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Environmental Assessment

EXPERIMENTAL REMOVAL OF COMPETING VEGETATION
FROM A POPULATION OF
RUTH'S GOLDEN ASTER (*Pityopsis ruthii*)
ON THE HIWASSEE RIVER

Ocoee-Hiwassee Ranger District, Cherokee National Forest
Polk County, Tennessee

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INTRODUCTION

Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four main sections plus appendices:

- *Introduction:* The section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Comparison of Alternatives, including the Proposed Action:* This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Environmental Consequences:* This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.
- *Agencies and Persons Consulted:* This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Tellico Ranger District Tellico Plains, TN.

Background

The global distribution of Ruth's golden aster (Pityopsis ruthii) is confined to a few miles along the Hiwassee and Ocoee Rivers in Polk County, Tennessee. The plants are only known to occur, rooted in crevices of phyllite or graywacke boulders, within the historic flood scour zone of the two rivers. The species was first collected in the Hiwassee River Gorge by Albert Ruth during the period 1894 to 1902, but was not seen again until 1970 (Bowers 1972, in USDI Fish and Wildlife Service 1992). The species was formally listed as Endangered by the USDI Fish and Wildlife Service (FWS) effective August 19, 1985. It is also listed as Endangered by the State of Tennessee under the provisions of the Rare Plant Protection and Conservation Act of 1985. The populations of Ruth's golden aster have been intensively monitored since 1986. Approximately 600 individuals are known to occur on the Ocoee River and approximately 10,000 on the Hiwassee.

Botanists involved in the annual Ruth's golden aster monitoring have noted a substantial increase in competing vegetation within the Hiwassee River monitoring plots each year. It is believed that this competition is negatively impacting individual plants through direct displacement and shading. Historically, such competing vegetation was probably removed by the scouring action of periodic floods; however, the free-flowing hydrology of the Hiwassee River has been altered by the construction of dams for power generation and flood control. Flood events occur much less frequently, which is allowing the establishment of competing vegetation. This decrease in availability of suitable habitat is one of the threats that lead to the original FWS listing and is stated as such in the Ruth's Golden Aster Recovery Plan (USDI Fish and Wildlife Service 1992) and the recent draft five year review for the species. Loss of habitat poses a threat to the continued existence of this endangered species.

Issues pertaining to the recovery of Ruth's golden aster have been discussed by botanists involved in annual monitoring since 1990. A result of these meetings was the development of an "informal recovery coordination working group" consisting of federal, state, and university representatives. This group works closely with the FWS and has taken on the responsibility for planning and implementation of federal recovery objectives for this species. Based upon input received from this group, the Cherokee National Forest (CNF) made a decision in May 1991, to mechanically remove poison ivy from one of the monitoring sites. Results from the mechanical removal appeared promising but were labor intensive and produced only temporary results. Based upon this, the group recommended that the CNF initiate a study to evaluate the effectiveness of herbicides in accomplishing the desired condition.

In 1993, an effort was initiated to implement a project to remove competing vegetation utilizing mechanical and chemical methods. The project was implemented in May 1996. Results from the project were again encouraging, but several inadequacies were realized. The small sample size precluded statistical analysis, baseline data should have been collected for at least 3 years pre-treatment, and follow-up treatments should have been applied to prevent re-establishment of competing vegetation for the period of the study. This new study and subsequent Proposed Action address these concerns.

Purpose and Need for Action

The purpose of this initiative is to evaluate the experimental removal of competing vegetation from a population of Ruth's golden aster along the Hiwassee River, in Polk County, Tennessee. This action is needed, because habitat for this federally endangered species is being lost to competing vegetation that is encroaching into areas where the aster grows.

This action responds to the goals and objectives outlined in the Cherokee National Forest Revised Land and Resource Management Plan (RLRMP), and helps move the project area towards desired conditions described in that plan (USDA Forest Service 2004a). It specifically addresses RLRMP Goal 14 "Contribute to conservation and recovery of federally listed threatened and endangered species…" and Objective 14.03 as it applies to Ruth's golden aster, "Increase number of populations/occurrences by improving and/or increasing available habitat and relying on natural recruitment rather than reintroduction and propagation." The project is also consistent with objectives outlined in the Ruth's Golden Aster Recovery Plan (USDI Fish and Wildlife Service 1992) and with the spirit of section 7(a)(1) of the Endangered Species Act, which directs federal agencies to carry "… out programs for the conservation of endangered species…".

Proposed Action

The Cherokee National Forest in cooperation with the Tennessee Department of Environment and Conservation (TDEC), and USDI Fish and Wildlife Service, is proposing an experimental study designed to enhance habitat for the federally endangered Ruth's golden aster by removing competing vegetation. Four plots (10 meter by 10 meter each) paired at two sites along the Hiwassee River have been selected for this pilot study. The two sites have similar habitat and threats. At each site the two plots were established in close proximity to each other with care to ensure similar aspect and level of vegetative encroachment. The plots were permanently marked on a 2m x 2m grid using lag bolts drilled into rock. Permanent photo points were also established at each plot. Baseline monitoring at each plot has been conducted annually during late summer from 2000 thru 2007. Beginning downstream and moving up, plots 1 and 2 are located at "the narrows" and plots 3 and 4 at Loss Creek. Plots 1 and 4 were randomly selected at each site for the vegetation removal treatments and plots 2 and 3 would remain as controls. Competing vegetation would be removed from the two treatment plots utilizing mechanical and chemical methods. The initial treatment would be implemented during the early spring (April-May) to coincide with a period of vigorous growth, and a post-implementation inspection and follow-up treatment would be conducted within 4 to 6 weeks. Annual inspections and possible follow-up spring treatments would be conducted for a period of 10 years. A detailed monitoring plan to annually evaluate the effects of the treatment has been developed and is attached (Appendix A).

Detailed Methodology

Ideally, all woody vegetation, including trees that cast shade on the treatment plots, would be cut and removed from the site, however based upon location; this may be a problem operationally. Three treatment options could be used to achieve control of woody vegetation. In option one, stems would be cut and removed and a 50% solution of Triclopyr, water, and an approved surfactant (i.e. dish detergent or vegetable oil) would be immediately applied directly to all cut surfaces using hand-held squirt bottles or brushes. If removal of trees is a problem, in some locations "hack and squirt" (option 2) or "basal bark" (option 3) methods could be used as an alternate treatment in which some trees could be left standing. In hack and squirt, vascular tissues are exposed by using a hatchet to remove bark and the same 50% formulation of Triclopyr would be used. In the basal bark treatment, a 100% solution of Triclopyr would be applied directly to the stem with a paintbrush.

All other vegetation (shrubs, vines, and herbaceous vegetation) within the 10x10 meter plots, with the exception of Ruth's golden aster, would be treated with a 3% solution of Glyphosate and an approved surfactant (i.e. dish detergent, vegetable oil). Only a very small amount (approx one to five ounces) of herbicide would be needed to treat a 10x10 meter plot. All herbicides would be used according to manufacturer's label direction for rates, concentrations, exposure times, and application methods. Herbicides would be directly applied to the target plants. Techniques that could be used include direct foliar applications using backpack sprayers, squirt bottles, or hand-held brushes, or cut surface treatments (spraying or wiping). No herbicides would be applied aerially. Only formulations approved for aquatic-use would be applied in or within 30' of wetlands, lakes, and streams, in accordance with RLRMP Forest Wide Standard FW-15.

All herbicide application techniques have been designed specifically to avoid non-target impacts to Ruth's golden aster plants. Additionally, specialized equipment including flexible wands with "no-drip tip" adjustable nozzles would be used on sprayers, and individual Ruth's golden aster

plants would be protected using a variety of shields (plastic sheets, Styrofoam cups, Tupperware™, PVC pipe, etc). All shields would be wiped dry with a towel before moving from one location to another. See Appendix B for a detailed emergency herbicide spill plan.

Detailed descriptions of Triclopyr and Glyphosate including comprehensive risk assessments for each can be found at: http://www.fs.fed.us/foresthealth/pesticide/risk.shtml (USDA 2007). All proposed application rates are within the parameters evaluated in each risk assessment.

Triclopyr is a selective herbicide that controls many species of herbaceous and woody broadleaf weeds, but has little to no effect on grasses. This chemical acts as a growth regulator and can be applied as a direct foliar application, stem injection, or cut-surface treatments. Specific formulations of Triclopyr have been labeled for aquatic application. Formulations labeled for aquatic sites can be effective on both emergent aquatics and shoreline vegetation. It has been proven effective on a wide variety on non-native invasive plant species. Commercial brand-names include, but are not limited to Garlon 3A™, Garlon 4™, Renovate 3™, and Pathfinder II™.

Glyphosate is a non-selective, broad spectrum herbicide that can be used to control many grasses, forbs, vines, shrubs, and tree species. Specific formulations of Glyphosate have been labeled for aquatic application. Formulations labeled for aquatic sites can be effective on both emergent aquatics and shoreline vegetation. This chemical is a growth inhibitor that can be applied through direct foliar application, stem injection, and cut-surface application. It has been proven effective on a wide variety of non-native invasive plant species. Commercial brand-names include, but are not limited to Accord™, Roundup™, and Rodeo™.

Decision Framework

The decision to be made from this analysis is whether to implement the Proposed Action or an alternative for the purpose of improving Ruth's golden aster habitat at two locations along the Hiwassee River. This assessment documents the comparison of alternatives regarding environmental impacts and capability to achieve desired results. The decision will be based in part on the capability of the chosen action to achieve the desired results in an environmentally sensitive manner and in response to issues and concerns identified by the public and the interdisciplinary team that developed the analysis.

This decision is not one of land allocation, nor is the analysis intended to look at every possible combination of activities. The scope of the decision is confined to a reasonable range of alternatives aimed at implementing the RLRMP in the project area and meeting the recovery objectives for a listed endangered species.

Public Involvement

This project was initially proposed in 2000, but due to funding issues an environmental analysis was never completed and thus the project was not implemented. Scoping was conducted from June 6th to July 5th, 2000 and again from January 29th to February 27th, 2004, to solicit the issues and concerns related to the Proposed Action. Scoping letters were mailed to interested and affected agencies, organizations, tribes and individuals. See the Consultation and Coordination section of this document for a listing of the interested and affected agencies, organizations, tribes and individuals contacted. These letters informed recipients of the Proposed Action and requested their input. Additional information was provided to those that requested it. The

proposal has also been listed quarterly in the Cherokee National Forest Schedule of Proposed Actions since April 2000.

Using the comments from the public, other agencies, and tribes, the interdisciplinary team developed a list of issues to address.

Issues

The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3

Only one significant issue, "the effects to the environment from the use of herbicides", was raised by the public and interdisciplinary team during scoping. This issue was carried forward and used to help develop the alternatives.

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

This chapter describes and compares the alternatives considered for this project. It includes a description of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative and some of the information is based upon the environmental, social and economic effects of implementing each alternative.

Alternatives

Alternative 1

No Action

Under the No Action Alternative, no changes to the existing environment would occur beyond those attributed to natural processes and disturbances. No project activities would be implemented.

Alternative 2

The Proposed Action

This is the proposal that was scoped to the public. A more detailed account of the proposed activities is presented in the previous chapter, thus only a summary of key points is presented below. In this alternative the CNF is proposing the following actions to achieve the purpose and need:

- Cut and remove all woody vegetation from two 10x10 meter treatment plots, including trees that cast shade on the plots. Treat cut stems using a 50% solution of Triclopyr.
- If removal of trees is a problem, use "hack and squirt" or "basal bark" methods and leave some trees standing. In hack and squirt, vascular tissues are exposed by using a hatchet to remove bark and the same 50% formulation of Triclopyr would be used. In the basal bark treatment, a 100% solution of Triclopyr would be applied directly to the stem with a paintbrush.
- Treat all other vegetation (shrubs, vines, and herbaceous vegetation) within the 10x10 meter plots, with the exception of Ruth's golden aster, with a 3% solution of Glyphosate and an approved surfactant.
- Conduct follow-up monitoring to evaluate the success of the treatments.

Alternatives Not Considered in Detail

Alternative 3

Mechanical Treatments Only

Several commenters requested that the Forest Service consider limiting the use of herbicides wherever possible or not use them at all. Because the potential impacts of herbicides on the natural environment are considered a significant issue by both the interdisciplinary team and the public, this was initially considered to be an alternative to the Proposed Action. However, upon further review it became apparent that mechanical treatments may do more harm than good. Many of the target species have documented responses of increased growth in response to mechanical disturbance (poison ivy, Japanese honeysuckle, sericea lespedeza) and perhaps more importantly, since many of these plants are rooted in the same cracks as Ruth's golden aster, hand pulling could result in accidental removal of Ruth's golden aster plants. Mechanical treatments may be effective on small, isolated plants within a plot, but cannot be effective as a broad scale treatment. Since a proposal of this nature would serve to make the existing problem worse than the current condition or No Action Alternative, it was determined that this alternative could not meet the purpose and need of the project proposal and was dropped from further consideration.

Mitigation Common to All Alternatives

The RLRMP contains Forest Wide (FW), Management Prescription specific, and Management Area specific standards that mitigate adverse effects to all resources. These standards are all part of the action alternative.

Additionally, the Pesticide Use Handbook (FSH 2109.14) and the Health and Safety Code Handbook (FSH 6709.11) would be used as guidance for workers. Herbicide notice signs (FSH

7109.11) would be clearly posted, and would include the application date, the herbicide, and safe reentry date. For herbicide spills, an emergency spill plan would be followed (see Appendix B).

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in Table 1 is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 1. Alternative Comparison

Resource	Effects Alternative 1	Effects Alternative 2
Biological Factors		
Wildlife - Terrestrial	None	None
Wildlife – T&E and Viability Concern	None	None
Vegetative Communities	None	None
T&E and Viability Concern Plants	Potential negative effects of competition could lead to reduced vigor and loss of individuals.	Potential competitive effects mitigated and habitat enhanced in long-term.
Aquatic Habitats	None	None
Aquatic T&E and Viability Concern	None	None
Management Indicator Species	Potential negative effects on Ruth's golden aster (MIS) as habitat quality decreases.	Improved habitat conditions should benefit Ruth's golden aster (MIS) in the long-term.
Socio-Economic Factors		
Scenery and Recreation	None	None
Cultural Resources	None	None
Civil Rights	None	None
Public Health and Safety	None	Impacts to public health and safety are negligible.
Physical Factors		
Water and Soil resources	None	Impacts to water and soil resources are negligible.

Monitoring

Pre-treatment monitoring has been performed annually at all four sites since 2000. Monitoring after treatment will be a necessary component in determining the frequency and type of successive treatments. A detailed monitoring plan is attached in Appendix A.

ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above.

The scope of analysis is generally the boundaries of the four individual plots with consideration of the adjacent aquatic system (Hiwassee River). The treatments are confined to the plots and any immediately adjacent woody vegetation that casts significant shade on the plots. The plots represent a tiny fraction of the available habitat for Ruth's golden aster across a larger, geographic area. The time frame for analysis is approximately one year before the project area is treated and approximately one year beyond the time when the area is treated.

When considering cumulative effects the following past, present and reasonably foreseeable activities will be considered: Dispersed recreational impacts such as hiking (John Muir Trail), fishing, and boating, could have an effect in this area, as would the timing and amounts of water flows released from the Appalachia Dam. Treatments of invasive plant species could also occur in this area and are currently being evaluated in another Environmental Assessment. Natural events such as wind-throw, wildfire, and forest insect and disease outbreaks may also have some impact within or adjacent to the project area. If monitoring shows that treatments are successful in restoring habitat, a proposal could be made to expand this type of work, but realistically, that would be several years into the future and is not predictable at this time.

Biological Factors

This section discloses effects to biological elements of the environment expected as a result of implementing the Proposed Action or No Action Alternative. The biological environment includes the diversity of plant and animal communities, habitat components, and individual species of concern or interest. Analysis of effects to these elements is organized in this document following the framework used within the Final Environmental Impact Statement for the RLRMP (USDA Forest Service 2004b). Use of this framework is designed to ensure comprehensive consideration of effects to the biological environment. Elements in this framework are listed in Table 2, where they are assessed for their relevance to this project. Only those relevant to the project are analyzed further in this document.

Table 2. Elements of the biological environment, derived from RLRMP analysis, their relevance to this project, and whether they will be further analyzed in this document.

Biological Element	Analyzed Further?	Relevance to this Project
Major Forested Communities		
Mesic Deciduous Forest	No	No mesic deciduous forests would be affected.
Spruce-fir Forest	No	No spruce-fir forests would be affected.
Eastern Hemlock and White Pine Forest	No	No eastern hemlock and white pine forests would be affected.
Oak and Oak-pine Forest	No	No oak and oak-pine forests would be affected.
Pine and Pine-oak Forest	No	No pine and pine-oak forests would be affected.
Woodlands, Savannas, and Grasslands	No	No woodlands, savannas, and grasslands would be affected.
Rare Communities		
Wetland Communities	No	No Wetland communities would be affected.
Barrens, Glades, and Associated Woodlands	No	No barrens, glades and associated woodlands would be affected.
Carolina Hemlock Forests	No	No Carolina hemlock forests would be affected.
Table Mountain Pine Forests	No	No Table Mountain pine forests would be affected.
Basic Mesic Forests	No	No basic mesic forests would be affected.
Beech Gap Forests	No	No beech gap forests would be affected.
Rock Outcrops and Cliffs (includes forested boulder fields)	Yes	Ruth's golden aster occurs on rock outcrops along the Hiwassee River.
High Elevation Balds and Meadows	No	No high elevation balds and meadows would be affected.
Caves and Mines	No	No caves and mines would be affected.
Successional Habitats	No	Vegetation manipulation would not alter existing forest age class distributions.
High Elevation Early Successional Habitats	No	High elevation early successional habitats would not be affected.
Permanent openings and old fields, Rights-of-way, Improved pastures	No	These habitats would not be affected.
Forest Interior Birds	No	Forest interior birds would not be affected.
Old Growth	No	Old growth would not be affected.
Riparian Habitats	Yes	A small amount of riparian vegetation would be treated by this proposal.
Snags, Dens, and Downed Wood	No	Snags, dens, and downed wood would not be affected.
Aquatic Habitats	Yes	The use of herbicides will be analyzed

Table 2. Elements of the biological environment, derived from RLRMP analysis, their relevance to this project, and whether they will be further analyzed in this document.

Biological Element	Analyzed Further?	Relevance to this Project
		relative to their potential to affect aquatic habitats.
Threatened and Endangered Species	Yes	Potential effects to T and E species will be analyzed.
Species Viability	Yes	Aquatic only. There are no known occurrences of terrestrial species with viability concerns within the project area.
Demand Species	No	Demand species would not be affected.
Migratory Birds	No	Migratory birds would not be affected.
Invasive Non-Native Plants and Animals	Yes	A few invasive non-native plant species are known to occur within the plots.
Forest Health	No	Forest health would not be affected.

The RLRMP selected management indicator species (MIS) as a tool to help indicate effects of management on some elements of this framework. A subset of these MIS is selected for consideration in this analysis because their populations or habitats may be affected by the project (see Table 3)

Table 3. Forest-level Management Indicator Species

Species Name	Purpose	Selected for Project Analysis?	Reasons for Selection/Non-Selection
Prairie warbler	To help indicate management effects of creating and maintaining early successional forest communities	No	No low elevation early successional habitat would be affected by this proposal.
Chestnut-sided warbler	To help indicate management effects of creating and maintaining high elevation early successional forest communities and habitat	No	No high elevation early successional habitat would be affected by this proposal.
Pine warbler	To help indicate effects of management in pine and pine-oak communities	No	No pine and pine oak communities would be affected by this proposal.
Pileated woodpecker	To help indicate management effects on snag dependent wildlife species	No	No snag dependent wildlife species would be affected by this proposal.
Acadian flycatcher	To help indicate management effects within mature riparian forest community	Yes	Riparian habitats may be affected by this proposal.

Table 3. Forest-level Management Indicator Species

Scarlet tanager	To help indicate effects of management in xeric oak and oak pine communities	No	No xeric oak and oak pine communities would be affected by non-native invasive plant species.
Ruth's golden aster	To help indicate management effects on the recovery of this T&E plant species	Yes	Effects of removing competing vegetation (native and non-native) will be analyzed for this species.
Ovenbird	To help indicate management effects of wildlife species dependent upon mature forest interior conditions	No	No interior mature forest would be affected by this proposal.
Black bear	To help indicate management effects on meeting hunting demand for this species	No	No demand species would be affected by this proposal.
Hooded warbler	To help indicate effects of management on providing dense understory and midstory structure within mature mesic deciduous forest communities	No	Mesic deciduous communities would not be affected by this proposal.

