

APPENDIX C

BIOLOGICAL ASSESSMENT

for

FEDERALLY PROPOSED, THREATENED, AND ENDANGERED SPECIES:

NANTAHALA/PISGAH PLAN AMENDMENT # 10

NATIONAL FORESTS IN NORTH CAROLINA

July, 2000

I. INTRODUCTION

Purpose and need. This programmatic Biological Assessment (BA) evaluates the effects of implementing new management standards proposed in Amendment 10 of the Nantahala/Pisgah (NP) National Forest Land and Resource Management Plan (Plan). Project-specific analysis will be conducted at the time of a project proposal to determine site-specific effects. Amendment 10 is proposed for the purpose of adding new standards to minimize take of the endangered Indiana bat (*Myotis sodalis*). The basis for this proposed action is a USDI Fish and Wildlife Service (Service) biological opinion and the terms and conditions contained therein.

Objectives of BA. The objectives of this analysis are (1) to assess potential effects, of the proposed standards and guidelines, on federally proposed, threatened, and endangered species that occur or could occur on the NP and, (2) to provide sufficient documentation for further Service consultation. Effects to Forest Service (USFS) sensitive and locally rare species are included in the Biological Evaluation, a separate document.

Legal direction. This BA was prepared in accordance with USFS manual 2671.44 and 2672.42 and regulations set forth in Section 7(a)(2) of the Endangered Species Act. Determinations of effects by species are made based on best available information. As significant new information becomes available through inventory, monitoring and research, a revision of this assessment will be done through consultation with the Service as appropriate.

Management location. The planning area is located in the western portion of North Carolina within the Southern Blueridge Section and includes all federal land managed or administered by the Nantahala and Pisgah National Forests. This area is approximately 1,020,000 acres in size and contains portions of 18 counties.

II. CONSULTATION HISTORY:

Amendment 5. The decision to implement the Plan was approved in 1987. Since that time, there have been nine amendments. The Service reviewed the Proposed Amendment # 5 (a significant amendment) and Draft Supplement to the Final Environmental Impact

Statement (DEIS). In their comments received December 16, 1992, they wrote “The Service does not oppose the selection of Alternative E in the DEIS. We support the shift in emphasis on more uneven-aged management as shown in this alternative and in Alternative B. Our main concerns with forest management direction are: (1) the need to focus more carefully on area-specific recovery objectives for threatened and endangered species, (2) the possible need to revise or reconsider the MIS concept, (3) the protection of old-growth and contiguous forest habitats, and (4) ensuring the continued suitability of lands for timber production.”

Biological Assessment – Amendment 5. The Service concurred with the USFS’s determination of “not likely to adversely affect” in the Biological Assessment for Amendment 5 of the NP Plan. They stated in their letter dated February 17, 1994 that “Our concurrence with this determination is contingent on the statement in the assessment that more detailed consultation under Section 7 of the Act will be conducted at the project level”.

Biological Assessment – Indiana bat. Following discovery of the Indiana bat on the Nantahala National Forest, the USFS initiated formal consultation with the Service (letter dated October 18, 1999). The Service concurred with the USFS’s determination that implementation of Amendment 5 of the Plan was not likely to jeopardize the continued existence of the Indiana bat. In their Biological Opinion (letter dated April 7, 2000), incidental take was determined for a four-county area and reasonable and prudent measures were described to minimize take. It was also concluded that implementation of the Plan (Amendment 5) outside the four-county area is not likely to adversely affect the Indiana bat and that an incidental take statement is not needed.

Biological Assessment – Amendment 10. This assessment tiers to previous completed Biological Assessments, i.e. the BA for Amendment 5, and the BA for the Indiana bat.

III. PROPOSED MANAGEMENT ACTION: Implementation of Amendment 10 is the proposed action. The amendment represents Alternative B, the preferred alternative. This alternative identifies direction and standards, for the Indiana bat, that would minimize the risk of incidental take and conserve habitat to allow for future recovery following all management activities, and requires monitoring of roost and forage use by this species on the NP.

Implementation Area. The immediate effect of the plan amendment is localized to the 4 county area of Graham, Swain, Macon, and Cherokee counties. The long term effect of the plan amendment is broader to encompass the entire NP. Standards would apply only in the following Forest types suitable for the Indiana Bat:

Cove Hardwoods = CISC types 8, 9, 41, 46, 50, 55, 56

Yellow Pine-Hardwood = CISC types 12, 13, 15, 16, 20

Upland Hardwoods = CISC types 10, 42, 44, 45, 47, 48, 51, 52, 53, 54, 57, 59, 60

Specific standards. (1) retain live trees with exfoliating bark, (2) retain suitable snags, hollow, den, or cavity trees, (3) retain additional living trees in the vicinity of snags for protection, (4) limit openings along intermittent streams to single tree gaps, (5) retain all trees within 30 feet of perennial streams and retain 60% canopy cover in the remainder of the riparian area, (6) protect all active roost trees, (7) do not decrease the Indiana bat habitat suitability index by more than 5% for projects impacting five or more acres of forest stands, and (8) continue monitoring efforts to determine use by Indiana bats, consultation with the Service, and coordination with universities, state, and other federal land management agencies to improve the understanding of Indiana bat distribution and abundance on the national forests.

IV. SPECIES CONSIDERED AND SPECIES EVALUATED: We considered all threatened, endangered, and proposed, federal species that either occur now or could potentially occur in the future within the administrative boundaries of the NP (Table 1). This includes 23 species: 16 federally endangered, and 7 federally threatened species.

Table 1. Occurrence and status of endangered and threatened species on the Nantahala/Pisgah National Forests. Highlighted species are those that may exist in forest types suitable for the Indiana bat.

Scientific Name	Common Name	Status / Lifetype / NP Occurrence
<i>Alasmidonta raveneliana</i>	Appalachian Elktoe	Endangered / mollusk / may occur
<i>Canis rufus</i>	Red Wolf	Endangered / mammal / extirpated
<i>Cyprinella monacha</i>	Spotfin Chub	Threatened / fish / may occur
<i>Felis concolor cougar</i>	Eastern Cougar	Endangered / mammal / may occur
<i>Geum radiatum</i>	Spreading Avens	Endangered / plant / occurs
<i>Gymnoderma lineare</i>	Rock Gnome Lichen	Endangered / lichen / occurs
<i>Glaucomys sabrinus coloratus</i>	Carolina N. Flying Squirrel	Endangered / mammal / occurs
<i>Helonias bullata</i>	Swamp Pink	Threatened / plant / occurs
<i>Hexastylis naniflora</i>	Dwarf-flowered Heartleaf	Threatened / plant / may occur
<i>Houstonia montana</i>	Mountain Bluet	Endangered / plant / occurs
<i>Hudsonia montana</i>	Mountain Golden-heather	Threatened / plant / occurs
<i>Isotria medeoloides</i>	Small Whorled Pogonia	Endangered / plant / occurs
<i>Liatris helleri</i>	Heller's Blazing Star	Threatened / plant / occurs
<i>Mesodon clarki nantahala</i>	Noonday Globe	Threatened / mollusk / occurs
<i>Microhexura montivaga</i>	Spruce-fir Moss Spider	Endangered / arachnid / occurs
<i>Myotis sodalis</i>	Indiana Myotis (bat)	Endangered / mammal / occurs
<i>Pegias fabula</i>	Littlewing Pearlymussel	Endangered / mollusk / may occur
<i>Corynorhinus town. virginianus</i>	Virginia Big-eared Bat	Endangered / mammal / may occur
<i>Sagittaria fasciculata</i>	Bunched Arrowhead	Endangered / plant / may occur
<i>Sarracenia jonesii</i>	Mountain Sweet Pitcher Plant	Endangered / plant / may occur
<i>Sarracenia oreophila</i>	Green Pitcher Plant	Endangered / plant / may occur
<i>Sisyrinchium dichotomum</i>	White Iresette	Endangered / plant / may occur
<i>Solidago spithamea</i>	Blueridge Goldenrod	Threatened / plant / occurs
<i>Spiraea virginiana</i>	Virginia Spiraea	Threatened / plant / occurs

