

**BOTANICAL ANALYSIS FOR PROPOSED, ENDANGERED, THREATENED,
SENSITIVE (PETS) AND FOREST CONCERN PLANT SPECIES**

**NATIONAL FORESTS IN NORTH CAROLINA
CHEOAH RANGER DISTRICT
A-9 Stecoah Gap Road Construction Project**

The Cheoah Ranger District proposes to issue an additional A-9 corridor easement to the North Carolina Department of Transportation. This section of the road extends from Edwards Gap through Stecoah and Cheoah to south of Robbinsville at the intersection of NC 143 and Graham County secondary road 1277. It primarily traverses through federal lands managed by the USFS near the town of Stecoah and Stecoah Gap. Two alternatives are proposed. Both include a tunnel through Stecoah Mountain. The two alternatives differ in the tunnel length. Alternative X, the preferred alternative, is proposing a longer tunnel (approximately 0.6 mile) and will start at an elevation between 2760 and 2800 feet on the east side of the mountain and end near the same elevation on the west side of the mountain. It will impact 37.2 acres of USFS land with construction of the road. Alternative Y is approximately 0.4 mile in length beginning near 2900 feet elevation on the east side of Stecoah Mountain and ending near 2820 on the west side of Stecoah Mountain. This alternative will impact more of Stecoah Mountain, approximately 57.4 acres. Both alternatives are proposing a road in the same vicinity of the mountain. Alternative Y is slightly southwest of the preferred alternative.

A query of the Biological Conservation Database indicates there are 43 currently tracked rare plant species known to occur within Graham County. One is federally listed, another is federally threatened, 24 are regional sensitive species (with viability concerns throughout the region as determined by a global rank of G3 or T3 or lower or a national rank of N3 or lower) and 18 are forest concern species. These forest concern species are either at the periphery of their range here in North Carolina or disjunct from their main range. All but 23 of these 43 species were dropped from further consideration because there was no suitable habitat for these excluded species within the proposed activity area. A large number of these excluded species are associated with humid, rocky conditions typically found in humid gorges, grottoes and spray cliff communities, with high elevation grassy openings, with spruce-fir forest, with high elevation granitic domes, with northern hardwood forest, with calcareous rock derived soils, with bogs, all of which are found in other portions of Graham County. Five (three sensitive and two forest concern) of the 23 species were known near the analysis area prior to the more intensive surveys for this road construction project. *Trillium simile*, *Silene ovata*, and *Vaccinium hirsutum* are all sensitive plant species. The two forest concern species previously located near here include *Carex purpurifera* and *Brachyelytrum septentrionale*. *Megaceros aenigmaticus* and *Hydrothyria venosa*, two sensitive aquatic plant species, were located during the field analysis for this project. Penelope Fouts, a contract botanist, conducted a field survey during the Fall of 1998 and the Spring and Summer of 1999 over most of the activity area. Gary Kauffman surveyed a small portion of the activity area and the cove forests surrounding Stecoah Gap in 1999 and 2000. He had conducted previous surveys there in the mid 1990's.

EXISTING CONDITION

The analysis area is located in eastern Graham County. Most of the area is either on the east to northeast or northwest face of Stecoah Mountain. Cheoah Bald is south of the analysis area, while Meetinghouse Mountain borders the northeast. The Hazanet Knob and Wauchecha Bald area of the Cheoah Mountain Range expand to the northwest of the analysis area. Two major rock groups dominate the area. Metasandstone, metagraywacke, metasilstone and mica schist are the dominant rock groups within the area interbedded with smaller amounts of calc-silicate. Calc-silicate rock, indicative of the higher soil nutrients and a richer vegetation type, predominates in the upper elevation east and northeast faces of Stecoah Mountain.

