could promote occurrence and flowering of host plants for several of these species. Some host plant species, such as violets may decrease in small gaps, but most of the forest matrix surrounding harvested gaps will be unaffected by the proposed activities.
The **northern bush katydid** (*Scudderia septentrionalis*) occurs in a variety of habitats with trees, including residential neighborhoods. Males tend to sing from the treetops, and females may be found on smaller trees, especially when feeding. Because western North Carolina is on the southern edge of the species’ geographical range, populations may be more fragmented here. Where this katydid has been found, populations are small and appear to be stable. The proposed project could kill some individuals, but is unlikely to affect the species at a population level.

Crayfish burrows were observed within the project area during field surveys, therefore this species may exist within the project area. If *Cambarus reburrus* (**French Broad crayfish**) occurs within the project area, adverse impacts of activities are unlikely, as buffers retained along streams will protect aquatic habitat and species. Heavy machinery will not enter streams or streamside zones, therefore *C. reburrus* and its habitat will not be impacted as a result of project implementation.

The Gap-Based Approach to Oak Regeneration Project will have no direct or indirect effect on federally-listed botanical species because none are known or are likely to occur within the Botanical Analysis Area.

Use of herbicides for timber stand improvement treatments and site preparation would not affect threatened or endangered species because herbicides would be applied selectively to targeted undesirable tree species. In addition, herbicides would be applied with proper application as per Material Safety Data Sheets, product labels, risk assessments, mitigation measures contained in the Vegetation Management in the Appalachian Mountains Final Environmental Impact Statement, and standards and guidelines from the Forest Plan.

**Cumulative Effects**

There are no federally-listed terrestrial or aquatic wildlife species known or likely to occur within the Analysis Area. Therefore, the Gap-Based Approach to Oak Regeneration Project will have no effect on federally-listed species.

Alternative B will have no impact on the French Broad crayfish, because buffers will be retained along all streams and no heavy machinery will enter this area.

Alternative B is not likely to adversely impact eastern small-footed myotis, as adults are mobile and can avoid logging activities. Additionally, young forest habitat created in small gaps by this project may benefit these species by providing suitable foraging habitat (Loeb and O’Keefe 2011) and greater flying insect abundance.

Alternative B may impact individual frosted elfin, northern bush katydids, or Diana fritillary during activities that crush plants with egg masses or caterpillars (i.e., gap creation). However, proposed gap creation will create open and edge conditions that could promote occurrence and flowering of host plants. One exception is that violets may decrease in small gaps (host for Diana fritillary), but most of the forest matrix surrounding harvested gaps will be unaffected by the proposed activities, therefore populations will continue to occur within the project area.

Because no federally-listed or regionally-sensitive botanical species are known or are likely to occur within the Botanical Analysis Area, no cumulative effects on federally-listed botanical species will occur.
3.6.3. Direct, Indirect, and Cumulative Effects on Forest Concern (FC) Species

Table 11 lists the terrestrial wildlife and aquatic species of forest concern (FC) that were evaluated for the Gap-Based Approach to Oak Regeneration Project. No FC plant species were located within the proposed Activity Area.
Table 11. Terrestrial wildlife and aquatic species of forest concern (FC) evaluated for the Gap-Based Approach to Oak Regeneration Project.

<table>
<thead>
<tr>
<th>Species</th>
<th>Type</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benfield’s small-bearded minnow mayfly</td>
<td>Insect: mayfly</td>
<td>Sand and smaller substrate deposits in streams and rivers</td>
</tr>
<tr>
<td>(Barbaetis benfieldi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A caddisfly (Homoplectra monticola)</td>
<td>Insect: caddisfly</td>
<td>Sand and smaller substrate deposits in streams and rivers</td>
</tr>
<tr>
<td>A caddisfly (Rhyacophila mycta)</td>
<td>Insect: caddisfly</td>
<td>Gravel and cobble in small streams</td>
</tr>
<tr>
<td>Rafinesque's big-eared bat</td>
<td>Bat</td>
<td>Hollow trees, caves &amp; mines in winter</td>
</tr>
<tr>
<td>(Corynorhynus rafinesquii rafinesquii)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southern zig-zag salamander</td>
<td>Amphibian</td>
<td>Moist rocky areas in mountain forests</td>
</tr>
<tr>
<td>(Plethodon ventralis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golden-banded skipper (Autochon cellus)</td>
<td>Insect: butterfly</td>
<td>Damp woods/streamside; host = hogpeanut</td>
</tr>
<tr>
<td>Dusky azure (Celastrina nigra)</td>
<td>Insect: butterfly</td>
<td>Rich moist woods; host = Aruncus dioicus</td>
</tr>
<tr>
<td>Mottled duskywing (Erynnis martialis)</td>
<td>Insect: butterfly</td>
<td>Upland woods’ edge; host = Ceanothus</td>
</tr>
<tr>
<td>Gray comma (Polygonia progne)</td>
<td>Insect: butterfly</td>
<td>Rich deciduous forest; host = Ribes</td>
</tr>
<tr>
<td>Hickory hairstreak (Satyrium caryaevorus)</td>
<td>Insect: butterfly</td>
<td>Mid to high elevations; host = Carya</td>
</tr>
</tbody>
</table>

3.6.3a. Alternative A – No Action
With implementation of Alternative A, impacts to aquatic forest concern species would result from the existing erosion and sedimentation occurring along roads and trails in the analysis area. There would be no other impacts to forest concern species under Alternative A as no actions are proposed and current conditions would be maintained.

3.6.3b. Alternative B – Proposed Action

Direct and Indirect Effects

Rafinseque's big-eared bat
Rafinseque's big-eared bat (Corynorhynus rafinesquii) roosts in old buildings or hollow trees, usually near water. It is highly unlikely that that C. rafinesquii is present within the project area, as it was last recorded in Buncombe County in 1905. Rafinseque's big-eared bat was not captured during 2009-2010 mist-netting efforts at Bent Creek Experimental Forest nearby (S. Loeb, pers. comm). However, bats move around the landscape and there is abundant habitat for these species within the project area. If they occur within the project area these species are unlikely to be adversely affected, as adults are mobile and can avoid logging activities. Young
forest habitat created in small gaps by this project may benefit these species by providing suitable foraging habitat (Loeb and O’Keefe 2011) and greater flying insect abundance.

**Zig-zag salamander**

One southern zig-zag salamander (*Plethodon ventralis*) was observed in a shallow perennial stream during a June survey of the project area. These salamanders often occur in woodlands as well. Although some individuals could potentially be harmed by heavy machinery, the salamanders are unlikely to be affected at a population level by the creation of small gaps, with most of the forested area left intact.

**Golden-banded skipper, dusky azure, mottled duskywing, gray comma, hickory hairstreak**

Habitats and host plants for these species are described in Appendix 1b. These butterfly species may occur within the project area. Any activities that crush plants with egg masses or caterpillars of these species could kill individuals. Also, Diana fritillary eggs or overwintering caterpillars could be destroyed with any ground-disturbing activity. Proposed harvests of small gaps would create open and edge conditions that could promote occurrence and flowering of host plants for several of these species. Some host plant species, such as violets may decrease in small gaps, but most of the forest matrix surrounding harvested gaps will be unaffected by the proposed activities.

**Benfield’s small-bearded minnow mayfly**

This mayfly species may occur in or near streams within the project area. If it does occur within the project area, adverse impacts of activities on aquatic larvae are unlikely. Buffers retained along streams will protect aquatic habitat as no heavy machinery will enter streams or streamside zones. Adults are mobile and are unlikely to be impacted at a population level.

**Caddisfly: *Hompectra monticola***

This caddisfly species occurs in sandy deposits in streams at scattered locations in the southern and central Appalachians. Adverse impacts to this species as a result of project activities are unlikely, as buffers retained along streams will protect stream habitat. No heavy machinery will enter streams or streamside zones.

**Caddisfly: *Rhyacophila mycta***

This caddisfly species occurs in gravel and cobble substrates in streams at scattered locations in the southern and central Appalachians. Adverse impacts to this species as a result of project activities are unlikely, as buffers retained along streams will protect stream habitat. No heavy machinery will enter streams or streamside zones.

Use of herbicides for timber stand improvement treatments and site preparation would not affect FC species because herbicides would be applied selectively to targeted undesirable tree species. In addition, herbicides would be applied with proper application as per Material Safety Data Sheets, product labels, risk assessments, mitigation measures contained in the Vegetation Management in the Appalachian Mountains Final Environmental Impact Statement, and standards and guidelines from the Forest Plan.
**Cumulative Effects**
This project would not affect any aquatic or terrestrial wildlife FC species at the population level. Therefore, there would be no cumulative effects to any aquatic or terrestrial wildlife forest concern species. Because no botanical FC species were observed in the Botanical Analysis Area, there are no cumulative effects on botanical FC species.

**3.7 Management Indicator Species**
The Forest-wide list of MIS was considered as it relates to the AA (MIS AA). Only those MIS that occur or have habitat within the MIS AA and may be affected by any of the alternatives were carried through a site-specific analysis. The documentation below shows which MIS were and were not analyzed along with the reasons.

Consistent with the Forest Plan and its associated FEIS (Volumes I and II), Management Indicator Species Habitat Population Trends Nantahala and Pisgah National Forests (August 30, 2004) and Amendment 17 to the Nantahala and Pisgah Land and Resources Management Plan (October 1, 2005) effects analyses focus on changes to MIS habitat. These project-level effects are then put into context with the Forest-wide trends for populations and habitats.

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

1) **Table 12**: This table displays biological communities and associated MIS, and reasons species were, or were not selected for analysis in the project. The source of these tables is Amendment 17 to the Nantahala and Pisgah Land and Resource Management Plan effective October 1, 2005, and the associated environmental assessment (EA) and project record.

2) **Table 13**: This table displays the habitat components and associated MIS, and reasons species were, or were not selected for analysis in the project.

3) **Table 14**: This table displays by MIS the Forest-wide population trend along with the associated biological community or habitat component. The information in this table is taken from the MIS Report for the Nantahala and Pisgah National Forests.

4) **Table 15**: This table compares effects (expressed as changes in habitat) by alternative to the Forest-wide estimates of habitats for each biological community and habitat component considered in the project-level analyses. This table explains how effects to communities and habitats affect forest-wide population trends for the species considered.
<table>
<thead>
<tr>
<th>Biological Community</th>
<th>MIS</th>
<th>Analyzed Further in Resource Report/ Evaluation Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fir dominated high elevation forests</td>
<td>Fraser fir</td>
<td>No/1</td>
</tr>
<tr>
<td>Northern hardwood forests</td>
<td>Ramps</td>
<td>No/1</td>
</tr>
<tr>
<td>Carolina hemlock bluff forests</td>
<td>Carolina hemlock</td>
<td>No/1</td>
</tr>
<tr>
<td>Rich Cove forests</td>
<td>Ginseng</td>
<td>No/1</td>
</tr>
<tr>
<td>Xeric yellow pine forests</td>
<td>Pine warbler</td>
<td>No/1</td>
</tr>
<tr>
<td>Reservoirs</td>
<td>Largemouth bass</td>
<td>No/1</td>
</tr>
<tr>
<td>Riparian forests</td>
<td>Acadian flycatcher</td>
<td>No/2</td>
</tr>
<tr>
<td>Coldwater streams</td>
<td>Wild brook trout, wild brown trout, wild rainbow trout, blacknose dace (lower tropic levels of streams)</td>
<td>No/2</td>
</tr>
<tr>
<td>Coolwater streams</td>
<td>Smallmouth bass</td>
<td>No/1</td>
</tr>
<tr>
<td>Warmwater streams</td>
<td>Smallmouth bass</td>
<td>No/1</td>
</tr>
</tbody>
</table>

1 Biological Community and its represented species do not occur within the activity areas; therefore, this biological community would not be affected by any of the alternatives. Given no effects to the community, the alternatives in this project would not cause changes to forest-wide trends or changes in population trends of species associated with this community.

2 Biological Community and its represented species would be protected in accordance with Forest Plan standards and guidelines. Populations would not be affected by management activities because the associated habitat would not be entered by the proposed activities, pursuant to forest plan direction; therefore, there would be no change to forest-wide population trends.
Table 13: Habitat Components, Associated MIS, and why species were eliminated from analysis

<table>
<thead>
<tr>
<th>Habitat Components</th>
<th>MIS</th>
<th>Analyzed Further in Resource Report/Evaluation Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early successional (0-10 years old)</td>
<td>Rufous-sided (eastern) towhee</td>
<td>Yes</td>
</tr>
<tr>
<td>Early successional (11-20)</td>
<td>Ruffed grouse</td>
<td>Yes</td>
</tr>
<tr>
<td>Soft mast producing species</td>
<td>Ruffed grouse</td>
<td>Yes</td>
</tr>
<tr>
<td>Hard mast-producing species (&gt;40 yrs)</td>
<td>Black bear</td>
<td>Yes</td>
</tr>
<tr>
<td>Large contiguous areas with low levels of human disturbance</td>
<td>Black bear</td>
<td>No</td>
</tr>
<tr>
<td>Large contiguous areas of mature deciduous forest</td>
<td>Ovenbird</td>
<td>Yes</td>
</tr>
<tr>
<td>Permanent grass/forb openings</td>
<td>White-tailed deer</td>
<td>Yes</td>
</tr>
<tr>
<td>Downed woody debris</td>
<td>Ruffed Grouse</td>
<td>No/1</td>
</tr>
<tr>
<td>Snags</td>
<td>Pileated woodpecker</td>
<td>No/1</td>
</tr>
</tbody>
</table>

1 Habitat and its represented species would be protected in accordance with Forest Plan standards and guidelines. Populations would not be affected by management activities; therefore, there would be no change to forest-wide population trends.

Table 14: MIS Estimated Forest Population Trend and Biological Community or Habitat Component

<table>
<thead>
<tr>
<th>Species</th>
<th>Estimated Population Trend</th>
<th>Biological Community and/or Habitat Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rufous-sided (eastern) towhee</td>
<td>Decreasing</td>
<td>Early successional (0-10 years old)</td>
</tr>
<tr>
<td>Ruffed grouse</td>
<td>Static to decreasing</td>
<td>Soft mast producing species &amp; Downed woody debris</td>
</tr>
<tr>
<td>Black bear</td>
<td>Increasing</td>
<td>Hard mast producing species (&gt;40 yrs)</td>
</tr>
<tr>
<td>Wild brook trout, wild brown trout, wild rainbow trout, blacknose dace (lower tropic levels of streams)</td>
<td>Static</td>
<td>Coldwater streams</td>
</tr>
<tr>
<td>Ovenbird</td>
<td>Slight decrease</td>
<td>Large contiguous areas of mature deciduous forest</td>
</tr>
<tr>
<td>White-tailed deer</td>
<td>Static to decreasing</td>
<td>Permanent grass/forb</td>
</tr>
<tr>
<td>Pileated woodpecker</td>
<td>Increasing</td>
<td>Snags</td>
</tr>
<tr>
<td>Habitat Component</td>
<td>Forest-wide Estimate</td>
<td>Alt A</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Early successional (0-10 years old)</td>
<td>26,800 acres, 5 year average of 2,040 acres Forest-wide, downward trend</td>
<td>0 acres, No change</td>
</tr>
<tr>
<td>Soft mast-producing species</td>
<td>13,144 acres early seral, highest potential on 5,800 acre, downward trend</td>
<td>No change</td>
</tr>
<tr>
<td>Hard mast-producing species (&gt;40 yrs)</td>
<td>681,000 acres, increasing trend</td>
<td>No change</td>
</tr>
<tr>
<td>Large contiguous areas of mature deciduous forest</td>
<td>279,000 acres</td>
<td>No change</td>
</tr>
<tr>
<td>Permanent grass/forb openings</td>
<td>3,000 acres</td>
<td>No change</td>
</tr>
<tr>
<td>Coldwater Streams</td>
<td>5,100 miles</td>
<td>No Change</td>
</tr>
</tbody>
</table>

There are no other known past, present, or reasonably foreseeable future actions that could be added to the proposed activities that would cause adverse cumulative effects to MIS in the Femelshlag AA.

