#### **BIOLOGICAL EVALUATION REPORT**

#### FOR THE

#### US 70 HAVELOCK BYPASS (R-1015)

## CROATAN RANGER DISTRICT CROATAN NATIONAL FOREST

## CRAVEN AND CARTERET COUNTIES

#### NORTH CAROLINA

March 30, 2015

Contact Person: Mary Frazer North Carolina Department of Transportation Natural Environment Section Biological Surveys Group

> 1598 Mail Service Center Raleigh, NC 27699 919.707.6119 mefrazer@ncdot.gov



# **Table of Contents**

1.0 INTRODUCTION	1
1.1 Project Area	1
1.2 Habitat Evaluation	2
2.0 SPECIES CONSIDERED AND EVALUATED	3
3.0 SITE SURVEYS AND DISCUSSION OF POTENTIAL EFFECTS	3
3.1 Site Surveys	3
3.1.1 Survey of Potential Habitat for Rare Species	3
3.1.2 Surveys for Non-native Invasive Plant Species	5
3.2 Plant Species	6
3.3 Summary of Plant Species	32
3.4 Terrestrial and Aquatic Animal Species	33
3.4.1 Mammals	35
3.4.2 Birds	38
3.4.3 Reptiles and Amphibians	41
3.4.4 Insects	43
3.4.5 Freshwater Fish, Mollusks, and Crustaceans	49
3.5 Summary of Terrestrial and Aquatic Animal Species	50
4.0 DETERMINATION OF EFFECT	51
5.0 MITIGATION MEASURES	53
5.1 Mitigation Measures to Minimize Indirect Impacts	53
5.2 Mitigation through Increasing Number of Occurrences under Protection	54
5.2.1 Croatan Mitigation Bank	54
5.2.2 Documentation of New Occurrences on NFS Lands	55
5.2.3 Seed Collection	56
6.0 TRIBAL COORDINATION WITH TUSCARORA NATION	56
7.0 LIST OF PREPARERS	56

# List of Appendices

Appendix A.	Habitat Descriptions		
Appendix B.	USFS Rare Plant Species on the Croatan National Forest		
Appendix C.	USFS Rare Animal Species on the Croatan National Forest		
Appendix D.	Summary of USFS Rare Species Documented in the Evaluation Area		
Appendix E.	Tuscarora Nation Tribal Coordination Letter		
Appendix F.	Figures		
Figure	1. Project Location		
Figure	2. Terrestrial Communities Map		

- U.S. Forest Service Rare Species Croatan Mitigation Bank (CMB) USFS Rare Species

Figure 2. Figure 3. Figure 4. Appendix G. At Attachments

# List of Attachments

December 2005	Havelock Bypass Environmental Survey – Nocturnal Lepidoptera
December 2005	Survey and Assessment for PETS (Animal) Species, Havelock Bypass, R-1015
May 2006	Results of Bat Surveys Conducted in the Vicinity of the Proposed Havelock Bypass
May 2008	Preliminary Habitat and PETS Species Evaluation for the Croatan Wetland Mitigation Bank
June 2009	2008 USFS PETS Species Surveys and Mitigative Measures Evaluation for the US 70 Havelock Bypass on the Croatan National Forest
July 2010	US 70 Havelock Bypass (R-1015) Task Order #8 (Rough-leaved Loosestrife Survey Update)
December 2012	Summary of Evaluation for Spring-flowering Goldenrod (Solidago verna)
January 2013	Summary of Revised USFS Rare Species Surveys Evaluation
August 2013	Summary of Evaluation for Mudbank Crowngrass (Paspalum dissectum)
August 2013	Summary of Evaluation for Summer Species: LeConte's Thistle ( <i>Cirsium lecontei</i> ), Short-bristled Beaksedge ( <i>Rhynchospora breviseta</i> ), and Yellow Fringeless Orchid ( <i>Platanthera integra</i> )
October 2013	Non-native Invasive Species Analysis
November 2013	Summary of Evaluation for Bryophyte Species: Two liverworts ( <i>Lejeunea</i> bermudiana and Plagiochila ludoviciana) and Florida Peatmoss (Sphagnum cribrosum)
June 2014	Summary of Evaluation for Awned Mountain-mint (Pycnanthemum setosum)
June 2014	Herbicide Evaluation Report for the US 70 Havelock Bypass (R-1015)
	December 2005 December 2005 May 2006 May 2008 June 2009 July 2010 December 2012 January 2013 August 2013 August 2013 October 2013 November 2013 June 2014 June 2014

## **1.0 INTRODUCTION**

The North Carolina Department of Transportation (NCDOT) is proposing to construct a United States Highway 70 (US 70) Bypass around the southwest side of the City of Havelock in Craven and Carteret Counties, North Carolina (see Figure 1, Appendix F). The project is commonly referred to as the US 70 Havelock Bypass and is identified by the NCDOT as Transportation Improvement Project (TIP) Number R-1015. On 10 April 2012, the Federal Highways Administration (FHWA) and the Section 404/National Environmental Policy Act (NEPA) Merger Process Team confirmed Alternative 3 as the Least Environmentally Damaging Practicable Alternative (LEDPA) for the US 70 Havelock Bypass. The proposed US 70 Havelock Bypass would cross National Forest System (NFS) lands in the Croatan National Forest (CNF).

This Biological Evaluation (BE) assesses the potential effects to rare species on NFS lands from the proposed construction and maintenance of the US 70 Havelock Bypass by the NCDOT. There are three objectives of this BE: 1) to ensure that Forest Service approval of the proposed NCDOT actions does not contribute to loss of viability of any native or desired non-native plant or animal species; 2) to include concerns for sensitive species and locally rare species within the planning process, thereby reducing potential negative effects to these species; and 3) to ensure that activities will not cause a species to move towards federal listing.

This BE conforms with legal requirements set forth in Section 7(a)(2) of the Endangered Species Act (19 U.S.C. 1536), and the direction given in Forest Service Manual (FSM) 2671.44, 2672.41, and 2673.42. As part of the National Environmental Policy Act (NEPA) decision making process, this evaluation provides information in sufficient detail to determine how proposed actions may affect rare species. Determinations of effects on each species are based on best available information.

## 1.1 Project Area

The proposed US 70 Havelock Bypass would be an approximately 10-mile, multi-lane, mediandivided facility with full control of access (access only at interchanges) around the southwest side of the City of Havelock (Figure 1). The southern terminus would be located at existing US 70 just south of the Craven/Carteret County line. The proposed facility would divert to the west of the existing US 70 alignment just north of the county line and extend in a generally northwestwardly direction on new location to rejoin US 70 approximately 1.7 miles north of the Slocum Road intersection. A new interchange with Lake Road [State Road (SR) 1756] would be constructed approximately 1.6 miles west of existing US 70. There would be three grade separations across railroads and one grade separation over Sunset Road.

The evaluation area for this BE includes NFS lands within the study area for Alternative 3 (referred to as the Alt. 3 study area) and NFS lands within the area encompassed between the Alt. 3 study area and existing US 70.

• Boundaries for NFS lands were provided by the United States Forest Service (USFS) for use in this evaluation. Only rare species occurrences or portions of rare species occurrences on NFS lands are of concern for the viability determination for NFS lands on the CNF.

- Direct impacts are presented for the Alt. 3 study area based on the tree clearing limits (slope stake limits plus 15 feet) plus an additional 25 feet. The area of NFS lands included for direct impact consideration covers approximately 295.4 acres.
- Potential indirect impacts were evaluated for rare species occurrence areas located on NFS lands between Alt. 3 and existing US 70 based on consideration that different postproject habitat management techniques may be required by USFS for areas isolated from larger, contiguous NFS lands by the project. The area of NFS lands included for indirect impact consideration covers approximately 1,239 acres.
- Cumulative impacts are considered for identified actions on NFS lands that could also affect the rare species impacted by the US 70 Havelock Bypass. Because the USFS concern for these species is for maintaining continued viability on NFS lands in the CNF, actions off NFS lands were not considered for determining whether an action will affect the viability of these species on NFS lands. Actions proposed on NFS lands are subject to independent review by USFS to assess potential effects to the continued viability of these species on NFS lands in the CNF. The following projects on NFS lands were identified as having potential impacts to USFS rare species also present within the Alt. 3 study area and therefore having the potential to contribute to cumulative impacts:
  - NCDOT US 17 Improvements (R-2514B, C, and D); NFS lands in Jones County.
  - Duke Energy Progress (DEP) Havelock-Morehead Wildwood 115kV North Line Overhead Ground Wire Replacement project; NFS lands in Carteret and Craven Counties.
  - North Carolina Wildlife Resources Commission (NCWRC) Wildlife Habitat Improvement Project; Little Road savanna location, Craven County (project completed in 2003).
  - Atlantic and East Carolina Railroad, potential future widening from a single track to multiple tracks.
  - USFS Forest Management Projects, various actions including habitat improvements and timber thinning.
  - Craven County Waste Transfer Facility at Hickman Hill Closure; no USFS rare species were identified in association with this facility.
  - US 70 Slocum Road Cherry Point Gate Improvements (R-5516); this project will not affect NFS lands based on most current project description.

#### **1.2 Habitat Evaluation**

Habitats were visited within the Alt. 3 study area at the onset of the rare species evaluations in 2003 and 2004 for the purposes of documentation of various habitat characteristics in the field. Controlled burning is conducted by USFS throughout much of this portion of CNF and influences the communities present. Habitats differ based on soil, hydrology, and topographic changes. Nine major habitat types were identified in the evaluation area. These include Pine Flatwoods, Pine/Hardwood Forest, Streamhead Pocosin, Swamp Forest, Small Pond, Powerline Corridor, Pine Plantation, Successional/Ruderal Habitat, and Rural/Urban Modifications. Five habitat types are further divided by characteristics of hydrology or vegetation. Pine Flatwoods is the most abundant habitat type within the Alt. 3 study area and includes areas denoted as either mesic or hydric. Streamhead Pocosin is divided into tree-dominated and shrub-dominated areas based on canopy coverage. Swamp Forest has been grouped into three distinct regimes with respect to hydrologic conditions and stream characteristics: large stream, small stream, and

ponded/depressional. Powerline Corridor and Pine Plantation habitats are divided into mesic and hydric areas. One habitat type, Rural/Urban Modifications, is used to include all obvious human-maintained landscape modifications including roadsides, lawns, and other landscaped areas. Habitats sustaining regular disturbance are included under Successional/Ruderal Habitat. Detailed descriptions of the habitats present are provided in Appendix A. Vegetation community mapping is provided in Figures 2a – 2d in Appendix F.

# 2.0 SPECIES CONSIDERED AND EVALUATED

All USFS rare species that occur or could occur on the CNF were considered in this BE including: federally Proposed, Endangered, or Threatened (PET) species, Regional Forester's Sensitive (S) species, and Locally Rare (LR) species. The database of Element Occurrence (EO) records maintained by the North Carolina Natural Heritage Program (NCNHP) (as updated through January 2015), U.S. Fish and Wildlife Service (USFWS) lists of Endangered and Threatened species in the project counties, individual species Recovery Plans, records provided to or by USFS biologists, and scientific literature were reviewed to determine areas of known populations of rare species within the proposed project area. These databases and literature include survey information collected by private individuals, USFS personnel, and other federal and state agencies. Federally listed threatened and endangered species with known occurrence on the CNF include the Red-cockaded Woodpecker (*Picoides borealis*) and the Rough-leaved Loosestrife (*Lysimachia asperulaefolia*).

# 3.0 SITE SURVEYS AND DISCUSSION OF POTENTIAL EFFECTS

## 3.1 Site Surveys

## 3.1.1 Survey of Potential Habitat for Rare Species

To supplement existing information available at the onset of the evaluation for the project study area, surveys and evaluations were completed by a combination of ESI and NCDOT biologists between 2004 and 2014. Initial habitat assessments, including field evaluations for USFS rare plant species were conducted in 2003-2004 for the species listed at that time. The field surveys conducted in 2003-2004 included a floristic inventory that documented several new plant species records for the CNF. Targeted surveys for USFS listed rare plants, terrestrial wildlife, and aquatic wildlife species were undertaken in 2003-2005. Additional surveys for selected species have been undertaken in subsequent years. A summary of site surveys and evaluations undertaken by NCDOT is provided below. Copies of referenced survey reports are provided as attachments to this BE.

- 2003
  - Habitat evaluation for 1000-foot wide study corridor 3.
  - Field surveys for spring flowering USFS rare plant species for study corridor 3.
  - Habitat evaluations and field surveys for USFS rare butterfly species for study corridors 1, 2, and 3.

- 2004
  - Habitat evaluation for 1000-foot wide study corridors 1 and 2.
  - Field surveys for spring flowering USFS rare plant species for study corridors 1 and 2.
- 2005
  - Field surveys for USFS rare plant species for 1000-foot wide study corridors 1, 2, and 3.
  - Habitat evaluations and field surveys for USFS rare bird species for study corridors 1, 2, and 3 (see Attachment 2).
  - Habitat evaluations and field surveys USFS rare butterfly and moth species for study corridors 1, 2, and 3 (see Attachments 1 and 2). Additional butterfly surveys were conducted by NCNHP on CNF, mostly in savanna and powerline habitats.
  - Habitat evaluations and field surveys for USFS rare fish species for study corridors 1, 2, and 3 (see Attachment 2).
  - Habitat evaluations and field surveys for USFS rare mollusk and crustacean species for study corridors 1, 2, and 3.
  - Habitat evaluations and field surveys for USFS rare reptile and amphibian species and Eastern Woodrat (*Neotoma floridana*) for study corridors 1, 2, and 3 (see Attachment 2).
  - Habitat evaluations and field surveys for USFS rare bat surveys for study corridors 1, 2, and 3 (see Attachment 3).
- 2008/2009
  - Field surveys for select USFS rare plant species identified by the USFS within portions of the Croatan National Forest outside study corridors 1, 2, and 3.
  - Habitat evaluation and field surveys for USFS rare plant and animal species for the NCDOT Croatan Mitigation Bank (CMB), formerly known as the Croatan Wetland Mitigation Bank (see Attachment 4). Bat surveys continued annually until 2010.
  - GIS-based habitat evaluation for newly listed USFS rare plant and animal species for study corridors 1, 2, and 3 and indirect impact areas.
  - Updated direct and indirect impact analysis for USFS rare plant and animal species (see Attachment 5).
  - Field surveys for USFS rare butterfly species within portions of the CNF outside study corridors 1, 2, and 3.
- 2010
  - Field surveys for Rough-leaved Loosestrife for the Alt. 3 study area and alternatives identified within study corridors 1 and 2 (Alt.1 and Alt.2). Surveys conducted both on and off NFS lands (see Attachment 6).
  - Seed collection for Spring-flowering Goldenrod (*Solidago verna*) was undertaken at the request of the USFS for occupied sites within the Alt. 3 study area.
- 2011
  - GIS-based habitat evaluation for newly listed USFS rare plant and animal species within the Alt. 3 evaluation areas.
  - Direct and indirect impact analysis for USFS rare plant and animal species.

- Seed collection for Spring-flowering Goldenrod was undertaken at the request of the USFS for occupied sites within the Alt. 3 study area.
- 2012
  - Field surveys for select USFS rare plant species identified by the USFS within the Alt. 3 study area (see Attachments 7, 9, and 10).
  - Field surveys and evaluation of known occurrences for select USFS rare plant species identified by the USFS within portions of the CNF outside the Alt. 3 study area (see Attachments 10 and 12).
  - GIS-based habitat evaluation for newly listed USFS rare plant and animal species within the Alt. 3 evaluation area.
  - Seed collection for Spring-flowering Goldenrod was undertaken at the request of the USFS for occupied sites within the Alt. 3 study area.
- 2013
  - Updated direct and indirect impact analysis for USFS rare plant and animal species (see Attachment 8).
  - Field surveys within the Alt. 3 study area for non-native invasive species (NNIS) of plants identified as concerns for CNF by USFS (see Attachment 11).
  - Field surveys to locate new occurrences and evaluation of known occurrences for select USFS rare plant species (bryophytes) within portions of the Croatan National Forest outside the Alt. 3 evaluation area (see Attachment 12).
  - Seed collection for Spring-flowering Goldenrod and LeConte's Thistle (*Cirsium lecontei*) was undertaken at the request of the USFS for occupied sites within the Alt. 3 study area.
- 2014
  - Field survey and evaluation for Awned Mountain-mint (*Pycnanthemum setosum*), a USFS rare plant species recently documented within the Alt. 3 study area (see Attachment 13).
  - Seed collection for Spring-flowering Goldenrod, LeConte's Thistle, and Awned Mountain-mint are being undertaken at the request of the USFS for occupied sites within the Alt. 3 study area.
  - Field surveys were conducted for bats within the evaluation area by NCDOT.
  - Herbicide usage was evaluated for the control of non-native invasive plant species associated with the construction and maintenance of the US 70 Havelock Bypass Alternative 3.

#### **3.1.2** Surveys for Non-native Invasive Plant Species

In order to address a concern that construction of the proposed project could result in indirect effects to USFS rare species as the result of the introduction and/or expansion of non-native invasive species (NNIS) of plants, the Alt. 3 study area was evaluated for the presence of known infestations of NNIS and potential effects evaluated. See Attachment 11 for the complete report.

Non-native invasive plant species surveys on NFS lands in the Alt. 3 study area were conducted in September 2013 to delineate infestations of species listed by USFS as warranting management consideration. Most of the NNIS infestations occurred in areas identified as Rural/Urban Modifications habitat, with some species or occurrences also present in adjacent habitats. Nonnative invasive plant species of concern to USFS that were identified as present in the Alt. 3 study area were Sericea Lespedeza (Lespedeza cuneata), Bicolor Lespedeza (Lespedeza bicolor), Mimosa (Albizia julibrissin), Chinese Privet (Ligustrum sinense), Multiflora Rose (Rosa multiflora), Japanese Honeysuckle (Lonicera japonica), Johnson Grass (Sorghum halapense), English Ivy (Hedera helix var. helix), Chinese Wisteria (Wisteria sinensis), and Brazilian Vervain (Verbena brasiliensis).

The proposed action will construct US 70 Havelock Bypass Alt. 3 on new location across NFS lands. The areas disturbed by road construction as well as the future road shoulders and maintained right-of-way (ROW) of the completed project could serve as potential areas for spread of NNIS on NFS lands. Without intervention, these NNIS are expected to increase in some portions of the evaluation area. It is expected that with no control efforts along the existing road shoulders and other existing disturbed habitats the infestations will continue to spread within these areas and potentially into adjacent natural areas.

## 3.2 Plant Species

There are 107 plant species on the most recent (October 2013) list of rare plant species maintained by the USFS for the CNF. Of these 107 rare plant species, 35 species were dropped from further consideration because no suitable habitat is present within or in close proximity to the evaluation area. The species dropped from further consideration due to absence of suitable habitats are summarized below by habitat types.

No Maritime Forests or Ocean Beaches were identified in the evaluation area. No CNF-listed federally Endangered, Threatened, or Proposed plant species are restricted to these habitats and none were eliminated from further consideration due to the lack of these habitats within the evaluation area. The following Sensitive plant species were eliminated from further consideration due to a lack of these habitats within the evaluation area: a Liverwort (*Lejeunea dimorphophylla*), a Liverwort (*Metzgeria unicigera*), Large-seed Pellitory (*Parietaria praetermissa*), Coastal Goldenrod (*Solidago villosicarpa*), and Sunrise Lichen (*Teloschistes flavicans*). The following Locally Rare plant species were eliminated from further consideration due to a lack of these habitats within the evaluation area: Spreading Sandwort (*Arenaria lanuginosa* var. *lanuginosa*) and Coastal Virgin's-bower (*Clematis catesbyana*).

No Tidal Swamps or Freshwater/Brackish Marshes were identified in the evaluation area. The following federally Endangered, Threatened, or Proposed plant species was eliminated from further consideration due to the lack of these habitats: Sensitive Jointvetch (*Aeschynome virginica*). The following Sensitive plant species were eliminated from further consideration due to a lack of these habitats: Long's Bittercress (*Cardamine longii*), a Liverwort (*Frullania donnellii*), and Godfrey's Sandwort (*Minuartia godfreyi*). The following Locally Rare plant species were eliminated from further consideration due to a lack of these habitats: Twig-rush (*Cladium mariscoides*), Littlespike Spikerush (*Eleocharis parvula*), Beaked Spikerush (*Eleocharis rostellata*), Terrell Grass (*Elymus virginicus* var. *halophilus*), and Winged Seedbox (*Ludwigia alata*).

No marl outcrops, other habitats with exposed marl, or Basic Mesic Forest were identified in the evaluation area. No CNF-listed federally Endangered, Threatened, or Proposed plant species are restricted to these habitats and none were eliminated from further consideration due to the lack of

these habitats within the evaluation area. The following Sensitive plant species were eliminated from further consideration due to a lack of these habitats within the evaluation area: Carolina Spleenwort (*Asplenium heteroresiliens*), a Liverwort (*Cylindrocolea rhizantha*), Quillwort (*Isoetes microvela*), and Piedmont Meadowrue (*Thalictrum macrostylum*). The following Locally Rare plant species were eliminated from further consideration due to a lack of these habitats within the evaluation area: Tennessee Bladder-fern (*Cystopteris tennesseensis*) and Bluff Oak (*Quercus austrina*).

No Cypress Savannas, Carolina Bays, or Limesink Ponds were identified in the evaluation area. No CNF-listed federally Endangered, Threatened, or Proposed plant species are restricted to these habitats and none were eliminated from further consideration due to the lack of these habitats within the evaluation area. The following Sensitive plant species were eliminated from further consideration due to a lack of these habitats within the evaluation area: Hirst's Panic Grass (*Dichanthelium hirstii*), Loose Watermilfoil (*Myriophyllum laxum*), Awned Meadowbeauty (*Rhexia aristosa*), Coastal Beaksedge (*Rhynchospora pleiantha*), and Chapman's Arrowhead (*Sagittaria chapmanii*). The following Locally Rare plant species were eliminated from further consideration due to a lack of these habitats within the evaluation area: Robbin's Spikerush (*Eleocharis robbinsii*), Flaxleaf Seedbox (*Ludwigia linifolia*), Northern White Beaksedge (*Rhynchospora alba*), Harper's Beaksedge (*Rhynchospora harperi*), Southern Beaksedge (*Rhynchospora microcarpa*), and Dwarf Bladderwort (*Utricularia olivacea*).

No Sandhills or Pine Barrens habitat was identified in the evaluation area. No CNF-listed federally Endangered, Threatened, or Proposed plant species are restricted to these habitats and none were eliminated from further consideration due to the lack of these habitats within the evaluation area. The following Sensitive plant species was eliminated from further consideration due to a lack of these habitats within the evaluation area: Southern Bogbutton (*Lachnocaulon beyrichianum*). The following Locally Rare plant species was eliminated from further consideration due to a lack of these habitats within the evaluation area: Showy Aster (*Eurybia spectabilis*).

Potentially suitable habitat or previously reported NCNHP or USFS records were identified in the evaluation area for 72 USFS rare plant species as noted in the table in Appendix B. The field surveys conducted in 2003-2004 included a floristic inventory that documented several new plant species records for the CNF. Additional surveys have been undertaken in subsequent years for selected species. Surveys conducted from 2003-2014 in combination with records available from NCNHP and the USFS resulted in documentation or confirmation of the presence within the evaluation area of 21 USFS rare plant species currently on the USFS rare plant list for the CNF. The botanical surveys did not identify the presence of 51 of the USFS rare plant species currently on the USFS rare plant list for which potential habitat had been identified in the Alt. 3 study area. Site survey results and/or NCNHP/USFS records for USFS rare plant species are presented on Figures 3a – 3d in Appendix F.

A summary of the evaluation for all 72 species with potentially suitable habitat identified or previously reported NCNHP records within the evaluation area is presented below.

- **Branched Gerardia** (*Agalinis virgata*) (LR) is found in savanna and depression pond habitats. Potentially suitable habitat was identified in the evaluation area. No Branched Gerardia plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 3.4 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Branched Gerardia.
- **Tall Bentgrass** (*Agrostis altissima*) (LR) is found in wet savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Tall Bentgrass plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 11 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Tall Bentgrass.
- **Bog Bluestem** (*Andropogon mohrii*) (LR) is found in wet savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Bog Bluestem plants were observed within the Alt. 3 study area; however, one occurrence of this species has been documented in powerline corridor habitat located within the area being considered for indirect impacts in the evaluation area (Figure 3b). Including this occurrence, there are six known occurrences of Bog Bluestem on NFS lands in the CNF.

Based on the apparent absence of this species in the Alt. 3 study area, there will be no direct impacts. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands. With implementation of the mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it is determined that the proposed project will have no impact on Bog Bluestem. Cumulative impacts identified consisted of the Duke Energy Progress (DEP) overhead ground wire (also known as static wire) replacement project, which may impact individuals of this species, but was determined to not likely result in viability concerns across the CNF.

- **Ovateleaf Cacalia** (*Arnoglossum ovatum*) (LR) is found in wet savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Ovateleaf Cacalia plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 33 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Ovateleaf Cacalia.
- **Stalked Milkwort** (*Asclepias pedicellata*) (LR) is found in dry savanna and moist flatwood habitats. Potentially suitable habitat was identified in the evaluation area. No Stalked Milkweed plants were observed within the evaluation area during site surveys.

The nearest known occurrence is approximately 5 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Stalked Milkweed.

- **Many-flower Grass Pink** (*Calopogon multiflorus*) (S) is found in savanna and sandhill habitats. Potentially suitable habitat was identified in the evaluation area. No Many-flowered Grass Pink plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 7 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Many-flowered Grass Pink.
- Savanna Campylopus (*Campylopus carolinae*) (S) is a moss found in savanna habitats. The nearest known occurrence is approximately 29 miles from the Alt. 3 study area. Potentially suitable habitat was identified in the evaluation area. No Savanna Campylopus plants were observed within the evaluation area during site surveys. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Savanna Campylopus.
- Widow Sedge (*Carex basiantha*) (LR) is found in mesic forests, bottomland, and lower slope habitats over calcareous rocks and sediments. Potentially suitable habitat was identified in the evaluation area. No Widow Sedge plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 12 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Widow Sedge.
- Calcium-fleeing Sedge (*Carex calcifugens*) (LR) is found in rich bluff forest and evergreen maritime forest habitats. Potentially suitable habitat was identified in the evaluation area. No Calcium-fleeing Sedge plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 18 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Calcium-fleeing Sedge.
- Emmon's Sedge (*Carex emmonsii*) (LR) is found in dry, sandy woodland habitats. Potentially suitable habitat was identified in the evaluation area. No Emmon's Sedge plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 12 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Emmon's Sedge.
- **Hop-like Sedge** (*Carex lupuliformis*) (LR) is found in wet forest, swamp, and riverbank habitats, and around ponds. Potentially suitable habitat was identified in the evaluation area. No Hop-like Sedge plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 12 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Hop-like Sedge.

- LeConte's Thistle (*Cirsium lecontei*) (LR) is found in savanna habitats. Potentially suitable habitat was identified in the evaluation area. Recent surveys completed since 2004 including surveys completed in 2012 by ESI within all known Element Occurrences (EOs) (see Attachment 10) on the CNF and surveys completed in 2013 and 2014 in five of the seven known EOs (Biotics GIS Database 2015) on the CNF confirmed the presence of LeConte's Thistle in seven EOs (12, 17, 24, 26, 27, 29, and 32). These seven areas collectively had at least 307 plants dispersed across 24.8 acres of occupied or potentially occupied habitat documented on NFS lands in the CNF.
  - Alt. 3 directly affects EO 26 (Figure 3c) and EO 29 (Figure 3a). EO 26 is composed of two discrete sites that are dispersed across 8.5 acres; one site will not be affected but approximately 1.7 acres of the other site will be directly affected. Individual LeConte's Thistle plants observed within this affected site occur to the north and south of the area to be directly impacted but no plants were observed within the direct impact area. EO 29 is composed of three discrete sites that in total were dispersed across 0.2 acre and Alt. 3 will impact the EO in its entirety. A total of 31 individuals of this species were observed in 2005.
  - An additional 13.4 acres of reported occurrence are in areas subject to indirect impact consideration for Alt. 3 including an additional 6.0 acres of EO 26 (Figure 3c). The entire 5.9 acres of EO 24 are in an area subject to indirect impact consideration (Figure 3b). The 2013 survey documented more than 50 individual plants in the area of EO 26 that may be subject to indirect impacts and 121 individual plants in the area of EO 26 that may be subject to indirect impacts (Biotics GIS Database 2015). These individual plants were observed within the powerline ROW which is currently being managed by a combination of mowing by the utility company operating the lines within the ROW and periodic prescribed burns conducted by the USFS. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued.

The US 70 Havelock Bypass (R-1015) Alt. 3 will result in unavoidable direct impacts to LeConte's Thistle habitat and has the potential for indirect impacts. Alt. 3 directly affects approximately 1.9 acres of two mapped LeConte's Thistle EOs containing an estimated 31 individual plants. An additional 13.4 acres and more than 171 individual plants observed during the 2013 survey are located in areas subject to indirect impact consideration. The area subject to consideration for indirect impacts represents a relatively large percentage of the population and areal extent of LeConte's Thistle recently documented as extant or potentially extant on NFS lands in the CNF. These three populations with either indirect or direct impacts represent the three highest quality LeConte's thistle populations documented in the CNF. The project is not expected to result in changes that would prevent the utility company from continued mowing to maintain the powerline ROW.

Mitigation measures are needed to reduce the threat for a loss of viability for LeConte's Thistle on NFS lands in within the CNF. Implementation of mitigation measures agreed

to between NCDOT and USFS, such as temporarily closing the bypass to allow for prescribed burns, and implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands would minimize viability concerns resulting from indirect impacts. In addition, NCDOT has agreed to collect seeds from viable EOs for use in supplementing existing EOs where suitable habitat occurs but numbers of individuals are low or individuals have not been recently documented. Seed collection was initiated for Leconte's Thistle in 2013.

The proposed project may impact individuals of LeConte's Thistle, but with implementation of these mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for LeConte's Thistle on NFS lands in the CNF.

Cumulative impacts identified consisted of the DEP overhead ground wire replacement project, which may impact individuals of this species, but was determined to not likely result in viability concerns across the CNF. No cumulative impacts from other USFS or NCDOT projects on NFS lands on the CNF have been identified.

• Small Coastal Spreading Pogonia (*Cleistesiopsis oricamporum*) (S), formerly known as *Cleistes bifaria* which was recently split into two separate taxa, is found in savannas and dry meadow habitats. Potentially suitable habitat was identified in the evaluation area. One occurrence of Small Coastal Spreading Pogonia is present within the Alt. 3 study area (Figure 3a) and two additional occurrences are present in the area being considered for potential indirect effects (Figure 3b-3c). Including these three occurrences, there are seven known occurrences of Small Coastal Spreading Pogonia on NFS lands in the CNF.

One occurrence of this species has direct impacts. The two occurrences in the indirect impact area are located in fire-maintained habitats. The ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands. The proposed project may impact individuals of Small Coastal Spreading Pogonia, but with implementation of these mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Small Coastal Spreading Pogonia on NFS lands in the CNF. Cumulative impacts identified consisted of the DEP overhead ground wire replacement project, which may impact individuals of this species, but was determined to not likely result in viability concerns across the CNF.

• **Spring Coral-root** (*Corallorhiza wisteriana*) (LR) is found in moist forest habitats. Potentially suitable habitat was identified in the evaluation area. No Spring Coral-root plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 19 miles from the Alt. 3 study area. Based on apparent

absence of this species, it is determined that the proposed project will have no impact on Spring Coral-root.

- **Beadle's Coreopsis** (*Coreopsis helianthoides*) (LR) is found in swamp forest, swamp edge, and bog habitats. Potentially suitable habitat was identified in the evaluation area. No Beadle's Coreopsis plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 13 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Beadle's Coreopsis.
- **Carolina Sunrose** (*Crocanthemum carolinianum*) (LR) is found in sandhill, pineland, and dry savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Carolina Sunrose plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 9 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Carolina Sunrose.
- **Spindle-fruited Witch Grass** (*Dichanthelium fusiforme*) (LR) is found in dry to moist sand of open pine and pine/oak wood habitats and clearings. Potentially suitable habitat was identified in the evaluation area. No Spindle-fruited Witch Grass plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 19 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Spindle-fruited Witch Grass.
- **Hidden-flowered Witch Grass** (*Dichanthelium* sp. 9) (LR) is found in pocosin, wet meadow, and ditchline habitats. Potentially suitable habitat was identified in the evaluation area. No Hidden-flowered Witch Grass plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 10 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Hidden-flowered Witch Grass.
- Eaton's Witch Grass (*Dichanthelium spretum*) (LR) is found in wet sand, peaty bog, and savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Eaton's Witch Grass plants were observed within the Alt. 3 study area, however, one occurrence of this species is present in a powerline ROW located within the area being considered for indirect impacts in the evaluation area (Figure 3b). Including this occurrence there are two known occurrences of Eaton's Witch Grass on NFS lands in the CNF.

Based on the apparent absence of this species in the Alt. 3 study area, there will be no direct impacts. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result

from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands. With implementation of these mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it is determined that the proposed project will have no impact on Eaton's Witch-grass.

- Venus Flytrap (*Dionaea muscipula*) (S) is found in savanna, seepage bog, and pocosin edge habitats with little competition. Potentially suitable habitat was identified in the evaluation area. No Venus Flytrap plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 4.5 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Venus Flytrap.
- Seven-angled Pipewort (*Eriocaulon aquaticum*) (LR) is found in pond and lake habitats. Potentially suitable habitat was identified in the evaluation area. No Seven-angled Pipewort plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 2.7 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Seven-angled Pipewort.
- Hall's Pocket Moss (*Fissidens hallii*) (S) is found on wet soil or bark of tree bases in cypress-gum swamp habitat and also on rotting logs and stumps. Potentially suitable habitat was identified in the evaluation area. No Hall's Pocket Moss plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 12 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Hall's Pocket Moss.
- **Comfortroot** (*Hibiscus aculeatus*) (LR) is found in pine savanna habitats and dry sandy or loamy soils of maritime forest edges. Potentially suitable habitat was identified in the evaluation area. No Comfortroot plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 4 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Comfortroot.
- **Catchfly Cutgrass** (*Leersia lenticularis*) (LR) is found in floodplain forest and swamp habitats. Potentially suitable habitat was identified in the evaluation area. No Catchfly Cutgrass plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 16 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Catchfly Cutgrass.
- A liverwort (*Lejeunea bermudiana*) (LR) is found on the bark on trees along the edges of swamp habitats. Potentially suitable habitat was identified in the evaluation area.

*Lejeunea bermudiana* has been confirmed as present in seven watersheds on NFS lands in the CNF during surveys conducted in 2012 and 2013 (see Attachment 12). Alternative 3 directly affects two watersheds that include EOs for this species.

- Within the Tucker Creek watershed, Alternative 3 directly affects EO 8 in its entirety, including the new confirmed sample locations documented in 2013 (Figure 3d). The occurrences in this watershed have been impacted by recent forest management activities (thinning) resulting in increased light penetration, but because the Havelock Bypass project would result in presumed loss of this population, the forest management activities would not contribute to significant adverse cumulative effects.
- Within the Southwest Prong Slocum Creek watershed, Alternative 3 directly affects a portion of the population (Figure 3b). The portion of the population represented by EO 4 could be directly affected by removal of one tree with confirmed occurrence, as well as other trees not sampled within the ROW clearing limits that could potentially harbor this species. The documented distribution of this species within this watershed extends approximately 3,000 feet upstream and 3,400 feet downstream of the potential impact to EO 4 associated with Alt. 3; however, the distribution of this species within this watershed is limited to suitable trees in appropriate hydrologic zones and is likely discontinuous. The portions of the population within this watershed represented by EOs 5 and 6 are not directly affected. Direct impacts from the proposed project could result in loss of a portion of this population, but is not expected to result in a complete loss of the population in the Southwest Prong Slocum Creek watershed.
- Within the Southwest Prong Slocum Creek watershed, Alternative 3 may result in indirect effects to a portion of the population (Figure 3b). Indirect effects from clearing of forest canopy in the ROW may be expected to extend up to 250 feet outside the ROW, which could result in effects to additional occupied habitat within the portion of the population represented by EO 4, including the two new confirmed sample locations documented in 2012. The portions of the population represented by EOs 5 and 6 are outside the zone considered for potential indirect effects from increased light penetration.

The US 70 Havelock Bypass (R-1015) Alternative 3 will result in unavoidable direct impacts to *Lejeunea bermudiana* and additional areas occupied by *L. bermudiana* are subject to consideration for indirect impacts. The direct impacts for Alternative 3 may lead to a loss of the population in Tucker Creek and a portion of the population in Southwest Prong Slocum Creek.

Because the loss of one of two populations and partial loss of the second population known prior to 2012 on NFS lands in the CNF resulting from the US 70 Havelock Bypass project could lead to viability concerns, mitigation measures were required to reduce the threat for a loss of viability for *Lejeunea bermudiana* on NFS lands in the CNF. Because this species is cryptic and not widely studied or easily documented, the identification of new populations of this species in secure locations elsewhere on NFS lands is considered by the USFS to be an important mitigation measure. Five new populations of *L*.

*bermudiana* have been identified in 2012-2013 on behalf of USFS by NCDOT on NFS lands in the CNF. These newly discovered occurrences are located in stream systems well outside the area affected by the US 70 Havelock Bypass project (see Attachment 12 for details).

Implementation of additional mitigation measures agreed to between NCDOT and USFS, including implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, particularly for Chinese Privet, would minimize potential for loss of the remaining portion of the Southwest Prong Slocum Creek from indirect impacts.

With the identification of five new populations by NCDOT on NFS lands in the CNF in watersheds not subject to effects by the US 70 Havelock Bypass project and the implementation of the additional mitigation measures to minimize potential for indirect effects to the remaining portion of the population in Southwest Prong Slocum Creek, the US 70 Havelock Bypass (R-1015) Alternative 3 project may result in loss of one population (Tucker Creek) and partial loss of one population (Southwest Prong Slocum Creek), but is not likely to cause a loss of viability for *Lejeunea bermudiana* on NFS lands in the CNF.

- **Pondspice** (*Litsea aestivalis*) (S) is found on the margins of limesink ponds and Carolina bays. Potentially suitable habitat was identified in the evaluation area. No Pondspice plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 4 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Pondspice.
- **Boykin's Lobelia** (*Lobelia boykinii*) (S) is found in cypress pond and depression meadow habitats. Potentially suitable habitat was identified in the evaluation area. No Boykin's Lobelia plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 21 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Boykin's Lobelia.
- **Raven's Seedbox** (*Ludwigia ravenii*) (S) is found in savanna, swamp, marsh, and wet open area habitats. Potentially suitable habitat was identified in the evaluation area. No Raven's Seedbox plants were observed within the evaluation area during site surveys. The nearest known occurrence is an historic occurrence documented approximately 0.6 mile from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Raven's Seedbox.
- **Globe-fruit seedbox** (*Ludwigia sphaerocarpa*) (LR) is found in boggy areas, pools, ditches, river marshes, interdune swales, and pond shores. Potentially suitable habitat was identified in the evaluation area. No Globe-fruit Seedbox plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 4.7 miles from the Alt. 3 study area. Based on apparent absence of this

species, it is determined that the proposed project will have no impact on Globe-fruit Seedbox.

- Rough-leaved Loosestrife (*Lysimachia asperulaefolia*) (E) is a federally Endangered species found in pocosin/savanna ecotone habitat. Potentially suitable habitat was identified in the evaluation area. Surveys targeting Rough-leaved Loosestrife were conducted for NFS lands in July 2004 and again for the entire project study area (NFS lands as well as non-NFS lands) in June 2010. No rough-leaved loosestrife plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 4.5 miles from the Alt. 3 study area. This location off Little Road in a Carolina Vegetation Survey (CVS) plot was recorded in 1991 and not updated since that initial survey. Gary Kauffman relocated the CVS plot and searched for Rough-leaved Loosestrife in 2010 and 2011. No individuals were located nor did the habitat appear as clearly defined as other occupied sites in the southern portion of the CNF. Based on the absence of individuals and potentially suitable habitat in the previously documented occurrence in the CVS plot in Craven County, and the apparent absence of this species based on surveys in the Alt. 3 study area in 2004 and 2010, it is determined that the proposed project will have No Effect to Rough-leaved Loosestrife.
- Loomis's Loosestrife (Lysimachia loomisii) (S) is found in moist to wet savanna and pocosin ecotone habitats. Potentially suitable habitat was identified in the evaluation area. This species is not tracked by NCNHP. This species is considered to be secure on the CNF with more than 50 known occurrences (personal communication, Gary Kauffman, USFS). Loomis's loosestrife has been recommended to be removed from USFS Region 8 Sensitive plant list. This list is scheduled to be updated in 2015. Incidental observations of this species within the Powerline Corridors, wet Pine Flatwoods, and open areas within the Streamhead Pocosins during the 2003-2004 field surveys indicate that this species is relatively common and is presumed present in suitable habitat within the Alt. 3 study area and the areas being considered for potential indirect effects.

This species was observed in areas with direct impacts. The occurrences in the indirect impact area are located in fire-maintained habitats. The ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands. The proposed project may impact individuals of Loomis's Loosestrife, but with implementation of these mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Loomis's Loosestrife on NFS lands in the CNF. In addition, surveys on the CMB identified several occurrences of this species on the property. Contingent upon USFS release of ROW for the Havelock Bypass, the transfer of the CMB property to USFS would provide an additional mitigation measure by adding these occurrences to NFS lands on the CNF.

Cumulative impacts identified consisted of the DEP overhead ground wire replacement project, which may impact individuals of this species, but was determined to not likely result in viability concerns across the CNF.

- **Carolina Birds-in-a-nest** (*Macbridea caroliniana*) (S) is found in blackwater swamp and savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Carolina Birds-in-a-nest plants were observed within the evaluation area during site surveys. The nearest known occurrence is located in Pender County. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Carolina Birds-in-a-nest.
- Florida Adder's Mouth (*Malaxis spicata*) (LR) is found in maritime swamp forest habitats, and in calcareous but mucky swamp, spring-fed swamp, and wet hammock habitats. Potentially suitable habitat was identified in the evaluation area. No Florida Adder's Mouth plants were observed within the Alt. 3 study area. However, one occurrence of this species is present in the area being considered for indirect impacts in the evaluation area, in the vicinity of Southwest Prong Slocum Creek (Figure 3b). The occurrence in the vicinity of Southwest Prong Slocum Creek is located in a swamp forest greater than 250 feet from the Alt. 3 study area. Including this occurrence, there are six known occurrences of Florida Adder's Mouth on NFS lands in the CNF.

Based on the apparent absence of this species in the Alt. 3 study area, there will be no direct impacts. No changes in management to the swamp forest habitat are expected to result from project implementation, reducing concerns for indirect impacts. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands. With implementation of these mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it is determined that the proposed project will have no impact on Florida Adder's Mouth.

