Biological Assessment

Managing Recreational Uses on the Upper Chattooga River

Sumter National Forest

Chattahoochee National Forest

Nantahala National Forest

I. INTRODUCTION

Three national forests, the Sumter (SNF), Chattahoochee (CONF), and Nantahala (NNF), are proposing a change in recreation management direction for the 21-mile section of the Chattooga Wild and Scenic River upstream of the bridge traversing US 28. This upstream area is known as the Upper Chattooga River. Approximately 70% of the upper Chattooga River is bordered by South Carolina on the eastern bank and Georgia on the west bank. The northernmost portion (30%) of the Upper Chattooga River is within North Carolina. This Biological Assessment (BA) was prepared to address potential project-related impacts to species listed as proposed, threatened, or endangered by the United States Fish and Wildlife Service (Service). It 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.

II. PROPOSED ACTION

The proprosal along the upper Chattooga River is to allow non-commercial boating beginning December 1 to March 1 for a 7.3-mile length from the confluence of Norton Mill Creek in North Carolina (NC) south to Burrels Ford Bridge. Suitable boats for use include tandem or single capicty hard boats or inflatable kayaks. Boating will be allowed when flows of 450 cfs or higher occur during a portion of a 24-hour period as measured at the Burrels Ford gauge or approximately 2.5 feet or higher as measured at the US 76 gauge. It is anticipated the maximum number of boatable days would be 11 with an average of 6. In dry years there may be no floatable days.

Access for the uppermost put-in at Norton Mill Creek will be by traversing County Line (delineating boundary of Macon and Jackson Counties) Trail off Whiteside Cove Road. The other put-in will be at the bridge along Bull Pen Road in NC. Take-outs will be either at Bull Pen Road bridge or Burrells Ford Road bridge in South Carolina (SC). Group use (from 2-6 boaters per group with a minimum of 2 crafts) along these two sections will not exceed 4 per day. An adaptive management strategy to control all recreational use will be implemented including self registration of boating and periodically assessing the amount of all recreational use ¼ mile from roads and bridges. The increased boating activity will not involve any increase in parking capicty in the upper Chattoga River corridor.

Two monitoring plans will be instigated with implementation of this recreational change. Large woody debris will be monitored annually for the first two years following

implementation of this proposed action and periodically thereafter if needed. This monitoring is intended to determine if any removal of large woody debris is occurring and if there are affects to the aquatic habitat. Prior to the start of the boating season a critical stretch of the river will be monitored for downed trees spanning the river and requiring portage. The search will be conducted from (1) the confluence with Norton Mill Creek downstream to Bull Pen Road Bridge and (2) 0.6 mile length downstream of where Fowler Creek Trail (# 431) intersects Chattooga River Trail from NC to the boundary between Ga and SC. If portage areas are located, a survey will be conducted by a qualified biologist for the presence of the following rare species by forest:

1) *Lejeunea bloomquistii* or *Listera smallii* on the CONF;
2) *Chiloscyphus muricatus, Homalia trichomanoides, Bryoxiphium norvegicum*, *Cephalozia macrostachya ssp. australis, Plagiomnium carolinianum*, or *Plagiochilla sullivantii var. sullivantii* on the NNF; and
3) *Lophocolea appalachiana* for either the NNF or the CONF.

If any of these rare species are located, a NEPA decision would be implemented to ensure boaters traversing that stretch of the river would avoid impacts to these species.

Other recreational access will be restricted to designated trails with closure of redunant trails or those with unacceptable resource damage. Camping will only be allowed in designated campsites with designated fire ring locations. Activities will include permanent closure of campsites with unacceptable resource damage.

An adaptive management strategy to control all recreational use will be implemented including self registration of boating and periodically assessing the amount of all recreational use ¼ mile from roads and bridges.