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**Note these crossing are in headwater streams with no fish habitat and little to no aquatic perennial habitat.
Discussion

Wild Rainbow, Brown and Brook Trout

Trout exist downstream of the aquatic activity area in Beaverdam Creek and at the mouth of several tributary streams. The stream crossing replacement activities associated with the action alternative are located upstream of fish habitat approximately a mile in most locations and would therefore not impact wild rainbow, brown or brook trout habitat. This project has been designed so that fluctuations in sediment will be minimized by the implementation of best management practices (BMP) and forest practice guidelines (FPG). Included in the FPG’s for the Pisgah and Nantahala National Forest is no stream disturbance during the trout spawning moratorium (October 15 thru April 15). This moratorium will protect any trout eggs and juveniles from being smothered or crushed during project implementation. Harvest activities will occur outside 100 linear feet of all perennial streams.

It is expected that long term benefits of more stable stream crossings, road drainage issues addressed and preventing further erosion will far outweigh possible short term impacts. Mobile organisms, such as trout, can move up or downstream to avoid disturbed areas within the stream.

There will be no impacts to the long-term viability of trout population or the populations across the Forest as a result of implementing the Femelshlag Project.

Eastern Towhee and Ruffed Grouse

ALTERNATIVE A - NO ACTION

DIRECT AND INDIRECT EFFECTS – EASTERN TOWHEE, RUFFED GROUSE

Under alternative A, the no action alternative, as no action will occur, there will be no direct effects to eastern towhee and ruffed grouse across the project area. Under alternative A, no new habitat will be created or altered. As no new eastern towhee and ruffed grouse habitat would be created under alternative A, this would represent a negative indirect effect to eastern towhee and ruffed grouse populations within the analysis area.

CUMULATIVE EFFECTS – EASTERN TOWHEE, RUFFED GROUSE

ALTERNATIVE A

Few cumulative effects are expected from implementing alternative A. By not creating new eastern towhee and ruffed grouse habitat within the analysis area, eastern towhee and ruffed grouse populations are not expected to expand within the analysis area.

ALTERNATIVE B - PROPOSED ACTION

DIRECT AND INDIRECT EFFECTS – EASTERN TOWHEE, RUFFED GROUSE

The effects of the proposed actions are expected to benefit eastern towhee and ruffed grouse. Early successional habitat created by the proposed action is expected to have positive indirect effects to eastern towhee and ruffed grouse in the form of new suitable habitat. While adult eastern towhee and ruffed grouse are likely to flee disturbance associated with commercial
timber harvests, nests could be lost, a negative direct effect. Pre-harvest oak shelterwood activities are likely to reduce stem density in affected stands. Eastern towhee and ruffed grouse may find the new conditions unsuitable and may seek out new, more suitable habitat within the analysis area. This disturbance would be considered a negative, indirect effect.

CUMULATIVE EFFECTS – EASTERN TOWHEE, RUFFED GROUSE

ALTERNATIVE B

Eastern towhee and ruffed grouse habitat is found within the analysis area, though it is generally lacking. The proposed action will create addition habitat for eastern towhee and ruffed grouse. No activities other than the proposed actions are planned within the analysis area for the next 5 years that will benefit eastern towhee and ruffed grouse.

Implementing Alternative B would provide positive effects for eastern towhee and ruffed grouse in the form of new habitat. There is suitable eastern towhee and ruffed grouse habitat on private lands in close proximity to the analysis area. This trend is not expected to change in the foreseeable future.

Ovenbird

ALTERNATIVE A - NO ACTION

DIRECT AND INDIRECT EFFECTS – OVENBIRD

Under alternative A, the no action alternative, as no action will occur, there will be no direct effects to ovenbird across the project area. As ovenbird habitat includes large tracts of mature forest with closed canopy, alternative A would continue to provide ovenbird habitat. Alternative A would provide beneficial indirect effects to ovenbird.

CUMULATIVE EFFECTS – OVENBIRD

ALTERNATIVE A

Alternative A would benefit ovenbird as there would be no habitat loss.

ALTERNATIVE B - PROPOSED ACTION

DIRECT AND INDIRECT EFFECTS – OVENBIRD

The effects of the proposed actions to ovenbird are generally expected to be negative. As ovenbird habitat includes large tracts of mature forest with closed canopy, commercial timber harvesting, and temporary road construction may segment and alter ovenbird habitat at the small scale, a negative indirect effect. The aforementioned activities also have the potential to take ovenbird nests, a direct negative effect.

CUMULATIVE EFFECTS – OVENBIRD

ALTERNATIVE B

Ovenbird habitat is present in the activity area and analysis area. The proposed actions are likely
to segment and alter ovenbird habitat at the small scale. No activities other than the proposed actions are planned within the analysis area for the next 5 years that will alter ovenbird habitat.

Implementing Alternative B could cause displaced individuals from the project area to seek out habitat adjacent to the analysis area. As there is adequate habitat adjacent to the analysis area, there is not likely to be a significant impact to the bird. This alternative is not likely to effect populations of ovenbird across the analysis area.

There is limited ovenbird habitat on private lands in close proximity to the analysis. This trend is not expected to change in the foreseeable future.

**Black bear and White-tailed deer**

**ALTERNATIVE A - NO ACTION**

**DIRECT AND INDIRECT EFFECTS – BLACK BEAR, WHITE-TAILED DEER**

Under alternative A, the no action alternative, as no action will occur, there will be no direct effects to black bear and white-tailed deer across the project area. Under alternative A, no new habitat will be created or altered. As no new black bear and white-tailed deer habitat would be created under alternative A, this would represent a negative indirect effect to black bear and white-tailed deer populations within the analysis area.

**CUMULATIVE EFFECTS – BLACK BEAR, WHITE-TAILED DEER**

**ALTERNATIVE A**

Few cumulative effects are expected from implementing alternative A. By not creating new black bear and white-tailed deer habitat within the analysis area, black bear and white-tailed deer populations are not expected to expand within the analysis area.

**ALTERNATIVE B - PROPOSED ACTION**

**DIRECT AND INDIRECT EFFECTS – BLACK BEAR, WHITE-TAILED DEER**

The effects of the proposed actions are expected to benefit black bear and white-tailed deer. Commercial harvesting and pre-harvest oak shelterwood treatments are expected to positively affect black bear and white-tailed. Early successional habitat created by commercial harvesting are expected to have positive indirect effects to black bear and white-tailed deer in the form of new suitable habitat in the form of early successional habitat. Black bear and white-tailed deer will use the newly created early successional habitat for food and escape cover. The proposed action is likely to result in increased productivity of desirable mast producing trees such as oak trees. The resulting acorns will benefit both black bear and white-tailed deer.

**CUMULATIVE EFFECTS – BLACK BEAR, WHITE-TAILED DEER**

**ALTERNATIVE B**

Black bear and white-tailed deer habitat is found within the analysis area, though it is generally lacking. The proposed action will create addition habitat for black bear and white-tailed deer. No activities other than the proposed actions are planned within the analysis area for the next 5 years.
that will benefit black bear and white-tailed deer.

Implementing Alternative B would provide positive effects for black bear and white-tailed deer in the form of new habitat. There is suitable black bear and white-tailed deer habitat on private lands in proximity to the analysis area. This trend is not expected to change in the foreseeable future.

Table 16. Management Indicator Species and Associated Habitat Descriptions.

<table>
<thead>
<tr>
<th>Indicator Species</th>
<th>Principal Habitat Characteristics</th>
<th>Existing Condition Within the Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine warbler <em>Setophaga pinus</em></td>
<td>Longleaf pine, scrub oak, pine savanna, and white pine–hemlock</td>
<td>No habitat present</td>
</tr>
<tr>
<td>Eastern towhee <em>Pipilo erythrophthalmus</em></td>
<td>dry, sunny southern and southwestern slopes, brushy clearings of spruce-fir forests</td>
<td>Habitat present</td>
</tr>
<tr>
<td>Ruffed grouse <em>Bonasa umbellus</em></td>
<td>Young mixed-deciduous forest</td>
<td>Habitat present</td>
</tr>
<tr>
<td>Ovenbird <em>Seiurus aurocapilla</em></td>
<td>Mature, large, contiguous tracts of deciduous or mixed deciduous/coniferous closed-canopy forest</td>
<td>Habitat present</td>
</tr>
<tr>
<td>Black bear <em>Ursus americanus</em></td>
<td>Large expanses of uninhabited woodland</td>
<td>Habitat present</td>
</tr>
<tr>
<td>White-tailed deer <em>Odocoileus virginianus</em></td>
<td>Forested and non-forested generalist</td>
<td>Habitat present</td>
</tr>
</tbody>
</table>
3.8 Forest Vegetation

3.8.1. Existing Condition

All proposed harvesting activities will occur on lands designated by the Forest Plan as suitable for timber management (MA 3B). Timber harvest activities proposed for the Gap-Based Approach to Oak Regeneration Project will occur on all slope aspects. Stand 024, which is the activity area, is a mature, full-haired upland hardwood stand with an average of 201 trees/acre and 135 ft²/acre of basal area in trees >2.9 inches dbh (4-in. diameter class) (Figure 1).

Figure 1 – Basal area (ft²/acre) by diameter class of Stand 024.

Species composition is characteristic of mid- to high-quality upland hardwood forest types, with yellow-poplar, northern red oak, and chestnut oak comprising 23%, 14%, and 23% of the stand basal area (of trees >2.9 inches dbh), respectively (Figure 2). Although red maple and sourwood comprise 26% of the total basal area (of trees >2.9 inches dbh), these species are primarily located in the midstory canopy layer.
This relatively dense midstory canopy layer is an impediment to the development of advance reproduction of desirable tree species (e.g., oaks and hickory species) capable of competing with shade-intolerant species (e.g., yellow-poplar) after regeneration harvests (Loftis, 1983a; Loftis, 1990). Currently, the regeneration layer contains abundant seedlings of many desirable and undesirable tree species. On average, there are 4090 seedlings/acre <4 ft. in height. Species composition of the small seedling layer is displayed in Figure 3. Total density as well as density of desirable tree species in the larger seedling size class (≥4 ft. but <1.6 in. dbh) is substantially lower. Currently, there are 260 large seedlings/acre, with only 25% of the total large seedling density comprised of various oak species (Figure 4).
Figure 3. Species composition of the small seedling layer as a percent of the average 4090 small seedlings/acre (<4 ft. in height).

- Red maple: 22%
- Hickory: 11%
- Yellow-poplar: 3%
- Blackgum: 3%
- White oak: 6%
- Chestnut oak: 3%
- Northern red oak: 27%
- Black oak: 18%
- Other: 12%

Figure 4. Species composition of the large seedling layer as a percent of the average 260 large seedlings/acre (≥4 ft. but <1.6 in. dbh).

- Red maple: 34%
- Hickory: 27%
- Yellow-poplar: 8%
- Blackgum: 8%
- Northern red oak: 15%
- Black oak: 8%
- Other: 8%
Of the 2,143 acres within Analysis Area, approximately 1,042 acres, or 83% of the Analysis Area, is inventoried as over 80 years old. Stands aged between 0-80 years total approximately 201 acres, and represent only 16% of the Analysis Area (Figure 5). Past landscape size disturbances in this analysis area include exploitive logging conducted prior to acquisition as National Forest System (NFS) lands, and the chestnut blight salvage, which occurred in the area in the 1930’s through the 1950’s. These two disturbances account for the majority of the stands (84% of stands in the Analysis Area) being in the >80 year age classes and also gave rise to the two-aged character of some stands within the Analysis Area. Two-aged stands are those in which trees that remained following disturbance now comprise a mature overstory of large sawtimber-sized trees, scattered or clumped throughout younger, immature timber. Over the last 40 years approximately 162 acres have been regenerated (via clearcutting, with an additional 28 acres undergoing thinning operations in this Analysis Area (see Figure 3.8.3 above). The 162 acres of regeneration harvests that occurred during the past 40 years coupled with lack of any other regeneration activities are responsible for the bimodal distribution of age classes displayed in Figure 5. All previously regenerated stands have been certified as successfully reforested. Currently, Compartment 2, which comprises the Analysis Area, does not contain any designated old growth patches.

**Figure 5 – Age Class Distribution Compartment 002 as of 2013.**

<table>
<thead>
<tr>
<th>Age class (years)</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>0</td>
</tr>
<tr>
<td>11-20</td>
<td>10</td>
</tr>
<tr>
<td>21-30</td>
<td>40</td>
</tr>
<tr>
<td>31-40</td>
<td>100</td>
</tr>
<tr>
<td>41-50</td>
<td>200</td>
</tr>
<tr>
<td>51-60</td>
<td>300</td>
</tr>
<tr>
<td>61-70</td>
<td>400</td>
</tr>
<tr>
<td>71-80</td>
<td>500</td>
</tr>
<tr>
<td>81-90</td>
<td>600</td>
</tr>
<tr>
<td>91-100</td>
<td></td>
</tr>
<tr>
<td>101-110</td>
<td></td>
</tr>
<tr>
<td>111-120</td>
<td></td>
</tr>
</tbody>
</table>

### 3.8.2. Direct and Indirect Effects

#### 3.9.2a. Alternative A – No Action

This alternative would allow vegetation to continue in its current state, but does not preclude analysis for other future projects. Some mortality of older trees that show signs of decline would occur. Growth rates would decline in mature stands, with eventual mortality of some trees, particularly in the red oak species. Using the Forest Vegetation Simulator (Crookston and Dixon 2005) and individual tree data collected from 20 Common Stand Exam plots from Stand 024,
structure and species composition is forecasted to change slowly under the No Action Alternative. FVS simulations performed with the oak decline event monitor function forecast an increase in basal area over the next 100 years (Table 17). Based on the assumptions of FVS, species composition is forecasted to change over the next 100 years under the No Action Alternative, with red maple becoming more dominant as stand development progresses (Figure 6).

Table 17. Changes in basal area (ft²/acre) forecasted to occur over the next 100 years using the Forest Vegetation Simulator (FVS) under the No Action Alternative. Note: 2012 represents current conditions.

<table>
<thead>
<tr>
<th>Year</th>
<th>Forecasted basal area (ft²/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>135</td>
</tr>
<tr>
<td>2037</td>
<td>148</td>
</tr>
<tr>
<td>2062</td>
<td>194.4</td>
</tr>
<tr>
<td>2087</td>
<td>195.2</td>
</tr>
<tr>
<td>2112</td>
<td>194.7</td>
</tr>
</tbody>
</table>

Figure 6. Changes in species composition forecasted over the next 100 years using the Forest Vegetation Simulator (FVS) under the No Action Alternative. Note: 2012 represents current conditions.
The cumulative effect for this alternative would be an interruption in the periodic regimen of forest regeneration by management activities conducted in order to achieve a more balanced age class distribution and sustain an even flow of habitats and resources in the project compartments.

3.8.2b. Alternative B – Proposed Action

**Direct and Indirect Effects**

Proposed group selection treatments would result in 36 acres (combined acreage of the group openings) in the 0-10 age class. This 0-10 age class would be dispersed throughout Stand 024 in small (0.25 acre) to medium-size (1 acre) openings. Regeneration in these stands would originate from a combination of advanced reproduction, stump sprouts of the species present on the sites, and from yellow-poplar seed, which can compete successfully from seed with other species’ regeneration sources. Species composition would be similar to that of the current stands. Site preparation would follow harvest to enhance the establishment of oaks, hickories and other species desirable for wildlife, timber, and overall diversity. Residual trees and snags would provide aesthetic value and provide some structural diversity for wildlife habitat. Favoring oaks and hickories as leave trees would provide a presence of these species in the regenerating stands and would provide some hard mast until the cohort of young trees mature in about 20-25 years, and begin providing hard mast.