Species eliminated from further analysis. Eight of the 23 threatened or endangered species do not occur in forest types suitable for the Indiana bat. Because standards and

guidelines presented in Amendment 10 apply only to habitats where Indiana bat may occur, implementation of this amendment would have “no effect” on these species. They include: Spreading Avens (*Geum radiatum*), Rock Gnome Lichen (*Gymnoderma lineare*), Carolina Northern Flying Squirrel (*Glaucomys sabrinus coloratus*), Mountain Bluet (*Houstonia montana*), Mountain Golden-heather (*Hudsonia montana*), Heller’s Blazing Star (*Liatris helleri*), Spruce-fir Moss Spider (*Microhexura montivaga*), and Blueridge Goldenrod (*Solidago spithamea*). These species will not be evaluated further for potential management impacts.

Species included in analysis. Fifteen species were evaluated for potential management impacts; they are highlighted in Table 1. They include: Appalachian Elktoe (*Alasmidonta raveneliana*), Red Wolf (*Canis rufus*), Spotfin Chub (*Cyprinella monacha*), Eastern Cougar (*Felis concolor cougar*) Swamp Pink (*Helonias bullata*, Dwarf-flowered Heartleaf (*Hexastylis naniflora*), Small Whorled Pogonia (*Isotria medeoloides*), Noonday Globe (*Mesodon clarki nantahala*), Indiana bat (*Myotis sodalis*), Littlewing Pearlymussel (*Pegias fabula*), Virginia Big-eared Bat (*Corynorhinus town. virginianus*), Bunched Arrowhead (*Sagittaria fasciculata*), Mountain Sweet Pitcher Plant (*Sarracenia jonesii*), Green Pitcher Plant (*Sarracenia oreophila*), White Irisette (*Sisyrinchium dichotomum*), and Virginia Spiraea (*Spirea virginiana*). Eleven of these species do not occur on the NP and therefore effects to these species are related to potential impacts to suitable habitat rather than to populations.

V. EVALUATED SPECIES SURVEY INFORMATION

The Nature Conservancy’s Biological and Conservation Database, North Carolina Natural Heritage Program Element Occurrence (EO) records, and species Recovery Plans were reviewed to determine the distribution and abundance of species included in the analysis. These databases include all current survey information collected by private individuals, USFS personnel, and other federal and state agencies. The analysis included intersecting a geographic information system point coverage of EOs with other features (USFS stands, streams, topography, ownership) to evaluate species habitat relationships and landscape distribution.

VI. ENVIRONMENTAL BASELINE FOR THE SPECIES EVALUATED

A. EXISTING ENVIRONMENT

Geography. The NP covers over a million acres of mountains and foothills within the Southern Appalachians, an area roughly 37.4 million acres in size. Forests cover 70 percent of the Appalachian region, pastures 17.4 percent, croplands 3.4 percent, and areas developed for roads, dwellings, and other human structures 3.1 percent (SAMAB 1996). The NP is located in western North Carolina within the Blue Ridge Mountains ecological Section; elevations range from 1000 to over 6000 feet.

Climate. Average precipitation is 40 to 50 inches but ranges up to 60 inches on the highest peaks. Along parts of the southern Blue Ridge escarpment bordering the Southern Appalachian Piedmont Section, rainfall averages over 100 inches.

Lithology and Soils. Bedrock is composed primarily of metasediments (quartzite, schist, and gneiss) and meta-igneous rocks (granite, rhyolite, basalt, and gabbro). Smaller areas underlain by granite occur along the eastern edge of the Section, with sandstone, shale and dolomite, and broad zones of intensely sheared and altered rock. Soils are generally moderately deep and medium textured, have a mesic temperature regime, a udic moisture regime, and mixed mineralogy (McNab and Avers 1994).

Disturbance Regimes. Fire, wind, ice, and precipitation are the principal causes of natural disturbance. Fire caused by lightning is more prevalent in some areas, especially in parts of the Grandfather Ranger District. Tornadoes are uncommon, but more prevalent are localized “microbursts” of intense winds that cause small patches of trees to be up-rooted. An introduced pathogen, the chestnut blight, caused considerable disturbance to composition of most forest stands from 1920 to 1940 by top-killing all American Chestnut trees.

Potential Natural Vegetation and Fauna. The predominant vegetation form is montane cold-deciduous broad-leaved forest dominated by oaks. The oak forests include black, white, red, and chestnut oaks that dominate montane slopes. Smaller areas of mixed oak – pine are present in the intermontane basins and along drier ridges. Mesophytic species such as yellow-poplar, hemlock, basswood, and sweet birch dominate the valleys and moist slopes and coves. Mesic sites at higher elevations (4500 ft.) are occupied by northern hardwoods (e.g. sugar maple, basswood, buckeye). The highest elevations, above 5000 ft., are dominated by spruce and fir.

B. AREA AFFECTED BY THE PROPOSED ACTION

Forest Composition. The NP is comprised of the following forest type groups:

Upland Hardwood - 464,200 acres (46%)	White Pine-Hardwood - 43,500 acres (4%)
Cove Hardwood - 289,400 acres (29%)	Yellow Pine-Hardwood - 37,700 acres (4%)
Conifer - 83,800 acres (8%)	Non-Forest - 25,200 (2%)
Northern Hardwood - 51,400 acres (5%)	Not inventoried - 23,400 (2%)

Forest Structure. These forests are distributed in the following age-classes (rounded):

0-10 years – 22,500 acres (2%)	70-99 years – 512,400 acres (50%)
11-39 years – 102,400 acres (10%)	100+ years – 184,500 acres (18%)
40-69 years – 204,900 acres (20%)	

Upland hardwoods, 70 to 99 years in age, cover roughly one-quarter of the NP.