III. EXISTING CONDITION

The topographic character of the Chattooga River watershed is abrupt with a deeply dissected landform that forms a portion of the Blue Ridge Escarpment as it divides the Blue Ridge from the Foothills and Piedmont. Steep gorge walls, narrow chutes, waterfalls and small shaded rock outcrops are prominent features across this dissected portion of the watershed. The steep vertical relief along the river changes rather abruptly downstream of Ellicott Rock turning into a relative gentle gradient with only small falls, broader chutes or scattered rapids such as at Big Bend Falls and at Rock Gorge.

The geological dominants have greatly influenced the vegetation types. Both graywacke-schist and greywacke-schist-amphibolite comprise over three-quarters of the watershed area (Hatcher 1971, USDA 1995). Mica gneisses, feldspathic gneisses, quartzite, and aluminum schist dominate the basin. The mafic derived rocks, amphibolites, are generally scarce and as such the soils tend to be less productive and plants within the heath family are particularly abundant across the watershed.

Various community classification reviews has been conducted within portions of the Chattooga River watershed during the past 30 to 35 years. Dumond completed a floristic and plant community study within the upper reaches of the watershed in 1970. A landscape ecosystem classification model was developed by Gattis (1992) and Carter

(1994) for portions of the Highlands Ranger District and by Moffat (1993) for the Chattooga Ranger District. Karen Patterson classified more complex vegetation patterns for the Ellicott Rock Wilderness in 1994. A land type phase model with incorporation of the diverse vegetation types each separated by soil characteristics was completed by the Chattooga Ecological Classification Team (USFS 1995). Permanent community classification plots within the escarpment area south of Highlands were established in 1997 by the North Carolina Vegetation Survey (Peet, et al. 1997).

Unique and high quality communities as well as rare species were characterized by Dellinger in 1992 throughout the Highlands Ranger District, by Gaddy in 1992 both within the Highlands area and within the Andrews Pickens District of the Sumter National Forest, by Zartman and Pittillo within spray cliffs in 1995 and by various bryologists in conducting a survey to determine the current status of those bryophytes formerly ranked as federal candidates (Anderson et. al. 1997). Previous bryology surveys had been completed by Anderson within a small portion of the watershed while characterizing moss diversity across the Blue Ridge Escarpment (Anderson and Zander 1973). All of these studies have expanded the knowledge of rare habitats and communities within the Chattooga River watershed.

There are about 178,700 acres in the Chattooga River Watershed. Table 1 indicates the ecological diversity across the watershed. Approximately two-thirds of the watershed, 126,300 acres, is national forest lands. The only ecological classification that has been modeled and mapped in a Geographic Information System throughout the Watershed includes the work completed by the USFS in 1995. Tables 1 and 2 lists the acreage managed by the three national forest units for the different ecological types present within the watershed and the lower and upper wild and scenic corridor. U.S. Highway 28 separates the lower and upper corridor. This database shows that about 47% of the watershed is dominated by hardwood types, primarily oaks, 25% is dominated by mixed yellow pine-oak types, 14% is dominated by hemlocks and hardwoods, and 10% by white pine and hardwoods. The remaining types, such as alluvial forest and rock outcrops are much less common within the watershed. As a result they are difficult to map or model and may significantly deviate from the tally.

The upper (upstream of highway US 28) and lower wild and scenic corridor differ in the abundance of these dominant types (Table 2). Within the upper corridor white pine dominant types, hemlock hardwood, pitch and table mountain pine communities, and dry oak-hickory are much more prevalent. In contrast shortleaf pine types dominate the lower wild and scenic corridor and acidic cove forest and mesic oak-hickory forest are more abundant in comparison to the upper corridor.

Table 1. Comparison of Ecological Type abundance within the Chattooga River Watershed, and the Upper (north of US 28) and Lower (south of US 28) Wild & Scenic Corridors.