- Narrowleaf Cowlily (*Nuphar sagittifolia*) (S) is found in blackwater streams, rivers, and lakes in swift, sluggish, or stagnant water, extending downstream into freshwater tidal areas. Potentially suitable habitat was identified in the evaluation area. No Narrowleaf Cowlily plants were observed within the evaluation area during site surveys. The nearest known occurrence is located in Jones County. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Narrowleaf Cowlily.
- Shortleaf Basket Grass (*Oplismenus hirtellus* spp. *setarius*) (LR) is found in hammocks, maritime forests, shell middens, and moist forest habitats. Potentially suitable habitat was identified in the evaluation area. No Shortleaf Basket Grass plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 12 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Shortleaf Basket Grass.

Piedmont Cowbane (Oxypolis ternata) (S), formerly referred to as Oxypolis denticulata, • is found in pine savannas and sandhill seeps. Potentially suitable habitat was identified in the evaluation area. Two occurrences of Piedmont Cowbane were identified within the Alt. 3 study area (Figure 3c) and two additional occurrences identified as present in the area being considered for potential indirect effects (Figure 3b). The NC Natural Heritage Program (NCNHP) previously tracked this species but found the species to be so common it was downgraded to the watch list in the mid 1990's (Misty Franklin, former NCNHP botanist, personal communication 2010). It has been documented within 17 NC counties including all three containing the CNF (Gadd and Finnegan 2012). The species has recently been dropped from the NC watch list (Gadd and Finnegan 2012). It is unknown how many records of this species occur in the CNF but it is not inconceivable 40-50 separate sites occur (personal communication, Gary Kauffman). For these reasons the species has been recommended to be removed from USFS Region 8 Sensitive plant list. This list is scheduled to be updated in 2015.

Two occurrences of this species are subject to direct impacts. The occurrences in the indirect impact area are located in fire-maintained habitats. The ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands. The proposed project may impact individuals of Piedmont Cowbane, but with implementation of these mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Piedmont Cowbane on NFS lands in the CNF. Cumulative impacts identified consisted of the DEP overhead ground wire replacement project, which may impact individuals of this species, but was determined to not likely result in viability concerns across the CNF.

- **Carolina Grass-of-parnassus** (*Parnassia caroliniana*) (S) is found in wet pine or cypress savanna (typically shallowly underlain by coquina limestone) and sandhill seepage bog habitats. Potentially suitable habitat was identified in the evaluation area. No Carolina Grass-of-parnassus plants were observed within the evaluation area during site surveys. The nearest known occurrence is located near the Onslow/Pender County border. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Carolina Grass-of-parnassus.
- **Mudbank Crown Grass** (*Paspalum dissectum*) (LR) is found on mudbank, open wet area, and wet ditch habitats. Potentially suitable habitat was identified in the evaluation area. This evaluation indicated that Mudbank Crown Grass is present in four discrete sites delineated on NFS lands, including one that is mostly on private lands and marginally extends onto NFS lands as depicted on Figure 3c (see also Attachment 9 for detailed assessment). A total of 1,079 individual Mudbank Crown Grass plants were estimated as present on NFS lands during the 2012 survey within these sites. These four

sites collectively cover 5.9 acres of occupied habitat documented on NFS lands in the CNF.

- Alt. 3 directly affects EO 7. EO 7 consists of two sites that total 3.9 acres. Alt. 3 will directly impact approximately 1.7 acres of the total 1.9 acres within the site identified as 7a of this EO. All seven culms observed within Site 7a are in the area that will be directly impacted. Alt. 3 avoids direct impacts to the other 1,072 estimated culms in the site identified as 7b within this EO.
- Approximately 4.2 acres of occupied habitat on NFS lands are in areas subject to indirect impact consideration for Alt. 3 including an additional 2.2 acres of EO 7. This includes Sites 7b (part of EO 7) and EO 12 in their entirety, and approximately 7% of EO 13. The 2012 survey estimated that approximately 1,072 culms are present on NFS lands that may be subject to indirect impacts. These culms were observed within the powerline ROW which is currently being managed by a combination of mowing by the utility company operating the lines within the ROW and periodic prescribed burns conducted by the USFS.

The US 70 Havelock Bypass (R-1015) Alt. 3 will result in unavoidable direct impacts to Mudbank Crown Grass and has the potential for indirect impacts. Alt. 3 directly affects approximately 1.7 acres and 7 culms of Mudbank Crown Grass identified within one occupied habitat site. An additional 4.2 acres and 1,072 culms estimated during the 2012 survey are located on NFS lands in areas subject to indirect impact consideration. Cumulative impacts identified for this species consisted of the DEP overhead ground wire replacement project, which may impact individuals of this species, but was determined to not likely result in viability concerns across the CNF. No additional cumulative impacts from other USFS or NCDOT projects on NFS lands on the CNF have been identified.

Based on the limited direct impact to this species for Alt. 3, the direct impacts are not likely to result in a loss of viability on NFS lands within the CNF. The area subject to consideration for indirect impacts represents the remainder of the population and areal extent of Mudbank Crown Grass known to occur on NFS lands in the CNF. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands.

The proposed project may impact individuals of Mudbank Crown Grass, but with implementation of these mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Mudbank Crown Grass on NFS lands in the CNF.

- Spoonflower (*Peltandra sagittifolia*) (LR) is found in pocosins and other wet peat dominated sites. Potentially suitable habitat was identified in the evaluation area. No Spoonflower plants were observed within the evaluation area during site surveys. The nearest known occurrence of Spoonflower is approximately 5 miles from the Alt. 3 study area. Based on the apparent absence of this species, it is determined that the proposed project will have no impact on Spoonflower.
- Hairy Smartweed (*Persicaria hirsuta*) (LR) is found in limesink pond, clay-lined Carolina bay, and blackwater stream edge habitats. Potentially suitable habitat was identified in the evaluation area. No Hairy Smartweed plants were observed within the evaluation area during site surveys. The nearest known occurrence is from a beaver impoundment within a powerline ROW located on Southwest Prong Slocum Creek approximately 400 feet west of the Alt. 3 study area (Figure 3b). Based on apparent absence of this species, it is determined that the proposed project will have no impact on Hairy Smartweed.
- **Small Butterwort** (*Pinguicula pumila*) (LR) is found in savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Small Butterwort plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 5 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Small Butterwort.
- A Liverwort (*Plagiochila ludoviciana*) (LR) is found on bark or moist rock in swamp habitats and mountain gorges. *Plagiochila ludoviciana* has been documented from three watersheds on NFS lands within the CNF during surveys conducted in 2012 and 2013 (see Attachment 12). In each watershed it was found in similar habitat and often on the same trees documented as having *Lejeunea bermudiana* present. Within the Tucker Creek watershed, Alt. 3 directly affects the known occurrence in its entirety (Figure 3d). This occurrence is located on a tree that has been damaged by a recent lightning strike and is sloughing off large areas of bark, with the tree expected to succumb to the lightning damage. However, this species may occur on other suitable, unsampled trees present in the direct impact area. Occupied habitat in the form of mature hardwood trees within the Southwest Prong Slocum Creek watershed is in an area that is subject to consideration for indirect effects by Alternative 3 (Figure 3b). Patches of this species were observed on tree trunks within the area under consideration for indirect effects.

The US 70 Havelock Bypass (R-1015) Alternative 3 will result in unavoidable direct impacts to *Plagiochila ludoviciana* and an additional area occupied by *P. ludoviciana* is subject to consideration for indirect impacts. The direct impacts for Alternative 3 may lead to a loss of the population in Tucker Creek. The occurrence in this watershed also has been impacted by recent forest management activities (thinning) resulting in increased light penetration, but because the Havelock Bypass project would result in presumed loss of this population, the forest management activities would not contribute to significant adverse cumulative effects. Alternative 3 may result in indirect effects to

the population in Southwest Prong Slocum Creek. No significant adverse cumulative impacts from other projects were identified.

No changes in management to the swamp forest habitat are expected to result from project implementation, reducing concerns for indirect impacts. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands. The identification of new populations of this species in secure locations on NFS lands is an important mitigation measure and one new population of *Plagiochila ludoviciana* has already been identified on behalf of USFS by NCDOT on NFS lands in the CNF in a watershed unaffected by the US 70 Havelock Bypass project. This new, unaffected occurrence was documented in 2013 in the Pettiford Creek watershed in association with *Lejeunea bermudiana*. Based on co-occurrences of *P. ludoviciana* with *L. bermudiana* at sites where *P. ludoviciana* has been documented so far, it is likely that *P. ludoviciana* may also be found in association with *L. bermudiana* at other sites in the CNF where *L. bermudiana* was documented in 2012-2013.

The proposed project may impact individuals of *Plagiochila ludoviciana*, but with implementation of these mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for *Plagiochila ludoviciana* on NFS lands in the CNF.

- A Liverwort (*Plagiochila miradorensis miradorensis*) (LR) is found on bark in maritime forest and swamp habitats. Potentially suitable habitat was identified in the evaluation area. No *P. m. miradorensis* plants were documented within the evaluation area during site surveys. The nearest known occurrence is approximately 10 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on *P. m. miradorensis*.
- **Pineland Plantain** (*Plantago sparsiflora*) (S) is found in wet savanna habitats over calcareous substrates and human created microhabitats adjacent to these sites, such as fire-plow lines, shallow ditches, and mowed powerline rights-of-way. Potentially suitable habitat was identified in the evaluation area. No Pineland Plantain plants were observed within the evaluation area during site surveys. The nearest known occurrence is located near the Onslow/Pender County border. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Pineland Plantain.
- Yellow Fringeless Orchid (*Platanthera integra*) (S) is found in savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Yellow Fringeless Orchid plants were observed within the Alt. 3 study area, however, one occurrence of this species, most recently observed in 2014 as four individuals at three separate microsites not previously known for this species, is present in a powerline right-of-way located in within the area being considered for indirect impacts in the evaluation area. (Figure 3b, see also Attachment 10 for detailed assessment). Including this occurrence, there are

seven known occurrences on NFS lands in the CNF, but USFS reports that one roadside occurrence is apparently extirpated and one other has been greatly reduced in population size from recent disturbance in a savanna.

Based on the apparent absence of this species in the Alt. 3 study area, there will be no direct impacts. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands. With implementation of these mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it is determined that the proposed project will have no impact on Yellow Fringeless Orchid.

Cumulative impacts considered include a wildlife habitat improvement project completed in the summer of 2003 in the Little Road savanna population (EO 7), which resulted in a loss of habitat and individuals of this species within EO 7. Mitigation measures at the site have since restored the habitat but the number of individuals has been low (approximately 27, based on 2014 survey results) compared to earlier counts that were as high as 200 individuals. Other cumulative impacts identified for this species consisted of the DEP overhead ground wire replacement project, which may impact individuals of this species, but was determined to not likely result in viability concerns across the CNF.

• Snowy Orchid (*Platanthera nivea*) (LR) is found in wet savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Snowy Orchid plants were observed within the Alt. 3 study area; however, one occurrence of this species is present in a powerline ROW within the evaluation area being considered for indirect impacts (Figure 3c). This is the only known occurrence of Snowy Orchid on NFS lands in the CNF.

Based on the apparent absence of this species in the Alt. 3 study area, there will be no direct impacts. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands. With implementation of these mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it is determined that the proposed project will have no impact on Snowy Orchid. Cumulative impacts identified for this species consisted of the DEP overhead ground wire replacement project, which may

impact individuals of this species, but was determined to not likely result in viability concerns across the CNF.

• **Hooker's Milkwort** (*Polygala hookerii*) (S) is found in savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Hooker's Milkwort plants were observed within the Alt. 3 study area; however, one occurrence of this species is present in a powerline ROW located within the evaluation area being considered for indirect impacts (Figure 3b). The occurrence being evaluated for potential indirect impacts is the largest known occurrence on the CNF and was conservatively estimated to include greater than 1,000 individuals in 2013. Including this occurrence, there are nine known occurrences of Hooker's Milkwort on NFS lands in the CNF.

Based on the apparent absence of this species in the Alt. 3 study area, there will be no direct impacts. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species along the ROW across NFS lands. With implementation of these mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it is determined that the proposed project will have no impact on Hooker's Milkwort. Cumulative impacts identified for this species consisted of the DEP overhead ground wire replacement project, which may impact individuals of this species, but was determined to not likely result in viability concerns across the CNF.

• Shadow-witch (*Ponthieva racemosa*) (LR) is found in blackwater forest and swamp habitats over calcareous rock (marl). Potentially suitable habitat was identified within the evaluation area. No Shadow-witch plants were observed within the Alt. 3 study area during site surveys. One occurrence of this species is located in an area being considered for potential indirect effects (Figure 3b). This occurrence is mapped as covering approximately 14.7 acres and includes an estimated 800 individual plants. During field reviews on 22 July 2008 and 6 May 2009 the highest concentration of individuals within this occurrence was observed in the northeast corner of this occurrence adjacent to Greenfield Heights Blvd. This is greater than 250 feet from the Alt. 3 study area. Including this occurrence, this species is known from nine occurrences documented on NFS lands in the CNF.

Based on the apparent absence of this species in the Alt. 3 study area, there will be no direct impacts. No changes in management to the swamp forest habitat are expected to result from project implementation, reducing concerns for indirect impacts. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including implementation of measures proposed for controlling the spread of NNIS plant species

along the ROW across NFS lands. With implementation of these mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it is determined that the proposed project will have no impact on Shadow-witch.

- Awned Mountain-mint (Pycnanthemum setosum) (LR) may be found in damp to wet • fields, clearings, and forest borders in sandy soils, often associated with blackwater Potentially suitable habitat was identified in the evaluation area. swamps. One occurrence of this species has been recently reported as present in a powerline ROW that is crossed by the Alt. 3 study area (Figure 3d). This occurrence (EO5), originally documented in July 2012, was assessed in June 2014 resulting in documentation of approximately 4,300 individual plants dispersed across five discrete sites totaling 2.18 acres extending farther along the powerline ROW (see Attachment 13 for detailed evaluation). This EO represents one of two EOs for Awned Mountain-mint reported on NFS lands in the CNF, with the other EO (EO 3) located in the Holston Creek Natural Area approximately 15 miles from the Alt. 3 study area. EO 3 was reported as approximately 0-1% cover within a 400 square meter Carolina Vegetation Survey Plot, but recent surveys have failed to relocate this species within this EO (personal communication, Gary Kauffman).
  - Alt. 3 directly affects a portion of EO 5. Approximately 0.52 acre of EO 5 will be directly impacted, resulting in direct impacts to approximately 500 individual plants.
  - Approximately 0.10 acre of EO 5 containing an estimated 50 individual plants is located in an area subject to indirect impact consideration for Alt. 3. These plants were observed within the powerline ROW which is currently being managed by a combination of mowing by the utility company operating the lines within the ROW and periodic prescribed burns by the USFS. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts.
  - The remaining portion of EO 5, comprising approximately 3,750 individual plants dispersed over 1.56 acres, is located outside the areas identified as subject to direct or indirect impacts from Alt. 3.

The US 70 Havelock Bypass (R-1015) Alt. 3 will result in unavoidable direct impacts to Awned Mountain-mint and has the potential for indirect impacts. No cumulative impacts from other USFS or NCDOT projects on NFS lands on the CNF have been identified.

Mitigation measures are needed to reduce the threat for a loss of viability for Awned Mountain-mint on NFS lands within the CNF. Conservation measures agreed to between NCDOT and USFS include closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures for controlling the spread of NNIS plant species on NFS lands. In addition, NCDOT has agreed to collect seeds from the impact areas for establishing new populations on NFS lands in areas identified as potentially suitable based on favorable soil and hydrology conditions.

The proposed project may impact individuals of Awned Mountain-mint, but with implementation of these mitigation measures agreed to between NCDOT and USFS, it is

determined that the proposed project is not likely to cause a loss of viability for Awned Mountain-mint on NFS lands in the CNF.

- **Dwarf Live Oak** (*Quercus minima*) (LR) is found in Pine Flatwood and Coastal Fringe Sandhill communities. Potentially suitable habitat was identified in the evaluation area. No Dwarf Live Oak trees were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 9.4 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Dwarf Live Oak.
- Short-bristled Beaksedge (Rhynchospora galeana) (S), formerly known as Rhynchospora breviseta, is found in wet savanna habitats and may colonize disturbed areas and roadsides. Potentially suitable habitat was identified in the evaluation area. No Short-bristled Beaksedge plants were observed within Alt. 3 study area during site surveys. One EO (27) had been depicted in the NCNHP database as extending into the Alt. 3 study area, but a review of the original record information submitted to NCNHP and discussion with NCNHP indicated that this extension was an error in interpretation (see Attachment 10). Based on survey results and the anticipated correction to NCNHP files for this August 2005 record, no Short-bristled Beaksedge plants have been documented in the Alt. 3 study area and no direct impacts to Short-bristled Beaksedge are expected to occur. Approximately 44.2 acres of EO 27 (100% of the corrected occurrence) are in an area subject to indirect impact consideration for Alt. 3 (Figure 3b). This EO contains an estimated 850 individual Short-bristled Beaksedge plants and represents the largest known population on NFS lands in the CNF. Including this occurrence, there are seven known occurrences of Short-bristled Beaksedge on NFS lands in the CNF, although one obscure record has not been observed for more than 50 years.

Based on the apparent absence of this species in the Alt. 3 study area, there will be no direct impacts. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands. With implementation of these mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it is determined that the proposed project will have no impact on Short-bristled Beaksedge. Cumulative impacts identified for this species consisted of the DEP overhead ground wire replacement project, which may impact individuals of this species, but was determined to not likely result in viability concerns across the CNF.

• Southern White Beaksedge (*Rhynchospora macra*) (S) is found in Sphagnum bogs, frequently-burned Streamhead Pocosins, and Sandhill Seepage Bogs. Potentially suitable habitat was identified in the evaluation area. No Southern White Beaksedge plants were

observed within the evaluation area during site surveys. The nearest known occurrence is approximately 5 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Southern White Beaksedge.

- **Thorne's Beaksedge** (*Rhynchospora thornei*) (S) is found in wet savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Thorne's Beaksedge plants were observed within the evaluation area during site surveys. The nearest known occurrence is located in western Onslow County. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Thorne's Beaksedge.
- **Grassleaf Arrowhead** (*Sagittaria weatherbiana*) (S) is found in fresh to brackish marsh, streambank, and pineland pool habitats. Potentially suitable habitat was identified in the evaluation area. No Grassleaf Arrowhead plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 16 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Grassleaf Arrowhead.
- **Canby's Bulrush** (*Schoenoplectus etuberculatus*) (LR) is found in beaver pond and peaty small depression pond habitats, and in flowing blackwater stream habitats. Potentially suitable habitat was identified in the evaluation area. No Canby's Bulrush plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 2.5 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Canby's Bulrush.
- **Drooping Bulrush** (*Scirpus lineatus*) (LR) is found in swamp forest habitats over coquina limestone. Potentially suitable habitat was identified in the evaluation area. No Drooping Bulrush plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 0.5 mile from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Drooping Bulrush.
- **Baldwin's Nutrush** (*Scleria baldwinii*) (LR) is found in wet savanna habitats associated with Longleaf Pine (*Pinus palustris*), Pond Pine (*Pinus serotina*), and Pond Cypress. (*Taxodium ascendens*). Potentially suitable habitat was identified in the evaluation area. No Baldwin's Nutrush plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 9 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Baldwin's Nutrush.
- Leavenworth's Goldenrod (*Solidago leavenworthii*) (LR) is found in savanna, claybased Carolina bay, peaty seep, and pocosin border habitats. Potentially suitable habitat was identified in the evaluation area. No Leavenworth's Goldenrod plants were observed within the evaluation area during site surveys. The nearest known occurrence is

approximately 8 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Leavenworth's Goldenrod.

• **Carolina Goldenrod** (*Solidago pulchra*) (S) is found in savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Carolina Goldenrod plants were observed within the Alt. 3 study area during site surveys. One occurrence is located in an area subject to consideration for potential indirect effects (Figure 3b). Including this occurrence, there are 38 known occurrences of Carolina Goldenrod on NFS lands in the CNF.

Based on the apparent absence of this species in the Alt. 3 study area, there will be no direct impacts. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands. With implementation of these mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it is determined that the proposed project will have no impact on Carolina Goldenrod. In addition, this species has been recommended to be removed from the USFS Region 8 sensitive plant list since it has been found to be locally abundant in the southern portion of the CNF and it responds to prescribed fire management (personal communication, Gary Kauffman).

- **Twisted-leaf Goldenrod** (*Solidago tortifolia*) (LR) is found in dry savanna and moist pine flatwood habitats. Potentially suitable habitat was identified in the evaluation area. No Twisted-leaf Goldenrod plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 13 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Twisted-leaf Goldenrod.
- **Spring-flowering Goldenrod** (*Solidago verna*) (S) is found in moist pine savanna habitats as well as lower slopes in sandhills and road sides in pineland habitats. Potentially suitable habitat was identified in the evaluation area and surveys confirmed this species is present in the Alt. 3 study area and the area being considered for potential indirect effects (Figure 3a-d, see Attachment 7 for detailed evaluation).
  - Alternative 3 directly affects 23.51 acres of occupied habitat on NFS lands and estimated 11,419 individual Spring-flowering Goldenrod plants.
  - An additional 63.53 acres of occupied habitat is in areas that may be indirectly affected by Alternative 3 that include an estimated 43,415 individual Spring-flowering Goldenrod plants.

The US 70 Havelock Bypass (R-1015) Alt. 3 will result in unavoidable direct impacts to Spring-flowering Goldenrod and additional areas occupied by spring-flowering goldenrod may be subject to indirect impacts. Cumulative impacts associated with US 17 (R-2514B, C, and D) will directly impact another large population on NFS lands. The two largest spring-flowering goldenrod populations within the Croatan NF may be potentially impacted by the two road projects. Cumulative impacts associated with the DEP overhead ground wire replacement project may impact individuals of this species, but the project was determined to not likely result in viability concerns across the CNF. The direct impacts for Alternative 3 are not likely to result in a loss of viability on NFS lands within the CNF, but with the inclusion of indirect and cumulative impacts, Alt. 3 would contribute to an impact to a significant portion of the overall population on the CNF, particularly for the population within the CNF.

Mitigation measures are needed to reduce the threat for a loss of viability for Springflowering Goldenrod on NFS lands within the CNF. Conservation measures agreed to between NCDOT and USFS include closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures for controlling the spread of NNIS plant species on NFS lands. In addition, NCDOT has also agreed to collect seeds from Spring-flowering Goldenrod from the impact areas for establishing new populations on NFS lands in areas identified as potentially suitable based on favorable soil and hydrology conditions. Seed collection was initiated for Spring-flowering Goldenrod from the Alt. 3 study area in 2010.

The proposed project may impact individuals of Spring-flowering Goldenrod, but with implementation of the mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Spring-flowering Goldenrod on NFS lands in the CNF.

- Florida Peatmoss (*Sphagnum cribrosum*) (S) is found in blackwater stream and ditch habitats. Potentially suitable habitat was identified in the evaluation area. There are 11 documented occurrences of Florida Peatmoss on NFS lands in the CNF that represent 6 populations (Gary Kauffman personal communication, 2013). One of these populations occurs in the evaluation area and consists of three individual sites with documented presence of Florida Peatmoss (see Attachment 12). One of the three sites (Site #1) is in the Alt. 3 study area and subject to consideration for direct impacts as well as indirect impacts. A second Florida Peatmoss site (Site #2) is located in a depression in a maintained powerline ROW outside the area of potential direct impact, but within the area for consideration for indirect impacts. A third Florida Peatmoss site in the project vicinity is located in a depression in a maintained powerline ROW approximately 600 feet south of the Alt. 3 study area and is outside the area considered for direct or indirect effects (Figure 3a).
  - Alternative 3 directly affects a portion of one occurrence of Florida Peatmoss (Site #1). Approximately 0.03 acre of Florida Peatmoss Site #1 is located in approximately 466 feet of a ditch adjacent to the Railroad where the Alt. 3 study area crosses the ditch and railroad with a bridge. An additional 0.11 acre of this

occurrence is located upstream of the Alt. 3 study area will not be affected by Alternative 3 (Figure 3a).

- Two occurrences are located in areas subject to consideration for potential indirect impacts associated with Alternative 3. This species was confirmed present in these occurrences; individual plant counts are not practicable for bryophyte species and total population was not determined.
  - Approximately 0.04 acre of Florida Peatmoss Site #1 is located in an area for consideration of potential indirect effects by Alternative 3. Potential indirect effects include shading from associated with the bridge crossing (Figure 3a).
  - An additional occurrence (Florida Peatmoss Site #2) is located in another area subject to consideration for indirect impacts by Alternative 3. Florida Peatmoss Site #2 is not anticipated to be affected by Alternative 3 due to its distance (approximately 3,300 feet east) from the Alt. 3 study area, with no changes in management of the powerline ROW in which it occurs expected to occur (figure 3b).

The US 70 Havelock Bypass (R-1015) Alt. 3 will result in unavoidable direct impacts to Florida peatmoss as a result of the proposed bridging of the railroad ditch where this species occurs in the Alt. 3 study area (Florida Peatmoss Site #1 on Figure 3). The portion of this occurrence in the ditch downstream from the proposed ROW is subject to consideration for indirect impacts. The documented extent of this occurrence on NFS lands was substantially expanded by the NCDOT survey in 2012. With the new documentation that the majority of this occurrence extends a considerable distance farther upstream of Alt. 3, only approximately 0.03 acre of the 0.21-acre known extent for Florida Peatmoss Site #1 is being directly impacted and approximately 0.04 acre of this occurrence is in the ditch downstream of the ROW and subject to consideration for indirect impacts. Cumulative impacts associated with the potential future widening of the Atlantic and East Carolina Railroad from a single track to multiple tracks may occur at Florida Peatmoss Site #1 if railway construction alters the ditches adjacent to the railway. Potential affects to Florida Peatmoss will need to be evaluated as part of the planning process for the railway project, should it occur. Currently the rail expansion is not reasonably foreseeable. No cumulative impacts from the DEP project, USFS, or NCDOT projects on NFS lands in the CNF have been identified for this occurrence of for any of the other five known populations on NFS lands in the CNF.

The project is not expected to result in changes that would prevent the utility company and/or railroad from continued mowing to maintain the ROW in which these occurrences are found, reducing the threat for indirect impacts. Other potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands. The proposed project may impact individuals of Florida Peatmoss, but with implementation of mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Florida Peatmoss on NFS lands in the CNF. One new occurrence of Florida Peatmoss was identified on the CMB as part of a previous evaluation by NCDOT in 2007. Contingent upon USFS release of ROW for the Havelock Bypass, the transfer of the CMB property to USFS would provide an additional mitigation measure by adding this occurrence to NFS lands on the CNF. In addition, this species has been recommended to be removed from the USFS Region 8 sensitive plant list based on more potential habitat in the CNF (personal communication, Gary Kauffman).

• **Fitzgerald's Peatmoss** (*Sphagnum fitzgeraldii*) (S) is found in pocosin and savanna habitats. Potentially suitable habitat was identified in the evaluation area. This species has been recently relocated by USFS in some historical sites as well as new sites across the CNF and is likely more common than previously determined. One occurrence of this species is located in the Alt. 3 study area and will be directly affected (Figure 3a). Areal extent and population estimates are not available for this occurrence. This species is considered to be secure on the CNF. Including this occurrence, there are eleven known occurrences Fitzgerald's Peatmoss on NFS lands in the CNF. This species has been recommended to be removed from the USFS Region 8 sensitive plant list based on more potential habitat in the CNF (personal communication, Gary Kauffman).

One occurrence of this species has direct impacts. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands. The proposed project may impact individuals of Fitzgerald's Peatmoss, but with implementation of mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Fitzgerald's Peatmoss on NFS lands in the CNF.

- **Giant Peatmoss** (*Sphagnum torreyanum*) (LR) is found in beaver ponds and old mill ponds habitats on blackwater creeks. Potentially suitable habitat was identified in the evaluation area. No Giant Peatmoss plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 6 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Giant Peatmoss.
- Eaton's Ladies'-tresses (*Spiranthes eatonii*) (LR) is found in wet savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Eaton's Ladies'tresses plants were observed within the Alt. 3 study area, however, one occurrence of this species is present in a powerline ROW located within the area being considered for indirect impacts (Figure 3b). This is the only known occurrence of Eaton's Ladies'tresses on NFS lands in the CNF.

Based on the apparent absence of this species in the Alt. 3 study area, there will be no direct impacts. No changes in management of the powerline ROW by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through conservation commitments made by NCDOT, including allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands. With implementation of these mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it is determined that the proposed project will have no impact on Eaton's Ladies'-tresses.

- **Giant Spiral-orchid** (*Spiranthes longilabris*) (S) is found in savanna habitats. Potentially suitable habitat was identified in the evaluation area. No Giant Spiral-orchid plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 11 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Giant Spiral-orchid.
- **Carolina Dropseed** (*Sporobolus pinetoreum*) (S) is found in wet savanna habitats, savanna-pocosin ecotones, sandhill-pocosin ecotones, and extending upslope into mesic flatwoods or loamy or clayey shelves in fall-line sandhills habitats. Potentially suitable habitat was identified in the evaluation area. No Carolina Dropseed plants were observed within the evaluation area during site surveys. The nearest known occurrence is in Jones County. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Carolina Dropseed.
- **Pickering's Dawnflower** (*Stylisma pickeringii* var. *pickeringii*) (LR) is found in sandhill habitats, usually in the driest, most barren, deep-sand areas. Potentially suitable habitat was identified in the evaluation area. No Pickering's Dawnflower plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 11 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Pickering's Dawnflower.
- **Carolina Asphodel** (*Tofieldia glabra*) (S) is found in wet pine savanna, sandhill seep, and savanna-pocosin ecotone habitats. Potentially suitable habitat was identified in the evaluation area. This species is not tracked by NCNHP, but is considered to be secure on the CNF with more than 50 known occurrences (personal communication, Gary Kauffman, USFS). No Carolina Asphodel plants were observed within the evaluation area during site surveys. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Carolina Asphodel.

- **Chapman's Redtop** (*Tridens chapmanii*) (LR) is found on loamy sands of disturbed Longleaf Pine woodland and roadside habitats. Potentially suitable habitat was identified in the evaluation area. No Chapman's Redtop plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 3.3 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Chapman's Redtop.
- Florida Yellow-eyed Grass (*Xyris floridana*) (LR) is found in savanna, wet pine flatwood, and ditch habitats. Potentially suitable habitat was identified in the evaluation area. No Florida Yellow-eyed Grass plants were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 20 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Florida Yellow-eyed Grass.
- An Unnamed **Yellow-eyed Grass** (*Xyris stricta*) (LR) is found in savanna, depression ponds, depressional meadow, and ditch habitats. Potentially suitable habitat was identified in the evaluation area. No plants of this species were observed within the evaluation area during site surveys. The nearest known occurrence is approximately 5 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on this species.

## **3.3 Summary of Plant Species**

There are 107 plant species on the most recent (October 2013) list of rare plant species maintained by the USFS for the CNF. Of these 107 rare plant species, 35 species were dropped from further consideration because no suitable habitat is present within or in close proximity to the evaluation area. Potentially suitable habitat or previously reported NCNHP or USFS records were identified in the evaluation area for 72 USFS rare plant species. Surveys conducted from 2003-2013 within the evaluation area in combination with records available from NCNHP and the USFS resulted in documentation or confirmation of the presence of 21 USFS rare plant species within the evaluation area. Surveys did not document the presence of the remaining 51 USFS rare plant species within the evaluation area. Based on the apparent absence of these 51 species, it is determined that the proposed project will have no impact on these 51 species and these species are dropped from further consideration.

The proposed project will have no effect on Rough-leaved Loosestrife, the only federal endangered, threatened, or proposed plant species that potentially could occur but surveys did not document the presence of this species in the evaluation area.

For sensitive plant species, with implementation of mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it was determined that the project would not impact Yellow Fringeless Orchid, Hooker's Milkwort, Short-bristled Beaksedge, or Carolina Goldenrod. For sensitive plant species, the project may impact individuals of Small Spreading Pogonia, Loomis's Loosestrife, Piedmont Cowbane, Spring-flowering Goldenrod, Florida Peatmoss, and Fitzgerald's Peatmoss, but with implementation of mitigation measures agreed to between NCDOT and USFS, it was determined the project is not likely to result in viability concerns for any of the species across the CNF.

For locally rare plant species, with implementation of mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it was determined that the project would not impact Bog Bluestem, Eaton's Witch Grass, Florida Adder's mouth, Snowy Orchid, Shadow-witch, or Eaton's Ladies'-tresses. For locally rare plant species, the project may impact individuals of LeConte's Thistle, Mudbank Crowngrass, Awned Mountain-mint, and two liverworts (*Lejeunea bermudiana* and *Plagochila lucoviciana*), but with implementation of mitigation measures agreed to between NCDOT and USFS, it was determined the project is not likely to result in viability concerns for any of the species across the CNF.

## **3.4 Terrestrial and Aquatic Animal Species**

There are 92 animal species on the most recent (August 2013) list of rare animal species provided by the USFS for the CNF. One additional mammal, Northern Long-eared Bat (*Myotis septentrionalis*), is not on the August 2013 list of rare animal species provided by the USFS for the CNF, but was considered in this BE based on its recent status change and anticipated addition to the USFS list. Of this total of 93 rare animal species considered, 56 species were dropped from further consideration because no suitable habitat is present within or in close proximity to the evaluation area.

Two species from the USFS list of rare animal species were eliminated from consideration since they are considered to be extirpated from North Carolina. The following federally Endangered, Threatened or Proposed animal species were eliminated from further consideration due to extirpation: Eastern Cougar (*Puma concolor cougar*) and Bachman's Warbler (*Vermivora bachmanii*). No Sensitive or Locally Rare animal species were identified as extirpated from the State and none were eliminated from further evaluation due to extirpation.

Several species were eliminated from consideration since the Croatan National Forest would be considered extralimital to known ranges and these species have not been documented in Carteret, Craven or Jones Counties. The following federally Endangered, Threatened, or Proposed animal species were eliminated from further consideration due to extralimital range: Red Wolf (*Canis rufus*) (experimental population reintroduced into North Carolina not documented as ranging south of Beaufort County) and Kirtland's Warbler (*Dendroica kirtlandii*). No Sensitive animal species were eliminated from further consideration due to extralimital range. The following Locally Rare animal species were eliminated from further consideration due to extralimital range. The following Locally Rare animal species were eliminated from further consideration due to extralimital range. The following Locally Rare animal species were eliminated from further consideration due to extralimital range. The following Locally Rare animal species were eliminated from further consideration due to extralimital range. The following Locally Rare animal species were sp. 1), Dwarf Salamander (*Eurycea quadridigitata*), Wood Frog (coastal plain population) (*Rana sylvatica* pop. 3), a Noctuid Moth (*Melanapamea mixta*), a Mayfly (*Baetisca obesa*), a Noctuid Moth (*Bleptina sangamonia*), a Noctuid Moth (*Gabara* sp. 1), Blackwater Ancylid (*Ferrisia hendersoni*), Least Brook Lamprey (*Lampetra aepytera*), and Grooved fingernail Clam (*Sphaerium simile*).

No maritime forests, maritime thickets, dunes, ocean beach, or marine habits were identified in the evaluation area. The following federally Endangered, Threatened, or Proposed plant species were eliminated from further consideration due to the lack of these habitats within the evaluation area: West Indian Manatee (*Trichechus manatus*), Piping Plover (*Charadrius melodus*), Roseate Tern (*Sterna dougallii*), Loggerhead Seaturtle (*Caretta caretta*), Green Seaturtle (*Chelonia mydas*), Leatherback Seaturtle (*Dermochelys imbricata*), Hawksbill Seaturtle (*Eretmochelys*)
*imbricata*), and Kemp's Ridley Seaturtle (*Lepidochelys kempii*). No Sensitive animal species are restricted to these habitats and none were eliminated from further consideration due to a lack of these habitats. The following Locally Rare animal species were eliminated from further consideration due to a lack of these habitats within the evaluation area: Buxton Woods Whitefooted Mouse (*Peromyscus leucopus buxtoni*), Pungo White-footed Mouse (*Peromyscus leucopus eastii*), Gull-billed Tern (*Gelochelidon nilotica*), Caspian Tern (*Hydropogne caspia*), Peregrine Falcon (*Falco peregrinus*), Eastern Painted Bunting (*Passerina ciris ciris*), Glossy Ibis (*Plegadis falcinellus*), Outer Banks Kingsnake (*Lampropeltis getula sticticeps*), an undescribed Skipper (*Atrytonopsis* sp.), a Noctuid Moth (*Faronta aleada*), and Giant Swallowtail (*Papilio cresphontes*).

No large or medium sized river habitats were identified in the evaluation area. The following federally Endangered, Threatened, or Proposed plant species were eliminated from further consideration due to the lack of these habitats within the evaluation area: Shortnose Sturgeon (*Acipenser brevirostrum*) and Atlantic Sturgeon (*Acipenser oxrhynchus*). The following Sensitive animal species was eliminated from further consideration due to a lack of these habitats within the evaluation area: Carolina Madtom (*Noturus furiusus*). No Locally Rare animal species are restricted to these habitats and none were eliminated from further consideration due to a lack of these habitats within the evaluation area.

No tidal swamps or freshwater/brackish marshes were identified in the evaluation area. The following federally Endangered, Threatened, or Proposed animal species were eliminated from further consideration due to the lack of these habitats within the evaluation area: Wood Stork (*Mycteria americana*). The following Sensitive animal species was eliminated from further consideration due to a lack of these habitats within the evaluation area: Carolina Salt Marsh Snake (*Nerodia sipedon williamengelsi*). The following Locally Rare animal species were eliminated from further consideration due to a lack of these habitats within the evaluation area: American Bittern (*Botaurus lentiginosus*), Northern Harrier (*Circus cyaneus*), Black-necked Stilt (*Himantopus mexicanus*), Black Rail (*Laterallus jamaicensis*), Purple Gallinule (*Porphyrio martinica*), Northern Diamondback Terrapin (*Malaclemys terrapin terrapin*), Marsh Killifish (*Fundulus confluentus*), and Spotfin Killifish (*Fundulus luciae*).

Streams in the evaluation area were determined to be too acidic to support suitable habitat for several species. No CNF-listed federally Endangered, Threatened, or Proposed animal species were eliminated from further consideration due to the acidic nature of stream habitats in the evaluation area. The following Sensitive animal species was eliminated from further consideration due acidic nature of stream habitats in the evaluation area: Green Floater (*Lasmigona subviridis*). The following Locally Rare animal species were eliminated from further consideration due to acidic nature of stream habitats within the evaluation area: Pod Lance (*Elliptio folliculata*), Chameleon Lampmussel (*Lampsilis* sp. 2), Tidewater Mucket (*Leptodea ochracea*), and Creeper (*Strophitus undulata*). In addition, NCDOT surveys for mollusks in evaluation area streams did not document the presence of any freshwater mussel fauna.

No lakes were identified in the evaluation area. No CNF-listed federally Endangered, Threatened, or Proposed plant species are restricted to these habitats and none were eliminated from consideration due to the lack of this habitat. No Sensitive animal species are restricted to these habitats and none were eliminated from further consideration due to a lack of this habitat. The following Locally Rare animal species was eliminated from further consideration due to a lack of this habitat within the evaluation area: Double-crested Cormorant (*Phalacrocorax auritus*).

No Sandhills or Pine Barrens were identified in the evaluation area. No CNF-listed federally Endangered, Threatened, or Proposed plant species are restricted to these habitats and none were eliminated from consideration due to the lack of these habitats. The following Sensitive plant species were eliminated from consideration due to a lack of these habitats within the evaluation area: Dotted Skipper (*Hesperia attalus slossonae*). The following Locally Rare plant species were eliminated from consideration due to a lack of these habitats within the evaluation area: Eastern Tiger Salamander (*Ambystoma tigrinum*), Eastern Coral Snake (*Micrurus fulvius*), and Buchholz's Gray (*Hypomecis buchholzaria*).

Potentially suitable habitat was identified in the evaluation area for 37 USFS rare wildlife species as noted in the table in Appendix C. NCNHP and USFS records indicate that only a few of these species have been documented within the evaluation area or in close proximity. Animal surveys that included light trapping for moths, mist netting and acoustic monitoring for bats, and surveys for terrestrial and aquatic species were conducted in 2005. Surveys conducted in 2005 in combination with records available through January 2015 from NCNHP and the USFS resulted in documentation or confirmation, or presumed presence of 15 USFS rare animal species within the evaluation area. Red-cockaded Woodpecker (*Picoides borealis*) (RCW) was evaluated in a separate Biological Assessment by NCDOT and is not evaluated in this BE. A summary of the evaluation for all 37 species with potentially suitable habitat identified within the evaluation area is presented below. Site survey results and/or NCNHP/USFS records for USFS rare animal species are presented on Figures 3a - 3d in Appendix F.

# 3.4.1 Mammals

- Star-nosed Mole (*Condylurus cristata*) (LR) is a burrowing mammal occupying moist meadow, bog, swamp, and bottomland habitats within its disjunct coastal plain population in the state. The nearest known occurrence is approximately 7.3 miles west of the Alt. 3 study area, based on a road-kill record from the CNF. This species was not encountered or found during the surveys, therefore, there is no impact on the Star-nosed Mole.
- **Rafinesque's Big-eared Bat** (*Corynorhinus rafinesquii macrotis*) (LR) roosts in hollow trees, old buildings, and beneath bridges, usually near water. Potentially suitable habitat was identified in the evaluation area in the vicinity of Southwest Prong Slocum Creek. NCNHP records indicate one occurrence of this species within Craven County. This NCNHP occurrence of this species is includes portions of the evaluation area. NCNHP has designated the accuracy of this occurrence as very low. A very low accuracy occurrence characterization is described by NHP as one with less than 5 percent of the area occupied. NCNHP records indicate that this occurrence is based on an observation of this species at an unspecified location in Craven County. There are approximately 9.4 acres of potentially occupied habitat identified within the Alt. 3 study area. Mist netting

and acoustic surveys conducted in the summer of 2005 did not identify the presence of Rafinesque's Big-eared Bat in the evaluation area (Attachment 3).

No direct impacts are anticipated. If individuals of this species are present, indirect impacts may result from road construction, which would fragment the bottomland habitat and could decrease the likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Based on the widespread availability of similar habitats on NFS lands adjacent to the proposed project, the proposed project would not significantly affect the availability of suitable habitat in the evaluation area.

One new occurrence of Rafinesque's Big-eared Bat was identified on the CMB as part of a survey by NCDOT in 2008 (Figure 4). Contingent upon USFS release of ROW for the Havelock Bypass, transfer of this tract to the USFS from NCDOT would add this occurrence to NFS lands on the CNF and would help ensure this species is viable on the CNF.