The 109 acres of advanced oak regeneration treatments would release advance regeneration of oak seedlings on these acres by temporarily eliminating competing vegetation in midstory canopy layer. The released oak seedlings would grow large enough to be released within 10 years (during the next group selection entry) following the shade management treatment, at which time they would be capable of competing with the fastest and most aggressive competitors (Loftis 1990). Without treatment, most if not all of the oak seedlings would die from competition of shade tolerant species such as red maple, sourwood, and blackgum (Loftis, 1983b).

Under Alternative B, the 36 acres of regeneration (the acreage of the combined group openings) would develop early successional habitat (stands aged 0-10 years) on 2.9% of the Analysis Area over a 3-5 year period beginning as early 2014. As per Forest Plan general standards and guides, snags that are not hazardous would be retained at about two per acre (Forest Plan page III-23) if present. Periodic regeneration ensures there would be a continuous flow of hard and soft mast production in the future resulting from a mix of age classes and provides structure across the analysis area as protection against forest threats such as large scale ice storms, wind events, and attacks by forest pests such as Gypsy Moth.

Depending on seed availability, supplemental planting of northern red oak seedlings will be conducted on approximately 4 acres within and surrounding the newly created gaps at a density of approximately 200 trees/acre. Seedlings will be one-year old bare-root nursery seedlings grown from acorns collected at the Cherokee National Forest’s Watauga Seed Orchard. If seed is unavailable from the Watauga Orchard, wild seed collected from the vicinity around the project area will be utilized. Acorns will be collected in Autumn 2014 from mother trees in the orchard that originate from Blue Ridge Mountain seed sources to ensure seedlings are locally adaptive to the planting sites. Seedlings will be planted within and just outside the gaps and monitored frequently for growth and survival. Genetic differences will be followed throughout the study.
Cumulative Effects
The effects of Alternative would be the establishment of a 0-10 age class and maintenance of growth and vigor in the project stand. Regeneration of the proposed stand would create and maintain a more balanced age class distribution than the current condition by shifting 36 acres of mature stands into the 0-10 year age class (refer to Appendix B, Age Class Distribution). In addition, the combination of Alternative B stand regeneration activities would help to provide for a continuous and sustainable flow of forest products and habitats.

The proposed alternative utilizes uneven-aged management cutting, with the expectation of creating and maintaining 4 distinct age classes in Stand 024 over a 40 year period. Unlike traditional group selection, under Alternative B a femelschlag system would be implemented, whereby the initial openings (the openings created as early as 2014) are expanded by their respective size (0.25 or 1.0 acres) every 10 years. Consequently, after the initial openings are created, 25% of the stand will be regenerated during each of 3 additional entries (30 years), with no harvesting occurring during the last 60 years creating an effective rotation length of 100 years. This treatment will result in the production of five age classes; four age classes will result from the regeneration harvests and the fifth age class will result from the retention of trees within groups and throughout the stand (e.g., small areas where harvesting was not feasible like ravine areas and small areas inaccessible by harvesting equipment). Unlike traditional group selection, after the initial entry, gaps will be expanded to more closely mimic the natural processes of gap formation. Because legacy trees will be retained during each entry, if, for example, stand age at the time of the first entry is approximately 100 years, by the end of the 100 year rotation, maximum age of legacy trees will be $\geq 200$ years, and therefore approach some of the maximum tree ages reported to occur in some eastern old-growth forests (e.g., Runkle 1982, Lorimer 1980).

In addition, to diversifying stand structure, alternative B would help to provide for a continuous and sustainable flow of forest products and habitats over time.

Because this is a long-term research project, we plan to address the following research questions; the answers to which apply directly to Forest Goal 6 (LMRP 1994 p. III-2), which identifies the following desired conditions:

A. Diversify silvicultural methods based on research and experimentation,
B. Provide for more natural appearing and diverse forest,
C. Develop regeneration methods based, in part, on natural disturbance patterns, and
D. Restore mast bearing species on suitable sites.

Research Questions
A. Can Alternative B (best described as an expanding gap-based version of group selection) be effectively implemented in upland hardwood forests in the southern Appalachian Mountains?
B. Does the application of the Alternative B result in an uneven-aged ($\geq 3$ age classes) structure, whereby the distinct age classes are comprised of desirable tree species (e.g., oaks, hickories)?
C. What are the effects of Alternative B on understory vegetation, including species diversity and understory production?
D. What are the long-term effects of Alternative B on residual stand structure and tree growth?
E. If/when natural regeneration is lacking, can artificial regeneration be used as a supplement to natural regeneration under the uneven-aged system outlined in Alternative B?

3.9 Cultural Resources

3.9.1. Existing Condition
The assessment for cultural resources within the Gap-Based Approach to Oak Regeneration activity area included ownership, historic land use and past project background studies, examination of cultural and historic references and oral histories, consultation with State Historic Preservation Office (SHPO), and archeological field survey based.

Archeological surveys were in response to proposed Alternative B actions: Potential ground and historic structure disturbances from proposed harvest activities within Stand 024 of Compartment 002 (Table 1) and road use and improvements on all project area FS roads.

The proposed activity areas were surveyed on the ground in their entirety in 2012. The background research identified no previously known sites or likely historic period site locations within the activity area. The field survey identified to prehistoric lithic scatters and a single isolated find within the Gap-Based Approach to Oak Regeneration activity area. All three resources appear to lack the potential to provide substantial additional information concerning prehistoric occupations of the region and are recommended not eligible for the National Register of Historic Places (NRHP).

3.9.2. Direct and Indirect Effects

3.9.2a. Alternative A – No Action
No known direct or indirect will occur from this project.

3.9.2b. Alternative B – Proposed Action
No known direct or indirect will occur from this project.
3.10 Recreation

3.10.1. Existing Condition

There are several recreation and visitor related existing conditions in the Gap-Based Approach to Oak Regeneration Analysis area. There is one system trail in the Femelschlag Project analysis area: a small portion (approximately 400 feet) of the Shut-In Ridge Trail (TR 345). Trail 135, coming out of Yellow Gap ends at the analysis area boundary adjacent to the treatment unit boundary. This trail follows the North Boundary Road (FSR 435) out of Bent Creek. A user created trail exists throughout the analysis connecting to TR 135 and traveling down slope on existing non-system roads in the treatment area. The Gap-Based Approach to Oak Regeneration TAP indicates that some illegal ATV activity does occur in this area on Gated NFS roads and existing non-system roads. The TAP also indicates In addition to the trails, many National Forest users enjoy activities that are not site-specific. Hunting, fishing, backcountry camping (more than 1,000 feet from roads) birding, nature study, and simply driving to view the forest scenery are recreational opportunities that are likely to occur within the Gap-Based Approach to Oak Regeneration Project area. The designated roads within this area are closed but may be used for hiking, trail running, mountain biking, and equestrian riders.

The Recreational Opportunity System (ROS) classification for this area has been designated as ‘Roded Natural’, which means that visitors should expect a lower degree of solitude and frequent encounters with other users.

3.10.2. Direct and Indirect Effects

3.10.2a. Alternative A – No Action

Hunting opportunities for wildlife species favoring late succession habitat would be expected to increase and decrease for wildlife species favoring early succession habitat. Any resource damage from user created mountain bike trails will continue.

3.10.2b. Alternative B – Proposed Action

In relation to recreation resources, Alternative B has little direct impacts to National Forest trails and improvements. As a result of the Femelschlag project FSR 485 will be maintained to standard. In addition, the non-system roads in the Femelschlag activity area would be brought onto the system and up to standard resulting in improvements to any resource damage present from the user created mountain bike trail. Additions of three new roads to the existing system would extend non-motorized recreational access in the analysis area. Table 18 summarizes the proposed access additions under Alternative B.
Table 18. Summary of proposed RMO changes and proposed road additions.

<table>
<thead>
<tr>
<th>Road ID</th>
<th>Name</th>
<th>Existing RMO/Access</th>
<th>Proposed RMO/Access</th>
<th>Length (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSR5011B</td>
<td>Sheep Rock Road</td>
<td>Non system road</td>
<td>D1/closed</td>
<td>0.87</td>
</tr>
<tr>
<td>FRS 5011A</td>
<td>Green Top Road</td>
<td>Non system road</td>
<td>D1/closed</td>
<td>0.50</td>
</tr>
<tr>
<td>FSR5011B</td>
<td>Long Gap Road</td>
<td>Non system road</td>
<td>D1/closed</td>
<td>1.1</td>
</tr>
</tbody>
</table>

There will be an addition of 2.47 miles of non-system roads to the transportation system with an RMO of D1. D1 would continue to allow non-motorized use (bikes, horses, hikers).

**Cumulative Effects**

There are no past, present, or reasonably future activities that would contribute to cumulative effects to the recreation resource in the Gap-Based Approach to Oak Regeneration analysis area.

### 3.11 Scenery Resources

#### 3.11.1. Existing Condition

The analysis area is bounded by the Blue Ridge Parkway to the south, Bent Creek Experimental Forest to the east, the community of Beaverdam to the North and other Pisgah National Forest lands to the West. Highest elevations are along the Blue Ridge Parkway to the South (approx. 4000 ft) and at Yellow Gap to the East (approx. 3600 ft).

For the portion of the Blue Ridge Parkway bordering the Femelschlag Project area, Ferrin Knob primarily blocks the view (Femelschlag Visual Profiles Map and related profiles). Views from Forest Service system roads and trails in the area are of a natural-appearing landscape with a mix of hardwood and coniferous forest.

There are no developed recreation sites in the project area and it has only one National Forest system trail: Shut-In Ridge Trail limiting minimally developed dispersed trail heads and designated campsites. There are access areas to Shut-in Ridge Trail from the Blue Ridge Parkway. The National Forest system roads in the project area are closed or have restricted access. However, some gated system roads are used by hikers, horsemen, and cyclists.

There is limited evidence of past timber management visible with in the project area. Existing regeneration areas have developed to a point where they have a predominately natural-appearing vegetative cover, with color and texture similar to the adjacent forest. In Middleground views, old harvest areas are primarily identified by a shadow-line at the upper unit boundary; in the foreground they appear as dense young growth.
Scenery Analysis

As specified in the USFS Scenery Management System, the scenery analysis considers viewpoints from all use areas, water bodies, and travel corridors (open roads, trails & closed roads designated as trails) in and around the project area. Typically, views from private lands and private roads are not considered unless there are businesses or use areas open to the public.

<table>
<thead>
<tr>
<th>Visual Quality Objectives</th>
<th>Area visible within:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreground</td>
<td>½ mile</td>
</tr>
<tr>
<td>Middleground</td>
<td>between ½ and 5 miles</td>
</tr>
<tr>
<td>Background</td>
<td>from 5 miles to the horizon</td>
</tr>
</tbody>
</table>
Within the Femelschlag analysis area, the proposed treatments are within Management Area (MA) 3B. Management Area 3B has an assigned VQO of Modification in all Distance Zones and Sensitivity Levels; except areas seen from the BRP, where a Partial Retention (PR) VQO must be met. In a PR VQO, activities must repeat form, line, color, and texture of the surrounding landscape to such an extent that activities are perceived as a visually subordinate feature in the characteristic landscape. Partial Retention VQO must be met within two growing seasons. Under Modification VQO, activities may be dominant, but must borrow elements of form, line, color, and texture so it appears as a natural occurrence within the characteristic landscape. Modification VQO must be met within three growing seasons.

<table>
<thead>
<tr>
<th>Sensitivity Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1</strong></td>
<td>Primary travel routes, water bodies, and use areas where at least 1/4 of users have a major concern for scenic quality, or they are areas of National or Regional significance</td>
</tr>
<tr>
<td><strong>Level 2 and 3</strong></td>
<td>Primary or secondary routes, water bodies, or use areas where less than 1/4 of users have a major concern for scenic quality; these might include secondary state roads or open FS roads</td>
</tr>
</tbody>
</table>

Typically, secondary state roads, Forest Service roads, Forest Service trails, and most trailheads would be classified as Sensitivity Level 2 or 3. The Blue Ridge Parkway and Shut-in-Ridge Trail are Sensitivity Level 1.

Computer analysis and leaf-off field surveys were used to identify viewpoints and determine visibility of proposed management activities (Femelschlag Visual Profiles Map). All travel corridors, water bodies and use areas in and around the project area were considered for potential viewpoints. Some of these locations were found to have views of the project area, and were subject to detailed analysis using digital imagery, GIS and/or 3D computer simulations. Other viewpoints were considered, but preliminary analysis determined no proposed activities would be visible from these locations.

For analyzed viewpoints, some of the views would be seen as the observer is moving (in a vehicle, hiking, mountain biking, etc.), others are from stationary vistas. Most views are partially filtered or screened by foreground vegetation, only one is open and unobstructed. The degree of potential impact varies with these and several other factors, such as distance from viewer and viewer position; as well as the slope, size, shape, and type of proposed harvest, road, log landing, etc. All of these factors are considered when determining what activities would meet assigned VQO’s, and what scenery design features should be incorporated. The following list identifies viewpoint locations considered in the analysis.

**Analyzed Viewpoints**
- Key trail viewpoints along the Shut-in-Ridge Trail
  - Shut in Trail Profile 1
- Shut in Trail - Ferrin Knob Profil
○ Shut in Trail Profile 2

○ Shut in Trail – Young Pisgah Ridge Profile
Other Viewpoints Considered (no proposed activities visible):

- Blue Ridge Parkway (roadside vistas, overlooks & trailhead)
  - Beaverdam Gap Profile 2 & Pull Off Profiles
- FSR5005 and 5006 road intersection
  - Non-Forest Service Profile 3
Other Viewpoints Not Considered (Non-Forest Service Properties):

- Non-Forest Service properties
  - Non-Forest Service Profiles 1 & 2

Effects by Alternative

Alternative A (No Action) – Direct & Indirect Effects

There would be no effects to scenery with implementation of the no action alternative. All Visual Quality Objective’s would continue to be met.

Alternative B (Action Alternative) - Direct & Indirect Effects

Proposed commercial treatments utilize group selection and commercial thinning harvest techniques. Non-commercial treatments include pre-harvest oak shelterwood and non-native invasive species (NNIS) plant control.

Proposed non-commercial treatments will have minimal, if any, impacts to scenery. Along the closed FSR 5011 road system, some dead or dying understory vegetation may be visible after treatment, but will decay over time and be unnoticeable to most viewers hiking, walking, or
biking in the area within one growing season. These treatments may also improve scenic quality by opening views into the understory, or removal of NNIS plants.

The first of two proposed commercial harvest methods: Group Selection utilizes a series of small openings distributed across a treatment area. This method replicates natural openings, which occur in the forest when dominant canopy trees fall as a result of age, disease, or storm events.

In Middleground views these openings may be visible as small shadow lines or a change in canopy texture; in most cases this treatment is not noticeable to the average viewer.

In the Foreground, an individual “group” would be seen as a small opening, and after one growing season would be difficult to distinguish from a natural opening. In leaf-off season, skid roads between groups may be visible.

The second of the two proposed commercial harvest methods: Thinning involved removing or reducing the density of trees in the mature overstory. No groups or openings larger than one to two trees are typically created.

In Middleground views, this treatment may be visible a change in canopy texture; in most cases this treatment is not noticeable to the average viewer. The change in the canopy texture will occur throughout the treatment area where gaps from the group selection are not created.

In the Foreground, thinning would be seen as a small disturbance in the interior of the forest, and after one growing season would be difficult to distinguish. In leaf-off season, skid roads may be visible.