Natural Communities	Acres	% in Watershed	Upper Wild & Scenic Corridor (Ac)	% Upper Corridor	Lower Wild & Scenic Corridor (Ac)	% Lower Corridor
High Elevation Red Oak Forest	1882	1%	23	0.3%	0	0%
Montane Oak-Hickory Forest	10667	6%	156	2%	0	0%
Montane White Oak Forest	1529	1%	13	0.2%	0	0%
White Pine/Heath Forest	17293	10%	1331	19%	436	2%
Mesic Oak-Hickory Forest	34391	19%	636	9%	4916	25%
Table Mountain Pine-Oak/Heath Forest	246	0.1%	0	0%	0	0%
Pitch Pine-Oak/Heath Forest	16837	9%	955	14%	2257	12%
Acidic Cove Forest	6373	4%	423	6%	2323	12%
Eastern Hemlock/ Rhododendron maximum Forest	18252	10%	842	12%	92	0.5%
Alluvial Forest River Bar/Island	1788	1%	156	2.2%	628	3%
Chestnut Oak/Northern Red Oak/ Rhododendron	5243	3%	528	7%	367	2%
Chestnut Oak/Scarlet Oak/Heath Forest	12005	7%	604	9%	187	1%
Dry Oak-Hickory Forest	18574	10%	1048	15%	976	5%
Shortleaf Pine-Southern Red Oak-Blackjack Oak Forest	11533	6%	9	0.1%	1099	6%
Shortleaf Pine-Southern Red Oak Forest	18601	10%	141	2%	5721	29%
Heath Bald	447	0.3%	0	0%	0	0%
Swamp Forest/Bog	1164	1%	0	0%	0	0%
Rock Outcrops	234	0.1%	0	0%	0	0%
Urban	216	0.1%	0	0%	0	0%
Water	1104	1%	182	3%	496	3%
Unmodeled	325	0.2%	0	0	0	0
Totals	**178704**		**7047**		**19498**	

Table 2. Comparison of Ecological Type Abundance in USFS management within the Chattooga River Watershed, and the Upper (north of US 28) and Lower (south of US 28) Wild & Scenic Corridors.

Ecological Types	USFS Acres	% on USFS	Upper Wild & Scenic Corridor (USFS Ac)	% Upper Corridor	Lower Wild & Scenic Corridor (USFS Ac)	% Lower Corridor
High Elevation Red Oak Forest	1183	1%	23	0.4%	0	0%
Montane Oak-Hickory Forest	7156	6%	155	2%	0	0%
Montane White Oak Forest	828	1%	13	0.2%	0	0%
White Pine/Heath Forest	14127	11%	1248	19%	361	4%
Mesic Oak-Hickory Forest	20554	16%	636	10%	1671	18%
Table Mountain Pine-Oak/Heath Forest	168	0.1%	0	0%	0	0%
Pitch Pine-Oak/Heath Forest	13561	11%	921	14%	710	8%
Acidic Cove Forest	4951	4%	423	6%	1735	18%
Eastern Hemlock/ Rhododendron maximum Forest	14005	11%	679	10%	24	0.3%
Alluvial Forest/Island/River Bar	1217	0.2%	156	2.4%	573	6%
Chestnut Oak/Northern Red Oak/ Rhododendron	4548	4%	486	7%	275	3%
Chestnut Oak/Scarlet Oak/Heath Forest	8275	7%	490	7%	157	2%
Dry Oak-Hickory Forest	14862	12%	1032	16%	498	5%
Shortleaf Pine-Southern Red Oak-Blackjack Oak Forest	6316	6%	9	0.1%	401	4%
Shortleaf Pine-Southern Red Oak Forest	13531	11%	141	2%	2773	29%
Heath Bald	347	0.3%	0	0%	0	0%
Swamp Forest/Bog	84	0.1%	0	0%	0	0%
Rock Outcrops	178	0.1%	0	0%	0	0%
Water	400	0.3%	117	2%	264	3%
Totals	**126291**		**6531**		**9444**	