- Northern Yellow Bat (*Lasiurus intermedius*) (LR) roosts in Spanish moss and other thick vegetation near water, often in Longleaf Pine habitats. Potentially suitable habitat was identified in the evaluation area in the vicinity of Southwest Prong Slocum Creek. There are no known records for this species in or near the evaluation area and the species is not known to be present in the CNF, but potentially suitable habitat is present in some portions of the evaluation area. Mist netting and acoustic surveys conducted in the summer of 2005 did not identify the presence of Northern Yellow Bat in the evaluation area (Attachment 3). The nearest known occurrences are in Brunswick and New Hanover Counties. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Northern Yellow Bat.
- Southeastern Myotis (*Myotis austroriparius*) (LR) roosts in buildings and hollow trees and forages near water. Potentially suitable habitat was identified in the evaluation area in the vicinity of Southwest Prong Slocum Creek. Mist netting and acoustic surveys conducted in the summer of 2005 identified the presence of Southeastern Myotis in the evaluation area (Figure 3b, Attachment 3).

Based on the mobility of this species, no direct impacts from project construction are anticipated. Indirect impacts may result from road construction, which would fragment the bottomland habitat and could decrease the likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Based on the widespread availability of similar habitats on NFS lands adjacent to the proposed project, the proposed project would not significantly affect the overall availability of suitable habitat in the evaluation area.

One new occurrence of Southeastern Myotis was identified on the CMB as part of a survey by NCDOT in 2008 (Figure 4). Contingent upon USFS release of ROW for the Havelock Bypass, transfer of this tract to the USFS from NCDOT would add this occurrence to NFS lands on the CNF and would help ensure this species is viable on the CNF.

• Northern Long-eared Bat (NLEB) (*Myotis septentrionalis*) is not on the current USFS list of rare animals for the CNF, but was considered in this BE based on its recent status change and anticipated addition to the USFS list. A USFWS proposal for listing the NLEB as an Endangered species was published in the Federal Register in October 2013. A listing determination may happen as early as April 2, 2015. As of March 25, 2015, this species is included in the USFWS's list of protected species for Craven and Jones Counties based on acoustic evidence. The nearest verified records are from New Hanover, Washington, and Wake Counties (USFWS 2014).

USFWS has developed a programmatic conference opinion (PCO) in conjunction with the Federal Highway Administration (FHWA), the US Army Corps of Engineers (USACE), and NCDOT for NLEB in eastern North Carolina. The PCO covers the entire NCDOT program in Divisions 1-8, including the proposed Havelock bypass. The programmatic determination for NLEB for the NCDOT program is "May Affect, Likely to Adversely Affect".

Once the NLEB is officially listed as a protected species, FHWA and USACE will request that USFWS convert the PCO to a programmatic biological opinion (PBO). The PBO will allow incidental take coverage for NLEB and will ensure compliance with Section 7 of the Endangered Species Act for five years for all NCDOT projects with a federal nexus in Divisions 1-8, which includes the proposed Havelock bypass.

Since the PCO does not include the USFS, the following survey results are provided. NLEB surveys were conducted in the summer of 2014 on the west side of Croatan National Forest (CNF) by NCDOT. The acoustic survey results (from 39 acoustic monitoring nights) were analyzed by two software programs. Several calls were identified as NLEBs from both automated identification programs, BCID and EchoClass. Multiple calls were also identified as Indiana bats and gray bats by BCID and EchoClass, although neither species' range extends into central or eastern North Carolina; the results were false positives.

In conjunction with the software analysis, manual analysis was conducted to select calls with the most NLEB characteristics. Subsets of these calls were sent to two acoustic experts (Chris Corben, Titley Scientific, and Dr. Joy O'Keefe, Indiana State University) for further analysis. Neither expert saw conclusive evidence that the calls could be attributed to NLEB. According to these experts, a few calls had potential to be from NLEBs, but most were determined to be from Southeastern Bats (*Myotis austroriparius*).

As a follow-up to the acoustic surveys, 14 nights of mist-netting were conducted by NCDOT in and adjacent to western CNF but no NLEBs were captured. In addition to the negative mist-netting results from 2014, the following negative surveys results were also obtained in and adjacent to CNF:

• Six nights of mist-netting in CNF along the proposed Havelock Bypass corridor in 2005 (NCDOT).

- Five nights of mist-netting adjacent to CNF at the NCDOT Croatan Mitigation Bank (CMB) from 2007-2010 (NCDOT).
- One night of mist-netting in Carteret County at the southern edge of CNF in 2009 (NCDOT).

Based on limited and inconclusive evidence to suggest that NLEBs are present within the study area and CNF, if the species is added to the USFS list of rare species, the proposed project will not affect the viability of NLEB on CNF.

• Eastern Woodrat (coastal plain population) (*Neotoma floridana floridana*) (LR) is found in lowland forests with a Dwarf Palmetto (*Sabal minor*) understory. NCNHP has a 1991 record of Eastern Woodrat located 16 miles from the study area; this is the closest record. Potentially suitable habitat was identified in the evaluation area near the western end of Gray Road between Alt. 3 and Alt 2. Surveys for conspicuous nests were conducted in April 2005 in areas of potentially suitable habitat in the evaluation area and no woodrat nests or Eastern Woodrats were observed, therefore there is no impact to the Eastern Woodrat.

# **3.4.2 Birds**

Eastern Henslow's Sparrow (Ammodramus henslowii susurrans) (LR) breeding habitat • can be described as relatively large, open fields and other similarly open habitat with tall, dense grass and little or no woody vegetation. Typical winter habitat consists of extensive, open, moist to wet Pine Flatwoods (Pine Savanna) or other similarly open, moist to wet areas having dense herbaceous cover, such as some abandoned fields and clearcuts. Powerline corridors adjacent to Pine Flatwoods may be important as winter habitat. Nesting habitat is not present within the Alt. 3 study area. There is only one reported breeding season record for this species in the CNF, from 1985 at a site approximately 6.5 miles from the Alt. 3 study area. Potentially suitable wintering habitat is present in the evaluation area within some of the Powerline Corridors and contiguous Pine Flatwoods. Three individuals were observed within the Alt. 3 study area during 1999 and an additional individual was observed in the Alt. 3 study area in 2005, all in the winter season (John Fussell, personal communication, 2005). The only other reported site where this species has been documented as overwintering on the CNF is located approximately 6.5 miles from the Alt. 3 study area. Although no breeding evidence has been documented in the evaluation area, individuals of this species may be present during winter.

Based on the absence of suitable breeding habitat, the proposed project will not impact breeding sites or breeding individuals of this species. The proposed project may impact individuals of Eastern Henslow's Sparrow through fragmentation of wintering habitat and through decreased likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Potential loss of individuals through roadcrossing mortality is anticipated to be relatively low based on the widespread availability of suitable habitat remaining in the evaluation area. The proposed project would not significantly affect the overall availability of suitable wintering habitat in the evaluation area. Potential indirect impacts to Eastern Henslow's sparrow wintering habitat that could result from construction or maintenance activities can be minimized through conservation measures previously proposed by NCDOT, such as temporarily closing the bypass to allow for prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, which would maintain the quality of the wintering habitat. Because there will be no impacts to breeding individuals or breeding habitat, with implementation of these habitat conservation measures agreed to between NCDOT and USFS to maintain the quality of adjacent wintering habitat, it is determined that the proposed project is not likely to cause a loss of viability for Eastern Henslow's Sparrow on NFS lands in the CNF.

• Black-throated Green Warbler (coastal plain population) (*Dendroica virens waynei*) (LR) is a disjunct race found in eastern North Carolina in spring and summer as a nesting species in forested wetland habitats that occur on interstream flats or in the uppermost portions of streams. This species is associated with hardwoods, especially when a component of mature conifers is present, including White Cedar (*Thuja occidentalis*), Baldcypress (*Taxodium* spp.), or Pines (*Pinus* spp.). Potentially suitable nesting habitat is present in the evaluation area. One NCNHP mapped occurrence of this species is located within the Alt. 3 study area (Figure 3a). This occurrence represents the identification of three singing male birds in this general location. Including this occurrence, this species is known from seven occurrences documented as EOs in NCNHP records for NFS lands in the CNF.

Based on the mobility of this species, no direct impacts from project construction are anticipated. The proposed project may impact individuals of Black-throated Green Warbler through habitat fragmentation and through decreased likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Potential loss of individuals through road-crossing mortality is anticipated to be relatively low based on the widespread availability of suitable habitat remaining in the evaluation The proposed project would not significantly affect the overall availability of area. suitable habitat in the evaluation area. Potential indirect impacts to Black-throated Green Warbler nesting habitat that could result from construction or maintenance activities can be minimized through conservation measures previously proposed by NCDOT, such as implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, which would maintain the quality of the nesting habitat. Based on the number of occurrences on CNF and the implementation of these habitat conservation measures agreed to between NCDOT and USFS to maintain the quality of adjacent nesting habitat, it is determined that the proposed project is not likely to cause a loss of viability for Black-throated Green Warbler on NFS lands in the CNF.

One new occurrence of Black-throated Green Warbler was identified on the CMB, consisting of several males singing on territory throughout the Non-riverine Swamp Forest/Bay Forest community on the tract. Contingent upon USFS release of ROW for the Havelock Bypass, transfer of this tract to the USFS from NCDOT would add this occurrence to NFS lands on the CNF and would help ensure this species is viable on the CNF.

- **Bald Eagle** (*Haliaeetus leucocephalus*) (S) typically inhabits mature conifer forests close to clean bodies of water populated with fish, most often rivers, estuaries, coasts or large lakes and nests are typically built in the tops of very tall conifers located near water. Biologists from Dr. J. H. Carter III & Associates, Inc. surveyed each of the three detailed study corridors and a 660-foot radius around the corridors for bald eagle nests by helicopter in January 2011. To ensure 100 percent visual coverage, the corridors were flown using a grid system (both north/south and east/west). Transects were oriented depending on the prevailing wind and spaced 250 to 500 feet apart depending on stand density. No eagle nests were found during the aerial surveys. However, one sub-adult bald eagle was observed flying outside of the 660-foot radius survey area north of the Bypass study corridors. Eagle monitoring data provided by the North Carolina Wildlife Resources Commission listed 12 nests in Craven County and two in Carteret County in 2010. Two of these 14 nests are located in the vicinity of the project. One nest is located approximately 1.5 miles east of the project study corridor on the Cherry Point Marine Corps Air Station and the other nest is approximately 3.5 miles northwest of the project site near East Prong Brice Creek on CNF property. None of the known nests are located within the 660-foot radius around the survey corridors. Additionally, construction activities for the proposed Havelock Bypass will not occur within 330 feet of, or be visible from, any known nest trees. Based on apparent absence of nest sites, communal roost sites, or foraging areas for this species, it is determined that the proposed project will have no impact on Bald Eagle.
- **Bachman's Sparrow** (*Peucaea aestivalis*) (LR), formerly known as *Ammodramus aestivalis*, is a bird that occupies open pine woodland habitats with grassy cover. Potentially suitable habitat is present in the evaluation area. Two NCNHP documented occurrences of this species are present within the evaluation area, and additional occurrences have been documented in the vicinity (Figures 3b and 3c; see also Attachment 2). These occurrences represent the identification of solitary singing birds in each location, which would be assumed to be males singing on territory. Additional suitable habitat areas associated with these occurrences are located within the area being considered for potential indirect impacts. Continued use of fire and mowing for habitat management is important in maintaining open habitat for this species and allowing individuals displaced by project construction to disperse into unoccupied suitable habitat. Including these occurrences in and adjacent to the evaluation area, this species is known from 18 occurrences documented as EOs in NCNHP records for NFS lands in the CNF.

Based on the mobility of this species, no direct impacts from project construction are anticipated. The proposed project may impact individuals of Bachman's Sparrow through habitat fragmentation and through decreased likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Potential loss of individuals through road-crossing mortality is anticipated to be relatively low based on the widespread availability of suitable habitat remaining in the evaluation area. The proposed project would not significantly affect the overall availability of suitable habitat in the evaluation area. Potential indirect impacts to Bachman's Sparrow habitat that could result from construction or maintenance activities can be minimized through conservation measures previously proposed by NCDOT, such as temporarily closing the bypass to allow for prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands. Based on the number of occurrences on CNF and the implementation of habitat conservation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Bachman's Sparrow on NFS lands in the CNF.

• **Red-cockaded Woodpecker** (*Picoides borealis*) (RCW) (E) is a federally endangered species with known occurrences on the CNF. The proposed US 70 Havelock Bypass would pass through foraging habitat partitions for five RCW clusters and four habitat management areas (HMA) proposed by USFS for future RCW recruitment clusters. Foraging data for this species was updated by Dr. J.H. Carter III & Associates, Inc. (JCA) in 2013. Potential effects for this species were evaluated in a separate Biological Assessment that was submitted to the USFS on November 12, 2013. The biological conclusion for this species was "May Affect, Not Likely to Adversely Affect."

#### 3.4.3 Reptiles and Amphibians

American Alligator (Alligator mississippiensis) [T(S/A)] is widespread across the CNF • and is known from 4 occurrences that represent watersheds. Potentially suitable habitat may be found in flooded areas within the evaluation area. Surveys were conducted in March – April 2005 in the bottomland swamps along the various tributaries of Slocum Creek. No nighttime surveys were conducted. Alligators have been observed in the CNF (NCNHP data; Dennis Foster, personal communication, 2005). Alligators can be assumed to be present in any of the larger creeks or swamps with the Alt. 3 study area, especially the Southwest Prong Slocum Creek and East Prong Slocum Creek. Both creeks would be impacted by Alt. 3. Individuals present in the proposed ROW would be expected to move out of the area during construction activities, but there is the potential for direct mortality of individuals. Based on the widespread availability of similar habitats on NFS lands adjacent to the proposed project, the proposed project would not significantly affect the availability of suitable habitat in the evaluation area. If individuals of this species are present, indirect effects may result from road construction.

Potential indirect impacts will be minimized through use of wildlife fencing and bridges. Wildlife fencing will prevent individuals from crossing the new roadway. Bridges will provide a few areas for wildlife passage. The proposed project may impact individuals of American Alligator during construction if individuals are present. American Alligator has been documented as relatively common on the CMB property, with documentation of successful reproduction occurring on the site. Contingent upon USFS release of ROW for the Havelock Bypass, transfer of the CMB lands to USFS would add this reproducing population segment to NFS lands. It is determined that the proposed project is not likely to cause a loss of viability for American Alligator on NFS lands in the CNF.

• Eastern Diamondback Rattlesnake (*Crotalus adamanteus*) (LR) may inhabit pine flatwood and savanna habitats similar to those adjacent to portions of the project ROW. This species is secretive and generally found far from human activity, utilizing stump holes, burrows of other animals, hollow logs, and brush piles. The nearest known occurrence is a 1991 record approximately 3.5 miles from the Alt. 3 study area.

Potentially suitable habitat for this species is present within the evaluation area. Surveys conducted in 2005 indicate that this species is not likely present within the evaluation area. Since the species was not observed during multiple surveys it is considered to be absent and there are no impacts to the Eastern Diamondback Rattlesnake. This species is not further analyzed.

Southern Hognose Snake (Heterodon simus) (LR) is found in sandy woodland habitats, particularly pine-oak sandhill habitats. One occurrence of this species is potentially located in the evaluation area. This is an historic occurrence that NCNHP has designated as low in accuracy. A low accuracy occurrence characterization is described by NHP as one with between 5% and 20% of the mapped EO area occupied. While typical sandhills habitat is not present in the evaluation area, the dryer phases of the open mesic pinelands in the evaluation area provide potentially suitable habitat for this species. Surveys conducted in 2005 indicate that this species is not likely present within the evaluation area. This species is known from four occurrences documented on NFS lands in the CNF. Because the North Carolina Museum of Natural Sciences (NCMNS) has records from north, east, and southwest of the Alt. 3 study area, it is possible that the southern hognose snake may be present. There are 113.8 acres of potentially occupied habitat within the Alt. 3 study area. These areas of potentially occupied habitat are predominately characterized as mesic Pine Flatwoods, mesic Pine Plantations, and mesic Powerline Corridors. However, these communities may be considered to provide low probability of occurrence compared to the dry pine-oak woodlands that this species typically inhabits. Based on the widespread availability of similar habitats on NFS lands adjacent to the proposed project, the proposed project would not significantly affect the availability of suitable habitat in the evaluation area.

The proposed project may impact individuals of Southern Hognose Snake. If individuals of this species are present, the proposed project may impact individuals of Southern Hognose Snake through habitat fragmentation and through decreased likelihood that individuals of this species could safely crawl across the road to suitable habitat on the opposite side. Potential loss of individuals through road-crossing mortality is anticipated to be relatively low based on the widespread availability of suitable habitat remaining in the evaluation area. The proposed project would not significantly affect the overall availability of suitable habitat in the evaluation area. Potential indirect impacts to Southern Hognose Snake habitat that could result from construction or maintenance activities can be minimized through conservation measures previously proposed by NCDOT, such as temporarily closing the bypass to allow for prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, which would maintain the quality of the adjacent habitat. With implementation of these habitat conservation mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Southern Hognose Snake on NFS lands in the CNF.

• **Mimic Glass Lizard** (*Ophisaurus mimicus*) (S) is found in pine flatwood, savanna, and pine-oak sandhill habitats. This species is known from two occurrences documented on NFS lands in the CNF. While typical sandhills habitat is not present in the evaluation

area the dryer phases of the open mesic pinelands in the evaluation area provide potentially suitable habitat for this species. The nearest known occurrence is approximately 4.4 miles from the Alt. 3 study area. The species was not observed during specific surveys for it and its presence is unlikely, therefore there are no impacts to the Mimic Glass Lizard. This species is not further analyzed.

- Carolina Gopher Frog (*Rana capito*) (S) breeds in temporary fish-free pools and forages in sandy woodland habitats, especially pine-oak sandhill habitats. While typical sandhills habitat is not present in the evaluation area, the dryer phases of the open mesic pinelands in the evaluation area were evaluated as potentially suitable habitat for this species. These areas of potentially occupied habitat are predominately characterized as mesic Pine Flatwoods, mesic Pine Plantations, and mesic Powerline Corridors. However, these communities may be considered to provide low probability of occurrence compared to the dry pine-oak woodlands that this species typically inhabits. The nearest known occurrence is approximately 3 miles from the Alt. 3 study area. The species was not observed during specific surveys for it and its presence is unlikely due to the lack of habitat, therefore there are no impacts to the Carolina Gopher Frog. This species is not further analyzed.
- **Glossy Crayfish Snake** (*Regina rigida*) (LR) is found in marsh, cypress pond, and other wetland habitats. There are four occurrences documented on the CNF, the closest approximately 0.4 mile from the Alt. 3 study area. Potentially suitable habitat is present in the evaluation area. The species was not observed during site specific surveys for it and its presence is unlikely, therefore there are no impacts to the Glossy Crayfish Snake. This species is not further analyzed.
- Black Swamp Snake (*Seminatrix pygaea*) (LR) inhabits lush vegetation of ponds, ditches, and sluggish streams where it feeds on small frogs, tadpoles, salamanders, small fish, and worms. There are two occurrences documented on the CNF, the closest approximately 1 mile from the Alt. 3 study area. Potentially suitable habitat is present in the evaluation area. The species was not observed during specific surveys for it and its presence is unlikely, therefore there are no impacts to the Black Swamp Snake. This species is not further analyzed.

# 3.4.4 Insects

- **Cypress Daggermoth** (*Acronicta perblanda*) (LR) is a moth that inhabits cypress swamp habitats. Moth surveys conducted in 2005 did not document the presence of this species in the Alt. 3 study area (see Attachment 1). The nearest known occurrence is from an unspecified location in Carteret County. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Cypress Daggermoth.
- A **Daggermoth** (*Acronicta sinescripta*) (LR) is a moth that inhabits savanna and flatwood habitats. Moth surveys conducted in 2005 did not document the presence of this species in the Alt. 3 study area (see Attachment 1). The nearest known occurrence is located in Pender County. Based on apparent absence of this species, it is determined that the proposed project will have no impact on *A. sinescripta*.

- A Dart Moth (*Agrotis carolina*) (LR) is a moth that inhabits flatwood habitats containing Pyxie Moss (*Pyxidanthera barbulata*). Potentially suitable habitat is present in the evaluation area in the form of Pine Flatwoods, however, the host plant for this species, Pyxie Moss, was not observed to be present. Moth surveys conducted in 2005 did not document the presence of this moth in the Alt. 3 study area (see Attachment 1). The nearest known occurrence is approximately 7 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on *A. carolina*.
- **Dusky Roadside Skipper** (*Amblyscirtes alternata*) (LR) is a skipper that inhabits open grassy pine flatwood and savanna habitats. Potentially suitable habitat is present in the evaluation area. Surveys by NCDOT in 2003 and NCNHP in 2005 did not document the presence of this species in the Alt. 3 study area (see Attachment 2). However, this species has been documented in the indirect impact evaluation area, which represents the only known occurrence (two sites) of this species on NFS lands in the CNF (Figure 3b).

Based on presence within the indirect impact evaluation area and suitability of habitat for this species identified in the Alt. 3 study area, Dusky Roadside Skipper is presumed present in the Alt. 3 study area and the proposed project may have direct impacts to an undetermined number of adults and/or larvae. The proposed project may impact individuals through habitat fragmentation and through decreased likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Direct loss of individuals from construction or maintenance activities and potential loss of individuals from road-crossing mortality may impact a relatively low percentage of the individuals that may be present in the evaluation area based on the widespread availability of suitable habitat remaining in the evaluation area. The proposed project would not significantly affect the overall availability of suitable habitat in the evaluation area. Potential indirect impacts to Dusky Roadside Skipper habitat that could result from construction or maintenance activities can be minimized through conservation measures previously proposed by NCDOT, such as temporarily closing the bypass to allow for prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, which would maintain the quality of the adjacent habitat. With implementation of these habitat conservation mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Dusky Roadside Skipper on NFS lands in the CNF.

• A **Tiger Moth** (*Apantensis* sp. 1 nr. *carlotta*) (LR) is a moth that inhabits savanna and sandhill seep habitats. Moth surveys conducted in 2005 did not document the presence of this species in the Alt. 3 study area (Attachment 1). The nearest known occurrence is approximately 9.2 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on *Apantensis* sp.1 nr. *carlotta*.

• Arogos Skipper (*Atrytone arogos arogos*) (S) is a skipper that inhabits mesic to boggy savanna habitats as well as mesic and hydric powerline corridors where its host plant species, Pinebarren Sand-reedgrass (*Calamovilfa brevipilis*), is present. Potentially suitable habitat is present in the evaluation area. While surveys did not document the presence of this species in the evaluation area they did identify the presence of its host plant species, Pinebarren Sand-reedgrass, within powerline corridors in the vicinity of the Alt. 3 study area and the area being considered for potential indirect impacts (Figures 2a, 2b, 2c). The closest and only known occurrence of Arogos Skipper from the CNF is approximately 6.6 miles from the Alt. 3 study area, although this population may no longer be extant due to impacts from a wildfire (personal communication, Gary Kauffman).

Although not documented from NCNHP or USFS records or during NCDOT surveys in the direct or indirect impact areas, Arogos Skipper has been presumed present in the Alt. 3 study area based on the suitability of habitat and presence of the host plant species. The proposed project will have direct impacts to powerline corridor habitat containing dispersed individuals of the host plant species, which in turn could result in impact to an undetermined number of adults and/or larvae. The host plant for this species, Pinebarrren Sand-reedgrass, has been reported in at least five powerline corridors in and near the evaluation area (John Fussell, personal communication, 2005) (see Attachment 2). In addition to presence in powerline corridor habitat in the direct and indirect impact areas, Pinebarren Sand-reedgrass is also more widespread in the vicinity of the Alt. 3 study area in powerline corridors that will not be affected by the project. The proposed project may impact Arogos skippers, if present, through habitat fragmentation and through decreased likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Direct loss of individuals from construction or maintenance activities and potential loss of individuals from road-crossing mortality may impact a relatively low percentage of the individuals presumed present in the evaluation area based on the widespread availability of suitable habitat remaining in the evaluation area postproject. Since the distribution of the host plant in the vicinity of Alt. 3 extends along powerline corridors well outside of the direct and indirect impact areas, the proposed project would not significantly affect the overall availability of suitable habitat in the evaluation area. Potential indirect impacts to Arogos Skipper habitat that could result from construction or maintenance activities can be minimized through conservation measures previously proposed by NCDOT, such as temporarily closing the bypass to allow for prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, which would maintain the quality of the adjacent habitat. With implementation of these habitat conservation mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Arogos Skipper on NFS lands in the CNF.

• Little Metalmark (*Calephelis virginiensis*) (LR) is butterfly that inhabits grassy field, savanna, and marsh habitat. Potentially suitable habitat is present in the evaluation area. Surveys by NCDOT in 2003 and NCNHP in 2005 did not document the presence of this species in the Alt. 3 study area, but the surveys did document this species within the area being evaluated for indirect impacts as well as another powerline in the immediate

vicinity (within 600 feet to the south of the Alt. 3 study area) (Figures 3b and 3c, respectively; see also Attachment 2). Including these occurrences, this species is known from seven occurrences documented on NFS lands in the CNF.

Based on presence within the indirect impact evaluation area and suitability of habitat for this species identified in the Alt. 3 study area, Little Metalmark is presumed present in the Alt. 3 study area and the proposed project may have direct impacts to an undetermined number of adults and/or larvae. The proposed project may impact individuals through habitat fragmentation and through decreased likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Direct loss of individuals from construction or maintenance activities and potential loss of individuals from road-crossing mortality may impact a relatively low percentage of the individuals that may be present in the evaluation area based on the widespread availability of suitable habitat remaining in the evaluation area. The proposed project would not significantly affect the overall availability of suitable habitat in the evaluation area. Potential indirect impacts to Little Metalmark habitat that could result from construction or maintenance activities can be minimized through conservation measures previously proposed by NCDOT, such as temporarily closing the bypass to allow for prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, which would maintain the quality of the adjacent habitat. With implementation of these habitat conservation mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Little Metalmark on NFS lands in the CNF.

- **Frosted Elfin** (*Callophrys irus*) (LR) is a butterfly that inhabits grassy opening or burn scars in pine barren and savanna habitats, as well as powerline ROW habitats. Surveys did not locate the presence of this species. There are no documented occurrences of this species on the CNF. The nearest known occurrence is approximately 17.5 miles from the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Frosted Elfin.
- **Dismal Swamp Stink Bug** (*Chlorochroa dismalia*) (LR) is an insect that inhabits canebrake habitats. There is only one occurrence of this species on the CNF, which is located approximately 4 miles from the Alt. 3 study area. This species has not been documented from the evaluation area on NFS lands. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Dismal Swamp Stink Bug.
- A **Prominent Moth** (*Datana robusta*) (LR) is a moth that inhabits savanna, flatwood, and sandhill habitats. Moth surveys conducted in 2005 did not document the presence of this species in the Alt. 3 study area. The nearest known occurrence is located in Onslow County. Based on apparent absence of this species, it is determined that the proposed project will have no impact on *D. robusta*.
- **Berry's Skipper** (*Euphyes berryi*) (LR) is a skipper that inhabits wet prairie, marsh, and savanna habitats containing pitcher plants. Potentially suitable habitat is present in the

evaluation area. While surveys did not document the presence of this species in the Alt. 3 study area, it has been documented in the indirect impact evaluation area and it is likely present in suitable habitat in the Alt. 3 study area (Figure 3c; see also Attachment 2). The occurrence within the indirect impact evaluation area represents one of three known occurrences of this species on NFS lands in the CNF.

Based on presence within the indirect impact evaluation area and suitability of habitat and presence of host species for this species identified in the Alt. 3 study area, Berry's Skipper is presumed present in the Alt. 3 study area and the proposed project may have direct impacts to an undetermined number of adults and/or larvae. The proposed project may impact individuals through habitat fragmentation and through decreased likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Direct loss of individuals from construction or maintenance activities and potential loss of individuals from road-crossing mortality may impact a relatively low percentage of the individuals that may be present in the evaluation area based on the widespread availability of suitable habitat remaining in the evaluation area. The proposed project would not significantly affect the overall availability of suitable habitat in the evaluation area. Potential indirect impacts to Berry's Skipper habitat that could result from construction or maintenance activities can be minimized through conservation measures previously proposed by NCDOT, such as temporarily closing the bypass to allow for prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, which would maintain the quality of the adjacent habitat. With implementation of these habitat conservation mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Berry's Skipper on NFS lands in the CNF.

• **Two-spotted Skipper** (*Euphyes bimacula*) (LR) is a skipper that inhabits wet savanna and bog habitats, and sedge areas near wet woods. Potentially suitable habitat is present in the evaluation area. While surveys did not document the presence of this species in the evaluation area, it is likely present in suitable habitat (see Attachment 2). There are two occurrences known from the CNF and the nearest known occurrence is from a powerline corridor approximately 3.3 miles from the Alt. 3 study area.

Based on the suitability of habitat within the Alt. 3 study area, Two-spotted Skipper is presumed present in the Alt. 3 study area and the proposed project may have direct impacts to an undetermined number of adults and/or larvae. The proposed project may impact individuals, if present, through habitat fragmentation and through decreased likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Direct loss of individuals from construction or maintenance activities and potential loss of individuals from road-crossing mortality may impact a relatively low percentage of the individuals that may be present in the evaluation area based on the widespread availability of suitable habitat remaining in the evaluation area. The proposed project would not significantly affect the overall availability of suitable habitat in the evaluation area. Potential indirect impacts to Two-spotted Skipper habitat that could result from construction or maintenance activities can be minimized through conservation measures previously proposed by NCDOT, such as temporarily closing the bypass to allow for prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, which would maintain the quality of the adjacent habitat. With implementation of these habitat conservation mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Two-spotted Skipper on NFS lands in the CNF.

• **Duke's Skipper** (*Euphyes dukesi dukesi*) (S) is a skipper that inhabits ecotones between brackish or freshwater marshes with swamp habitats, as well as sedge patches in forested swamps. Larval host species have been identified as sedges (*Carex* spp.). Potentially suitable habitat is present in the evaluation area. While surveys did not document the presence of this species in the evaluation area, it may be present in suitable habitat. There are two occurrences known from the CNF and the nearest known occurrence is approximately 4.5 miles from the Alt. 3 study area.

Based on the suitability of habitat and presence of potential host species for this species identified in the Alt. 3 study area, Duke's Skipper is presumed present in the Alt. 3 study area and the proposed project may have direct impacts to an undetermined number of adults and/or larvae. The proposed project may impact individuals, if present, through habitat fragmentation and through decreased likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Direct loss of individuals from construction or maintenance activities and potential loss of individuals from road-crossing mortality may impact a relatively low percentage of the individuals that may be present in the evaluation area based on the widespread availability of suitable habitat remaining in the evaluation area. The proposed project would not significantly affect the overall availability of suitable habitat in the evaluation area. Potential indirect impacts to Duke's Skipper habitat that could result from construction or maintenance activities can be minimized through conservation measures previously proposed by NCDOT, such as temporarily closing the bypass to allow for prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, which would maintain the quality of the adjacent habitat. With implementation of these habitat conservation mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Duke's Skipper on NFS lands in the CNF.

- Venus Flytrap Cutworm Moth (*Hemipachnobia subporphyrea*) (S) is moth that inhabits savanna habitats containing Venus Flytraps. While potentially suitable habitat in the form of pine savannas is present in the evaluation area, no Venus Flytraps were observed. The nearest known occurrence is approximately 7 miles from the Alt. 3 study area. Surveys indicate that this species is not likely present within the evaluation area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Venus Flytrap Cutworm Moth.
- Anointed Sallow Moth (*Pyreferra ceromatica*) (LR) is a moth that inhabits flatwood and pocosin habitats, as well as ecotones between mesic woodland and bottomland habitats. Moth surveys were not conducted during the flight period for this species, but habitat

evaluation determined that suitable host plant species are present and this species is likely to occur in the Alt. 3 study area (see Attachment 1). The closest and only known occurrence from the CNF is approximately 6.4 miles from the Alt. 3 study area. This species has been collected where Witch Hazel (*Hamamelis virginiana*) occurs near small streams with Dwarf Palmetto nearby. Such habitat occurs in the Alt. 3 study area on both sides of Southwest Prong Slocum Creek.

Based on suitability of habitat and presence of host species for this species identified in the Alt. 3 study area, Anointed Sallow Moth is presumed present in the Alt. 3 study area and the proposed project may have direct impacts to an undetermined number of adults and/or larvae. The proposed project may impact individuals, if present, through habitat fragmentation and through decreased likelihood that individuals of this species could safely fly across the road to suitable habitat on the opposite side. Direct loss of individuals from construction or maintenance activities and potential loss of individuals from road-crossing mortality may impact a relatively low percentage of the individuals that may be present in the evaluation area based on the widespread availability of suitable habitat remaining in the evaluation area. The proposed project would not significantly affect the overall availability of suitable habitat in the evaluation area. Potential indirect impacts to Anointed Sallow Moth habitat that could result from construction or maintenance activities can be minimized through conservation measures previously proposed by NCDOT, such as temporarily closing the bypass to allow for prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, which would maintain the quality of the adjacent habitat. With implementation of these habitat conservation mitigation measures agreed to between NCDOT and USFS, it is determined that the proposed project is not likely to cause a loss of viability for Anointed Sallow Moth on NFS lands in the CNF.

- **Carter's Noctuid Moth** (*Spartiniphaga carterae*) (S) is a moth that inhabits savanna and sandhill habitats containing Pinebarren Sand-reedgrass. The nearest known occurrence is approximately 8 miles from the Alt. 3 study area. Surveys indicate that this species is not likely present within the evaluation area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on Carter's Noctuid Moth.
- A gray moth (*Tornos cinctarius*) (LR) is a moth that inhabits savanna and sandhill habitats. The nearest known occurrence is located in Pender County. Moth surveys conducted in 2005 did not document the presence of this species in the Alt. 3 study area. Based on apparent absence of this species, it is determined that the proposed project will have no impact on *T. cinctarius*.

# 3.4.5 Freshwater Fish, Mollusks, and Crustaceans

• **Graceful Clam Shrimp** (*Lynceus gracilicornis*) (LR) is a small crustacean that occupies temporary water features, primarily ephemeral pools. The best habitat for this species was determined to be in ponds located off FSR 613 in the Southwest Prong Flatwoods Natural Area, which would be affected by Alt. 3. No individuals of this species were found in visual searches or substrate samples collected surveys conducted for this species in ephemeral and semi-permanent ponds in June 2005 (see Attachment 2). NCNHP

records indicate that Graceful Clam Shrimp has been found within five miles of the Alt. 3 study area on the other side of Havelock in the year 2000. Due to the ephemeral nature of the species' habitat, the nauplii hatch as soon as the pond they inhabit fills; the eggs rest in the substrate during the dry season. There is only one generation of the clam shrimp per wet season, so sampling for adults can be problematic. Due to the presence of the species within five miles of the project area, and due to the difficulty in timing the sampling event when adults are present, graceful clam shrimp could be present in ephemeral ponds in the project vicinity. This species is probably more common than is currently known by the scientific communication, 2005). The proposed project may result in loss of potential habitat, but would not impact any known occurrences of Graceful Clam Shrimp.

• Bridle Shiner (*Notropis bifrenatus*) (LR) is a fish that has been documented from streams near the lower Neuse River. The nearest known occurrence is a 1978 record from Tucker Creek approximately 0.8 mile downstream from the Alt. 3 study area. Fish communities were sampled using nets and backpack electroshockers in two streams in April 2005, Southwest Prong Slocum Creek and East Prong Slocum Creek (see Attachment 2). A total of 12 fish species were found, but Bridle Shiner was not documented as present. Based on the apparent absence of this species in the fish surveys conducted, it is assumed that bridle shiner is not present in the study area and Alt. 3 will have no impact on Bridle Shiner.

#### 3.5 Summary of Terrestrial and Aquatic Animal Species

There are 92 animal species on the most recent (August 2013) list of rare animal species provided by the USFS for the CNF and one additional species, Northern Long-eared Bat, which is expected to be added based on recent change in federal status. Of this total of 93 rare animal species considered, 56 species were dropped from further consideration because no suitable habitat is present within or in close proximity to the evaluation area. Potentially suitable habitat or previously reported NCNHP or USFS records were identified in the evaluation area for 37 rare wildlife species. Surveys conducted in 2005 in combination with records available through January 2015 from NCNHP and the USFS resulted in documentation or confirmation, or presumed presence of 15 USFS rare animal species within the evaluation area. Based on the apparent absence of these remaining 22 species, it is determined that the proposed project will have no impact on these 22 species and these species are dropped from further consideration.

Red-cockaded Woodpecker (RCW), the only federal Endangered or Threatened animal species for which potential habitat was identified or individuals confirmed present, was evaluated in a separate Biological Assessment by NCDOT and is not evaluated in this BE. Copies were sent to USFS staff on November 12, 2013. Northern Long-eared Bat is the only federal Proposed animal species for which potential habitat was identified; surveys found limited and inconclusive acoustic evidence to suggest the presence of this species in the evaluation area, and no evidence of presence from mist-nesting. American Alligator, a species federally listed as Threatened due to Similarity of Appearance, does not require consultation with U.S. Fish and Wildlife. The project may impact individuals of American Alligator but is not likely to result in viability concerns for this species across the CNF.

The proposed project may impact one Sensitive animal species, Duke's Skipper. For Locally Rare animal species, the project may impact individuals of Rafinesque's Big-eared Bat, Southeastern Myotis, Eastern Henslow's Sparrow, Black-throated Green Warbler, Bachman's Sparrow, Southern Hognose Snake, Dusky Roadside Skipper, Arogos Skipper, Little Metalmark, Berry's Skipper, Two-spotted Skipper, and Anointed Sallow Moth, but with implementation of conservation commitments agreed to by NCDOT, it was determined the project is not likely to result in viability concerns for any of the species across the CNF.

# 4.0 DETERMINATION OF EFFECT

The proposed US 70 Havelock Bypass (R-1015) project will have no effect on Rough-leaved Loosestrife or any other federally listed Endangered, Threatened, or Proposed plant species. Red-cockaded Woodpecker (RCW), the only federal Endangered or Threatened animal species for which potential habitat was identified or individuals confirmed present, was evaluated in a separate Biological Assessment by NCDOT that was already sent to USFS. The biological conclusion was "May Affect, Not Likely to Adversely Affect." Northern Long-eared Bat is the only federal Proposed Animal species for which potential habitat was identified. The programmatic determination is "May Affect, Not Likely to Adversely Affect" and the proposed project will not affect the viability of Northern Long-eared Bat on the CNF. American Alligator, a species federally listed as Threatened due to Similarity of Appearance [T(S/A)], does not require consultation with U.S. Fish and Wildlife. The project may impact individuals of American alligator but is not likely to result in viability concerns for this species across the CNF.

Ten Regional Forester's Sensitive plant species have been recently or previously been located within the proposed activity area. Of these, the project may impact individuals of Small Coastal Spreading Pogonia, Loomis's Loosestrife, Piedmont Cowbane, Spring-flowering Goldenrod, Florida Peatmoss, and Fitzgerald's Peatmoss, but with implementation of mitigation measures agreed to between NCDOT and USFS, it was determined the project is not likely to result in viability concerns for any of the species across the CNF. These mitigation measures (see Section 5.0) include allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands; in addition, seed collection will be undertaken for Spring-flowering Goldenrod. For Yellow Fringeless Orchid, Hooker's Milkwort, Short-bristled Beaksedge, and Carolina Goldenrod, with implementation of the mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it was determined that the project would not impact these species or result in viability concerns for any of the species across the CNF. These mitigation measures (see Section 5.0) include allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands. The proposed project will not impact any other Sensitive plant species.

One Regional Forester's Sensitive animal has recently or previously been located within the proposed activity area, or is presumed present. The proposed project may impact individuals of Duke's Skipper, which is presumed present, but with implementation of mitigation measures agreed to between NCDOT and USFS, it was determined the project is not likely to result in viability concerns for this species across the CNF. These mitigation measures (see Section 5.0) include allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands. The proposed project will not impact any other Sensitive animal species.

Eleven CNF Locally Rare plant species have been recently or previously been located within the proposed activity area. Of these, the project may impact individuals of LeConte's Thistle, Mudbank Crowngrass, Awned Mountain-mint and two liverworts (Lejeunea bermudiana and Plagochila lucoviciana), but with implementation of mitigation measures agreed to between NCDOT and USFS, it was determined the project is not likely to result in viability concerns for any of the species across the CNF. These mitigation measures (see Section 5.0) include allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands; in addition, seed collection will be undertaken for LeConte's Thistle. For Bog Bluestem, Eaton's Witch Grass, Florida Adder's Mouth, Snowy Orchid, Shadow-witch, and Eaton's Ladies'-tresses, with implementation of mitigation measures agreed to between NCDOT and USFS to minimize potential for indirect impacts, it was determined that the project would not impact these species or result in viability concerns for any of the species across the CNF. These mitigation measures (see Section 5.0) include allowing for the closure of the highway to allow the USFS to conduct periodic prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands. The proposed project will not impact any other Locally Rare plant species.

Twelve CNF Locally Rare animal species have recently or previously been located within the proposed activity area, or are presumed present. The project may impact individuals of Rafinesque's Big-eared Bat, Southeastern Myotis, Eastern Henslow's Sparrow, Black-throated Green Warbler, Bachman's Sparrow, Southern Hognose Snake, Dusky Roadside Skipper, Arogos Skipper, Little Metalmark, Berry's Skipper, Two-spotted Skipper, and Anointed Sallow Moth, but with implementation of mitigation measures agreed to between NCDOT and USFS, it was determined the project is not likely to result in viability concerns for any of the species across the CNF. For the species requiring open habitats or habitats free of NNIS shrub encroachment (the sparrow, snake, butterfly, skipper, and moth species), implementation of habitat conservation measures previously proposed by NCDOT, such as temporarily closing the bypass to allow for prescribed burns and implementation of measures proposed for controlling the spread of NNIS plant species on NFS lands, would provide appropriate mitigation to maintain the quality of adjacent habitats for these species. Contingent upon USFS release of ROW for the Havelock Bypass, transfer of the CMB tract to the USFS from NCDOT would add occurrences of the two bat species and the warbler species to NFS lands on the CNF and would help ensure these species are viable on the CNF. The proposed project will not impact any other Locally Rare animal species.

# 5.0 MITIGATION MEASURES

Through consultation with USFS, NCDOT has agreed to provide appropriate mitigation measures to offset direct and indirect impacts associated with the US 70 Havelock Bypass. Proposed mitigation measures include measures to facilitate prescribed burns on fragmented NFS lands, manage herbicide use for right-of-way (ROW) maintenance, and manage non-native invasive plant species. A detailed evaluation of herbicide use to manage non-native invasive plant species is included as Attachment 14. For selected USFS rare species of particular concern that may be directly or indirectly impacted, work was done to identify new populations that are on protected lands not impacted by the project or that can be protected. Seed collection has been determined to be an appropriate mitigation measure for three plant species, Spring-flowering Goldenrod, LeConte's Thistle, and Awned Mountain-mint; collected seeds would be used to help establish new populations in suitable areas or bolster existing populations.