Perennial streams. There are approximately 2,550 miles of perennial streams on the NP. There are approximately 1,300 miles of perennial streams within management areas suited for timber production. A perennial stream buffer, 100 feet on each side of streams in management areas suited for timber production, would occupy about 32,000 acres. These buffers would be comprised of the following forest type groups and age-classes:

Upland Hardwood – 8,530 acres (27%)	White Pine-Hardwood – 2,540 acres (8%)
Cove Hardwood – 15,770 acres (49%)	Yellow Pine-Hardwood – 680 acres (2%)
Conifer – 2,060 acres (6%)	Non-Forest – 135 (<1%)
Northern Hardwood – 1,810 acres (6%)	Not inventoried – 510 (2%)
0-10 years – 590 acres (2%)	70-99 years – 17,535 acres (55%)
11-39 years – 1,900 acres (6%)	100+ years – 3,040 acres (9%)
40-69 years – 8,950 acres (28%)	

Intermittent streams. There are approximately 3,320 miles of intermittent streams on the NP. There are approximately 1,800 miles of intermittent streams within management areas suited for timber production. An intermittent stream buffer, 30 feet on each side of the streams in management areas suited for timber production, would occupy about 12,300 acres. These buffers would be comprised of the following forest type groups and age-classes:

Upland Hardwood – 4,390 acres (36%)	White Pine-Hardwood – 650 acres (5%)
Cove Hardwood – 5,430 acres (44%)	Yellow Pine-Hardwood – 370 acres (3%)
Conifer – 790 acres (6%)	Not inventoried – 140 (1%)
Northern Hardwood – 550 acres (4%)	
0-10 years – 374 acres (3%)	70-99 years – 6,300 acres (51%)
11-39 years – 1,170 acres (10%)	100+ years – 1,250 acres (10%)
40-69 years – 3,230 acres (26%)	

Past activities in perennial and intermittent stream buffers. In the past 10 years, timber harvest and regeneration activities occurred in over 630 stands on the Nantahala National Forest. Individual stands or management units averaged about 26 acres in size (EA Chapter 3). The location of these stands relative to perennial and intermittent streams was calculated to determine the type of landscapes where past management activities occurred. It was assumed that future management activities on the NP would likely occur in similar landscape positions.

On the Nantahala National Forest in the last decade, approximately 360 acres of timber harvest occurred within 100 feet of a perennial stream and about 260 acres occurred within 30 feet of an intermittent stream. This represents about 4% of the over 16,000 acres of harvest activities during this period. These activities include timber management, recreation, and wildlife management projects. On average, about ½ acre of perennial stream buffer and 1/3 acre of intermittent stream buffer occurred within the individual management units. Over two-thirds of the stands examined had 1% or less of

their area within an intermittent stream buffer. Only nine of the 631 stands examined had 10-14% (the highest amount) of their area within an intermittent stream buffer. Similarly, 83% of the stands had 1% or less of their area within a perennial stream buffer and only four stands had 33-88% (the maximum amount) of their area within the perennial stream buffer.

Status, Distribution, Habitat Relationships, Threats, and Potential Effects. Appendix C1 includes a brief discussion of the current status, species description, habitat relationships, and threats/limiting factors, for each of the 16 listed species that may exist in forest types suitable for the Indiana bat. Potential impacts of implementing Amendment 10 are highlighted in Appendix C1. and summarized below.

VII. EFFECTS OF PROPOSED MANAGEMENT ACTION ON EACH SPECIES EVALUATED.

A. GENERAL HABITAT CHANGES

The potential effects of implementing Amendment 10 on habitat suitability for threatened, endangered, and candidate species can be evaluated by examining the extent of the NP landscape where the new standards apply and the degree to which these standards affect forest structure and composition in these areas.

Extent of habitat change. Implementing Amendment 10 will result in no measurable change in forest structure and composition on nearly three quarters of the NP that are unsuitable for timber production. This is due to standards that emphasize minimizing incidental take and conserving Indiana bat habitat during timber management activities. For example: 14(1a)-(1e), and 14(2a)-(2c). In the past and foreseeable future, these activities are more likely in areas suitable for timber production (275,798 acres – NP Plan, Appendix E). For this reason, most potential habitat change would occur only in 27% of the total 1,024,902 acres on the NP. Consequently, perennial and intermittent stream standards 14(2a), (2b) could potentially affect habitat conditions on just 8% (44,300) of management areas with all lands suitable and management areas where lands unsuitable for timber production are mixed with suitable lands. Finally, limiting a change in the Indiana bat habitat suitability index to no more than 5% (Standard 14(4)) applies only where activities impact at least five acres in size and these are also more likely to occur in lands suitable for timber production.

Degree of habitat change. In general, implementation of Amendment 10 would result in greater structure in upland and riparian forest habitats. This structure would include downed woody debris, standing dead trees, live canopy layers, and cavity trees. Again, this change would occur primarily in areas suitable for timber production. More trees (snags and live trees) would remain in harvest units. Over time, forests in harvest units would become more multi-aged and would have more canopy layers. However, this may not be measurably different from current conditions because of the present emphasis on

modified shelterwood harvests that already retain some overstory trees. Likewise, retaining shagbark and shellbark hickories (Standard 14(1b)), both relatively uncommon species, and retaining bitternut hickory which is not a common species, will not noticeably change species composition in harvest units.

The greatest potential habitat change, from current direction, could occur in riparian areas associated with perennial and intermittent streams. Standards expand riparian areas along intermittent streams to 30 feet on each side of the stream and limit tree removal from this area to single tree gaps at least 75 feet apart. Standards also require that management activities must leave at least 60% canopy cover beyond the 30-foot no-cut areas on each side of perennial streams. This could alter the current direction in the Plan for tree cover and density within riparian areas. However, during the last decade, timber management activities in the past have impacted only 4% of all riparian areas on the Nantahala Forest (EA, Chapter 3) an area that, if avoided, would not significantly change forest habitats structure or composition on the NP.

B. POTENTIAL EFFECTS TO THREATENED, ENDANGERED AND FEDERAL CANDIDATE SPECIES

Short-term effects. The extent of potential changes in forest composition and structure will differ in the short-term versus the long-term. If we assume that timber harvest and other management activities in the next decade are similar to the past decade (EA, Section 3), changes in forest condition in riparian areas across the landscape will be insignificant. Similarly, it is unlikely that maintaining more snags and live trees with exfoliating bark or with suitable cavities would have a significant effect on forest composition and structure. However, localized short-term effects may be more noticeable.

Long-term cumulative effects. Implementation of Amendment 10 is likely to result in a change in forest composition and structure in the long-term (beyond 50 years) in localized areas and localized habitats such as riparian areas. This cumulative effect may benefit species that rely on plentiful snag habitat (Indiana bat) or foraging habitat (Virginia big-eared Bat). Increasing riparian vegetation density along intermittent streams will not only improve downstream nutrient transport but may also reduce erosion and downstream sedimentation. This may in turn improve downstream perennial stream habitats and adjacent riparian areas through reduced effects of sedimentation. This may benefit species that rely on some extended periods of nearly-sediment free water (Appalachian Elktoe, Little-wing Pearly Mussel, Spotfin Chub) and species associated with properly functioning riparian and wetland habitat, e.g., no dramatic changes in normal fluctuations of hydrologic condition (Swamp Pink, Bunched Arrowhead, Mountain Sweet Pitcher Plant, and Green Pitcher Plant).

VIII. DETERMINATION OF EFFECT: The Plan directs the NP to follow threatened and endangered species Recovery Plans during implementation. Management activities proposed for individual projects will undergo site specific environmental analyses and must adhere to both the Forest Plan and to Recovery Plans. Also, management activities will therefore incorporate best management practices and will require consultation and concurrence from the USDI Fish and Wildlife Service to ensure implementation will not adversely affect listed species. This does not change under Amendment 10 and consequently there will be no change in the “not likely to adversely affect” determination made in the BA for the Plan.