From the analyzed view points along the Shut in Ridge Trail, the project area is within the middle ground at greater than a mile and up to two miles from the trail. In each case the view is partially obstructed during leaf-off condition (photos) and close to fully obstructed during leaf-on conditions. The view from the young Pisgah Ridge profile is heavily obstructed by dense mountain laurel (photos). Views from the Blue Ridge Parkway – Young Pisgah Ridge Profile (Photo) are unobstructed but there is no hardened pull off at this location due to its proximity to the tunnel. It is anticipated that visitors passing this view would be traveling at posted parkway speeds making disturbance from this project hard to discern including roads, trail, and landings. The existing infrastructure is not apparent from the view point during leaf off and the view point is behind a locked gate that closes off higher elevations during the winter season. It is anticipated that these conditions, combined with the use of group selection and thinning would result in the assigned VQO (Modification/Partial Retention) being met as proposed for this project. All proposed non-commercial activities would meet VQOs.

**Cumulative Effects**

Past timber harvests, clearings, roads, prescribed burns, and other landscape modifications may be visible from various analyzed viewpoints. The degree to which these modifications impact scenic quality varies greatly with feature type, scale, and contrast with the surrounding natural landscape. Proposed treatments in this project would create small openings, or the canopy may appear thinner in places; and road improvements, skid roads or trails, and log landings may be visible from foreground locations during leaf off conditions.
CHAPTER 4 – CONSULTATION WITH AGENCIES AND OTHERS

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

4.1. ID Team Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Position/Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derek Ibarguen</td>
<td>District Ranger</td>
</tr>
<tr>
<td>Jason Rodrigue</td>
<td>Forest Silviculturist – IDT co-leader/Vegetation</td>
</tr>
<tr>
<td>Tara Keyser</td>
<td>Research Forester – IDT co-leader/Vegetation</td>
</tr>
<tr>
<td>Cathryn Greenberg</td>
<td>Research Ecologist – Wildlife and Fisheries</td>
</tr>
<tr>
<td>Ted Oprean, III</td>
<td>Zone Silviculturist – Vegetation effects</td>
</tr>
<tr>
<td>W. Henry McNab</td>
<td>Research Forester – Soils and Hydrology</td>
</tr>
<tr>
<td>Heather Luczak</td>
<td>Assistant Forest Planner – NEPA support</td>
</tr>
<tr>
<td>Sheryl Bryan</td>
<td>Forest Biologist – BE/BA support</td>
</tr>
<tr>
<td>Brady Dodd</td>
<td>Forest Hydrologist – Hydrology support</td>
</tr>
<tr>
<td>Gary Kauffman</td>
<td>Forest Botanist/Ecologist – BE/BA support</td>
</tr>
<tr>
<td>Rodney Snedeker</td>
<td>Forest Archeologist – Archeology support</td>
</tr>
</tbody>
</table>

4.2. Government Agencies and Elected Officials Contacted

Hendersonville Water Department; National Forests in North Carolina; Natural Resources Conservation Service; North Carolina Clearinghouse; North Carolina Cooperative Extension Service; North Carolina Department of Cultural Resources; North Carolina Department of Natural Resources; North Carolina Department of Transportation; North Carolina Division of Parks and Recreation; North Carolina Natural Heritage Program; North Carolina Wildlife Resources Commission; Southern Research Station; and United States Fish and Wildlife Service.

4.3. Others Contacted

Over 100 members of the public were contacted by mail during the scoping period that was initiated on December 19, 2012. A complete list of individuals and their comments is located in the project record.
4.4. References


APPENDIX A – BIOLOGICAL EVALUATION

BIOLOGICAL EVALUATION

for the

GAP-BASED APPROACH TO OAK REGENERATION (FEMELSCHLAG) PROJECT

PISGAH NATIONAL FOREST
PISGAH RANGER DISTRICT
BUNCOMBE COUNTY
NORTH CAROLINA

PROPOSED ACTION

The proposed project includes irregular shelterwood harvest in several stands using the Femelschlag method. The proposed project area is in compartment 002 stand 024 of the Pisgah Ranger District in Buncombe County, North Carolina. The silvicultural treatment will be conducted off of Forest Service Road (FSR) 5011. A complete description of proposed activities can be found in the Environmental Assessment for this project.

This biological evaluation addresses activities with the potential to affect federally-listed (threatened (T) and endangered (E)) and Regional Forester’s sensitive (S) species, and may not include all activities for all species. Additional discussion of potential effects of the proposed action on biological resources can be found in the resource reports and Environmental Assessment for the Femelschlag Project.

POTENTIAL EFFECTS: AQUATIC RESOURCES

Boundaries of Aquatic Analysis Area

The Femelschlag Project occurs within the Pisgah and Nantahala Land and Resources Plan (LRMP) watershed #27, a part of the French Broad River. An unnamed tributary to Jesse Branch and some smaller unnamed streams are included in the project area. Project area waters are defined as those in the area of potential site-specific impacts (direct and indirect effects) on aquatic habitat and populations, and do not necessary overlap effects to botanical and wildlife resources. In addition to project area waters, the analysis area encompasses waters downstream that potentially could be impacted by project activities when considered within the watershed.
context (cumulative effects). These streams (and parts of streams) represent the bounds of analysis area for aquatic resources.

Existing Conditions

The available aquatic habitat within Jesse Branch and the unnamed tributaries is considered shallow, slow-moving perennial and intermittent streams with a small amount of depositional wetland habitat along the streamside. This habitat within project waters provides minimal habitat for fish, but does support habitat for aquatic macroinvertebrates.

Species Evaluated and Rationale

There are no federally-listed (threatened or endangered) aquatic species likely or known to occur in the project area.

One sensitive (S) aquatic species, the French Broad crayfish (*Cambarus reburrus*) may occur within the project area based on vicinity records and the presence of suitable habitat. Further discussion of the species selection and evaluation process can be found in the Femelschlag Wildlife Report and Environmental Assessment. Therefore, *C. reburrus* is the only aquatic species considered in this Biological Evaluation.

Effects of Alternatives on Aquatic Species

In North Carolina, *Cambarus reburrus* is apparently restricted to the French Broad River system, where it is most often associated with sand and small substrate deposits in streams and rivers. Crayfish burrows were observed within the project area during field surveys, therefore *C. reburrus* may occur within the project area.

If *C. reburrus* occurs within the project area, adverse impacts of activities are unlikely, as buffers retained along streams will protect aquatic habitat and species. Heavy machinery will not enter streams or streamside zones, therefore *C. reburrus* and its habitat will not be impacted as a result of project implementation. There would be no cumulative impacts resulting from any past ongoing, or foreseeable future actions to any sensitive aquatic species resulting from implementation of the Femelschlag Project because there would be no direct or indirect impacts on sensitive aquatic species.

Determination of Effect on Aquatic Species

The Femelschlag Project will have no effect on federally-listed aquatic species because none are known or are likely to occur within the project area. Consultation with the U.S. Fish and Wildlife Service is not required.

The Femelschlag Project will have no impact on the French Broad crayfish (*Cambarus reburrus*) because riparian buffers (streamside zones) will be retained and heavy machinery will not enter streams or streamside zones.
POTENTIAL EFFECTS: BOTANICAL RESOURCES

Boundaries of Botanical Analysis Areas

Because plants are rooted species that must be present in the proposed treatment areas to undergo effects, the analysis area for endangered and threatened species was confined to the expected impact zone surrounding the proposed treatment areas of the project.

Species Evaluated and Rationale

There are no federally-listed (threatened or endangered) or regionally-sensitive rare plant species known or likely to occur within the botanical analysis area. Further discussion of the species selection and evaluation process can be found in the Femelschlag Botanical Report and Environmental Assessment. Therefore, there no plant species are considered in this biological evaluation.

Determination of Effect on Botanical Species

The Femelschlag Project will have no effect on federally-listed botanical species because none are known or are likely to occur within the project area. Consultation with the U.S. Fish and Wildlife Service is not required. Likewise, The Femelschlag Project will have no impact on regionally-sensitive botanical species because none are known or are likely to occur within the project area.

POTENTIAL EFFECTS: WILDLIFE RESOURCES

Boundaries of Terrestrial Wildlife Analysis Area

The project area is dominated by mature Montane Oak Forest with smaller areas of mature Chestnut Oak Forest and Acidic Cove Forest (Schafale and Weakley 1990). Elevation within the project area is < 3500’-- no high-elevation forest types occur within the project area. Specifically, the bounds of this analysis have been defined as Buncombe County.

Species Evaluated and Rationale

No federally-listed (threatened or endangered) terrestrial wildlife species are known or likely to occur within the project area. Northern long-eared bat, *Myotis septentrionalis*, has been proposed to be listed as Federally Endangered. Project design features will incorporate any direction given to the Nantahala and Pisgah National Forests by the Fish and Wildlife Service into our documentation and project implementation (as appropriate). No regionally-sensitive species were detected during field surveys of the project area or during nearby surveys conducted by the USFS (see Baldwin Gap Project Environmental Assessment, 2005). Further, none of these species was detected in the course of research studies conducted on the nearby Bent Creek Experimental Forest involving breeding bird surveys (Greenberg and Lanham 2001), small mammal trapping (Greenberg 2002; Greenberg and Miller 2004; *unpubl. data*), and reptile and amphibian trapping (Greenberg 2002). However, quality habitat exists within the Femelschlag project area for four sensitive wildlife species that are known to occur in Buncombe County (Table 1). These species are included in this Biological Evaluation.
Table 1: Federally Proposed and Sensitive terrestrial wildlife species included in this Biological Evaluation.

<table>
<thead>
<tr>
<th>Species</th>
<th>Type – Rating</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern long-eared bat</td>
<td>Mammal – E (proposed)</td>
<td>Roosts in live and dead trees (warm months); caves, mines (winter)</td>
</tr>
<tr>
<td><em>Myotis septentrionalis</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern small-footed myotis</td>
<td>Mammal - S</td>
<td>Roosts in hollow trees (warm months); caves, mines (winter)</td>
</tr>
<tr>
<td><em>Myotis leibeii</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frosted elfin</td>
<td>Butterfly - S</td>
<td>Open woods and borders; <em>Lupinus</em> and <em>Baptisia</em> sp. host</td>
</tr>
<tr>
<td><em>Callophrys irus</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diana fritillary</td>
<td>Butterfly - S</td>
<td>Rich woods and edge; <em>Viola spp.</em> host</td>
</tr>
<tr>
<td><em>Speyeria diana</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern bush katydid</td>
<td>Katydid - S</td>
<td>Forests</td>
</tr>
<tr>
<td><em>Scudderia septentrionalis</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Potential Effects on Terrestrial Wildlife Species**

The eastern small-footed myotis (*Myotis leibeii*) roosts in hollow trees or rock outcrops during the summer. It is highly unlikely that that *M. leibeii* is present within the project area, as it was not captured during 2009-2010 mist-netting efforts at Bent Creek Experimental Forest nearby (S. Loeb, *pers. comm*). However, bats move around the landscape and there is abundant habitat for these species within the project area. If they occur within the project area these species are unlikely to be adversely impacted, as adults are mobile and can avoid logging activities. Young forest habitat created in small gaps by this project may benefit these species by providing suitable foraging habitat (Loeb and O’Keefe 2011) and greater flying insect abundance.

Habitats and host plants for the frosted elfin (*Callophrys irus*) occur within the project area. Activities that crush plants with egg masses or caterpillars of these species could kill individuals. In the Femelschlag Project, this includes accessing harvest areas, where equipment may crush plants. However, harvest of small gaps will create open and edge conditions that promote occurrence and flowering of host plants for *C. irus*. Most of the forest matrix surrounding harvested gaps will be unaffected by the proposed activities.

Habitats and host plants for the Diana fritillary (*Speyeria diana*) occur within the project area. Any activities that crush plants with egg masses or caterpillars of these species could kill individuals. Diana fritillary eggs or overwintering caterpillars could be destroyed with ground-disturbing activity such as timber harvest. Host plant species for S. diana, such as violets may decrease in small gaps as sunlight increases, however, most of the forest matrix surrounding harvested gaps will be unaffected by the proposed activities. This potential impact is not
expected to affect *S. diana* populations over the species’ range or lead to a trend towards federal listing.

The **northern bush katydid** (*Scudderia septentrionalis*) occurs in a variety of habitats with trees, including residential neighborhoods. Males tend to sing from the treetops, and females may be found on smaller trees, especially when feeding. Because western North Carolina is on the southern edge of the species’ geographical range, populations may be more fragmented here. Where this katydid has been found, populations are small and appear to be stable. The proposed project could kill some individuals, but is unlikely to affect the species at a population level. However, this potential impact is not expected to affect *S. septentrionalis* populations over the species’ range or lead to a trend towards federal listing.

**Determination of Effect on Terrestrial Wildlife Species**

The Femelschlag Project will have no effect on federally-listed aquatic species because none are known or are likely to occur within the project area. Consultation with the U.S. fish and wildlife Service is not required.

The Femelschlag Project will have no adverse impact on *Myotis leibei*ii. In fact, young forest habitat created in small gaps by this project may benefit these species by providing suitable foraging habitat (Loeb and O’Keefe 2011) and greater flying insect abundance.

The Femelschlag Project may impact individual *Calophrys irus* and *Speyeria diana* if egg masses or host plants are crushed. However, these impacts are small in comparison to the undisturbed forest around the project and are not likely to lead to a loss of species viability or trend towards federal listing. Additionally, harvest of small gaps will create open and edge conditions that promote occurrence and flowering of host plants for *C. irus*.

**PREPARED BY:**

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Tracy W. Roof, Forestry Technician, Bent Creek Experimental Forest  
Sheryl Bryan, Fisheries and Wildlife Biologist, National Forests in North Carolina  
Gary Kauffman, Botanist, National Forests in North Carolina

/s/ Sheryl A. Bryan

March 21, 2013
Fisheries and Wildlife biologist
National Forests in North Carolina
160a Zillicoa Street
Asheville, NC 28801

REFERENCES


Attachment 1 to the Biological Evaluation

FEDERALLY LISTED, THREATENED, REGIONALLY SENSITIVE OR FOREST CONCERN PLANT SPECIES IN BUNCOMBE CO, NC.

Attachment 1a. List of federally listed threatened (T) or endangered (E) botanical species, botanical species listed as sensitive (S) by the Regional Forester, or botanical species of forest concern (FC) within Buncombe and Henderson Counties, NC as detailed in the (1) Classification of the Natural Communities of North Carolina and (2) the North Carolina Natural Heritage Program List of Rare Plants of North Carolina. Species documented to occur in the Botanical Analysis Area (which is the 145 acre Activity Area) are discussed in the text. ND = Not detected in the Botanical Analysis Area during field surveys.