The dominant vegetation seen across the analysis area is rich cove forest, particularly on the east-facing slopes of Stecoah Mountain. *Liriodendron tulipifera* has almost complete dominance in the overstory in the rich coves of the lower elevation slopes of the analysis area, but dominance in the upper areas is shared by *Aesculus flava*, *Fagus grandifolia*, *Acer saccharum*, *Tilia americana*, *Fraxinus americana*, *Betula lenta*, *Prunus serotina*, *Carya cordiformis* and *Quercus rubra*. Midstory tree species include *Halesia tetraptera*, *Acer pensylvanicum*, and *Cornus florida*. An open shrub layer is present through out most of this community. Common shrubs include *Hydrangea arborescens* and *Lindera benzoin* with scattered occurrences of *Calycanthus floridus*, *Hamamelis virginiana* and *Rhododendron maximum*.

Herb diversity is lush in many locations and included *Adiantum pedatum*, *Aplectrum hyemale*, *Aster divaricatus*, *Aster saggitifolius*, *Aster cordifolius*, *Aralia racemosa*, *Botrychium virginianum*, *Brachyelytrum erectum*, *Campulastrum americanum*, *Cardamine diphylla*, *Carex austrocaroliniana*, *Carex blanda*, *Carex digitalis*, *Carex plantaginea*, *Claytonia virginica*, *Caulophyllum thalictroides*, *Cimicifuga racemosa*, *Dicentra cucullaria*, *Prosartes lanuginosa*, *Dryopteris goldiana*, *Dryopteris intermedia*, *Dryopteris marginalis*, *Erythronium umbilicatum*, *Euonymus obovatus*, *Galearis spectabilis*, *Galium aparine*, *Galium lanceolatum*, *Galium trifoliatum*, *Geranium maculatum*, *Heliopsis helianthoides*, *Hydrophyllum canadense*, *Hydrophyllum virginianum*, *Iris cristata*, *Lilium superbum*, *Ligusticum canadense*, *Mitella diphylla*, *Podophyllum peltatum*, *Tiarella cordifolia*, *Eupatorium steelei*, *Phlox amplifolia*, *Triosteum aurantiacum*, *Diplazium pycnocarpon*, *Desmodium glutinosum*, *Prenanthes altissima*, *Stellaria pubera*, *Thalictrum dioicum*, *Thalictrum thalictroides*, *Polygonum virginianum*, *Physalis heterophylla*, *Physalis virginiana*, *Phryma leptostachya*, *Ranunculus hispidus*, *Toxicodendron radicans*, *Trillium erectum*, *Trillium vaseyi*, *Trillium luteum*, *Medeola virginiana*, *Tradescantia ohioensis*, *Uvularia perfoliata*, *Uvularia grandiflora*, *Viola pubescens*, *Viola hastata*, *Viola blanda*, *Viola striata*, *Viola canadensis*, *Veratrum parviflorum*, *Laportea canadensis*, *Impatiens pallidum*, *Parthenocissus quinquefolia*, *Arisaema triphyllum*, *Polygonatum biflorum*, *Maianthemum racemosum*, *Sanguinaria canadensis*, *Polystichum acrostichoides*, *Uvularia sessilifolia*, *Geum canadense*, *Smallanthus uvedalia*, *Solidago flexicaulis*, *Solidago curtisii*, *Smilax herbacea*, *Dioscorea quaternata*, *Collinsonia canadensis*, *Thelypteris noveboracensis*, *Cystopteris protrusa*, *Deparia acrostichoides*, *Viola rotundifolia*, *Hepatica acutiloba*, *Phegopteris hexagonoptera*, *Aristolochia macrophylla*, *Osmorhiza claytonii*, *Osmunda claytonia*, *Osmunda cinnamomea*, *Oxalis grandis*, *Actaea pachypoda*, *Amphicarpaea bracteata*, *Panax quinquefolius*, *Luzula bulbosa* and *Luzula acuminata*.

The highest quality examples of this type occur in the upper elevations of Stecoah Mountain outside the activity area. Occurrences of the three sensitive species *Trillium simile*, *Helianthus glaucophyllus* and *Silene ovata*, and the two forest concern species, *Carex purpurifera* and *Brachyelytrum septentrionale* were located in these high quality examples. These 6 rare species were not located in any portion of the proposed activity area. These high quality examples also included occurrences of *Diplazium glutinosum*, *Dryopteris goldiana*, *Carex albursina*, *Eupatorium steelei*, *Triosteum auranticum*, and *Phlox amplifolia*, all of which are tracked as watch list species by the North Carolina Natural Heritage Program. Of these six species, *Eupatorium steelei* and *Phlox amplifolia* were the most widespread and located within a portion of the activity area. These two watch list species are neither scarce across the Forest or within the analysis area.