Existing Condition Rock Outcrops and Cliffs

Rock outcrops and cliffs are a common occurrence along the banks of the Hiwassee River. While these outcrops may not seem important to the casual observer, the total Hiwassee population of Ruth's golden aster (a federally listed endangered species) coincides with an exposure of Precambrian phyllite bedrock in this area. Historically these rock outcrops were kept in a relatively open condition, scoured by frequent flooding and annual high water within the river channel. Typical herbaceous plant species found on these outcrops include Ruth's golden aster (*Pityopsis ruthii*), small-headed blazing star (*Liatris microcephala*), little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropgon gerardii*), slenderleaf false foxglove (*Agalinis tenuifolia*), button aster (*Symphyotricum dumosum*), wavyleaf aster (*Symphyotricum undulatum*), and goldenrods (*Solidago spp*.). In 1943, however, the Tennessee Valley Authority constructed a water diverting flume for energy production which effectively de-watered the section of the river where Ruth's golden aster occurs. The existing condition of these rock outcrops is now changing as successional vegetation gains a stronghold. As more soil accumulates in the cracks and crevices on these outcrops, grasses and other herbaceous vegetation including species that were not previously part of this community, have become more easily established. Vines, such as poison ivy (*Toxicodendron radicans*), Virginia creeper (*Pathenocissus quinquefolia*), grape (*Vitis rotundifolia*), trumpet creeper (*Campsis radicans*), and Japanese honeysuckle (*Lonicera japonica*) are rapidly expanding across the open rock, and shrubs and trees from the neighboring forest are rapidly expanding into these areas, creating shaded conditions that further alter the vegetative composition. Of particular concern is the increased abundance of non-native species, including Japanese honeysuckle, sericea lespedeza (*Lespedeza cuneata*), and Nepal grass (*Microstegium viminium*). These changes threaten to permanently alter the open habitat conditions on these rock outcrops.

Direct and Indirect Effects Rock Outcrops and Cliffs

Alternative 1 (No Action)

Under the No Action Alternative, no treatments to remove encroaching vegetation would occur within the plots, and succession would continue to alter the vegetative composition in these areas. The open character of these outcrops has already been affected to some degree by encroaching vegetation. Direct and indirect effects of the No Action Alternative include continued loss of open character on these outcrops and subsequent changes to species composition in these areas.

Alternative 2

Under Alternative 2, all vegetation with the exception of Ruth's golden aster would be removed from the two treatment plots. Effects to riparian vegetation from these treatments are discussed in the next section. Habitat conditions would be created within these two plots that approximate expected conditions resulting from years of frequent flood scour. The two control plots would not be affected and would follow the course described in the No Action Alternative, allowing direct comparison of effects. While the direct effects of the action would be expected to restore rock outcrop habitat to more natural conditions within the treated plots, the combined size of the two treatment plots (200 square meters) would only account for a negligible effect to the total rock outcrop habitat along this stretch of river.

Cumulative Effects Rock Outcrops and Cliffs

All Alternatives

Past, present and reasonably foreseeable activities are listed on page 10. The proposed project area is located within the Hiwassee River corridor in an area that is not subject to much active management based upon RLRMP management prescriptions. Rock outcrops are common within the Hiwassee River corridor and the proposal would only directly affect 200 square meters of this habitat, a negligible amount relative to the total present. Recreational impacts in the area are concentrated along the John Muir Trail, and while fishermen may access the river across some rock outcrop habitat, their effects are dispersed and unpredictable. Recreational impacts combined with natural events may have some effect on this habitat; however the magnitude and timing are such that they are not considered to be of any significance. Thus, regardless of the alternative chosen, there would be no cumulative effects associated with this project.

Existing Condition Riparian Habitats

Riparian habitats along the Hiwassee River include the immediate riverine vegetation found along the banks and rock outcrops and the adjacent riparian forest. With the elimination of natural flows within the river corridor in 1943, successional processes have taken place, effectively bringing the riparian forest closer to the water's edge. While some amount of germination of woody species has probably always occurred within the historically flooded zone, high flows, scour, and inundation likely inhibited establishment. The lack of these high flows has allowed soil and organic material to build up, creating additional seedbeds enabling establishment of less water-tolerant plants and many woody species. Tree species that have become established within the rocky floodplain and can currently be found within the plots

include river birch (*Betula nigra*), alder (*Alnus serrulata*), sweet gum (*Liquidambar styraciflua*), tulip poplar (*Liriodendron tulipifera*), Virginia pine (Pinus virginiana), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), and winged elm (*Ulmus alata*). The encroachment of the riparian forest and the continued succession of herbaceous vegetation on rock outcrops (see previous section) are altering the condition of riparian habitats in this area. The RLRMP (USDA Forest Service 2004a) lists the Acadian flycatcher as a management indicator species (MIS) for riparian habitats. Existing condition for this species is described below.

Acadian Flycatcher (MIS)

The breeding range of the Acadian flycatcher (*Empidonax virescens)* includes southeastern South Dakota east across the southern Great Lakes region to southern New England, south to southern Texas, Gulf Coast, and central Florida, west to central Kansas; in Canada, restricted to southwestern Ontario (NatureServe 2002). The highest nesting densities were in the Cumberland Plateau and in Virginia and West Virginia. Key habitat requirements are moist deciduous forests with a moderate understory, generally near a stream (Hamel 1992). Humid deciduous forest (primarily mature), woodland, shaded ravines, floodplain forest, river swamps, hammocks and cypress bays of south, thickets, second growth, and plantations are used for nesting and breeding. Acadian flycatchers require a high dense canopy and an open understory. These birds tend to be scarce or absent in small forest tracts, unless the tract is near a larger forested area. North American Breeding Bird Survey data indicate a stable population in the Eastern U.S. from 1966-2005, but a declining trend in the Blue Ridge Mountains in the same time period (Sauer et al. 2005).

Direct and Indirect Effects Riparian Habitats

Alternative 1 (No Action)

Under the No Action Alternative, no treatments to remove encroaching vegetation would occur within the plots, and succession would continue to alter the vegetative composition in these areas. The open character within the plots has already been affected to some degree by encroaching vegetation. Direct and indirect effects of the No Action Alternative include continued loss of open character and subsequent changes to species composition in these areas. Riparian forests would continue to expand in this area.

Based upon the very small size of the affected area, this alternative would have no direct or indirect effect to **Acadian flycatchers.** Habitat conditions would remain largely unchanged with the possible exception of effects from natural storm events or wildfire. This alternative would have no short-term or long-term effects

Alternative 2

Under Alternative 2, all vegetation with the exception of Ruth's golden aster would be removed from the two treatment plots. Effects to riparian vegetation within these plots are intended to simulate the long-term results of sustained, frequent flooding, though immediate and short-term effects (complete removal) would be more extreme. Direct effects to targeted vegetation would be death. The two control plots would not be affected and would follow the course described in the No Action Alternative, allowing direct comparison of effects. While the direct effects of the

action would be expected to restore riparian vegetation within the treated plots to more natural conditions for the flood zone, the combined size of the two treatment plots (200 square meters) would only account for a negligible effect to the riparian habitat along this stretch of river.

All herbicide application techniques have been designed specifically to avoid non-target impacts. Specialized equipment including flexible wands with "no-drip tip" adjustable nozzles would be used on sprayers, and individual Ruth's golden aster plants would be protected using a variety of shields (plastic sheets, Styrofoam cups, Tupperware™, PVC pipe, etc). All shields would be wiped dry with a towel before moving from one location to another. The total amount of herbicide that would be necessary to treat an individual plot is estimated to be between one to five ounces, thus non-target impacts (indirect effects) would be expected to be minimal to none. Risk assessments for herbicides proposed for use in this alternative were completed for the Forest Service by Syracuse Environmental Research Associates, Inc. (SERA 2003a, 2003b). A summary from those documents of potential effects to terrestrial organisms is presented below, though it should be noted that application rates considered in those documents far exceed those that are proposed here. The complete text of these documents can be found at: http://www.fs.fed.us/foresthealth/pesticide/risk.shtml (USDA 2007).

Potential Effects of Glyphosate on Terrestrial Organisms

"The current risk assessment for glyphosate generally supports the conclusions reached by U.S. EPA: Based on the current data, it has been determined that effects to birds, mammals, fish and invertebrates are minimal. At the typical application rate of 2 lbs a.e./acre, none of the hazard quotients for acute or chronic scenarios reach a level of concern even at the upper ranges of exposure for terrestrial organisms. For the application rate of 7 lbs a.e./acre, central estimates of the hazard quotients somewhat exceed the level of concern for the direct spray of a honey bee. That the upper range of the hazard quotients, the level of concern is exceeded modestly in acute scenarios for a large mammal consuming contaminated vegetation and a small bird consuming insects. In the chronic exposure scenarios, the hazard quotient for a large bird consuming contaminated vegetation on site exceeds the level of concern by a factor of about 3. As with all longer term exposure scenarios involving the consumption of contaminated vegetation, the plausibility of this exposure scenario is limited because damage to the treated vegetation – i.e., vegetation directly sprayed at the highest application rate – would reduce and perhaps eliminate the possibility of any animal actually consuming this vegetation over a prolonged period. For relatively tolerant nontarget species of plants, there is no indication that glyphosate is likely to result in damage at distances as close as 25 feet from the application site. For sensitive species at the upper range of application rates, there is a modest excursion about the NOEC at offsite distances of 100 feet or less. It should be noted, however, that all of these drift estimates are based on low-boom ground sprays. Many applications of glyphosate are conducted by directed foliar applications using backpacks. In such cases, little if any damage due to drift would be anticipated. Nontarget terrestrial plants are not likely to be affected by runoff of glyphosate under any conditions." (SERA 2003a)

Potential Effects of Triclopyr on Terrestrial Organisms

"For terrestrial mammals, the central estimates of hazard quotients do not exceed the level of concern for any exposure scenarios. At the upper range of exposures, the hazard quotients exceed the level of concern for large mammals and large birds consuming contaminated vegetation exclusively at the application site. At higher application rates, concern for exposure

scenarios involving the consumption of contaminated vegetation is augmented substantially. At the maximum application rate of 10 lbs a.e./acre, the central estimate of the hazard quotient exceed the level of concern for several acute exposure scenarios: the direct spray of a small mammal assuming 100% absorption, a large mammal consuming contaminated vegetation, and a small bird consuming contaminated insects. The central estimates of the hazard quotients for the chronic consumption of vegetation is exceeded for a large mammal and a large bird and the upper range on the hazard quotients are also increased by a factor of 10: i.e., to 60 for a large mammal and 50 for a large bird. This risk assessment is consistent with the risk characterization given by U.S. EPA indicating that contaminated vegetation is primary concern in the used of Triclopyr and that high application rates will exceed the level of concern for both birds and mammals in longer term exposure scenarios." (SERA 2003b)

Habitat for Acadian flycatchers would not be substantially changed though potential impacts to two 10x10 meter plots. Very few trees would be removed, and most are only sapling sized, therefore overstory composition would not be affected. The Proposed Action would have no effect on Acadian flycatchers.

Cumulative Effects Riparian Habitats

All Alternatives

Past, present and reasonably foreseeable activities are listed on page 10. The proposed project area is located within the Hiwassee River corridor in an area that is not subject to much active management based upon RLRMP management prescriptions. Riparian habitats affected are common within the Hiwassee River corridor, and the proposal would only directly affect 200 square meters of this habitat, a negligible amount relative to the total present. Recreational impacts in the area are concentrated along the John Muir Trail, and while fishermen may access the river across some rock outcrop habitat, their effects are dispersed and unpredictable. Recreational impacts combined with natural events may have some effect on riparian habitat; however the magnitude and timing are such that they are not considered to be of any significance. Herbicide use could be approved in areas adjacent to the project area through another Environmental Assessment that is currently being written, however, there are very specific standards and mitigations associated with riparian systems and proximity to federally listed species that would put considerable constraints on their widespread use. The small amount of herbicide proposed in this project combined with the specific methodologies to minimize non-target impacts are examples of these types of mitigations, and no cumulative effects from the two projects would occur. Thus, regardless of the alternative chosen, there would be no cumulative effects associated with this project.

Existing Condition Aquatic Habitats, Aquatic Threatened, Endangered and Sensitive Species, and Aquatic Species Viability

The Hiwassee River is the only stream in the Ruth's golden aster project area. It is a cool water fisheries with an elevation of about 900 feet; a gradient of 0.40%; and a stream order of 8. Stream order is positively correlated with fish species; gradient is negatively correlated with fish species; and elevation is negatively correlated with fish species (Herrig 2004).

Forest Service (USDA Forest Service 2008) and other agency crews conducted 19 aquatic surveys between 1993 and 2007 on the Hiwassee River in the Ruth's golden aster project area. None of the surveys indicated a sediment or chemical problem existed.

Populations of aquatic animals were also evaluated. The Hiwassee River in the project area is a very productive system do to the large stream order, low gradient, and low elevation. Three amphibian, 43 fish, 15 mussel, 2 aquatic snail, 2 snake and 2 turtle species have been found in the project area. All of these populations are assumed to have viable populations on this Forest except those displayed in Table 4. The table displays Threatened, Endangered, Sensitive and Locally Rare aquatic species; their relative abundance in the project area (presumed to be one population of each based on the small project area) and across the CNF; and their Viability Status (USDA Forest Service 2008). None of the 6 insects listed in Table 4 have been documented in the project area; however, suitable habitat for them does exist. No additional species of aquatic animals with these Viability Status categories are expected to occur in the project area.

Table 4. Threatened, Endangered, Sensitive and Locally Rare aquatic species documented as occurring within the project area or that have the potential to be in the project area. Their abundance in the project area is compared to their abundance across the CNF.

Group	Species	Populations		Viability Status
		Project Area	Forest Wide	
Fish	blackspotted topminnow	1	3	Locally Rare
Fish	mountain brook lamprey	1	3	Sensitive
Fish	olive darter	1	1	Sensitive
Fish	Tennessee dace	1	36	Sensitive
Insects	Helma's net-spinning caddisfly	0	1	Sensitive
Insects	Cherokee clubtail	0	0	Sensitive
Insects	mountain river cruiser	0	0	Sensitive
Insects	green-faced clubtail	0	1	Sensitive
Insects	Allegheny snaketail	0	0	Sensitive
Insects	Appalachian snaketail	0	1	Sensitive
Mussels	common pocketbook	1	1	Locally Rare
Mussels	Cumberland bean	1	2	Endangered
Mussels	elktoe	1	1	Locally Rare
Mussels	longsolid	1	1	Locally Rare
Mussels	mountain creekshell	1	1	Locally Rare
Mussels	pink heelsplitter	1	1	Locally Rare
Mussels	rainbow	1	2	Locally Rare
Mussels	slabside pearlymussel	1	1	Sensitive
Mussels	spike	1	1	Locally Rare
Mussels	tan riffleshell	1	1	Endangered
Mussels	Tennessee clubshell	1	2	Sensitive
Mussels	Tennessee heelsplitter	1	1	Sensitive
Mussels	Tennessee pigtoe	1	1	Sensitive
Mussels	wavy-rayed lampmussel	1	2	Locally Rare
Snails	Elimia christyi	1	1	Locally Rare

Protection of extant populations on the Forest and restoration are the primary foci for all species with a viability status of Threatened, Endangered, Sensitive or Locally Rare. Threatened and Endangered species are defined by the Endangered Species Act (USDI Fish and Wildlife Service 1973); Sensitive species are defined by Forest Service Manual 2670 (USDA Forest Service 2005a); and Locally Rare species are described in the Final Environmental Impact Statement for the RLRMP (USDA Forest Service 2004b). Aquatic species with a Viability Status of Locally Rare are natives with fewer than 5 populations on the Forest (USDA Forest Service 2005b). Forest activities may impact populations of species with viability concerns. Forest Service Manual 2670.22 directs the agency to maintain viable populations of all native species. Opportunities to improve habitat conditions and increase populations through re-introduction on the Forest are pursued.

Direct and Indirect Effects Aquatic Habitats, Aquatic Threatened, Endangered and Sensitive Species, and Aquatic Species Viability

Alternative 1 (No Action)

Alternative 1 would not involve any ground disturbance or use of herbicides. No new adverse direct or indirect effects would occur to the aquatic environment or to species with a viability concern including: Threatened, Endangered, Sensitive and Locally Rare species.

Alternative 2

Alternative 2 would not involve any ground disturbance; however, some woody and herbaceous vegetation would be removed and herbicides would be used within the riparian zone adjacent to the Hiwassee River. Triclopyr, in the Garlon 3A™ formulation (Renovate 3™), has a low toxicity to fish (SERA 2003b). Based on treatment rates and RLRMP standards, the expected concentration of Triclopyr that might get into the Hiwassee River adjacent to the area being treated is 0.37 mg/L while a concentration of 158 mg/L is the lethal dosage for fish. At least 427 times as much Triclopyr would have to enter the water body to reach lethal levels. Potential runoff from herbicide applications or an accidental spill would have no effects or impacts on aquatic species, because the amount of Triclopyr applied and on-site would be insignificant relative to the volume of water in the Hiwassee River. Renovate 3™ or other formulations that do not contain toxic surfactants would be used in the riparian zone (SERA 2003b).

Glyphosate, in the Rodeo™ formulation, does not contain a surfactant and therefore, is approved for use in water bodies and within riparian areas on the CNF (USDA Forest Service 2004a). Surfactants are far more lethal to aquatic fauna than is Glyphosate alone (SERA 2003a). The Environmental Protection Agency classified technical grade Glyphosate as non-toxic to practically non-toxic to freshwater fish (SERA 2003a). Based on treatment rates and RLRMP standards, the expected concentration of Glyphosate that might get into the Hiwassee River adjacent to the area being treated is 0.2 mg/L while a concentration of 70 mg/L is the lethal dosage for fish. At least 350 times as much Glyphosate would have to enter the water body to reach lethal levels. Potential runoff from herbicide applications or an accidental spill would have no effects or impacts on aquatic species, because the amount of Glyphosate applied and on-site would be insignificant relative to the volume of water in the Hiwassee River. Only Rodeo™ or other formulations that do not contain toxic surfactants would be used in the riparian zone (SERA 2003a).

Forest Wide Standards: FW-10, FW-14, FW-15, and FW-16 would be employed (USDA Forest Service 2004a). Vegetation management within the defined riparian corridor would be for improvement of Ruth's golden aster. Riparian Prescription Standards: RX11-1 and RX11-8 (USDA Forest Service 2004a) would be followed.

Implementation of Alternative 2 with full consideration of these standards would result in no direct or indirect adverse effects to aquatic habitats or aquatic species with viability concerns, including Threatened, Endangered, Sensitive or Locally Rare species (USDA Forest Service 2004b) because only insignificant amounts of sediment and herbicides, if any, would enter the Hiwassee River. See Appendix C, Biological Evaluation for determinations of effect.

Cumulative Effects Aquatic Habitats, Aquatic Threatened, Endangered and Sensitive Species, and Aquatic Species Viability

Alternative 1 (No Action)

Other activities in the area listed on page 10 may be contributing sediment to streams. Alternative 1 does not propose any new ground disturbance. Consequently, past and present activities in conjunction with Alternative 1 would not increase adverse cumulative effects on aquatic habitats or species. Activities, on National Forest System (NFS) lands, that are reasonably foreseeable would be implemented under the standards for protecting streams listed in the RLRMP (USDA Forest Service 2004a). Implemented in conjunction with Alternative 1, they would not have an adverse cumulative effect on aquatic habitats or species because there would be no increase in sediment or chemicals.

Alternative 2

Alternative 2 would not involve any ground disturbance; however, some woody and herbaceous vegetation would be removed and herbicides (Triclopyr and Glyphosate) would be used within the riparian zone adjacent to the Hiwassee River. These activities would follow the standards for protecting streams listed in the RLRMP (USDA Forest Service 2004a). Following these standards while implementing Alternative 2 would result in increased viability for Ruth's golden aster. No cumulative adverse effects to aquatic habitats or aquatic species with viability concerns, including Threatened, Endangered, Sensitive or Locally Rare species (USDA Forest Service 2004b) would occur because only insignificant amounts of sediment and herbicides, if any, would enter the Hiwassee River.

Existing Condition Terrestrial Threatened and Endangered Species

One terrestrial endangered species, Ruth's golden aster is known to occur within the project area. The worldwide distribution of Ruth's golden aster occurs along the Hiwassee and Ocoee Rivers on the CNF. This species has been cooperatively monitored by the Tennessee Valley Authority, TDEC, and the Forest Service since 1987. Ruth's golden aster was selected as a Management Indicator Species in the RLRMP (USDA Forest Service 2004a) "to indicate effectiveness of management activities designed specifically to meet recovery objectives for this species." The population on the Hiwassee River has long been estimated to contain approximately 10,000 individuals and is monitored through permanent quadrants at several key sites. A detailed census and assessment of the Hiwassee population was completed during Fiscal Year 2000 through a Challenge Cost Share with TDEC. The results of this census indicate a total of 8,235 plants along

a four mile section. Monitoring data from the Hiwassee River and associated field observations there have indicated that suitable habitat is being lost to the encroachment of woody and herbaceous vegetation. The following excerpt from the federal Ruth's Golden Aster Recovery Plan also addresses the issue of competing vegetation.