IV. SPECIES CONSIDERED AND EVALUATED

All federally threatened or endangered plant or terrestrial wildlife species that occur or could occur on the Nantahala National Forest (NNF), Chattahoochee-Oconee National Forest (CONF), or the Sumter National Forest (SNF) were initially considered in this analysis. The list of federally listed species was compiled by reviewing: (1) U.S. Fish & Wildlife Service county occurrence records for known and potential species, (2) North Carolina Natural Heritage Program Element Occurrence (EO) records, (3) Georgia Nonngame Conservation Section EO records, (4) South Carolina Department of Natural Resources EO records, and (5) U.S. Forest Service rare plant and animal inventory records. The initial wildlife list (Appendix A, Table 2) did not include some Piedmont species and Ridge and Valley species which are included on the CONF list and SNF list, but do not occur in the Southern Blue Ridge Subsection. One wildlife species, the southern bog turtle, while not formally listed is treated as threatened since it closely resembles the northern bog turtle, which is federally listed as threatened, and by treating it as listed it facilitates enforcement of listed northern members.

The initial list included 11 plants and 6 wildlife species (Appendix A, Tables 1 and 2). All the federally listed species are plants or terrestrial animals. There are no federally listed aquatic species known in the entire Chattooga River watershed or its tributaries.

Of these 17 species, one endangered plant species, two threatened plant species, and the southern bog turtle are known to occur on one of the three national forests within the Chattooga River Watershed (highlighted in bold in the two tables in Appendix A.) A geographic information system was used to examine the distribution of EOs on the three forests and general vicinity. These records and distribution maps were reviewed to determine areas of known populations of rare species within the proposed project area. Based on these information sources the potential affected rare species list for the upper Chattooga River project was filtered to derive those species with the greatest likelihood of occurrence. Species were eliminated based on range information such as only occurring at higher elevations in the NC or GA mountains, or in the foothills or Piedmont at lower elevations in SC or GA. Other species were excluded from further analysis because proper habitat did not occur within the proposed activity area. These habitats included Southern Appalachian Bogs, Swamp Forest Bogs, Rich Cove Forest, Pine-Oak/Heath Forest, and various Oak-Hickory Forests. Bog turtles were excluded for this reason since its preferred habitats, Southern Appalachian Bogs or wet pastures such as sites with mucky high organic content soils, did not occur within or near the proposed activity areas. Some species were eliminated from further analysis if they were known to occur within the project area but unlikely to be impacted by any project activities. *Isotria medeloides,* which does not occur under dense *Rhododendron maximum* thickets and is unlikely to be impacted by portage trails, was excluded for this reason. Finally a single species, eastern cougar, was dropped from further consideration since it is believed to be extirpated from the Southern Appalachians.

The final filtered list of federally listed species that occurs within the Chattooga River corridor and might be affected by the proposed project included only one species, *Gymnoderma lineare*, rock gnome lichen. A field survey for this species was completed by a team of USFS botanists/ecologists (Robin Mackie from the Sumter NF, David Danley from the Pisgah NF, Dr.Wilson Rankin from the Nantahala NF, and Gary Kauffman from the National Forests in NC) and a botanical consultant, Dr. L. L. Gaddy, from mid August to early October of 2007.

V. RESULTS

There were two documented populations of *Gymnoderma lineare* known within tributaries, Scotsman Creek and Fowler Creek, to the Upper Chattooga River in North Carolina (see Appendix B). The survey work completed in 2007 relocated both of these populations in addition to finding a new subpopulation on the east bank of the Chattooga River. This new occurrence was documented in NC just upstream from the confluence of Fowler Creek about 1500 feet north of the SC and Ga border (Appendix B).

VI. EFFECTS ANALYSIS

A) Species Biology and Distribution

Gymnoderma lineare is a squamulose lichen with a narrow strap-shaped olive-grey thallus which grades to a blackened base (Evans 1947). Apothecia, the fruiting bodies, occur on the squamule tips from July through September. Rock gnome lichen is a narrow Southern Appalachian endemic primarily occurring in the North Carolina mountains with peripheral populations in the mountains of Tennessee, Georgia, South Carolina, and

Virginia (Natureserve 2008, Weakley 2008, F. Huber, USFS botanist personal communication). The lichen was federally listed as endangered in the Federal Register in 1995 (U.S. Fish & Wildlife Service 1995) and currently has a G2 global rank.