Past and recent disturbance within these communities is evidenced by the presence of *Ligustrum sinense*, *Lonicera japonica*, *Rosa multiflora*, *Dioscorea oppositifolia* and *Microstegium vimineum*. These species were more frequent within the west-facing portion of the analysis area.

Embedded within the cove community, along a few open portions of the riparian zones, a different herbaceous component persists. These include *Chelone lyoni*, *Diphylleia cymosa*, *Monarda didyma*, *Oxypolis rigidior*, *Oxalis violacea*, *Rudbeckia laciniata*, *Saxifraga micranthidifolia*, and *Packera aurea*. *Megaceros aenigmaticus*, a sensitive plant species, was located within this riparian community. A portion of the population seen within this community along Cody Branch will be impacted by the two road alternatives.

Most of the draws on the east, northeast and northwest-facing slopes throughout the analysis area are rich cove forests. Acidic cove forest communities also occur in a few of these locations. It is prominent in the small southwest-facing draw in the unnamed tributary to Sweetwater Creek. These acidic cove forests are dominated by *Betula lenta*, *Liriodendron tulipifera*, *Tilia americana*, *Magnolia fraseri*, and *Tsuga canadensis* with a dense understory layer of *Rhododendron maximum* and *Leucothoe fontanesiana*. Other less common shrubs included *Clethra acuminata*, *Ilex montana*, *Hamamelis virginiana*, and *Pyrularia pubera*. Little herbaceous development was evident within these communities except where there were widely scattered breaks in the shrub layer. The herb species located within this community included *Polystichum acrostichoides*, *Goodyera pubescens*, *Hexastylis arifolia*, *Galax urceolata*, *Viola blanda*, *Viola rotundifolia*, *Luzula acuminata*, *Trillium undulatum*, *Chimaphila maculata* and *Thelypteris noveboracensis*. Within the streams of these acidic cove forests, two sensitive aquatic species were noted. The hornwort, *Megaceros aenigmaticus*, and the lichen, *Hydrothyria venosa*, were located on the bedrock of the streams.

Only a small population of *Hydrothyria venosa* was seen on the upper headwaters of an unnamed tributary to Sweetwater Creek. It did not occur in any stream that could be affected by the proposed road construction. A larger population of *Megaceros aenigmaticus* was located within 3 tributaries to Sweetwater creek and within different stretches of Cody Branch. The majority of the populations were seen outside the activity area.

On the convex slopes of the activity area a montane oak–hickory forest community occurs. It is not as abundant as the rich cove forest community present within the analysis area. Along these generally mesic slopes, oak species, such as *Quercus rubra*, *Quercus alba* and *Quercus montana*, predominate with varying amounts of *Carya glabra*, *Castanea dentata*, *Nyssa sylvatica*, and *Acer rubrum* also co-occurring. *Oxydendrum arboreum* and *Quercus coccinea* were more dominant in this community as the slope increased. Most examples of this community type had a moderately open shrub layer and a relatively diverse herbaceous layer. Common shrubs included *Ilex opaca*, *Hamamelis virginiana*, *Pyrularia pubera*, *Viburnum acerifolium* and *Rhododendron calendulaceum*. Typically *Thelypteris noveboracensis*, *Dennstaedtia punctilobula*, *Desmodium nudiflorum*, *Medeola virginiana*, *Viola sororia*, *Veratrum parviflorum*, *Erigeron pulchellus*, *Amphicarpaea bracteata*, *Brachyelytrum erectum*, *Arnoglossum atriplicifolium*, *Viola pubescens*, *Houstonia purpurea*, *Smilax herbacea*, *Aster saggitifolius*, *Athyrium asplenoides*, *Luzula bulbosa*, *Lilium michauxii*, *Viola hastata*, *Uvularia sessilifolia*, *Lycopodium lucidulum*, *Solidago curtisii*, *Carex pensylvanica*, *Coreopsis rigida*, *Dichanthelium dichotomum* var. *dichotomum*, *Dichanthelium bosci*, *Aureolaria flava*, *Vicia caroliniana*, *Lactuca biennis*, *Helianthus microcephalus*, *Poa autumnalis*, *Eupatorium purpureum*, *Tipularia discolor*, *Corallorhiza odontorhiza*, *Galium pilosum*, *Hypopitys monotropa*, *Campanula divaricata*, *Antennaria plantaginifolia*. *Dioscorea quaternata*, *Gentiana villosa*, *Carex virescens* and *Lysimachia quadrifolia* predominated.