<table>
<thead>
<tr>
<th>Species</th>
<th>Forest Status</th>
<th>Habitat preference</th>
<th>Occurrence</th>
<th>Considered in Analysis</th>
<th>Rationale for Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buckleya distichophylla</td>
<td>Sensitive</td>
<td>Acidic Cove Forest</td>
<td>Known to occur in Buncombe Cty.</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Calamagrostis porteri</td>
<td>Forest Concern</td>
<td>Montane Oak-Hickory Forest</td>
<td>Documented in Henderson Cty.</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Carex roanensis</td>
<td>Sensitive</td>
<td>Montane Oak-Hickory Forest</td>
<td>Documented in Buncombe Cty.</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Euphorbia purpurea</td>
<td>Sensitive</td>
<td>Montane Oak-Hickory Forest</td>
<td>Documented in Buncombe Cty.</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Helianthus glaucophyllus</td>
<td>Sensitive</td>
<td>Montane Oak-Hickory Forest</td>
<td>Documented in Buncombe and Henderson Counties</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Hexastylis rhombiformis</td>
<td>Sensitive</td>
<td>Acidic Cove Forest</td>
<td>Documented in Buncombe and Henderson Counties</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Juglans cinerea</td>
<td>Sensitive</td>
<td>Montane Oak-Hickory Forest</td>
<td>Documented in Buncombe and Henderson Counties</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Peltigera venosa</td>
<td>Sensitive</td>
<td>streams</td>
<td>Documented in Buncombe and Henderson Counties</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Prenanthes alba</td>
<td>Forest Concern</td>
<td>Montane Oak-Hickory Forest</td>
<td>Documented in Henderson Cty.</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Silene ovata</td>
<td>Sensitive</td>
<td>Montane Oak-Hickory Forest</td>
<td>Documented in Buncombe and Henderson Counties</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Smilax lasioneura</td>
<td>Forest Concern</td>
<td>Montane Oak-Hickory Forest</td>
<td>Documented in Henderson Cty.</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Thermopsis mollis</td>
<td>Forest Concern</td>
<td>Montane Oak-Hickory Forest, Chestnut Oak Forest</td>
<td>Documented in Buncombe and Henderson Counties</td>
<td>No</td>
<td>ND</td>
</tr>
<tr>
<td>Thermopsis fraxinifolia</td>
<td>Sensitive</td>
<td>Montane Oak-Hickory Forest, Chestnut Oak Forest</td>
<td>Documented in Buncombe and Henderson Counties</td>
<td>No</td>
<td>ND</td>
</tr>
</tbody>
</table>
Attachment 1b. List of aquatic federally listed threatened (T) or endangered (E) species, species listed as sensitive (S) by the Regional Forester, or of forest concern (FC), and other species listed as rare in North Carolina by the NC Natural Heritage Program (NCNHP) (LeGrande et al. 2010) that occur within Buncombe County, NC. Species known or likely to occur in the project area are discussed in the text. Species unlikely to occur within the project area are denoted, with reasons for elimination from further consideration during project analysis (NSH = no suitable habitat; ND = does not occur in drainage).

<table>
<thead>
<tr>
<th>Species</th>
<th>Type</th>
<th>Status</th>
<th>General habitat description</th>
<th>Considered in Analysis</th>
<th>Rationale for Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. blotched chub <em>(Erimystax insignia eristigma)</em></td>
<td>Fish</td>
<td>FC</td>
<td>Large streams and rivers</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Spotfin chub <em>(Cyprinella monachus)</em></td>
<td>Fish</td>
<td>T</td>
<td>Large streams and rivers</td>
<td>No</td>
<td>NSH, ND</td>
</tr>
<tr>
<td>Striped shiner <em>Luxilus chrysocephalus</em></td>
<td>Fish</td>
<td>FC</td>
<td>Large streams and rivers</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Highland shiner <em>Notropis micropteryx</em></td>
<td>Fish</td>
<td>FC</td>
<td>Large streams and rivers</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Percina burtoni <em>Blotchside logperch</em></td>
<td>Fish</td>
<td>S</td>
<td>Large streams and rivers</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Sickle darter <em>Percina williams</em></td>
<td>Fish</td>
<td>FC</td>
<td>Large streams and rivers</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Paddlefish <em>Polyodon spathula</em></td>
<td>Fish</td>
<td>FC</td>
<td>Large streams and rivers</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Appalachian elktoe <em>Alasmidonta raveneliana</em></td>
<td>Mussel</td>
<td>E</td>
<td>Large streams and rivers</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Long-solid <em>Fusconaia subrotunda</em></td>
<td>Mussel</td>
<td>FC</td>
<td>Large streams and rivers</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>French Broad crayfish <em>Cambarrus reburrus</em></td>
<td>Crayfish</td>
<td>S</td>
<td>Sand and smaller substrate deposits in streams and rivers</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Benfield’s small-bearded minnow mayfly <em>Barbaetis benfieldi</em></td>
<td>Mayfly</td>
<td>FC</td>
<td>Sand and smaller substrate deposits in streams and rivers</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>A mayfly <em>Ephemerella berner</em></td>
<td>Mayfly</td>
<td>None</td>
<td>Sand and smaller substrate deposits in streams and rivers: associated with <em>Podestemum</em></td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>A caddisfly <em>Homoplectra monticola</em></td>
<td>Caddisfly</td>
<td>FC</td>
<td>Sand and smaller substrate deposits in streams and rivers</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>A caddisfly <em>Rhyacophila mycata</em></td>
<td>Caddisfly</td>
<td>FC</td>
<td>Gravel and cobble in small streams</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
Attachment 1c. List of terrestrial federally listed threatened (T) or endangered (E) species, listed as sensitive (S) by the Regional Forester, or of forest concern (FC), and other species listed as rare in North Carolina by the NC Natural Heritage Program (NCNHP) (LeGrande et al. 2010) that occur within Buncombe Cty., NC. Species known or likely to occur in the project area are discussed in the text. Species unlikely to occur within the project area are denoted, with reasons for elimination from further consideration during project analysis (NSH = no suitable habitat; NHP = no host plant; NDS = not detected during project or other recent surveys).

<table>
<thead>
<tr>
<th>Species</th>
<th>Type</th>
<th>Status</th>
<th>General habitat description</th>
<th>Considered in analysis</th>
<th>Rationale for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aegolius acadius pop. 1</td>
<td>Bird</td>
<td>FC</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Catharus guttatus</td>
<td>Bird</td>
<td>FC</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Certhia americana</td>
<td>Bird</td>
<td>FC</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Coccyzus erythropthalmus</td>
<td>Bird</td>
<td>FC</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Setophaga cerulea</td>
<td>Bird</td>
<td>FC</td>
<td>Mature hardwood forests/gaps</td>
<td>No</td>
<td>NDS</td>
</tr>
<tr>
<td>Setophaga madhonia</td>
<td>Bird</td>
<td>FC</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Empidonias alnorum</td>
<td>Bird</td>
<td>FC</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Falco peregrinus</td>
<td>Bird</td>
<td>S</td>
<td>Cliffs</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Loxia curvirostra pop. 1</td>
<td>Bird</td>
<td>FC</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Poecile atricapillus</td>
<td>Bird</td>
<td>FC</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Thyromanes bewickii altus</td>
<td>Bird</td>
<td>S</td>
<td>High elevation forests; edges and fields</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Vermivora chrysoptera</td>
<td>Bird</td>
<td>FC</td>
<td>High elevation forests; edges and fields</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Vermivora cyanoptera</td>
<td>Bird</td>
<td>FC</td>
<td>Young forests/thickets</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Vireo gilvus</td>
<td>Bird</td>
<td>FC</td>
<td>Groves along streams</td>
<td>No</td>
<td>NDS</td>
</tr>
<tr>
<td>Myotis leibii</td>
<td>Bat</td>
<td>S</td>
<td>High elevation forests; edges and fields</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Corynorhynus rafinesquii rafinesquii</td>
<td>Bat</td>
<td>FC</td>
<td>Hollow trees, caves &amp; mines in winter</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Myotis leibii</td>
<td>Bat</td>
<td>S</td>
<td>Hollow trees, caves &amp; mines in winter</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Glaucomys sabrinus</td>
<td>Mammal</td>
<td>E</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Species</td>
<td>Type</td>
<td>Status</td>
<td>General habitat description</td>
<td>Considered in analysis</td>
<td>Rationale for exclusion</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------</td>
<td>--------</td>
<td>-----------------------------------------------------------------</td>
<td>------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td><em>coloratus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Least weasel <em>Mustela nivelis</em></td>
<td>Mammal</td>
<td>FC</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Appalachian woodrat <em>Neotoma magister</em></td>
<td>Mammal</td>
<td>FC</td>
<td>Rocky areas in upland forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Eastern fox squirrel <em>Sciurus niger</em>  pop. 1</td>
<td>Mammal</td>
<td>None</td>
<td>Open forests (longleaf pine)</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Long-tailed shrew <em>Sorex dispar</em></td>
<td>Mammal</td>
<td>None</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Southern water shrew <em>Sorex palustris punctulatus</em></td>
<td>Mammal</td>
<td>S</td>
<td>Stream banks within montane forests at higher elevations</td>
<td>No</td>
<td>NSH, NDS</td>
</tr>
<tr>
<td>Eastern spiny softshell <em>Apalone spinifera spinifera</em></td>
<td>Reptile</td>
<td>FC</td>
<td>Large streams and rivers</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Timber rattler <em>Crotalus horridus</em></td>
<td>Reptile</td>
<td>None</td>
<td>Rocky areas in upland forests</td>
<td>No</td>
<td>NSH, NDS</td>
</tr>
<tr>
<td>Coal skink <em>Eumeces anthracinus</em></td>
<td>Reptile</td>
<td>FC</td>
<td>Rocky slopes</td>
<td>No</td>
<td>NSH, NDS</td>
</tr>
<tr>
<td>Bog turtle <em>Glyptemys muhlenbergii</em></td>
<td>Reptile</td>
<td>T (S/A) = S</td>
<td>Bogs, wet thickets</td>
<td>No</td>
<td>NSH, NDS</td>
</tr>
<tr>
<td>Mole salamander <em>Ambystoma talpoideum</em></td>
<td>Amphibian</td>
<td>FC</td>
<td>Fish-free ponds in woodlands</td>
<td>No</td>
<td>NSH, NDS</td>
</tr>
<tr>
<td>Hellbender <em>Cryptobranchus aleganiensis</em></td>
<td>Amphibian</td>
<td>FC</td>
<td>Large, fast, clear streams</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Northern pigmy salamander <em>Desmognathus folkertsi</em></td>
<td>Amphibian</td>
<td>FC</td>
<td>High elevation forests</td>
<td>No</td>
<td>NSH, NDS</td>
</tr>
<tr>
<td>Four-toed salamander <em>Hemidactylum scutatum</em></td>
<td>Amphibian</td>
<td>None</td>
<td>Wetlands in hardwood forests</td>
<td>No</td>
<td>NDS</td>
</tr>
<tr>
<td>Common mudpuppy <em>Necturus maculosus</em></td>
<td>Amphibian</td>
<td>FC</td>
<td>Rivers and large streams</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Blue Ridge gray-cheeked salamander <em>Plethodon amplus</em></td>
<td>Amphibian</td>
<td>FC</td>
<td>Endemic to Hickory Nut Gorge</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Southern zig-zag salamander <em>Plethodon ventralis</em></td>
<td>Amphibian</td>
<td>FC</td>
<td>Moist rocky areas in montane forests</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Crevice salamander <em>Plethodon yonahlossee</em> pop. 1</td>
<td>Amphibian</td>
<td>FC</td>
<td>Endemic to Hickory Nut Gorge</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Sawtooth disc <em>Discus bryanti</em></td>
<td>Mollusc</td>
<td>FC</td>
<td>Cove hardwoods, high elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>High mountain supercoil <em>Paravitrea andrewsae</em></td>
<td>Mollusc</td>
<td>FC</td>
<td>Cove hardwoods, high elevation forests</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>A lampshade spider <em>Hypochilus coylei</em></td>
<td>Arachnid</td>
<td>S</td>
<td>Rock outcrops and crevices</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>A lampshade spider <em>Hypochilus sheari</em></td>
<td>Arachnid</td>
<td>S</td>
<td>Rock outcrops and crevices</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>A nesticid spider <em>Hypochilus sheari</em></td>
<td>Arachnid</td>
<td>S</td>
<td>Rock outcrops and crevices</td>
<td>No</td>
<td>NSH</td>
</tr>
<tr>
<td>Species</td>
<td>Type</td>
<td>Status</td>
<td>General habitat description</td>
<td>Considered in analysis</td>
<td>Rationale for exclusion</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------</td>
<td>--------</td>
<td>------------------------------------------------------------------</td>
<td>------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td><em>Nesticus sylvanis</em> crevices</td>
<td>Insect: butterfly</td>
<td>FC</td>
<td>Damp woods/streamside; host = hogpeanut</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><em>Autochon cellus</em></td>
<td>Insect: butterfly</td>
<td>S</td>
<td>Dry open woods; host = <em>Baptisia</em></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><em>Callotrophus irus</em></td>
<td>Insect: butterfly</td>
<td>FC</td>
<td>Rich moist woods; host = <em>Aruncus dioicus</em></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><em>Erynnis martialis</em></td>
<td>Insect: butterfly</td>
<td>FC</td>
<td>Upland woods’ edge; host = <em>Ceonothus</em></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><em>Euphydryas phaeton</em></td>
<td>Insect: butterfly</td>
<td>FC</td>
<td>Marsh areas; host = <em>Chelonia</em></td>
<td>No NSH</td>
<td></td>
</tr>
<tr>
<td><em>Papilio cresphontes</em></td>
<td>Insect: butterfly</td>
<td>FC</td>
<td>Host = <em>Zanthoxylem</em></td>
<td>No NHP</td>
<td></td>
</tr>
<tr>
<td><em>Phyciodes batesii maconensis</em></td>
<td>Insect: butterfly</td>
<td>FC</td>
<td>Openings, roadside at higher elevations</td>
<td>No NSH</td>
<td></td>
</tr>
<tr>
<td><em>Smythia faunus smithyi</em></td>
<td>Insect: butterfly</td>
<td>FC</td>
<td>Hemlock-hardwood forest; host = birch</td>
<td>No NSH, NHP</td>
<td></td>
</tr>
<tr>
<td><em>Polygonia progne</em></td>
<td>Insect: butterfly</td>
<td>FC</td>
<td>Rich deciduous forest; host = <em>Ribes</em></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><em>Satyrium caryaevorus</em></td>
<td>Insect: butterfly</td>
<td>FC</td>
<td>Mid to high elevations; host = <em>Carya</em></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><em>Speyeria Diana</em></td>
<td>Insect: butterfly</td>
<td>S</td>
<td>Rich woods and edges; host = <em>Viola</em></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><em>Melanoplus acrophilus acrophilus</em></td>
<td>Insect: grasshopper</td>
<td>FC</td>
<td>Shrubby high elevations</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><em>Scudderia septentrionalis</em></td>
<td>Insect: katydid</td>
<td>S</td>
<td>Forested areas and trees in urban areas</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
## Attachment 2 to the Biological Evaluation