The lichen occurs both on sloping to vertical rock faces with some seepage at higher elevations, generally above 5000 feet. Typically it occurs on rock outcrops partially shaded by Spruce-Fir Forests and occasionally Northern Hardwood Forest. In portions of its range it occurs on partially shaded Rocky Summits. The species has also been located in riparian areas on boulders within and adjacent to streams. These streamside populations occur both within the very headwaters, some occurring above 5500 feet, as well as larger 5^{th} to 6^{th} order streams. Populations vary in density from tiny dispersed clumps, barely 1 centimeter square, to dense colonies, greater than 4 meters square in extent.

Gymnoderma lineare occurs within the Chattooga River Watershed both in the CONF and the NNF. It has not been documented within the SNF. Within the Wild & Scenic Corridor *Gymnoderma lineare* is restricted to NC, occurring on boulders within Scotsman Creek, Fowler Creek and the newly discovered site along the main stem of the Chattooga upstream of the NC/SC/GA border. The populations on Fowler Creek and the east bank of the Chattooga River represent the lowest elevation, approximately 2240 feet, located for the species across its range.

Gymnoderma lineare is assumed to have been restricted to the same geographic range as it presently occurs. Several populations are believed to have been extirpated or reduced in size during the last 25 years. It is not specifically known why certain populations of this lichen have declined although recreational use, pathogens impacting canopy trees previously providing shade, road construction, and high sulfur levels have been documented in the same areas (USFWS 1997, Martin and Noble 1996).

B) Direct and Indirect Effects

Direct effects are those occurring at the same time and place in the proposed action area. Indirect effects are those caused by the action, which occur after the activity has taken place or occur at a distance from the action area.

There are no visible direct impacts from any current recreational usage within the two *Gymnoderma lineare* populations, including the new subpopulation along the main stem of the Chattooga River, in the Wild & Scenic Corridor. Potential direct effects to the *Gymnoderma lineare* subpopulation along the Chattooga River from the proposed modification of recreational activities includes trampling by anglers traversing the river, scraping of rocks by boats traversing the river at different high flows, and portaging of boats around log jams which are anticipated to increase with the decline and dropping of eastern hemlock from hemlock wooly adelgid.

The location of the new subpopulation along the Chattooga River bank is partially protected under a narrow rock shelf. The physical features of the site probably have previously and will continue to discourage access by anglers as well as any visitation from boaters when floating this section of the river. There is no hiking trail within the

vicinity of this site nor is there any trail proposed for this area. The site is not flat enough to allow a rest opportunity for boaters. If adjacent Canadian hemlocks fell across the river at this site resulting in a possible portage the natural area to traverse would be the flatter western bank where the species does not occur. For all these reasons there are no measurable direct effects anticipated with seasonal boating allowing along this stretch of the Chattooga River

Potential indirect effects to the *Gymnoderma lineare* subpopulation from this recreational proposal are unknown. Given the relative remoteness of the site and the physical characteristics discouraging any stops by boaters it is doubtful there will be increased visitation to this site if the recreation proposal is implemented. Nevertheless an indirect affect that may occur irregardless of the proposed recreational activity is denser shading from dead hemlock trees that fall directly above and overtop the existing subpopulation. It is unknown how much shade tolerance this lichen has. However most occupied sites have a moderate amount of light with these amounts declining within sites to *Gymnoderma lineare* more exposed southern or western exposures (USFWS 1997). As such it is suspected a subpopulation decline could result from a nearby fallen tree.

During a site visit in October of 2007 with U.S. Fish & Wildlife Service personnel (Asheville, NC and Columbia, SC offices) it was determined based on the previous discussion points that any increased recreational activity associated with the proposed project may affect but is not likely to adversely affect *Gymnoderma lineare*. It was also determined that periodic monitoring of the subpopulation along the main stem of the river is implemented to ensure that no impacts are occurring from implementation of this recreational proposal.