> *"Pityopsis ruthii* is strongly associated with *Liatris microcephala*, which usually is found wherever *P. ruthii* occurs (Collins and Gunn 1986, 1987). Other associates include *Andropogon ternarius*, *Aster dumosus*, *A. linariifolius*, and *Solidago arguta* ssp. *caroliniana* (Bowers 1972a, White 1977). White (1977) terms *A. dumosus*, *L. microcephala*, and *S. arguta* ssp. *caroliniana* "secondary invaders," which, in the absence of natural flooding, gradually are outcompeting *P. ruthii* for habitat as soil depths increase. His greenhouse studies demonstrated the inability of *P. ruthii* to compete with *A. dumosus* and *S. arguta* ssp. *caroliniana*." (USDI Fish and Wildlife Service 1992)

Direct and Indirect Effects Terrestrial Threatened and Endangered Species

Alternative 1 (No Action)

Under the No Action Alternative, no treatments to remove encroaching vegetation would occur within the plots, and succession would continue to alter the vegetative composition in these areas. The open character within the plots has already been affected to some degree by encroaching vegetation, and individual plants of Ruth's golden aster would be at risk of being out competed or over-topped by herbaceous vegetation and vines. Allowing competing vegetation to continue to expand in Ruth's golden aster habitat would have long-term adverse effects by decreasing habitat quality through shading and displacement. This would reduce the number of Ruth's golden aster plants on the Hiwassee River.

Alternative 2

Under Alternative 2, all vegetation with the exception of Ruth's golden aster would be removed from the two treatment plots. Direct effects to targeted vegetation would be death. None of the species targeted for removal are rare or uncommon, and all are also abundant outside of the treatment areas, thus direct and indirect impacts to these plant species would be negligible to the species' population. Effects to vegetation within the treatment plots are intended to simulate the long-term results of sustained, frequent flooding, though immediate and short-term effects (complete removal) would be more extreme to the target vegetation. The two control plots would not be affected and would follow the course described in the No Action Alternative, allowing direct comparison of effects.

All herbicide application techniques have been designed specifically to avoid non-target impacts. Specialized equipment including flexible wands with "no-drip tip" adjustable nozzles would be used on sprayers, and individual Ruth's golden aster plants would be protected using a variety of shields (plastic sheets, Styrofoam cups, Tupperware™, PVC pipe, etc). All shields would be wiped dry with a towel before moving from one location to another. The total amount of herbicide that would be necessary to treat an individual plot is estimated to be between one to five ounces, thus non-target impacts (indirect effects) would be expected to be minimal to none.

This project is being proposed for the benefit of Ruth's golden aster. Ruth's golden aster is a shade intolerant plant. Removal of competing vegetation in the project sites would reduce the

negative effects of shading and displacement on this endangered species. This would improve habitat quality and is likely to have long-term beneficial effects on the Hiwassee River population of Ruth's golden aster (see Appendix C, Biological Evaluation for determinations of effect).

Risk assessments for herbicides proposed for use in this alternative were completed for the Forest Service by Syracuse Environmental Research Associates, Inc. (SERA 2003a, 2003b). A summary of these effects is presented above in the section on effects to "Riparian Habitats". The complete text of these documents can be found at: http://www.fs.fed.us/foresthealth/pesticide/risk.shtml (USDA 2007).

Cumulative Effects Terrestrial Threatened and Endangered Species

All Alternatives

Past, present and reasonably foreseeable activities are listed on page 10. The proposed project area is located within the Hiwassee River corridor in an area that is not subject to much active management based upon RLRMP management prescriptions. The project lies within occupied habitat of the federally listed Ruth's golden aster and is designed to improve habitat conditions for this species. However, the proposed treatments would only directly affect 200 square meters of this habitat, a negligible amount relative to the total habitat present. Recreational impacts in the area are concentrated along the John Muir Trail, and while fishermen may access the river across some occupied habitat, their effects are dispersed and unpredictable. Recreational impacts combined with natural events may have some effect on this species; however the magnitude and timing are such that they are not considered to be of any significance. Thus, regardless of the alternative chosen, there would be no cumulative effects associated with this project.

Existing Condition Non-Native Invasive Plants and Animals

Several species of non-native invasive plants including sericea lespedeza (*Lespedeza cuneata*), Japanese honeysuckle (*Lonicera japonica*), and Nepal grass (*Microstegium viminium*) occur within the sample plots, and others including privet (*Ligustrum sinense*) and multiflora rose (*Rosa multiflora*) are encountered frequently in the adjacent riparian forest. These species threaten the integrity of native ecosystems and are invading habitat occupied by the federally endangered Ruth's golden aster. There are no known issues regarding non-native animals within the study plots.

Direct and Indirect Effects Non-Native Invasive Plants and Animals

Alternative 1 (No Action)

Under the No Action Alternative, no treatments to remove encroaching vegetation, including non-native invasive plants, would occur within the plots. Succession would continue to alter the vegetative composition in these areas and non-native species would increase within these communities. Individual plants of Ruth's golden aster would be at risk of being out competed or over-topped by non-native plants, especially Japanese honeysuckle and sericea lespedeza. Direct and indirect effects of the No Action Alternative could include loss of native biodiversity and possible loss of vigor or death for individual Ruth's golden aster plants.

Alternative 2

Under Alternative 2, all vegetation with the exception of Ruth's golden aster would be removed from the two treatment plots. Non-native invasive plant species would be included in this treatment, however, they typically have populations that are also abundant outside of the treatment areas, thus direct and indirect impacts to these plant species would be negligible to the species' population. The two control plots would not be affected and would follow the course described in the No Action Alternative, allowing direct comparison of effects.

All herbicide application techniques have been designed specifically to avoid non-target impacts. Specialized equipment including flexible wands with "no-drip tip" adjustable nozzles would be used on sprayers. The total amount of herbicide that would be necessary to treat an individual plot is estimated to be between one to five ounces, thus non-target impacts (indirect effects) would be expected to be minimal to none. Risk assessments for herbicides proposed for use in this alternative were completed for the Forest Service by Syracuse Environmental Research Associates, Inc. (SERA 2003a, 2003b). A summary of these effects is presented above in the section on effects to "Riparian Habitats". The complete text of these documents can be found at: http://www.fs.fed.us/foresthealth/pesticide/risk.shtml (USDA 2007).

Cumulative Effects Non-Native Invasive Plants and Animals

All Alternatives

Past, present and reasonably foreseeable activities are listed on page 10. The proposed project area is located within the Hiwassee River corridor in an area that is not subject to much active management based upon RLRMP management prescriptions. Herbicide use could be approved in areas adjacent to the project area through another Environmental Assessment that is currently being written, however, there are very specific standards and mitigations associated with riparian systems and proximity to federally listed species that would put considerable constraints on their widespread use. The small amount of herbicide proposed in this project combined with the specific methodologies to minimize non-target impacts are examples of these types of mitigations, and no cumulative effects from the two projects would occur. Thus, regardless of the alternative chosen, there would be no cumulative effects associated with this project.

Social/Economic Factors

Existing Condition Scenery and Recreation Resources

The affected environment is a section of the Hiwassee River managed as a part of Management Prescription 7.B-Scenic Corridors/Sensitive Viewsheds under the RLRMP. The management emphasis is to provide high-quality scenery in sensitive recreational and travel way settings through maintenance or restoration and design.

Located above the Appalachia Powerhouse the affected section of the Hiwassee River is primarily accessed by the John Muir National Recreation Trail. This is a hiking trail that also functions as part of the Benton MacKaye long-distance trail. Limited access points and restricted water flows keep recreational use low in this section of the river. The trail does not provide visitors with a direct view of the potential plot sites.

In contrast, the river section below the Appalachia Powerhouse is accessed by a paved road and receives scheduled water releases. It is a destination for fishing, boating and sightseeing and receives high recreational use. This section of the river is not part of the affected environment.

Direct and Indirect Effects Scenery and Recreation Resources

Alternative 1 (No Action)

The restriction of water flow through the affected section of the Hiwassee River has created a noticeable change in the scenery including increased vegetation within the riverbed itself. The No Action Alternative would perpetuate this encroachment of vegetation and consequent change in landscape character. However, the potential impacts to scenery and recreation would be negligible relative to the effects of restricting the natural water flow through the affected environment. No action would be consistent with the RLRMP direction for scenery and recreation resources.

Alternative 2

Proposed actions taken to impede the encroachment of vegetation within the riverbed would restore the landscape to a character more aligned with that of a typical free flowing river. These actions would be consistent with direction in the RLRMP for Management Prescription 7.B. The potential effects would be limited to 2 plots measuring 10x10 meters. The scale of potential effects for each plot would roughly be equivalent to an area of 5 parking spaces in a typical parking lot. Therefore, the impacts to scenery and recreation would be considered negligible and not expected to be noticed by the casual forest visitor.

Cumulative Effects Scenery and Recreation Resources

Alternative 1 (No Action)

Without regular water flows through the affected section of the Hiwassee River or actions taken to impede encroaching vegetation, the landscape character would continue to evolve toward a rocky, wooded landscape in contrast to an open riverbed. Over time, the aesthetic appeal typically associated with a free flowing river would diminish. However, the landscape would continue to be valued by forest visitors as a wooded, rocky gorge. The setting would continue to be consistent with RLRMP direction.

Alternative 2

If the results of the proposed actions are deemed successful, it would be reasonable to expect that these actions would replicated at a larger scale in the future. Actions taken to impede encroaching vegetation and restore the riverbed landscape would be more consistent with the RLRMP than no action. The increased populations of Ruth's golden aster, a wildflower that blooms in late summer, would be considered a positive effect to the scenery and recreation resources.

Existing Condition Herbicide Hazard Quotients and Effects to Human Health

Effects and associated risks of all herbicides listed in the Proposed Action for this project have been assessed by Syracuse Environmental Research Associates, Inc. (SERA 2003a, 2003b). The

complete text of these documents in Adobe Acrobat format can also be found at: http://www.fs.fed.us/foresthealth/pesticide/risk.shtml (USDA 2007).

In the risk assessments, there are two terms that are very important as they pertain to human health. These are Reference Dose (RfD) and Hazard Quotient (HQ).

- RfD - Derived by U.S. EPA, this is the maximum dose in mg of herbicide active ingredient per kg of body weight per day that is not expected to cause injury over a lifetime of exposure. In other words, it is, in EPA's opinion, a "safe" lifetime daily dose. This is a conservative estimate, and is designed to be protective.
- HQ - This is the ratio of the estimated exposure dose to the RfD. A HQ of 1 equals exposure to the RfD; HQs less than 1 represent exposures to less than the RfD, while HQs greater than 1 represent exposures greater than the RfD. HQs of 1.0 or less represent exposure levels that are not of concern. HQs greater than 1.0 represent possible effects to be examined more closely. The assumptions for any exposures producing a HQ greater than 1.0 are examined to see if the exposures need to be mitigated or avoided. For the effects on wildlife, one must remember that these effects are constructed for individuals and not populations.

Direct and Indirect Effects Herbicide Hazard Quotients and Effects to Human Health

Alternative 1 (No Action)

Under Alternative 1, no activities using herbicides are proposed resulting in no effects to human health.

Alternative 2

Under Alternative 2, the pesticide emergency spill plan (Appendix B) would be in place. Alternative 2 also assumes that all herbicides would be applied in accordance with their label requirements and that all of the mitigation measures of this document would be followed. The total amount of herbicide that would be necessary to treat an individual plot is estimated to be between one to five ounces, thus non-target impacts (indirect effects) would be expected to be minimal to none. The following excerpts from the herbicide risk assessments are based upon application rates that exceed those proposed in this alternative, however, even at those rates, all hazard quotient (HQ) values are within acceptable limits and represent exposure levels that are well under levels of concern to human health.

Glyphosate – For workers, the highest hazard quotient – i.e., 0.2, the upper range for workers involved in broadcast ground spray – is below the level of concern by a factor of about 5. The highest hazard quotient for any accidental exposure scenario for workers - i.e., 0.006 for the upper range of the hazard quotient for spill over the lower legs for one hour - is lower than the level of concern by a factor of over 150. Confidence in these assessments is reasonably high because of the availability of dermal absorption data in human as well as worker exposure studies. The Forest Service may apply Glyphosate at a maximum rate of 7 lbs a.e./acre, a factor of 3.5 higher than the typical application rate of 2 lbs a.e./acre. This has essentially no impact of the risk characterization for workers. The highest hazard quotient for the typical application rate

is 0.2. For an application rate of 7 lbs a.e./acre, the corresponding hazard quotient would be higher by a factor of 3.5 or 0.7, which is still below the level of concern (SERA 2003a).

Triclopyr – There is no indication that workers would be subject to hazardous levels of Triclopyr at the typical application rate of 1 lb/acre and under typical exposure conditions. Nonetheless, at the upper range of exposures, all application methods exceed the level of concern based on the chronic RfD but not the acute RfD. Thus, for workers who may apply Triclopyr repeatedly over a period of several weeks or longer, it is important to ensure that work practices involve reasonably protective procedures to avoid the upper extremes of potential exposure. At higher application rates, particularly rates that approach the maximum application rate of 10 lbs/acre, measures should be taken to limit exposure. These measures would need to be developed on a case-by-case basis depending on the specific application rates that are used and the type of the applications that are employed. For members of the general public, the risk characterization is thus relatively unambiguous at the typical application rate of 1 lb/acre: based on the available information and under the foreseeable conditions of exposure, there is no route of exposure or exposure scenario suggesting that the general public would be at risk from longer-term exposure to Triclopyr (SERA 2003b).

Cumulative Effects Herbicide Hazard Quotients and Effects to Human Health

Alternative 1 (No Action)

Under the No Action Alternative, no herbicide use is proposed. There are no cumulative effects associated with this alternative.

Alternative 2

The herbicide risk assessments specifically consider the effects of repeated exposures and no adverse effects are anticipated. As discussed in the dose-response and dose-severity relationships (SERA 2003a, 2003b), the daily dose rather than the duration of exposure determines the toxicological response. Consequently, repeated exposure to levels below the toxic threshold should not be associated with cumulative effects. Cumulative effects that might result from the use of herbicides on private land are difficult to assess. The use of various herbicides on private land is generally for the widespread control of unwanted plants in agricultural treatments or by private individuals near their homes. Information about additional effects of herbicide use in an environment already impacted by industrial pollution, pesticide use, and automobile emissions is unavailable. For these reasons, because these treatments are unlikely to interact with other activities, and because effects to human health and safety are likely to be small, Alternative 2 would result in no cumulative effects to human health and safety.

Existing Condition Cultural Resources

Cultural resources are the non-renewable, physical remains of prehistoric and historical human activities. They are subject to damage or destruction from land disturbing activities, including those associated with vegetation manipulation and road construction. Area disturbance can damage or destroy the historical, cultural, or scientific integrity of historical or prehistoric resources. Disturbance of historical sites, such as old cabins, can reduce the ability to reconstruct the recent history of settlement in the local area. Disturbance of ethnographic sites, such as

traditional Native American campsites or burial grounds, can reduce the interpretive significance of the site or can infringe on religious rites. The current direction on the CNF is to protect significant cultural resources from adverse impacts that may occur as the result of land disturbing activities, and to inventory NFS lands in order to locate and evaluate all cultural resources. This policy is based on adherence to Federal and state laws and regulations. Cultural resources are closely coordinated with the State Historic Preservation Officer (SHPO).

Direct and Indirect Effects Cultural Resources

Alternative 1 (No Action)

This alternative would have no direct or indirect effects on cultural resources.

Alternative 2

All sites proposed for treatment occur on rock outcrop habitats and involve no ground disturbance. Based upon this, Alternative 2 would have no direct or indirect effects on cultural resources

Cumulative Effects Cultural Resources

There are no known cumulative effects under either alternative.

Civil Rights

None of the alternatives would have disproportionate adverse health or environmental impacts to minority groups, women, or low-income populations. It is difficult to assess the degree of impact each alternative presents to these groups due to other variables. The best information suggests that when assessing the effects of each alternative on minority and low-income groups, the effects are minimal and not disproportionate to these groups when compared to other groups.

Physical Factors

Existing Condition Water Resources

The project area consists of two 10x10 meter plots that have been placed in the historic flood scour zone of the Hiwassee River. The plots are comprised mainly of rock with small pockets of soil surrounded by rock.

The majority of the land that surrounds the Hiwassee River is NFS land. The Hiwassee River is considered to be Exceptional Tennessee Waters from North Carolina state line downstream to river mile 32.8 (TDEC 2008). This river is classified by the State of Tennessee as "domestic and industrial water supply", and it is also listed on the Tennessee 303d list of impaired water bodies because of habitat loss due to flow alteration.

Characteristics of water quality associated with forested, Blue Ridge Eco-region streams include low concentrations of conductivity, total dissolved solids, suspended sediment, alkalinity and hardness. This would be indicative of water which has a limited capacity to neutralize acids, and is low in dissolved minerals and ionized substances.

Direct and Indirect Effects Water Resources

Alternative 1 (No Action)

The No Action Alternative would result in a continuation of existing conditions within the analysis area. No potential effects to the water resources would result from the No Action Alternative.

Alternative 2

Removal of vegetation would expose the small areas of soil. Soil exposure could result in a minor amount of sediment reaching the Hiwassee River.

Herbicides that would be used include Triclopyr and Glyphosate.

Triclopyr is not highly mobile in the soil, and is not a leaching problem under normal conditions since it binds to clay and organic matter in the soil. It may leach from sandy soils if rainfall is heavy after application. The herbicide is broken down by soil microorganisms and ultraviolet light, and persists for 30 to 90 days (46 day average) in the soil depending on soil type and weather (Extoxnet Fact Sheet 1996). Specific formulations of Triclopyr are registered and labeled for aquatic use and these would be used on selective sites where removal of competing vegetation needs to occur close to water.

Glyphosate is inactivated when it comes into contact with soil since it is strongly adsorbed onto soil particles. It is readily metabolized by soil bacteria and many species of soil micro-organisms can use Glyphosate as a carbon source. Because of its adsorption to soil, Glyphosate is not easily leached and is not likely to contaminate ground water. Glyphosate remains unchanged in the soil for varying lengths of time depending on soil texture, organic matter content and environmental conditions (SERA 2003a). Proposed surfactants that would be used with Glyphosate in this treatment area would have no effects on the water resource.

In general, herbicides can enter surface waters via three main routes including:

1. Movement or leaching through the soil profile to subsurface water and travel until contact is made with surface systems,
2. Absorption to a soil particle and movement to surface water systems during heavy rains and;
3. Direct contact with surface water during application.

Several factors are important to consider related to the potential for surface or ground water contamination by herbicides.

1. Mitigation such as streamside buffer zones applied during treatment activity would greatly reduce contamination potential. Generally speaking, buffer zones of 50 feet or larger are effective in minimizing pesticide residue contamination of streamflow (Neary 1996).
2. The small amount of herbicide used (generally a pint or less per acre) would greatly reduce the chance of any detectable herbicide reaching ground or surface water.
3. The method of herbicide application (generally foliar treatments) would minimize herbicide contact with the soil and eliminate direct application or drift to surface water.
4. Timing the herbicide application to avoid rainfall during and immediately after application reduces the risk of contamination.

The herbicides that would be used in the analysis area are low-toxicity chemicals. No herbicide would be applied within 30 feet of open water except for selective treatments that use herbicides labeled for aquatic use. This along with careful control over the weather conditions during which the herbicide would be applied would prevent direct contamination of surface water. The greatest hazard to surface and ground water quality would result from a possible accident during transportation, storage, mixing and disposal of the chemicals. Due the little amount of herbicide used in this project effects to the water resource are negligible.

Cumulative Effects Water Resources

All Alternatives

No cumulative effects would occur from the implementation of Alternative 1.

Dams along the Hiwassee River have reduced flood stages and intervals where the plots are located. It is possible that chemicals, and/or other pollutants may be entering the Hiwassee from roads and/or private lands located along the river corridor. There would be no cumulative effects from the implementation of Alternative 2 due to the minor amounts of sediment and/or herbicide that could possibly enter the Hiwassee River.