# 5.1 Mitigation Measures to Minimize Indirect Impacts

Alt. 3 would fragment NFS lands that are currently being managed using periodic prescribed burns. Fragmentation may affect the use of prescribed burning as a management tool on NFS lands. The USFS has previously stated that the US 70 Havelock Bypass will need to be closed in order to maintain prescribed burning for NFS lands between the US 70 Havelock Bypass and existing US 70. NCDOT has agreed to close the US 70 Havelock Bypass under general conditions outlined with USFS to accommodate prescribed burning.

Implementation of mitigation measures agreed to between NCDOT and USFS would minimize viability concerns that could result from indirect impacts. These mitigation measures include:

- Allow for the temporary closure of the bypass to allow the USFS to conduct periodic prescribed burns;
- Prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction;
- Avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable;
- Avoid placing heavy equipment within powerline corridors outside of the proposed slope stakes without prior approval from the USFS;
- Avoid use of broadcast sprays for herbicides and pesticides on NFS lands;
- Minimize the use of herbicides and pesticides; and
- NCDOT Division 2 forces will work with USFS staff on a periodic basis to control the
  presence of priority species of non-native plants along the Havelock bypass easement on
  CNF. NCDOT will also work on adjacent NCDOT ROW to prevent the encroachment of
  priority non-natives on to CNF. In turn, USFS will work cooperatively with NCDOT to
  identify and effectively control prioritized non-native invasive plant species.

In coordination with the USFS, NCDOT has developed mitigation measures to minimize the spread of NNIS plant species on NFS lands within the CNF associated with the construction and maintenance of the US 70 Havelock Bypass.

- To prevent the spread of non-native invasive plant species on NFS lands, NCDOT will require contractors to pressure wash all off-road equipment, including cranes, graders, pans, excavators, and loaders, prior to being brought in the CNF construction areas.
- To control the spread of non-native invasive plant species on NFS lands, NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species within the study area for Alt, 3 of the US 70 Havelock Bypass. If any of these areas are within areas of proposed fill, those areas will be cleared and grubbed, and the material disposed of outside the limits of the CNF. If non-native invasive plant species are located in areas of proposed cuts then the material and actual thickness of root mat or other defined amount will be disposed of outside the limits of the CNF.
- In consultation with the USFS, seed mixes of native grasses and forbs or non-aggressive, non-natives will be used on NFS lands for erosion control and revegetation.
- NCDOT will utilize rolled matting or weed-free mulch for erosion control and revegetation on NFS lands.
- NCDOT will coordinate with the USFS on a landscaping plan for NFS lands. The plan will detail appropriate native seeding mixes for erosion control and site specific control methods for invasive species, including a suite of acceptable herbicides for the corridor and adjacent natural habitats. The plan will also outline a plan for ongoing coordination between NCDOT and USFS personnel to maintain vegetation diversity and ensure no long-term impacts to rare species along the bypass corridor.

With the implementation of the mitigation measures developed by NCDOT, in coordination with the USFS, the threat of spread of NNIS plants on NFS lands associated with the construction and maintenance of the US 70 Havelock Bypass is expected to be minimal.

# 5.2 Mitigation through Increasing Number of Occurrences under Protection

NCDOT has initiated efforts to begin mitigating the potential impacts to USFS rare species through efforts to identify new populations of USFS rare species on NFS lands and other areas within the CNF that can be protected.

# 5.2.1 Croatan Mitigation Bank

In 2008 NCDOT conducted a preliminary habitat and USFS rare species evaluation of the Croatan Mitigation Bank (CMB), an in-holding located within the boundaries of the CNF to assess the potential for current use by, and as potential mitigation for USFS rare species (see Attachment 4). NCDOT purchased the 4,035-acre tract of land for the purpose of developing a mitigation bank for wetland impacts and mitigating NFS lands affected by the project. Contingent upon USFS release of ROW for the Havelock Bypass, the CMB property will be transferred to the USFS to become part of the CNF and managed by USFS.

The topography of the CMB is essentially flat with minimal slope to the north that is more prominent at the northern end of the site. A few very low ridges generally parallel the main access road maintained through the site. Soils on the CMB can be divided into two basic classes, loamy soils with substantial amounts of clay in their lower horizons and organic soils with profiles formed in accumulations of decayed plant material. Soil series mapped for the CMB include: Bayboro, Croatan, Dare, Dorovan, Goldsboro, Leaf, Leon, Lynchburg, Masontown, Muckalee, Murville, Pantego, and Rains. Thirteen general vegetative communities were identified on the CMB including: Swamp Forest (small stream), Pine Flatwoods (hydric, mesic, transitional), Successional/Ruderal Habitat (grass-sedge, shrub-scrub), Powerline Corridor (hydric), Non-riverine Wet Hardwood Forest, Non-riverine Swamp/Bay Forest, Lake Ridge Pine Forest, Pond, Hydric Pine Plantation, Hydric Pine Savanna, Upland Hardwood Forest, Pine/Hardwood Forest, Rural/Urban Modifications.

Six USFS rare species with potential direct affects associated with the proposed project have been documented on the CMB. These species are Florida Peatmoss, Loomis's Loosestrife, Rafinesque's Big-eared Bat, Southeastern Myotis, Black-throated Green Warbler, and American Alligator. Bald Eagle has been observed on the CMB, but nesting of this species has not been confirmed.

# 5.2.2 Documentation of New Occurrences on NFS Lands

During the 2008 growing season, surveys were undertaken on NFS lands within portions of the CNF not affected by the US 70 Havelock Bypass project to attempt to identify additional occurrences of specific USFS rare species of concern not previously documented by USFS or in NCNHP records. Non-targeted USFS rare species identified during the course of the surveys were also documented. Also at the request of USFS, known occurrences of several potentially affected USFS rare species were also reviewed to determine if they continued to exist. Specific areas surveyed within the CNF for new occurrences of USFS rare species were selected based on a combination of ecological factors including: soil type, vegetative community type, frequency of fire management, hydrology, slope aspect, forest age, and known occurrences of other rare species.

During the course of these 2008 surveys two new occurrences of Fitzgerald's Peatmoss, one new occurrence of Hooker's Milkwort, one new occurrence of Spoonflower (*Peltandra sagittifolia*), one new occurrence of Shadow-witch, one new occurrence of Venus Flytrap, and three new occurrences of Piedmont Cowbane were identified. Additional occurrences of Twining Screwstem (*Bartonia paniculata paniculata*) and a Bird Dropping Moth (*Lithacodia* sp.), species that have since been removed from the USFS rare species list for the CNF, were also identified during these surveys.

During 2012 and 2013, surveys were undertaken within portions of the CNF not directly affected by the US 70 Havelock Bypass project to attempt to identify additional occurrences of *Lejeunea bermudiana*, a cryptic species with limited number of known occurrences. Specific areas surveyed within the CNF were selected based on a combination of ecological factors including: soil type, vegetative community type, frequency of fire management, hydrology, slope aspect, forest age, and known occurrences of other rare species. Non-targeted USFS rare species identified during the course of the surveys were also documented. During the course of these 2012 - 2013 surveys new occurrences of *L. bermudiana* were documented from five watersheds not impacted by the US 70 Havelock Bypass. Two new occurrences of another liverwort, *Plagiochila ludoviciana* were also identified in association with *L. bermudiana* within each of the other three new watersheds.

#### 5.2.3 Seed Collection

As mitigation to offset direct impacts for LeConte's Thistle, NCDOT has agreed to collect seeds from viable EOs for use in supplementing existing EOs where suitable habitat occurs but numbers of individuals are low or individuals have not been recently documented. NCDOT has also agreed to collect seeds from Spring-flowering Goldenrod and Awned Mountain-mint from the impact areas for establishing new populations on NFS lands in areas identified as potentially suitable based on favorable soil and hydrology conditions. Seed collection was initiated in the Alt. 3 study area for LeConte's Thistle in 2013, for Spring-flowering Goldenrod in 2010, and for Awned Mountain-mint in 2014.

Several areas have been identified as potentially suitable for establishment of new Springflowering Goldenrod sites (see Attachment 7), and where existing LeConte's Thistle sites may be able to be augmented through sowing of seeds collected from the impact areas (see Attachment 10). NCDOT has also identified potentially suitable sites for establishing new Awned Mountainmint sites from seeds collected from the impact areas.

The preference is to utilize sites with sparser understory under a regular burning regime that are appropriate to the species as to habitat and soils. Periodic burning would be the preferable maintenance tool. If initial site preparation or manipulation is required, such as clearing or scarifying the soil initially to enhance seed germination, the site would be surveyed to ensure that no existing rare plant populations would be impacted by these actions. Prior to site construction, NCDOT will arrange for test germination of samples of the collected seeds for each species to check viability.

For sites ultimately selected either seeds or plugs will be used to establish the species at the selected site. Selected sites will be monitored for a period of five years to document survival. Planting failures will be replanted until USFS and NCDOT staff concur that further plantings would not be beneficial.

# 6.0 TRIBAL COORDINATION WITH TUSCARORA NATION

The Havelock Bypass study area contains an identified archaeological site that may have relevance to the Tuscarora Nation. Through the Federal Highway Administration, coordination has been initiated which requests a Tuscarora Nation review of the proposed project and the preferred alternative. The coordination letter is affixed to this Biological Evaluation (Appendix E). The referenced Archaeological Surveys are available electronically upon request.

#### 7.0 LIST OF PREPARERS

Mary Frazer, NCDOT Natural Environment Section; Project Coordination, Document Preparation, Botanical and Animal Surveys

Matt Smith, Environmental Services, Inc.; Document Preparation, Botanical Surveys Kevin Markham, Environmental Services, Inc.; Document Preparation, Botanical Surveys Contributors:

Katie Talavera, Environmental Services, Inc.; GIS Analysis, Graphics
David DuMond, Environmental Services, Inc.; Habitat Characterizations, Botanical Surveys
Mary K. Clark, Moonlight Environmental Consulting; Bat Surveys
J. Bolling "Bo" Sullivan, Beaufort, NC; Moth Surveys
Mike Sanderson, NCDOT Natural Environment Section; Bird Surveys
Dennis Herman, NCDOT Natural Environment Section; Reptile and Amphibian Surveys, Eastern Woodrat Survey
Logan Williams, NCDOT Natural Environment Section, retired; Butterfly Surveys
Neil Medlin, NCDOT Natural Environment Section; Fish Surveys
Jay Mays, NCDOT Natural Environment Section; Crustacean and Mollusk Surveys

Dr. J.H. Carter III & Associates; Bald Eagle Surveys, Red-cockaded Woodpecker Surveys

Date: \_\_\_\_\_

Gary Kauffman Botanist/Ecologist, U.S. Forest Service National Forest in North Carolina

# APPENDIX A

# Habitat Descriptions

#### Habitat Descriptions for Alternative 3

Habitats were visited within the Alt. 3 study area at the onset of the rare species evaluations in 2003 and 2004 for the purposes of documentation of various habitat characteristics in the field. Nine major habitat types were identified in the evaluation area. These include Pine Flatwoods, Pine/Hardwood Forest, Streamhead Pocosin, Swamp Forest, Small Pond, Powerline Corridor, Pine Plantation, Successional/Ruderal Habitat, and Rural/Urban Modifications. Five habitat types are further divided by characteristics of hydrology or vegetation. Pine Flatwoods is the most abundant habitat type within the Alt. 3 study area and includes area denoted as mesic and hydric. Streamhead Pocosin is divided into tree-dominated and shrub-dominated areas based on canopy coverage. Swamp Forest has been grouped into three distinct regimes with respect to hydrologic conditions and stream characteristics; large stream, small stream, and ponded/depressional. Powerline Corridor and Pine Plantation habitats are divided into mesic and hydric areas. One habitat type, Rural/Urban Modifications, is used to include all obvious human-maintained landscape modifications including roads, residential areas, businesses, etc. Habitats sustaining regular disturbance are included under Successional/Ruderal Habitat. Vegetation community mapping is provided in Figures 2a - 2d in Appendix F.

Common and scientific names of vascular plants used in this text generally follow Kartesz and Meacham (1999), Weakley (2012), or other names in more common usage. Scientific names of liverworts follow Hicks (1992), and scientific names of mosses follow Crum and Anderson (1981).

#### **Pine Flatwoods**

Pine Flatwoods is the most abundant habitat type within the Alt. 3 study area. Mesic, or moist and hydric, or wet, variations have been mapped (identified respectively as Mesic PFm and Hydric PFh on Figures 2a – 2d). Mesic Pine Flatwoods occupies approximately 98.3 acres and hydric Pine Flatwoods approximately 48.7 acres on NFS lands within the area that may be directly impacted. Pine Flatwoods develop naturally when landscapes in this region are exposed to regular fire. In the CNF the burning cycle is more systematically and evenly applied than under natural conditions. Under completely natural conditions fires would be more random and the effects would be more discontinuous. More severe fires would be expected to result under natural conditions, and the resulting seres would be considerably different than those that currently exist in the project area. Naturally, the landscape would support more of a heterogeneous mosaic of forest seres. Not only frequency, but also severity of fires governs the density of vegetation through pine flatwoods. The difference between mesic and hydric Pine Flatwoods variations is the greater tendency for the hydric form to hold moisture for longer periods of time during and following precipitation. Hydric Pine Flatwoods are not permanently wet, but may be wet in those winter seasons experiencing normal or above normal rainfall.

Soils of the region are characteristically loamy with substantial B2t horizons below loamy sand or sometimes sandy loam A horizons. These soils are Ultisols. The E-horizons of the mesic soils are well developed with chromas above 2. Goldsboro and Norfolk series are common mapping units for these soils in Palaeudult Great Groups (USDA 1989). Higher clay contents exist in B-horizons of the hydric form of pine flatwoods subsoils. Sola with more clay normally hold or perch water for longer periods at their surfaces and are generally placed in the Paleaquult Great Group. The Rains series is a frequently applied soils mapping unit of the wetter forms where E-horizons have a low chroma (2 or below). Wetter and drier inclusions are typically found in many flatwoods areas and the moisture variations can influence canopy and understory changes including changes in shrub and herb layer species contents.

On slopes above swamp forests, seepage from ground water discharge over time has created narrow wetland terraces that are underlain by sands heavily coated with black organic matter. Below the black sands are often spodic fragipans that perch and promote lateral movement of water to down-slope areas in the floodplain. The wetland conditions may be lost up-slope or merge with those of the floodplain. These small shelves of hydric soil have not been mapped (USDA 1989), but are here considered Alaquods. As with most seepage of this nature in the coastal plain such areas can change through time depending on up-slope land use.

Increased runoff promoted by ditching and plowed firebreaks has reduced the amount of water that enters the solum in some Pine Flatwoods habitats. Soil indicators in many areas have apparently developed in profiles wetter than those that currently exist. The extent to which these landscape modifications continue to affect change is not known.

Pine Flatwoods are dominated by two or sometimes three strata or vegetation layers. The uppermost layer or canopy is composed primarily of pine. Longleaf Pine (*Pinus palustris*) is prevalent in dryer areas or mesic sites while Loblolly Pine (*Pinus taeda*) and/or Pond Pine (*Pinus serotina*) are most abundant in wetter or hydric areas. Under a regime of intermittent fire a single layer of two to five foot high shrubby vegetation composed of tree and shrub species is common in the mesic and hydric variations of this type. Occasional young trees may extend above the shrub stratum. Within the habitats examined pine stems are usually within the 14 to 20 inch diameter classes, but stands of younger trees can be found, particularly paralleling utility corridors. The pine canopies are not usually dense, due to thinning, and provide only a characteristic 20 to 25 percent cover over the forest floor. Shrub covers are much higher and approach 100 percent in some thick areas, but most usually do not exceed 60 to 70 percent cover. Herbaceous species generally provide scattered, sparse cover except in a few areas where high light levels reach the forest floor.

The single most abundant shrub species in mesic areas is Blue Huckleberry (*Gaylussacia frondosa*). Sweet-gum (*Liquidambar styraciflua*) is the most abundant tree species present below the pine canopy, but this species may be represented by only shrub or sapling-sized individuals. Other woody species frequently present in mesic areas include Horsesugar (*Symplocos tinctoria*), Southern Bayberry (*Morella cerifera*), Swamp Bay (*Persea palustris*), and Small Black Blueberry (*Vaccinium tenellum*). Evening Trumpet-flower (*Gelsemium sempervirens*) is a frequent woody vine that grows by twining through young trees and scrambling across the ground.

Openings in shrubs make sunlight more available and provide habitat for a variety of herbaceous species. In addition, this is prime habitat for a species of particular interest, Spring-flowering Goldenrod (*Solidago verna*) which is quite abundant throughout this habitat type and even occurs in the more hydric variations of this habitat. Northern Bracken Fern (*Pteridium aquilinum* var. *pseudocaudatum*) and Pineland Three-awn or Wire-grass (*Aristida stricta*) are

abundant and provide thick cover in some areas. Additional, but rarely dominant species represented are Round-leaf Thoroughwort (*Eupatorium rotundifolium*), Spiked Hoary-pea (*Tephrosia spicata*) and Narrow-leaf Silk-grass (*Pityopsis graminifolia* var. *tenuifolia*).

Hydric variations of pine flatwoods are characterized by an intermittent to nearly continuous shrub stratum frequently dominated by Giant Cane (*Arundinaria gigantea* ssp. *tecta*). While Sweet-gum is frequent in these habitats, Red Maple (*Acer rubrum*) is somewhat more abundant. Wetter versions of this habitat are similar to streamhead pocosins and may have some of the same species in common. Southern Blueberry (*Vaccinium formosum*), Evergreen Bayberry (*Morella caroliniensis*), Black Blueberry (*Vaccinium fuscatum*), Swamp Bay, Southern Bayberry, Horsesugar, and Shinyleaf (*Lyonia lucida*) are often present. Herbaceous species include Cinnamon Fern (*Osmunda cinnamomea*) and Virginia Chain-fern (*Woodwardia virginica*) that are favored by scattered openings in the thick shrub cover.

Narrow seepage shelves along slopes above swamp forests at the edges of mesic Pine Flatwoods habitats are characterized by the clonal stands of Coastal Doghobble (*Leucothoe axillaris*). Stands of this species may remain visible for years following modification of the conditions that allowed them to establish. Loblolly Pine is a regular canopy associate. Other species that can be found are Cinnamon Fern, American Holly (*Ilex opaca*) and Tulip Poplar (*Liriodendron tulipifera*).

Bryophyte species are sparse through the mesic portions of this habitat. Wetter stages with fallen logs and hardwood tree bases may support mixed species dominated by the leafy liverwort *Odontoschisma prostratum* and the moss *Leucobryum albidum*. Depressions holding water for extended periods of time may support small mounds of sphagnum (usually *Sphagnum palustre* or *S. affine* but also possibly *S. perichetiale*). These are never extensive or abundant and are widely scattered unless associated with plowed firebreaks where moisture is perched over subsoil clays. Bryophyte cover in mesic habitats is sparse to non-existent especially under heavy leaf litter. Increased cover by bryophytes was observed in some hydric stands.

Natural modifications in Pine Flatwoods habitats accompany topographic variation. Topographic variation is found along slopes of natural drainage lines, for example, Southwest Prong Slocum Creek. Changes accompanying topographic breaks are marked by an increase in occurrence of broadleaf deciduous tree species in the forest canopy or subcanopy. As the slope breaks from mesic Pine Flatwoods, Longleaf Pine may be partially replaced in the canopy by Loblolly Pine, White Oak (*Quercus alba*), Southern Red Oak (*Quercus falcata*), hickory (*Carya spp.*) and Water Oak (*Quercus nigra*). Sourwood (*Oxydendrum arboreum*) and Flowering Dogwood (*Cornus florida*) are regular constituents of a subcanopy well drained sandy slopes. Red Maple and Sweet-gum often become more abundant on moist slopes, as well. Lower along the slope soils may become moister from seepage or sandier as fine particulates are leached from the soil and moved further down the slope. Tulip Poplar and Swamp Chestnut Oak (*Quercus michauxii*) are often important in the canopy while American Holly becomes a characteristic subcanopy species. Near the base of the slope, swamp forest species increase in importance as soil moisture increases and as textures become more loamy or mucky.

#### **Pine/Hardwood Forest**

As indicated above, Pine/Hardwood Forests may develop along stream slopes. Pine/Hardwood Forest (identified as PH on Figures 2a – 2d) occupies approximately 21.1 acres on NFS lands within the area that may be directly impacted. This forest type is also one of the intermediate results of fire exclusion from otherwise natural forest systems. In mature pine forests protected from fire, particularly mature loblolly pine forests, hardwood forest species tend to invade as soils become coarser and as light levels are reduced at the forest floor. Reduced light levels offer a competitive advantage to broadleaf deciduous or hardwood species. At intermediate seral stages hardwoods may grow into a subcanopy stratum. Eventually, as pines mature, senesce, and die, hardwoods replace them in the canopy. This process of natural succession is often truncated in natural systems where fire is experienced. Pine forests may be the temporary result. Additional disturbances can further confuse successional stages and promote further diversity in forest variation. Mesic and hydric variations in Pine/Hardwood Forests were not recognized during mapping due in part to the subtle successional and hydrologic factors present in these communities that are difficult to discern from aerial photography.

Additionally, Pine/Hardwood Forest variations were not recognized because aerial photographic resources were inadequate without intensive ground truthing. As a result many variations of this type along slopes have been included with Pine Flatwoods. In some areas, somewhat more extensive pine canopy covers are broken by hardwood occurrences. Examination of these areas in the field indicates that while pines appear to be functioning as a canopy, high hardwoods, though not quite as tall as the pines, were functioning in the lower canopy as well. In such situations, photographic signatures returned only pine in the canopy. From a strictly aerial photographic view, pine-hardwood canopy mixing was not readily visible unless pines were more widely spaced.

Soils supporting Pine/Hardwood Forests are often coarser than those that support Pine Flatwoods. Differences not practically applicable as map units at the level of countywide surveys occur largely as inclusions and are not specifically defined (USDA 1989). For instance, along slopes where sola are widely variable, several soil types may occur across a relatively short distance. They have developed in response to variations in gravity, moisture content or seepage, organic matter content, and other soil forming factors. In one example, a Torhunta-like soil with an umbric epipedon and a deep A horizon forms a large inclusion in an area mapped as Rains in the southwestern intersection of the railroad and Duke Energy Progress power line south of Creek Road (USDA 1989). The latter example is of a hydric Pine/Hardwood Forest.

Pine/Hardwood Forests are present in a wide range of landscape conditions. Successional trends across these habitats are not always clear, as indicated by the wetland example in the last paragraph. In one area there was a visible trend toward pine standing stock with greater diameters where hardwoods were present in the canopy. Combined cover by the canopy species (hardwood and pine) exceeded 50 percent in some areas. The successional sere was older. As in Pine Flatwoods, shrub strata were relatively dense with covers up to 60 percent. Covers were low for herbaceous plants. Bryophytic species were largely corticolous because of the presence of hardwood bark substrates. However, bryophytes were also favored on rotten wood and soil with the naturally increased moisture under multiple canopy layers. Fire, still a management factor in such habitats, was responsible for thinner litter layers and additional stand diversity.

In the above area post mature Loblolly Pine was the dominant tall canopy species, while a welldeveloped lower canopy of hardwood consists primarily of Water Oak, Sweet-gum, Red Maple, and large Swamp Bay. Horsesugar makes up the bulk of the subcanopy stratum along with younger individuals of canopy species. Swamp Titi (*Cyrilla racemiflora*) and Large Gallberry (*Ilex coriacea*) constitute a high shrub layer along with younger individuals of canopy and subcanopy species.

Bluff areas along Southwest Prong Slocum Creek are marked by the occurrence of a greater percentage of hardwood species in the canopy and replacement of Longleaf Pine by Loblolly Pine. One outstanding parcel along the south side of the creek at the eastern boundary of the Alt. 3 study area has been partially separated from the mainland by stream dissection. The top of the resulting knoll rises 10 to 15 feet above the elevation of the surrounding swamp to about the height of the adjacent upland flatwoods landscape. With minimal connection to the main portion of the upland landscape, seepage characteristics have been lost. Soils were deep Arenic Hapludults, possibly of Conetoe series with a shallow sandy A-horizon and a deep, dry, loamy sand B-horizon that extended almost 60 inches below the surface.

A mix of hardwood species joins loblolly pine in the canopies of the above pine/hardwood parcels. Tulip Poplar, hickory, White Oak, Southern Red Oak, an occasional Northern Red Oak (*Quercus rubra*), Water Oak, and Sweet-gum are included among the canopy dominants. Longleaf Pine is absent from these parcels, but present in the nearby adjacent landscapes. A subcanopy is composed of younger individuals of the canopy species as well as Flowering Dogwood and Sourwood. In other more mesic areas such as the bluff along the north side of Southwest Prong Slocum Creek, American Beech (*Fagus grandifolia*) grows on the low slopes and ridges just above the wet floodplain along with a typical subcanopy species American Hornbeam (*Carpinus caroliniana*). Shrub species included Small-flower Pawpaw (*Asimina parviflora*), Silky-camellia (*Stewartia malacodendron*), Swamp Bay and several species of woody vines including Muscadine (*Vitis rotundifolia*) and Virginia-creeper (*Parthenocissus quinquefolia*) on the sandy knoll. Partridge-berry (*Mitchella repens*) and Variable Rosette Grass (*Dichanthelium commutatum*) were the most abundant herbaceous species, though these were only scattered.

Additional exemplary areas of Pine/Hardwood Forest were found. Two areas were found along the ridge paralleling the east and west sides of the East Prong Slocum Creek. Several areas were found along the upland slopes of Tucker Creek west and south of the Craven County Transfer Facility (recycling facility adjacent to the old landfill site along US 70).

#### **Streamhead Pocosin**

Significant Streamhead Pocosin habitats occur largely in the southern portions of Alt. 3 study area. These are located near the western and eastern sides of East Prong Slocum Creek and in the proposed southern interchange with US 70. Scattered pocosin habitat also occurs along the west side of Creek Road just south of Havelock and west of East Prong Slocum Creek. These habitats consist of a high, dense shrub stratum under a scattered canopy of Pond Pine, occasionally Loblolly Pine, and Loblolly Bay (*Gordonia lasianthus*). Areas with a relatively continuous canopy are identified as tree dominated (identified as SPt on Figures 2a – 2d). Areas

containing only widely scattered trees in the canopy are identified as shrub dominated (identified as SPs on Figures 2a - 2d). Most of the pocosin habitat seen in the project area exists at the heads of streams or in upper stream divides where runoff is slow. That is, they occur in areas above discernable stream dissection. Tree-dominated Streamhead Pocosin occupies approximately 9.0 acres and shrub-dominated Streamhead Pocosin approximately 1.3 acres on NFS lands in the area that may be directly impacted.

Most of the Streamhead Pocosin occurs within soil map units identified as Pantego (Umbric Palaeaquult), Croatan (Terric Medisaprist), Onslow (Spodic Palaeudult), and Rains (Typic Palaequult) (USDA 1989). Croatan and Pantego soils are likely the most important pocosin soils of the area. Pantego soils were identified in the strip of pocosin east of US 70 at the southeast edge of the proposed interchange. An umbric epipedon of about 20 inches with a strong argillic horizon below were the characteristic parts of the pedon sampled and identified. Croatan soils were not sampled at the time of the fieldwork since they were significantly flooded. Croatan soils are Histisols and appear to be more directly associated with the open shrub dominated pocosin in the northeastern portion of the proposed southern interchange.

A single soil sample taken in the small power line corridor passing through pocosin (and other) habitat west of Creek Road indicated the presence of a different kind of habitat in the area. Textures of horizons examined along the power line were very sandy except at the very top. More loamy horizons may exist elsewhere. The water table was close to the surface, but precipitation had been abnormally high during the immediate time period. The soil may have been a Psammaquent. This is unusual in an area that is otherwise dominated by loamy soils and may indicate areas of sand fill or possible the course of an old stream bed. Pocosin habitats with and without a tree canopy in this area possess boggy surfaces and frequently are dissected by plowed firebreaks that create many small openings potentially favorable to growth of a variety of wet savanna plants.

Pond Pine is the dominant canopy species of most pocosin habitat. Occasional Loblolly Pine and Longleaf Pine may be present depending to some extent on variance in soil characteristics. A thick stratum of shrubs is typical of most areas. The shrub layers contain varying mixtures of several species of shrubs including Shinyleaf, Swamp Titi, Carolina-laurel (*Kalmia carolina*), Swamp Doghobble (*Leucothoe racemosa*), Southern Blueberry, Honeycup (*Zenobia pulverulenta*), Inkberry (*Ilex glabra*), Horsesugar, and Large Gallberry. Red Maple, Loblolly Bay, and Swamp Bay occur as trees or younger individuals. Swamp Tupelo (*Nyssa biflora*) and Pond Cypress (*Taxodium ascendens*) may be found in somewhat lower areas that experience nearly permanent standing water. Laurel-leaf Greenbrier (*Smilax laurifolia*) is an abundant woody vine that adds significantly to the thickness of these habitats.

Shrub cover in most pocosin habitats approaches or exceeds 80 percent, while the canopy may have only 20 to 30 percent cover. Controlled burning may be responsible for reducing shrub cover in scattered areas, but that management practice has not been used to create any significant wet savannas. Pines dominating the canopy may exceed 18 inches in diameter, but most are within the 12 to 16 inch classes. In a few areas canopy trees are considerably smaller. Some areas are more open where the shrub stratum is intermittently broken such as the habitats west of Creek Road. These open areas support a wider variety of herbaceous species than do the more

shaded systems. Two species commonly found throughout these habitats are Cinnamon Fern and Virginia Chain-fern. Many other species are regular constituents of more open phases of pocosins. Bryophytes are most visible in open habitats and include several species of *Sphagnum* as well as *Aulacomnium palustre*. In more shaded areas a variety of both mosses and leafy liverwort species can be found on decaying wood and tree bases.

#### **Swamp Forest**

Swamp Forest is typically subject to saturated soils and/or standing water for most of the year. These forests have been grouped under three distinct regimes with respect to hydrologic conditions. Swamp Forests occur along large streams such as East Prong Slocum Creek, and Southwest Prong Slocum Creek (identified as SFI on Figures 2a – 2d). Larger streams often have been impounded by beaver (*Castor canadensis*) activity. Swamp Forests occur along small streams (identified as SFs on Figures 2a – 2d) that are generally free-flowing and possibly intermittent tributaries of a larger stream. Swamp Forests occur, as well, in depressions or ponds scattered through head water areas of small or large streams (identified as SFp on Figures 2a – 2d). During dry weather these depressions may be isolated from tributary streams. Some are permanently isolated. Swamp Forest along large streams occupies approximately 9.4 acres, along small streams approximately 12.9 acres, and in ponds approximately 20.0 acres on NFS lands within the area that may be directly impacted.

Soils of large stream Swamp Forests are mapped as a generalized mixture of Masontown (Cumulic Humaquept) and Muckalee (Typic Fluvaquent) (USDA 1989). Some of these map units may contain unmapped inclusions of soils with partial parent material origins in weathered and secondarily deposited basic or circum-neutral (marl or limestone) sediments. These alluvial/colluvial soils occur along slow-moving blackwater streams and may extend into some ponds in the headwaters of Wolf Pit Branch at the eastern edge of the Alt. 3 study area. Soils in other Swamp Forests along small streams and in ponds have not been specifically mapped. Some of these areas are more generally covered by such map units as Lenoir and Rains, both of which are Palaeaquults. Leaf has been used to map a few of the small streams of the region and it is a Typic Albaquult. Matrix landscapes containing scattered Swamp Forest ponds are not necessarily wetlands.

Soils in small streams and Swamp Forest ponds were sampled in selected areas. Sola in small streams show results of mixing with sands and organic silts thoroughly intermixed or sandwiched between lenses of sand or organic sediments that contain larger organic debris including bits of bark, wood and small plant stems or small logs. Soils of Swamp Forest ponds had mineral sola, were loamy and similar to the soils of the surrounding landscape, except they were hydric. Several inches of water logged litter (leaves, branches) and organic silt usually covered the bottoms of the Swamp Forest ponds. Below the organic debris an A-horizon darkened by deposition of organics could be found several inches into the mineral soil. Below the A-horizon the C-Horizon was usually gray fine sandy clay loam or sandy clay loam. In Swamp Forest ponds with a shorter hydroperiod, horizons could be better developed, displaying A, E, and B-horizon differentiation.

Canopy cover in Swamp Forest was highly variable. Generally, canopy coverage across more open large stream Swamp Forests was intermittent, primarily because of landscape drowning due

to beaver activity. Small streams and inner edges of large stream Swamp Forests were usually quite well shaded with up to 60 or 70 percent cover by largely deciduous trees with a small percent contributed by pine. Cover by shrubs and herbs were usually low in small stream floodplains and ponded areas, but high along large streams particularly in areas flooded by beaver activity. Standing large trees nearest the main channels of large stream Swamp Forest were typically dead. Away from the deeper portions of the swamp, larger trees could be found that were in the 20 to 24 inch diameter classes. Along small stream channels, tree stems usually matched in size those of adjacent upland areas. Stems in ponded Swamp Forest were quite variable and ranged from 8 inches to 16 inches in diameter.

Tree species commonly represented in large stream Swamp Forest are Green Ash (*Fraxinus pennsylvanica*), Southern Bald-cypress (*Taxodium distichum*), Sweet-gum, Red Maple, Swamp Tupelo, and Willow Oak (*Quercus phellos*). The subcanopy contained younger individuals of the canopy species. Linear beaver dams add a dynamic elevation continuum from below ambient water levels to well above. Fallen dead trees provide additional habitat diversity for a time and ultimately assist in the accumulation of sediment and detritus in areas impounded by beaver activity. Living plant stems provide additional flow reduction and diversion as the floodplain builds and spreads laterally.

Shrub and herb strata along large streams within the corridor have a species diversity that is accentuated and controlled largely by the course of beaver activity. A wide variety of species occur over the three-dimensional mosaic of beaver-influenced Swamp Forest in large streams. Swamp-loosestrife (*Decodon verticillatus*), Eastern Poison-ivy (*Toxicodendron radicans*), Woodvamp (*Decumaria barbara*), Horsebrier (*Smilax rotundifolia*), Giant Plume Grass (*Saccharum giganteum*), Swamp Bay, Lizard's-tail (*Saururus cernuus*), Virginia Blueflag (*Iris virginica*), Virginia Sweetspire (*Itea virginica*), Swamp Doghobble, and Swamp Rose (*Rosa palustris*) are but a few of the species found within or along edges of beaver-influenced Swamp Forest.

Included in large stream Swamp Forest habitat are those areas that are adjacent and slightly above regular water flow, but still within the floodplain. These areas may be flooded during periods of heavy precipitation but otherwise remain saturated to within several inches of the surface of the soil. An example of such an area occurs along the western edges of Southwest Prong Slocum Creek within the Alt. 3 study area. This forest contains Loblolly Pine along with Red Maple, Southern Bald-cypress, and other canopy species of the more open Swamp Forest. Along with many of the shrub and herb species characteristic of more open areas, Cinnamon Fern, Virginia Chain-fern, Royal Fern (*Osmunda regalis* var. *spectabilis*), Netted Chain-fern (*Woodwardia areolata*), which often marks the zone of transition between wetland and upland habitats, Small-spike False Nettle (*Boehmeria cylindrica*), and Southern Wood Fern (*Dryopteris ludoviciana*) may occur.

Small stream Swamp Forests are narrow linear features that support at least an intermittent flow and are well shaded by a combination of pine and deciduous tree species. In some areas they differ little from hydric Pine Flatwoods except for a larger proportion of hardwood species in the canopies. The most well developed examples were found in the southern portion of the northern interchange area of the Alt. 3 study area with US 70 in upper branches of Tucker Creek including Daniels Branch and along an unnamed tributary of Southwest Prong Slocum Creek between the creek and Gray Road. Other habitats of this type are scattered in mesic flatwoods forest east of Lake Road and west of Sunset Road. Some are scarcely more than 20 feet in width, while others are over 100 feet wide. Customary canopy constituents are Loblolly Pine, Red Maple, Swamp Tupelo, and Sweet-gum. Pond Pine is occasionally present. Shrub species present are influenced by the nature of the surrounding habitat and usually consist of varying combinations of Southern Bayberry, Giant Cane, Swamp Bay, Southern Blueberry, Shinyleaf, Large Gallberry, Inkberry, and Horsesugar. Netted Chain-fern and Cinnamon fern are among the most abundant herbs.

Ponded Swamp Forest habitat occurs in depressions that can be perennially isolated or those that contribute to outflow during precipitation events. Those areas that are perennially isolated have a limited habitat diversity, and support a single mixed species stand typically consisting of Swamp Tupelo, Pond Cypress, and Red Maple. Swamp Bay and Sweet-bay (*Magnolia virginiana*) may also be present. Shrub and herb constituents are usually limited to the peripheries of these ponds.

Another type of ponded Swamp Forest is subject to through-flow and is found in hydric Pine flatwoods or Streamhead Pocosin habitats. These are shallow depressions that fill during precipitation events. Upon filling, there may be a partial flow reversal either above or below the soil surface so that there is a slow redistribution of moisture away from the location of the hydrologic head. A forest canopy and/or a thick shrub stratum usually shade these basin-like depressions. In some habitats they are more open to direct light as a result of a partial thinning of the forest canopy. The largest such habitats seen are in the proposed southern interchange portion of Alt. 3 study area west of US 70.

Vegetation adjacent to the second example of ponded swamp forest is intermediate between hydric Pine Flatwoods and Streamhead Pocosin. The habitat is broken by an irregularly interconnected system of pools up to two feet deep and short channels bordered by narrow ridges supporting trees and shrubs. Largely Loblolly Pine with or without Pond Pine forms the highest canopy with deciduous species including Red Maple, Swamp Tupelo, Sweet-gum, and scattered Pond Cypress below. Swamp Bay and Sweet-bay are characteristic subcanopy trees. Southern Bayberry and Shinyleaf grow on ridges and in clumps often over hanging water. Younger individuals of subcanopy species are generously present. Other species present depend on the character of the surrounding vegetation and whether it is more similar to hydric Pine Flatwoods or Streamhead Pocosin. Cinnamon Fern and Virginia Chain-fern are typically present.

Cover by bryophyte species was variable between different types of swamp forest. In ponded Swamp Forest corticolous bryophytes occupied the surfaces of tree bases and fallen logs. These include, among others, *Odontoschisma prostratum*, *Pallavicinia lyellii*, and *Leucobryum albidum*, *Leucolejeunea clypeata*, and *Sematophyllum adnatum*. In small stream Swamp Forest and more shaded edges of Swamp Forests along large streams, corticolous species were also very abundant with a greater number leafy liverworts and large mosses in soil at the upper edges of floodplains such as *Mnium cuspidatum* and *Climacium americanum*. In addition to the above corticolous species in Swamp Forest ponds others were seen on exposed roots and tree bases in swamp forest along major streams. These included *Metzgeria furcata*, *Entodon macropodus*,

*Schwetschkeopsis fabronia*, and *Steercleus serrulatus*. In more perennial streams, aquatic species were also present. North of Gray Road the stream contained *Fontinalis sullivantii*. The genus *Fissidens* was also represented. Swamp Forests are rich habitats for bryophytes. Bryophytes were not regularly noted in the main channels of large stream Swamp Forests, but were abundant well away from areas exposed to frequent flooding in the floodplains, particularly along all portions of Southwest Prong of Slocum Creek.

# Small Pond

Small Ponds are habitat features that are isolated by mesic flatwoods from any natural drainage system. Several areas of such ponds were found during the course of the field work. One area was in the mesic Pine Flatwoods within the Alt. 3 study area. Small Ponds (identified as P on Figures 2a - 2d) occupy approximately 0.2 acre on NFS lands within the area that may be directly impacted. The flatwoods ponds were essentially without canopy species except for the presence of a stem of Swamp Tupelo in one and a stem of Loblolly Pine in the other in the deepest parts of the depressions. Both were only ephemerally wet and only one supported wetland vegetation. Soils in one pond were marginally hydric but fully hydric in the other. Inkberry, Giant Cane, Wand Panic Grass (*Panicum virgatum*), and Cypress Rosette Grass (*Dichanthelium dichotomum*) were additional species present.

# **Powerline Corridor**

Sections of the Alt. 3 study area includes portions of maintained Powerline Corridor north of Sunset Road, along FR 638, and across the end of Pine Grove Road (FR 156). A small fragment of Powerline Corridor occurs in the project area east of Creek Road (FR 604) nearest the railroad. Portions of Powerline Corridor habitats designated as mesic (identified as PCm on Figures 2a - 2d) do not normally support standing water for significant periods of time. Powerline Corridor habitats designated as hydric (identified as PCh on Figures 2a - 2d) are subject to prolonged periods of standing water normally during winter, spring, and sometimes early summer. Vegetation along these corridors is mowed on a frequent basis. Mesic Powerline Corridor habitat occupies approximately 6.0 acres and hydric Powerline Corridor habitat approximately 1.9 acres on NFS lands within the area that may be directly impacted.

Soils along the Powerline Corridors reflect those in adjacent flatwoods and other habitats. Rains, Onslow, and Lenoir mapping units have been used to cover the majority of the soils variation in these areas. Leaf is used occasionally. As with other soils in the study area, these are loam to clay loam soils with substantial argillic horizons, particularly in the B-Horizon. The most characteristic differences between mesic and hydric soils are the colors of the E-Horizon. Mesic E-Horizons have a chroma of 2 or greater, while hydric E-Horizons have chromas usually less than 2. Chromas of the upper B-Horizons are generally 1or lower in hydric areas.

Plant species of mesic areas include Inkberry, Giant Cane, Loblolly Pine, Small Black Blueberry, Narrow-leaf Silk-grass, Pineland Three-awn, Broom-sedge (*Andropogon virginicus*), Springflowering Goldenrod, and Hair-awn Muhly (*Muhlenbergia capillaris var. trichopodes*). Plants in hydric Powerline Corridors are, among many others, Slender Goldentop (*Euthamia caroliniana*), Giant Cane, Inkberry, Broom Rosette Grass (*Dichanthelium scoparium*), Woolly Rosette Grass (*Dichanthelium scabriusculum*), rushes (*Juncus spp.*), sedges (*Carex spp.*), beak rushes (*Rhynchospora spp.*), Blue-flower Butterwort (*Pinguicula caerulea*), Yellow Pitcherplant (*Sarracenia flava*), Purple Pitcherplant (*Sarracenia purpurea*), and Little Floating Bladderwort (*Utricularia radiata*). The most common bryophytes are several species of *Sphagnum* as well as *Aulacomnium palustre*. Where Powerline Corridors are crossed by ponds or small streams they may be submerged for a substantial portion of the year.