Specifically, implementation of standards in Amendment 10 (Alt. B or C) of the Nantahala-Pisgah Land and Resource Plan will have “no effect” on:

Spreading Avens (*Geum radiatum*),
Rock Gnome Lichen (*Gymnoderma lineare*),
Carolina Northern Flying Squirrel (*Glaucomys sabrinus coloratus*),
Mountain Bluet (*Houstonia montana*),
Mountain Golden-heather (*Hudsonia montana*),
Heller’s Blazing Star (*Liatris helleri*),
Spruce-fir Moss Spider (*Microhexura montivaga*),
Blueridge Goldenrod (*Solidago spithamea*)
Red Wolf (*Canis rufus*)
Eastern Cougar (*Felis concolor cougar*)

Specifically, implementation of standards in Amendment 10 of the Nantahala-Pisgah Land and Resource Plan is “not likely to adversely affect”:

Swamp Pink (*Helonias bullata*)
Small Whorled Pogonia (*Isotria medioloides*)
Noonday Globe (*Mesodon clarki nantahala*)
Virginia Spiraea (*Spiraea virginiana*)
Dwarf-flowered Heartleaf (*Hexastylis naniflora*)
Bunched Arrowhead (*Sagittaria fasciculata*)
Mountain Sweet Pitcher Plant (*Sarracenia jonesii*)
Green Pitcher Plant (*Sarracenia oreophila*)
White Iresette (*Sisyrinchium dichotomum*)
Appalachian Elktoe (*Alasmidonta raveneliana*)
Spotfin Chub (*Cyprinella monacha*)
Littlewing Pearlymussel (*Pegias fabula*)
Indiana Bat (*Myotis sodalis*)
Virginia big-eared bat (*Corynorhinus townsendii virginianus*)

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APPENDIX A. Current Status, Distribution, Habitat Relationships, Threats to Species, and Potential Effects.

Appalachian Elktoe
(*Alasmidonta raveneliana*)
endangered: may occur

The Appalachian elktoe endemic to the upper Tennessee river system in western North Carolina and eastern Tennessee and but once a more widespread species. Historical records for the species in North Carolina exist for the Little Tennessee and French Broad River systems including the Nolichucky, Little, Swannanoa, and Pigeon rivers, and the French Broad River-main stem. There are currently 8 extant element occurrence records for the Appalachian Elktoe in North Carolina. In Tennessee, the species is known only from its present range in the main stem of the Nolichucky River. In 1998 and 1999, the species was located in two rivers where it was thought to have been extirpated; the West Fork of the Pigeon and the Little River, and its known range was extended upstream within the Nolichucky River. The NP include the headwaters, but not the sites, where the Appalachian elktoe mussel occurs.

The Appalachian Elktoe is medium-sized mussel reaching up to about 3.2 inches in length. The shell is thin, but not fragile, kidney shaped, and 1 inch in width. Because of its rarity, little is known about the autecology of the species. It has been reported from relatively shallow medium-sized creeks and rivers with cool, well-oxygenated, and moderate – to fast-flowing water. It has been observed in gravelly substrate, often mixed with cobble and boulders; in cracks in bedrock; and occasionally in relatively silt-free, coarse, and sandy substrata. Like other freshwater mussels, the Appalachian elktoe feeds by filtering food particles from the water column.

The decline of this species throughout its range has been attributed to several factors, including siltation resulting from past logging, mining, agricultural, and construction activities; the run-off and discharge of organic and inorganic pollutants; habitat alterations associated with impoundments, channelization, and dredging; and other natural and human- related factors that adversely modify the aquatic environment. Land-clearing and other land disturbance activities carried out without proper sedimentation control pose a significant threat to freshwater mussels (USDI Fish and Wildlife Service 1996).

Potential Effects: Standards in the Nantahala and Pisgah Land and Resource Management Plan will continue to minimize potential effects to streams through site-specific project design, effects analysis, and mitigation. Implementation of Amendment 10 (Alt. B or C) will result in less activity in intermittent streams. This will not only increase riparian vegetation density in these areas but may also reduce erosion and downstream sedimentation. Over time, downstream perennial stream habitats may be improved through reduced sedimentation. This could indirectly improve the existing habitats where the species occurs and may provide more suitable conditions on the NP for future recovery of the species. Implementation of Amendment 10 (Alt. B or C) therefore “is not likely to adversely affect” the Appalachian elktoe mussel (*Alasmidonta raveneliana*).

Red Wolf
(Canis rufus)
endangered: may occur

The red wolf was once found throughout the southeastern United States, from the Atlantic coast to central Texas and from the gulf Coast to central Missouri and southern Illinois. Between the period of 1900 and 1920, red wolves were extirpated from most of the eastern portion of their range. The last red wolves were found in coastal prairie and marsh habitat because this was the last area in which the animals were allowed to remain. The disappearance of the last red wolves from the wild is attributed to two factors: habitat changes which favored expansion of the historic coyote range into red wolf territory, and the local breakdown of red wolf social structure (caused by extensive trapping, poisoning, and shooting).

Any habitat area in the southeastern United States of sufficient size, which provides adequate food, water, and basic cover requirement of heavy vegetation, should be suitable habitat for the red wolf (U.S. Fish and Wildlife Service 1990). Telemetry studies indicate that red wolf home range requirements vary from about 25 to 50 square miles. Prey studies indicate that the diet of the red wolf includes any abundant small to medium-sized mammals (U.S. Forest Service 1995). However, the more recent reintroduction of red wolves in the Great Smoky Mountain National Park has not been nearly as successful and this has been attributed to the extent of interior forest habitat and shortage of open habitat (USDI Fish and Wildlife Service, 1997).

Potential Effects: It is estimated that major red wolf reintroduction areas should be at least 225 square miles (144,000 acres) in size. The Nantahala-Pisgah exceeds this size and although ownership is fragmented, numerous large, unbroken forest patches exist. Implementation of amendment 10 would not result in greater fragmentation of potential red wolf habitat and provides Standards and Guidelines that maintain habitat components that may benefit prey species that the wolf depends on. This will enable future recovery efforts to occur. Implementation of Amendment 10 (Alt. B and C) therefore will have "no effect" on the red wolf (*Canis rufus*).

Spotfin Chub
(*Cyprinella monacha*)
threatened: may occur

The Spotfin chub was once known to be endemic to the Tennessee river system in Alabama, Georgia, North Carolina, Tennessee, and Virginia. It occurred in 12 tributary systems: French Broad, Little Tennessee, Clinch, Powell, Holston – north and south forks, Chickamauga, Emory, Whites, Shoal, Little Bear, and Duck. Presently it occurs in approximately 166 km. of 4 isolated tributary systems: the Duck, Little Tennessee, Emory, and North Fork of Holston River systems. In North Carolina, there are 6 extant element occurrences of the Spotfin chub in the Little Tennessee river. The Nantahala National Forest includes the headwaters, but not the sites, where the species occurs

The Spotfin chub is a fish having a slightly compressed, elongated body ranging from about 20 mm early in the first year to 85 mm in the third year of growth. Except for nuptial males, the color is a dusky green above and silver on the lower sides bordered mid-dorsally and dorso-laterally by gold and green stripes. Nuptial males develop a prominent metallic blue color above the lateral line and the fins bear white margins. The species is an insectivore, feeding diurnally in benthic areas of slow to swift current over various substrates with little siltation. The streams may range from 15-60 m in width and 0.3 – 1.0 m in depth. Water temperature in their summer habitat usually reaches greater than 20° C. The species has been observed in streams with sand, gravel, rubble, boulder, and bedrock substrates. They spawn from mid-May to late August.