Existing Condition Soils

Rock outcrops make up the majority of the area in the 10x10 meter plots. Soils that do exist have alluvium parent material and are coarse in texture. Because the project area is in a historic scour zone a thin organic layer has developed on the soil surface.

Direct and Indirect Effects Soils

Alternative 1 (No Action)

The No Action Alternative would result in a continuation of existing conditions within the analysis area. No potential effects to the soil resources would result from the No Action Alternative.

Alternative 2

Removal of vegetation would expose soil to direct rainfall impact. Because the area is comprised mainly of rock and soil surrounded by rock soil erosion would be minor.

Many field studies involving microbial activity in soil after Glyphosate exposures note an increase in soil micro-organisms or microbial activity, while other studies have noted a transient decrease in soil fungi, bacteria and microbial activity (SERA 2003a). There is very little information suggesting that Glyphosate would be harmful to soil microorganisms under field conditions and a substantial body of information indicating that Glyphosate is likely to enhance or have no effect on soil microorganisms (SERA 2003a).

Overall, removal of competing vegetation with manual methods would have little to no effect on the soil resource.

Cumulative Effects Soils

All Alternatives

The implementation of Alternative 1 would have no cumulative effects on the soil resource.

Because dams control flooding along the Hiwassee River more soil may exist in these areas now than in the past. Due to the location of the area, little existence of soil, and the small amount of herbicide being used there would be no cumulative effects to the soil resource from implementing Alternative 2.

CONSULTATION AND COORDINATION

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

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Mary Dodson, South Zone Wildlife Biologist

Janan Hay, South Zone Planning Team Leader

Mark Pistrang, Forest Botanist/Ecologist

Jim Herrig, Forest Fisheries Biologist

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Quentin Bass, Forest Archeologist

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APPENDIX A

MONITORING PLAN

Monitoring Plan to Assess the Effectiveness of Experimental Removal Of Competing Vegetation From A Population Of Ruth's Golden Aster (Pityopsis ruthii) On The Hiwassee River

Methodology

Sites were chosen for the establishment of four 10x10 meter macro-plots along the Hiwassee River using the following criteria:

1) Area supports large population of Pityopsis ruthii.
2) Plants appear to be suffering from encroachment of competing vegetation.
3) Sun/shade regime is similar.

The four macro-plots were numbered 1-4. Beginning downstream and moving up, plots 1 and 2 are located at "the narrows" and plots 3 and 4 are at Loss Creek. Plots 1 and 4 were randomly selected at each site for the vegetation removal treatments and plots 2 and 3 will remain as controls. Competing vegetation will be removed from the two treatment plots utilizing mechanical and chemical methods. Lag bolts were drilled into the rock every two meters around the perimeter of the plots to create a 2 X 2 meter grid system over each macro-plot. String attached in parallel lines between each bolt create twenty-five 2 X 2 meter sub-plots that are easily re-created on an annual basis (see diagram below).

01 02 03 04 05
06 07 08 09 10
11 12 13 14 15
16 17 18 19 20
21 22 23 24 25

Plots are oriented with the 01-21 line closest to the river. Permanent photo points were also established at each plot. Baseline monitoring at each plot began in the summer of 2000. Treatment will consist of the removal of all competing vegetation including any woody plants nearby that create shade over the plot. Treatments will begin in the spring of 2009. The initial treatment would be implemented during the early spring (April-May) to coincide with a period of vigorous growth, and a post-implementation inspection and follow-up treatment would be conducted within 4 to 6 weeks. Annual inspections and possible follow-up spring treatments would be conducted for a period of 10 years.

The following data will be collected for each 2 X 2 meter sub-plot:

1) # of *Pityopsis* plants/plot. (a single plant is defined as a clump of stems within a given rock crack that is separated from the next clump by 6" or more).
2) # of stems/plant.
3) # of vegetative stems/plant > 2cm tall.

4) # of rosettes (vegetative stems/plant < 2cm tall)
5) # of flowering stems/plant.
6) % cover of *Pityopsis*.
7) % cover other (by species/bare rock/lichen/dead organic/etc.).
8) A sketch map of each plot showing the location of *Pityopsis* plants and other distinguishing features, i.e. downed logs, trees, clumps of other vegetation, etc. (note: for mapping purposes the bottom of the plot represented on the datasheet corresponds to the side of the plot closest to the river)

In addition, the total # of *Pityopsis* plants in each 10x10 meter macro-plot will be recorded and photos will be taken at each photo monitoring point for the macro-plot.

Special data forms have been developed in order to ensure consistency in data recording. These forms are on file with the Forest Botanist located in the Supervisor's Office, Cleveland, Tennessee.

The null hypothesis is that there will be no difference in measurements between the treatment and the control plots. Mapping of individual plants within the sub-plots will allow direct observation of changes over time.

APPENDIX B

PESTICIDE EMERGENCY SPILL PLAN

NOTE: Field personnel transporting or working with pesticides should familiarize themselves with this plan, as well as with the labels and Material Safety Data Sheets (MSDS) of all pesticides to be used in a project. A copy of this plan is to be carried to the field by all crews working with pesticides; a copy is also to be kept in an easily accessible location near the telephone at the district dispatch, work center, or reception desk.

Emergency procedures to follow when a pesticide spill occurs at the work site or when transporting pesticides to and from the work site:

1. PROVIDE FOR CARE OF INJURED OR CONTAMINATED PERSONNEL

Immediately determine if any personnel are injured or contaminated. Each situation may differ, but the major and immediate effort should be to assist injured personnel and minimize further contamination. Accordingly, the following must be accomplished as rapidly as possible.

- If a fumigant or dangerous vapor is involved, put on the appropriate respirator or breathing device. REMEMBER, this is an emergency procedure and not intended for prolonged exposure. Since many pesticides can produce toxic fumes or vapors, always ventilate enclosed areas to prevent build-up of toxic fumes.
- Remove injured or contaminated personnel from the spill site to a safe area.
- If eyes are contaminated with a pesticide, give first priority to washing them out using a portable eyewash bottles, or if these are unavailable, any clean water. Remove contaminated clothing from affected individuals and wash pesticides off skin with detergent and clean water.
- If pesticides have been ingested, see Material Safety Data Sheet for specific first aid measures.
- Immediately seek medical assistance for injured and contaminated personnel. Do not leave contaminated individuals alone unless essential to secure first aid. If necessary, direct a third person to stay with the injured until a physician takes charge and has been advised of the actual or possible pesticide exposure.
- Watch for the following symptoms of pesticide poisoning: eye irritation, skin irritation, gastrointestinal discomfort, dizziness, headache, nausea, vomiting, diarrhea, slurred speech, muscle twitching or convulsions, or difficulty in breathing

2. SPILL IDENTIFICATION

Determine product name for chemical(s) spilled and check Label and Material Safety Data Sheet for immediate hazards. Shut off ignition sources and stop any smoking in case chemicals may be flammable. Isolate contaminated area and keep unnecessary people away.

3. NOTIFY

Cherokee National Forest HAZMAT coordinator: Maurice Artis (423) 476-9774

Cherokee National Forest Pesticide Coordinator: Tim Dalton (423) 338-3301

Give the following information: Chemical name, location of spill, compartment number and stand number, if known, road name, and estimated size of spill in gallons.

The Forest Pesticide Coordinator or HAZMAT Coordinator will notify other key personnel and agencies as required (see attached notification list).

4. CONTAIN SPILL

Spilled pesticides must be contained as much as possible on the site where the spill occurs. Wear appropriate protective clothing. At a minimum, this will include suitable clothing for pesticide application, plus rubber or nitrile gloves and safety glasses or goggles. In addition, use coveralls or a rain suit, rubber gloves or overshoes, and/or a respirator if extra protection is needed. Keep spilled pesticides from entering streams, storm drains, wells, ditches, or water systems by following these procedures:

- Prevent further leakage from containers by positioning them so that the damaged part of the container is above the level of the contents or by applying rags, tape, or other materials at hand to temporarily seal the leak
- Separate leaking containers from undamaged containers.
- Rope or flag off the area and post warning signs to keep unprotected personnel from entering.
- Confine the spill to prevent it from spreading. Encircle the spill area with a dike of sand or other absorbent material: rags or similar material may be used if necessary. If spilled material may flow toward sensitive areas, divert it by ditching. If the spill involves a small watercourse, dam it up to confine the spill if possible. If available, activated charcoal may be used to filter contaminated water. For larger waterways, baled straw may be used to contain the spill.
- Dam or divert the flow of clean water around the spill if possible. **Muddying the water may inactivate glyphosate**. If the pesticide spilled is a liquid, cover it with absorbent material (kitty litter is ideal). If the spilled pesticide is in a dry formulation, cover it with a secured plastic tarpaulin to prevent it form becoming wet or being blown away. (NOTE: Unless this material can be reused in accordance with the pesticide label, it must be disposed of as a hazardous material.)
- DO NOT flush the spill into a ditch, sewer, drain, or off of a road, since this will further spread the chemical.
- Vehicle spill kits contain necessary items for containing small spills (see list below for items needed in vehicle spill kit). Large spills may require the use of a dozer and/or additional items from a storage facility spill kit, located at the District Office or Work Center pesticide storage building.

5. CLEAN-UP

Spill containment is the objective of this emergency spill plan. Clean-up and disposal procedures are covered in FSH 2109.12, Chapter 33, Project Safety Plan, in the 1990 Emergency Response Guidebook ("Orange Book"), and in the Material Safety Data Sheets for each pesticide.

6. DOCUMENTATION

Document spill type, action taken, and any needed follow-up or assistance necessary in a letter to the Forest Supervisor, with cc to Regional Pesticide Specialist.

SUMMARY OF CLEAN-UP STEPS

DRY SPILLS

Immediately cover powders or dusts with plastic or tarpaulin to prevent the pesticide from becoming airborne. A fine mist of water may also be used to dampen the dust and reduce spreading. CAUTION: Too much water may dissolve the pesticide and move it into the soil.

- Sweep the material together, rolling the tarp back slowly as you do.
- Shovel the material into plastic bags or drums.
- Seal the bags and label them, identifying the pesticide and other contents.
- Store the containers of material in the pesticide storage building until the contents can be evaluated for disposal or re-use in a manner consistent with labeling.

LIQUID SPILLS

Pump or bail as much of the spilled liquid as possible into containers, then:

- Use absorbent material, such as commercially bagged clay, kitty litter, or sawdust to soak up the spill. Begin spreading the absorbent material around the edge of the spill and work toward the center.
- Shovel the absorbent material and pesticide, along with any contaminated soil into leak-proof containers.
- Label all containers.
- Store the containers in the pesticide storage building until the contents can be evaluated for disposal or re-use in a manner consistent with labeling.

NOTIFICATION LIST OF KEY PERSONNEL AND AGENCIES

Forest HAZMAT Coordinator: Maurice Artis (423) 476-9774

Cherokee National Forest Pesticide Coordinator: Tim Dalton (423) 338-3301

District Safety Officers

Ocoee-Hiwassee Ranger District: Dave Martin (423) 338-3307

Tellico Ranger District: Mike Bot (423) 253-8404

Bradley Memorial Hospital, (423) 559-6000. Local medical facility to be used in event of an emergency in Bradley or Polk Counties.

Woods Memorial Hospital, (423) 263-3600. Local medical facility to be used in event of an emergency in Polk or McMinn Counties.

notify if spill is larger than five (5) gallons

USFS Region 8 Spill Coordinator: Walt Sternke Office – (404) 347-3369

USFS Region 8 Pesticide Coordinator: Paul Mistretta Office – (404) 347-2229

CHEMTREK – EPA number for technical assistance – 1-800-424-9300 (NOTE: Chemicals we normally use are not on EPA's hazardous list: you are not required to contact them.)

EPA National Emergency Response Center – 1-800-424-9346
(Notify only if spilled chemical is on CERCLA Consolidated Chemical List)

Pesticide Safety Team of the National Agricultural Chemicals Association (for technical assistance) (513) 961-4300

State Office of Emergency Services (Report Toxic Chemical & Oil Spills)
Phone: 1-800-424-9300 (Notify only if assistance is necessary or if required by State law)

RECOMMENDED PESTICIDE SPILL KIT CONTENTS

STORAGE FACILITY KIT

4 pairs nitrile gloves
2 pairs unvented goggles
2 respirators and cartridges (chemical resistant)
2 pairs rubber or neoprene boots or overshoes
2 pairs of coveralls or rain suits
l roll of flagging or engineers' tape
l dust pan
l shop brush
l gallon liquid detergent
l dozen polyethylene bags with ties
l polyethylene or plastic tarp
100 feet of rope
l0 blank labels
l ABC-type fire extinguisher
80 lbs absorbent material
3 gallons household bleach
l square-point "D" handled shovel
l 55-gallon open-head drum, or 50-gallon plastic trash can with lid
l l8-inch push broom with synthetic fiber
l bung and l bung wrench for 2.5 inch and 0.75 inch bungs
l drum spigot
30 ft of .5 inch polyethylene tubing or l50 feet of garden hose

VEHICLE KIT

2 pairs nitrile gloves
1 pair unvented goggles
1 respirator and cartridges
1 pair rubber or neoprene boots
l dust pan
l shop brush
6 polyethylene bags with ties
l pint liquid detergent
l polyethylene or plastic tarp
l0 blank labels
l ABC-type fire extinguisher
10-30 lbs absorbent material
2 eyewash bottles
l round-point shovel
l portable weatherproof container for storage and transport (may also be used for cleanup

APPENDIX C

BIOLOGICAL EVALUATION

Experimental Removal of Competing Vegetation from a Population of Ruth's Golden Aster (*Pityopsis ruthii*) on the Hiwassee River - Compartment 142
USDA FOREST SERVICE, SOUTHERN REGION
CHEROKEE NATIONAL FOREST
OCOEE-HIWASSEE RANGER DISTRICT

INTRODUCTION

The purpose of this biological evaluation (BE) is to document any potential effects of the proposed action on threatened, endangered, or sensitive (TES) species or their habitat, and to ensure land management decisions are made with the benefit of such knowledge. The objectives of this evaluation are to:

1) Ensure U.S. Forest Service (USFS) actions do not contribute to a loss of viability of any plant or animal species or cause a trend toward federal listing of any species.
2) Comply with the requirements of the Endangered Species Act, to ensure that actions by federal agencies do not jeopardize or adversely modify critical habitat for federally listed species.
3) Provide a process and a standard by which TES species receive full consideration in the decision-making process.

PROPOSED ACTION AND ALTERNATIVES

The Ocoee-Hiwassee Ranger District of the Cherokee National Forest (CNF) in cooperation with the Tennessee Department of Environment and Conservation (TDEC), and U.S. Fish and Wildlife Service (USFWS), is proposing an experimental study designed to enhance habitat for the federally endangered Ruth's golden aster (*Pityopsis ruthii*). The global distribution of Ruth's golden aster (*Pityopsis ruthii*) is confined to a few miles along the Hiwassee and Ocoee Rivers in Polk County, Tennessee. The plants are only known to occur, rooted in crevices of phyllite or graywacke boulders, within the historic flood scour zone of the two rivers. The species was first collected in the Hiwassee River Gorge by Albert Ruth during the period 1894 to 1902, but was not seen again until 1970 (Bowers 1972 in USFWS 1992). The species was formally listed as endangered by the USFWS effective August 19, 1985 (USFWS 1985). It is also listed as endangered by the State of Tennessee under the provisions of the Rare Plant Protection and Conservation Act of 1985. Since 1986, populations of Ruth's golden aster have been intensively monitored. Approximately 600 individuals are known to occur on the Ocoee River and approximately 10,000 on the Hiwassee River.

Botanists involved in the annual Ruth's golden aster monitoring have noted a substantial increase in competing vegetation within the Hiwassee River monitoring plots each year. It is believed that this competition is negatively impacting individual plants through direct displacement and shading. Historically, such competing vegetation was probably removed by the scouring action of periodic floods; however, the free-flowing hydrology of the Hiwassee River has been altered by the construction of dams for power generation and flood control. Flood events occur with less frequency and intensity, which is allowing the establishment of competing vegetation. This

decrease in availability of suitable habitat is one of the threats that lead to the original USFWS listing, and is stated in the Recovery Plan and the recent draft five-year species review (USFWS 1992). Loss of habitat poses a threat to the continued existence of this endangered species. Issues pertaining to the recovery of Ruth's golden aster have been discussed by botanists involved in annual monitoring since 1990. As a result of these meetings an "informal recovery coordination working group" was developed consisting of federal, state, and university representatives. This group works closely with the USFWS and has taken on the responsibility for planning and implementation of federal recovery objectives for this species. Based upon input received from this group, the CNF made a decision in May 1991, to mechanically remove poison ivy from one of the monitoring sites. A legal notice was published describing this action and no comments were received from the public. Results from the mechanical removal appeared promising but were labor intensive and produced only temporary results. Based upon this, the group recommended that the CNF initiate a study to evaluate the effectiveness of herbicides in accomplishing the desired condition.

In 1993, an effort was initiated to implement a project to remove competing vegetation utilizing mechanical and chemical methods. The project was implemented in May 1996 and results from the project were again encouraging, but several inadequacies were realized. The small sample size precluded statistical analysis, baseline data should have been collected for at least 3 years pre-treatment, and follow-up treatments should have been applied to prevent re-establishment of competing vegetation for the period of the study. This new study addresses these concerns by removing competing vegetation from two 10m x 10m sites along the Hiwassee River, in Polk County, Tennessee. Each alternative is described below.

Alternative A - No Action

Alternative A is the No Action Alternative. With this Alternative, no project activities would be implemented. No changes to the existing environment would occur beyond those attributed to natural processes and disturbances.

Alternative B - Proposed Action

Alternative B is the Action Alternative. The proposed action would implement an experimental study designed to enhance habitat for the federally endangered Ruth's golden aster by removing competing vegetation by mechanical and chemical methods. Four plots (10m x 10m each) paired at two sites along the Hiwassee River have been selected for this pilot study. The two sites have similar habitat and threats. At each site two plots were established in close proximity to ensure similar aspect and level of vegetative encroachment. The plots were permanently marked on a 2m x 2m grid using lag bolts drilled into rock. Permanent photo points were also established at each plot. Annual baseline monitoring at each plot has been conducted during late summer 2000-2007. Plots #1 & 2 are located at "the narrows" and plots #3 & 4 at Loss Creek. Plots #1 and 4 were randomly selected for the vegetation removal treatments. Plots #2 & 3 would function as controls for comparison. Competing vegetation would be removed from the two treatment plots utilizing mechanical and chemical methods. The initial treatment would be implemented during the early spring (April-May) to coincide with a period of vigorous growth, and a post-implementation inspection and follow-up treatment would be conducted within 4-6 weeks. Annual inspections and possible follow-up spring treatments would be conducted for a

period of 10 years. A detailed monitoring plan to annually evaluate the effects of the treatment has been developed and is presented in Appendix A of the Environmental Analysis.

Detailed Methodology

Ideally, all woody vegetation including trees that cast shade on the treatment plots would be cut and removed from the site, however; based upon location other treatment options may be utilized. Three treatment options could be used to achieve control of woody vegetation. In option one, stems would be cut and removed and a 50% solution of Triclopyr, water and an approved surfactant (i.e. dish detergent, vegetable oil) would be immediately applied directly to all cut surfaces using hand-held squirt bottles or brushes. If removal of trees is problematic, "hack and squirt" or "basal bark" methods may be used as an alternative method and some trees could be left standing. In hack and squirt, vascular tissues are exposed by using a hatchet to remove bark and the same 50% formulation of Triclopyr would be used. In the basal bark treatment, a 100% solution of Triclopyr would be applied directly to the stem with a paintbrush.

All other vegetation (shrubs, vines, and herbaceous vegetation) within the plots, with the exception of Ruth's golden aster, would be treated with a 3% solution of Glyphosate and an approved surfactant (i.e. dish detergent, vegetable oil). Only a very small amount (approximately one to three ounces) of herbicide would be needed to treat a $10m^2$ plot. All herbicides would be used according to manufacturer's label direction for rates, concentrations, exposure times, and application methods. Herbicides would be directly applied to the target plants. Techniques that could be used include direct foliar applications using backpack sprayers, squirt bottles, or hand-held brushes, or cut surface treatments (spraying or wiping). No herbicides would be applied aerially. Only formulations approved for aquatic-use would be applied within 30' of the river, in accordance with the CNF RLRMP Standard FW-15 (USFS 2004).

All herbicide application techniques have been designed specifically to avoid non-target impacts to Ruth's golden aster plants. Additionally, specialized equipment including flexible wands with "no-drip tip" adjustable nozzles would be used on sprayers, and individual Ruth's golden aster plants would be protected using a variety of shields (plastic sheets, styrofoam cups, Tupperware ™, PVC pipe, etc). All shields would be wiped dry with a towel before moving from one location to another. A detailed emergency herbicide spill plan is presented in Appendix B of the Environmental Analysis.