C) Cumulative Effects

Cumulative effects are those resulting from incremental impacts of the proposed action when added to other past, present and reasonably foreseeable future actions. Cumulative effects can result from individually minor, but collectively significant actions that take place over a period of time.

One rock gnome lichen population is known on the CONF and up to 13 populations, exact number variable depending on how they are delineated, across 21 sites are documented on the NNF. There are no known direct or indirect effects to populations of *Gymnoderma lineare* across the NNF or the CONF over the last decade that has resulted from implementation of projects within either Forest. Intermittent monitoring has occurred within 3 of the sites on the NNF. A population decline was recorded within one of the sites while the remaining two sites have stable trends although one of the populations with a stable trend has not been resampled for many years. All except four of the other occupied sites on the NNF and CONF have been revisited once in the last 15 years with cursory observations on presence and health recorded. Within these revisited sites all except one population or subpopulation was relocated. The one un-relocated population is considered to be extirpated as a result of sedimentation from new road construction by the Federal Highway Administration.

In the past 10-20 years there has been an increase in recreational use on the trails and on the river within the Wild and Scenic Corridor. These recreational trends are anticipated to continue in the future in the most accessible portions of the river corridor. However as indicated above it is doubtful there will increased visitation to the occupied sites currently known in the Chattooga River Wild & Scenic Corridor. Within private property in the corridor and the watershed recent home development, road construction, and reconstruction has primarily contributed to the loss of suitable habitat for the forest associated species and to a lesser extent to the gorge river-associated species such as *Gymnoderma lineare* since the majority of potential habitat is within public ownership where there has been less frequent and smaller disturbances.

There are no future projects on the CONF or the NNF that are anticipated to affect *Gymnoderma lineare*. The cumulative affects from these past and future actions on *Gymnoderma lineare* within the corridor are not anticipated to result in any measurable loss of this species. Periodic monitoring of the documented populations within the corridor will help to ensure this determination is true.

VII. DETERMINATION OF EFFECT

Gymnoderma lineare, federally endangered, was located within the main stem of the Chattooga River north of the confluence with Fowler Creek in an inaccessible area with minimal existing recreational use. Onsite informal consultation with the U.S. Fish and Wildlife Service was completed in early October, 2007. The population occurs in a protected shelf of the river. Therefore it is anticipated the introduction of boating within this area of the river is unlikely to result in trampling impacts and **not likely to adversely affect Gymnoderma lineare.**

The proposed activities associated with opening up a portion of the upper Chattooga River to limited whitewater boating will have no effect on any other federally listed species.

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REFERENCES

Ayers, H. B. and W.W. Ashe. 1905. The Southern Appalachian Forests. U.S. Geological Survey Forestry Series. Professional Paper 37. Washington D.C.

Biotics Database. 2008. As maintained by the North Carolina Natural Heritage Program, Division of Parks and Recreation, Raleigh, North Carolina.

Brown, R. L. and R. K. Peet. 2003. Diversity and invisibility of southern Appalachian plant communities. Ecology 84(1):32-39.

Carter, R. E. 1994. Landscape ecosystem classification of successional Forest Types on Highlands Ranger District, Nantahala National Forest in North Carolina. MS Thesis, Clemson University, Clemson, SC. 73 p.

Dellinger, B. 1992. Inventory of Natural Areas and Rare Species of Highlands Ranger District, Nantahala National Forest. Unpublished report submitted to the Highlands Biological Station, North Carolina Natural Heritage Program and National Forests in North Carolina.

Dumond, D. M. 1970. Floristic and Vegetational Survey of the Chattooga River Gorge. Castanea 35:201-244.

Evans, A.W. 1947. A study of certain North american Cladoniae. Bryologist 50:14-51.

Franklin, Misty A., and John T. Finnegan. 2006. Natural Heritage Program List of Rare plant species of North Carolina. North Carolina Natural Heritage Program, N.C. Department of Environment and Natural Resources, Raleigh, North Carolina. 136 p.