The primary reasons for the loss of this once more widely distributed species include silt or coal fine sedimentation, pollution, inundation by reservoir, temperature depression of dam tail water, and channelization. Of 24 once inhabited stream sections, at least two of these factors were noted to have impacted each species population (USDI Fish and Wildlife Service, 1983). It has also been observed, that its competitive abilities (feeding habits, fecundity) may be low.

Potential Effects: Standards in the Nantahala and Pisgah Land and Resource Management Plan will continue to minimize potential effects to streams through site-specific project design, effects analysis, and mitigation. Implementation of Amendment 10 (Alt. B or C) will result in less activity in intermittent streams. This will not only increase riparian vegetation density in these areas but may also reduce erosion and downstream sedimentation. Over time, downstream perennial stream habitats may be improved through reduced sedimentation. This could indirectly improve the existing habitats where the species occurs and may provide more suitable conditions on the Forests for future recovery of the species. Implementation of Amendment 10 (Alt. B or C) therefore “is not likely to adversely affect” the Spotfin chub (*Hybopsis monacha*).

Eastern Cougar
(*Felis concolor couguar*)
endangered: may occur

The eastern cougar is one of 27 cougar subspecies. Although the exact range is unknown, it is thought to have originally occurred within South Carolina, Tennessee, Kentucky, Indiana, and all states to the north and east (Young and Goldman 1946). Cougars were virtually eliminated from these areas soon after they became settled by European immigrants (U.S. Fish and Wildlife Service 1981). Much of the cougars habitat has been eliminated through land development, and its primary prey, the white-tailed deer, has also been reduced in number and range. Cougars have survived in a few areas having rugged terrain and lack of access.

Although no preference for specific habitat requirements has been noted, the primary need is apparently for a large wilderness area with an adequate food supply. Cougars feed primarily on deer, but their diet may also include small mammals, wild turkeys, and occasionally domestic livestock. Male cougars of other subspecies have been observed to occupy a range of 25 or more square miles (16,000 acres).

Potential Effects: The Nantahala-Pisgah has numerous large, unbroken forest patches. The extent and remoteness of areas managed as Wilderness on the NP and the availability of prey species for Eastern cougar will not be affected by implementation of Amendment 10. Suitable habitat for this species will be maintained. Implementation of Amendment 10 (Alt. B or C) will therefore have "no effect" on the eastern cougar (*Felis concolor couguar*).

Swamp Pink
(*Helonias bullata*)
threatened: occurs

There are approximately 200 records of this species in eight states. However, only 112 extant populations are known from New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia. Populations vary widely in size and habitat quality. There are two meta-populations on the Nantahala-Pisgah National Forests. One of these, the Pink Beds, is probably the largest known range-wide population.

Swamp pink is a perennial obligate wetland species with a thick stocky rhizome. Its leaves form an evergreen basal rosette. It occurs along streams and seepage areas in freshwater swamps and other wetland habitats. The groundwater influenced wetlands supporting the species are perennially saturated and rarely, if ever, inundated by floodwaters (Rawinski and Cassin 1986). On the NP, Swamp pink occurs primarily in bogs and swampy forested wetlands bordering meandering streams. On these sites, the water table is at or very near the surface and fluctuates only slightly during spring and summer months (Sutter 1982).

The major threat to the species is loss and degradation of its wetland habitat due to encroaching development, sedimentation, pollution, succession, and wetland drainage. Many Southern Appalachian bogs have been destroyed by drainage and development, particularly for industrial sites and recreational resorts. Declines in plant numbers have also been noted in the Pink Beds following accelerated down cutting of a stream caused by adjacent road runoff. Habitat near the stream was degraded through a localized lowering of the water table and it could no longer support the species (Sutter 1982).

Potential Effects: Standards in the Nantahala and Pisgah Land and Resource Management Plan afford protection to bog and other wetland stream-side habitats that support or could support Swamp Pink. Implementation of Amendment 10 (Alt. B or C) will result in less activity in both intermittent and perennial streams but this is unlikely to cause any significant measurable improvement of Swamp pink habitat. Implementation of Amendment 10 (Alt. B or C) is therefore “not likely to adversely affect” Swamp Pink (*Helonias bullata*).

Dwarf-flowered heartleaf
(*Hexastylis naniflora*)
threatened: may occur

This species is known only from an eight-county area in the upper piedmont of North Carolina and adjacent South Carolina. When the species was listed in 1989, there were 24 known populations. Several large populations have been discovered recently in North Carolina. There are no records of Dwarf-flowered heartleaf on the Nantahala-Pisgah National Forests although suitable habitat may exist.

Dwarf-flowering heartleaf is a low-growing herbaceous plant seldom exceeding 15 cm. in height. The leaves are dark green in color, evergreen and leathery, and are supported by long thin petioles from a subsurface rhizome. The flowers are small and inconspicuous and found near the base of the petioles. Dwarf-flowering heartleaf grows in acidic soils along bluffs and adjacent slopes, in boggy areas next to streams and creek heads, and along the slopes of nearby hillsides and ravines (Gaddy 1980, 1981). The species is distinguished from other members of the genus *Hexastylis* by its small flowers and its distinctive habitat.

Much of the habitat preferred by Dwarf-flowering heartleaf has been destroyed by land clearing and creation of ponds. A large number of known populations occur near expanding urban areas and are threatened by residential, commercial, and industrial development. Competition with trees and evergreen shrubs for light is also identified as a factor that has caused declines in populations. It has been recommended that thinning of very dense forests would benefit this species (Gaddy 1981)

Potential Effects: Retention of snags required in Amendment 10 would have no effect on habitat suitability for Dwarf-flowering heartleaf. Increased canopy cover adjacent to perennial and intermittent streams that could result from implementation of Amendment 10 (Alt. B or C) would not reduce habitat suitability for Dwarf-flowering heartleaf because some overstory removal could occur in these habitats that might favor this species. Implementation of Amendment 10 (Alt. B or C) is therefore “not likely to adversely affect” Dwarf-flowering heartleaf (*Hexastylis naniflora*).

Small Whorled Pogonia
(*Isotria medeoloides*)
endangered: occurs

There are currently at least 86 sites in 15 states and Canada that support Small whorled pogonia. This species historically occurred in 7 additional states. In North Carolina, there are 5 known sites; only one of these is located on the Nantahala National Forest and it has steadily declined over the last 2 decades (USDI Fish and Wildlife Service 1992).