One area deviating from the regional range of variation was found west of Creek Road (FR 604) and east of the bluff at East Prong Slocum Creek in the vicinity of a small Powerline Corridor crossing that is designated as Powerline Corridor, hydric (PCh) (Figure 2a). This small Powerline Corridor crossing exhibits characteristics of a wet Pine Savanna, whereas much of the adjacent area is designated as Streamhead Pocosin and somewhat resembles pocosin habitats supported over Typic or Aeric Alaquods in Leon or Murville soils.

# **Pine Plantation**

Pine Plantations occur within various sections of the Alt. 3 study area (Figures 2a - 2d). Soils within these habitats have been heavily disturbed either by bedding for pine silviculture or by the importation of soil material, as in the case of the old landfill. The bedding process in plantation areas turns furrow slices of soil material, usually the A-Horizon and part of the E-Horizon, to something of an upside-down position over an adjacent linear strip of undisturbed soil. This process changes the character of the soil and surface drainage, but creates a ridge that better supports pine seedlings, particularly in areas that tend to be wet. Otherwise, soils are similar to those found in the area in general. Soils at the Pine Plantation on the old landfill site are visibly mixed fill material with no natural horizons present. Mesic Pine Plantation (identified as PPm on Figures 2a - 2d) approximately 5.5 acres on NFS lands within the area that may be directly impacted.

In the case of the old landfill site, pine was planted in loamy soil material brought in from some other site to cap the landfill (Figure 2d). The dominant plant is young Loblolly Pine planted in rows. A scattered subcanopy of Sweet-gum has begun to grow between the rows and southern bayberry is scattered. Meadow Rye grass (*Lolium pratense*), Sericea Lespedeza, and Slender wood-oats (*Chasmanthium laxum*) have either volunteered or were spread at the time of capping.

A very small segment of hydric Pine Plantation at the side of Creek Road consists of very closely planted young Loblolly Pine planted on bedded rows (Figure 2a). Saw-tooth Blackberry (*Rubus argutus*) is residual from early growth following site preparation. Loblolly Pine and Longleaf Pine occur at the large Pine Plantation along FR 638 north of Sunset Road (Figure 2b). The plantation is largely mesic, though unmapped sections of it in the western half are somewhat wetter than the eastern half. Sweet-gum is the major deciduous tree species present, though yet very young. Horsesugar, Huckleberry, Southern Bayberry, and Swamp Bay are the customary shrubs. Herbaceous species commonly represented are Northern Bracken Fern, Spring-flowering goldenrod, Broom-sedge, and Virginia Chain-fern occur throughout.

# Successional/Ruderal Habitat

Natural communities in which natural soil/vegetation relationships have been modified for human use and then abandoned are considered successional. Abandoned agricultural fields, borrow pits, sand mines are examples. Ruderal habitats may exist where soil material is
maintained in a constant state of disturbance. Successional/Ruderal Habitat (identified as SR on Figure 2d) occupies approximately 1.2 acres on NFS lands within the area that may be directly impacted.

#### **Rural/Urban Modifications**

Rural/Urban Modifications habitats (identified as M on Figures 2a - 2d) include all those landscape features in the Alt. 3 study area within CNF that are currently functioning features within the human infrastructure. Examples are transportation corridors, ditches, transportation corridor shoulders, and recycle or transfer facilities. These features are a part of the overall habitat complex of the project corridor, albeit a part with minimal non-human functional importance. These areas provide habitat for a wide assortment of weedy, non-native plant species as well as native flora and also provide corridors for their movement and redistribution. Rural/Urban Modifications habitat occupies approximately 50.4 acres of NFS lands within the area that may be directly impacted. See Section 3.1.2 for a list of non-native invasive plant species (NNIS).

#### References

Biotics GIS Database. 2014. As maintained by the North Carolina Natural Heritage Program, NC Department of Environment and Natural Resources, Raleigh.

- Crum, H. A. and L. E. Anderson. 1981. Mosses of Eastern North America. Two volumes. Columbia University Press, New York. 1330 pp.
- Hicks, M. L. 1992. Guide to the Liverworts of North Carolina. Duke University Press, Durham. 239 pp.
- Kartesz, J.T. & C.A. Meacham. 1999. Synthesis of the North American Flora, Version 1.0. North Carolina Botanical Garden, Chapel Hill, NC. ISBN 1-889065-05-6 [CD-ROM]
- U.S. Department of Agriculture (USDA). 1989. Soil Survey of Craven County, North Carolina. USDA Natural Resources Conservation Service (Soil Conservation Service). Washington, DC.
- U.S. Fish and Wildlife Service (USFWS). Endangered Species, Threatened Species, Federal Species of Concern, and Candidate Species, Craven County, North Carolina http://www.fws.gov/raleigh/species/cntylist/craven.html (Accessed July 7, 2014).
- Weakley, A. S. 2012. Flora of the Southern and Mid-Atlantic States. Working Draft of 30 November 2012. North Carolina Botanical Garden, Chapel Hill, NC. 1225 pp.

## **APPENDIX B**

USFS Rare Plant Species on the Croatan National Forest

(October 2013 List)

# Table B-1. Proposed, Endangered, Threatened, Sensitive, and Locally Rare Plant Specieson the Croatan National Forest.

Species No.	Scientific Name	Common Name	USFS Status <sup>a</sup>	Habitat Type	Potentially Suitable Habitat Identified in Evaluation Area
1	Aeschynomene virginica	Sensitive Jointvetch	Т	Tidally influenced marshes and creeks and ditches	No
2	Agalinis virgata	Branched Gerardia	LR	Savannas and depression ponds	Yes
3	Agrostis altissima	Tall Bentgrass	LR	Wet savannas	Yes
4	Andropogon mohrii	Bog Bluestem	LR	Wet savannas	Yes
5	Arenaria lanuginosa var. lanuginosa	Spreading Sandwort	LR	Maritime grasslands and forests, sandy sites	No
6	Arnoglossum ovatum	Ovateleaf Cacalia	LR	Wet savannas	Yes
7	Asclepias pedicellata	Stalked Milkweed	LR	Dry savanna and moist flatwoods	Yes
8	Asplenium heteroresiliens	Carolina Spleenwort	S	Marl, coquina limestone outcrops	No
9	Calopogon multiflorus	Many-flower Grass Pink	S	Savannas and sandhills	Yes
10	Campylopus carolinae	Savanna Campylopus	S	Savanna	Yes
11	Cardamine longii	Long's Bittercress	S	Tidal marshes, tidal cypress-gum forests	No
12	Carex basiantha	Widow Sedge	LR	Marl, mesic forests and bottomlands over calcareous rocks	Yes
13	Carex calcifugens	Calcium-fleeing Sedge	LR	Evergreen maritime forest, calcareous bluff forest	Yes
14	Carex emmonsii	Emmon's Sedge	LR	Dry, sandy woodlands	Yes
15	Carex lupuliformis	Hop-like Sedge	LR	Mesic bottomlands, especially in calcareous or mafic areas	Yes
16	Cirsium lecontei	LeConte's Thistle	LR	Savannas	Yes
17	Cladium mariscoides	Twig-rush	LR	Bog marshes, brackish fens, sandhill seeps	No
18	Cleistesiopsis oricamporum (=Cleistes bifaria)	Small coastal Spreading Pogonia	S	Savannas, dry meadows	Yes
19	Clematis catesbyana	Coastal Virgin's-bower	LR	Dunes, maritime forest edge, dolomite	No
20	Corallorhiza wisteriana	Spring Coral-root	LR	Moist to dry nutrient-rich forests, especially over limestone, mafic rocks or shell-rich sands	Yes
21	Coreopsis helianthoides	Beadle's Coreopsis	LR	Swamp, peaty wetlands	Yes
22	Crocanthemum carolinianum	Carolina Cunrose	LR	Sandhills pinelands and dry savannas	Yes
23	Cylindrocolea rhizantha	A Liverwort	S Marl outcrops		No
24	Cystopteris tennesseensis	Tennessee Bladder-fern	LR	Marl, calcareous rock outcrops	No
25	Dichanthelium fusiforme	Spindle-fruited Witch Grass	LR	Sandy pine or pine-oak forests	Yes
26	Dichanthelium hirstii	Hirst's Panic Grass	S	Cypress savannas	No
27	Dichanthelium sp. 9	Hidden-flowered Witch Grass	LR	Pocosins, wet meadows, ditchlines	Yes
28	Dichanthelium spretum	Eaton's Witch Grass	LR	Wet sands and peaty bogs, savannas	Yes

Species No.	Scientific Name	Common Name	USFS Status <sup>a</sup>	Habitat Type	Potentially Suitable Habitat Identified in Evaluation Area
29	Dionaea muscipula	Venus Flytrap	S	Savannas, seepage bogs, pocosin edges with little competition	Yes
30	Eleocharis parvula	Littlespike Spikerush	LR	Tidal brackish and freshwater marshes	No
31	Eleocharis robbinsii	Robbin's Spikerush	LR	Ponds, lakes, Carolina bays	No
32	Eleocharis rostellata	Beaked Spikerush	LR	Tidal brackish and freshwater marshes	No
33	Elymus virginicus var. halophilus	Terrell Grass	LR	Brackish marsh, maritime forest	No
34	Eriocaulon aquaticum	Seven-angled Pipewort	LR	Pond or lake margins	Yes
35	Eurybia spectabilis	Showy Aster	LR	Pine barrens, woodland borders	No
36	Fissidens hallii	Hall's Pocket Moss	S	On bark in cypress-gum swamps	Yes
37	Frullania donnellii	A Liverwort	S	Ilex bark in marshes	No
38	Hibiscus aculeatus	Comfortroot	LR	Bay forests, sand ridges, roadsides	Yes
39	Isoetes microvela	Quillwort	S	Emergent or calcareous riverbanks	No
40	Lachnocaulon beyrichianum	Southern Bogbutton	S	Sandhills	No
41	Leersia lenticularis	Catchfly Cutgrass	LR	Low moist woods	Yes
42	Lejeunea bermudiana	A Liverwort	LR	On marl outcrops and on decaying logs in blackwater swamps	Yes
43	Lejeunea dimorphophylla	A Liverwort	S	On bark in maritime forests No	
44	Litsea aestivalis	Pondspice	S	Limesink ponds and other pools	Yes
45	Lobelia boykinii	Boykin's Lobelia	S	Depression ponds, meadows, Yes clay-based cypress savannas	
46	Ludwigia alata	Winged Seedbox	LR	Freshwater to brackish marshes	No
47	Ludwigia linifolia	Flaxleaf Seedbox	LR	Limesink ponds	No
48	Ludwigia ravenii	Raven's Seedbox	S	Savannas, swamps, marshes, wet Y open areas	
49	Ludwigia sphaerocarpa	Globe-fruit Seedbox	LR	Bogs, pools, and lakeshores	Yes
50	Lysimachia asperulaefolia	Rough-leaved Loosestrife	Е	Pocosin/savanna ecotones	Yes
51	Lysimachia loomisii	Loomis's Loosestrife	S	Moist to wet savannas and pocosin ecotones	Yes
52	Macbridea caroliniana	Carolina Birds-in-a-nest (Carolina Bogmint)	S	Blackwater swamps, savannas	Yes
53	Malaxis spicata	Florida Adder's Mouth	LR	Maritime swamp forest, Yes calcareous mucky outer coastal plain swamps	
54	Metzgeria unicigera	A LIverwort	S	On bark in maritime forests	No
55	Minuartia godfreyi	Godfrey's Sandwort	S	Tidal freshwater marshes	No
56	Myriophyllum laxum	Loose Watermilfoil	S	Limesink ponds, natural lakes	No
57	Nuphar sagittifolia	Narrowleaf Cowlily	S	Blackwater streams, rivers, and lakes	Yes
58	<i>Oplismenus hirtellus</i> ssp. <i>setarius</i>	Shortleaf Basket Grass	LR	Maritime forests, bottomlands	Yes
59	Oxypolis ternata (=O. denticulata)	Piedmont Cowbane	S	Pine savannas, sandhill seeps	Yes
60	Parietaria praetermissa	Large-seed Pellitory	S Shell middens, disturbed sites, N maritime forest		No

Species No.	Scientific Name	Common Name	USFS Status <sup>a</sup>	Habitat Type	Potentially Suitable Habitat Identified in Evaluation Area
61	Parnassia caroliniana	Carolina Grass-of- parnassus	S	Wet calcareous savannas	Yes
62	Paspalum dissectum	Mudbank Crown Grass	LR	Mudbanks, open wet areas, wet ditches	Yes
63	Peltandra sagittifolia	Spoonflower	LR	Pocosins, wet peat-dominated sites	Yes
64	Persicaria hirsuta	Hairy Smartweed	LR	Limesink ponds, clay-lined Carolina bays, blackwater stream edges	Yes
65	Pinguicula pumila	Small Butterwort	LR	Savannas	Yes
66	Plagiochila ludoviaciana	A Liverwort	LR	On bark in swamps and maritime forests	Yes
67	Plagiochila miradorensi miradorensis	A Liverwort	LR	On bark in maritime forests and swamps	Yes
68	Plantago sparsiflora	Pineland Plantain	S	Wet calcareous savannas	Yes
69	Platanthera integra	Yellow Fringeless Orchid	S	Savannas	Yes
70	Platanthera nivea	Snowy Orchid	LR	Wet savannas	Yes
71	Polygala hookeri	Hooker's Milkwort	S	Savannas	Yes
72	Ponthieva racemosa	Shadow-witch	LR	Blackwater forests and swamps over calcareous rock (marl)	Yes
73	Pycnanthemum setosum	Awned Mountain-mint	LR	Dry pinelands and blackwater swamps	Yes
74	Quercus austrina	Bluff Oak	LR	Bluff or basic mesic forest	No
75	Quercus minima	Dwarf Live Oak	LR	Pine flatwoods, coastal fringe sandhills	Yes
76	Rhexia aristosa	Awned Meadow-beauty	S	Clay-lined Carolina bays, limesink ponds	No
77	Rhynchospora alba	Northern White Beaksedge	LR	Limesink ponds, pocosin openings	No
78	Rhynchospora galeana	Short-bristled Beaksedge	S	Wet savannas, may colonize disturbed areas/roadsides	Yes
79	Rhynchospora harperi	Harper's Beaksedge	LR	Limesink ponds and cypress savannas	No
80	Rhynchospora macra	Southern white Beaksedge	S	Seepage or sphagnum bogs in Yes frequently burned streamhead pocosins	
81	Rhynchospora microcarpa	Southern Beaksedge	LR	Limesink ponds, maritime No grasslands, clay-lined Carolina bays	
82	Rhynchospora pleiantha	Coastal Beaksedge	S	Sandy margins of limesink ponds No	
83	Rhynchospora thornei	Thorne's Beaksedge	S	Wet savannas	Yes
84	Sagittaria chapmanii	Chapman's Arrowhead	S	Limesink ponds with drawdown	No
85	Sagittaria weatherbiana	Grassleaf Arrowhead	S	Fresh to slightly brackish Yes marshes, swamps and ponds	
86	Schoenoplectus etuberculatus	Canby's Bulrush	LR	On peat in depression ponds, in flowing blackwater streams	Yes
87	Scirpus lineatus	Drooping Bulrush	LR	Low rich swamp forests over coquina limestone	Yes
88	Scleria baldwinii	Baldwin's Nutrush	LR	Wet savannas associated with longleaf pine, pond pine, and pond cypress	Yes

Species No.	Scientific Name	Common Name	USFS Status <sup>a</sup>	Habitat Type	Potentially Suitable Habitat Identified in Evaluation Area
89	Solidago	Leavenworth's	LR	Savannas, clay-based Carolina	Yes
	leavenworthii	Goldenrod		bays, peaty seeps, pocosin borders	
90	Solidago pulchra	Carolina Goldenrod	S	Savannas	Yes
91	Solidago tortiflora	Twisted-leaf Goldenrod	LR	Dry savannas and moist flatwoods	Yes
92	Solidago verna	Spring-flowering Goldenrod	S Moist pine savannas, lower slopes in sandhills, roadsides in pinelands		Yes
93	Solidago villosicarpa	Coastal Goldenrod	S Maritime, edge of coastal fringe evergreen forest in outer coastal plain		No
94	Sphagnum cribrosum	Florida Peatmoss	S	Blackwater streams, ditches	Yes
95	Sphagnum fitzgeraldii	Fitzgerald's Peatmoss	S	S Pocosins and savannas	
96	Sphagnum torreyanum	Giant Peatmoss	LR	Millponds, beaver ponds	Yes
97	Spiranthes eatonii	Eaton's Ladies'-tresses	LR	Wet savannas	Yes
98	Spiranthes longilabris	Giant Spiral Orchid	S Wet savannas		Yes
99	Sporobolus pinetorum	Carolina Dropseed	S	Wet savannas	No
100	Stylisma pickeringii var. pickeringii	Pickering's Dawnflower	LR Dry sandy roadsides, sandhills		Yes
101	Teloschistes flavicans	Sunrise Lichen	S	Maritime forest	No
102	Thalictrum macrostylum	Piedmont Meadowrue	S	Bogs, wet woods, tidal No freshwater marshes, associated with circumneutral soils and mafic outcrops over olivine	
103	Tofieldia glabra	Carolina Asphodel	S Wet pine savannas and sandhill Yes seeps, savanna-pocosin ecotones		Yes
104	Tridens chapmanii	Chapman's Redtop	LR Roadside, loamy sands of Yes disturbed longleaf pine woodlands		Yes
105	Utricularia olivacea	Dwarf Bladderwort	LR	Limesink ponds, beaver ponds	Yes
106	Xyris floridana	Florida Yellow-eyed Grass	LR	Savannas	Yes
107	Xyris stricta	A Yellow-eyed Grass	LR	Savannas, depression ponds, depressional meadows, ditches	Yes

<sup>a</sup> E – Endangered; LR- Locally Rare; S – Sensitive; T – Threatened.

# **APPENDIX C**

USFS Rare Animal Species on the Croatan National Forest

(August 2013 List)

# Table C-1.Proposed, Endangered, Threatened, Sensitive, and Locally Rare AnimalSpecies on the Croatan National Forest (August 2013 List)

Species No. <sup>a</sup>	Scientific Name	Common Name	USFS Status <sup>b</sup>	Habitat Type	Potentially Suitable Habitat Identified in Evaluation Area	
		I	MAMMAL	S		
108	Canis rufus	Red Wolf	E	Upland and lowland forests, shrublands, coastal prairies, marshes with heavy cover – in North Carolina limited to Albemarle Peninsula	No <sup>d</sup>	
109	<i>Condylura cristata</i> pop. 1	Star-nosed Mole (coastal plain population)	LR	Moist meadows, bogs, swamps, bottomlands	Yes	
110	Corynorhinus rafinesquii macrotis	Rafinesque's Big-eared Bat	LR	Abandoned structures, caves, hollow trees, loose bark trees near wooded areas	Yes	
111	Lasiurus intermedius	Northern Yellow Bat	LR	Roosts in Spanish moss and other thick vegetation near water, often in longleaf pine habitats	Yes	
112	Myotis austroriparius	Southeastern Myotis	LR	Roosts in buildings and hollow trees, forages near water	Yes	
113	Neotoma floridana floridana	Eastern Woodrat (coastal plain population)	LR	Lowland deciduous forest with dense palmetto cover	Yes	
114	Peromyscus leucopus buxtoni	Buxton Woods White- footed Mouse	LR	Maritime forests in Cape Hatteras area	No	
115	Peromyscus leucopus easti	Pungo White-footed Mouse	LR	Dunes and maritime thickets along coast south to Corolla	No	
116	Puma concolor couguar	Eastern Cougar	E	Extensive forests and remote areas – considered extirpated from North Carolina since 1880s	No <sup>e</sup>	
117	Sorex sp. 1	An Undescribed Shrew	LR	Early successional fields, possibly low pocosin on the Albemarle Peninsula	No <sup>c</sup>	
118	Trichechus manatus	West Indian Manatee	E	Warm waters of estuaries and river mouths	No	
	BIRDS					
119	Ammodramus henslowii susurrans	Eastern Henslow's Sparrow	LR	Clearcut pocosins, damp weedy fields	Yes	
120	Botaurus lentiginosus	American Bittern	LR	Freshwater or brackish marshes, lake and pond edges with emergent vegetation	No	
121	Charadrius melodus	Piping Plover	Т	Sandy upper beaches especially where scattered grass tufts are present, sparsely vegetated shores and islands of shallow lakes, ponds, rivers, and impoundments	No	
122	Circus cyaneus	Northern Harrier	LR	Marshes, meadows, grasslands	No	
123	Dendroica kirtlandii	Kirtland's Warbler	E	Jack pine forests; migrates through NC	No <sup>c</sup>	
124	Dendroica virens waynei	Black-throated Green Warbler (coastal plain population)	LR	Nonriverine wetland forests, especially where white cedar or cypress are mixed with hardwoods	Yes	
125	Falco peregrinus	Peregrine Falcon	S	Cliffs, bay, sound, tidal flats, river mouth, herbaceous wetland	No	

Species No. <sup>a</sup>	Scientific Name	Common Name	USFS Status <sup>b</sup>	Habitat Type	Potentially Suitable Habitat Identified in Evaluation Area	
126	Gelochelidon nilotica	Gull-billed Tern	LR	Coastlines, salt marshes, estuaries, sand flats on maritime islands	No	
127	Haliaeetus leucocephalus	Bald Eagle	S	Large bodies of water with mature trees for perching	Yes	
128	Himantopus mexicanus	Black-necked Stilt	LR	Fresh or brackish ponds	No	
129	Hydroprogne caspia	Caspian Tern	LR	Seacoasts, bays, estuaries, lakes, marshes, and rivers	No	
130	Laterallus jamaicensis	Black Rail	LR	Salt, brackish, and freshwater marshes; pond borders, wet meadows, grassy swamps	No	
131	Mycteria americana	Wood Stork	Ε	Freshwater or brackish marshes, swamps, lagoons, ponds, flooded fields, nests in trees over water or on islands	No	
132	Passerina ciris ciris	Eastern Painted Bunting	LR	Maritime shrub thickets, forest edges	No	
133	Peucaea aestivalis (=Ammodramus aestivalis)	Bachman's Sparrow	LR	Open pine woods with grassy cover	Yes	
134	Phalacrocorax auritus	Double-crested Cormoran	LR	Lakes, ponds, rivers, lagoons, swamps, and coastal bays with scattered trees for nesting	No	
135	Picoides borealis	Red-cockaded Woodpecker	Е	Pine savannas	Yes	
136	Plegadis falcinellus	Glossy Ibis	LR	Forests or thickets on maritime islands	No	
137	Porphyrio martinica	Purple Gallinule	LR	Freshwater ponds and rivers with floating vegetation	No	
138	Sterna dougallii	Roseate Tern	E	Seacoasts, bays, estuaries, sand flats on maritime islands	No	
139	Vermivora bachmanii	Bachman's Warbler	E	Moist hardwood forests, swamps, and canebrakes; last observed in NC in 1891	Noʻ	
	REPTILES AND AMPHIBIANS					
140	Alligator mississippiensis	American Alligator	T(S/A)	Fresh and brackish marshes, ponds, lakes, rivers, swamps	Yes	
141	Ambystoma tigrinum	Eastern Tiger Salamander	LR	Breeds in fish-free semi-permanent ponds; forages adjacent sandy pinelands		
142	Caretta caretta	Loggerhead Seaturtle	Т	Nests on beaches, forages in ocean and sounds	No	
143	Chelonia mydas	Green Seaturtle	Т	Nests on beaches, forages in ocean and sounds	No	
144	Crotalus adamanteus	Eastern Diamondback Rattlesnake	LR	Pine flatwoods, savannas, pine-oak sandhills	Yes	
145	Dermochelys imbricata	Leatherback Seaturtle	Е	Oceans, rarely sounds	No	
146	Eretmochelys imbricata	Hawksbill Seaturtle	Е	Oceans, very rarely in sounds	No	
147	Eurycea quadridigitata	Dwarf Salamander	LR	Pocosins, Carolina bays, pine flatwoods, savannas, wetland habitats	No <sup>c</sup>	
148	Heterodon simus	Southern Hognose Snake	LR	Sandy woods, particularly pine-oak sandhills	Yes	
149	Lampropeltis getula sticticeps	Outer Banks Kingsnake	LR	Maritime forests, thickets, and grasslands on the Outer Banks	No	

Species No. <sup>a</sup>	Scientific Name	Common Name	USFS Status <sup>b</sup>	Habitat Type	Potentially Suitable Habitat Identified in Evaluation Area
150	Lepidochelys kempii	Kemp's Ridley Seaturtle	E	Oceans and sounds	No
151	Malaclemys terrapin terrapin	Northern Diamondback Terrapin	LR	Coastal marshes, tidal flats, coves, estuaries, lagoons	No <sup>c</sup>
152	Micrurus fulvius	Eastern Coral Snake	LR	Pine-oak sandhill, sandy flatwoods, maritime forests	No <sup>c</sup>
153	Nerodia sipedon williamengelsi	Carolina Salt Marsh Snake	S	Salt or brackish marshes	No
154	Ophisaurus mimicus	Mimic Glass Lizard	S	Dry, sandy pine flatwoods, savannas, pine/oak sandhills	Yes
155	Rana capito	Carolina Gopher Frog	S	Dry turkey oak-pine associations, sandy areas in pine savannas	Yes
156	Rana sylvatica pop.3	Wood Frog (coastal plain population)	LR	Mesic to moist hardwood forests on Albemarle Peninsula	No <sup>c</sup>
157	Regina rigida	Glossy Crayfish Snake	LR	Marshes, cypress ponds, other wetlands	Yes
158	Seminatrix pygaea	Black Swamp Snake	LR	Lush vegetation of ponds, ditches, sluggish streams	Yes
			INSECTS		
159	Acronicta perblanda	Cypress Daggermoth	LR	Cypress swamps	Yes
160	Acronicta sinescripta	A Daggermoth	LR	Savannas and flatwoods	Yes
161	Agrotis carolina	A Dart Moth	LR	Open longleaf pine or longleaf pine- oak savanna with pyxie-moss	Yes
162	Amblyscirtes alternata	Dusky Roadside Skipper	LR	Open grassy pine flatwoods, savannas, sandhill ridges	Yes
163	Melanapamea mixta (=Apamea mixta)	A Noctuid Moth	LR	Savannas, wet meadows No	
164	<i>Apantensis</i> sp. 1 nr. <i>carlotta</i>	A Tiger Moth	LR	Savannas and sandhill seeps Ye	
165	Atrytone arogos arogos	Arogos Skipper	S	Mesic to boggy reedgrass savannas	Yes
166	Atrytonopsis sp. 1	An Undescribed Skipper	LR	Dunes and sandy flats	No
167	Baetisca obesa	A Mayfly	LR	Lower Tar River	No <sup>c</sup>
168	Bleptina sangamonia	A Noctuid Moth	LR	Ecology not yet assessed; only NC record from Bladen County	No <sup>c</sup>
169	Calephelis virginiensis	Little Metalmark	LR	Grassy fields, savannas, marshes	Yes
170	Callophrys irus	Frosted Elfin	LR	Grassy openings or burn scars in barrens and savannas, ROW and powerlines	Yes
171	Chlorochroa dismalia	Dismal Swamp Stink Bug	LR	Canebrakes Yes	
172	Datana robusta	A Prominent Moth	LR	Savannas, flatwoods, and sandhills	Yes
173	Euphyes berryi	Berry's Skipper	LR	Wet prairies, marshes, savannas Yes with pitcher plants	
174	Euphyes bimacula	Two-Spotted Skipper	LR	Wet savannas, bogs, sedge areas Yes near wet woods	
175	Euphyes dukesi dukesi	Duke's Skipper	S	Ecotones of brackish or freshwater Yes marshes with swamps	
176	Faronta aleada	A Noctuid Moth	LR	Maritime grasslands	No
177	Gabara sp. 1	A Noctuid Moth	LR	Savannas; southeastern NC	No <sup>c</sup>
178	Hemipachnobia subporphyrea	Venus Flytrap Cutworm Moth	S	Large stands of Venus flytraps in wet pine savannas, around pocosins	Yes
179	Hesperia attalus slossonae	Dotted Skipper	S	Xeric natural communities on sterile white sands (or disturbances within)	No

Species No. <sup>a</sup>	Scientific Name	Common Name	USFS Status <sup>b</sup>	Habitat Type	Potentially Suitable Habitat Identified in Evaluation Area
180	Hypomecis buchholzaria	Buchholz's Gray	LR	Fire-maintained glades and pine barrens, xeric scrub-oak	No
181	Papilio cresphontes	Giant Swallowtail	LR	Primarily coastal in maritime forests or thickets	No
182	Pyreferra ceromatica	Anointed Sallow Moth	LR	Flatwoods and pocosins, ecotones between mesic woodland and bottomlands	Yes
183	Spartiniphaga carterae	Carter's Noctuid Moth	S	Savannas and sandhills with Pinebarren Sand-reedgrass (Calamovilfa brevipilis)	Yes
184	Tornos cinctarius	A Gray Moth	LR	Savannas and sandhills	Yes
		FRESHWATER FISH, N	<b>IOLLUSK</b>	S, AND CRUSTACEANS	
185	Acipenser brevirostrum	Shortnose Sturgeon	E	Brackish water of large rivers and estuaries; spawns in freshwater areas	No
186	Acipenser oxyrhynchus	Atlantic Sturgeon	S	Coastal waters, estuaries, large rivers	No
187	Elliptio folliculata	Pod Lance	LR	R Coastal plain, mainly Lake Waccamaw	
188	Ferrissia hendersoni	Blackwater Ancylid	LR	Mainly margins of Carolina Bay No lakes	
189	Fundulus confluentus	Marsh Killifish	LR	Fresh to brackish waters along coast	No
190	Fundulus luciae	Spotfin Killifish	LR	Ponds and pools along coast	No
191	Lampetra aepyptera	Least Brook Lamprey	LR	Tar and Neuse drainages	No <sup>c</sup>
192	Lampsilis sp. 2	Chameleon Lampmussel	LR	Neuse, Tar, and Cape Fear systems; above Fall Line	No
193	Lasmigona subviridis	Green Floater	S	Tar, Neuse, and Cape Fear systems downstate; New and Watauga systems in mountains	No <sup>c,g</sup>
194	Leptodea ochracea	Tidewater Mucket	LR	A number of systems primarily in No <sup>c,g</sup> the coastal plain, abundant in Lake Waccamaw	
195	Lynceus gracilicornis	Graceful Clam Shrimp	LR	Temporary ponds, pools, and ditches	Yes
196	Notropis bifrenatus	Bridle Shiner	LR	Stream near lower Neuse River	Yes
197	Noturus furiosus	Carolina Madtom	S	Tar and Neuse drainages, small to medium rivers	No <sup>c</sup>
198	Sphaerium simile	Grooved Fingernail Clam	LR	White Oak River	No <sup>c</sup>
199	Strophitus undulatus	Creeper	LR	Tar, Neuse, Cape Fear, and other systems	No <sup>g</sup>

<sup>a</sup> Species numbering continued from Appendix B.
<sup>b</sup> E – Endangered; LR – Locally Rare; S – Sensitive; T – Threatened.

<sup>c</sup>No documented occurrence in Craven, Carteret, or Jones Counties; not carried forward for further evaluation.

<sup>d</sup> Red wolf is extirpated from North Carolina except for an experimental population on the Albemarle Peninsula and there are no documented occurrences in Craven, Carteret, or Jones Counties; not carried forward for further evaluation.

<sup>e</sup> Eastern cougar is extirpated from North Carolina, last records in 1880s; not carried forward for further evaluation.

<sup>f</sup> Bachman's warbler is considered extinct, last records documented in North Carolina were 1891; not carried forward for further evaluation.

<sup>g</sup> Streams in the evaluation area are too acidic to provide suitable habitat for freshwater mussels.

# **APPENDIX D**

Summary of USFS Rare Species Documented in the Evaluation Area

#### Table D-1. USFS Rare Species Documented in the Evaluation Area.

Thirty-six USFS rare species have been documented or are presumed present in the evaluation area based on a combination of NCNHP records, USFS records, and field surveys undertaken in 2004 – 2014 for NFS lands within the evaluation area. USFS rare species with potential effects can be divided into two broad categories based on generalized habitat requirements for discussing potential for effects and possible minimization measures: 1) species that occur in open fire-maintained habitats; and 2) species that occur in mature swamp forest and/or peatland forest habitats.

Habitat	cies nber	Common Nome	Scientific Nome	USFS	Potential Impacts	
Group	N S S S S S S S S S S S S S S S S S S S		Scientific Name	Status <sup>b</sup>	Direct	Indirect
	18	Small Spreading Pogonia	Cleistesiopsis oricamporum (=Cleistes bifaria)	S	Yes	Yes
	51	Loomis's Loosestrife	Lysimachia loomisii	S	Yes	Yes
	59	Piedmont Cowbane	Oxypolis ternata (=0. denticulata)	S	Yes	Yes
	69	Yellow Fringeless Orchid	Platanthera integra	S	No	Yes
	71	Hooker's Milkwort	Polygala hookeri	S	No	Yes
	78	Short-bristled Beaksedge	Rhynchospora galeana	S	No	Yes
	90	Carolina Goldenrod	Solidago pulchra	S	No	Yes
	92	Spring-flowering Goldenrod	Solidago verna	S	Yes	Yes
	94	Florida Peatmoss	Sphagnum cribrosum	S	Yes	Yes
	95	Fitzgerald's Peatmoss	Sphagnum fitzgeraldii	S	Yes	No
	4	Bog Bluestem	Andropogon mohrii	LR	No	Yes
	16	LeConte's Thistle	Cirsium lecontei	LR	Yes	Yes
Fire	28	Eaton's Witch Grass	Dichanthelium spretum	LR	No	Yes
Maintained	62	Mudbank Crown Grass	Paspalum dissectum	LR	Yes	Yes
	70	Snowy Orchid	Platanthera nivea	LR	No	Yes
	73	Awned Mountain-mint	Pycnanthemum setosum	LR	Yes	Yes
	97	Eaton's Ladies'-tresses	Spiranthes eatonii	LR	No	Yes
	119	Eastern Henslow's Sparrow	Ammodramus henslowii susurrans	LR	Yes	Yes
	133	Bachman's Sparrow	Peucaea aestivalis (=Ammodramus aestivalis)	LR	Yes	Yes
	135	Red-cockaded Woodpecker	Picoides borealis	Е	Analyzed i Biological A	n separate Assessment
	148	Southern Hognose Snake	Heterodon simus	LR	Yes	Yes
	162	Dusky Roadside Skipper	Amblyscirtes alternata	LR	Yes	Yes
	165	Arogos Skipper <sup>c</sup>	Atrytone arogos arogos	LR	Yes	Yes
	169	Little Metalmark	Calephelis virginiensis	LR	Yes	Yes
	173	Berry's Skipper	Euphyes berryi	LR	Yes	Yes
	175	Two-spotted Skipper <sup>c</sup>	Euphyes bimacula	LR	Yes	Yes
	42	A Liverwort	Lejeunea bermudiana	LR	Yes	Yes
	53	Florida Adder's Mouth	Malaxis spicata	LR	No	Yes
	66	A Liverwort	Plagiochila ludoviciana	LR	Yes	Yes
Swamp	72	Shadow-witch	Ponthieva racemosa	LR	No	Yes
Swallip Forest /	140	American Alligator <sup>c</sup>	Alligator mississippiensis	T(S/A)	Yes	Yes
Peatland	110	Rafinesque's Big-eared Bat	Corynorhinus rafinesquii macrotis	LR	Yes	Yes
rorest	112	Southeastern Myotis	Myotis austroriparius	LR	Yes	Yes
	124	Black-throated Green Warbler	Dendroica virens waynei	LR	Yes	Yes
	175	Duke's Skipper	Euphyes dukesi dukesi	S	Yes	Yes
	182	Anointed Sallow Moth <sup>c</sup>	Pyreferra ceromatica	LR	Yes	Yes

<sup>a</sup> Species number corresponds with species number presented in Tables A-1 and B-1 located in Appendices A and B. <sup>b</sup> USFS Status: E – Endangered; FC – Forest Concern; LR – Locally Rare; S – Sensitive

<sup>c</sup> Species not observed in the evaluation area but determined to likely be present.

# **APPENDIX E**

**Tuscarora Nation Tribal Coordination Letter** 



North Carolina Division

January 6, 2014

310 New Bern Avenue, Suite 410 Raleigh, NC 27601 (919) 856-4346 . (919) 747-7030 http://www.fhwa.dot.gov/ncdiv/

> In Reply Refer To: HDA-NC

Chief Leo Henry Tuscarora Nation 2006 Mt. Hope Road Lewiston, NY 14092

Dear Chief Henry:

The North Carolina Department of Transportation (NCDOT) proposes to construct a four-lane, divided roadway on new location in the vicinity of the City of Havelock in Craven County, North Carolina. The length of the project is 10.1 miles. This transportation improvement project is identified in the 2013-2023 Draft Statewide Transportation Improvement Program (STIP) as Project No. R-1015.

The study area for this project includes an identified archeological site that may have relevance to the Tuscarora Nation. We are requesting your review of the enclosed information and appreciate any input you may have. A response by February 14, 2014, is requested. The enclosed exhibits show the project study area vicinity and the Preferred Alternative. A summary of the project's history, purpose and need, and archaeological resources is included below.

#### Project History

NCDOT began the initial planning and environmental studies for the Havelock Bypass project in the early 1990's. These studies included an analysis of improving the existing highway versus various proposed bypass routes (corridors) with respect to potential impacts to the human and natural environment resources in the project study area.

NCDOT presented the findings of the initial planning studies in the Environmental Assessment (EA) that was approved by the Federal Highway Administration (FHWA) on Jan. 27, 1998. That document included a recommendation for the selection of Corridor 3 as the Preferred Alternative because it generated the lowest environmental impacts and was the most cost effective route.

After the EA was distributed for review and comment, NCDOT held a Corridor Public Hearing in May 1998, to present three bypass corridors for review and the majority of the public, the municipal officials, and the Interagency Team supported Corridor 3.

After the Corridor Public Hearing, FHWA, NCDOT, and other members of a federal and state "Interagency Team" selected Corridor 3 as the Preferred Alternative. NCDOT subsequently

prepared preliminary design plans for Corridor 3, as the associated potential impacts were assessed and evaluated.

Based upon the magnitude of the potential impacts from Corridor 3, it was determined that an Environmental Impact Statement (EIS) would be needed to assess the potential impacts from each of the three bypass corridors in greater detail.

In order to prepare the EIS, design plans needed to be refined, and existing features such as historic architectural and archaeological sites, streams, wetlands, threatened and endangered species, and the existing and predicted land uses needed to be updated and documented for each of the three bypass corridors. Indirect and cumulative impacts resulting from the construction of the project also needed to be considered and discussed in the Environmental Impact Statement. Those studies were updated during 2007 and 2008 to determine the potential impacts related to the bypass corridors.

NCDOT presented the findings of those updated environmental studies in the Draft EIS that was approved by FHWA on Sept. 6, 2011, and distributed during September (a CD with the DEIS is affixed). NCDOT began the public comment period for the document on Sept. 9, 2011. NCDOT held a Pre-Hearing Open House & Corridor Public Hearing on Dec. 6, 2011.

Preparation of the Final EIS is currently in progress, with completion anticipated for the summer of 2014. After the Final EIS is approved and circulated, a Record of Decision (ROD) will be issued by the FHWA. The current project schedule is for right of way acquisition to begin in 2014 and for construction to begin in 2016.

#### Project Description and Purpose and Need

The US 70 corridor connects Raleigh, Smithfield, Goldsboro, Kinston, New Bern, Havelock and Morehead City. Regionally, US 70 provides connectivity with the Port of Morehead City, Global TransPark, industries in New Bern and Craven County, Cherry Point US Marine Corps Air Station, Camp Lejeune and other military facilities, and it functions as a primary route for seasonal beach traffic.

The lack of highway access control on US 70 through Havelock, with its 14 signalized intersections and numerous unsignalized street and driveway connections, substantially reduces the mobility of this corridor. Commercial, institutional, and residential growth in the City of Havelock and an increasing regional reliance on US 70 has led to a deterioration of traffic operations along the existing route. The capacity of US 70 is currently limited by the operational capabilities of its signalized intersections. In 2008, the level of service (LOS) performance of two of the major existing signalized intersections along US 70 (at NC 101 and SR 1765, Catawba Road) were already undesirable. By the design year 2035, none of the major existing signalized intersections will operate at an acceptable LOS without substantial improvements.

Because US 70 is the state's primary connection to the Port of Morehead City and a main route between military facilities and the port, the NCDOT Strategic Highway Corridors (SHC) Program goal to protect the mobility and connectivity of critical highway facilities is particularly relevant to the proposed project. The North Carolina Maritime Strategy Final Report identifies the proposed Havelock Bypass as one of a number of recommended infrastructure projects to improve the regional transport of goods. US 70's function as part of the US Department of Defense Strategic Highway Network for moving military personnel and equipment also illustrates the regional need for the proposed project.

#### Archeological Resources

Between March 18 and June 11 of 1999, an intensive archaeological survey was conducted within the study area of the proposed US 70 Havelock Bypass preferred corridor. All fieldwork was designed to comply with guidelines established by the Secretary of the Interior's Guidelines and Standards for Archaeological Documentation (Federal Register 48: 44734, September 29, 1983). A report, An Intensive Archaeological Survey of the Preferred Corridor for the US 70 Havelock Bypass, Craven County, North Carolina, was prepared in April of 2000. A copy of this report is enclosed. It was the finding of that report that one site was eligible for listing in the National Register of Historic Places (Site 31CV302). This site is a Woodland Period Site and is located approximately 1148 feet north of Tuckers Creek and 246 feet west of US 70. The artifacts recovered were prehistoric potsherds representing the Middle and Late Woodland periods. The diversity reflected in the ceramic assembly may merely be the result of using a variety of clay sources or may reflect trade or use of the site by different cultures over time. With regard to the latter, the site is located at the point where the Tuscarora, Algonquian, and Waccamaw linguistic groups are thought to have overlapped (Phelps 1983: 37)

Given its location at the interface of three cultural groups, and cultural diversity represented in the recovered assemblage, additional work at this site would provide further information on prehistoric socio-economic and political aspects of the region, making it eligible for listing in the National Register of Historic Places. The site will be preserved in place. A redesign of the proposed US 70 Havelock Bypass has effectively avoided the site. No impacts will occur as a result of the proposed project, but it is recommended that further work be undertaken at Site 31CV302 if it is threatened in the future.

Section 4(f) of the Federal-Aid Highway Transportation Act of 1968, (PL-90-495), requires consideration of cultural resources, particularly preservation-in-place, of archaeological resources that are eligible for the National Register. If potentially significant sites are found within the Preferred Alternative and, based on a program of site testing, such sites are determined eligible for the National Register; it is most likely that a data recovery program will be the appropriate form of mitigation.

We would appreciate any information you might have that would be helpful in identifying and evaluating archeological resources within the project corridor. Please identify any areas of concern and indicate in writing if the Tuscarora Nation would like to request consulting party status under 36 CFR 800.3(f)(2).

If you have any questions concerning the subject project, please contact me at (919) 747-7019 or Ron.Lucas@dot.gov.