A Pine-oak/heath forest (Schafale and Weakley 1990) occurs north of the activity area on a southwest-facing ridge and toe slope. *Pinus rigida* and *Quercus coccinea* are the dominant canopy trees within this community. Common subcanopy trees include *Oxydendrum arboreum*, *Carya glabra*, and *Acer rubrum*, with scattered occurrences of *Pinus strobus*, *Tsuga canadensis*, *Nyssa sylvatica*, *Quercus montana*, and *Cornus florida*. A dense shrub layer, dominated by ericaceous species is present here. *Gaylussacia ursina* is the most common shrub. Other scattered shrubs include *Vaccinium pallidum*, *Vaccinium stamineum*, *Kalmia latifolia*, *Rhododendron maximum*, and *Pyrularia pubera*. Herbs are scarce within this closed canopy. Common species include *Solidago odora*, *Pteridium aquilinum*, *Tephrosia virginiana*, *Epigaea repens*, and *Coreopsis major*. A population of *Vaccinium hirsutum* was previously located here. Neither *Vaccinium hirsutum* nor the pine-oak/heath community was located within the activity area.

On those sharper convex slopes and steep southeast-facing slopes the oak component graded to dominance by *Quercus coccinea* and *Quercus montana* with some black oak *Quercus velutina*. Generally a dense layer of *Kalmia latifolia* occurred here. Herbaceous diversity is quite sparse within this community with *Melampyrum lineare*, *Dichanthelium villosissimum*, *Hypoxis hisutus*, *Epigaea repens*, *Chimaphilia maculata*, *Pteridium aquilinum*, *Galax urceolata*, *Baptisia tinctoria*, and *Uvularia puberula* most prevalent. This chestnut oak forest was seen northwest of Stecoah Gap and did not occur within the activity area.

Sensitive Species

Megaceros aenigmaticus

Megaceros aenigmaticus is a large dark green thalloid hornwort with erose margins (Hicks 1992, Schuster 1992). It is a narrow southern Appalachian endemic occurring in nine counties in North Carolina and Tennessee. It extends from the Tellico River in eastern Tennessee east to Burningtown Falls northwest of Franklin, NC and south to Pounding Mill Creek near Shooting Creek, NC. Based on recent survey work across this area, over 30 populations, depending on definition and extent of the population, are known to occur in the Nantahala National Forest (Marie Hicks & Jame Amoroso 1997). Large populations of this species occur in the waters of the Joyce Kilmer/Slickrock Wilderness and in the waters of Santeetlah Creek, which is the center of distribution for this species. This hornwort prefers shaded rocks and boulders in small streams with a water depth of 1-2 inches that are infrequently flooded and have low sediment loads. Major threats to this species are increase in sediment loading and/or water flow as a result of a disturbance upstream of the occurrence (personal communication, Dr. Ken McFarland and Dr. David Smith, University of Tennessee biology professors). Some small stream tributaries in watersheds where *Megaceros aenigmaticus* was located did not have any individuals even though nearby similar size streams had thriving populations (Marie Hicks & Jame Amoroso 1997). Two primary threats appear to create risk for this species. Increased sediment load and water flow, as a result of disturbance within the watershed upstream of the occurrence, either dislodges or buries the plants, smothering them under dirt and debris. Also, canopy removal at the occurrence site would increase light at the microsite and dry a site to the point that this liverwort could no longer exist at a given location.