Herbicides

Triclopyr is a selective herbicide that controls many species of herbaceous and woody broadleaf weeds, but has little to no effect on grasses. This chemical acts as a growth regulator and can be applied as a direct foliar application, stem injection, or cut-surface treatments. Specific formulations of Triclopyr have been labeled for aquatic application. Formulations labeled for aquatic sites can be effective on both emergent aquatics and shoreline vegetation It has been proven effective on a wide variety of non-native invasive plant species. Commercial brand-names include, but are not limited to Garlon 3A™ (Renovate 3™), Garlon 4™, and Pathfinder II™.

Glyphosate is a non-selective, broad spectrum herbicide that can be used to control many grasses, forbs, vines, shrubs, and tree species. Specific formulations of Glyphosate have been labeled for aquatic application. Formulations labeled for aquatic sites can be effective on both emergent aquatics and shoreline vegetation. This chemical is a growth inhibitor that can be applied through direct foliar application, stem injection, and cut-surface application. It has been proven effective on a wide variety of non-native invasive plant species. Commercial brand-names include, but are not limited to Accord™, Roundup™, and Rodeo™.

Forest Plan Direction Applicable to Action Alternative

Forestwide goals, objectives, and standards apply to the entire Forest unless superseded by specific management prescription direction. Projects are evaluated to determine if they are consistent with the management direction in the CNF RLRMP (USFS 2004). This evaluation is documented in the project-level environmental document with a finding of consistency incorporated into the decision document. Adherence to Forest plan directions is monitored during project implementation.

Additionally, the Pesticide Use Handbook (FSH 2109.14) and the Health and Safety Code Handbook (FSH 6709.11) would be used as guidance for workers. Herbicide notice signs (FSH 7109.11) would be clearly posted, and would include the application date, the herbicide, and safe reentry date. For herbicide spills, an emergency spill plan would be followed (see Appendix B in the Environmental Analysis Document).

The Forestwide Standards and Riparian Prescription Directions listed below apply to this proposed project. There are no specific Management Area Directions applicable to this proposed project (USFS 2004).

FW-10: The removal of large woody debris from within the channeled ephemeral stream zone is allowed only if the woody debris poses a significant risk to stream flow or water quality, degrades habitat for riparian dependant species or poses a threat to private property or Forest Service infrastructure (i.e., bridges). The need for removal is determined on a case-by-case basis.
FW-14: Soil-active herbicides are not broadcast within channeled ephemeral stream zones. Selective treatments with aquatic-labeled herbicides may occur within this zone following site-specific analysis. Stream zones are identified before treatment, so applicators can easily avoid them.
FW-15: No herbicide is aerially applied within 200 horizontal feet, nor ground applied within 30 horizontal feet, of lakes, wetlands, or perennial or intermittent springs and streams. No herbicide is applied within 100 horizontal feet of any public or domestic water source. Selective treatments (which require added site-specific analysis and use of aquatic-labeled herbicides) may occur within these buffers only to prevent environmental damage such as noxious weed infestations. Buffers are clearly marked before treatment so applicators can easily see and avoid them.
FW-16: Pesticide mixing, loading, or cleaning areas are not located within the channeled ephemeral stream zone.
FW-29: Control exotic species with priority given to areas where they are causing adverse effects to federally listed threatened or endangered species, or species of viability concern within the planning area.

FW-72: Herbicides and application methods are chosen to minimize risk to human and wildlife health and the environment. No class b, c, or d chemical may be used on any project, except with regional forester approval. Approval will be granted only if a site-specific analysis shows that no other treatment would be effective and that all adverse health and environmental effects will be fully mitigated. Diesel oil will not be used as a carrier for herbicides, except as it may be a component of a formulated product when purchased from the manufacturer. Vegetable oils will be used as the carrier for herbicides when available and compatible with the application proposed.
FW-73: Herbicides are applied at the lowest rate effective in meeting project objectives and according to guidelines for protecting human (NRC 1983) and wildlife health (EPA 1986a). Application rate and work time must not exceed levels that pose an unacceptable level of risk to human or wildlife health. If the rate or exposure time being evaluated causes the margin of safety or the hazard quotient computed for a proposed treatment to fail to achieve the current Forest Service r-8 standard for acceptability (acceptability requires a mos > 100 or, using the sera risk assessments found on the Forest Service website, a hq of < 1.0) additional risk management must be undertaken to reduce unacceptable risks to acceptable levels or an alternative method of treatment must be used.
FW-74: Areas are not burned under prescription for at least 30 days after herbicide treatment.
FW-75: Weather is monitored and the project is suspended if temperature, humidity, or wind becomes unfavorable as follows:

UNFAVORABLE CONDITIONS TO SUSPEND PROJECT			
Temperatures Higher Than	Humidity Less Than		Wind (at Target) Greater Than
Ground:			
Hand (cut surface)	N.A.	N.A.	N.A.
Hand (other)	98 ^{o}F	20%	15 mph
Mechanical:			
Liquid	95 ^{o}F	30%	10 mph
Granular	N.A.	N.A.	10 mph
Aerial:			
Liquid	90 ^{o}F	50%	5 mph
Granular	N.A.	N.A.	8 mph

FW-76: Nozzles that produce large droplets (mean droplet size of 50 microns or larger) or streams of herbicide are used. Nozzles that produce fine droplets are used only for hand treatment where distance from nozzle to target does not exceed 8 feet.
FW-77: A certified pesticide applicator supervises each Forest Service application crew and trains crew members in personal safety, proper handling and application of herbicides, and proper disposal of empty containers.
FW-78: People living within one-fourth mile of an area to be treated aerially are notified during project planning and shortly before treatment.
FW-79: With the exception of permittee treatment of right-of-way corridors that are continuous into or out of private land and through Forest Service managed areas, no herbicide is broadcast

within 100 feet of private land or 300 feet of private residence, unless the landowner agrees to closer treatment. Buffers are clearly marked before treatment so applicators can easily see and avoid them.
FW-80: No herbicide is aerially applied within 200 horizontal feet of an open road or a designated trail. Buffers are clearly marked before treatment so applicators can easily see and avoid them.
FW-81: No soil-active herbicide is applied within 30 feet of the drip line of non-target vegetation (e.g., den trees, hardwood inclusions, and adjacent untreated stands) specifically designated for retention within or next to the treated area. Side pruning is allowed, but movement of herbicide to the root systems of non-target plants must be avoided. Buffers are clearly marked before treatment so applicators can easily see and avoid them.
FW-82: Application equipment, empty herbicide containers, clothes worn during treatment, and skin are not cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate labeled containers.
FW-83: No herbicide is broadcast on rock outcrops or sinkholes except for management of TES species, for example, Ruth's golden aster (P*ityopsis ruthii)*. No soil-active herbicide with a half-life longer than 3 months is broadcast on slopes over 45 percent, erodable soils, or aquifer recharge zones. Such areas are clearly marked before treatment so applicators can easily see and avoid them.
FW-84: Herbicide mixing, loading, or cleaning areas in the field are not located within 200 feet of private land, open water or wells, or other sensitive areas.
FW-87: No herbicide is aerially applied within 300 feet, nor ground-applied within 60 feet, of any known threatened, endangered, proposed, or sensitive plant, except for selective applications to control vegetation within this buffer designed to protect TES plants from encroachment by invasive plants or by over-topping native species and when a non-soil-active herbicide is used. Buffers are clearly marked before treatment so applicators can easily see and avoid them.
RX11-1: The removal of LWD (pieces greater than four feet long and four inches in diameter on the small end) is allowed only if it poses a risk to water quality, degrades habitat for riparian-dependent species, or when it poses a threat to private property, public safety, or Forest Service infrastructures (i.e., bridges). The need for removal must be determined on a case-by-case (project) basis.
RX11-8: Tree removals may only take place if needed to enhance the recovery of the diversity and complexity of vegetation, rehabilitate both natural and human-caused disturbances, provide habitat improvements for PETS or riparian-dependent species, reduce fuel buildup, provide for visitor safety, to accommodate appropriate recreational uses or for approved facility construction/renovation.

AFFECTED AREA

The proposed project sites are located along the Hiwassee River on the McFarland Quadrangle in Compartment/Stand: 142/26. Elevation at the project sites is approximately 900 feet ASL. Site One (consisting of Plots #1 and 2) is located in an area known as the "The Narrows" and Site Two (consisting of Plots #3 and 4) is located near Loss Creek. Both sites are located on the north side of the river on riparian rock outcrops and cliffs (a special habitat feature) within the historic flood scour zone. Riparian and aquatic habitats are located immediately adjacent to the project sites. No other special habitat features including caves, talus, spray cliffs, waterfalls, seeps, or springs have been identified at the project sites.

Rock outcrops and cliffs are a common occurrence along the banks of the Hiwassee River. The total Hiwassee population of Ruth's golden aster coincides with an exposure of Precambrian phyllite bedrock in this area. Typical herbaceous plant species found on these outcrops include Ruth's golden aster (*Pityopsis ruthii*), small-headed blazing star (*Liatris microcephala*), little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropgon gerardii*), slenderleaf false foxglove (*Agalinis tenuifolia*), button aster (*Symphyotricum dumosum*), wavyleaf aster (*Symphyotricum undulatum*), and goldenrods (*Solidago* spp.). Historically, these rock outcrops were kept in a relatively open condition, scoured by frequent flooding and annual high water within the river channel. In 1943, the Tennessee Valley Authority (TVA) constructed a water diverting flume for energy production which effectively de-watered the section of the river where Ruth's golden aster occurs. The existing condition of these rock outcrops is now changing as successional vegetation has expanded. As more soil accumulates in the cracks and crevices on these outcrops, grasses and other herbaceous vegetation including species that were not previously part of this community, have become established. Vines, such as poison ivy (*Toxicodendron radicans*), Virginia creeper (*Pathenocissus quinquefolia*), grape (*Vitis rotundifolia*), trumpet creeper (*Campsis radicans*), and Japanese honeysuckle (*Lonicera japonica*) are rapidly expanding across the open rock. Shrubs and trees from the adjacent forest are rapidly expanding into these areas. These changes are creating shaded conditions that further alter the vegetative composition of these rock outcrops. Of particular concern is the increased abundance of non-native species, including Japanese honeysuckle, sericea lespedeza (*Lespedeza cuneata*), and Nepal grass (*Microstegium viminium*).

Riparian habitats along the Hiwassee River include the immediate riverine vegetation found along the banks and rock outcrops and the adjacent riparian forest. With the elimination of natural flows within the river corridor in 1943, successional processes have effectively expanded the riparian forest closer to the water's edge. While some amount of germination of woody species has probably always occurred within the historically flooded zone, high flows, scour, and inundation likely inhibited establishment. The lack of these high flows has allowed soil and organic material to build up, creating additional seedbeds enabling establishment of less water-tolerant plants and many woody species. Tree species that have become established within the rocky floodplain and can currently be found within the project sites include river birch (*Betula nigra*), alder (*Alnus serrulata*), sweet gum (*Liquidambar styraciflua*), tulip poplar (*Liriodendron tulipifera*), Virginia pine (*Pinus virginiana*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), and winged elm (*Ulmus alata*). The encroachment of the riparian forest and the continued succession of herbaceous vegetation on rock outcrops threaten to permanently alter the open habitat conditions on these rock outcrops.

SPECIES EVALUATED AND METHODS USED

Using information from project area habitat conditions, species habitat requirements, species distributions and limiting factors; the entire 2001 Cherokee National Forest TES Species list was reviewed along with the species habitat list to determine if any TES species were likely to occur in or near the project area (CNF TES Species List 2001). The CNF Geographic Information System (GIS) TES Data Layer was examined to locate any records of TES species present in or near the project area (CNF TES GIS Data Layer 2008). This GIS Data Layer is based on data from past species surveys conducted on the CNF.

The Hiwassee River population of Ruth's golden aster has been cooperatively monitored by the TVA, TDEC, and the USFS since 1987. Baseline monitoring at the proposed project plot sites has been conducted annually during late summer 2000-2007. No TES plant (other than Ruth's golden aster) or terrestrial wildlife species have been documented within the project area during previous monitoring efforts.

The treatment sites occur directly adjacent to the aquatic habitats of the Hiwassee River. U.S. Forest Service and other agency crews have conducted 19 aquatic surveys between 1993-2007 on the Hiwassee River in the Ruth's Golden Aster analysis area (USFS 2008). Nine TES aquatic species (3 fish and 6 mussels) are known to occur in this area. This includes 2 endangered mussel species. Additionally, 6 sensitive aquatic insect species and one sensitive aquatic salamander may occur in this area of the Hiwassee River. Although they have not been documented during previous surveys, suitable habitat for them does exist.

Each species listed on the CNF TES 2001 Species List (Attachment A) was evaluated and assigned a Project Review Code (PRC) based on Attachment B.
Many species were eliminated from further analysis based on known range of occurrence, habitat requirements, and/or survey results. Based on the TES species evaluation methods, 17 TES species were identified as requiring further analysis and a determination of effect (Table 1).

SPECIES ECOLOGY
Species ecology was reviewed for each species requiring further analysis. Understanding species ecology is imperative in order to determine potential effects associated with project activities. Species do not occur at random, but are related to specific habitat types. A review of the best available science was conducted to determine potential effects of the proposed action.

Table 1. Species requiring further analysis for the proposed Ruth's Golden Aster Project, Cherokee National Forest, 2008.

Scientific Name	Common Name	TES Rank
Amphibians		
Eurycea junaluska	Junaluska salamander	Sensitive
Fish		
Ichthyomyzon greeleyi	Mountain brook lamprey	Sensitive
Percina squamata	Olive darter	Sensitive
Phoxinus tennesseensis	Tennessee dace	Sensitive
Insects		
Cheumatopsyche helmai	Helma's net-spinning caddisfly	Sensitive
Gomphus consanguis	Cherokee clubtail	Sensitive
Gomphus viridifrons	Green-faced clubtail	Sensitive
Macromia margarita	Mountain river cruiser	Sensitive
Ophiogomphus alleghaniensis	Allegheny snaketail	Sensitive
Ophiogomphus incurvatus	Appalachian snaketail	Sensitive
Mussels		
Epioblasma florentina walkeri	Tan riffleshell	Endangered

Scientific Name	Common Name	TES Rank
Fusconaia barnesiana	Tennessee pigtoe	Sensitive
Lasmigona holstonia	Tennessee heelsplitter	Sensitive
Lexingtonia dolabelloides	Slabside pearlymussel	Sensitive
Pleurobema oviforme	Tennessee clubshell	Sensitive
Villosa trabalis	Cumberland bean pearly mussel	Endangered
Vascular Plants		
Pityopsis ruthii	Ruth's golden aster	Endangered

Junaluska salamander *(Eurycea junaluska)*
The junaluska salamander occurs in the Blue Ridge Mountains of southwestern North Carolina and southeastern TN. On the CNF, it has been documented in Sevier and Monroe counties in the Tellico, Bald, and North Rivers; and Citico and Slickrock Creeks. It may occur in the Hiwassee River drainage, but has not been documented. This salamander is found at low elevations (1100-2000 ft.) in large streams and rivers with sand-gravel substrate. Adults hide under objects in or along streams. It also utilizes riparian forests but is primarily aquatic. Populations appear to be stable. Potential threats include siltation and impacts to water quality (NatureServe 2008).

Mountain brook lamprey (Ichthyomyzon greeleyi)
The mountain brook lamprey occurs in the upper Ohio, Tennessee and Cumberland River systems. In Tennessee, it is found in the Ocoee, Tellico, Little Tennessee, French Broad, Nolichucky and Watauga River systems. On the CNF it has been documented in the Hiwassee River and Spring Creek; it was last observed in 1995. This lamprey is found at high and low elevation large streams (6+ stream order) with moderate gradient (2% to 4%). It prefers gravel riffles and sandy runs of clean, clear water. This species is somewhat migratory. Eggs are laid in the middle and lower sections of gravel riffles. Larvae burrow into beds of mixed sand and organic debris in pools and backwaters. This lamprey is nonparasitic. Adults do not feed; larvae filter-feed on microscopic organisms and detritus. This species is threatened by habitat degradation due to pollution, siltation, and stream alteration projects; damming prevents the migration of adults and ammocoetes (NatureServe 2008, Etnier and Starnes 1993).

Olive darter (Percina squamata)
The olive darter is endemic to the upper Tennessee and Cumberland River systems; with at least 20 known populations. It occurs on the Cherokee NF in the Hiwassee, French Broad, Nolichucky, and Watauga Rivers. The last observation was in the Hiwassee River in 1995. This darter is found at high and low elevations in large streams (6+ stream order) with moderate gradient (2% to 4%). It prefers strong chutes with rubble and boulders or in deeper downstream portions of gravel. They feed on small invertebrates. Spawning occurs from mid-May through late July. This species is threatened by siltation, channelization, impoundment, and agricultural and urban runoff (NatureServe 2008, Etnier and Starnes 1993).

Tennessee dace (Phoxinus tennesseensis)
Tennessee dace occur sporadically in the Ridge and Valley and the margins of the Blue Ridge and Cumberland Plateau provinces of the Upper Tennessee River drainage. Fewer than 40 populations were known throughout its range when Etnier and Starnes published "The Fishes of Tennessee" (1993). Since 1993, at least 10 new populations have been discovered on the CNF

bringing our total known populations to 30. There have been 15 documented occurrences in the Hiwassee watershed. It is restricted to very small, low gradient, forested streams. They inhabit shallow pools with undercut banks and woody debris. They feed on algae and small invertebrates. Spawning occurs from April through July over silt-free gravel areas. This species is threatened by channelization, drying of streams, impoundment, and siltation (NatureServe 2008, Etnier and Starnes 1993).

Helma's net-spinning caddisfly (Cheumatopsyche helmai)
Helma's net-spinning caddisfly is found from Maine to Alabama along the Appalachian Mountains. On the CNF, it occurs in Big Lost Creek of the Hiwassee River system where it was last collected in 1982. Preferred habitat includes large streams with low gradient at low elevations. These caddisflies build nets to capture floating organic matter. They are threatened by turbid water which tends to decrease their feeding efficiency (Harris et. al. 1991, Brigham et. al. 1982).

Cherokee clubtail (Gomphus consanguis)
The Cherokee clubtail ranges from Virginia to Alabama along the Appalachian Mountains. It is only known from about 15 occurrences throughout its range, with only two or three in Tennessee. It has not been documented on the CNF, but habitat is available. This dragonfly inhabits small, spring-fed streams with sand, gravel, and detritus in open to partially shaded areas. Adults and larvae are often concentrated in mud-bottoms. The larvae overwinter, and flight season is May through June. These dragonflies are apparently tolerant to some organic pollution, but require good water quality (NatureServe 2008, Benz and Collins 1997, Peckarsky et. al. 1990).

Green-faced clubtail (Gomphus viridifrons)
The green-faced clubtail is found from Minnesota to New York south through the Appalachian Mountains to northern Alabama. It has not been documented on the CNF, but habitat is available. This dragonfly inhabits large streams with low gradient at low elevation and requires high water quality. The larvae burrow in silt and overwinter. Flight season is May through July. Adults forage in trees. Threats include impoundments, channelization, dredging, siltation, agricultural non-point source pollution, and municipal and industrial pollution (NatureServe 2008).

Mountain river cruiser (Macromia margarita)
The mountain river cruiser ranges from Virginia to Alabama and South Carolina. Less than 20 occurrences are known, but more are likely to be discovered. This species has not been documented on the CNF, but habitat is available. This dragonfly inhabits small streams to large rivers with high water quality, forested watersheds, and rocky substrates with silt deposits. The eggs are scattered in water and the larvae sprawl on the stream bottom debris. The larva over winter and flight season is June through August. Adults forage widely. Degradation of water quality is its primary threat (NatureServe 2008).

Allegheny snaketail (Ophiogomphus alleghaniensis)
The Allegheny snaketail is known from at least 9 occurrences in West Virginia, Virginia, Alabama, and Tennessee. Distribution data is known to be incomplete for this species. In

Tennessee, it is known from at lest 5 locations; including the Great Smokey Mountains National Park and Monroe and Polk Counties. It has not been documented on the CNF. This dragonfly inhabits small streams with low gradient and seems to prefer areas where gravel overlies soft mud in shallow water. It breeds in riffle areas. Threats are unknown (NatureServe 2008, Benz and Collins 1997).

Appalachian snaketail (Ophiogomphus incurvatus)
The Appalachian snaketail is known from the Piedmont foothills on either side of the Appalachians from Alabama to Maryland. It occurs in the Conasauga River on the CNF and was last collected there in 1999. Preferred habitat includes small streams with low gradients. Threats are unknown (NatureServe 2008, Tennessean 1999).