Sincerely,

iold and

For John F. Sullivan, III, P.E. Division Administrator

Enclosures: 2000 Archeological Study Exhibits 1 and 2 2011 DEIS

## **APPENDIX F**

Figures



ath: P:\GeoGra\Projects\2012\050\10\GIS\Fig\_topo.mxd Date: 7/1/2014 11:37:01 AM







ath: P:\GeoGra\Projects\2012\050\10\GIS\Fig\_veg2.mxd Date: 7/1/2014 11:41:51 AM





U.S. Forest Service Rare Species US 70 Havelock Bypass Biological Evaluation Croatan National Forest, North Carolina T.I.P. R-1015

Project: ER12050.10

Drwn/Chkd: KT/MKS

June 2014

3a

Date:

Figure:

th: P:\GeoGra\Projects\2012\050\10\GIS\Fig\_Species2\_update.mxd Date: 7/1/2014 11:19:40 AM

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000

> U.S. Forest Service Rare Species US 70 Havelock Bypass Biological Evaluation Croatan National Forest, North Carolina T.I.P. R-1015

Project: ER12050.10 Date: June 2014 Drwn/Chkd: KT/MKS Figure: **3b** 

ath: P:\GeoGra\Projects\2012\050\10\GIS\Fig\_Species2\_update.mxd Date: 7/1/2014 11:19:40 AM



NC OneMap

June 2014

3c

Project: ER12050.10

Drwn/Chkd: KT/MKS

Date:

Figure:

U.S. Forest Service Rare Species US 70 Havelock Bypass Biological Evaluation Croatan National Forest, North Carolina T.I.P. R-1015

GeoGra\Projects\2012\050\10\GIS\Fig\_Species2\_update.mxd Date: 7/1/2014 11:19:40 AM



U.S. Forest Service Rare Species US 70 Havelock Bypass Biological Evaluation Croatan National Forest, North Carolina T.I.P. R-1015

Project:	ER12050.10
Date:	June 2014
Drwn/Chk	d: KT/MKS
Figure:	3d

C OneMar

C

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



Croatan Mitigation Bank (CMB) - USFS Rare Species US 70 Havelock Bypass Biological Evaluation Croatan National Forest, North Carolina T.I.P. R-1015

1	Project: E	R12050.10
I	Date:	June 2014
I	Drwn/Chkd	KT/MKS
	Figure:	4

## **APPENDIX G**

# Attachments

ATTACHMENT 1

#### Havelock Bypass Environmental Survey-Noctournal Lepidoptera

This survey was initiated to sample for six species of moths whose habitats are rapidly declining and whose status is or could become threatened by the disturbance associated with the construction of a road bypass around Havelock in Craven County. They are Acronicta sinescripta, Agrotis n. sp. 1, Hemipachnobia subporphyrea, Lithacodia sp. 1, Pyreferra ceromatica and Spartiniphaga carterae.

Moths were sample by blacklight trapping (Hall, et. al. 1999) at numerous locations within the area potentially affected by the Havelock Bypass. These sites are described in Table 1. Sites were chosen based on their flora, access, and surrounding habitats. The study focused on four chosen sites and attempted to sample the most promising ones monthly. The actual sampling days and relevant collections are given in Table 2. Forty four traps were set out at dusk and picked up the following dawn. Each trap held 100-200 specimens on average and they were examined for the target species and for any other species of special interest.

Hemipachnobia subporphyrea adults are on the wing from late March through the first 3 weeks in April in locations where their foodplant, Venus flytraps, occur. Pyreferra ceromatica adults are active from early December through early April (on warm nights). The caterpillars feed on Witch Hazel and were reared this year for the first time (Sullivan and Wagner (U. Conn.)). Clearly the sampling period did not overlap the flight period for either of these species. While flytraps could occur in the study area, I am unaware of any colonies. Pyreferra caterpillars were collected in Craven County and have only been seen in habitats where witch hazel occurs near small streams with cabbage palmetto nearby. Such habitat occurs in the study area on both sides of the southwest prong of Slocum Creek. This species very likely occurs there.

Agrotis n. sp. 1 has now been described as a new species, Agrotis carolina (Schweitzer and McCabe, 2004). Caterpillars have been reared for several stages (Sullivan, unpublished) on Pyxidanthera barbulata a ground cover growing on xeric sand ridges in Longleaf Pine savannas. Adults are on the wing in April, June and September but none were taken in this study. If Pyxidanthera does occur in the study area, I did not locate it. However, should it be found in moderate sized populations (it is most visible in early spring when in bloom), the moths will likely accompany it. Acronicta sinescripta has been taken as far north as Millis Road in Carteret County where it occurs in Longleaf pine savannas. Unfortunately, the moth is rarely seen and we do not know its foodplant nor its habitat requirements. Its status in the study area is problematical. Spartiniphaga caterae is tightly associated with its foodplant, Calamovilfa brevipilis and flys in late October-early November. This grass is associated with open savannas and power line right-of-ways and is known to occur in the study area. It usually can be found at the junction of open savanna and pocosin. In spite of real efforts to

locate the species, it was not found. However, the power lines in the study area were mowed to a height of several inches in October and trapping in them was fruitless. No moths ventured into the mowed areas which were made even more inhospitable by a loss of warmth in the evening resulting in a 5-10 degree drop in temperature relative to the surrounding woodlands.

Lithacodia new species 1 is actually a complex of two undescribed species. They have arbitrarily been called species 1 and species 2. Only Lithacodia species 2 was found in the study area at the power line site west of Sunset Road and in the swamp forest east of Sunset Road. Severn specimens were captured on July 5 and 17 on August 26, 28. Both undescribed Lithacodia species seem to be associated with high quality, mature Arundinaria (cane grass) habitat but because this plant species has been searched extensively for caterpillars by Eric Quinter at the American Museum of Natural History without finding any Lithacodia, the two undescribed species are probably feeding on other plant species that grow in the same habitat. Both Lithacodia species have been trapped from the sandhills to the coast in North Carolina.

Several non-target species of special concern were taken. In the swamp forest east of Sunset Road a single specimen of Melanomma auricinctaria, a rivuline noctuid, was taken on May 19. The caterpillar is thought to feed on Gaylussacia sp. and only 4 specimens are known from North Carolina. However, this rarely encountered species is regularly found outside of North Carolina from Florida to Texas. On July 5 nine specimens of an undescribed cane borer (Quinter genus 2 species 3) were trapped in the cane break west of the Sunset Road power line. Only a few records of this species are known from North Carolina, most from the Dismal Swamp area. Two specimens of an undescribed species of the noctuid genus Rivula were taken. This species was known from 6 specimens taken in Craven and Onslow Counties in North Carolina. It seems to be associated with small streams in mesic forests which suport a flora of streamside grasses and sedges and has not been taken out of the state. A single specimen of Eupithecia pecorum was taken at the Hillman Loop site on September 30. Adults of this uncommon species are on the wing in the early spring and fall. The foodplant of the caterpillars is unknown but could be pond pine.

CONCLUSIONS: It is difficult to draw extensive conclusions based on the limited trapping data in this study. The power line sites have been burned or cut regularly and are supporting a lot of the flora associated with Longleaf pine savannas which at one time must have been throughout the study area. The cane breaks near the power line west of Sunset Road are in excellent condition and appear to support most of the fauna associated with high quality stands. This type of habitat is far less extensive than in the past but remains scattered throughout the area. Well over ten undescribed moth species are associated with high quality cane breaks. The swamps and associated woodlands along the southwest prong of Slocum Creek are excellent examples of their habitats and

few remain in the Coastal Plain. Hopefully, they will be disturbed a little as possible by the upcoming bypass.

References:

Hall, S.P., J. B. Sullivan and D. F. Schweitzer 1999. Assessment of risk to nontarget macro-moths after Bacillus thuringiensis var. kurstaki application to Asian Gypsy Moth in the Cape Fear region of North Carolina. United States Department of Agriculture. Forest Health Technology Enterprise Team publication 98-16, 95 pp.

Schweitzer, D. F. and T. L. McCabe 2004. The taxonomy, larva and ecology of Agrotis buchholzi (Noctuidae) with a new sibling species from North Carolina. J. Lep. Soc. 58: 65-74.

Submitted by: J. Bolling Sullivan 200 Craven St. Beaufort, N. C. 28516 Dec. 10, 2005

Table 1

Havelock Bypass Trapping Localities



# 

# Table 2
ATTACHMENT 2





STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

December 2, 2005

MICHAEL F. EASLEY GOVERNOR LYNDO TIPPETT SECRETARY

MEMORANDUM

TO: Matt Smith, ESI

FROM: Mary Frazer, PDEA

SUBJECT: Survey and assessment for PETS species, Havelock Bypass, R-1015

NCDOT has conducted surveys or assessments along the proposed Havelock bypass alternatives for several protected, endangered threatened and sensitive species, as requested by the US Forest Service (USFS). The surveys were conducted by Logan Williams (butterflies), Neil Medlin (fish), Mike Sanderson (birds), Dennis Herman (herps and Eastern woodrat), and Jay Mays (crustaceans and mollusks), with assistance from other PDEA staff. Other PETS species requiring surveys have been covered by ESI and its subcontractors, and by Jay Carter and Associates.

#### METHODS

Aerial photographs, topographic maps, and on-the-ground analysis were used to find the best habitat for the target species within the three project alternatives. Habitat information was also provided by ESI, Dave DuMond and John Fussell. Information was collected about habitat preferences and known occurrences in the project vicinity for each of the species to be surveyed. Surveys were conducted as appropriate for each species. Supporting information for some of these surveys (such as I received) is attached.

#### RESULTS

#### Butterflies

Two-spotted Skipper (Euphyes bimacula)

Berry's Skipper (Euphyes berryi)

Little Metalmark (Calephelis virginiensis)

Arogos Skipper (Atrytone arogos arogos)

Surveys were conducted on four days in September and October of 2003, targeting species' preferred habitat, primarily transmission lines and forest edges, mostly around alternative 3. One little metalmark was observed in a powerline where alternatives 2 and 3 join on the north side of the project. John Fussell has also reported it from the project vicinity (Harry LeGrand, pers. comm., 2005). A survey was conducted by the NC Natural Heritage Program (NHP) staff on August 28, 2005, primarily in the powerline corridors and savannas of Croatan National Forest. They counted the following PETS species: three little metalmark, one Arogos skipper, and two Berry's skippers. NHP also has records of these three species, as well as the two-spotted skipper, within Croatan boundaries prior to this 2005 survey.

Two-spotted skippers and Berry's skippers have been found in a powerline clearing near Catfish Lake Road, 4-4.5 miles west of the proposed bypass. The hydric powerline corridors that provide habitat preferred by Berry's skipper and the two-spotted skipper occur in the project study area. Given that these species occur nearby and that suitable habitat is present, it is reasonable to assume that they occur in the study area. Alternatives 2 and 3 would affect more hydric powerline habitat than alternative 1; however, alternative 1 will cause more fragmentation, leading to potential indirect effects on these species.

The little metalmark most likely inhabits hydric powerline corridors in the project study area. As with the two skippers above, alternatives 2 and 3 would affect more hydric powerline habitat than alternative 1, however, alternative 1 will cause more fragmentation, leading to potential indirect effects.

The only site where the Arogos skipper is currently known to occur in North Carolina is in Croatan along Millis Road, about 7.4 miles south of the proposed bypass. It may occur in mesic and hydric powerlinecorridors as well as pine flatwoods, but requires Calamovilfa brevipilis (pinebarren sand-reedgrass), which has been found in at least five powerline corridors scattered in and near the project study area (John Fussell, pers. comm., 2005). Due to these occurrences of Calamovilfa, there may be widely scattered plants in flatwoods of the project area, and it is likely that the Arogos skipper may be in the project area, especially during the first growing season after a burn is conducted. All three alternatives will affect areas where Calamovilfa has been found. Proper fire management, which could be affected by the construction of the bypass, is critical for maintaining the Arogos skipper's habitat.

#### Dotted Skipper (Hesperia attalus slossonae)

The dotted skipper is unlikely to be in the project area, as its range has mostly contracted to the sandhills region (Harry LeGrand, pers. comm., 2005).

#### Grasshoppers

Slender-bodied Melanoplus (Melanoplus attenuatus)

## A short-winged Melanoplus (Melanoplus nubilus)

Surveys were conducted on four days in September and October of 2003, targeting preferred habitat; neither species was found. The short-winged melanoplus inhabits flatwoods and savannas, while the slender-bodied melanoplus inhabits wet swales in pine woods. Since little is known about these species, and since their preferred habitat is common throughout the study area, it should be assumed that they are present and that they will be affected by any of the three bypass alternatives.

### Fish

#### Pinewoods Shiner (Lythrurus matutinus)

Fish communities were sampled using nets and backpack shockers in two streams: Southwest Prong Slocum Creek and East Prong Slocum Creek. Surveys were conducted April 11-12, 2005. A total of 12 species were found, but the target fish species, the pinewoods shiner, was not. The lower coastal plain streams with dark, slow-flowing water, do not provide optimal habitat for the pinewoods shiner; it should not be affected by the proposed bypass.

#### Birds

Point counts were conducted March 30 and April 20-21 in the project corridors. Surveys were also conducted within the corridors in areas of preferred habitat. None of the five target PETS species were detected. Alternative 3 was determined to have the best habitat for a wide range of species. The habitat in alternative 2 was also considered excellent, especially for the mature stands of longleaf pine. Alternative 1, the outermost corridor, was determined to have the least appropriate habitat. Alternative 2 will alter some of the preferred habitat in the forest, however it will prevent extensive fragmentation within Croatan. It is important to note that even though alternative 1 has the least amount of preferred

habitat for target species, the resulting fragmentation of the forest and subsequent secondary impacts will have a greater overall negative effect. Species-specific information is below.

#### Henslow's Sparrow (Ammodramus henslowii)

In 1999, three Henslow's sparrows were seen in a power line corridor and adjacent pine flatwoods in the Southwest Prong Flatwoods Natural Area, within alternative 3. In March of 2005, an individual was seen in a power line corridor and adjacent pine flatwoods in the Southwest Prong Flatwoods Natural Area, within the corridor that is common to alternates 2 and 3 (John Fussell, pers. comm., 2005). It is assumed to be a winter resident, albeit a rare one, within Croatan. There is one breeding-season record within the Croatan National Forest from 1985, in a clearcut/young pine plantation on a moist site [Chat 50(1):27].

Currently the best (wintering) habitat for Henslow's sparrow in the project area is within some of the power line corridors and contiguous pine flatwoods within the Southwest Prong Flatwoods Natural Area that would be affected by alternative 3 or the common alternatives 2/3. Habitat also occurs within the section of Southwest Prong Flatwoods Natural Area power line corridor that will be fragmented by (i.e. lies north of) alternatives 3/2. Other good habitat lies within the power line corridor immediately adjacent to the stretch of alternative 2 that is next to FSR 3086, in the Havelock Station Natural Area. Potential habitat also is within a power line corridor adjacent to alternative 1 (near FSR 3084).

#### Black-necked Stilt (Himantopus mexicanus)

This species inhabits shallow freshwater and brackish ponds, alkaline lakes, wet meadows, open marshes, and flooded fields and pastures. In North Carolina, it is found in close proximity to coastal areas. Habitat preferred by the black-necked stilt does not exist within any of the project corridors.

#### Black-throated Green Warbler Wayne's Race (Dendroica virens waynei)

These birds might occur anywhere in the project area where there are mixtures of pines and hardwood on hydric soils. The best habitat on USFS land within the study area is 1) the western fringe of the common corridor at the north end of the project area, between US 70 and the railroad, 2) within the common corridor adjacent to and south of FSR 601, and 3) within the common corridor between Scott Road (Forest Service Road 604) and US 70. Three males were observed in this last area in April, 2001 (John Fussell, pers. comm., 2005).

#### Migrant Loggerhead Shrike (Lanius ludovicianus migrans)

The loggerhead shrike occurs in habitat characterized by short grasses, interspersed with spiny shrubs and low trees. Pastures and hay meadows with hedges or shrubs are particularly suitable. Within Croatan, there is no optimal habitat for the species in the project area. Potential habitat in the project area occurs along the borders of the power line corridors within the Southwest Prong Flatwoods Natural Area (alternatives 3 and 2/3) and along the borders of the power line corridor in the Havelock Station Natural Area (alternate 2), adjacent to FSR 3086. However, the species is unlikely to occur in the project area because its range has contracted westward in recent decades such that it now very rare or absent as far east as the project area, even in optimal habitat.

#### Bachman's Sparrow (Aimophila aestivalis)

In the Croatan National Forest, Bachman's sparrow is a fairly common summer resident and possible winter resident in the extreme southern portion of the forest, i.e. within about five miles of NC 24. It is now of rare and sporadic occurrence in the central and northern portions of the National Forest, i.e. within Jones and Craven counties, but has recently been observed four times in the general project area (John Fussell, pers. comm., 2005).

Habitat for Bachman's sparrow in the project area has become marginal due largely to an alteration of the natural fire regime. However, portions of the project area contain some of the most restorable habitat remaining within the northern/central Croatan. The areas having such potential habitat are 1) most of the Southwest Prong Flatwoods Natural Area, 2) much of the Havelock Station Natural Area (which lies adjacent to FSR 3086), and 3) areas adjacent to FSR 3085. All of the three alternatives will affect various portions of the above three areas. In terms of direct impacts, alternative 3 will be the most damaging to Bachman's sparrow habitat. Alternative 1 will have the least direct impact, while alternative 2 will have intermediate impacts. If burning frequency is reduced in lands that are fragmented by the bypass after construction is complete, then alternative 1 may ultimately have the greatest negative impact on Bachman's sparrow habitat.

#### Herps

American Alligator (*Alligator mississippiensis*) Surveys were conducted March – April in the bottomland swamps along the various forks of Slocum Creek. No nighttime surveys were conducted. Alligators have been observed in Croatan National Forest (NHP data; Dennis Foster pers. comm. 2005), in the adjacent Croatan mitigation bank (ESI staff), and within the town of Havelock adjacent to Croatan National Forest (Mary Frazer, 7/05). Alligators can be assumed to be present in any of the larger creeks or swamps within the project study area, especially the Southwest Prong Slocum Creek and East Prong Slocum Creek. Both creeks will be affected by the project regardless of which alternative is selected.

#### Eastern Diamondback Rattlesnake (Crotalus adamanteus)

Southern Hognose Snake (Heterodon simus)

Mimic Glass Lizard (Ophisaurus mimicus)

Surveys were conducted on 3/29, 3/30, 4/19, 4/20, 4/21, and 6/14 of 2005. Search techniques included 1) walking the pinewoods searching in an around stump holes, push piles (logs, limbs, etc.), fallen trees, etc.; 2) peeling bark on dead pine trees and lifting fallen pine bark at the base of dead trees; 3) lifting logs, boards, trash around dumps, and raking through woody debris; and 4) driving along USFS and adjacent paved roads during early morning, late afternoon, and after dark looking for dispersing snakes. None of these three species were observed.

Eastern diamondbacks may occur in the study area because of NHP and NC Natural Sciences Museum (NCSM) records for them around and within the Croatan National Forest. An eastern diamondback was found in 1991 crossing Roberts Road (SR 1140) near the junction with Nine Mile Road (SR 1124) adjacent to Croatan National Forest property. This area was searched briefly on 4/21/05 (although it was not in the project corridor) and was found to have the best diamondback habitat seen during the surveys.

Based on survey results and records from NCSM, it is unlikely that the mimic glass lizard occurs within the project area. It is possible that the southern hognose snake occurs is present, because NCSM has records from north, east, and southwest of the project area.

Only two small areas provided the more or less, open, park-like habitat optimal for these three species within the study area, although more habitat could be created with more frequent burns. One was north of the intersection of Greenfield Blvd and Sunset Drive (FSR 613 @ Sunset Road and FSR 3087 along the powerline); this site would be directly affected by alternative 3. The other site was southeast of the interchange with SR 1756 (FSR 3085/3084 quad), where it will be affected by alternatives 1 and 3.

Herps will be able to cross under the proposed bypass in areas where extensive bridging will take place, i.e., the Southwest Prong and East Prong Slocum Creek. However, additional crossings should be considered to provide connectivity between populations and to reduce mortality.

#### Crustaceans

## Tar River Crayfish, (Procambarus medialis)

## North Carolina Spiny Crayfish (Orconectes carolinensis)

Crayfish were collected on 6/6 using dip nets and on 6/14-15, 2005 using crayfish traps in ephemeral and semi-permanent ponds. The majority of the ponds were located under the powerline and extending back into the forest, just east of FSR 613. Additional ponds were surveyed with dip nets in other areas of the project. In addition to the trapping and dip netting, crayfish that were captured during fish surveys in the Southwest Prong and East Prong Slocum Creek were examined to determine species presence. Neither the Tar River crayfish nor North Carolina spiny crayfish was captured. Croatan crayfish (*Procambarus plumimanus*) were found to be abundant, however. It is likely that the Tar River crayfish does not occur in the project study area, as it is not known to co-occur with the Croatan crayfish (John Cooper, pers. comm., 2005). Although the potential range for the North Carolina spiny crayfish includes the Havelock area, the closest NHP record is over 15 miles away; the proposed bypass will presumably not affect it.

#### Graceful Clam Shrimp (Lynceus gracilicornis)

The best habitat for this species was determined to be in ponds located off FSR 613, in the Southwest Prong Flatwoods Natural Area, which would be affected by alternative 3. Visual searches were conducted for this species on 6/6, 6/14-6/15 of 2005 in ephemeral and semi-permanent ponds. In addition, substrate was dug by hand and examined in detail. No individuals were found. NHP records indicate the graceful clam shrimp has been found within five miles of the proposed bypass on the other side of Havelock in the year 2000. Due to the ephemeral nature of the species' habitat, the nauplii hatch as soon as the pond they inhabit fills; the eggs rest in the substrate during the dry season. There is only one generation of the clam shrimp per wet season, so sampling for adults can be problematic. Due to the presence of the species within five miles of the project area, and due to the difficulty in timing the sampling event when adults are present, *Lynceus gracilicornis* could be present in ephemeral ponds in the project vicinity. This species is probably more common than is currently known by the scientific community because of its ephemeral nature and the lack of data (Barbara Taylor, pers. comm., 2005).

#### **Mollusks**

Triangle Floater, Alasmidonta undulata Atlantic Pigtoe, Fusconaia masoni Eastern Lampmussel, Lampsilis radiata A Bivalve, Lampsilis species 2 Green Floater, Lasmigona subviridus Creeper (formerly Squawfoot), Strophitus undulatus Savannah Lilliput, Toxolasma pullus

It was determined, based on stream pH (5.4 in both Southwest Prong Slocum Creek and East Prong Slocum Creek) and previous mussel work in the area conducted by NCDOT and the NC Wildlife Resources Commission, that suitable habitat was not present for any PETS mussels in any of the bypass alternatives. Mussel surveys were not conducted.

### Eastern Woodrat (Neotoma florida sp.1)

Surveys for the conspicuous nests of the Eastern woodrat were conducted on 4/20-21, 2005 in two locations where this species' preferred habitat, lowland deciduous forests with a palmetto understory, was observed. Only one of these sites was in the project study area, located at the western end of Gray Road, between alternatives 2 and 3. No nests or woodrats were found. NHP has a 1991 record of *Neotoma floridana floridana* located 16 miles from the study area; this is the closest record. It is assumed that the woodrat is not present in the study area.

If you have any questions or need additional information please call Mary Frazer at (919) 715-1419.





STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY GOVERNOR

LYNDO TIPPETT SECRETARY

	June 9, 2005	way have send frend
Memorandum To:	Mary Frazer Natural Environment Biological Survey Group	Matt whit first sported
From:	Neil Medlin Natural Environment Biological Survey Group	you this is version.
Subject:	Fisheries surveys associated with the Havelock By-p R-1015.	pass, TIP No.

## Background

Fisheries surveys were conducted for this project as part of the overall surveys for US Forest Service Protected, Endangered and Threatened Species (PETS) list of species. The specific fish species of concern was the pinewoods shiner, Lythrurus matutinus, which is known from the Neuse River Basin.

## **Survey Location and Methods**

Fish communities were sampled from two streams, Southwest Prong Slocum Creek and East Prong Slocum Creek. The Southwest Prong collection location was off of SR 1747 and the collection location on the East Prong was immediately above the railroad tracks near SR 1734.

The fish surveys were conducted by using two Smith-Root model LR-24 backpack electrofishing units to stun the fish, which were then collected with dip nets and temporarily placed in 5-gallon buckets. All available habitat types, flow regimes, and water depths were sampled. With the exception of two voucher specimens, all fish were identified and released onsite.

Physical water chemistry parameters were measured at both fish collection sites using a YSI Model 85 multiparameter field meter.

## **Results and Discussion**

Physical water chemistry measurements were typical of lower coastal plain swamp stream systems. The results are presented in Table 1.

LOCATION: TRANSPORTATION BUILDING **1 SOUTH WILMINGTON STREET** RALEIGH NC

WEBSITE: WWW.DOH.DOT.STATE.NC.US

긜펯숎탒 CHIC , C - 10

Table 1. Physical Water Chemistry for Southwest Prong Slocum Creek and East Prong Slocum Creek, April 2005, Craven County.

Southwest Pr. 20.7	<u>East Pr.</u> 14.5	
7.4	5.0	
65	40	
5.4	5.4	
	<u>Southwest Pr.</u> 20.7 7.4 65 5.4	Southwest Pr.East Pr.20.714.57.45.065405.45.4

The habitat in Southwest Prong Slocum Creek was variable with a large open impoundment above a series of beaver dams and a single channel below the dams. The open portions of the impoundment were dominated by submerged aquatic vegetation while the wooded areas at the dams and the channel below lacked the vegetation. The habitat pattern was reversed in the East Prong Slocum Creek location, with a single channel present at the railroad crossing and beaver dams and impoundments upstream.

The dark-water, slow flowing, lower coastal plain streams potentially affected by this project do not provide appropriate habitat for the pinewoods shiner. The completion of this project will not affect this species. Fish species that were collected in the project area are presented below in Table 2.

Table 2. Fish Species and Relative Abundance for Southwest Prong Slocum Creek and East Prong Slocum Creek, April 2005, Craven County

Species Bowfin, Amia calva American eel, Anguilla rostrata Eastern mosquitofish, Gambusia holbrooki Creek chubsucker, Erimyzon oblongus Redfin pickerel, Esox americanus Pirate perch, Aphredoderus sayanus Plueapotted sunfish Emagagathug gloriogus	Southwest Pr. Abundant Abundant Rare Common Common	East Pr. Rare Abundant Rare Rare Common Abundant
Pumpkinseed, Lepomis gibbosus	Common	Common
Flier, Centrarchus macropterus Bluegill, Lepomis macrochirus Warmouth, Lepomis gulosus Mud sunfish, Acantharchus pomotis	Common Abundant Rare	Common Rare Rare Common

## NORTH CAROLINA NATURAL HERITAGE PROGRAM SPECIAL ANIMAL SURVEY FORM

Scientific Name : Procambarus (Ortmannicus) plumimanus

Common Name: Croatan Crayfish

Observer(s): Jason W. Mays (NCDOT)

Date(s) of Observation: 6, 14,15 June 2005

County: Craven

#### Quad Map: Havelock

7.5'

Exact Location (be specific! – attach copy of map with site marked): NC: Craven County, ~1 mi west of the town of Havelock, Croatan National Forest. The site is located off of Forest Road (FR) 613. Access to 613 is off of Sunset Road (aka. Dogwood Road *Delorme*). Pools are located along the east side of the FR partially under under the powerline cuts and extending back into the woods. N 34.90693 W 76.94454

Number of Animals (include age and sex, if known): 7 adult male, 4 adult female

Type of Observation (sight record, vocal record, specimen, photograph, etc.): Specimens collected in traps, vouchers held at NC Museum

Behavior of Animals (singing, foraging, at nest, etc.): Foraging in open water

Habitat (use NC NHP natural community name if known; describe dominant vegetation, maturity of vegetation, slope, aspect, etc.): Specimens were collected from ephemeral and semipermanent pools in swamp forest depressions of the Croatan National Forest. Pools are located at the edge of disturbance caused by the road and powerline cut. Pools are approximately .10-.25 acre in area and extend back into the natural forested area. Area dominated by pines with a moderately dense shrub layer.

Owner(s) of Land, if known: Croatan National Forest

Other Comments (significance of record, disturbance to habitat, etc.):

Person making this report: Jason W. Mays Address: 1324 Takeaway Place, Morrisville, NC 27650 Date: 29 June 2005

the children in the

Phone: 919-270-9213

Return form to: N.C. Natural Heritage Program; Office of Conservation and Community Affairs MSC 1601; Raleigh, NC 27699-1601



Subject: Calamovilfa brevipilis Date: Wed, 23 Nov 2005 14:47:28 -0500 From: "John Fussell" <jfuss@clis.com> To: "Mary E. Frazer" <MEFrazer@dot.state.nc.us>

Mary,

Here's what I have.

John Fussell

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on his exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000

# R-1015: U.S. 70 / Havelock By-pass Croatan National Forest PETS Surveys

# Reptile & Amphibian Observation List (2005)

----

## 29 March

h .

\$

1.	Catfish Lake Road (DWH, LW, KL,	MS, RB, CD, DR, MF, EA, AB)	
	Florida Cooter Yellowbelly Slider	Pseudemys floridana floridana Trachemys scripta scripta	8 3 ,
2.	East side of Catfish Lake (lunch bread RB, CD, DR, MF, EA, AB)	k) along FSR 158 (.3 mi NW jct. Catfish	Lake Rd.) (DWH, LW, KL, MS,
10.000	Northern Black Racer Scarlet Kingsnake Green Anole	Coluber constrictor constrictor Lampropeltis triangulum elapsoides Anolis carolinensis	1 ····································
3.	Along powerline E Little Road, .1 mi S DR, MF, EA, AB)	iE jct. Catfish Lake Road (DWH, LW, K	(L, MS, NM, JG, JM, RB, CD,
	Little Grass Frog	Pseudacris ocularis	1
4.	★FSR 613 @ Sunset Road (DWH,	MF, MS, NM. JG)	
	Northern Black Racer Green Anole Ground Skink	Coluber constrictor constrictor Anolis carolinensis Scincella lateralis	1 1 1
5.	5. FSR 3086, ca. 1 mile ESE Lake Road (SR 1756) (DWH & MS)		
	Southeastern Five-lined Skink Green Anole Atlantic Coast Slimy Salamander	Eumeces inexpectatus Anolis carolinensis Plethodon chlorobryonis	1 2 1
<u>30 Mai</u>	<u>ch</u>		
1.	★FSR 3087 along powerline (north o (DWH, MS, John Fussel)	f FSR 613 where powerline splits) near	r horse farm/cell tower road
	Northern Black Racer Atlantic Coast Slimy Salamander	Coluber constrictor constrictor Plethodon chlorobryonis	3 1
2.	★FSR 604 off Creek Road near elect	ric substation & powerline	(DWH, MS, John Fussel)
	Little Grass Frog	Pseudacris ocularis	1
<u>19 Ap</u>	<u>il</u>	e	
1.	★FSR 613 @ Sunset Road quad (inc	luding big hill) (DWH & Jerry H. Reyn	olds)
	Corn Snake Green Anole Southeastern Five-lined Skink	Elaphe guttata guttata Anolis carolinensis Eumeces inexpectatus	1 5 7
2.	★FSR 3087 quad (above powerline s	plit); West of powerline(DWH & JHR)	
	Eastern Hognose Snake Scarlet Kingsnake SE Five-lined Skink	Heterodon platirhinos Lampropeltis triangulum elapsoides Eumeces inexpectatus	1 1 5

3.	★FSR 3087 quad (above powerline sp	olit); East of powerline (DWH, .	JHR, & MS)
	Corn Snake Northern Black Racer	Elaphe guttata guttata Coluber constrictor constrictor	1 1
4.	Brice Road @ Brice Creek (DWH,	JHR, & MS)	
	Bullfrog	Rana catesbeiana	4
<u>20 Apri</u>	!		
1.	FSR 604/Substation/Powerline quad	(DWH, JHR, & MS)	
•	Eastern Box Turtle Atlantic Coast Slimy Salamander	Terrapene carolina carolina Plethodon chlorobryonis	1 1
2.	★FSR 3085/3084 quad; SSE Lake Roa	<b>id (SR 1756)</b> (DWH, JHR, & N	MS)
3.	Corn Snake Pinewoods Snake Eastern Worm Snake Southern Copperhead Green Anole SE Five-lined Skink Ground Skink Southern Cricket Frog Atlantic Coast Slimy Salamander Green Treefrog Pinewoods Treefrog Squirrel Treefrog Southern Toad <b>*Horse Farm/Cell Tower quad</b> (DWH, Eastern Worm Snake SE Five-lined Skink Atlantic Coast Slimy Salamander	Elaphe guttata guttata Rhadinaea flavilata Carphophis amoenus amoenus Agkistrodon contortrix contortrix Anolis carolinensis Eumeces inexpectatus Scincella lateralis Pseuadacris gryllus gryllus Plethodon chlorobryonis Hyla cinerea Hyla femoralis Hyla squirella Bufo terrestris JHR, MS, & Jeff Hall) Carphophis amoenus amoenus Eumeces inexpectatus Plethodon chlorobryonis	3 1 1 1 5 9 3 5 1 1 1 3 1 1 1 3 1
4.	Millis Road (DWH, JHR, MS, & Jeff Rough Green Snake	Hall) Opheodrys aestivus	1
	Eastern Box Turtle	Terrapene carolina carolina	_ 1
<u>21 April</u>			
5.	Gray Road quad (DWH, JHR, & i	MS)	• •
	Southern Ringneck Snake SE Five-lined Skink Green Anole Chamberlain's Dwarf Salamander Atlantic Coast Slimy Salamander Gray Treefrog	Diadophis punctatus punctatus Eumeces inexpectatus Anolis carolinensis Eurycea chamberlaini Plethodon chlorobryonis Hyla chrysoscelis	1 4 2 1 1 1
6.	★Roberts Road (SR 1140) @ jct. Nine	Mile Road (SR 1124) quad	(DWH & JHR)
	Northern Black Racer Green Anole SE Five-lined Skink	Coluber constrictor constrictor Anolis carolinensis Eumeces inexpectatus	1 3 3

. .

14

### <u>14 June</u>

1

.1

#### 1. ★FSR 3087 along powerline (north of FSR 613 where powerline splits) near horse farm/cell tower road

Southern Toad Southern Leopard Frog Bufo terrestris Rana utricularia

#### 2. Trail to Southwest Prong Slocum Creek off Sunset Road (across from FSR 613 gate)

Eastern Box Turtle Southern Leopard Frog Terrapene carolina carolina Rana utricularia

## 3. Greenfield Heights Boulevard and Southwest Prong Slocum Creek bridge

Eastern Box Turtle (nesting)

2.244

Terrapene carolina carolina

#### 4. Millis Road

Pinewoods Treefrog Southern Leopard Frog Hyla femoralis Rana utricularia

# \* Indicates the sites that have the best potential for the eastern diamondback rattlesnake, southern hognose, and mimic glass lizard.

#### Checklist of Reptiles & Amphibians Observed in Croatan National Forest (Craven & Carteret counties) 2005

Class Amphibia

**Order Caudata** 

#### Family Plethodontidae

Eurycea chamberlaini Plethodon chlorobryonis

#### Order Anura

#### Family Bufonidae

Bufo terrestris

Southern Toad

Southern Cricket Frog

Little Grass Frog

Gray Treefrog

Green Treefrog Pinewoods Treefrog

Squirrel Treefrog

Southern Leopard Frog

Bullfrog

Chamberlain's Dwarf Salamander

Atlantic Coast Slimy Salamander

#### Family Hylidae

Acris gryllus gryllus Pseudacris ocularis Hyla chrysoscelis Hyla cinerea Hyla femoralis Hyla squirella

Family Ranidae

Rana catesbeiana Rana utricularia

#### Class Reptilia

#### **Order Squamata (Suborder Serpentes)**

#### Family Colubridae

Carphophis amoenus amoenus Coluber constrictor constrictor Diadophis punctatus punctatus Elaphe guttata guttata Heterodon platirhinos Lampropeltis triangulum elapsoides Opheodrys aestivus Rhadinaea flavilata

#### Family Viperidae (Subfamily Crotalinae)

Agkistrodon contortrix contortrix

#### Order Squamata (Suborder Lacertilia)

#### Family Polychridae

Anolis carolinensis

Eastern Worm Snake Northern Black Racer Southern Ringneck Snake Corn Snake Eastern Hognose Snake Scarlet Kingsnake Rough Green Snake Pinewoods Snake

Southern Copperhead

Green Anole

#### Family Scincidae

Eumeces inexpectatus Scincella lateralis

**Order Testudines** 

Family Emydidae

Pseudemys floridana floridana Trachemys scripta scripta Terrapene carolina carolina Southeastern Five-lined Skink Ground Skink

Florida Cooter Yellowbelly slider Eastern Box Turtle

#### **Results of Herp Surveys**

American Alligator (*Alligator mississippiensis*) - Surveys were conducted March – April in the bottomland swamps along the various forks of Slocum Creek. No night time surveys were conducted. Alligators have been observed in Croatan National Forest (NHP data; Dennis Foster pers. comm. 2005), in the adjacent Croatan mitigation bank (ESI staff), and in Havelock adjacent to Croatan National Forest (M. Frazer, 7/26/05). Alligators can be assumed to be present in any of the larger creeks or swamps within the project study area, especially the Southwest Prong Slocum Creek and East Prong Slocum Creek.

Eastern diamondback rattlesnake (*Crotalus adamanteus*), Southern hognose snake (*Heterodon simus*), and the mimic glass lizard (*Ophisaurus mimicus*) – surveys were conducted on 3/29/05, 3/30/05, 4/19/05, 4/20/05, 4/21/05, and 6/14/05. Search techniques included 1) walking the pinewoods searching in an around stump holes, push piles (logs, limbs, etc.), fallen trees, etc.; 2) peeling bark on dead pine trees and lifting fallen pine bark at the base of dead trees; 3) lifting logs, boards, trash around dumps, and raking through woody debris; and 4) driving along USF and adjacent paved roads during early morning, late afternoon, and after dark looking for dispersing snakes. None of these species were observed, but they may likely occur in study area because of NC State Museum and NHP records for them around and within the Croatan National Forest. An eastern diamondback was found in 1991 crossing Roberts Road (SR 1140) near the junction with Nine Mile Road (SR 1124) adjacent to Croatan National Forest property. This area was searched briefly on 4/21/05 (although it was not in the project corridor) and was found to have the best diamondback habitat seen during the surveys.

Eastern Woodrat (*Neotoma florida* sp.1) - surveys for the woodrat nests were conducted on 4/20/05 & 4/21/05 in two locations where palmetto was observed. Only one of these sites was in the project corridor. No nests or woodrats were found. (No NHP records of this spp.?) It is assumed that the woodrat is not present in the study area.

•



## STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY GOVERNOR LYNDO TIPPETT Secretary

November 29, 2005

Memorandum to:	Mary Frazer, Natural Environment Unit
From:	Mike Sanderson, Natural Environment Unit
Subject:	R-1015 Havelock Bypass PETS Bird Surveys in the Croatan National Forest Craven County, NC

Five species of birds listed as protected, endangered, threatened or sensitive, which occur in the Croatan National Forest, were requested to be surveyed by the US Forest Service. This memo addresses these five species in context of the proposed Havelock Bypass, R-1015.

## Methods

Using a combination of aerial photographs, topographic maps, and on the ground analysis, the project area was examined to find the best potential habitat for the target species. Corridor number 3, the preferred corridor, was determined to have the best habitat for a wide range of species. The habitat in corridor 2 was also considered excellent, especially for the mature stands of Longleaf Pine (*Pinus palustris*). Corridor 1, the outermost corridor, was determined to have the least appropriate habitat for target species.

Following "A Land Manager's guide to Point Counts of Birds in the Southeast" (Hamel et al, 1996), point counts were conducted March 30 and April 20-21 in the project corridors. Surveys were also conducted by walking along the project corridors in areas of preferred habitat and birding in those areas. Species were detected by sight and by vocalizations. Approximately 42 person/hours were spent on surveys. In addition to fieldwork in the spring of 2005, historical data provided by John Fussell and other experts has been used in the preparation of this document.

Henslow's Sparrow (Ammodramus henslowii) Federal Species of Concern

**Habitat:** Breeding habitat can be described as relatively large open fields and other similarly open habitats with tall, dense grass and little or no woody vegetation. Typical winter habitat is extensive, open, moist to wet pine flatwoods (pine savanna) or other similarly open, moist to wet areas having dense herbaceous cover, such as some

LOCATION: TRANSPORTATION BUILDING 1 SOUTH WILMINGTON STREET RALEIGH NC

WEBSITE: WWW.DOH.DOT.STATE.NC.US

abandoned fields and some clearcuts. In some areas (Carter 1993), power line corridors that are contiguous with pine flatwoods may be important as winter habitat.

This secretive species occurs within the Croatan National Forest primarily as a very local winter resident. Judging its abundance in winter is difficult, because of its secretive nature, but it is apparently rare. To date, it has been observed at only two locations within the Croatan in the overwintering period —the Millis Road Savanna in Carteret County, and in power line corridors and contiguous flatwoods in the Southwest Prong Flatwoods Natural Area. There is also one breeding-season record (1985) within the Croatan National Forest [Chat 50(1):27]. That record of a single territorial male was in a clearcut/young pine plantation on a moist site.

Henslow's Sparrows have been observed in the project area during two different winters. In 1999, three individuals were seen in a power line corridor and adjacent pine flatwoods in the Southwest Prong Flatwoods Natural Area on 23 & 27 February, by John Fussell, Susan Arrington, and Ray Winstead [Chat 63 (3):152]. The locations of these observations were within Corridor 3. In 2005, a single individual was seen in a power line corridor and adjacent pine flatwoods in the Southwest Prong Flatwoods Natural Area on 14 & 24 March by John Fussell, Paul Spitzer, and Nan Bowles. The locations of these observations lie within the corridor that is common to Alternatives 2 and 3.

Currently the best wintering habitat for the species in the project area that is within the alignments of proposed corridors occurs in the power line corridors and contiguous pine flatwoods located within the Southwest Prong Flatwoods Natural Areas. These sections of power line corridors lie within corridor 3 or the common corridor alternative 2/3. Habitat of similar quality also exists within the section of Southwest Prong Flatwoods Natural Area power line corridor that will be fragmented by Alternatives 3/2. Other similarly good quality habitat lies within the power line corridor immediately adjacent to the alternative 2 corridor next to FSR 3086—Havelock Station Natural Area. Potential habitat also occurs within the power line corridor adjacent to Corridor 1 near FSR 3084.

### Bachman's Sparrow: (Aimophila aestivalis) Federal Species of Concern

**Habitat**: Primarily open-canopied pine woods with little or no understory/shrub vegetation but having a well-developed herbaceous ground layer. In portions of the range, may also occupy overgrown weedy fields, pastures, and clearcuts. However, in the Croatan National Forest and nearby areas, Bachman's sparrow has not been found to occur in the latter types of habitats.