A *Megaceros aenigmaticus* population within Cody Branch and one unnamed tributary to Sweetwater Creek will be impacted by the proposed road construction. Direct impacts would result from installing culverts on portions of the stream. Indirect impacts could result from sedimentation as a result of the ground disturbance. Stream flow increase from the increase in impervious surface could also dislodge or totally submerge *Megaceros aenigmaticus* individuals in the receiving stream, thereby negatively impacting these individuals.

These potentially impacted portions of the *Megaceros aenigmaticus* populations represent less than 15% of the two main populations (Sweetwater Creek and Cody Branch) seen across the analysis area. Alternative X would have less road construction higher in the two respective watersheds. A rough estimate of the impacted portion of the populations from this alternative would be less than 5% of the population, while it may be as high as 15% with the implementation of alternative Y. However, both construction alternatives should not affect the continued existence of this species within the analysis area since this species does not seem to be limited in the upper headwaters of the analysis area.

Abundant populations of this species are known within 3-5 air miles from the activity area in both the south and north facing streams flowing into the Nantahala River in the Nantahala Gorge. Other large populations of this aquatic hornwort are known west and northwest of the analysis area, in the heart of its range. The species is less common east of the analysis area. One population is known from a stream in the Meetinghouse Mountain area, another from Watia Creek, and another one from Reid Branch. All of these populations occur within less than 6 air miles of the analysis area.

For *Megaceros aenigmaticus*, there are five timber sales with associated roading, both within the Wayah Ranger District and the Cheoah Ranger District, which may impact a portion of the populations seen if severe sedimentation results. In addition a horse trail and two road improvement projects may impact three other populations. And another population may no longer be in federal ownership if the Thrash land exchange is implemented as presently proposed. Two of these timber sales and the three other road and trail projects occur within an area of the Forest where *Megaceros aenigmaticus* is abundant. None of these projects are anticipated to result in the loss of this species from the immediate areas provided proper installation of erosion control measures is implemented. Twenty to twenty-five other populations occur on federal land across the range of this species within North Carolina with no known or anticipated impact from any upcoming project.

BIODIVERSITY EFFECTS

Old Growth Management

There were no rare communities located within the proposed activity area. The portion of the analysis area surrounding Stecoah Gap has been recommended for a North Carolina Natural Heritage Program natural heritage area (Heiman 1993). Primary reasons for proposing the 173-acre heritage area are the presence of the previously mentioned rare plant species and 3 state listed bird and butterfly species. This proposed natural heritage site is outside the activity area for both road construction alternatives.

Additionally, a portion of the western edge of potentially affected USFS land is included within the designated Cheoah Bald large old growth patch. This portion of the 2500-acre patch does not currently have high quality old growth communities. In fact this western edge has one of the most disturbed plant communities seen within the analysis area. Alternative X, the preferred alternative, will impact less than 1 acre of this large old growth patch, while alternative Y will impact 4.5 acres of the large old growth patch. This loss of five acres within the old growth large patch could be compensated for within portions of the south face of the Nantahala Gorge. Most portions of the Nantahala Gorge on the periphery of the Cheoah Bald large old growth patch are significantly less disturbed than the western edge of the proposed activity area. This small change in the designation of the large old growth patch should be completed prior to any decision being made on a road action alternative.

Invasive Plant species

Exotic introduced species are known to be a problem throughout the southern Appalachians (Bowen 1996), the southeast (Miller 1997), and a major ecological problem worldwide (Williamson 1996). A list of the most invasive species within the Pisgah and Nantahala National Forest lands includes the following plants: *Pueraria montana*, *Rosa multiflora*, *Microstegium vimineum*, *Ligustrum sinense*, *Lonicera japonica*, *Miscanthus sinensis*, *Celastrus orbiculata*, *Spiraea japonica*, *Ailanthus altissima*, *Paulownia tomentosa*, *Dioscorea oppositifolia*, and *Albizia julbrissin*. While other exotic species, such as *Vinca minor* or *Hedera helix*, are also widely dispersed in the Forest, they do not possess as invasive characteristics as those plants above and have less of an impact on plant communities.