Gaddy, L.L. 1992. Natural Areas of the Highlands Region, Inventory of Primary Natural Areas of the Highlands Township Region , in Macon and Jackson Counties, North Carolina. Report submitted to the N.C. Natural Heritage Foundation, Raleigh, NC. 127 p.

Gaddy, L.L. 1992. An inventory of endangered, threatened, and otherwise noteworthy plant species and natural and unique areas of the Andrew Pickens District of the Sumter National Forest. Report submitted for the Sumter NF, The Nature Conservancy, and S.C. Wildlife and Marine Resources Department. Columbia, SC. 54 p.

Gattis, J.T. 1992. Landscape ecosystem classification on the Highlands Ranger District, Nantahala National Forest in North Carolina. MS Thesis, Clemson University, Clemson, SC. 55 p.

Goff, F. Glen, Gary A. Dawson and John J. Rochow. 1982. Site Examination for Threatened and Endangered Plant Species. Environmental Management 6(4):307-316.

Kartesz, J. T. 1994. *A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. 1st edition. In: Kartesz, J. T. and C. A. Meacham. Synthesis of the North American Flora, Version 1.0.* North Carolina Botanical Garden, Chapel Hill, NC.

Martin, Juri, and Reginald D. Noble. 1996. A quantitative study on ecological status and trens in an endangered lichen, *Gymnoderma lineare* (Evans) Yoshimura and Sharp. Final Report. Prepared for the USDA Forest Service, National Forests in North Carolina, Asheville, NC, and USDI Fish and Wildlife Service, Asheville, NC. 30 p.

Moffat, S.O. 1994. Landscape ecosystem classification for the Chattooga Ranger District, Chattahoochee National Forest, Georgia. MS Thesis, Clemson University, Clemson, SC. 83 p.

NatureServe. 2008. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: December 1, 2008).

Patterson, Karen D. 1994. Classification of Vegetation in Ellicott Rock Wilderness, Southern Blue Ridge Escarpment. MS Thesis, North Carolina State University, Raleigh, North Carolina. 91 p.

Peet, Robert K., Claire L. Newell, Gary L. Kauffman, J. Dan Pittillo, Michael P. Schafale, Alan S. Weakley and Thomas R. Wentworth. 1997. Vegetation of the Nantahala Mountains.

Radford, Albert E., H.E. Ahles and C.R. Bell. 1967. *Manual of the Vascular Flora of the Carolinas.* University of North Carolina Press, Chapel Hill, North Carolina.

Schafale, Michael .P. and Alan S. Weakley. 1990. *Classification of the Natural Communities of North Carolina: Third Approximation.* North Carolina Natural Heritage Program, Raleigh, North Carolina.

USDA, NRCS. 2007. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70844-4490 USA

USFS. 1995. Ecosystem Classification, Mapping, and Inventory of the Chattooga River Watershed (draft manuscript). National Forests in North Carolina, Asheville, NC. 500+ p.

U.S. Fish and Wildlife Service. 1995. Endangered and Threatened Wildlife and Plants; determination of *Gymnoderma lineare* (rock gnome lichen) to be an endangered species. Federal Register 60(11):3557-3562.

U.S. Fish and Wildlife Service. 1997. Recovery Plan for Rock Gnome Lichen (*Gymnoderma lineare*) (Evans) Yoshimura and Sharp. Atlanta, Ga. 30 pp.

Zartman, C. E. 1996. Inventory and Ecological Analysis of Spray Cliff Plant Communities in the Chattooga Basin. MS Thesis, Western Carolina University, Cullowhee, NC. 90 p.

Zartmen, C.E. and J. Dan Pittillo. 1995. An inventory of Spray Cliff Communities in the Chattooga Basin. Unpublished report submitted to the National Forests in North Carolina, Asheville, NC. 99 p.

Weakley, Alan S. 2008. Flora of the Carolinas, Virginia, Georgia, northern Florida and surrounding areas (Working Draft of 7 April, 2008). University of NC Herbarium, University of NC at Chapel Hill, Chapel Hill, North Carolina. 924 p.