Tan riffleshell (Epioblasma florentina walkeri)
The tan riffleshell is endemic to the major tributaries of the Tennessee and Cumberland Rivers. It is now restricted to only 5 known populations and has become extirpated from a significant portion of its former range. The viability of this mussel is questionable. The USFWS listed this species as endangered in 1977. It is known from 2 sites in the Hiwassee River on the CNF. The upper-site was augmented in 1999 with juveniles raised by Dr. Dick Neves at Virginia Tech. It is found at low elevations (<=1200 feet) in large streams and small rivers (7+ stream order) with low gradient (<=2%). It prefers shallow riffles (less than 3 feet deep) in coarse sand, gravel, and some silt. Fish hosts include sculpins (*Cottus* spp.), greenside darter (*Etheostoma blennioides*), fantail darter (*Etheostoma flabellare)*, and redline darter (*Etheostoma rufilineatum*). This species is threatened by impoundments that flood habitat or alter flow regime; siltation; pollution from municipal, agricultural, and industrial waste discharges, and loss of gloichidial hosts (NatureServe 2008, Parmalee and Bogan 1998, Neves 1984).

Tennessee pigtoe (Fusconaia barnesiana)
The Tennessee pigtoe is endemic to the Tennessee River system. It is known from 4 sites on the CNF; 2 locations in the Hiwassee River, 1 in Spring Creek, and 1 in Tellico River. This mussel is found at low elevations (<=1200 feet) in large streams (5+ stream order) with low gradient (<=2%). It prefers moderate current in depths less than 2 feet with coarse sand, silt, and gravel substrate. Fish host is unknown. This species is threatened by impoundments that flood habitat or alter flow regime; siltation; and pollution from municipal, agricultural, and industrial waste discharges (NatureServe 2008, Parmalee and Bogan 1998).

Tennessee heelsplitter (Lasmigona holstonia)
The Tennessee heelsplitter is endemic to upper Tennessee River system. It is known from 3 sites on the CNF; one in the French Broad (probably in Trail Fork of Big Creek) and two sites in Spring Creek of the Hiwassee River. This mussel is found at low elevations (<=1200 feet) in small to large streams (stream order 4-6) with low gradient (<=2%). It prefers sand and mud substrate with some current. Fish host is unknown. This species is threatened by impoundments that flood habitat or alter flow regime; siltation; and pollution from municipal, agricultural, and industrial waste discharges. This species is threatened by its fragmented distribution and pollution from municipal, agricultural, and industrial waste discharges (NatureServe 2008, Evans 2001, Parmalee and Bogan 1998).

Slabside pearlymussel (Lexingtonia dolabelloides)
The slabside pearlymussel is endemic to the Tennessee River system. There maybe only 9 populations remaining rangewide. It is known from 2 sites on CNF; both in the Hiwassee River. This mussel is found at low elevations (<=1200 feet) in large streams (5+ stream order) with low gradient (<=2%). It prefers moderately strong current with sand, fine gravel, and cobble substrate. Fish hosts include: popeye *(Notropis ariommus)*, rosyface *(Notropis rubellus)*, saffron *(Notropis rubricroceus)*, silver *(Notropis photogenis)*, telescope *(Notropis telescopus)*, and Tennessee shiners *(Notropis leuciodus)*. This species is threatened by impoundments that flood habitat or alter flow regime; siltation; and pollution from municipal, agricultural, and industrial waste discharges, over collecting, and loss of gloichidial hosts (NatureServe 2008, Parmalee and Bogan 1998).

Tennessee clubshell (Pleurobema oviforme)
The Tennessee clubshell is endemic to the Tennessee and Cumberland River Systems. Much of its former habitat has been inundated by reservoirs. Although there are numerous populations, it appears to be declining throughout its range. It is known form 2 sites on the CNF; both in the Hiwassee River where it was last collected in 1996. This mussel is found at low elevations (<=1200 feet) in large streams (5+ stream order) with low gradient (<=2%). It prefers moderate current with coarse gravel and sand substrate. Fish hosts include whitetail *(Cyprinella galactura)* and common shiners *(Luxilus cornutus)*, river chub *(Nocomis micropogon)*, central stoneroller *(Campostoma anomalum)*, and fantail darter *(Etheostoma flabellare)*. This species is threatened by impoundments that flood habitat or alter flow regime; siltation; and pollution from municipal, agricultural, and industrial waste discharges (NatureServe 2008, Parmalee and Bogan 1998).

Cumberland bean pearly mussel (Villosa trabalis)
The Cumberland bean pearly mussel is endemic to the Tennessee and Cumberland River systems. It is now restricted to only 4 populations (known from 4 rivers) and has become extirpated from a significant portion of its former range. The viability of this mussel is questionable. The USFWS listed this species as endangered in 1976. It is known from 2 sites on the CNF; both in the Hiwassee River where it was last collected in 2000. This mussel is found at low elevations (<=1200 feet) in large streams and small rivers (7+ stream order) with low gradient (<=2%). It prefers fast current with gravel or sand and gravel substrate. Fish host is unknown. This species is threatened by impoundments that flood habitat or alter flow regime; siltation; and pollution from municipal, agricultural, and industrial waste discharges (NatureServe 2008, Parmalee and Bogan 1998, Ahlstedt 1984).

Ruth's golden aster (Pityopsis ruthii)
The global distribution of Ruth's golden aster (*Pityopsis ruthii*) is confined to a few miles along the Hiwassee and Ocoee Rivers in Polk County, Tennessee. Approximately 600 individuals are known to occur on the Ocoee River and approximately 10,000 on the Hiwassee River. The plants are only known to occur, rooted in soil-filled crevices of phyllite or graywacke boulders, within the historic flood scour zone of the two rivers. This plant is shade-intolerant and is adapted to periodic high-flow events. These high-flow events scour the boulders and remove competing vegetation (NatureServe 2008). The free-flowing hydrology of the Ocoee and

Hiwassee Rivers has been altered by dam construction for power generation and flood control. Flood events occur much less frequently and at altered regimes. On the Hiwassee river, flood events are very infrequent and this has allowed competing vegetation to become established on and adjacent to the rock outcrops where Ruth's golden aster occurs. Over time, the amount of competing vegetation in these areas has increased. This has resulted in shading and displacement of Ruth's golden aster plants. Due to this plants very limited distribution and threats from hydrological alterations, the USFWS formally listed this species as endangered in 1985 (USFWS 1985).

EFFECTS ANALYSIS

Effects associated with the alternatives of the proposed project will be analyzed for potential impacts to the 17 species known to occur or having the potential to occur in the project area.

Direct and Indirect Effects

Alternative A - No Action

Alternative A is the No Action Alternative. With this Alternative, no project activities would be implemented. No changes to the existing environment would occur beyond those attributed to natural processes and disturbances. Consequently, there would be no effects or impacts on TES species, except Ruth's golden aster. Allowing competing vegetation to continue to expand in Ruth's golden aster habitat would have long-term adverse effects by decreasing habitat quality through shading and displacement. This would reduce the number of Ruth's golden aster plants on the Hiwassee River.

Alternative B – Proposed Action

Activities associated with the proposed action with potential effects to TES species include herbicide application, removal of vegetation, and siltation. All Forest Wide Standards and Riparian Prescription Standards previously listed would be followed (USFS 2004). Additionally, the Pesticide Use Handbook (FSH 2109.14) and the Health and Safety Code Handbook (FSH 6709.11) would be used as guidance. For herbicide spills, an emergency spill plan would be followed (see Appendix B in the Environmental Analysis Document).

Junaluska salamander, Fish, Aquatic Insects, & Mussels

Alternative B would not involve any ground disturbance; however, some woody and herbaceous vegetation would be removed and herbicides would be used within the riparian zone adjacent to the Hiwassee River. The amount of vegetation to be removed from the two 10x10 meter plots would be extremely small relative to the amount of existing vegetation in the riparian zone of the project area. Consequently, there would be no effects or impacts to aquatic TES species, because only an insignificant amount of vegetation would be removed.

Triclopyr has a low toxicity to fish (Syracuse Environmental Research Associates, Inc. (SERA) 2003a). Based on treatment rates and forest plan standards, the expected concentration of triclopyr that might get into the Hiwassee River adjacent to the area being treated is 0.37 mg/L. A concentration of 158 mg/L is considered the lethal dosage for fish (SERA 2003a). At least 427 times as much Triclopyr would have to enter the water body to reach lethal levels. Potential runoff from herbicide applications or an accidental spill would have no effects or impacts on

aquatic species, because the amount of Triclopyr applied and on-site would be insignificant relative to the volume of water in the Hiwassee River.
Glyphosate formulations not containing toxic surfactants are approved for use in water bodies and within riparian areas on the CNF (USFS 2004). Certain surfactants are far more lethal to aquatic fauna than is glyphosate alone. The Environmental Protection Agency classified technical grade glyphosate as non-toxic to practically non-toxic to freshwater fish (SERA 2003b). Based on treatment rates and forest plan standards, the expected concentration of glyphosate that might get into the Hiwassee River adjacent to the area being treated is 0.2 mg/L. A concentration of 70 mg/L is considered the lethal dosage for fish (SERA 2003b). At least 350 times as much glyphosate would have to enter the water body to reach lethal levels. Potential runoff from herbicide applications or an accidental spill would have no effects or impacts on aquatic species, because the amount of glyphosate applied and on-site would be insignificant relative to the volume of water in the Hiwassee River.

Ruth's golden aster
This project is being proposed for the benefit of Ruth's golden aster. Ruth's golden aster is a shade intolerant plant. Removal of competing vegetation in the project sites would reduce the negative effects of shading and displacement on this endangered species. This would improve habitat quality and is likely to have long-term beneficial effects on the Hiwassee River population of Ruth's golden aster.

Cumulative Effects
Cumulative effects analysis is based on the past, present, and reasonably foreseeable activities in the general project area in addition to the proposed action (Table 2). The following past, present and reasonably foreseeable activities will be considered: Dispersed recreational impacts such as hiking (John Muir Trail), fishing, hunting, and boating, could have a potential effect in this area, as would the timing and amounts of water flows released from the Appalachia Dam. Treatments of invasive plant species could also occur in this area and are currently being evaluated in another Environmental Assessment. Natural events such as wind-throw, wildfire, and forest insect and disease outbreaks may also have some impact within or adjacent to the project area.

Table 2. Past, Present, and Reasonably Foreseeable Activities in the proposed Ruth's Golden Aster Project area, Cherokee National Forest, 2008.

Past	Present	Reasonably Foreseeable
Dispersed Recreational Uses: John Muir Trail; hunting/fishing, boating.	Dispersed Recreational Uses: John Muir Trail; hunting/fishing, boating.	Dispersed Recreational Uses: John Muir Trail; hunting/fishing, boating.
Invasive plant treatments	Invasive plant treatments	Invasive plant treatments
Natural Events: wind-throw, wildfire, forest insect and disease outbreaks.	Natural Events: wind-throw, wildfire, forest insect and disease outbreaks.	Natural Events: wind-throw, wildfire, forest insect and disease outbreaks.

Alternatives A and B

The proposed project area is located within the Hiwassee River corridor in an area that is subject to little active management based upon CNF RLRMP management prescriptions. The proposed project would only directly affect 200 square meters of habitat, a negligible amount relative to the total present. Recreational impacts in the area are concentrated along the John Muir Trail, and while fishermen and hunters due access the Hiwassee River corridor, their effects are dispersed and unpredictable. Recreational impacts combined with natural events may have some effect on habitat; however the magnitude and timing are such that they are not considered to be of any significance. Thus, regardless of the alternative chosen, there would be no cumulative effects or impacts on TES species associated with this project.

DETERMINATIONS OF EFFECT

Determinations of effect were ascertained based on the possible impacts from project activities to species and/or species habitats (Table 3). Alternative A and B would have no direct, indirect, or cumulative impacts on the Sensitive aquatic species in the project area. Alternative A and B would have no direct, indirect, or cumulative effects on the endangered tan riffleshell or Cumberland bean pearly mussels. Alternative A "is likely to adversely affect" and Alternative B is "not likely to adversely affect" the endangered Ruth's golden aster. The USFWS concurs with these findings (Barclay 2008).

Table 3. Determinations of effect for TES species in the proposed Ruth's Golden Aster Project Area, Cherokee National Forest, 2008.

Scientific Name	Determination of Effect - Alternative A	Determination of Effect – Alternative B
Eurycea junaluska-	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Ichthyomyzon greeleyi	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Percina squamata	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Phoxinus tennesseensis	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Cheumatopsyche helmai	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Gomphus consanguis	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Gomphus viridifrons	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Macromia margarita	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Ophiogomphus alleghaniensis	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Ophiogomphus incurvatus	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Epioblasma florentina walkeri	No effect. No activities would occur; no habitat would be affected.	No effect. Project activities would occur; no TES species or habitat would be negatively affected.
Fusconaia barnesiana	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Lasmigona holstonia	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Lexingtonia dolabelloides	No impact. No activities would occur; no habitat would be affected.	No impact. Project activities would occur; no TES species or habitat would be negatively affected.
Pleurobema oviforme	No impact. No activities would occur; no	No impact. Project activities would occur; no TES

	habitat would be affected.	species or habitat would be negatively affected.
Villosa trabalis	No effect. No activities would occur; no habitat would be affected.	No effect. Project activities would occur; no TES species or habitat would be negatively affected.
Pityopsis ruthii	May affect, likely to adversely affect. No activities would occur; habitat quality for Ruth's golden aster would continue to decline; plants would be eliminated through shading and displacement.	May affect, not likely to adversely affect; beneficial effects. Project activities would occur; habitat quality for Ruth's golden aster would be improved; plants would not be eliminated through shading and displacement.

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/s/ John J. Lane
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CHEROKEE NATIONAL FOREST

Threatened, Endangered, and Sensitive Species List

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PRC*	Scientific Name	Common Name	Range/Watershed/Co*	CNF Records	Habitat Information	TES	G-Rank
Amphibians							
1A	Desmognathus carolinensis	Carolina Mountain Dusky Salamander	NC & TN; Doe River Valley SW to Pigeon River Valley	Common in Carter, Unicoi, Greene, Cocke, Washington Counties	Seeps, springs, headwater streams, wet rock faces at lower elevations; more terrestrial at higher elevations; v. common in spruce/fir & northern hardwood forests; 900-6600 ft	S	G4
1A	Desmognathus santeetlah	Santeetlah dusky salamander	NC & TN; Unicoi, Great Smoky, &Great Balsam Mtns. Monroe to Cocke Co.	4 records; Monroe Co. & SW Cocke Co.	Mid-high elevation seeps, stream headwaters, rock faces; 640-1805 m, primarily > 3200 ft	S	G3Q
4A	Eurycea junaluska	Junaluska salamander	W NC & SW TN; Sevier & Monroe Co.	8 Monroe Co. records Tellico, Bald & North Rivers, Citico & Slickrock Creeks; potentially Hiwassee River drainage; total 17 streams rangewide	Large streams with sand-gravel substrate, large rocks & adjacent riparian forests. Low elevation, 1100-2000 ft.	S	G3Q
1A	Plethodon aureolus	Tellico salamander	Unicoi Mtns & adjacent valleys of TN and NC, between Little TN & Hiwassee Rivers	1 Monroe Co. record; also in Polk Co.	Hardwood and pine-hardwood forest; terrestrial breeder in leaf litter humus/rotting logs	S	G2G3Q
1A	Plethodon teyahalee	Southern Appalachian salamander	TN, NC, SC, GA; W of French Broad in Cocke Co. to Unicoi Mtns in Polk & Monroe Co.	Polk, Monroe, Cocke Cos.	Deciduous, mesic forest; terrestrial breeders (underground); <5000 ft.	S	G2G3Q
1A	Plethodon welleri	Weller's salamander	SW VA to NE TN & NW NC; Johnson, Carter & Unicoi Co.	10 TDEC records; Johnson, Carter, Unicoi Cos. (3 new records submitted)	Spruce-fir, birch-hemlock and other mesic, rocky forests; boulderfields; grassy open areas; terrestrial breeder-moss mats & rotting logs; > 2200 ft.	S	G3
Arachnids							
1A	Microhexura montivaga	Spruce-fir moss spider	Mountains of NC, TN	3 TDEC records; Roan Mtn.; Carter Co.	Moss and liverwort mats on rocks/boulders in mature spruce-fir forest > 5400 ft.	E	G1
Birds							
1A	Falco peregrinus	Peregrine Falcon	US and CAN	2 TDEC records; hacking Big Bald 1987-89. Carter, Greene, Unicoi Cos.	Nests at ledges of vertical rocky cliffs. Feeds in fields, lakeshores, and river mouths.	S	G4
1A	Haliaeetus leucocephalus	Bald eagle	US and CAN	2 TDEC records; active nest at Parksville Lake 2006-7; hacking S. Holston Lake 1991-94; other recent nests at Tellico Lake. Carter, Johnson, Unicoi, Sullivan, Monroe Washington, Polk Cos.	Nests in large "supercanopy" trees along lake & river shores. Prefers roosts in conifers & protected areas along open water in winter.	S	G5
1A	Lanius ludovicianus migrans	Migrant loggerhead shrike	ME to MN south, from GA to AR; OK, TX; CAN: PE to MB	O TDEC records; occurs thruout E. Tennessee; Greene Co. near Forest	Low elevation crop & grasslands and old fields with scattered trees, shrubs, posts	S	G5T3Q
Fish							
1A	Cottus baileyi	Black sculpin	SH	4 occ. Laurel Creek, 2 occ. Beaverdam Creek, Doe Creek,	Cool and cold water rivers and streams to headwater springs. Rare in Streams over 15m wide. Utilize riffles,runs, and pools with gravel, stone, and boulder substrates. Mod. To high gradient.	S	G4Q
1A	Cyprinella caerulea	Blue shiner	C	2 occ. Conasauga & Jack's Rivers	Large streams, small to medium-sized rivers, moderate gradient, low elevation	T	G2

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1A	Erimonax monachus	Spotfin chub	LT,FB,SH	0 occ. on CNF; Experimental pop. being introduced into Tellico R.	Large streams, moderate gradient, low elevation	T	G2
1A	Etheostoma acuticeps	Sharphead darter	N	1 occ. Nolichucky R.	Large creeks to medium rivers, moderate gradient, cool warm water	S	G2G3
1A	Etheostoma brevirostrum	Holiday Darter	C	2 occ. Conasauga & Jack's Rivers	Large streams to medium rivers, moderate gradient, low elevation	S	G2
1A	Etheostoma percnurum	Duskytail darter	LT	1 occ. Citico Creek; Experimental pop. being introduced into Tellico R.	Large creeks & small-med rivers 10-80 m wide; moderate gradient, warm	E	G1
1A	Etheostoma vulneratum	Wounded darter	LT, FB (extirpated)	1 occ. Citico Creek	Small to large rivers, low to moderate gradient, low to moderate elevations	S	G3
7B	Ichthyomyzon greeleyi	Mountain brook lamprey	H,O, LT, FB, N, W	3 occ. Hiwassee R. #4 & #5; Spring Cr.; poss in many other streams	Small streams to small upland rivers, moderate to high gradient	S	G3
1A	Noturus baileyi	Smoky madtom	LT	1 occ. Citico Creek; Experimental pop. being introduced into Tellico R.	Large streams, low gradient, low elevation.	E	G1
1A	Noturus flavipinnis	Yellowfin madtom	LT	1 occ. Citico Creek; Experimental pop. being introduced into Tellico R.	Large streams to large rivers, low gradient, low elevation	T	G1
1A	Percina antesella	Amber darter	C	Conasauga River < 5 miles from Forest Bdy.	Large streams and small rivers, low gradient, low elevation	E	G1
1A	Percina burtoni	Blotchside logperch	H, SH (extirpated)	2 occ. Spring Cr. & Hiwassee R.	Large streams to small rivers, moderate gradient, low elevation	S	G2
1A	Percina jenkinsi	Conasauga logperch	C	1 occ. Conasauga River; possibly in Jack's R.	Medium river, moderate gradient, low elevation	E	G1
1A	Percina macrocephala	Longhead darter	SH, W	Watauga & South Holston R. <5 miles from the Forest Bdy.	Large streams to medium rivers, moderate gradient, low to moderate elevations.	S	G3
1A	Percina palmaris	Bronze darter	C	2 occ. Conasauga & Jack's Rivers	Small to medium rivers, moderate gradient, low elevation.	S	G3
7B	Percina squamata	Olive darter	H, FB, N, W	1 occ. Hiwassee R. #4; poss in French Broad, Nolichucky & Watauga	Small to medium rivers, moderate to high gradient, moderate elevations	S	G2
1A	Percina tanasi	Snail darter	O, H, LT	1 occ. Hiwassee R.; Ocoee River < 5 miles from Forest Bdy. LT habitat destroyed by Tellico Res.	Large streams to medium rivers, low to moderate gradient, low elevation.	T	G2
1A	Phenacobius crassilabrum	Fatlips minnow	P, FB, N, W, SH	1 occ. Nolichucky R.; poss French Broad, Nolichucky, Watauga, & South Holston R.	Large streams to medium rivers, moderate to high gradient, moderate elevation	S	G3
7B	Phoxinus tennesseensis	Tennessee dace	O, H, LT, N, W, SH; Ridge & Valley of upper TN system in VA in TN	28 occ. O=8; H=15; LT=3; SH=1; poss Nolichucky & Watauga tribs.	1st order spring-fed streams (1-2 m wide) of R&V region & mountain fringes; low to moderate gradients, low to moderate elevation	S	G2G3