### 2005 Rare Aquatic Species List - NANT/ PIS NATIONAL FORESTS

<table>
<thead>
<tr>
<th>Group</th>
<th>Designation*</th>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Status</th>
<th>Status</th>
<th>NC</th>
<th>US</th>
<th>NC</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mollusk</td>
<td>Endangered</td>
<td>Alasmidonta raveneliana</td>
<td>Appalachian elktoe</td>
<td>E</td>
<td>E</td>
<td>S1</td>
<td>G1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mollusk</td>
<td>Endangered</td>
<td>Pegias fabula</td>
<td>little-wing pearlymussel</td>
<td>E</td>
<td>E</td>
<td>S1</td>
<td>G1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mollusk</td>
<td>Endangered</td>
<td>Villosa trabalis</td>
<td>Cumberland bean</td>
<td>E</td>
<td>E</td>
<td>S1</td>
<td>G1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td>Threatened</td>
<td>Cyprinella monacha</td>
<td>spotfin chub</td>
<td>T</td>
<td>T</td>
<td>S1</td>
<td>G2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crayfish</td>
<td>Sensitive</td>
<td>Cambarus chaugaensis</td>
<td>Chauga crayfish</td>
<td>SC</td>
<td></td>
<td>S2</td>
<td>G2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crayfish</td>
<td>Sensitive</td>
<td>Cambarus georgiae</td>
<td>Little Tennessee</td>
<td></td>
<td></td>
<td>S2S3</td>
<td>G1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crayfish</td>
<td>Sensitive</td>
<td>Cambarus parrishi</td>
<td>Hiwassee headwaters</td>
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<td>S2?</td>
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<td>S2?</td>
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<td>yellowfin shiner</td>
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<td>Fish</td>
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<td>Stizistedion canadense</td>
<td>sauger</td>
<td>SR</td>
<td>S2</td>
<td>G5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Acerpenna macdunnoughi</td>
<td>a mayfly</td>
<td>SR</td>
<td>S2S3</td>
<td>G5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Baetis punctiventris</td>
<td>a mayfly</td>
<td>SR</td>
<td>S2</td>
<td>G?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Baetopsis sp. 1</td>
<td>a mayfly</td>
<td>SR</td>
<td>S1</td>
<td>G?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Barbaetis benfieldi</td>
<td>Benfield's bearded small minnow mayfly</td>
<td>SR</td>
<td>S1</td>
<td>G2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Barbaetis cestus</td>
<td>a mayfly</td>
<td>SR</td>
<td>S1</td>
<td>G?</td>
<td></td>
<td></td>
<td></td>
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<td>Mayfly</td>
<td>Locally rare</td>
<td>Barbaetis gloveri</td>
<td>a mayfly</td>
<td>SR</td>
<td>S2</td>
<td>G?</td>
<td></td>
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<td></td>
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<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Drunella longicornis</td>
<td>a mayfly</td>
<td>SR</td>
<td>S3</td>
<td>G5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Ephemerella bernerii</td>
<td>a mayfly</td>
<td>SR</td>
<td>S3</td>
<td>G3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Habrophlediodes spp</td>
<td>a mayfly</td>
<td>SR</td>
<td>S2</td>
<td>G5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Heterocleon petersi</td>
<td>a mayfly</td>
<td>SR</td>
<td>S2S3</td>
<td>G4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Homoeneuria cahabensis</td>
<td>Cahaba sand-filtering mayfly</td>
<td>SR</td>
<td>S1S2</td>
<td>G2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Leptohyphes</td>
<td>a mayfly</td>
<td>SR</td>
<td>S1</td>
<td>G3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species</td>
<td>Status</td>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Rank</td>
<td>G</td>
<td>Notes</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Macdunnoa brumnea</td>
<td>a mayfly</td>
<td>SR</td>
<td>S2</td>
<td>G2</td>
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<td></td>
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<tr>
<td>Mayfly</td>
<td>Locally rare</td>
<td>Serratella spiculosa</td>
<td>spicilose serratellan mayfly</td>
<td>SR</td>
<td>S1</td>
<td>G2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mussel</td>
<td>Locally rare</td>
<td>Alasmidonta viridis</td>
<td>slippershell mussel</td>
<td>E</td>
<td>S1</td>
<td>G4G5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mussel</td>
<td>Locally rare</td>
<td>Elliptio dilatata</td>
<td>spike</td>
<td>SC</td>
<td>S1</td>
<td>G5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mussel</td>
<td>Locally rare</td>
<td>Epioblasma capsaeformis</td>
<td>oyster mussel</td>
<td>EX</td>
<td>E</td>
<td>SX</td>
<td>G1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mussel</td>
<td>Locally rare</td>
<td>Lampsis fasciola</td>
<td>wavy-rayed lampmussel</td>
<td>SC</td>
<td>S1</td>
<td>G4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mussel</td>
<td>Locally rare</td>
<td>Pleurobema oviforme</td>
<td>Tennessee clubshell</td>
<td>SR</td>
<td>FSC</td>
<td>S1?</td>
<td>G3</td>
<td></td>
<td></td>
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<tr>
<td>Mussel</td>
<td>Locally rare</td>
<td>Toxolasma lividus</td>
<td>purple lilliput</td>
<td>EX</td>
<td>FSC</td>
<td>SX</td>
<td>G2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mussel</td>
<td>Locally rare</td>
<td>Villosa constricta</td>
<td>notched rainbow</td>
<td>SR(PSC)</td>
<td>S3</td>
<td>G3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mussel</td>
<td>Locally rare</td>
<td>Villosa delumbis</td>
<td>Eastern creekshell</td>
<td>SR</td>
<td>S3</td>
<td>G4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mussel</td>
<td>Locally rare</td>
<td>Villosa iris</td>
<td>rainbow</td>
<td>SC</td>
<td>S1</td>
<td>G5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mussel</td>
<td>Locally rare</td>
<td>Villosa trabilis</td>
<td>Cumberland bean</td>
<td>SR</td>
<td>E</td>
<td>S1</td>
<td>G1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mussel</td>
<td>Locally rare</td>
<td>Villosa vanuxemensis</td>
<td>mountain creekshell</td>
<td>T</td>
<td>S1</td>
<td>G4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snail</td>
<td>Locally rare</td>
<td>Elimia (Goniobasis) interrupta</td>
<td>knotty elimnia</td>
<td>E</td>
<td>S1</td>
<td>G1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snail</td>
<td>Locally rare</td>
<td>Leptoxis virgata</td>
<td>smooth mudalia</td>
<td>SR</td>
<td>FSC</td>
<td>SU</td>
<td>G2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stonefly</td>
<td>Locally rare</td>
<td>Attaneuria ruralis</td>
<td>a stonefly</td>
<td>SR</td>
<td>S2?</td>
<td>G4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stonefly</td>
<td>Locally rare</td>
<td>Bolotoperla rossi</td>
<td>a stonefly</td>
<td>SR</td>
<td>S3</td>
<td>G4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stonefly</td>
<td>Locally rare</td>
<td>Isoperla frisoni</td>
<td>a stonefly</td>
<td>SR</td>
<td>S3</td>
<td>G5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stonefly</td>
<td>Locally rare</td>
<td>Megaleuctra williamsae</td>
<td>Williams' rare winter stonefly</td>
<td>SR</td>
<td>S1</td>
<td>G2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stonefly</td>
<td>Locally rare</td>
<td>Zapada chila</td>
<td>a stonefly</td>
<td>SR</td>
<td>S1S2</td>
<td>G2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Endangered (E), Threatened (T), or Proposed (PE, PT): as listed by the U.S. Fish and Wildlife Service
Sensitive (S): as listed by the U.S. Forest Service (Region 8, 2001)
Locally Rare (LR): as listed by the National Forests in North Carolina, must meet at least one of the following:
1. State Rank S1, S2, or S3
2. Federal Species of Concern
3. State Threatened or Endangered
Definitions

Threatened, or Endangered (T&E) is a species that has been listed or is proposed for listing by the United States Fish and Wildlife Service. These species are included in every BE conducted for projects where the species is known to, likely to, or may occur. These species are also included in projects where the species occurred historically but hasn’t been found during recent surveys.

Sensitive Species (S) is a species appearing on the Regional Forester’s Sensitive Species List for the Southern Region (March 19, 2002). These species are included in every BE conducted for projects within an area where the species is known to, likely to, or may occur.

Known to Occur: those species in which there are records that they exist within a specified area, or it was found in the area during project specific surveys.

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

Potential to Occur: the species probably occurs in a specified area in the broadest sense. Only very general habitat preferences and species distribution are used to determine if a species may occur. This does not imply their existence in an area, but that their general habitat description is found in the area, so therefore the species may occur. See the attached resource reports for “may occur”.

Forest Plan Analysis Area (AA): 4th order watersheds as determined by the Forest Plan.

Biological Analysis Area: The maximum geographic boundary where cumulative biological effects of analyses from past, present, and reasonably foreseeable actions are expected to be combined with effects from the proposal. Analysis Areas are specific to individual resources and may be different boundaries. The botanical Analysis Area is the 145 acre treatment area or known EO (Element occurrence) of any plant TES species. The wildlife Analysis Area effects were evaluated over the 1,243 acres of Compartnent 002. The aquatic Analysis Area encompasses Beaver Dam watershed.

Management Area: Forest Plan designated areas with specific management objectives, standards, and guidelines.

Project Area: The general location identified by the Responsible Official where actions are proposed.

Treatment (Activity) Area: The geographic boundary where direct effects of the proposal would specifically occur, i.e. specific timber stands, haul routes, temporary roads, linear wildlife fields, trails, prescribed fire, areas where invasive exotic species would be treated, etc. and would change by alternative.
Coldwater Streams: Are usually defined as those with maximum temperatures of 68 degrees F or less. In North Carolina, these streams are largely ground-water fed, have relatively stable flows and generally elevations of 1,100 feet or more. They have gradients that are steep with stable banks. Boulder-rubble dominates their bottoms, and their turbidity is low. Productivity is usually limited.

Coolwater Streams: Represent the transitional community between coldwater streams and warmwater streams. Components of the community may include elements of both coldwater and warmwater habitats.

Warmwater Streams: Are characterized by having annual maximum temperatures greater than 68 degrees F.

Classified (system) Road: Roads wholly or partially within or adjacent to National Forest System Lands that are determined to be needed for long-term motor vehicle access, including State roads, Cty. roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service. (36 CFR 212.1, FSM 7705)

Log Landing (log deck): a cleared area to which logs or stems are yarded to, a processing operation is performed, and loading of logs onto a transport vehicle for haul to a mill occurs.

Unclassified (non-system) Roads: Roads on National Forest System Lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization. (36 CFR 212.1, FSM 7705)

Temporary Road: Road authorized by contract, permit, lease, other written authorization, or emergency operation not intended to be a part of the forest transportation system and not necessary for long-term resource management. (36 CFR 212.1, FSM 7705)

Haul Road: A road capable of accommodating the transport of logs or products loaded onto a highway legal motor vehicle (a motor vehicle travelway over 50 inches wide, unless designated and managed as a trail). A road may be classified, unauthorized, or temporary. (36 CFR 212.1, FSM 7705).

Skid Road: Road cut through the woods for skidding. This is usually assumed to be a skidding pathway that has had excavation of material in order to facilitate the safe passage of the skidding operation.

Skid Trail: Skidder path through the woods. This is usually assumed to mean a pathway made by the skidding of a turn(s) in which no excavation of material was performed to facilitate the skidding operation.
APPENDIX B – AGE CLASS DISTRIBUTION

The Gap Based Approach to Oak Regeneration Project is located on the Pisgah District in Analysis Area 01 (6,674 acres) and contains Compartments 01 (1,370 ac), 02 (1243 ac), 03 (918 ac), 04 (918 ac), 05 (1304 ac) and 06 (921 ac). Analysis Area 01 contains Management Areas 2A emphasize motorized recreational enjoyment and Timber production, 2C emphasize high quality motorized recreational enjoyment, 3B Timber emphasis and few open roads, 4A emphasize visual quality, wildlife habitat and Timber production, MA 4C scenery and older forest habitat emphasis, 4D emphasizes high quality wildlife habitat through Timber production, 13 Mt. Pisgah special interest area and MA 18 embedded within the other management areas consists of aquatic and riparian ecosystems.

Management Area 3B, suitable for timber production (Forest Plan, page III-71) dominates the Pisgah District Analysis Area 01 with 3663 acres or 54% of the analysis area. Inventory data shows that the age-class distribution is unbalanced for MA 3B in the Analysis Area.

This analysis is to determine the minimum and maximum harvest levels for the project area according to the Forest Plan. All action alternatives would help to balance the age-class distribution to a lesser or greater degree.

Forest Plan Direction for Distribution of Early Successional Habitat

The Forest Plan contains specific desired conditions for the amount of 0-10 year age-class in management areas with timber production, 1B and 3B - at least 5% not to exceed 15%, 2A - at least 5% not to exceed 10% and 4A and 4D - not to exceed 10%, (Forest Plan Amendment 5, pages 29-32). The amount of 0-10 age class is regulated at three geographic scales: the analysis area; the management area within the analysis area; and the compartment(s) within the analysis area. Projects which create 0-10 year age class must meet analysis area, management area, and compartment regulations as directed by the Land and Resource Management Plan (Forest Plan) Amendment 5.

The tables below summarize the existing 0-10 year age-class and regeneration goals for Analysis Area 01 Pisgah Ranger District and for the Gap Based Approach to Oak Regeneration Research project in Compartment 02. Acres in management areas not suitable for timber management are not considered in the analysis of 0-10 year old regeneration at the analysis area scale.

Analysis Area Analysis

For every analysis area with at least 250 acres in MAs 1B, 2A, 3B, 4A and/or 4D, the amount of 0-10 year age class allowed in the analysis area is calculated as follows: for MA’s 1B, 2A, 3B, 4A and 4D multiply the number of acres in each MA by the maximum percent allowed.
1B & 3B ~ 3,663 acres x 15% = 549 acres
2A ~ 287 acres x 10% = 29 acres
4A & 4D ~ 1,307 acres x 10% = 131 acres

5,257 709 acres

For Management Areas 1B, 2A, 3B, 4A and 4D multiply the number of acres in each MA by the minimum percent allowed in Analysis Area 14:

1B & 3B ~ 3,663 acres x 5% = 183 acres
2A ~ 287 acres x 5% = 14 acres
4A & 4D ~ 1,307 acres x 0% = 0 acres

5,257 197 acres

The sum of these is the amount of 0-10 year age class allowed in the analysis area.

<table>
<thead>
<tr>
<th>Analysis Area</th>
<th>Suitable Acres</th>
<th>0-10 Year Age-Class</th>
<th>Harvest Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min. Desired</td>
<td>Max. Allowed</td>
</tr>
<tr>
<td>01</td>
<td>5,257</td>
<td>197</td>
<td>709</td>
</tr>
</tbody>
</table>

1 – minimum and maximum 0-10 allowed cannot exceed levels allowed under Compartment analysis, thus the lower number than 5%-15% allowed in each Analysis Area

Management Area Analysis

For every management area with at least 250 acres in the analysis area, the amount of 0-10 year age-class allowed in the management area is calculated by multiplying the number of acres in each management area in the analysis area by the maximum percent allowed. Each result is the amount of 0-10 year age-class allowed in that management area.

<table>
<thead>
<tr>
<th>Mgmt. Area</th>
<th>Forested Acres</th>
<th>0-10 Year Age-Class</th>
<th>Harvest Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min. Desired</td>
<td>Max. Allowed</td>
</tr>
<tr>
<td>3B</td>
<td>3,663</td>
<td>183</td>
<td>549</td>
</tr>
<tr>
<td>2A</td>
<td>287</td>
<td>14</td>
<td>29</td>
</tr>
<tr>
<td>4A, 4D</td>
<td>1,307</td>
<td>-</td>
<td>131</td>
</tr>
<tr>
<td>2C, 4C, 13</td>
<td>1,417</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>6,674</td>
<td>197</td>
<td>709</td>
</tr>
</tbody>
</table>

1 – minimum and maximum 0-10 allowed cannot exceed levels allowed under Compartment analysis, thus the number lower than 5%-15% allowed in the Management Areas
**Compartment Area Analysis**

For every compartment with at least 250 acres in MA 1B, 2A, 3B, 4A, or 4D, the amount of 0-10 year age-class allowed in each compartment is calculated by determining which of the MA’s has the most acres in the compartment (1B, 3B, 2A, 4A, or 4D). If 1B and 3B have the most, then the maximum 0-10 year age-class is 15 percent of all acres in the compartment. If 2A, 4A, or 4D have the most acres, then the maximum amount allowed 0 – 10 year age-class is 10 percent of all acres in the compartment. The following table displays the allowable 0 - 10 age-class by compartment:

Table B-3: 0-10 Year Age-Class Distribution - Pisgah District Analysis Area 01 Compartments 01, 02, 03, 04, 05 and 06

<table>
<thead>
<tr>
<th>COMPARTMENT ANALYSIS SUITABLE ACRES</th>
<th>0-10 YEAR AGE-CLASS</th>
<th>HARVEST GOALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp</td>
<td>Total comp acres</td>
<td>MA 2A</td>
</tr>
<tr>
<td>------</td>
<td>------------------</td>
<td>-------</td>
</tr>
<tr>
<td>01</td>
<td>1370</td>
<td>0</td>
</tr>
<tr>
<td>02</td>
<td>1243</td>
<td>0</td>
</tr>
<tr>
<td>03</td>
<td>918</td>
<td>0</td>
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<td>04</td>
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<td>0</td>
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<tr>
<td>05</td>
<td>1304</td>
<td>287</td>
</tr>
<tr>
<td>06</td>
<td>921</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6674</td>
<td>287</td>
</tr>
</tbody>
</table>

1 – Minimum and maximum 0-10 allowed cannot exceed levels allowed under Compartment analysis, thus the lower number than 5%-15% allowed in each Analysis Area. Existing 0-10 age class is based on year 2013 planned year of decision for the Gap Based Approach to Oak Regeneration Research Project EA. No Regeneration Harvest will occur until 2014 or later.