Small whorled pogonia is a perennial orchid with slender, hairy, fibrous roots that radiate from a crown or rootstock. The five or six leaves of *Isotria* plants occur in a false whorl at the apex of a robust, smooth, hollow stem. A single flower, or flower pair, stands in the center of the whorl of leaves. The species is found in mixed-hardwood and mixed hardwood-conifer stands generally in second- or third-growth forest. Although site and stand conditions are variable, microhabitat around the plants is usually sparse, the understory canopy is relatively open, and they are usually close to a long-persisting gap in the forest canopy (e.g. – a road).

The primary threat to the species is habitat destruction, although over collection of this intriguing plant has occurred in the past. Residential or commercial development, both directly and indirectly, is a primary factor in the destruction of small whorled pogonia habitat. Grazing of plants early in the season, and clearcutting are known threats (USDI Fish and Wildlife Service 1992). On the other hand, the species appears to prefer forests that have been partially harvested.

Potential Effects: Retention of snags required in Amendment 10 would have no effect on Small whorled pogonia. Increased canopy cover adjacent to perennial and intermittent streams that could result from implementation of Amendment 10 (Alt. B or C) is not likely to alter habitat suitability for Small whorled pogonia because some overstory removal would occur in these habitats that might favor this species. Implementation of Amendment 10 (Alt. B or C) is therefore “not likely to adversely affect” the Small whorled pogonia (*Isotria medeoloides*).

Noonday Snail
(*Mesodon clarki nantahala*)
threatened: occurs

Snails of the genus *Mesodon* live throughout the eastern United States. *Mesodon clarki* is confined to southeastern Tennessee, the extreme western counties of North Carolina and a few sites in northern Georgia. It is generally distributed in this area but is rather uncommon. The noonday snail (*Mesodon clarki nantahala*) has only been reported from the Nantahala Gorge in North Carolina. Most all documented occurrences are on the Nantahala National Forest.

The noonday snail is a moderate-sized snail with a subglobose shell about 17-18 mm in width and 11 mm in height. The shell is reddish, often shiny when fresh, and the lip of the aperture is sharply reflected. This snail is a woodland species and has been located in the Nantahala Gorge along very mesic cliffs with frequent streams and waterfalls. There is much exposed rock there and an often thick humus layer covering the forest floor. This area is underlain by Murphy Marble (Roe and Moore, 1983) which has produced relatively high-base soils, and supports mixed mesophytic forests with a diverse herbaceous understory. The area where the noonday snail has been found has deeper litter and is wetter and undoubtedly cooler than areas of southern exposure within the gorge.

Our understanding of the ecological relationships of the Noonday snail is incomplete. No estimates of population size have been made because the exact range has never been determined. Furthermore, little is known about the snail's food preferences or feeding behavior. The snail is known at present only from a very limited habitat within the Nantahala Gorge. Human activity within the gorge has increased dramatically over the last decade. This increase of activity enhances the threat of forest fire or trampling, which would damage the unusual habitat that the snails need (USDI Fish and Wildlife Service 1984).

Potential Effects: Standards in the Nantahala and Pisgah Land and Resource Management Plan provide protection to rocky cliffs and the zone where the Noonday snail occurs. This area is not in a management area suited for timber production but recreational development is allowed and this could impact sites where the species occurs. The current Nantahala-Pisgah Land and Resource plan requires site specific analysis and the use of mitigation measures to avoid impacts to this species. Implementation of Amendment 10 (Alt. B or C) does not change this requirement and may result in less activity in riparian areas adjacent both intermittent and perennial streams. Within the Nantahala gorge, these mesic habitats could support the Noonday snail. Implementation of Amendment 10 (Alt. B or C) is therefore "not likely to adversely affect" the Noonday snail (*Mesodon clarki nantahala*).

Indiana Bat
(Myotis sodalis)
endangered: occurs

The Indiana bat has been found in 27 states throughout much of the eastern United States. Based on censuses taken at hibernacula, the total known Indiana bat population was estimated to number about 353,000 bats in 1995-1997; this represented a decline of about 60% since population surveys began in the 1960s. In 1999, two Indiana bats were netted on the Nantahala National Forest in North Carolina. Additional field work verified the presence of a summer maternity colony of up to 28 bats on the Forest.

The Indiana bat is a medium-sized migratory species. Head and body length ranges from 1 5/8 – 1 7/8 in. It is similar in appearance to both the little brown bat and the northern long-eared bat but has several distinct morphological characteristics (Barbour and Davis 1969). Indiana bats hibernate in winter and are restricted to a few suitable hibernacula (typically caves). The Whiteoak Blowhole cave is within 20 miles of the Nantahala National Forest and is the closest hibernacula.

Bats emerge from their hibernacula in late March or early April, migrating varying distances, usually north, to their summer habitats. During the summer, Indiana bats roost in trees and forage for insects primarily in riparian and upland forests. The most important characteristics of roost trees probably are structural – exfoliating bark with space for bats to roost between the bark and the bole of the tree; to a limited extent, tree cavities and crevices also are used for roosting (USDI Fish and Wildlife Service 1999). Maternity colonies use multiple roosts. Indiana bats forage in and around the tree canopy of flood-plain, riparian, and upland forests.

A serious cause of Indiana bat decline has been human disturbance of hibernating bats during the decades of the 1960s through the 1980s. However, even in areas where hibernacula have been protected, population declines have been recorded. Direct mortality due to human vandalism, indiscriminate collecting, handling and banding of hibernating bats, and flooding of caves due to rising waters in reservoirs have been documented. The Indiana bats' maternity range has been changed dramatically from pre-settlement conditions: forest has been fragmented in the upper Midwest, fire has been suppressed, and prairie has been supplanted with agricultural systems. These changes in habitat are also thought to be one cause of the decline of the species (USDI Fish and Wildlife Service, 1999).

Potential Effects: Implementation of standards in Amendment 10, especially those that maintain potential dead and live potential roost habitat, limit openings along intermittent streams to single tree gaps, and maintain Indiana bat habitat suitability across the Forest at 95% of current levels will likely benefit the species. Implementation of Amendment 10 (Alt. B or C) is therefore “not likely to adversely affect” the Indiana bat (*Myotis sodalis*).

Little-wing Pearly Mussel
(*Pegias fabula*)
endangered: may occur

The little-wing pearly mussel is a Cumberlandian species and probably inhabited many of the moderately high gradient, small to medium-sized tributaries of the Tennessee and Cumberland River systems in Alabama, Kentucky, Tennessee, North Carolina, and Virginia. Historical records exist for 24 stream reaches in these States, but the species is presently known from only 7 streams (three in Kentucky, one in Tennessee, two in Virginia, and one in North Carolina). In North Carolina, in the last decade, the species has been relocated in the Little Tennessee river. The Nantahala National Forest includes the headwaters, but not the sites, where Little-wing pearly mussel occurs.

The little-wing pearly mussel is a small species, not exceeding 1.5 inches in length and 0.5 inches in width. The shell's outer surface is usually eroded, giving the shell a chalky or ashy white appearance. It has been reported from small to medium, low turbidity, cool-water, high to moderate gradient streams in the Cumberland and Tennessee River basins. The little-wing pearly mussel has been found in riffles lying on top of the substratum, buried in or on top of the substratum in the transition zone between a long pool and riffle, and buried in gravel or beneath boulders and slabrock. Specific food habits are unknown, but it likely feeds on food items similar to those consumed by other freshwater mussels; detritus, diatoms, phytoplankton, and zooplankton.