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Insects and Millipedes							
4A	Cheumatopsyche helma	Helma's net-spinning caddisfly	Known from at least one occurrence in 8 states: NH, PA, WV, KY, NC, TN, AL, AR; most recently discovered in Arkansas and in Abrams Cr in the GSMNP, TN	1 occ. Big Lost Cr (Hiwassee)	Large streams, low gradient, low elevation	S	G1G3
1A	Dixioria fowleri	A millipede	VA, TN, Laurel Fork drainage in VA; Beaverdam Crk in TN	1 occ., Holston Mtn near Backbone Rock	Leaf litter, deciduous forests	S	G2
4A	Gomphus consanguis	Cherokee clubtail	Known from at least one occurrence in 6 states: VA, NC, SC, TN, GA, AL; 15 known occurrences	2 occ. (TDEC records); known from Polk and Sullivan Counties	Small, spring-fed streams, mod to high gradient	S	G3
4A	Gomphus viridifrons	Green-faced clubtail	Known from 16 states and 1 Canadian province with as many as 6 occurrences in some states; some populations are protected from habitat degradation	1 occ. Chestoa, Nolichucky R. 2001	Small-large rivers, moderate gradient	S	G3
4A	Macromia margarita	Mountain river cruiser	Known from at least one occurrence in 6 states: VA, NC, SC, TN, GA, AL; at least 13 occurrences; occurs in Blount Co., TN	0 occ.	Small streams to large rivers, rocky with silt deposits	S	G2G3
1A	Megaleuctra williamsae	William's giant stonefly	Known from at least one occurrence in 4 states: VA, NC, SC, TN; at least 3 occurrences in VA; known from Mt. Rogers & GSMNP	0 occ.	Springs and seeps at high elevations (>4000 feet).	S	G2
4A	Ophiogomphus alleghaniensis	Allegheny Snaketail	Known from at least one occurrence in 4 states: WV, VA, TN, AL; at least 5 occurrences in TN; considered a subspecies of O. incurvatus by some.	2 occ. Monroe, Polk Cos.	Spring-fed Piedmont streams	S	G3Q
1A	Ophiogomphus edmundo	Edmund's snaketail	Known from at least one occurrence in 3 states: TN, NC, GA; probably restricted to the Conasauga River in TN	1 occ. Conasauga R.	Large streams, low gradient, low elevation	S	G1
4A	Ophiogomphus incurvatus	Appalachian snaketail	Known from at least one occurrence in 4 states: PA, TN, NC, GA	1 occ. Conasauga River < 5 miles from CNF	Small streams, low gradient	S	G3
1A	Speyeria diana	Diana fritillary	WV to AL	23 TDEC records, Monroe, Cocke, Greene, Carter, Johnson, Sullivan, Unicoi, Washington Cos.	Mature mesic forests, edges & grassy openings; caterpillar host is Viola sp.	S	G4
Mammals							
1A	Corynorhinus rafinesquii	Rafinesque's big-eared bat	OH to MO, south to FL and LA; OK, TX	1 TDEC record; Cocke Co.	Caves & mine portals; summer roosts in hollow trees, under loose bark, & abandoned buildings; forages primarily in mature forest	S	G3G4
1A	Glaucomys sabrinus coloratus	Carolina northern flying squirrel	Mountains of NC, TN, VA	4 TDEC records; Monroe and Carter Cos.	Mature spruce fir and adjacent northern hardwood/hemlock forests above 4000 feet; abundant snags & woody debris, fungi	E	G5T1
1A	Microtus chrotorrhinus carolinensis	Southern rock vole	Mountains of MD, NC, TN, VA, WV	0 TDEC records; likely Monroe, Carter, Unicoi Cos.	Cool, damp coniferous and mixed forest; moist/mossy talus and logs at higher elevations	S	G4T3
1A	Myotis grisescens	Gray bat	VA to KS south, from TN to OK; SC to FL, AL	4 TDEC records, Cocke & Greene Cos.; pvt in Carter & Sullivan Cos.	Uses caves year round; forages along riparian areas/shorelines with forest cover	E	G3

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1A	Myotis leibii	Eastern small-footed bat	ME to OH south, from SC to AL; AR, MO, OK; CAN: ON, QC	16 TDEC records, Polk, Monroe, Cocke, Greene, Unicoi, Carter, Johnson, Sullivan Cos.	Bridges, cliffs, mine portals, buildings; summer roosts buildings, hollow trees, loose bark	S	G3
1A	Myotis sodalis	Indiana bat	VT to MI south, to SC, AL; IA to AR, OK	1 TDEC record; Monroe Co; addtl. ANABAT records Monroe Co.	Hibernates limestone caves; maternity roosts primarily hollow trees or trees with loose bark; forages riparian areas and upland water holes	E	G2
1A	Sorex palustris punctulatus	Southern water shrew	Mountains of MD, NC, PA, TN, VA, WV	4 TDEC records Monroe Co.	Swift rocky streams in northern & cove hardwoods; often hemlock, mossy rocks, rhododendron; riparian dependent	S	G5T3
Mussels							
1A	Alasmidonta raveneliana	Appalachian elktoe	N	1 occ. Nolichucky R.	Small to medium rivers, moderate gradient, moderate elevation	E	G1
7B	Epioblasma florentina walkeri	Tan riffleshell	H	2 occ Hiwassee R. #4 & #5	Small to large rivers, low gradient, low elevation	E	G1T1
1A	Epioblasma metastriata	Upland combshell	C	O occ Critical Habitat	Large streams to medium rivers, low to moderate gradient, low elevation	E	GH
1A	Epioblasma othcaloogensis	Southern acornshell	C	O occ Critical Habitat	Large streams to medium rivers, low to moderate gradient, low elevation	E	GHQ
7B	Fusconaia barnesiana	Tennessee pigtoe	H, LT, N, FB, W, SH	2 occ Hiwassee R. #4 & #5; LT habitat is inundated by Tellico Res.	Small to medium rivers, moderate to high gradient, low elevation	S	G2G3
1A	Lampsilis altilis	Finelined pocketbook	C	1 occ. Conasauga R. last obs 1999	Large streams to medium rivers, low to moderate gradient, low elevation	T	G2
7B	Lasmigona holstonia	Tennessee Heelsplitter	H, FB	Hiwassee and French Broad tribs. < 5 miles from the Forest Bdy.	Small streams to small rivers, low to moderate gradient, low elevation	S	G3
1A	Lasmigona subviridis	Green floater	W	Watauga R. <5 miles from the Forest Bdy (only location in TN).	Large streams to small rivers, low gradient, low elevation	S	G3
7B	Lexingtonia dolabelloides	Slabside pearlymussel	H	2 occ Hiwassee R. #4 & #5	Small streams to large rivers, moderate to high gradient, low elevation	S{C}	G2
1A	Medionidus acutissimus	Alabama moccasinshell	C	O occ Critical Habitat	Large streams, low gradient, low elevation	T	G1
1A	Medionidus parvulus	Coosa moccasinshell	C	O occ Critical Habitat	Large streams, low gradient, low elevation	E	G1
1A	Pleurobema decisum	Southern clubshell	C	O occ Critical Habitat	Large streams to medium rivers, low to moderate gradient, low elevation	E	G1G2
1A	Pleurobema georgianum	Southern pigtoe mussel	C	1 occ. Conasauga R.	Medium rivers, moderate gradient, low elevation	E	G1
1A	Pleurobema hanleyianum	Georgia pigtoe	C	Conasauga River < 5 miles from Forest Bdy.	Small streams to large rivers, moderate to high gradient, low elevation	S{C}	GHQ
7B	Pleurobema oviforme	Tennessee clubshell	H	2 occ Hiwassee R. #4 & #5	Large streams, low gradient, low elevation	S	G3
1A	Pleurobema perovatum	Ovate clubshell	C	O occ Critical Habitat	Large streams, low gradient, low elevation	E	G1
1A	Ptychobranchus greenii	Triangular kidneyshell	C	O occ Critical Habitat	Large streams, low gradient, low elevation	E	G1
1A	Strophitus connasaugaensis	Alabama creekmussel	C	1 occ. Conasauga R.	Large streams, low gradient, low elevation	S	G3
1A	Villosa nebulosa	Alabama rainbow	C	1 occ. Conasauga R.	Large streams, low gradient, low elevation	S	G3
7B	Villosa trabalis	Cumberland bean pearly mussel	H	2 occ Hiwassee R. #4 & #5	Large streams and small rivers, low gradient, low elevation	E	G1G2
1A	Villosa vanuxemensis umbrans	Coosa creekshell	C	1 occ. Conasauga R.	Small and large streams, low gradient, low elevation	S	G4T2

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Reptiles							
1A	Glyptemys muhlenbergii (S. pop)	Bog turtle	MA south to GA, TN	1 TDEC record Johnson Co.; CNF record Carter Co.	Slow, shallow, mucky rivulets of sphagnum bogs, seeps, wet cow pastures, & shrub swamps	T (SA)	G3
Snails							
1A	Pallifera hemphilli	Black mantleslug	MI, NC, TN, GA,VA	0 TDEC records; Field Museum records Polk (2), Carter (4) Cos.	Spruce fir and mesic forests with moist litter, downed wood and rock cover; high elevation	S	G4
1A	Paravitrea placentula	Glossy supercoil	VA, TN, NC, KY, GA Off-forest Cocke Co.; unk location Sullivan Co.	0 TDEC records; Field Museum & CNF records Polk(4), Monroe(2), Carter(2), Unicoi(1) Cos.	Leaf litter of deciduous forests and streamside forests with moist litter, downed wood & rock cover.	S	G3
1A	Patera archeri	Ocoee covert	Polk County , TN	3 CNF records Polk County	Leaf litter under rock ledges in ravines; Ocoee River drainage endemic	S	G1
1A	Ventridens coelaxis	Bidentate dome	NC, TN, KY, VA Off-CNF & unk locations Carter, Johnson, Sullivan Co.	Field Museum & Forest records; Carter (5) and Johnson (3) Cos.	Mesic deciduous forest, mid-high elevation	S	G3
1A	Vertigo bollesiana	Delicate vertigo	ME south to TN, NC (17 states, 3 Canadian provinces)	2 records Monroe Co.; 1 Field Museum record Johnson County	Rich coves, acidic coves, other deciduous forests with downed wood	S	G3G4
1A	Vertigo clappi	Cupped vertigo	KY, TN, VA, WV	5 TDEC records Monroe Co.; TDEC record Carter Co.	leaf litter and debris on steep wooded slopes with boulders and rotting timber	S	G1G2
Non-vascular Plants							
1A	Acrobolbus ciliatus	A liverwort	Mountains of NC, TN, SC, GA. AK, Japan, Taiwan, and India. Monroe Co.	1 Record	On rock in moist ravines, spray cliffs, cascading streams, and spruce/fir forests; Riparian dependent except when in the spruce/fir forest zone.	S	G3?
1A	Aneura maxima (=A. sharpii)	A liverwort	Mountains of VT, south to NC and TN	0 Records	Humus or gravelly soil at base of wet outcrops, along streams, and waterfalls. Mostly riparian dependent	S	G1G2
1A	Aspiromitus appalachianus	A hornwort	TN, NC, SC	Undocumented records have been reported.	On rock in streams. Riparian dependent.	S	G1
1A	Bartramidula wilsonii	Dwarf apple moss	Macon & Jackson Counties, NC and Monroe County, TN	O Records. Known from Monroe County however site is undocumented.	Wet, acidic rock in the mtns, especially road cuts. Also on spray cliffs and in humid gorges. Mostly riparian dependent.	S	G3?
1A	Bazzania nudicaulis	A liverwort	Mountains of VA, TN, and NC	2 locations; Roan Mountain	On rock and bark of *Abies fraseri, Picea rubens, Betula lutea, Prunus pennsylvanica,* and *Sorbus americana* in spruce/fir forests.	S	G2G3
1A	Brachydontium trichodes	Peak moss	Europe, Mount Rainier, NH, NC, and TN	Unknown # on Roan Mountain	Moist, shady, acidic rock, especially sandstone; rocky seepage along mountain trails.	S	G2
1A	Buxbaumia minakatae	Hump-backed Elves	Nova Scotia, MA, NY, MI, VT, VA, NC and Japan	0 Records	Swampy areas; habitats occupied by *Nowellia, Lophocolea*, and *Tetraphis;* rotten logs or stumps; found on elm, ash and yellow birch logs.	S	G2G3
7A	Cephalozia macrostachya ssp australis	A liverwort	NC to MS	0 Records	On soil in rock crevices along streams. Riparian dependent.	S	G4T1
1A	Cephaloziella massalongi	A liverwort	Europe, VT, TN, and NC	0 Records	Rock crevices and soil above 5,500'. Often with copper or sulphur deposits.	S	G2G3

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1A	Cheilolejeunea evansii	A liverwort	NC, SC, AL, and TN. Monroe Co.	1 Record	On tree bark in humid gorges. Variety of mesic to dry-mesic hardwoods including *Quercus* spp., *Liriodendron tulipifera, Nyssa sylvatica, Carya* spp., *Liqyuidambar styraciflua, Fraxinus* spp., and *Ilex opaca*. The moss *Fissidens subbasilaris* is nearly a constant associate.	S	G1
1A	Chiloscyphus appalachianus	A liverwort	KY, NC, SC, and TN. Monroe Co.	1 Record	On wet rock, usually near cascades or waterfalls. Riparian dependent.	S	G1G2
1A	Diplophyllum apiculatum var taxifoliodes	A liverwort	NC, TN The variety *taxifolioides* is known from several locations in NC and from Mt. Leconte in TN.	0 Records.	On moist soil or rocks at moderate to high elevations. *Diplophyllum* collected below 3,000 feet is likely to be *D. apiculatum* (Hicks 1992*)*. The variety is thought to be a hybrid of *D. apiculatum* and *D. taxifolioides* (Shuster 1974).	S	G5T1Q
1A	Diplophyllum obtusatum	A liverwort	Newfoundland, MN, mountains of NC & TN	0 Records.	In crevices of rock outcrops in spruce/fir forests; >5,500 ft. Always associated with damp, shaded rocks. It is also known to occur within mixed mesophytic forest in NC (Shuster 1974).	S	G2?
1A	Ditrichum ambiguum	A moss	CA, MT, NC, NH, NY, OR, VT, WA; BC, QC, SK	0 Records.	On bare soil of moist banks of roads or streams in wooded, upland, or montane habitats. Also acidic coves.	S	G3?
1A	Drepanolejeunea appalachiana	A liverwort	Mountains of VA, TN, NC, SC, and GA; PR	4 Records.	On rock and the bark of trees and shrubs along streams, mixed mesophytic forest, and in humid gorges. Most often found on *Kalmia Rhododendron, Clethra,* and *Ilex.* Substrates for the CNF pops include rock, *Quercus alba*, and *Betula allegheniensis.*	S	G2?
1A	Entodon concinnus	Lime entodon	NC, TN; AB, BC, NS	0 Records.	On moist calcareous rock.	S	G4G5
7A	Fissidens appalachensis	Appalachian pocket moss	NC and TN. Monroe Co.	1 Record.	In rock crevices submerged in swift running, shallow water. Riparian dependent.	S	G2G3
1A	Frullania appalachiana	A liverwort	Mountains of TN, NC, GA, and SC	0 Records.	Usually on the bark of hardwoods (*Acer spicatum, Betula allegheniensis, Sorbus americana*) above 3,500 ft. in spruce/fir zone. Also known from mesic forests and escarpment gorges on the bark of *Castanea dentata* and *Liriodendron tulipifera*.	S	G1?
1A	Frullania oakesiana	A liverwort	Northern Europe, Japan, and Mountains of VT to NC and TN	0 Records.	Tree bark in spruce/fir forests.	S	G3?
1A	Gymnoderma lineare	Rock gnome lichen	TN, NC, SC, GA	1 Record, Roan Mountain	High elevation rocky summits and rock outcrops.	E	G2
1A	Homaliadelphus sharpii	Sharp's homaliadelphus	Japan, Vietnam, Mex; MO, VA, NC, and TN	0 Records.	Vertical surfaces and ledges of calcareous cliffs and boulders. Dry mafic or calcareous rocks in gorges.	S	G3
7A	Hydrothyria venosa	An aquatic lichen	CA to MT and Canada; Appalachians from Canada to TN & NC. Monroe Co.	1 Record	On rock substrates in clear, cold mountain streams. Riparian dependent.	S	G3
1A	Lejeunea blomquistii	A liverwort	Mountains of NC, TN, and GA. Monroe Co.	2 Records.	Rock and bark in humid gorges, and dead trees or vertical rock faces of spray cliffs.	S	G1G2
1A	Lejeunea dimorphophylla	A liverwort	The Caribbean; coastal plain of FL and NC	~~1 possible Record, Monroe County~~. This has proven to be *Lejeunea ulicina* ssp. *bullata*.	On bark of trees in the outer coastal plain. Riparian dependent.	S	G2G3

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1A	Leptodontium excelsum	Grandfather Mountain leptodontium	VA, TN, NC, and GA	Unkown # on Roan Mountain	Bark of trees in high elevation, spruce/fir forests.	S	G2
1A	Leptohymenium sharpii	Mount Leconte moss	TN, NC, and SC	0 Records.	On shaded, moist or wet rock (often cliffs and waterfalls) and within hemlock/hardwood cove forests. Elevation ranged from 1900- 5400'.	S	G1
1A	Lophocolea appalachiana	A liverwort		see Chiloscyphus appalachianus	See Chiloscyphus appalachianus	S	G1G2?
1A	Marsupella emarginata var. latiloba	A liverwort	Range unknown	0 Records.	Moist rocks in humid gorges, waterfall spray zones, wet rock & seeps along streams, or humid microclimates at high elevation. Riparian dependent.	S	G5T1T2
1A	Megaceros aenigmaticus	A hornwort	NC, TN, and GA. Monroe and Cocke Co's.	25+ Records (often abundant in areas where found).	Shaded rocks in small streams and springs, or spray cliffs. Riparian dependent.	S	G2G3
1A	Metzgeria fruticulosa (= M. temperata)	A Liverwort	Asia, Europe; PNW US; VA, NC, and TN	1 Record, Roan Mountain	Rock and bark of trees from spruce/fir zone to hemlock/hardwood forests above 3000'.	S	G2Q
1A	Metzgeria furcata var. setigera	A liverwort	NC and SC, possibly TN	0 Records.	In humid gorges or on damp, shaded rocks in spruce/fir forests.	S	G4T1
1A	Metzgeria uncigera	A liverwort	PR; SE coast to mountains of NC	0 Records.	On *Rhododendron* bark in mountains.	S	G3
1A	Nardia lescurii	A liverwort	VA, WV, KY, TN, NC, SC, and GA. Monroe Co.	3 Records	Low elevations in mountains, on peaty soil over rock near shaded streams. Riparian dependent.	S	G3?
1A	Pellia appalachiana	A liverwort	MN, NC, SC, TN, and GA. Monroe and Polk Co.	3 Records.	Permanently damp or wet sites and moist outcrops, usually near waterfalls. Mostly riparian dependent	S	G1?
1A	Plagiochila austinii	A liverwort	NH and VT to NC and TN	0 Records.	On shaded, moist rock outcrops in the mountains	S	G3
1A	Plagiochila caduciloba	A liverwort	Mountains of TN, NC, SC, and GA. Monroe Co. (Historic record from Greene County)	2 Records.	Damp, shaded rock faces, usually along streams in mountain gorges and on spray cliffs; 1000-4900 ft. Riparian dependent.	S	G2
1A	Plagiochila echinata	A liverwort	Mountains of TN, NC, and SC. Monroe and Polk Co.	4 Records.	Damp, shaded rock faces and crevices in mountain gorges, above cascades and near waterfalls. Riparian dependent.	S	G2
1A	Plagiochila sharpii	Sharp's leafy liverwort	TN, NC, SC, and GA	0 Records.	Shaded, moist rocks in humid gorges. Riparian dependent.	S	G2G3
1A	Plagiochila sullivantii var spinigera	A liverwort	Mountains of VA, WV, NC, SC, and TN. Monroe Co.	1 Record.	Moist, shaded rock outcrops, under cliff ledges, and in rock crevices; spray cliffs and spruce/fir forests; > 2500 ft.	S	G2T1
1A	Plagiochila sullivantii var sullivantii	Sullivant's leafy liverwort	Mountains of VA, WV, KY, TN, NC, SC, and GA. Monroe Co.	1 Record.	Moist, shaded rock outcrops, cliff ledges and rock crevices; spray cliffs and spruce/fir forests; > 2500 ft.	S	G2T2
1A	Plagiochila virginica var caroliniana	A liverwort	VA, NC, SC, and TN	2 Records, no varietal info.	On moist rock near waterfalls; humid gorges, and rocky banks of shaded streams. Riparian dependent. Generally at lower elevations.	S	G3T2
7A	Plagiochila virginica var virginica	A liverwort	WV, to NC, SC, TN, GA, and MS	2 Records, no varietal info.	On shaded rock along streams and moist rock faces, especially limestone. Riparian dependent. Generally at lower elevations.	S	G3T3
1A	Plagiomnium carolinianum	Carolina plagiomnium	TN, NC, SC, and GA	0 Records.	Moist, granitic or humus covered rock, especially on cliff ledges near streams or waterfalls; rocks or streambanks in humid gorges. Riparian dependent.	S	G3
1A	Platyhypnidium pringlei	A moss	Mexico, AZ; NC, SC, and suspected in TN	0 Records.	Attached to acidic rock in running water, permanent seeps, or spray cliffs of waterfalls in hemlock/hardwood forests. Riparian dependent.	S	G2
1A	Polytrichum appalachianum	Appalachian haircap moss	TN and NC	0 Records.	High elevation rocky summits, rock outcrops, and shrub balds.	S	G3