**Comparison of Alternatives for Early Successional Habitat**

The Forest Plan Amendment 5 General Direction for 0-10 age-class distribution states “Assure a regular and sustained flow of habitats across the Forests through space and time for diversity and viability of plant and animal populations.” (Forest Plan III-29)

This analysis will compare the action and no-action alternatives to see which alternatives will best meet the desired future conditions for early successional habitat (0-10 age class) for acres at the 3 geographic scales and through time based on a 10 year entry cycle as directed by Forest Plan Amendment 5 Standards, Page III-75.

Table B-4 shows the acres of proposed regeneration by alternative with respective % by geographic scale. All alternatives but the No-Action Alternative meets the minimum % of 0-10 age class by Compartment. Further analysis is needed to determine if the percent of 0-10 shown here meets Forest Plan Amendment 5 direction for the Management and Analysis Areas.
The comparison of alternatives in Table 5 show that Alternative B meets Forest Plan Amendment 5 Direction and Standards for regulating the 0-10 age class distribution at the 3 geographic scales. Neither Alternative A nor B meets any of the standards for the three geographic scales but, Alternative B is moving towards them where Alternative A is not.

In addition to meeting Forest Plan Standards for 0-10 age class distribution spatially at 3 geographic scales the project must also meet the minimum 0-10 age class distribution during the 10 year entry cycle as specified in the Forest Plan.
Tables B6 and B7 display the 0-10 age-class distribution for each alternative, based on the 10 year entry cycle. *Analysis Area 01 should maintain a minimum of 197 acres (2.95%) in the 0-10 age class at all times during the 10 year period.*

### Table B6: Alternative A – 0-10 Age-Class Distribution over 10 year Period in Analysis Area 01

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Total Acreage % Analysis Area</td>
<td>126</td>
<td>126</td>
<td>132</td>
<td>132</td>
<td>132</td>
<td>132</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>6</td>
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<tr>
<td>Compartment 1 % Compartment</td>
<td>126</td>
<td>126</td>
<td>132</td>
<td>132</td>
<td>132</td>
<td>132</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Compartment 2 % Compartment</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Compartment 3 % Compartment</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
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<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
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</tr>
<tr>
<td>Compartment 4 % Compartment</td>
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<td>0%</td>
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<td>0%</td>
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</tr>
<tr>
<td>Compartment 5 % Compartment</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
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<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Compartment 6 % Compartment</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

### Table B7: Alternative B - 0-10 Age-Class Distribution Over 10 Year Period in Analysis Area 01

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Acreage % Analysis Area</td>
<td>126</td>
<td>162</td>
<td>168</td>
<td>168</td>
<td>168</td>
<td>168</td>
<td>168</td>
<td>101</td>
<td>101</td>
<td>101</td>
<td>42</td>
<td>6</td>
</tr>
<tr>
<td>Compartment 1 % Compartment</td>
<td>126</td>
<td>126</td>
<td>132</td>
<td>132</td>
<td>132</td>
<td>132</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Compartment 2 % Compartment</td>
<td>0%</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>0%</td>
</tr>
<tr>
<td>Compartment 3 % Compartment</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Compartment 4 % Compartment</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Compartment 5 % Compartment</td>
<td>0%</td>
<td>10</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Compartment 6 % Compartment</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
None of the Alternatives meet Forest Plan Direction for 0-10 in at any of the 3 scales. Alternative A, the No Action alternative, early successional habitat will be present within Analysis Area 01 up to year 2024 but, at no time does it meet the minimum required by the Forest Plan. The early successional habitat comes out of the Baldwin Gap EA signed in 2006. Alternative B although increases the 0-10 age class with the Gap Based Approach to Oak Regeneration Research Project still falls short of meeting the minimum required 0-10 age class for Analysis Area 01 at all 3 scales. At least 29 more acres of regeneration harvest is needed to bring Analysis Area 01 up to Forest Plan Direction in order to assure a regular and sustained flow of habitats for diversity and viability of plant and animal populations through space and time.
APPENDIX C – OLD GROWTH ANALYSIS

Forest Plan Direction for Old Growth Restoration Patches

The Forest Plan (Land and Resource Management Plan Amendment 5) contains specific directions and management guidelines for designating large, medium, and small old growth restoration patches (Forest Plan, pages III-26 – III-28). The Pisgah Ranger District is covered by Old Growth Patch 16 (Forest Plan, Appendix K page K-5). The administrative watershed affected by this project is 27. The requirements for this project are as follows: (1) Check for large old growth patches in Pisgah Analysis Area 01; (2) check for medium old growth patches in Pisgah Analysis Area 01; (3) select small old growth patches for Compartments 01, 02, 03, 04, 05, and 06; and (4) field check stands in the initial inventory of old growth that would be directly affected by this project.

The purpose of the large patches is to serve as permanent reservoir of biological diversity and to provide preferred habitats for forest interior birds across the landscape. The intent is to allow the restoration of functional old growth ecosystems at the sub-regional, Forest and landscape scales.

The purpose of the medium patches is to serve as permanent reservoirs of biological diversity and to allow for the restoration of functioning old growth ecosystems at the landscape and Forest scales.

The purpose of the small patches is to serve to increase biological diversity and to provide structural components of old growth at both the stand and landscape levels.

Large Patch: There are 616 acres of Large old growth patch 2701 in Analysis Area 01 located in Compartment 06 (616 ac).

Medium Patch: There are no medium old growth patches within Pisgah District Analysis Area 01.

Small Patch: There is one (1) designated small old growth patch (88 total acres) within Pisgah District Analysis Area 01 (Table C-1). One (1) additional small patch old growth totaling 67 acres is identified for Compartment 02 which will bring this Compartment up to the 5% minimum required by Forest Plan standards.

Initial Inventory of Old Growth

Four (4) patches of initial inventory old growth were identified by the Forest Plan within Analysis Area 01.

Table C-1: Initial Old Growth Patches Analysis Area 01.

<table>
<thead>
<tr>
<th>Patch#</th>
<th>Compartment/Stand(s)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>432, 433</td>
<td>C04/S01 &amp; S10</td>
<td>Not inventoried for this project, no ground disturbing activities planned in Compartment 4 this entry.</td>
</tr>
<tr>
<td>431, 434</td>
<td>C05/S23, S25, S26, S30 &amp; S31</td>
<td>Not inventoried for this project, no ground disturbing activities planned in Compartment 5 this entry.</td>
</tr>
<tr>
<td>434</td>
<td>C06/S26 &amp; S27</td>
<td>These stands were Incorporated into Large Old Growth Patch #2701.</td>
</tr>
</tbody>
</table>
Small Patch Designation

There is currently 1 (one) designated small patch within Analysis Area 01 in Compartment 01 (Table C-1) designated in the Baldwin Gap Environmental Assessment 2006. There are no designated small or large patches within Compartments 02, 03, 04, 05 and 06 (Compartment 06 does not need a small patch as it is covered by 616 acres of large Patch 2701).

Table C-2: Analysis of Initial, Existing and Needed Old Growth for Analysis Area 01
Pisgah Ranger District

<table>
<thead>
<tr>
<th>Comp</th>
<th>Comp acres</th>
<th>Acres old growth required</th>
<th>Initial old growth</th>
<th>Designated large patch ac/#</th>
<th>Designated medium patch</th>
<th>Designated small patch Acre</th>
<th>Stand</th>
<th>Reference</th>
<th>Total OG acres</th>
<th>Acres old growth needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>1370</td>
<td>69</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>56</td>
<td>S13</td>
<td>Baldwin Gap EA</td>
<td>88</td>
<td>0</td>
</tr>
<tr>
<td>02</td>
<td>1243</td>
<td>62</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>n/a</td>
<td>n/a</td>
<td>0</td>
<td>62</td>
</tr>
<tr>
<td>03</td>
<td>918</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>n/a</td>
<td>n/a</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>04</td>
<td>918</td>
<td>50</td>
<td>73</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>n/a</td>
<td>n/a</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>05</td>
<td>1304</td>
<td>65</td>
<td>88</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>n/a</td>
<td>LRMP #5</td>
<td>616</td>
<td>00</td>
</tr>
<tr>
<td>06</td>
<td>921</td>
<td>50</td>
<td>77</td>
<td>616ac/2701</td>
<td>0</td>
<td>0</td>
<td>n/a</td>
<td>n/a</td>
<td>616</td>
<td>00</td>
</tr>
<tr>
<td>Totals</td>
<td>6674</td>
<td>262</td>
<td>238</td>
<td>616</td>
<td>0</td>
<td>88</td>
<td></td>
<td></td>
<td>704</td>
<td>212</td>
</tr>
</tbody>
</table>

AA01 currently contains 616 acres of OG Large Patch 2701 in Compartment 06. In addition there exist 1 small OG patch in Compartment 01 designated in the Baldwin Gap Environmental Assessment Decision 09/27/2005. Analysis shows Compartments 02, 03, 04 and 05 do not have any designated OG patches meeting the LRMP5 standards of 5% or 50 acres of each Compartment that does not include a Large or Medium Old Growth Patch.

As described in the Forest Plan, in each Compartment containing more than 250 acres of National Forest Land, select a small patch for future old growth management. If 5% of the compartment acres are already part of a large or medium patch, an additional small patch is not needed. Whenever possible, areas should incorporate some riparian habitat to enhance old growth values.

Select the small patches prior to the first ground disturbing project of at least 5 acres proposed in the Compartment.

Select a contiguous area at least 5% the size of the national forest land in the compartment or at least 50 acres, whichever is greater.

*The purpose of the small patch designation is to increase biological diversity and to provide structural components of old growth at the stand and landscape levels.*

The following stands will be designated as small patches for long-term old growth retention to meet Forest Plan standards for old growth: Compartment 02 Stands 25 and 21.
Table C-3: Designated Old Growth Small Patches in Gap Based Approach to Oak Regeneration Research Project, Analysis Area 01 (Compartments 01, 02, 03, 04, 05 and 06).

<table>
<thead>
<tr>
<th>Comp</th>
<th>Total Acres</th>
<th>MA 2A Acre</th>
<th>MA 2C Acre</th>
<th>MA 3B Acre</th>
<th>MA 4A Acre</th>
<th>MA 4D Acre</th>
<th>MA 4C Acre</th>
<th>MA 13 Acre</th>
<th>Existing Designated Old Growth Large and Medium Patch Acres</th>
<th>Designated Small Patch Old Growth</th>
<th>Reference</th>
<th>Total OG Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>1370</td>
<td>0</td>
<td>0</td>
<td>1370</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>56 S13</td>
<td>Baldwin Gap EA</td>
<td>88</td>
</tr>
<tr>
<td>02</td>
<td>1243</td>
<td>0</td>
<td>0</td>
<td>668</td>
<td>113</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>32 n/a</td>
<td>n/a</td>
<td>0</td>
</tr>
<tr>
<td>03</td>
<td>918</td>
<td>0</td>
<td>0</td>
<td>305</td>
<td>0</td>
<td>359</td>
<td>254</td>
<td>0</td>
<td>0</td>
<td>0 n/a</td>
<td>n/a</td>
<td>0</td>
</tr>
<tr>
<td>04</td>
<td>918</td>
<td>0</td>
<td>0</td>
<td>769</td>
<td>0</td>
<td>149</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0 n/a</td>
<td>n/a</td>
<td>0</td>
</tr>
<tr>
<td>05</td>
<td>1304</td>
<td>287</td>
<td>317</td>
<td>214</td>
<td>373</td>
<td>0</td>
<td>113</td>
<td>0</td>
<td>0</td>
<td>0 n/a</td>
<td>n/a</td>
<td>0</td>
</tr>
<tr>
<td>06</td>
<td>921</td>
<td>0</td>
<td>0</td>
<td>337</td>
<td>0</td>
<td>0</td>
<td>199</td>
<td>385</td>
<td>616</td>
<td>0 n/a</td>
<td>LRMP #5</td>
<td>616</td>
</tr>
<tr>
<td>Totals</td>
<td>6674</td>
<td>287</td>
<td>317</td>
<td>3663</td>
<td>486</td>
<td>821</td>
<td>715</td>
<td>385</td>
<td>616</td>
<td>88</td>
<td></td>
<td>704</td>
</tr>
</tbody>
</table>

Currently there are **704** acres or **10.54%** of Analysis Area 01 in old growth restoration. When OG small patches are designated in Compartment 02 by the *Femelschlag Project EA*, designated OG will total **766 acres** comprising **11.48%** of Analysis Area 01.
Regeneration methods are discussed at length in Appendix E of the FEIS for the Forest Plan, and on pages E1-E2 in Amendment 5 of the Forest Plan. Four choices for regeneration methods include (1), shelterwood cutting (even-aged management system) (2), clearcutting (even-aged management system), (3), shelterwood with reserves (two-aged system), and (4), group selection (uneven-aged system). At this time, single-tree selection (uneven-aged management) is not being considered as appropriate in meeting long-term regeneration needs to sustain productive stands of desirable tree species except in northern hardwood (beech-birch-sugar maple) or hemlock stands (shade tolerant species). Other forest management activities such as thinning and sanitation cuts may also occur, but they are intermediate treatments that do not cause overstory replacement and do not result in regeneration recruitment or establishment.

With any silvicultural method, there is a requirement that enough quantity and quality of timber to be removed to make a sale operable, i.e. economically feasible to log at a given stumpage price (stumpage is the price paid for standing timber). For this analysis area, the minimum quantity is approximately three thousand board feet of sawtimber per acre, unless there is a current market for lower value products. Sawtimber is defined as trees that are large enough, less than 25% defect, and of commercially valuable species which could be sawed into grade 3 or better lumber. Silvics for some tree species such as Quercus coccinea (scarlet oak) are such that they seldom will contain any grade 3 logs because of defect due to knots, hear-rot and cankers caused by Cryphonectria parasitica (chestnut blight fungus). Other species like Oxydendron arboretum (sourwood) seldom reach large enough diameter to become sawtimber. Changes in markets may change operability standards in a local area as well as affecting stumpage price.

Operability and stumpage price are also affected by transportation cost, logging cost, and size of the area being logged. Costs of getting logs from the stump to the mill are higher for timber in remote areas, where haul roads must be built, or for timber logged with specialized logging equipment, e.g. with cable systems or with a helicopter. As costs increase, prospective timber purchasers lower their bid prices on stumpage to compensate. If the price they can pay becomes less than the minimum acceptable stumpage price, the timber becomes inoperable (no one will buy it).

Each logging crew, depending on the size of their operation and the value of the timber to be logged, would have a minimum amount of timber that would be economical for them to move in and cut. For instance, in a given stand, it might be economical for a given logging crew to harvest a clearcut as small as 10 acres to obtain 50 MBF. If group selection is chosen, where only about 25 percent of the area is regenerated per entry, 40 acres would be needed to provide the crew with the same amount of sawtimber. Therefore, operability (influenced by topography and stand condition and structure) within a stand is critical for determining which regeneration method(s) are appropriate.
Much concern has been expressed over clearcutting as a management tool. Other regeneration methods will be used when management objectives can be met and when the other methods are economically feasible. In a memo to Regional Foresters dated June 4, 1992, the Chief of the Forest Service stated that “Clearcutting would be limited to areas where it is essential to meet forest plan objectives and involve one or more of the following circumstances:

1. To establish, enhance, or maintain habitat for threatened, endangered, or sensitive species.
2. To enhance wildlife habitat or water yield values, or to provide for recreation, scenic vistas, utility lines, road corridors, facility sites, reservoirs, or similar development.
3. To rehabilitate lands adversely impacted by events such as fires, windstorms, or insect or disease infestations.
4. To preclude or minimize the occurrence of potentially adverse impacts or insect or disease infestations, windthrow, logging damage, or other factors affecting forest health.
5. To provide for the establishment and growth of desired trees or other vegetative species that are shade intolerant.
6. To rehabilitate poorly stocked stands due to past management practices or natural events.
7. To meet research needs.”