The primary reasons for the loss of this once more widely distributed species include habitat loss and water quality deterioration attributed to impoundments, industrial and municipal pollution, acid mine drainage, and siltation resulting from mining, agriculture, and construction activities. However, some losses are apparently due to less drastic changes in water and habitat quality since some populations have been extirpated from stream reaches that still contain other mussel communities (Stansbery 1976). All remaining populations could potentially be impacted by such actions as road construction, stream channel modifications, logging activities, agricultural activities, impoundments, land use changes, and pesticide use (USDI Fish and Wildlife Service, 1989).

Potential Effects: Standards in the Nantahala and Pisgah Land and Resource Management Plan will continue to minimize potential effects to streams through site-specific project design, effects analysis, and mitigation. Implementation of Amendment 10 (Alt. B or C) will result in less activity in intermittent streams. This will not only increase riparian vegetation density in these areas but may also reduce erosion and downstream sedimentation. Over time, downstream perennial stream habitats may be improved through reduced sedimentation. This could indirectly improve the existing habitats where the species occurs and may provide more suitable conditions on Forests for future recovery of the species. Implementation of Amendment 10 (Alt. B or C) is therefore "not likely to adversely affect" the Little-wing Pearly Mussel (*Pegias fabula*).

Virginia Big-eared Bat
(Corynorhinus townsendii virginianus)
endangered: may occur

There are currently 10 known hibernacula and 12 maternity sites that support Virginia big-eared bat colonies. They occur in West Virginia (7 hibernacula, 10 maternity), Virginia (1 hibernaculum, 1 maternity), Kentucky (1 hibernaculum, 1 maternity), and in North Carolina (1 hibernaculum). Five colony sites have been designated as critical habitat (Federal Register, November 30, 1979). All critical habitat occurs in West Virginia. In North Carolina, the Black Rock Cliffs hibernaculum is located on private land in Avery county less than 1 mile from the northern portion of the Pisgah National Forest, Grandfather Ranger District. Twenty hibernating Virginia big-eared bats were reported in Black Rock Cliffs Cave in 1984. Suitable foraging habitat exists on the NP, however no Virginia big-eared bats have been found there.

The Virginia big-eared bat is a subspecies of Townsend's big-eared bat (*Corynorhinus townsendii*). Townsend's big-eared bat is a medium sized bat with large ears, mitten-shaped glandular masses on the muzzle, and elongated nostril openings. The adults weigh from 5 to 13 grams. Virginia big-eared bats inhabit caves during both summer and winter. These caves typically are located in karst regions dominated by oak-hickory or beech-maple-hemlock associations (Barbour and Davis, 1969).

There is a lack of information available on the life history of the subspecies *virginianus* however it is believed to be similar to the non-endangered subspecies of Townsend' big-eared bat. These species are relatively sedentary and exhibit a high degree of site attachment, returning year after year to the same maternity roosts. No long distance migrations have been reported. During late March or early April, female big-eared bats congregate and form maternity colonies in the warm parts of certain caves. Shortly after dark, the females emerge from the cave to forage. They feed mostly along forested edges (in Kunz and Martin, 1982).

Causes of decline of Townsend's big-eared bat likely include loss of habitat, vandalism, and increased human visitation to maternity roosts and hibernacula. Human disturbance at maternity and hibernation sites has been a major concern (USDI Fish and Wildlife Service, 1984). The vulnerability of big-eared bats is increased further by their exotic appearance which makes them targets of collection and intensive observation and their apparent lower tolerance to disturbance than most bats.

Potential Effects: Implementation of standards in Amendment 10 that maintain potential dead and live roost habitat will have no effect on the Virginia big-eared bat because of their exclusive use of caves as maternity roosts. However, standards that require maintenance of foraging habitat and reemphasis on monitoring for the Indiana bat will likely benefit the Virginia big-eared bat. Implementation of Amendment 10 (Alt. B or C) is therefore "not likely to adversely affect" the Virginia big-eared bat (*Corynorhinus townsendii virginianus*).

Bunched Arrowhead
(Sagittaria fasciculata)
endangered: may occur

Currently there are five extant populations of Bunched arrowhead within a 50-mile radius that includes Greenville, South Carolina, and Asheville, North Carolina. The historical range of the bunched arrowhead included 87 additional populations. These were found in Henderson and Buncombe counties, North Carolina. All records are from the French Broad River Valley from south of East Flat Rock north to Asheville. The species has not been located on the NP although there is a possibility, although slight, that suitable habitat may exist.

Bunched arrowhead is a small perennial plant growing in saturated to flooded soils. Emergent leaves are spatulate in shape and up to 3 dm long and 2 cm wide. Habitat rarity limits the distribution of this species. Bunched arrowhead occupies seepages in gently sloping bogs with a slow, continuous flow of cool, clean water (Rayner, 1981). Sites may be underlain by a clay layer (Wooten 1973) and seepages may be related to a long, linear fault that occurs in the four northwestern South Carolina counties (Douglass 1981).

Little remains today of habitats in the Hendersonville – East Flat Rock area in North Carolina that once supported Bunched arrowhead. Sites have been degraded or completely eliminated throughout development and wetland drainage. There is only a slight chance that suitable habitat exists today on the Nantahala-Pisgah National Forests.

Potential Effects: Standards in the Nantahala and Pisgah Land and Resource Management Plan afford protection to bogs and seepages where Bunched arrowhead could occur. Implementation of Amendment 10 (Alt. B or C) will result in less activity in both intermittent and perennial streams which could indirectly benefit wetlands. However, this is unlikely to cause any significant improvement of Bunched arrowhead habitat. Implementation of Amendment 10 (Alt. B or C) is therefore “not likely to adversely affect” Bunched arrowhead (*Sagittaria fasciculata*).

Mountain Sweet Pitcher Plant
(*Sarracenia rubra* ssp. *jonesii*)
endangered: may occur

Mountain sweet pitcher plant is a rare insectivorous plant endemic to a few mountain bogs and streams in the Blue Ridge Mountains of North Carolina and South Carolina. Only 10 populations are currently known to exist – four are in the French Broad River drainage in Henderson and Transylvania Counties, North Carolina, the remainder are in South Carolina. The species has also been reported from Buncombe County in North Carolina, but it is not currently known to survive there. The species has not been located on the NP although suitable habitat exists there.

Mountain sweet pitcher plant is one of eight species in the genus *Sarracenia* which occur primarily on the coastal plain of the Southeastern United States (Bell 1949). This species is an insectivorous, rhizomatous, perennial herb, which grows from 21 to 73 cm tall. The numerous erect leaves grow in clusters and are hollow and trumpet-shaped, forming slender, almost tubular pitchers.

The habitat of mountain sweet pitcher plant consists of mountain bogs and streamsides, usually on deep, poorly drained soils with a high organic matter content. Most sites occur in level depressions associated with floodplains, however, a few occur in “cataract bog” or “waterslide” situations, where sphagnum and other typical bog species line the sides of waterfalls on granite rock faces. Bogs occupied by this species are typically dominated by herbs and shrubs but may have scattered trees such as red maple, hemlock, pitch pine, and white pine, and, at high elevations, red spruce.