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1A	Porella wataugensis	Watauga porella	KY, TN, NC, and SC Monroe Co.	2 Records	Rock faces in humid gorges & wet rock near small streams above inundation. Riparian dependent.	S	G2
1A	Radula sullivantii	A liverwort	Mountains of NC, SC, TN, and GA	0 Records.	Shaded rock outcrops near streams and waterfalls in mountain gorges. Riparian dependent.	S	G2
1A	Radula voluta	A liverwort	Europe, South America; mountains of NC and TN. Monroe Co.	1 Record	Shady rock faces in spray areas around waterfalls. Riparian dependent.	S	G3
1A	Riccardia jugata	A liverwort	Mountains of NC and TN. Monroe and Polk Co.	3 Records.	On moist wood and humus in mesic areas and humid gorges.	S	G1G2
1A	Sphenolobopsis pearsonii	A liverwort	Europe, Africa, Asia, Atlantic and Pacific Islands, Pacific NW; NC and TN	Roan Mountain (Undocumented)	On rock and bark of *Abies fraseri, Picea rubens, Prunus pennsylvanica,* and *Sorbus americana* in spruce/fir forests.	S	G2
1A	Sticta limbata	A foliose lichen	Canada to CA; mountains of NC and TN	0 Records.	Bark of hardwoods in high elevation northern hardwood forests	S	G3G4
1A	Taxiphyllum alternans	Japanese yew-moss	Asia; MD to FL, NC, and LA	0 Records.	Soil, humus, or bark in wet, swampy areas; on limestone in the spray area of waterfalls. Riparian dependent. .	S	G3?
1A	Tortula ammonsiana	Ammons' tortula	Africa; WV, NC, and TN	0 Records.	Cliff overhangs and crevices with seepage in rich hardwood forests. Riparian dependent.	S	G2?
Vascular Plants							
1A	Aconitum reclinatum	Trailing white monkshood	South and central mountains of NC, PA, TN, VA, WV. Carter Co.	1 Record.	Rich forest habitats on seepage slopes, boulderfields, streambanks, and coves at high elevations, associated with mafic rock.	S	G3
1A	Aster georgianus	Georgia aster	AL, FL, GA, NC. Suspected in SE TN	0 Records	Dry, rocky, open woods and roadsides in areas with a history of frequent fire; Likely associated with historic post or blackjack oak woodlands.	S	G2G3
1A	Berberis canadensis	American barberry	PA to IL, south to AL, GA; IL, MO. Monroe, Johnson, Sullivan, Washington, Carter, and several ridge and valley counties.	0 Records	Open rocky woods, openings, and streambanks, usually over mafic or calcareous rock; occurring in thin soil. Historic habitats were fire maintained.	S	G3
1A	Botrychium jenmanii	Dixie grapefern	MD to FL; TN, AL, MS, LA. Monroe, Hamblen, Putnum Co.	0 Records	Dry to moist forests; open, grassy areas; and disturbed areas.	S	G3G4
1A	Buckleya distichophylla	Piratebush	Mountains of NC, TN, VA. Carter, Cocke, Greene, Sullivan, Unicoi, Washington Co.	14 Records.	Open, dry, rocky woods and bluffs, typically calcareous-shaley soils; Known sites occur between 1900-3300 ft.	S	G2
1A	Calamagrostis cainii	Cain's reed grass	Mountains of NC, TN. Sevier Co.	0 Records	High elevation rocky summits and disturbed areas 4000-6000 ft.	S	G1
1A	Cardamine clematitis	Small mountain bittercress	Mountains of AL, NC, SC, TN, VA. Carter, Johnson, Unicoi, Washington, Monroe, Sevier Co.	13 Records	Wet, rocky areas; springs, seeps, and streambanks; moss or moist soil; > 3,500'; Mostly riparian dependent.	S	G2G3
1A	Carex misera	Wretched sedge	Mountains of GA, NC, TN. Blount, Sevier, Carter, Unicoi	4 Records	Medium to high elevation cliffs, balds and rocky areas	S	G3
1A	Carex roanensis	Roan sedge	GA, KY, NC, TN, VA. Carter, Johnson, Unicoi, Cocke, Sullivan Co.	25 Records	Mesic forests; often associated with birch and beech at high elevations.	S	G1
1A	Cimicifuga rubifolia	Appalachian bugbane	AL, IL, IN, KY, TN. Monroe, Sullivan, & several Ridge and Valley cos.; Primary Cumberland Plateau in TN.	0 Records	River bluffs, ravines, and rich cove forests over talus and rocky calcareous soils; typically north facing slopes; 800-1500 ft.	S	G3
1A	Collinsonia verticillata	Stoneroot	MD to GA; OH, KY, TN. Monroe, McMinn, Blount, Sevier, Johnson, and several counties to west.	0 Records	Rich forests in moist coves to dry oak forests over mafic or calcareous rock.	S	G3

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1A	Coreopsis latifolia	Broadleaf tickseed	Mountains of GA, NC, SC, TN. Polk, Carter, Greene Co.	6 Records	Rich, moist cove and slope forests 1,500 to 4,500 ft. Flowering triggered by canopy gaps.	S	G3
1A	Danthonia epilis	Bog oat-grass	GA, NC, NJ, SC, TN. Cocke Co.	0 Records	Seeps around rock outcrops in the mountains. Riparian dependent.	S	G3?
1A	Delphinium exaltatum	Tall larkspur	OH, PA south to TN, NC; AL, MO, ME. Mostly Ridge and Valley Co's, but reported from Cocke Co.; Known from the Blue Ridge in NC.	0 Records;	Dry to moist habitats over mafic rock, usually in full or partial sun (grassy balds or forest edges). Also rich woods (and edges of woods), rocky slopes, semi-open woodlands, glades and prairie openings.	S	G3
7A	Diervilla rivularis	Riverbank bush-honeysuckle	Mountains of AL, GA, NC, TN. Unicoi, Washington, Polk, and some Ridge and Valley Co's.	12 Records	Bluffs, rock outcrops, and riverbanks	S	G3
1A	Fothergilla major	Large witchalder	AL, AR, GA, NC, SC, TN. Polk, Sevier, Greene, and some west of Blue Ridge	3 Records	Dry ridge top and bluff forests of moderate elevations.	S	G3
1A	Gentiana austromontana	Appalachian gentian	Mountains of NC, TN, VA, WV. Carter, Greene, Johnson, Sullivan, Unicoi, Washington Co.	70 Records	High elevations in open forests, grassy balds, and along roads and trails.	S	G3
1A	Geum geniculatum	Bent avens	Mountains of NC, TN. Carter Co.	5 Records	High elevation peaks, seeps, wet boulderfield forests, grassy balds, cliff bases, and stream banks.	S	G2
1A	Geum radiatum	Spreading avens	Mountains of NC, TN. Sevier, Blount, Carter Co.	3 Records	Thin soil on rocky summits, cliffs, & ledges; open, grassy balds near *Rhododendron catawbiense*; >4200'.	E	G1
1A	Glyceria nubigena	Great Smoky Mountain mannagrass	Mountains of NC, TN. Sevier Co.	0 Records	Moist to soggy ground at higher elevations, especially seepage areas on heath balds and high ridges and miry places in spruce-fir forests	S	G2
1A	Hedyotis purpurea var. montana	Roan Mountain bluet	Mountains of NC, TN. Carter Co.	1 Record	Habitat includes crevices in rock outcrops and gravelly soils at the edges of grassy balds.	E	G5T2Q
1A	Helianthus glaucophyllus	Whiteleaf sunflower	AL, NC, SC, TN. Carter, Greene, Johnson, Unicoi Co.	12 Records	Mesic forests and woodlands at medium elevations. Flowering associated with increased light.	S	G3
1A	Heuchera longiflora var. aceroides	Maple-leaf alumroot	Range for H. longiflora is AL, KY, NC, OH, TN, VA, WV. No published range info for variety. Cocke & Greene Co.	9 Records	Moist ravines and rich cove forests, especially over mafic or calcareous rock.	S	G4T2Q
1A	Hymenophyllum tayloriae	Taylor's filmy fern	NC, SC, TN, GA. Sevier, Fentress, Overton Co.	0 Records	Humid gorges, moist ceilings of rock grottoes and spray cliffs. Riparian dependent.	S	G1G2
1A	Hypericum graveolens	Mountain St. Johnswort	Mountains of NC, TN. Sevier, Unicoi, Carter, Johnson, Co.	3 Records	High elevation grassy balds and forest openings.	S	G3
1A	Hypericum mitchellianum	Blue Ridge St. Johnswort	Mountains of NC, TN, VA, WV. Unicoi, Carter, Cocke, Greene, Johnson, Sevier, Blount, Monroe Co.	12 Records	Grassy balds, seeps, and forest openings.	S	G3
1A	Ilex collina	Longstalked holly	NC, VA, WV. Suspected in TN	0 Records	Wetlands, seeps, or streambanks >2,000 ft often in association with *Tsuga canadensis, Betula lenta, Ilex montana, Picea rubens*, and *Rhododendron maximum*. Also moist, rocky slopes in northern hardwood or mixed spruce/hardwood forests.	S	G3
1A	Isotria medeoloides	Small whorled pogonia	ME to GA; Midwestern US and CAN. Washington, Hamilton.	0 Records	Open deciduous, or mixed pine-deciduous forests, often on dry to moist leaf litter.	T	G2G3
7A	Juglans cinerea	Butternut	Central and eastern US and southeastern CAN. All Blue Ridge counties and scattered throughout TN.	11 Records	Moist, rich forests especially along rivers in bottomlands and floodplains.	S	G3G4

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1A	Lilium grayi	Gray's lily	Mountains of NC, TN, VA. Carter and Johnson Co.	8 Records	Bogs, seeps, grassy balds, moist forest edges, and wet meadows at medium to high elevations.	S	G3
7A	Lysimachia fraseri	Fraser's yellow loosestrife	Regional endemic of AL, GA, NC, SC, TN; KY, IL. Polk, Sevier, Cocke, Hamilton, and a few counties in west TN.	10 Records	Forest edges, road banks, Along streams and rivers, and thin soil near rock outcrops. Locally abundant in the Ocoee River Gorge. Dependent upon cyclical natural disturbances to maintain open conditions.	S	G2
1A	Minuartia godfreyi	Godfrey's stitchwort	Regional endemic AL, AR, FL, NC, SC, TN. Carter, Johnson Co.	3 Records	Wet ditches, meadows, seeps, streams banks, and springs; associated with calcareous soils. Riparian dependent.	S	G1
1A	Monotropsis odorata	Sweet Pinesap	DE to FL, AL, KY, TN, WV; Centered in Appalachians. Polk, Monroe, Blount, Sevier, Cocke, Greene, and a few counties west.	8 Records	Dry to mesic pine and mixed pine/hardwood forests.	S	G3
1A	Penstemon smallii	Small's beardtongue	Mountains of AL, GA, NC, SC, TN. Polk, Cocke, Greene, Washington, Unicoi, Carter, and several counties west.	0 Records	Woodlands, cliffs, glades, and roadsides.	S	G3
3A	Pityopsis ruthii	Ruth's golden aster	Southeast TN	12 Records; Polk Co.	Crevices in phyllite & graywacke boulders in historical flood zone Ocoee & Hiwassee Rivers.	E	G1
1A	Platanthera integrilabia	White fringeless orchid	VA to GA, KY to AL, MS. Polk, Monroe and several Cumberland Plateau counties	2 Records	Forested wetlands with open or semi-open canopy. Wet, flat, boggy areas at the head of streams or seepage slopes. Often found in association with *Sphagnum* and *Osmunda cinnamonea, Woodwardia areolata*, and *Thelyptris novaboracensis,* in acidic muck or sand, and in partially, but not fully shaded areas.	S	G2G3
1A	Potamogeton tennesseensis	Tennessee pondweed	OH, PA, TN, VA, WV. Polk, Monroe, Blount and counties west	1 Record	Slow moving streams and rivers. Riparian dependent.	S	G2
1A	Prenanthes roanensis	Roan Mountain rattlesnake root	Mountains of NC, TN, VA. Polk, Sevier, Greene, Unicoi, Carter, Johnson Co.	48 Records	High elevation rich woods, grassy balds, and forest openings.	S	G3
1A	Pycnanthemum beadlei	Beadle's mountain mint	Mountains of southwest VA to GA, TN. Carter Co.	0 Records	Forests and woodland borders.	S	G2G4
1A	Rosa obtusiuscula	Appalachian Valley rose	TN endemic. Only known collection from Cocke Co.	0 Records; not tracked by TDEC; NY Botanical Garden Database lists one record (1897) in Cocke County near French Broad River between Paint Rock and Del Rio.	Listed by TN Natural Heritage (1999) as a rare endemic, known from wooded slopes and riverbanks. Taken off after Rare Plant Advisory Committee meeting (1999) until taxonomic issues are resolved. It could be *Rosa palustris*. At this point it is considered to be "State Historic".	S	G1G3Q
1A	Rugelia nudicaulis	Rugel's Indian plantain	Mountains of NC, TN. Cocke, Sevier, Blount Co.	0 Records	Spruce/fir and northern hardwood forest openings	S	G3
1A	Saxifraga caroliniana	Carolina saxifrage	Mountains of GA, NC, TN, VA, WV. Carter, Cocke, Johnson Co.	4 Records	Moist rock outcrops and cliffs; wet soil at the base of rocks; cool, shaded, rocky woods. Almost always in steep terrain and often in areas misted by spray from nearby waterfalls or in areas where water trickles down the rocky slopes.	S	G2
1A	Scutellaria arguta	Hairy skullcap	GA, KY, NC, TN, VA. Unicoi	0 Records	High to mid elevation forests and moist talus slopes	S	G2?Q
1A	Scutellaria saxatilis	Rock skullcap	CT to IN, south to AL, GA, SC, AR. Polk, Blount, Unicoi, Carter, Johnson, Cocke, Greene Co.	43 Records	Rocky, dry to mesic forests and open areas	S	G3

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1A	Sedum nevii	Nevius' stonecrop	AL, GA, TN. Polk	9 Records all restricted to the Ocoee River Gorge.	Shaded, rocky bluffs and cliffs	S	G3
7A	Sida hermaphrodita	Virginia fanpetals	KY, MD, OH, PA, TN, VA, IN, MI, Ontario. Cocke, Washington, Claiborne Co.	0 Records	Sandy or rocky riverbanks	S	G2
1A	Silene ovata	Blue Ridge catchfly	AL, AR, GA, IL, IN, KY, MS, NC, SC, TN, VA. Polk, Sevier, Cocke, Greene, Unicoi Co. and west.	4 Records	Mid elevations over mafic or calcareous soils. Rich cove and oak/hickory forests.	S	G2G3
1A	Solidago spithamaea	Blue Ridge goldenrod	Mountains of NC, TN. Carter Co, Roan Mtn.	1 Record	Rocky places (outcrops, ledges, cliffs, balds) above 4500 ft.	T	G1
7A	Spiraea virginiana	Virginia spiraea	AL, GA, KY, LA, NC, OH, PA, TN, VA, WV	1 Record, no longer extant; Unicoi Co., Nolichucky River	Riverbanks and riverside shrub thickets; rocky areas susceptible to flood scour. Riparian dependent.	T	G2
1A	Stachys clingmanii	Clingman's hedge-nettle	AL, IN, MD, NC, SC, TN, WV. Monroe, Sevier, Blount, Cocke, Unicoi Co.	7 Records	Rich boulderfields, cove, northern hardwood, and spruce/fir forests, and clearings at high elevations.	S	G2Q
1A	Thaspium pinnatifidum	Cutleaved meadow parsnip	AL, GA, KY, NC, OH, TN, VA. Greene, Cocke, Hamilton	1 Record	Forests and woodlands over calcareous rock	S	G3?
1A	Thermopsis mollis var. fraxinifolia	Ashleaf goldenbanner	Mountains of GA, NC, SC, TN; AL. Polk, Monroe, Blount, Greene Co.	28 Records	Openings and ridges in dry woodlands. Often on road banks.	S	G4? T3?
1A	Trillium rugelii	Southern nodding trillium	Mtns & Piedmont of AL, GA, NC, SC, TN. Carter, Cocke, Unicoi, Washington, Polk, Blount, Sevier Co.	6 Records	Rich forests and coves often over mafic or calcareous substrates.	S	G3
1A	Trillium simile	Sweet white trillium	Mountains of GA, NC, SC, TN. Polk, Monroe, Sevier, Blount, Cocke Co.	Several Records, not in database.	Rich soils of slopes or coves over mafic or calcareous rock.	S	G3
1A	Tsuga caroliniana	Carolina hemlock	Mountains of GA, NC, SC, TN, VA. Carter, Johnson, Sullivan, Unicoi, Washington	51 Records	Ridge tops, rocky bluffs and open forests. Generally dry conditions.	S	G3

*PRC = Project Review Code; to get the appropriate code for each species use the Project Review Code Key.

*Co. = Counties from which the species is currently known. Does not represent potential occurrence. Counties of occurrence for vascular plants obtained from University of TN Plant Atlas, online version, 4/04.

Range abbreviations for major watersheds on the Cherokee NF: C = Conasauga, O = Ocoee, H = Hiwassee, LT = Little Tennessee, P = Pigeon, FB = French Broad, N = Nolichucky, W = Watauga, and SH = South Holton.

Forest Occurrence Data is based upon currently known records. It is NOT necessarily reflective of potential occurrence, especially for plants.

Habitat Information is only a summary. For a more thorough discussion on species, refer to the individual species write-ups that have been provided.
For streams the following definitions apply:

Orders	**Gradients**	**Elevations**
small 3, 4	low <=2%	low<=1200'
medium 5, 6, 7	moderate>2% - <=4%	high>1200'
large 8, 9	high>4%	

Attachment B

Project Review Codes (PRC) for each TES Species

1a = The project is located out of the species known range, or suitable habitat does not exist in the project area.

2a = All requisite habitat has been identified and excluded from disturbance associated with the project. Therefore, the project is expected to have no effects regardless of the number and location of individuals in the area affected by the project.

3a = The project is being implemented for the benefit of the species, and is expected to have totally beneficial effects regardless of the number and location of individuals in the area affected by the project.

4a = It is assumed that the species is present. Additional information on the number and location of individuals is not needed to improve the design and/or application of mitigation to reduce adverse effects, or to allow a better assessment of effects to viability of the population.

5a = The species is already covered by a current site-specific inventory for the project area and additional inventories are not needed.

6a = Inventory methods are not technically or biologically feasible and effective for providing substantial information on the number and location of individuals. It is assumed that the species is present.

7a = A site-specific inventory was conducted, but the species was not found in the project area.

7b = A site-specific inventory was conducted, and the species was found in the project area.