In many cases, exotic plants hold a competitive edge over native plants because their natural enemies present in their native lands are not present here. The worst invasive species are capable of dispersing rapidly and producing copious amounts of propagules. They have the potential to overtake native vegetation, particularly in areas of recent disturbance, either of natural or anthropogenic origin. Within the activity area, the most invasive species are *Microstegium vimineum*, *Dioscorea oppositifolia*, *Rosa multiflora*, *Ligustrum sinense* and *Lonicera japonica*. They are most common within the western edge of the project area. The proposed road construction project will probably result in an increase in these species, particularly since it will result in an increase in roadside edge. It is recommended that monitoring of these 5 invasive species should be implemented following the completion of the project.

The roadside edge, other disturbed areas and forest edge openings provides suitable habitat for rapid establishment and incursion by a number of exotic plant species. Recent research in Florida suggests that roadways facilitate the transport of nonnative plant propagules to new sites (Greenberg, Crownover & Gordon 1997). This invasion by nonnative species tends to be enhanced in areas where roadside soils have been markedly modified as will happen with the proposed project. Native species of roadside plants tend to sort themselves into associations that will reflect the microhabitat conditions. Graminoids dominate the roadside edge. Their apical meristem, positioned at the base of the plant, allows for quick regrowth following a disturbance such as mowing or vehicular trampling. Drought tolerant species tend to occupy the extreme south and west facing cut slopes. Plants with higher moisture requirements will colonize ditch lines, walls of drainage structures, and naturally low areas. Taller species tend to occur on those cut banks, fill slopes, fence lines and other locations protected from mowing equipment and with adequate moisture to allow sufficient growth. By quickly establishing appropriate native species along disturbed areas, it is anticipated that undesirable exotic species will be competitively discouraged. A study currently is to identify native plant associations in these different microhabitats both along the roadside edge and in other appropriate open or partially open plant communities.

Some wide-ranging species that also occur in the southern Appalachians, such as big bluestem *Andropogon gerardii*, *Sorghastrum nutans*, *Panicum virgatum*, or *Schizachyrium scoparium* have been successfully established in disturbed soils in the Midwest prairie states for a number of years. Others such as *Tridens flavus*, *Elymus hystrix*, *Elymus virginicus* and *Saccharum alopecuroideum* have been experimentally sown on disturbed sites in the southern Appalachians with some success (Kris Johnson, Great Smoky Mountains National Park vegetation manager, personal observation). This road construction project with the creation of significant amounts of disturbed ground provides an opportunity to experiment with these native species. Seeds of some of these species are available within the horticultural trade. However, none of this seed is from ecotypes within the southern Appalachians. Studies have shown wide variation in seed germination and production (Baskin and Baskin 1998) and life history (Soule & Wilcox 1980) based on genotypic variation. Local germplasm of both the more common prairie species and other native grasses have been recently collected for an experimental project on the Blue Ridge Parkway. Increase beds of prospective species have been established at three separate sites, varying from 2200 to 5500 feet in elevation. Potentially these locally collected ecotypes should provide a competitive edge in comparison to usage of the same species from a Midwest ecotype, although this assumption has not been definitively answered in the science of restoration ecology (Cairns 1987). It is recommended that some portion of the disturbed areas created with this project serve as experimentation beds for establishment of native species with local provenance and those with seed collected from outside the southern Appalachians.

DETERMINATION OF EFFECT

The proposed activities associated with this additional A-9 road easement centered around Stecoah Gap in the Cheoah Ranger District will have no effect on any Federally listed or proposed plant species. The proposed project for both alternatives X and Y may impact individuals of the sensitive species *Megaceros aenigmaticus* but will not affect the viability of this species across the Forest. Neither road construction alternative is anticipated to affect any other sensitive plant species. Both road construction alternatives are not anticipated to impact any forest concern plant species. There will be no cumulative effects on any plant species from the activities associated with this road construction project.

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October 22, 2000

Revised Wilson T. Rankin, Nantahala National Forest Botanist
May 5, 2003

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