In the Croatan National Forest, the Bachman's Sparrow is a fairly common summer resident in suitable habitat in the extreme southern portion of the forest, i.e. within about five miles of NC 24. In this same area, it may overwinter sporadically. Overwintering is most likely at sites that have been burned over during the previous year, especially if the burn was during the growing season. Such burns are more likely to produce abundant wiregrass seeds, which are known to be an important food source for the sparrow in winter.

Bachman's Sparrows are now of rare and sporadic occurrence in the central and northern portions of the National Forest, i.e. within Jones and Craven counties. However, it is likely that the species was formerly a common summer resident in these areas. For instance, Brown (1929) said of this species "found rather commonly between Havelock and Lake Ellis during late June, July, and early August." Furthermore, Pearson et al. (1942) state that in the "pinelands of Craven and Brunswick, we have often found it after a little search." The current scarcity of the species in the central and northern Croatan is likely related to the reduction in fire frequency during the 20th Century as well as other factors. Fire suppression has had a more dramatic impact on altering vegetation structure on the loam soils common in the north and central Croatan as compared to the sand soils which are more common in the south Croatan (see Frost 1996).

Bachman's sparrow has recently been observed four times in the general project area. 1) On 2 April & 12 April 2002 John Fussell observed a singing male adjacent to FSR 3085, near the intersection of FSR 3085 and FSR 3084. This site is within the corridor for Alternative1/Alternative 3. 2) On 11 April 2002, Fussell observed a singing male within the Southwest Prong Flatwoods Natural Area, near the intersection of the two power lines, near FSR 3087. This site is within the corridor of Alternative 3, and is immediately adjacent to the corridor of Alternative 2. 3) On 11 April 2002, Fussell observed a singing male within the Southwest Prong Flatwoods Natural Area, adjacent to FSR 3087. This site is adjacent to the corridor of Alternative 3. 4) On 17 February & 10 March 2005, Charles Thomas and John Fussell found a Bachman's sparrow adjacent to the intersection of FSR 3085 and FSR 3086. This bird responded to a tape recording of the species' song. Its presence in winter was likely due to the fact that the site was burned over during the previous year. This site lies near Alternative 2.

As is generally the case for the northern/central Croatan National Forest, the project area is an area where habitat for the Bachman's Sparrow has become marginal due largely to an alteration of the natural fire regime during the last half of the 20th Century. However, portions of the project area contain some of the most restorable habitat remaining within the northern/central Croatan. The areas having such potential habitat are 1) most of the Southwest Prong Flatwoods Natural Area, 2) much of the Havelock Station Natural Area (which lies adjacent to FSR 3086), and 3) areas adjacent to FSR 3085.

All of the three alternative corridors will include various portions of the above three areas. In terms of direct impacts, Alternative 3 will be the most damaging to Bachman's Sparrow habitat. Alternative 1, the westernmost; will have the least direct impact. Alternative 2, the easternmost, will have intermediate impacts.

In terms of indirect impacts, a major question is whether or not the introduction of a bypass will lead to a reduction in burning frequency/efficiency in those lands that are fragmented by the bypass. If that is the case, than Alternative 1 may ultimately have the greatest negative impact on Bachman's Sparrow habitat.

#### **Black-necked stilt** (*Himantopus mexicanus*)

**Habitat:** Inhabits shallow freshwater and brackish ponds, alkaline lakes, wet meadows, open marshes, and flooded fields and pastures. In North Carolina, this species is found in close proximity to coastal areas. Commonly associates with other shorebirds, especially avocets, godwits, and curlews.

Typical habitat for the black-necked stilt does not exist within any of the project corridors.

### Black-throated green warbler – Wayne's Race (Dendroica virens waynei)

Habitat: Found in forested wetlands that occur on interstream flats or in the uppermost portions of streams. Generally shuns riverine situations. Associated with hardwoods, especially where having a component of mature conifers (may be white cedar, baldcypress, or pines). These birds might occur anywhere in the project area where there are mixtures of pines (mostly pond and loblolly) and hardwoods lying on hydric soils.

The best habitat on Forest Service land lying within actual corridors is 1) the western fringe of the common corridor at the north end of the project area, between US 70 and the Atlantic and East Carolina Railroad, 2) within the common corridor adjacent to and S of FSR 601; 3) within the common corridor between Scott Road (FSR 604) and US 70. Within a portion of the last area, John Fussell observed 3 singing males on 7 & 8 April 2001.

We did not detect black-throated green warblers during our 2005 surveys.

#### Migrant loggerhead shrike: (Lanius ludovicianus migrans)

**Habitat:** The loggerhead shrike occurs in habitat characterized by short grasses, interspersed with spiny shrubs and low trees. Pastures and hay meadows with hedges or shrubs are particularly suitable. Shrubs and trees are required for nesting and perching as well as for sites on which to impale their prey, which ranges from ants and spiders to small birds and mammals.

On Croatan National Forest land, there is no optimal habitat for the species in the project area. The best habitat in the project area is probably along the borders of the power line corridors that lie within the Southwest Prong Flatwoods Natural Area (alternatives 3 and 2/3) and along the borders of the power line corridor in the Havelock Station Natural Area (alternative 2), adjacent to FSR 3086. However, the species is currently very unlikely to occur in the project area because its range has contracted westward in recent decades such that it now very rare or absent as far east as the project area, even in optimal habitat.

Bird species detected as present during surveys of proposed Havelock bypass in Croatan National Forest: Surveys conducted on March 30, April 20-21, 2005.

Wood Duck Hooded Merganser Northern bobwhite Great Blue Heron Great Egret Snowy Egret Little Blue Heron Black vulture Turkey vulture Osprey Red-shouldered Hawk Red-tailed Hawk Killdeer Spotted sandpiper Ring-billed gull Rock Pigeon Mourning Dove Barred Owl Chuck-will's-widow Whip-poor-will **Chimney Swift** Ruby-Throated Hummingbird Belted Kingfisher Red-headed Woodpecker Red-bellied Woodpecker Downy Woodpecker Hairy Woodpecker **Red-cockaded Woodpecker\*** Northern Flicker Pileated Woodpecker Acadian Flycatcher Eastern Kingbird White Eyed Vireo Blue-Headed Vireo Red-eyed Vireo Blue Jay American Crow Fish Crow Purple Martin Tree Swallow Barn Swallow Carolina Chickadee

Aix sponsa Lophodytes cucullatus Colonis virginianis Ardea herodias Ardea alba Egretta thula Egretta caerulea Coragyps atratus Cathartes aura Pandion haliaetus Buteo lineatus Buteo jamaicensis Charadrius vociferus Actitis macularius Larus delawarensis Columba livia Zenaida macroura Strix varia Caprimulgus carolinensis Caprimulgus vociferus Chaetura pelagica Archilochus colubris Ceryle alcyon Melanerpes erythrocephalus Melanerpes carolinus Picoides pubescens Picoides villosus Picoides borealis Colaptes auratus Dryocopus pileatus Empidonax virescens Tyrannus tyrannus Vireo griseus Vireo solitarius Vireo olivaceus Cyanocitta cristata Corvus brachyrhynchos Corvus ossifragus Progne subis Tachycineta bicolor Hirundo rustica Poecile carolinensis

Tufted titmouse Red-breasted Nuthatch White-breasted Nuthatch Brown-headed Nuthatch Carolina Wren House Wren Ruby-crowned Kinglet Blue-gray Gnatcatcher Eastern bluebird Hermit Thrush Wood Thrush American Robin Gray Catbird Northern Mockingbird Brown Thrasher European Starling Northern Parula Yellow-rumped Warbler Yellow-throated Warbler Pine Warbler Prairie Warbler Black and White Warbler Prothonotary Warbler Worm-eating Warbler Swainson's Warbler Ovenbird Common Yellowthroat Hooded Warbler Yellow-breasted Chat Summer Tanager Eastern Towhee Swamp Sparrow Northern Cardinal Common Grackle Brown-headed Cowbird American Goldfinch

Baeolophus bicolor Sitta canadensis Sitta Carolinensis Sitta pusilla Thryothorus ludovicainus Troglodytes aedon Regulus Calendula Polioptila caerulea Sialia sialis Catharus guttatus Hylochchla mustelina Turdus migratorius Dumetella carolinensis Mimus polyglottos Toxostoma rufum Sturnus vularis Parula americana Dendroica coronata Dendroica dominica Dendroica pinus Dendroica discolor Mniotilta varia Prothonitaria citrea Helminteros vermivorum Limnothlypis swainsonii Seirus aurocapilla Geothlypis trichas Wilsonia citrina Icteria virens Piranga rubra Pipilo erythrophthalmus Melospiza georgiana Cardinalis cardinalis Ouiscalus quiscula Molothrus ater Carduelis tristis

\* The Federally Endangered Red-cockaded Woodpecker was found foraging in the preferred corridor on 30 March, 2005 by Mike Sanderson, Dennis Herman and John Fussell.

Note: This list is not intended to represent the entire species list one might encounter in the Croatan National Forest. Rather, it is an indication of the diversity and complexity of the habitats encountered along the proposed corridors during a seasonal snapshot of surveys. The spring of 2005 was considered by many to be "late." Therefore many species which would otherwise be easily detectable may not have arrived on the breeding grounds at the time of the surveys.

#### Discussion

Some of the species detected or known to be found in the Croatan National Forest are considered to be in decline (Rich et al. 2004). The primary cause of decline in these species is loss of habitat through alteration and fragmentation. Additional fragmentation of habitat in the Croatan National forest caused by the development of the Havelock bypass is expected to have a negative effect on several bird species of conservation concern. The option that causes the least fragmentation (alternative corridor 2) will alter some of the preferred habitat in the forest, however it will prevent extensive separation of habitat from the interior of the Croatan. It is important to note from an ecological perspective, that even though alternative corridor 1 has the least amount of preferred habitat for target species, the resulting fragmentation of the forest and subsequent secondary impacts will have a greater negative effect on these species.

John Fussell provided extensive comments and expertise in the preparation of this document. Mr. Fussell also assisted with field research in the spring of 2005.

#### **References:**

Bechtoldt, Catherine L. and Philip C. Stouffer. 2005. Home-Range Size, Response to Fire, and Habitat Preferences of Wintering Henslow's Sparrows. The Wilson Bulletin 117 (3): 211-225.

Carter, Robin M. 1993. Finding Birds in South Carolina. University of South Carolina, Columbia, South Carolina.

Herkert, James R., Peter D. Vicery, and Donald E. Kroodsma. 2002. Henslow's Sparrow (*Ammodramus henslowii*). In The Birds of North America, No. 672 (A. Poole and F. Gills, eds.).

The Birds of North America, Inc., Philadelphia, PA.

Paul B. Hamel, et al. 1996.US Forest Service, Southern Research Station, General Technical Report. SO-120

Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Buthcer, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Inigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY.

Frost, Cecil C. 1996. Presettlement Vegetation and Natural Fire Regimes of the Croatan National Forest. North Carolina Department of Agriculture, Plant Conservation Program. Prepared for the U.S. Forest Service.

Pearson, Thomas G., Clement S. Brimley, and Herbert H. Brimley. 1942.

Birds of North Carolina. North Carolina Department of Agriculture, State Museum.

Brown, E.E. 1929. A List of Mid-Summer Birds of the Beaufort Region Observed from June 12 to August 12, 1929. A student report submitted at the North Carolina College at Greensboro. . 1

ATTACHMENT 3

# Results of Bat Surveys Conducted in the Vicinity of the Proposed Havelock Bypass

Prepared for: Environmental Services, Inc. 524 South New Hope Road Raleigh, 27610

Submitted 19 May 2006

Prepared by Mary K. Clark, Moonlight Environmental Consulting 1612 Bayleaf Trail, Raleigh, NC 27614 <u>mkclark141@aol.com</u>; 919-848-8117

**Notice:** *This report has been prepared by Moonlight Environmental Consulting solely for the benefit of the client in accordance with an approved scope of work.* 

# Results of Bat Surveys Conducted in the Vicinity of the Proposed Havelock Bypass

Mary K. Clark, Moonlight Environmental Consulting 1612 Bayleaf Trail, Raleigh, NC 27614 mkclark141@aol.com; 919-848-8117

## **INTRODUCTION**

Moonlight Environmental Consulting was contracted by Environmental Services, Inc. (ESI, 524 South New Hope Road, Raleigh, NC 27610) to conduct a habitat assessment and mist-net survey to assist with detection of protected and endangered bats in the vicinity of the Havelock Bypass proposed by the N. C. Department of Transportation. This report summarizes the methods and results of efforts conducted for that purpose.

Three federally protected bats are known from western North Carolina: Indiana bat, gray bat and Virginia big-eared bat (*Myotis sodalis, M. grisescens,* and *Corynornhinus townsendii virginianus*). No federally endangered or threatened bat species are known from the Coastal Plain of the state; however, two species are in categories of concern and protected by North Carolina native wildlife legislation. Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) is state threatened and the southeastern bat (*Myotis austroriparius*) is a species of concern. Additionally, each of these species has a "sensitive" designation within the USDA Forest Service.

It was deemed that the state-threatened status of Rafinesque's big-eared bat warranted survey for that species in the proposed bypass area. The specific contract request was to survey sites that represented the best habitat for the species in the bypass proposal area in order to determine presence/absence of Rafinesque's big-eared bat.

## **STUDY AREA**

The proposal to create a bypass around the city of Havelock includes alternative routes that are all primarily within Craven County. Fourteen communities in the Havelock Bypass proposal area were identified in the materials provided by ESI (Table 1).

## **METHODS**

## Habitat Assessment

Topographic and aerial maps showing the bypass options as well as detailed descriptions of the community types within the proposed bypass areas were provided by ESI in spring of 2005. A tour of the survey area was conducted in spring 2005 to view sites and to begin to make assessments of the habitat potential for Rafinesque's big-eared bat. The community descriptions and site visit were used in combination to determine the likelihood of occurrence of this species in each of the community types (Table 1).

Code	Community Label	Occurrence	Comment
		likelihood	
Μ	Rural/Urban Modifications	Not expected	Open, lacks roost potential
Р	Pond	Not expected	Open, lacks roost potential
PCh	Powerline Corridor, hydric	Not expected	Open, lacks roost potential
PCm	Powerline Corridor, mesic	Not expected	Lacks roost potential
PFh	Pine Flatwoods, hydric	Not expected	Lacks roost potential
PFm	Pine Flatwoods, mesic	Not expected	Lacks roost potential
PH	Pine Hardwoods	Not expected	Lacks roost potential
PPh	Pine Plantation, hydric	Not expected	Lacks roost potential
PPm	Pine Plantation, mesic	Not expected	Lacks roost potential
SFl	Swamp Forest, large stream	Possible	Potential for roost habitat
SFp	Swamp Forest, ponded depressional	Possible	Potential for roost habitat
SFs	Swamp Forest, small stream	Possible	Potential for roost habitat
SPs	Streamhead Pocosin, shrubdominated	Not expected	Lacks roost potential
SPt	Streamhead Pocosin, tree-dominated	Possible	Potential for roost habitat

<u>Table 1.</u> Likelihood of occurrence of Rafinesque's big-eared bat in the 14 communities within the proposed Havelock bypass options in Carven County, NC.

NCDOT Havelock Bypass bat report/ May 2006/ Moonlight Consulting, M.K.Clark

## Site Selection

Mist net sites were selected using the plant community data provided by ESI in combination with the onsite visits to wetlands in the bypass areas. Bat surveys are most often conducted near water sources such as ponds, beaver impoundments, streams and other waterways because bats are likely to congregate in these areas for drinking and feeding. Sites were selected based on habitat characteristics for Rafinesque's big-eared bat that are described in literature and from my 20+ years of experience with surveys for this species.

In coastal plain portions of its range the target species has been most often associated with old-growth bottomland hardwood swamp forests. The forest stand characteristic that is thought to be most important is the presence of a preponderance of large diameter trees with cavities. These cavities are used as roosts by this species (and also by the southeastern bat) and roosts are believed to be a limiting factor for some bat species (Kunz 1982, Kunz and Lumsden 2003). Large, shallow ponded areas (sloughs) within the forest and small protected streams or black water rivers are present in preferred habitat in juxtaposition with the large diameter hollow trees (tree roost and foraging characteristics described by Clark et al 1998).

#### **Bat Survey**

Mist nets of 2-ply, 50 denier nylon construction with a mesh size no larger than 38 mm were used in this survey. Net lengths varied based on the size of the area to be covered. Nets were suspended in forested areas over waterways in areas as described above. They were deployed at dusk, and monitored every 10-15 minutes for three-five hours. Data collected on bats that were captured included species, sex, age (adult or young) and reproductive condition. An acoustic detector was used in conjunction with mist-netting to determine general bat activity levels. Acoustic detection devices are not recommended as a primary survey means for Rafinesque's big-eared bat due to the fact that the echolocation calls for this species have characteristics that make detection by such devices difficult.

#### RESULTS

#### Habitat assessment

Preferred habitat in the proposed bypass area appears to be limited for Rafinesque's big-eared bat. The acreage of bottomland hardwood forest is small and the stands in the area do not contain a significant number of large diameter trees (24 inches or greater) with cavities. Sites in the Southwest Prong Slocum Creek, in the vicinity of the Greenlevel Road bridge, were selected for mist net survey. Although the bottomland forest in this area does not contain a large number of high diameter trees this area does contain a number of other characteristics that are similar to those where Rafinesque's big-eared bat has been found in other areas. A beaver impounded area upstream from the bottomland swamp was also netted due to the presence of a large number of cavity trees and its proximity to the bottomland hardwood forest. GPS coordinates were recorded for these mist net sites by Mary Frazer of the NC Department of Transportation.

## Survey results-mist netting

Mist-netting was conducted in the summer of 2005 for six nights. Two-to-six nets were set per night for a minimum of 12 net nights ("net night"=one net set for one night), and a total of 10 bats of four species were captured (Table 2). All captures occurred in nets set in the bottomland swamp along the Southwest Prong of Slocum Creek; no captures occurred in the beaver impoundment. There were no Rafinesque's big eared bats captured or otherwise documented during these surveys, however, one species of concern, the southeastern bat, was captured in the bottomland swamp forest.

## Survey results-acoustic survey

Mary Frazer, NC DOT, collected acoustic data at each site that was netted. This data provided some additional documentation of species habitat use and some insight into activity levels at the beaver impoundment and in the swamp forest. The data is in NCDOT files, but a brief summary of those efforts was provided to me and information from that summary is included in this report courtesy of M. Frazer. All four species that were captured in the swamp forest were also documented by acoustic detection in the beaver impoundment (Table 2). Over 300 call sequences that could be analyzed were recorded in the beaver impounded area, but no species other than those documented by mist netting were identified.

Acoustic monitoring during the netting sessions in the bottomland swamp forest indicate that the low capture rates may be due to low activity in the area. Very few passes were recorded or heard during mist netting sessions there, on several nights one to two hours elapsed before a lone bat pass was heard. In contrast, bat activity was high in the beaver impounded area during the September survey period. In the beaver impoundment peak bat activity occurred between 7:15 and 8:00 p.m. Eastern Daylight Time which coincides with the period when most bats emerge from their roosts (20-30 minutes before and after dusk).

<u>Table 2.</u> Bats documented from the Havelock Bypass vicinity in summer 2005. (# = number captured in mist-nets)

#	Species
4	Eastern pipistrelle, Pipistrellus subflavus
1	Evening bat, Nycticieus humeralis
4	Red bat, Lasiurus borealis
1	Southeasern bat, Myotis austroriparius

## DISCUSSION

The primary purpose of this report was to determine if protected bat species, in particular, Rafinesque's big-eared bat, were present in the vicinity of proposed bypass options for the city of Havelock, NC. The range of this species in the state includes the entire coastal plain and it seems likely that, even though the survey efforts did not produce any documentation for this species, it could be in the area. This species is known to be difficult to detect with acoustic means and many have reported that this species is difficult to capture in mist nets due to its ability to detect and avoid nets. Habitat in the Southwest Prong Slocum Creek area appears to have suitable characteristics for roosting. The capture and detection of the southeastern bat in both the beaver impoundment area and the swamp forest also indicates that habitat is present in this area for Rafinesque's big-eared bat as the two species have been found to use the same types of roost trees, even using the same tree on occasion. Fragmentation of the swamp forest may adversely affect roosting, foraging and commuting habitat for this species by creating open areas between roost sites. This species is not known to regularly frequent open areas and its flight behavior may make it more susceptible to predation by avian predators such as hawks and owls.

#### LITERATURE CITED

- Clark, M. K., A. Black and M. Kiser. 1998. Roosting and foraging activities of the *Corynorhinus rafinesquii* and *Myotis austroriparius* in the Francis Beidler Forest In South Carolina. Bat Research News. 39:162-163.
- Kunz, T. H. 1982. Roosting ecology of bats. Pp. 1-55 *in* Ecology of Bats (T.H. Kunz, Ed). Plenum Press, New York.
- Kunz, T. H. and L. F. Lumsden. 2003. Ecology of cavity and foliage roosting bats.Pp. 3-89 *in* Bat Ecology (T. H. Kunz and M. B Fenton, Eds). University of Chicago Press, Chicago, IL.

ATTACHMENT 4

# PRELIMINARY HABITAT AND PETS SPECIES EVALUATION

# FOR THE

# **CROATAN WETLAND MITIGATION BANK (CWMB)**

# **CRAVEN COUNTY, NORTH CAROLINA**

State Project No. 8.T170701

T.I.P. No. R-1015

Federal Aid Project No. R-56-4(34)

Consulting Project No. 06-ES-03

Prepared for:

The North Carolina Department of Transportation Division of Highways Planning and Environment Project Development and Environmental Analysis Branch Office of Natural Environment Raleigh, North Carolina



May 2008

## **Table of Contents**

1.0	Introduction and Background	1
2.0	Aims and Methods	4
3.0	Mapped Vegetation Assemblages	5
3.1	Swamp Forest, small stream (SFs)	6
3.2	Pine Flatwoods, mesic (PFm)	7
3.3	Pine Flatwoods, transitional (PFt)	7
3.4	Pine Flatwoods, hydric (PFh)	8
3.5	Successional/Ruderal Habitat, wet grass-sedge (SRg) and Powerline Corridor, hydric (PCh)	8
3.6	Successional/Ruderal Habitat, wet shrub-scrub (SRs)	9
3.7	Non-riverine Wet Hardwood Forest (NWH)	10
3.8	Non-riverine Swamp/Bay Forest (NSB)	11
3.9	Lake Ridge Pine Forest (LPF)	. 12
3.10	Pond (P)	. 12
3.11	Pine Plantation, hydric (PPh)	. 13
3.12	Pine Savanna, hydric (PSh)	. 13
3.13	Upland Hardwood Forest (UHF)	14
3.14	Pine/Hardwood Forest (PH)	. 14
3.15	Rural/Urban Modifications (M)	. 15
4.0	General Comparison of Havelock Bypass Corridors and CWMB Habitats	16
5.0	Occurrences of USFS PETS Plant Species	18
6.0	Occurrences of USFS PETS Animal Species	23
7.0	PETS Species and Potential Habitat Management Strategies	27
8.0	Summary	. 29
9.0	References Cited	. 30

## List of Tables

Table 1.	Mapped soil series at the CWMB	2
Table 2.	Summary of vegetation mapping units for the CWMB	5
Table 3.	Summary of PETS plant species currently as applicable to the CNF	.18
Table 4.	Summary of USFS PETS animal species as applicable to the CNF	.23

## List of Figures

Figure 1.	Project Location
Figure 2.	Vegetative Units

Figure 3. PETS Species Occurrences

## List of Appendices

Appendix	1.	Figures
пррепал	1.	I iguics

Appendix 2. List of PETS Species Taxonomic Changes

## Preliminary Habitat and PETS Species Evaluation for the Croatan Wetland Mitigation Bank (CWMB) Craven County, North Carolina

## 1.0 Introduction and Background

The North Carolina Department of Transportation (NCDOT) is the current landowner and steward for an approximately 4,035-acre property referred to as the Croatan Wetland Mitigation Bank (CWMB), an in-holding located within the boundaries of the Croatan National Forest (CNF). Restoration of the wetland and stream systems on this property was completed during 2001 and 2002. The CWMB is expected to provide compensatory mitigation for wetland impacts associated with the US 70 Havelock Bypass and other NCDOT projects. The CMWB is also expected to be used to offset the loss and fragmentation of U.S. Forest Service (USFS) property by the US 70 Havelock Bypass. In 2007, NCDOT determined that a preliminary evaluation of the CWMB should be conducted to assess the potential for current use by, and as potential mitigation for, USFS Proposed, Endangered, Threatened, or Sensitive (PETS) species.

Specifically a preliminary evaluation of the CWMB was undertaken to: 1) determine the presence and type of habitats currently existing on the CWMB; 2) determine which habitats may be potentially suitable for PETS species, with specific emphasis on the species potentially affected directly or indirectly by the US 70 Havelock Bypass; 3) document any PETS species occurrences found during the course of the field work; and 4) evaluate existing habitats in CWMB for potential mitigation value for PETS species affected by the US 70 Havelock Bypass. The current effort represents a preliminary evaluation of PETS species on the CWMB.

The CWMB was established as a coastal plain wetland mitigation bank by the NCDOT and is currently being managed by the N.C. Ecosystem Enhancement Program (EEP). The mitigation bank includes approximately 4,035 acres of low-lying and varying habitats located between Catfish Lake Road (SR 1100) and Long Lake, a naturally occurring blackwater lake in western Craven County, North Carolina (Figure 1). The property is roughly 5 miles in length and up to two miles in width in locations. It is largely surrounded by USFS holdings with privately owned lands located adjacent to the east and southeast boundaries, and a NCDOT parcel located along the east central boundary. Mitigation success monitoring of the CWMB is essentially complete at the end of the 2007 growing season except for final agency approvals of mitigation credits.

Much of the current flow of water leaving the mitigation bank exits the site via East Prong Brice Creek which flows north across Catfish Lake Road and eventually into the Trent River upstream of New Bern, North Carolina. Water moves across the CWMB from an elevation at Long Lake of approximately 38 feet above sea level downslope toward East Prong Brice Creek drainage at the stream's crossing at Catfish Lake Road with a low at approximately 20 feet above sea level (1994 Havelock 7.5" US Geological Survey Quadrangle Map). This is an average fall of approximately 3.6 feet per mile. There are few visible topographic prominences throughout the
area and it is essentially flat with a minimal slope to the north that is more prominent at the northern end of the site. A few very low ridges generally parallel the main access road maintained through much of the length of CWMB. These ridges are accompanied by soil textural changes to sand and slight topographic highs may represent relic sand features associated with ancient estuarine limits.

Soils throughout most of the project area have mucky or hydric loamy profiles frequently associated with lower coastal plain wetlands. Three major soil series have been mapped (Goodwin 1989, and later modified by ESI 2002) within the project area, Bayboro, Croatan and Pantego (Table 1). Bayboro and Pantego are wet loamy, mineral soils with heavy organic horizons at their surfaces. Croatan is an organic soil, composed largely of deposited or redeposited residue from the decay of plant material. All three have formed under long regimes of flooding and saturation. These three soils may occur over as much as 75% of the project area. By soil taxonomic convention, all named soil series mapped within CWMB have formed under conditions of permanent or periodic saturation and reduction (Soil Survey Staff 1999; Table 1).

There are two basic classes of soils, loamy soils with substantial amounts of clay in their lower horizons and organic soils with profiles formed in accumulations of decayed plant material. Loamy soils such as Leaf, Rains, Pantego, and Bayboro, give evidence of long hydroperiods by gray subsurface horizons and surface horizons with high organic content. Organic soils have mucky, organic horizons through their profiles, direct indications of long hydroperiods. As the re-introduction of water is completed some, not all, of the soil will regain some of the original hydrological characteristics that were in effect at the time of their first drainage. This process will involve a slow filling of soil profile interstices, pores, root spaces, and animal tunnels. The new hydroperiods will achieve equilibrium with extant climatic events and, as a result, plant species will be redistributed along new hydrologic gradients. This sorting process will require many years. Some species will slowly disappear. Some may reappear, provided a seed source is available. The new balance will ultimately affect new vegetation patterns across the landscape.

••		
Soil Series Name	<b>Textural Classification</b>	Subgroup Name
Bayboro	Mucky loam	Umbric Paleaquults
Croatan	Muck	Terric Medisaprists
Dare	Muck	Typic Medisaprists
Dorovan	Muck	Typic Medisaprists
Goldsboro	Loamy fine sand	Aquic Paleudults
Leaf	Silt loam	Typic Albaquults
Leon	Sand	Aeric Alaquods
Lynchburg	Fine sandy loam	Aeric Paleaquults
Masontown	Mucky fine sandy loam	Cumulic Humaquepts
Muckalee	Sandy loam	Typic Fluvaquents
Murville	Mucky loamy sand	Typic Endoaquods
Pantego	Fine sandy loam	Umbric Paleaquults
Rains	Fine sandy loam	Typic Paleaquults

Table 1.	Mapped	soil	series	at	the	CWMB
I doit I.	mapped	5011	501105	uı	une	CHID

The length of time these soils remained under non-characteristic hydrological conditions is not known; aerial photographs indicate that some hydrologic modifications were in place by 1949, with the pre-mitigation hydrological modifications apparently in place by 1981. It must be assumed that there were pedological changes that took place during the years they remained hydrologically modified and experienced significantly reduced hydroperiods. Some of these changes may have been loss of organic materials through oxidation of surface horizons, chemical modifications of spodic soils and some leaching of E-horizons, and drying and oxidation of at least the upper A-horizons of loamy soils. With the re-introduction of water these drying changes may be reversed or further modified. The long-term future may see a return to some simulation of natural conditions in some areas.

Extensive areas of forested habitat were cleared in the period immediately prior to NCDOT acquiring the site for mitigation purposes. The entire acreage has an apparent long history of timber harvest with associated drainage of wetlands. Some trees seen on spoil adjacent to channelized sections of East Prong Brice Creek may be as old as 60 to 75 years. Fires are evidenced by charred stumps and tree boles. Thin layers of ash in upper soil horizons were observed in areas in close proximity to Long Lake. However, fire was not likely a recurrent factor in more recent years.

As part of the mitigation activities in 2000-2001, approximately 675 acres of the recently clear cut areas were drum chopped as part of the site preparation to remove undesirable, early successional shrubs and tree saplings. These areas were checked for target vegetation community plantings with combinations of tree species that included water oak (*Quercus nigra*), swamp chestnut oak (*Quercus michauxii*), overcup oak (*Quercus lyrata*), cherrybark oak (*Quercus pagoda*), laurel oak (*Quercus laurifolia*), willow oak (*Quercus phellos*), green ash (*Fraxinus pennsylvanica*), swamp tupelo (*Nyssa biflora*), pond pine (*Pinus serotina*), loblolly pine (*Pinus taeda*), longleaf pine (*Pinus palustris*), and bald cypress (*Taxodium distichum*).

Plantings have grown to the extent they are now visible in some of the habitats. Many other areas are progressing largely under the effects of natural conditions and the plantings have been heavily browsed by wildlife or overtopped by vigorous early stages of natural vegetation succession. Native shrubs have rebounded from stump, rhizome or root sprouts as have the more common canopy trees such as red maple (*Acer rubrum*) and sweetgum (*Liquidambar styraciflua*) where clearing has taken place. Some areas that remain un-cleared are associated with the historically wettest soils. Many cleared wet areas are currently dominated by a mix of early successional coarse graminoid and shrubby species.

#### 2.0 Aims and Methods

On November 14 and November 27-30, 2007, and January 15, 2008, a brief field effort was completed for the purpose of gathering information at CWMB for vegetation community mapping and assessment of possible occurrences of PETS species as well as possible PETS species mitigation measures. During this field work it was determined that normal seasonal senescence was exacerbated by drought that had persisted through the year into fall. Soils in many areas that were normally flooded were exposed during the period of the field work and appeared to have been so for much of the past growing season. Most ditches were largely dry. Ponds held little water. Evidence in the form of water marks on trees, water stained leaves, and monitoring gauge data indicate that many of these areas are typically significantly wetter than what was observed during the field work.

Habitat over the extent of the mitigation bank was visited as time allowed. Observations were made at points recorded by a Global Positioning System (GPS) handheld unit to facilitate graphical projection of information on aerial photographs upon returning from the field. This information was used in constructing a vegetation map containing 16 vegetation units (Figure 2). The mapping units are subjective and represent a diversity of both mature climax and early seral stages of vegetation. It should be assumed that some of the units represent vegetation that is currently changing following recent hydrological restoration efforts in the mitigation area.

Of initial interest in the current survey is a preliminary assessment of CWMB vegetation assemblages as potential habitat for a group of rare plant species considered by the USFS to be PETS species. PETS plant and animal species are listed in Section 5.0 and are the topic of the current report. PETS species have been named by the US Forest Service as important to overall species diversity management in the CNF. Many of these species also have been listed by the North Carolina Natural Heritage Program (NCNHP) as important rare species in North Carolina.

A number of PETS species known from or near alternatives of the proposed US 70 Havelock Bypass that pass through US Forest Service property in Croatan National Forest may be subjects for mitigation efforts in CWMB. The vegetation map that accompanies this report represents current vegetation conditions present at CWMB, but offers no portents of future conditions. Hopefully these early observations will allow some estimates for habitats and management scenarios for PETS species. Future conditions may be in the realm of best estimates.

Common and scientific names of vascular plant species are taken, where possible, from Weakley 2007.

## **3.0 Mapped Vegetation Assemblages**

Sixteen vegetation cover types have been recognized and mapped for purposes of this project in the CWMB. These plant cover types represent various levels of past disturbance, response to water level changes and a variety of human landscape manipulations. No attempt has been made to delineate minor variations within these plant cover patterns. Most of the units used can not be relegated to any one level of plant assemblage whether community, association, consocies, etc. Because of past disturbances, some map units may represent seral stages of more mature units also present on the landscape. Mapped unit names and conventions follow those used for the US 70 Havelock Bypass vegetation mapping to the greatest extent feasible. Additional community assemblages not found in association with the Bypass occur on large portions of the CWMB.

Map units named and defined below are a mix of types easily recognized for this preliminary mapping exercise. More careful field analysis and ground truthing efforts would be necessary to resolve finer detail within these map units. Mapped renderings of vegetation cover at CWMB will be subject to varying degrees of change on the ground until disturbed cover types regain equilibrium with their new environments. Map unit areas are summed below by type (Table 2). Map unit abbreviations used on the accompanying map are included in parentheses with each map unit discussion. The CWMB was divided into Management Units (MUs) during mitigation feasibility studies and implementation, and these MUs are used to reference specific regions of the CWMB in this report (Figure 2).

Vegetation Mapping Unit Name		Summary of Acreages
Swamp Forest, small stream	SFs	122.0
Pine Flatwoods, mesic	PFm	53.7
Pine Flatwoods, transitional	PFt	40.7
Pine Flatwoods, hydric	PFh	76.7
Successional/Ruderal Habitat, grass-sedge	SRg	593.3
Powerline Corridor, hydric	PCh	47.0
Successional/Ruderal Habitat, shrub-scrub	SRs	667.7
Non-riverine Wet Hardwood Forest	NWH	99.5
Non-riverine Swamp/Bay Forest	NSB	1912.0
Lake Ridge Pine Forest	LPF	5.0
Pond	Р	6.9
Pine Plantation, hydric	PPh	46.1
Pine Savanna, hydric	PSh	111.5
Upland Hardwood Forest	UHF	1.4
Pine/Hardwood Forest	PH	234.4
Rural/Urban Modifications	М	17.7
Total Mapped Acreage		4035.6

Table 2.	Summarv	of vegetation	mapping	units for	• the C	WMB.
I UDIC #	Summary	or vegetation	mapping	units 101		·· ·· D.

#### 3.1 Swamp Forest, small stream (SFs)

Most surface runoff leaving CWMB reaches shallow drainage ways slowly carved and filled as runoff moves across 18 feet of slope over 5 miles from headwater wetland habitats in and adjacent to the mitigation area toward Catfish Lake Road. To the west the Sheep Ridge Wilderness Area, owned by the US Forest Service, supplies water to Brice Creek via a western branch of the East Prong of the stream as well as West Prong proper. This western branch of the stream system is also fed by runoff from the western half of CWMB. An eastern branch in the stream along the northern boundary has been partially channelized in the past and carries flow that rises from the extensive swamps in the southeastern portions of CWMB. These two branches of East Prong meet near the northern end of the mitigation area and flow under the bridge on Catfish Lake Road. Some of this drainage may at times carry water that leaves Long Lake at the southern tip of CWMB. A fragment of this vegetation unit just west of the main entrance to CWMB was cut off by construction of Catfish Lake Road and may now feed into a ditch just west of the entrance to CWMB.

The waters carried by the stream originate in wetlands with deposits of organic matter and are stained by tannins derived from vegetation detritus, hence the color. The western branch of East Prong has been used by beaver (*Castor canadensis*) that appear to have benefited from the rising water levels within CWMB. Their dams and culvert plugs can be seen along the main entrance road. Other signs where tree bark has been gnawed are visible along much of the western branch and some of the eastern branch. Where more open, the channel is wide and scattered with the trunks of dead, fallen trees that have died either from the rising water levels or from damming by beaver. Within some headwater areas, the flow is more sheet-like, often indiscernible below trees, shrubs, and in some cases, fairly widely spaced trees in swamps. This particular mapping unit, identified as Coastal Plain Small Stream Swamp (blackwater subtype) in Schafale and Weakley (1990), has been applied to small, blackwater streams throughout the eastern part of the state.

Characteristic soils along these streams are a mix of Masontown and Muckalee as evidenced by mixing of the alluvial layers. Dorovan and Croatan soils representing deeper organic deposits may also be found in some middle reaches. Croatan soils are mapped for some headwater areas. Some histosol deposits may be relicts of previously active stream channels that now contain deposits of organic material, as suggested by their linear shapes on soils maps (Goodwin 1989).

The characteristic tree species within the more open channels are swamp tupelo, red maple, sweetgum, and sweet bay (*Magnolia virginica*). Cherrybark oak is scattered. Titi (*Cyrilla racemiflora*) is one of the more common large shrubs. Shining fetterbush (*Lyonia lucida*) clearly marks the channel edge, particularly along the lower stream reaches, and in the upper reaches may be common across the areas of flow where water passes through thick stands of pocosin-like vegetation. Loblolly pine and water oak may occur on hummocks slightly above regular flow.

#### **3.2** Pine Flatwoods, mesic (PFm)

Areas identified as mesic Pine Flatwoods occupy low upland to mesic sandy ridges scattered along the main access road through CWMB. The soils in these areas are often mapped as Goldsboro (Aquic Paleudults) extending into adjacent areas of Rains, Leaf, and Pantego mapping units. Not all areas seem to show evidence of aquic moisture conditions. Mesic Pine Flatwoods parcels along the access road in the central eastern portion of the site are loamy in the B-Horizon and retain bright soil chromas, similar to Autryville (Arenic Paleudults). With the exception of a small area of Upland Hardwood Forest discussed in Section 3.13, these are the driest habitats seen at CWMB. Soils of pine stands, included within this mapping unit, nearer the entrance are darker and seem to have accumulated more organic matter, perhaps more indicative of somewhat poorer drainage. The more northern habitats grade into wetter habitats to the east (Swamp Forest, small stream) and, west of the access, into transitional Pine Flatwoods and hydric Pine Flatwoods.

The canopy dominants of the mesic Pine Flatwoods map unit are usually loblolly pine, but longleaf pine is occasionally an important co-dominant. Pond pine may become more important near transitions to wetter habitats. Important subcanopy species include sweetgum, red maple, and water oak. Swamp chestnut oak becomes more common toward streams. American beech (*Fagus grandifolia*) may be scattered in well drained soils adjacent to streams. Red bay (*Persea palustris*), not usually competitive in the forest canopy in these habitats, is often present as a subcanopy species or shrub layer. Other species functioning in the understory shrub layer within this forest type include horse sugar (*Symplocos tinctoria*) and sweet pepper bush (*Clethra alnifolia*). Switch cane (*Arundinaria tecta*) is also common, particularly in moister soils.

#### **3.3** Pine Flatwoods, transitional (PFt)

Areas identified as transitional Pine Flatwoods can represent an intermediate step between mesic Pine Flatwoods as discussed in Section 3.2 and hydric Pine Flatwoods as discussed in Section 3.4. Soils supporting this forest canopy type are intermediate along a textural gradient between sandier Goldsboro soils mapped near the road and wetter silt loam soils in the Leaf series. Along with the textural gradation, a drainage gradient may account for poor drainage from the Goldsboro through Rains and across Leaf soils.

Within this map unit, loblolly pine and longleaf pine are joined by pond pine. Red maple is more abundant and somewhat replaces sweetgum in the subcanopy. Swamp tupelo seems to replace water oak. American beech disappears. Pond cypress (*Taxodium ascendens*) is scattered in the canopy and below. Wetland species including bamboo-vine (*Smilax laurifolia*), inkberry (*Ilex glabra*), Virginia chain fern (*Woodwardia virginica*), and coastal plain gentian (*Gentiana catesbaei*) are commonly present. Carolina loosestrife (*Lysimachia loomisii*), a PETS plant species, and eastern narrowleaf seedbox (*Ludwigia linearis*) are common where seeds have been scattered by human foot traffic along trails used for installation and checking of shallow water monitoring gauges.

## 3.4 Pine Flatwoods, hydric (PFh)

Areas identified as hydric Pine Flatwoods have a scattered canopy cover shared by pond cypress and pond pine in loamy Rains, Leaf, and Pantego soils. Scattered stands of clonal shrubs dominate much of the understory shrub stratum. Many clumps are somewhat elevated above the substrate, with bases that appear to usually be flooded during periods of normal precipitation. This growth form often regenerates several years following passage of severe wild fire through a pocosin-like wetland. Root mats were frequently exposed, possibly resulting from oxidation of organic matter during drained site conditions prior to site restoration.

A widely scattered canopy of pond cypress and pond pine may also contain stems of red maple, red bay, loblolly bay (*Gordonia lasianthus*), and swamp tupelo. The shrub stratum contains several clump-forming species that have assumed dominance from place to place depending on how the original occurrence of each species was favored following fire. Titi, sweet gallberry (*Ilex coriacea*), shining fetterbush, inkberry, myrtle holly (*Ilex myrtifolia*), and bamboo-vine are principle among the closely spaced clumps of woody vegetation.

Many open areas between and at the bases of clonal shrubs are occupied by species of sphagnum moss (*Sphagnum* spp.) characteristic of open pocosin habitats. These include *Sphagnum affine*, *S. molle*, *S. perichaetiale*, and *S. magellanicum*. Mounds of sphagnum moss form the basis of habitat for purple pitcher plant (*Sarracenia purpurea*), several species of beak-rushes (*Rhynchospora* spp.), common ten-angled pipewort (*Eriocaulon decangulare*), and other species not readily identifiable in the fall season. Potential for occurrence of rare species in this habitat is high.