The most serious threat to mountain sweet pitcher plant is the destruction or degradation of its wetland habitat (USDI Fish and Wildlife Service, 1990). Sixteen populations have been extirpated due to drainage, impoundment, cultivation and intensive grazing, natural succession, and facilities development. The importance of moderate periodic fires to other members of this genus is well documented for coastal plain species (McDaniel 1971, Folkerts 1977, Barker and Williamson 1988). The role played by fire in the montane habitat of mountain sweet pitcher plant is not known.

Potential Effects: Standards in the Nantahala and Pisgah Land and Resource Management Plan provide protection to bogs but some activities are allowed that may impact streamside zones. Implementation of Amendment 10 (Alt. B or C) will result in less activity in both intermittent and perennial streams. This is unlikely, however, to cause any significant measurable increase in the amount of protection already given to these wetland systems. Suitable habitat will be maintained for this species. Implementation of Amendment 10 (Alt. B or C) is therefore “not likely to adversely affect” the Mountain sweet pitcher plant (*Sarracenia rubra* ssp. *jonesii*).

Green Pitcher Plant
(*Sarracenia oreophila*)
endangered: may occur

Green pitcher plant is currently restricted to areas of the Cumberland Plateau and Ridge and Valley Province in northeast Alabama and to the Blue Ridge of Georgia. This species previously occurred in Coastal Plain and Piedmont areas in Alabama and Georgia and also in central Tennessee. It is believed that North Carolina is just north of the species historic northern extent. Green pitcher plant has not been located on the NP although suitable habitat may exist there.

Green pitcher plant is an insectivorous, rhizomatous, perennial herb, which grows from 20 to 75 cm tall. The erect hollow, pitcher leaves are 6-10 cm. in circumference at the orifice and are gradually narrowed from the orifice to the base. Most of the known populations occur in one of three habitats: mixed oak flatwoods in areas of flat relief and poor drainage, seepage bogs, and sandy, rocky banks or shoals on sandstone geology.

Increased rural residential and agricultural development have caused and continue to cause reductions in the range of green pitcher plant and degradations to its populations and habitats (USDI Fish and Wildlife Service 1985). Land use changes have resulted in reductions in natural fires and controlled burning, allowing succession and competition to lead to the decline of some colonies and reduced vigor of others. Other colonies have been lost due to flooding and streambank changes along rivers where it occurs (Troup and McDaniel, 1980).

Potential Effects: Standards in the Nantahala and Pisgah Land and Resource Management Plan afford protection to habitats that may support green pitcher plant (bogs and streams). Implementation of Amendment 10 (Alt. B or C) will result in less activity in both intermittent and perennial streams but this is unlikely to cause any significant increase in the amount of protection already given to these wetland systems. Implementation of Amendment 10 is therefore “not likely to adversely affect” the Green pitcher plant (*Sarracenia oreophila*).

White Irisette
(*Sisyrinchium dichotomum*)
endangered: may occur

There are currently at least nine self-sustaining populations of White irisette. Twenty-five element occurrences are documented in the Southern Blueridge Mountains Subsection. They are located in a few scattered mountain slopes in western North Carolina southeast of the Asheville basin and in northern South Carolina. Although the historic range has not been determined, it is believed that the species was once more common in natural openings maintained by fire or grazing animals. There are no records of White irisette on the Nantahala-Pisgah National Forests although some suitable habitat may exist.

White irisette is a perennial herb 26 to 40 cm. tall. Stems are winged and basal leaves are one-third to one-half the height of the flowering stalk. The species is found in open, dry to mesic, circumneutral oak-hickory mountain slopes, with aspects ranging primarily from southeast to southwest (Schafale and Weakley 1990). The species seems to grow best on regularly disturbed sites, such as power lines, roadsides, and woodland edges. Populations occur at elevations ranging from 1200 to 3100 feet on gentle to very steep slopes.

The major threat to the species is residential development, road and trail construction and maintenance, herbicide use, and off-road vehicles. Exotic weeds like Kudzu, Japanese honeysuckle, and *Microstegium vimineum* are encroaching at several sites (USDI Fish and Wildlife Service 1995). One of the major limiting factors to expansion of the species is suppression of certain types of disturbance that maintains open quality of habitat. Fire and large native herbivores, such as bison and elk, have been identified as once important agents of this type of disturbance.

Potential Effects: Standards in the Nantahala and Pisgah Land and Resource Management Plan provide some recognition and protection of barrens and glades that could provide suitable habitat for this species. Increased canopy cover adjacent to perennial and intermittent streams that could result from implementation of Amendment 10 (Alt. B or C) is not likely to alter habitat suitability for White irisette; this is not the preferred habitat for the species. In addition, maintenance of greater snags following implementation of Amendment 10 would not degrade habitats that may be suitable for the species and opportunities for expansion of White irisette along more exposed roads and powerlines would not change. Implementation of Amendment 10 (Alt. B or C) is therefore “not likely to adversely affect” White Irisette (*Sisyrinchium dichotomum*).

Virginia spiraea
(*Spiraea virginiana*)
threatened: occurs

There are currently 31 stream populations of Virginia spiraea in seven states. They include Georgia, Kentucky, North Carolina, Ohio, Tennessee, Virginia, and West Virginia. The species is probably extirpated from Alabama and Pennsylvania. There are 16 element occurrences of Virginia spiraea in the mountains of North Carolina, three are on the NP. In addition, a recent extensive population was discovered along the Cheoah River on the Nantahala National Forest.

Virginia spiraea is a perennial shrub that is 1-3 meters in height. The species is clonal, with a root system and vegetative characteristics that allow it to thrive under appropriate disturbance regimes. Virginia spiraea is found along the banks of high gradient sections of second and third order streams, or on meander scrolls and point bars, natural levees, and other braided features of lower reaches. The riverine sites in which the species now occurs have enough erosion to inhibit arboreal competition and fragment the colonies, combined with a deposition pattern suitable for establishment of vegetative propagules (USDI Fish and Wildlife Service 1992). The single exception to the species riverine habitat is a population growing in a wet meadow in Raleigh, West Virginia.

Competition appears to be the most important variable related to the persistence of the species in particular riverine localities. Overtopping by arboreal species or fast-growing herbaceous vegetation is tolerated for some time, but will eventually eliminate Virginia spiraea. Scour must be sufficient to topple the larger, heavier trees without being so extreme as to wash out the plant's fine fibrous root mass or heavy lateral rhizome. Although scour is needed to control competition, the riverine sites where plants occur are not usually sites of maximum erosion. Rather, these sites are areas where deposition occurs after high water flows (e.g., floodplains and overwash islands).

Potential Effects: Standards in the Nantahala and Pisgah Land and Resource Management Plan provide protection to riverine habitats that could support Virginia spiraea. Implementation of Amendment 10 (Alt. B or C) will result in less activity in both intermittent and perennial streams. However, this is unlikely to cause any significant change in the in-stream processes that affect growth and survival of Virginia spiraea. Implementation of Amendment 10 (Alt. B or C) is therefore "not likely to adversely affect" Virginia spiraea (*Spiraea virginiana*).