These circumstances will be referred to on a site-specific basis when showing that clearcutting is optimum for a given stand.

Regeneration using the group selection method is appropriate where logging costs are relatively low and where there is enough volume and value in the stands to make selection cutting operable. Group selection is not traditionally done in very small stands or on slopes greater than 40 percent where cable logging is necessary, where timber volume or value is low, or in stands where insect or disease hazards are high and widespread. It is also not appropriate where partial cutting and leaving a white pine seed source would result in conversion of mixed pine/hardwood stands to almost pure pine stands, if the accompanying long-term loss of mast production would be detrimental to local wildlife populations.

The shelterwood method of regeneration has been traditionally used where a residual seed source was needed for stand establishment or where new seedlings developed best with partial shade or protection from exposure. In the Appalachian Mountain region, seed from reserve trees (or "leave trees") are usually not needed to establish a new stand, but visual concerns often make shelterwood desirable. Leave trees must be those that would not likely be windthrown after having the adjacent trees cut. The residual overstory of a new shelterwood cut would look more park-like with the biggest and best trees evenly distributed across the landscape, rather than having a denuded appearance like a fresh clearcut might have. Regeneration would become established under the residual overstory. Then, at some later time depending on objectives, all or part of the overstory may be removed so it will not hinder further growth and development of the new stand. Some damage to the regeneration would occur during the overstory removal. Shelterwood is not appropriate on slopes greater than 40 percent where cable logging is necessary unless timber volume and values are very high. Shelterwood is not appropriate in stands where leaving an overstory would make the stands inoperable, or in stands where insect or disease hazards are high and widespread. It is also not appropriate where partial cutting and leaving a white pine seed source would result in conversion of mixed pine/hardwood stands to almost pure pine stands, if the
accompanying long-term loss of mast production would be detrimental to local wildlife populations.

The **shelterwood with reserves** is a **two-age** regeneration method that is similar to the shelterwood method except the overstory removal is deferred until mid-rotation (40-60 years for cove hardwoods) or indefinitely. In many cases it would remain until a new age class reaches rotation. With the development and growth of a new age class in the understory along with the continued growth of the overstory, the stand takes on a two-aged structure. Since leave trees will not have to support a future operable sale, they do not have to be merchantable and not as many need to be left. The type of leave trees retained would depend on site-specific objectives. Basal area of leave trees should not exceed 30 sq. ft./acre fifteen years following harvest in order not hinder further growth and development of the new stand. More than one harvest entry may be used to reduce basal area to this level. For example, a shelterwood removal could reduce basal area from 35 sq. ft./ac to 15 sq. ft./ac, thus perpetuating a two-aged stand. The two-age method is appropriate in operable stands on slopes greater than 40 percent and whenever there are enough suitable trees to leave that will live to be a part of the stand for 40-60 years into the future. Two-age would be appropriate to meet objectives other than timber production, e.g. if continuous acorn production is needed within a stand, if den trees are scarce, or if aesthetics is a consideration. Two-age would be appropriate on slopes greater than 40 percent if timber value is high enough to offset increased costs of skyline logging systems, and if visual concerns or wildlife habitat objectives cannot be met by clearcutting. Two-age is not appropriate in stands where leaving an overstory would make the stands inoperable or in stands that require full sunlight for propagation of the management species.

The following table describes factors to be considered in determining appropriateness of regeneration methods for each stand:
Table D-1: Factors Considered in Determining Appropriate Regeneration Methods

<table>
<thead>
<tr>
<th>Comp/Stand</th>
<th>Acres Alt B</th>
<th>ST Vol./ac (CCF)</th>
<th>PW Vol./ac (CCF)</th>
<th>1/ Timber Quality</th>
<th>2/ Leave Trees</th>
<th>3/ Future Removal</th>
<th>4/ Access</th>
<th>5/ Special Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/24</td>
<td>36</td>
<td>36.17</td>
<td>8.72</td>
<td>VH</td>
<td>N</td>
<td>N</td>
<td>G</td>
<td>-</td>
</tr>
<tr>
<td>02/24</td>
<td>109</td>
<td>5.46</td>
<td>3.74</td>
<td>VW</td>
<td>Y</td>
<td>Y</td>
<td>G</td>
<td>-</td>
</tr>
</tbody>
</table>

1/ Timber Quality:  
- Very High = ave. dia. > 20” - Northern Red Oak, White Oak, Black Cherry  
- High = ave. dia. > 18” - Northern Red Oak, White/Chestnut Oak, Yellow Poplar, White Pine  
- Medium = ave. dia. < 18” - Small Diameter Sawtimber, Mixed Oak  
- Low = ave. dia. does not come into play - Small Roundwood, Scarlet Oak, Chestnut Oak

2/ Leave Trees:  
- Y = Well distributed, long-lived, meet objectives  
- Spotty = Available in clumps; not well distributed  
- N = Scarce, scattered, or high mortality risk

3/ Future Removal:  
- Yes = Potential for operable removal of overstory  
- No = Removal will not be operable within 10 years  
- Cable = Slopes >40 percent require cable logging systems

4/ Access:  
- Good = Less than 0.5 mile from existing haul road  
- Fair = 0.5-1.0 mile from existing haul road  
- Poor = Greater than 1.0 mile from existing haul road

5/ Special Concerns:  
- Conversion = Risk that oak component be lost to pine  
- Wildlife = Modify to provide needs for wildlife  
- Visual = Modify to mitigate aesthetic concerns  
- Insect/Disease = High risk of loss due to SPB and/or loss due to oak decline  
- Heritage = High risk, existing sites or mitigate needed  
- Botanical = Modify to mitigate botanical concerns

Table D-1: Stand description and summary list of appropriate regeneration methods for each stand.

<table>
<thead>
<tr>
<th>Comp/stand</th>
<th>Ac</th>
<th>Age year</th>
<th>Forest type</th>
<th>MA</th>
<th>Harvest method</th>
<th>Logging method</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/24</td>
<td>36</td>
<td>1910</td>
<td>56 – Yellow Poplar, Northern Red Oak &amp; White Oak</td>
<td>3B</td>
<td>Group Selection 0.25 - 1 acre openings</td>
<td>Rubber Tired Skidder</td>
</tr>
<tr>
<td>02/24</td>
<td>109</td>
<td>1910</td>
<td>56 – Yellow Poplar, Northern Red Oak &amp; White Oak</td>
<td>3B</td>
<td>Free Thinning (reduce basal area to 90 sqft/ac)</td>
<td>Rubber Tired Skidder</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Timber Cutting Methods Considered

The following is a list of timber cutting methods which were considered in this analysis. A brief description is provided to help the reader understand these terms as they are used in this document:

Cutting for Even-aged

Clearcutting

Regeneration or harvest method that removes essentially all the trees in a single operation to establish a new stand in a fully exposed microclimate. All merchantable trees on an area are
harvested, and remaining trees are treated in site preparation. This method will be used only when no other method is feasible.

Shelterwood Cutting

The cutting of most trees, leaving those needed to produce sufficient shade to produce a new age class in a moderated microenvironment. Removal of the overwood is done in a sequence of treatments that can include three types of cuttings: (a) an optional preparatory cut to enhance conditions for seed production, usually 50-60 square feet per acre of basal area is left after this cut, (b) an establishment cut to prepare the seed bed and to create a new age class, usually 20-40 sq. ft./acre of basal is left, and (c) a removal cut to release established regeneration from competition with the overwood. Normally, only healthy, wind-firm trees are left as overwood. The usual time frame for the preparatory cut, establishment cut to the removal cut falls within a 10 year period.

Cutting for Two-aged Regeneration

Two-Age Cutting (Shelterwood with Reserves)

Similar to shelterwood cutting except fewer overstory trees are left in place, and they are not subsequently removed, so that two distinct ages of trees are maintained on the same site. Trees left as overwood should be long-lived since they may be expected to live 120 years or more (Beck 1986).

Cutting for Uneven Aged Regeneration

Uneven-aged (selection) methods regenerate and maintain a multi-aged structure by removing some trees in all size classes either singly, in small groups, or in strips. (The Dictionary of Forestry, 1998).

Group Selection Cutting

Cutting small openings between 0.2-to-1.0 acres, distributed over a stand size area, with the intent to establish three or more distinct age-classes within a prescribed rotation. Width of an individual opening would be 1.5-to-2 times the average height of trees adjacent to the opening. Small trees having good growth potential may be left standing within openings, and priority for openings would be where mature timber occurs. The number of openings would depend on the size of the area where selection would be used, the frequency of timber sale entry, and the desired age of the oldest trees. Intermediate harvests to improve the condition of the residual stand or to establish advance regeneration may be done between openings when needed.

Intermediate Harvest

Cutting to anticipate mortality and improve the growth and vigor of the remaining trees without regard for the establishment of regeneration

Free Thinning

The removal of trees that are crowding desirable trees without regard to crown position as in selection thinning. The best trees in terms of species, size or quality are left to grow. Some minimum basal area is usually set using this type of cultural treatment.

Sanitation Thinning

Cutting trees that have been attacked or appear in imminent danger of attack from injurious agents (such as disease or insects) other than competition between trees. The best trees in
terms of species or vigor are left to grow. No minimum basal area is set using this type of cultural treatment.

Selection or Crown Thinning

The removal of trees from the dominant and co-dominant crown classes in order to improve the growth of the remaining trees, but leaving enough desirable, healthy trees to recapture the potential of the site and develop into larger merchantable trees themselves in a reasonable time. This may be done with yellow-poplar on a good site, but only once during a rotation (Beck 1988).

Other Forestry Terms Used:

Advance Reproduction

Young trees, usually seedlings and saplings, growing in the understory of existing stands.

Rotation

The time between regeneration and final harvest.

Stand

A community of trees sufficiently uniform in composition, age, site productivity, spatial arrangement, or condition to be distinguishable from adjacent communities, thereby forming a silvicultural or management entity.

Cutting Cycle

The planned interval between partial harvests in an uneven-aged stand.

Residual

A tree or snag remaining after an intermediate or partial cutting of a stand.

Residual Stand

A stand composed of trees remaining after any type of intermediate harvest.

Basal Area

The cross sectional area of a single stem, including the bark, measured at breast height (4.5 feet or 1.37 meters above the ground).

Stand Basal Area

The cross sectional area of all stems of a species or all stems in a stand measured at breast height and expressed per unit of land area.
APPENDIX E – FINANCIAL EFFICIENCY

Purpose

The purpose of the financial efficiency analysis is to present the estimated costs and revenues of the alternatives considered in the Environmental Analysis for the Proposed Gap-Based Approach to Oak Regeneration Project on the Pisgah Ranger District, Pisgah National Forest. As per Forest Service Handbook 2409.18, each timber sale in the project proposal expected to exceed $100,000 in advertised value requires a financial analysis to determine financial efficiency.

Assumptions

For the purpose of this analysis, the following assumptions will apply:

1. Discount Rate is 4%.
2. Inflation rate is 4% throughout the analysis period (60 years plus).
3. Estimated timber revenues for pine and poletimber were calculated using base prices from the Pisgah and Nantahala National Forests FY 2012 1st Quarter Adjustment Sheet to FY 2012 4th Quarter ZONE 1. Base prices for hardwood species are from the Base Price Calculation Worksheet dated 10/18/2013 prepared by Forest Timber Staff Officer, Supervisor’s Office National Forests in North Carolina, Asheville, North Carolina.
4. Sale preparation costs and timber harvest administration costs were obtained from Fiscal Year 2012 budget figures for the National Forests in North Carolina. Sale preparation costs (layout, cruising and marking) are funded at $10.00/CCF which includes $2,500 per sale package prepared. Timber harvest administration costs are funded at $10,810 per year of Sale (generally sales run 1-3 years depending on size and complexity).
5. Reforestation treatment and stand certification costs are taken from current KV Plans that are similar in size and type of reforestation activities. Current overhead cost (Washington, Regional and Supervisors Offices) of 56.1% is included in this figure.
6. Road construction costs are estimated at an average of $30,000/mile and road reconstruction costs at an average of $20,000/mile based on inventory of road conditions in the project area. The one existing road to be added to the Forest Road system has a high unit cost because of a creek crossing with special a structure to facilitate aquatic passage.
7. A 60-year long-term projection was used for comparison basis only. Many of these stands will be carried for a longer rotation period.

Limitations of Analysis

Any financial analysis must draw limitations on the amount of data to be included or the entire process would quickly become a mix of different alternatives and expected yields or losses. For instance, inflation rate is assumed to be 4% over the entire analysis period; a situation rarely encountered in the real world. The differences between the economic values of the alternatives remain the same, regardless of the inflation rate, so constant dollars were used for comparisons between alternatives. The following tables are an estimate of total project costs directly associated with a timber sale (sale preparation, essential reforestation and logging costs) and are used to determine timber sale financial efficiency.
### Financial Analysis Worksheets

#### Table E-1: Sale Revenue Estimates
for all Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Timber Volume (CCF)</th>
<th>Revenues</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>B</td>
<td>1,897</td>
<td>$203,545</td>
</tr>
</tbody>
</table>

#### Table E-2: Sale Cost Estimates –
Alternative B

<table>
<thead>
<tr>
<th>Activity</th>
<th>Units</th>
<th>Number</th>
<th>Cost/Unit</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale Preparation</td>
<td>CCF</td>
<td>1,897</td>
<td>$10.00</td>
<td>$18,970</td>
</tr>
<tr>
<td>Harvest Administration</td>
<td>Year</td>
<td>3</td>
<td>$10,810</td>
<td>$32,430</td>
</tr>
<tr>
<td>Site Preparation Natural–Herbicide &amp; Handtools</td>
<td>Acres</td>
<td>36</td>
<td>$364</td>
<td>$13,104</td>
</tr>
<tr>
<td>Road Engineering and Design Add Roads to System</td>
<td>Miles</td>
<td>2.5</td>
<td>$22,650</td>
<td>$55,946</td>
</tr>
<tr>
<td>Road Engineering and Design Reconstruction</td>
<td>Miles</td>
<td>1.8</td>
<td>$20,000</td>
<td>$35,000</td>
</tr>
<tr>
<td>Temporary Road Construction</td>
<td>Miles</td>
<td>0.6</td>
<td>$15,000</td>
<td>$9,000</td>
</tr>
<tr>
<td><strong>TOTAL Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$164,450</strong></td>
</tr>
</tbody>
</table>

#### Table E-3: Benefit Cost Ratio –
Alternative B

<table>
<thead>
<tr>
<th>Year</th>
<th>Discount Factor</th>
<th>Revenue</th>
<th>Cost</th>
<th>PNV</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>$203,545</td>
<td>$164,450</td>
<td>$30,906</td>
<td>1.24</td>
</tr>
<tr>
<td>60</td>
<td>4%</td>
<td>$8,142</td>
<td>$6,578</td>
<td>$1,564</td>
<td>1.24</td>
</tr>
</tbody>
</table>

PNV – present net value

BCR - benefit cost ratio
Gap Based Approach to Oak Regeneration
Alternative B
Analysis Area 01 Pisgah Ranger District
Pisgah National Forest

Legend
- Forest System Road Reconstruction
- Existing Road Add to Forest Road System
- NC State Road
- Forest System Road
- Existing Road Use as Skid Road
- Existing Road Use as Temporary Haul Road
- Federal and State Highways
- Study Area Boundary
- Old Growth Small Patch
- Compartment Boundary
- Management Area
- Private Land 1 inch = 1,500 feet

This GIS product was prepared using a variety of sources, including
existing ESRI data, as well as input from Forest staff and other
advocates. The resulting map is used for planning, regulatory,
and public information purposes only. For specific items shown
here and/or additional information, contact the Forest GIS Coordinator,
National Forests, Region 8, Asheville, NC.