# 3.5 Successional/Ruderal Habitat, wet grass-sedge (SRg) and Powerline Corridor, hydric (PCh)

Successional/Ruderal Habitat with a dominance by wet grass and sedge species have most characteristically formed where existing non-riverine swamp/bay forest vegetation has been removed and soils have been disturbed by heavy machinery. Closure of drainage systems has resulted in subsequent flooding of these areas. Extensive areas recently cleared of forest cover, as well as much of the length of the power line easement passing through CWMB, are now occupied by variations of this map unit; the powerline easement is presented here as a separate community based on the regular and frequent maintenance schedule that keeps the area in an early successional state. The soil map units Pantego, Bayboro, and Croatan serve as substrate for this map unit. However, other soil map units may be included as well. In addition, smaller inclusions of areas dominated by shrub-scrub vegetation can be found within grass and sedge dominated areas. Mapping resolution did not always allow separation of variations.

Much of the microtopographic structure of these wet habitats is associated with the remains of downed trees, stumps, and variable mixtures of rotting branches and low mounds of soil materials. These surfaces offer a gradient of growing conditions relative to hydric conditions.

Together with seasonal and yearly variations in water levels, these diverse habitats offer a wide range of flooded as well as draw-down growing conditions.

The most abundant plant forms within the grass and sedge dominated areas are graminoids such as giant plume grass (*Saccharum giganteum*), bunched broomsedge (*Andropogon glomeratus*), velvet grass (*Dichanthelium scoparium*), tall swamp witch grass (*Dichanthelium scabrisculum*), warty panic grass (*Panicum verrucosum*), and sedges that include wool grass (*Scirpus cyperinus*) and beak-rushes (*Rhynchospora glomerata*, *R. chalarocephala*, *R. inexpansus*, *R. gracilenta*). Variations of these habitats due to slight differences in soils, flooding, past land use, and seed or diaspore availability may promote considerable differences in species content.

Residual plant materials remaining from the original clearing process have also contributed to the complement of plant species. Woody plant materials have regenerated from stumps, roots, and layered materials. Mobile plant seeds, root materials, and rhizomes can take advantage of the newly exposed wet substrates. Some of the other common species that occupy these habitats are red maple, dog fennel (*Eupatorium capillifolium*), flat-top golden rod (*Euthamia tenuifolia*), sweetgum, hairy seedbox (*Ludwigia pilosa*), swamp black gum (*Nyssa sylvatica*), fireweed (*Erechtites heiracifolia*), yellow-eyed grass (*Xyris ambigua*), Virginia chain fern, and shortspur creeping bladderwort (*Utricularia gibba*). Weak rush (*Juncus debilis*) and Canadian rush (*Juncus canadensis*) are irregularly common from place to place. Wetter areas may display a greater variety of wetland or aquatic species.

During years where draw-down of water exposes organic muck surfaces, such pioneering species as long-beak baldsedge (*Rhynchospora scirpoides*) are able to complete their life cycles. One large occurrence of this PETS plant species was found within the Progress Energy power transmission corridor near the east side of CWMB.

#### 3.6 Successional/Ruderal Habitat, wet shrub-scrub (SRs)

The creation of areas dominated by wet shrub-scrub vegetation within the CWMB has resulted from clear-cutting and subsequent early regeneration within a variety of wetland vegetation map units. Clear-cutting has taken place numerous times over a period of years that extends into previous land ownerships. The most recent clear-cuts immediately preceded conversion of the area to a mitigation bank. Some regeneration seems to be following a course that will lead directly back to mature woodlands resembling those that were harvested. Other stands, some seeming to have been cut multiple times and/or burned, appear to be following a course through a form of pocosin. These latter areas may eventually regain bay forest content and stature. Other stands in less hydric soils are following a course of regeneration through a different set of species.

A number of variables effective prior to cutting, during, and following cutting may be responsible for some of the observed regeneration differences. The timing or number of times areas have been cut or burned could be responsible for differences in regeneration. Soil factors including texture, major profile contents, oxidation and drainage characteristics can modify the course of regeneration. Soil series characteristically applied to these habitats include Croatan, Pantego, Bayboro, and Murville. All these soils have either organic profiles or organic epipedons and may have been subject to burning in the past. Diaspore availability can be important to stand species composition. For instance, in large monotypic stands absence or abundance of seed source for some species may figure strongly into the course of regeneration. Fire during regeneration can profoundly change the multi-factor succession process.

Within one larger stand of the vegetation mapping unit Non-riverine Swamp/Bay Forest, a recently cut area just south of the eastern end of Progress Energy power corridor (CWMB MU 9), shows the simpler form of regeneration. This area supports young individuals of the same dominant species as adjacent areas that have not been recently cut. Few if any species differences occur between the two age stands. Additionally, there were no particular variations within the young stand even though a line defining Croatan soils from Pantego soils bisects the regenerating stand. A few large trees remain uncut from the pre-existing forest. Dominant trees were young stems of sweetgum, red maple, and red bay. These were not particularly thick. Red bay was present in multiple size classes from seedlings to young trees, having been stimulated by increased light. Other species present were Virginia chain fern, scattered young stems of giant plume grass, high bush blueberry (*Vaccinium formosum*), muscadine (*Vitis rotundifolia*), and seedlings of loblolly pine. Within another variation of this stand type a bit further south, there were widely scattered patches of dense shining fetterbush and titi.

Another area, further south along the east side of CWMB (MU 14), appeared to have been timbered several years ago. Currently this area supports a dense pocosin-like shrub stratum from which emerge scattered canopy individuals of red maple, red bay and sweet bay. The shrub stratum consists largely of shining fetterbush with scattered patches of dense titi, red bay, inkberry, high bush blueberry, bamboo-vine, and whiteleaf greenbrier (*Smilax glauca*). Dense pocosin-like vegetation dominates both north and south sides of the road removed between MUs 10A and 13A. This latter area has soils segments mapped as Croatan and Bayboro. Similar immature vegetation dominates in more southerly timbered areas mapped as having Murville soils.

Westward, along the main operational access road into the site, a different variation on the areas dominated by wet shrub-scrub vegetation dominates several large timbered areas along the east side of the road. These areas, mapped as having largely Pantego soils, appear to have somewhat coarser textures. Dominants consist of water oak, sweetgum, loblolly pine. Shining fetterbush, titi, southern bayberry (*Morella caroliniensis*), and inkberry are common. Muscadine is the main woody vine while whiteleaf greenbrier is scattered. These latter stands represent a sub-climax stage of an altogether different forest type that is not yet understood.

#### 3.7 Non-riverine Wet Hardwood Forest (NWH)

Two stands of Non-riverine Wet Hardwood Forest occupy segments of Pantego soils in the northwest portion of CWMB. One smaller stand occupies segments of soils mapped as Pantego,

Murville, and Croatan soils near the south end of the project area not far from Long Lake. These tentative forest designations are subject to change.

In the north, along the western boundary of Brice Creek, young stages of what appear to be Nonriverine Wet Hardwood Forest merge very gradually with the blackwater phase of the small stream Swamp Forest. The two occurrences extended westward and joined across what is now a removed roadway. These two segments have been timbered and have begun to regenerate in young trees at least somewhat representative of the pre-existing forest stands.

Some of the regeneration of this cover type appears to now be passing through a pine forest stage in which loblolly pine is dominant. Much of the rest of this cover type is largely hardwood or mixed loblolly pine and hardwood. With more critical analysis, several communities may eventually be recognized. Currently, much of the area is dominated by either young stems of hardwoods possibly representing such species as sweetgum, water oak, swamp chestnut oak, and cherrybark oak. With the return of flooded soils at CWMB, a different course of natural succession may be defined. Understory strata within these areas include shining fetterbush, common wax myrtle (*Morella cerifera*), bamboo vine, and others.

## 3.8 Non-riverine Swamp/Bay Forest (NSB)

The most extensive tracts of largely natural forest have been mapped as Non-riverine Swamp/Bay Forest. Two forested wetland types have been combined as one map unit for the purposes of the current evaluation. Both Non-riverine Swamp Forest and Bay Forest habitats have been outlined by Schafale and Weakley (1990). With more extensive examinations in the future, it may be possible to separate these entities at CWMB. For the current effort these two forested entities have been lumped as one extensive forest system occupying nearly half of the CWMB.

The Non-riverine Swamp/Bay Forest vegetation occupies approximately 1912 acres within CWMB (Table 2). This map unit extends from near the margins of Long Lake in irregular parcels northward to north of the Progress Energy power transmission corridor that crosses the project just north of the center. It is likely that much of this habitat, at least historically, served as watershed for Brice Creek. Construction of drainage ditches and roads from the 1940s to the 1970s within what is now CWMB altered the flow of groundwater and surface water through this system. Wetland mitigation activities appear to have restored movement of groundwater and surface water through these wetland forests.

Bay Forest, at least, and Non-riverine Swamp/Bay Forest have been modified in various ways and at various places through out the extent of this forest system. These modifications have resulted in the regeneration of vegetation cover types that resemble young Non-riverine Swamp Forest and those that resemble pocosin, or the successional precursor of Bay Forest. As indicated above, the nature of or sequence of events responsible for development of these seres is not understood at this time. Timbering, fire, soils, and flooding likely have been influential. This forest complex becomes more fragmented from south to north within CWMB, possibly because historical disturbances began in the north and shifted south with time. A history of land use events in the area accompanied by a chronology of the removal of timber resources would aid in explaining current differences through these landscapes, their current cover of vegetation, and the general course of future changes.

The canopy species composition of what appear to be the most mature stands of Non-riverine Swamp/Bay Forest is presently dominated by a small group of deciduous hardwood and conifer species. These are sweetgum, red maple, and swamp tupelo. Cypress (*Taxodium* spp.) is scattered, as is mature loblolly pine. The characteristic species of the understory is red bay, even though this species is occasionally present in the canopy. Within forests with relatively large, buttressed canopy trees, red bay is often a widely dispersed sapling. Shining fetterbush may occur in scattered small or large clones as a significant part of the shrub layer. Other shrub or woody vine species present are often inkberry, sweet gallberry, scattered clumps of bamboo vine and jessamine (*Gelsemium* spp.).

One specimen of jessamine collected from a regularly flooded portion of this habitat fits descriptions of vegetative material for swamp jessamine (*Gelsemium rankinii*), somewhat north of the recognized range of the species. Verification of this material would have to be accomplished during spring (March). Carolina jessamine (*Gelsemium sempervirens*) is common in other stands of this and other map units.

## 3.9 Lake Ridge Pine Forest (LPF)

A low sandy ridge follows the northern margin of Long Lake for a short distance in the vicinity of the hunting lodge that is no longer extant. This ridge may have developed as an artifact of wind and wave action and deposition of sand, perhaps somewhat augmented by construction of a sandy beach during historical human use of the area. This sandy substrate currently supports an aging forest stand dominated by large loblolly pine. A subcanopy composed largely of water oak, Darlington oak (*Quercus hemisphaerica*), sweetgum, and red bay occurs below the pine canopy. Switch cane is an important shrub species along with common wax myrtle.

## **3.10 Pond** (**P**)

Ponds within the CWMB were largely either very low or dry during the period of the reconnaissance survey. Most of these ponds appeared to have been created during excavations for fill material for construction along the road system built through the area. During seasons of ordinary rainfall these ponds offer a diverse set of aquatic and/or draw-down habitats. Some of these habitats have succeeded naturally and contain somewhat more diverse assemblages of plant species.

Species noted within some of these ponds were short-leaf yellow-eyed grass (*Xyris brevifolia*), small-seed spikerush (*Eleocharis microcarpa*), creeping rush (*Juncus repens*), diffuse rush (*Juncus diffusissimus*), sphagnum mosses, water sundew (*Drosera intermedia*), shining

fetterbush, and others. One nearly dry pond contained an extensive occurrence of Florida peat moss (*Sphagnum cribosum*, previously known as *S. floridanum* or *S. macrophyllum* ssp. *floridanum*) that floats at and just below the surface when the pond contains water; this species is a PETS species on the CNF.

Ponded areas considered more directly artifacts of land clearing exist within other map units, but have not been specifically mapped separately. Most are more ephemeral than the borrow ponds created specifically by removal of fill material. Most pools that expand and contract with seasonal precipitation variations occur within the Successional/Ruderal Habitats, including those areas dominated by wet shrub-scrub vegetation and wet grass and sedge vegetation. Some of these, as well as the borrow areas, support species of bladderwort (*Utricularia* spp.) and sundew (*Drosera* spp.).

## 3.11 Pine Plantation, hydric (PPh)

Three stands of hydric Pine Plantation were seen within CWMB during the course of the survey. These stands were planted prior to creation of the mitigation area, and are not associated with pine plantings completed during construction of CWMB. It appears that these monoculture stands, located along the eastern boundary south of the Progress Energy power corridor, are dying. Water levels have risen since completion of the mitigation area and the soils supporting the plantations are now largely depleted of oxygen needed for root growth and functioning.

The plantations seem to have been created in areas previously dominated by Non-riverine Swamp/Bay Forest. A juvenile sere of that mapping unit resembling pocosin has begun to regenerate beneath the dying pines. Titi, shining fetterbush, inkberry, sweet gallberry, and bamboo-vine dominate the shrub layers between and under the pines.

#### 3.12 Pine Savanna, hydric (PSh)

Hydric Pine Savanna has been created where thick pocosin-like vegetation with an emergent, scattered canopy of Pond Pine has been cleared over Murville and some Pantego soils. Both these soils customarily support traditional pocosin vegetation similar to much of the mapped wet shrub-scrub dominated areas. Following clearing, much of the substrate supports a variety of species characteristic of wet savanna that is often maintained by burning. In this instance, mechanical clearing has to some extent taken the place of burning. Burning of the hydric Pine Savanna community mapped here has not been a recent ecological factor and without fire these areas will soon succeed again to wet shrub-scrub dominated, pocosin-like vegetation.

Cleared areas currently support a variety of low shrubs, grasses and sedges. Abundant shrubs consist of inkberry, sweet gallberry, wax myrtle, creeping blueberry (*Vaccinium crassifolium*), southern sheepkill (*Kalmia carolina*), and southern bayberry. Titi may occupy lower, wetter areas where not removed during clearing.

Common herbaceous species include wire grass (*Aristida stricta*) and numerous species of beak rushes (*Rhynchospora* spp.) along with broomsedge (*Andropogon* spp). Walter's sedge (*Carex striata*) and Virginia chain fern most frequently occupy lower areas subject to seasonal standing water. Giant plume grass is commonly scattered throughout these areas along with several species of yellow-eyed grasses (*Xyris* spp.). Yellow pitcher plant (*Sarracenia flava*) and purple pitcher plant grow in some areas.

## 3.13 Upland Hardwood Forest (UHF)

One small stand of Upland Hardwood Forest is mapped near the south-central part of CWMB. The stand is associated with a source of sandy upland soil apparently used for fill material during construction of roads through the area prior to its use as a mitigation area. As an inclusion this sandy, upland soil has not been specifically mapped. However, it has some characteristics of the Kureb series (Spodic Quartzipsamments).

The sandy soils in this small habitat support a small stand of Darlington oaks scattered over a level to pitted topographic micro-relief, an artifact of sand removal. Understory shrubs consist of switch cane, southern bayberry, inkberry, and southern blueberry (*Vaccinium tenellum*). Depressions contain sphagnum moss and Virginia chain fern. Larger borrow pits are included as ponds.

# 3.14 Pine/Hardwood Forest (PH)

Most stands of Pine/Hardwood Forest are located in the northern half of CWMB and are supported on previously drained portions of Leaf or Bayboro soils. Southeastern stands within this vegetative unit (MUs 2B, 3, 7) are often surrounded by the remnants of ditches. These plugged ditches are adjacent to and once likely fed the channelized eastern branch of East Prong Brice Creek. Channelization of the eastern branch was likely completed years ago, judging by the size of older trees occupying spoil mounds that parallel the channel. The adjacent lattice work of ditches may have been completed subsequent to channelization. A period of timber harvest followed channelization and ditching. Most of this area is again re-flooding and taking on the character of young, non-riverine hardwood forest with, however, a substantial contingent of loblolly pine.

Two additional stands of Pine-Hardwood forest are located on a low ridge near the junction of the two branches of East Prong Brice Creek; the access road separates these two stands (MU 2a, 5). Both of these forest stands are relatively young, but the stand west of the road seems the older of the two. Loblolly pine is more abundant in the stand east of the road. Both these stands are largely upland. Though soils are mapped as Leaf, significant Goldsboro or other less hydric inclusions may be present in these two stands.

Water oak, red maple, southern red oak (*Quercus falcata*), swamp chestnut oak, white oak (*Quercus alba*), sweetgum, and loblolly pine occupy the canopies of the more upland stands.

Cherrybark oak and willow oak occupy drained soils adjacent to the East Prong Brice Creek channelization and are included in this mapping unit. Large American beech are scattered along the spoil mound. Hardwoods are widely scattered in some areas. Red bay and horse sugar are functioning as subcanopy species as well as shrubs along with sweet pepperbush. More frequently flooded areas support more of a predominance of red maple. Open, wet areas where a continuous canopy thins usually support a thicker herb layer.

## 3.15 Rural/Urban Modifications (M)

The main gravel roads and adjacent shoulders that will be maintained for future access to the CWMB are included in the classification of Rural/Urban Modifications in the mapping scheme for this project, consistent with the inclusion of these types of areas in this designation in the evaluation of the US 70 Havelock Bypass investigation.

#### 4.0 General Comparison of Havelock Bypass Corridors and CWMB Habitats

Since some level of mitigation effort may be considered for CWMB with respect to rare plant and animal species considered by the USFS as PETS species found within corridor alternatives for the US 70 Bypass of Havelock, a preliminary comparison of the landscape control of plant habitats within these two disparate geographic areas may be in order. For many habitats found along Havelock Bypass alternatives, there are few or no similar CWMB analogues. A look at the general dissimilarity of basic landforms provides an overview explanation of this dissimilarity. Even where similarity in general vegetation coverage can be observed, variations in soils, landscape position, and hydroperiods distinguish the vegetation assemblages of the US 70 Havelock Bypass from those present on the CWMB in many cases.

The dominant landform in the bypass area is a slightly undulating upland/wetland plateau with an elevation of 25-30 feet above sea level. Substantial slopes have been formed by lateral stream dissection along the edges of the plateau. The plateau has been further dissected by human landscape manipulations and a variety of habitats dedicated to various sorts of corridors have increased the overall diversity of landscape features. These modifications, along with natural variations in soil textures, mineral components, and varying parent material characteristics further increase the landscape diversity within the various alternatives. Stream slopes offer wide variation in soil textures and chemistry, particularly within and near flood plain deposits. This is particularly true where dissection and/or deposition may have exposed or deposited circumneutral soils through active flood plains. Water flow, and hence hydrologic characteristics, within streams is quite rapid due to higher stream gradients. Slopes that have developed as a result of stream dissection have a variety of aspects, that is, they face a variety of different cardinal points of the compass. Aspect may account for considerable variation in insolation and effective light availability, soil temperature, moisture residence times, organic material decay speeds, and weathering and soil characteristics, particularly within A-horizons.

The general landscape at CWMB is a made up of a single plateau that slopes very gently northward. Substantial stream dissection across this plateau is absent; however minor dissection does occur at the northern end of the mitigation area. Topographic variation is barely unidirectional as opposed to multidirectional. Most of the plateau is distinctly hydric in nature and soils are dominated by the slow deposition of organic material derived from decay of plant material. The topographic gradient over the length of CWMB, even though generally unidirectional, is only about 18 feet over roughly 5 miles. Lateral topographic gradient is only a few feet. East Prong Brice Creek and its tributaries constitute the only main topographic variations. The major causes of landscape and habitat diversity results from human manipulation and degradation, such as sand deposits near the center of the mitigation bank that have been diversified by excavation. Additional habitat diversity has been caused by road placement and power line corridor clearing.

The greatest landscape and habitat variations at CWMB have been the short-term effects of hydrologic modifications and the changes in ecological succession resulting from clearing and timber harvesting. The most profound landscape changes in the bypass corridors have been the long-term effects of stream dissection. In summary, overall topographic and habitat diversity is greatest within the bypass corridors.

Within the CWMB, there may be more opportunities for small variations in larger expanses of what are most apparently similar habitat types. Some variations of stream head pocosin that were found in a limited area within the bypass corridors may occur over greater extents as shrub-scrub and grass-sedge wetland. Similarly, the occurrence of narrow, shallow, water flow-dominated wetlands in the bypass corridors have variations at CWMB that have developed over very wide extents. However, they exist without the abrupt topographic marginal relief. Effectively, there are few directly comparable habitat analogues between the two geographies, due mostly to the lack of abrupt topographic variations at CWMB.

One more example focusing on variations in dissimilarities between the Havelock Bypass Alternative Corridors and CWMB will be useful. The largest vegetation map unit at CWMB, Non-riverine Swamp/Bay Forest, may have several successional seres visible on the landscape. These seres seem to be dependent on degree, repeated occurrence, and type of disturbance. Disturbances combined with fire may be responsible for these sere variations. When timbered, these habitats can return from stump and root sprouts and regenerate into the parent forest type. With some other mix of factors added, such as fire or very severe disturbance along with the diaspore introduction, these habitats appear to regenerate through early pocosin-like habitat. If these latter habitats are successively burned, other habitats including possibly Atlantic white cedar (*Chamaecyparis thyoides*) swamp, may develop. Areas mapped as containing wide areas of Murville soils seem, to a greater extent, to reflect this tendency. These suggestions are highly speculative at this point and should be investigated further before consideration in any management plan. These successional tendencies seem generally to be absent within the bypass corridors.

## 5.0 Occurrences of USFS PETS Plant Species

The USFS has issued a list of plant species that are considered important to the overall plant species diversity supported within Croatan National Forest. This list of the PETS plant species is presented below (Table 3). Among these plant species are those which have been reported within or near the US 70 Havelock Bypass Alternative Corridors, as well as three which thus far have been reported from the CWMB area.

Common Name <sup>a</sup>	Scientific Name <sup>a</sup>	Habitat at CWMB <sup>f</sup>
Mosses		
Carolina campylopus	Campylopus carolinae	None
Hall's fissiden moss	Fissidens hallii	SFs
Fitzgerald's peatmoss	Sphagnum fitzgeraldii <sup>a</sup>	SRg
Florida peatmoss	Sphagnum cribrosum <sup>b,d,e</sup>	P, SFs (streams)
giant peatmoss	Sphagnum torreyanum	P, SFs (streams)
Liverworts		
a liverwort	Cylindrocolea rhizantha	None
a liverwort	Frullania donnellii	Moist, open habitats
a liverwort	Lejeunea bermudiana <sup>d</sup>	Moist bases of hardwoods
a liverwort	Lejeunea dimorphophylla	None
a liverwort	Metzgeria uncigera	None
a liverwort	Plagiochila ludoviaciana <sup>d</sup>	None
a liverwort	Plagiochila miradorensis	Moist upland habitats
Lichens		
sunrise lichen	Teloschistes flavicans	None
Vascular Plants		
sensitive jointvetch	Aeschynomene virginica	None
scale-leaf gerardia	Agalinis aphylla <sup>d</sup>	SRg, PCh
branched gerardia	Agalinis virgata	PSh
tall bentgrass	Agrostis altissima	PSh
bog bluestem	Andropogon mohrii	PSh
dogbane	Apocynum sp. <sup>d</sup>	None
spreading sandwort	Arenaria lanuginosa ssp. lanuginosa	None
Chapman's three-awn	Aristida simpliciflora	PSh
savanna indian-plantain	Arnoglossum ovatum var. lanceolatum <sup>c</sup>	None
savanna milkweed	Asclepias pedicellata	None
Carolina spleenwort	Asplenium heteroresiliens	None
twining screwstem	Bartonia paniculata spp. paniculata <sup>d</sup>	SRg, PCh
many-flowered grass pink	Calopogon multiflorus	SRg, PCh
Long's bittercress	Cardamine longii	None
widow sedge	Carex basiantha <sup>c</sup>	None
Leconte's thistle	Cirsium lecontei <sup>d</sup>	None
twig-rush	Cladium mariscoides	Potential in draw-down areas
small spreading pogonia	Cleistes bifaria <sup>d</sup>	SRg, PCh
carolina sunrose	Crocanthemum carolinianum	PFm
Tennessee bladder-fern	Cystopteris tennesseensis	None
Hirst's panic grass	Dichanthelium hirstii	PSh

Table 3. Summary of PETS plant species currently as applicable to the CNF.

Table 3 Continues.

Table 3 Continued.

Common Name <sup>a</sup>	Scientific Name <sup>a</sup>	Habitat at CWMB <sup>f</sup>
a witch grass	Dichanthelium sp.	None
Venus flytrap	Dionaea muscipula	SRg, PCh
Robbin's spikerush	Eleocharis robbinsii	None
dissected sneezeweed	Helenium pinnatifidum	SRg, PCh
comfortroot	Hibiscus aculeatus	None
quillwort	Isoetes microvela	None
white wicky	Kalmia cuneata	None
southern bogbutton	Lachnocaulon beyrichianum	None
pondspice	Litsea aestivalis	None
Boykin's lobelia	Lobelia boykinii	PFh
flaxleaf seedbox	Ludwigia linifolia	SRg, PCh
Raven's seedbox	Ludwigia ravenii	SRg, PCh
rough-leaved loosestrife	Lysimachia asperulaefolia	PFh, PSh
Loomis's loosestrife	Lysimachia loomisii <sup>d,e</sup>	Scattered throughout
Carolina birds-in-a-nest	Macbridea caroliniana	None
Florida adder's mouth	Malaxis spicata <sup>d</sup>	None
Godfrey's sandwort	Minuartia godfreyi	None
loose watermilfoil	Myriophyllum laxum	Р
narrowleaf cowlily	Nuphar sagittifolia	None
savanna cowbane	Oxypolis denticulate <sup>c,d</sup>	SRg,PCh
southeastern panic grass	Panicum tenerum	PSh
large-seed pellitory	Parietaria praetermissa	None
Carolina grass-of-parnassus	Parnassia caroliniana	None
mudbank crown grass	Paspalum dissectum <sup>d</sup>	Р
spoonflower	Peltandra sagittifolia	PSh, SRs
hairy knotweed	Persicaria hirsuta <sup>c,d</sup>	P, SFs
pineland plantain	Plantago sparsiflora	None
yellow fringeless orchid	Platanthera integra <sup>d</sup>	PFh
snowy orchid	Platanthera nivea <sup>d</sup>	PFh
Hooker's milkwort	Polygala hookeri <sup>d</sup>	PSh
small butterwort	Pinguicula pumila	PSh
shadow-witch	Ponthieva racemosa <sup>d</sup>	None
awnpetal meadow-beauty	Rhexia aristosa	PFh
West Indies meadow-beauty	Rhexia cubensis	P, SRg,PCh
short-bristled beaksedge	Rhynchospora breviseta	PSh
Harper's beaksedge	Rhynchospora harperi	None
large beakrush	Rhynchospora macra	PFh
feather-bristle beaksedge	Rhynchospora oligantha <sup>d</sup>	SRg, PCh
coastal beaksedge	Rhynchospora pleiantha	SRg, PCh
long-beak baldsedge	Rhynchospora scirpoides <sup>e</sup>	SRg, PCh
Thorne's beaksedge	Rhynchospora thornei	None
Chapman's arrowhead	Sagittaria chapmanii <sup>c</sup>	SRg, PCh
grassleaf arrowhead	Sagittaria weatherbiana <sup>°</sup>	SRg, PCh
drooping bulrush	Scirpus lineatus	None
Baldwin's nutrush	Scleria baldwinii	PSh
Georgia nutrush	Scleria georgiana <sup>a</sup>	PFm (edges)
graceful goldenrod	Solidago gracillima	None
Leavenworth's goldenrod	Solidago leavenworthii	PFh
Carolina goldenrod	Solidago pulchra	PSh

Table 3 Continues.

Table 3 Concluded.

Common Name <sup>a</sup>	Scientific Name <sup>a</sup>	Habitat at CWMB <sup>f</sup>
spring-flowering goldenrod	Solidago verna <sup>d</sup>	PFm
coastal goldenrod	Solidago villosacarpa	None
giant spiral ladies'-tresses	Spiranthes longilabris	PSh, PFh
piedmont meadowrue	Thalictrum macrostylum	None
smooth tofieldia	Tofieldia glabra	PSh
dwarf bladderwort	Utricularia olivacea	Р
savanna yellow-eyed grass	Xyris flabelliformis	PSh
Florida yellow-eyed grass	Xyris floridana <sup>c</sup>	PSh
a yellow-eyed grass	Xyris stricta	PSh

<sup>a</sup> Common and scientific names in this table follow those in use by the NCNHP (Franklin and Finnegan 2006) unless otherwise indicated.

<sup>b</sup>Recent name change documented in McQueen and Andrus 2007.

<sup>c</sup> Recent name changes documented in Weakley 2007.

<sup>d</sup> PETS plant species potentially affected by the US 70 Havelock Bypass.

<sup>e</sup> PETS plant species reported from CWMB.

<sup>f</sup> P=Pond; PCh=Powerline Corridor, hydric; PFh=Pine Flatwoods, hydric; PFm=Pine Flatwoods, mesic; PSh=Pine Savanna, hydric; SFs=Swamp Forest, small stream; Srg=Successional/Ruderal Habitat, wet grass-sedge; SRs=Successional/Ruderal Habitat, wet shrub-scrub.

A brief review of each species potentially directly or indirectly affected by the US 70 Havelock Bypass study corridors and an assessment of its potential for occurring within the CWMB follows.

- *Sphagnum fitzgeraldii*--Fitzgerald's peatmoss is found in scattered and isolated mats in open mesic savanna habitats, sometimes along regularly mowed power transmission corridors. Since the species does not compete effectively in wet or submerged habitats as do many other Sphagnum species, its potential presence at CWMB would currently be limited to non-flooded savanna sites, making it most likely non-existent in the CWMB.
- *Sphagnum cribrosum*--Florida peatmoss is found in continuous or broken mats, often floating or sometimes stranded during periods of draw down, in slowly flowing blackwater streams or ponds. These sorts of habitats are present at CWMB, and the species already has been found in a linear borrow pond.
- Lejeunea bermudiana--This species of liverwort occurs at the bases of large hardwood trees (black gum, sweetgum, etc.) near or possibly in heavily forested blackwater swamps where it is not regularly inundated by flood waters. Habitat may possibly occur along some of the tributaries of Brice Creek at CWMB, but this species may have some affinities for circum-neutral soils formed from weathered limestone in the bypass area. No evidence of circum-neutral soils has been seen at CWMB. However, lower in the watershed of Brice Creek, downstream of CWMB, plant species favored by circum-neutral soils do occur.

- *Plagiochila ludoviciana--*This liverwort species has been found on the bases of American Beech near and above blackwater streams. This species may also have an affinity for soils influenced by weathered limestone. It is likely not present at CWMB
- Agalinis aphylla--Scale-leaf gerardia is found in open, moist savanna habitat, characteristically in power transmission corridors that are regularly mowed. Habitat at CWMB may be present near the southwestern sections of the site where soils are sandier and contain a large amount of organic matter in pocosin-like habitats recently cleared for mitigation plantings in soils mapped as Murville. Reported occurrences of this species have not been verified in the study corridors for the US 70 Havelock Bypass for purposes of the current study.
- *Apocynum* sp.--This unidentified species of dogbane was found atop a heavily forested sandy ridge along a stream channel on the US 70 Havelock Bypass. This sort of habitat does not occur at CWMB.
- *Bartonia paniculata* spp. *paniculata*--Twining screwstem is found in cleared wet pocosin soils under power transmission corridors in the bypass area, but was not added by the USFS as a PETS plant species until late 2007. Habitats at CWMB where this species may reside may be associated with Successional/Ruderal Habitats including those dominated by wet shrub-scrub and wet grass-sedge species.
- *Cirsium lecontei*--Leconte's thistle occurs in mesic savanna over loamy soils. These habitats occur largely within power transmission corridors maintained by regular mowing in the bypass area. No such habitat occurs in CWMB.
- *Cleistes bifaria*--Small spreading pogonia has been found within the US 70 Havelock Bypass Alternative Corridors in longleaf pine/switch cane savanna over loamy soils and at the edge of mucky loam soils in disturbed pocosin at the edge of stream channels. Suitable habitats may be present at CWMB within Successional/Ruderal Habitats including those dominated by wet shrub-scrub and wet grass-sedge species.
- *Lysimachia loomisii*--Loomis' loosestrife is a ubiquitous species of open wet areas where it is easily spread by animal and human vectors. This species is common in many open wet or mesic edge habitats at CWMB.
- *Malaxis spicata*--Florida adder's mouth may associate most closely with wooded, somewhat organic soils subject to slight sedimentation by calcium carbonate leached from limestone. Apparent preferred habitats are most usually found at the bases of slopes near blackwater streams. This combination of habitat features probably is not present at CWMB.
- *Oxypolis denticulata*--Savanna cowbane is a species of savannas over loamy soils with organic epipedons. Habitats of this sort may be found at CWMB associated with Successional/Ruderal Habitats including those dominated by wet shrub-scrub and wet grass-sedge species.
- *Paspalum dissectum*--Mudbank crown grass is associated with lentic habitats and seen during seasonal draw-down phases when bottom substrate is exposed. Habitat may exist in association with borrow ponds at CWMB.

- *Persicaria hirsuta*--Hairy knotweed is characteristically found in more or less permanent pond, stream or ditch habitats. It may also be associated with beaver impoundments along streams. This species may be sought along small stream Swamp Forest or flooded borrow area Ponds.
- *Platanthera integra--*Yellow fringeless orchid is most usually associated with wet savannas in the coastal plain. Habitat associated with hydric Pine Flatwoods may exist at CWMB.
- *Platanthera nivea*--Snowy orchid is often found in wet savanna habitats dominated by Pond Cypress. Habitat associated with hydric Pine Flatwoods may exist at CWMB.
- *Polygala hookeri*--Hooker's milkwort is known from loamy, mesic savannas in the bypass corridors and is most usually associated with power corridors. Its occurrence in the CWMB project area is doubtful, but it may be found in drier phases of Successional/Ruderal Habitats, wet grass-sedge.
- *Ponthieva racemosa*--Shadow-witch is known to associate most closely with wooded somewhat organic soils subject to slight sedimentation by calcium carbonate leached from limestone. Apparent preferred habitats are most usually found at the bases of slopes near blackwater streams. This combination of habitat features probably is not present at CWMB.
- *Rhynchospora oligantha*--Feather-bristle beaksedge may be found associated with somewhat disturbed wet savannas or open bog edges. Habitat for this species in wet grass-sedge Successional Ruderal Habitat may be present at CWMB.
- *Rhynchospora scirpoides*--Long-beak baldsedge has not been reported from the Havelock Bypass Corridors. It was documented at the CWMB in the power transmission corridor near the eastern boundary and, given the right conditions, should be expected more extensively within the mitigation bank. This is an annual and a drawdown species. It may appear as a pioneer on non-flooded, mucky substrate wherever the seed manages to germinate, if other variables allow.
- *Scleria georgiana--*Georgia nutrush is associated with savannas and may be found along the upper rims of natural ponds in the Havelock Bypass Alternative Corridors. Its occurrence at CWMB is doubtful, but if present it may be found in savanna-like habitat along the more open edges of Pine Flatwoods, mesic near the central western edge of the CWMB.
- *Solidago verna--* Spring-flowering goldenrod is found in mesic pine savanna under closed or scattered pine canopy and responds positively to canopy loss along power transmission corridors and to fire. Mesic Pine Flatwoods over loamy soils at CWMB may provide needed habitat essentials, but preliminary searches in this limited habitat at CWMB have had only negative results.

## 6.0 Occurrences of USFS PETS Animal Species

The USFS has issued a list of animal species that are considered important to the overall species diversity supported within Croatan National Forest. This list of the PETS animal species is presented below (Table 4). Among these, animal species are those which have been reported within or near the US 70 Havelock Bypass Alternative Corridors, as well as seven which thus far have been reported from the CWMB.

Common Name <sup>a</sup>	Scientific Name <sup>a</sup>	Habitat at CWMB <sup>d</sup>
Mollusks		
Atlantic geoduck	Panopea bitruncata	None
triangle floater	Alasmidonta undulata	None
Atlantic pigtoe	Fusconaia masoni	None
eastern lampmussel	Lampsilis radiata	None
chameleon lampmussel	Lampsilis sp. 2	None
green floater	Lasmigona subviridis	None
squawfoot	Strophitus undulatus	None
Savannah lilliput	Toxolasma pullus	None
blackwater ancylid	Ferrissia hendersoni	None
Crustaceans		
graceful clam shrimp	Lynceus gracilicornis	PSh, SRg
North Carolina spiny	Orconectes carolinensis	SFs
crayfish		
Tar River crayfish	Procambarus medialis	None
Croatan crayfish	Procambarus plumimanus <sup>d</sup>	Scattered throughout
Aquatic Insects		
a mayfly	Baetisca laurentina	None
Fish and Aquatic		
Salamanders		
Atlantic sturgeon	Acipenser oxyrhynchus	None
spinycheek sleeper	<i>Eleotris pisonis</i>	None
Lyre goby	Evorthodus lyricus	None
freckled blenny	Hypsoblennius ionthas	None
least brook lamprey	Lampetra aepyptera	None
pinewoods shiner	Lythrurus matutinus	None
Carolina madtom	Noturus furiosus	None
bridle shiner	Notropis bifrenatus	None
sandhills chub	Semotilus lumbee	None
Neuse River waterdog	Necturus lewisi	SFs
Non-Aquatic Insects		
a dart moth	Agrotis carolina	PFm
Venus flytrap cutworm moth	Hemipachnobia subporphyrea	SRg

**Table 4.** Summary of USFS PETS animal species as applicable to the CNF.

Table 4 Continues.

Table 4 Continued.

Common Name <sup>a</sup>	Scientific Name <sup>a</sup>	Habitat at CWMB <sup>d</sup>
a bird-dropping moth	<i>Lithacodia</i> sp. 1 <sup>b</sup>	SRs
Lemmer's pinion	Lithophane lemmeri	None
an owlet moth	Meropleon diversicolor sullivani	None
an owlet moth	Franclemontia interrogans	Scattered throughout
southern ptichodis	Ptichodis bistrigata	None
annointed sallow moth	Pyreferra ceromatica	PSh, PFh, SRs
Carter's noctuid moth	Spartiniphaga carterae	PSh
arogos skipper	Atrytone arogos arogos	PSh
little metalmark	Calephelis virginiensis <sup>b</sup>	PSh
Berry's skipper	Euphyes berryi	Р
two-spotted skipper	Euphyes bimaculata	PSh
Duke's skipper	Euphyes dukesi	None
dotted skipper	Hesperia attalus slossonae	None
slender-bodied melanoplus	Melanoplus attenuatus	SRs, PFh, PSh
a short-winged melanoplus	Melanoplus nubilus	SRs, PFh, PSh
Terrestrial Amphibians		
Carolina gopher frog	Rana capito	UHF, PH
Reptiles		
American alligator	Alligator mississippiensis <sup>c</sup>	Scattered throughout
eastern diamondback	Crotalus adamanteus	UHF, PH
rattlesnake		
southern hognose snake	Heterodon simus	UHF, PH
Carolina salt marsh snake	Nerodia sipedon williamengelsi	None
mimic glass lizard	Ophisaurus mimicus	UHF, PH
black swamp snake	Seminatrix pygaea	P, SFs
Mammals		
red wolf	Canis rufus	Throughout
Rafinesque's big-eared bat	Corynorhinus rafinesquii	Scattered throughout
southeastern myotis	Myotis austroriparius <sup>d</sup>	Scattered throughout
eastern woodrat - coastal population	Neotoma floridana floridana	None
eastern cougar	Puma concolor couguar	Throughout
Dismal Swamp southern	Synaptomys cooperi helaletes	SRs
Birds		
Bachman's sparrow	Aimophila aestivalis <sup>b</sup>	PSh PFh PFm SRg (edges)
Henslow's sparrow	Ammodramus henslowii <sup>b</sup>	SRs SRg PCh
anhinga	Anhinga anhinga <sup>c</sup>	P SFs NSB (flooded portions)
American bittern	Botaurus lentiginosus <sup>c</sup>	SRo PCh
northern harrier	Circus cvaneus	None – nesting habitat
	CHEND CYMICHD	(marshes) not present
yellow rail	Coturnicops noveboracensis	SRg
black-throated green	Dendroica virens waynei coastal	NSB
warbler	population <sup>b,c</sup>	
·		•

Table 4 Continues.

Table 4 Concluded.

Common Name <sup>a</sup>	Scientific Name <sup>a</sup>	Habitat at CWMB <sup>d</sup>
bald eagle	Haliaeetus leucocephalus <sup>c</sup>	Observed, nesting not
		confirmed
black-necked stilt	Himantopus mexicanus	None
Mississippi kite	Ictinia mississippiensis <sup>c</sup>	SFs, NSB
migrant loggerhead shrike	Lanius ludovicia migrans	SRg, PSh
painted bunting	Passerina ciris ciris	None
double-crested cormorant	Phalacrocorax auritis <sup>c</sup>	NSB (along Long Lake)
red-cockaded woodpecker	Picoides borealis <sup>b</sup>	TBD

<sup>a</sup> Common and scientific names in this table follow those in use by the North Carolina Natural Heritage Program (Franklin and Finnegan 2006) unless otherwise indicated.

<sup>b</sup>PETS animal species potentially affected by the US 70 Havelock Bypass.

<sup>c</sup> PETS animal species reported from CWMB.

<sup>d</sup> P=Pond; PCh=Powerline Corrider, hydric; PFh=Pine Flatwoods, hydric; PFm=Pine Flatwoods, mesic; PSh=Pine Savanna, hydric; SFs=Swamp Forest, small stream; Srg=Successional/Ruderal Habitat, wet grass-sedge; SRs=Successional/Ruderal Habitat, wet shrub-scrub; NSB=Non-riverine Swamp/Bay Forest; PH=Pine/Hardwood Forest; UHF=Upland Hardwood Forest.

A brief review of each species potentially directly or indirectly affected by the US 70 Havelock Bypass study corridors and an assessment of its potential for occurring within the CWMB follows.

- *Aimophila aestivalis* The focus of conservation efforts in the CNF is on breeding habitat for Bachman's sparrow. Bachman's sparrow breeds in dense grassy areas with an open canopy of pine species. On the CWMB these habitats may occur in drier areas that resemble pine savanna habitat including portions of the grass-sedge Successional/Ruderal areas.
- Animodramus henslowii -- Henslow's sparrow can be found in similar habitats to Bachman's sparrow but generally occupies areas with a higher occurrence of shrub strata as opposed to tree strata. These habitats may be found on the CWMB in the vegetation assemblages grass-sedge and shrub-scrub Successional/Ruderal areas and hydric powerline corridors.
- *Calephelis virginiensis* Little metalmark is found in open pine savanna habitats with open pine canopies with thistle (*Cirsium* spp.). Potential habitat for this species is present on the CWMB in the Pine Savanna habitat areas.
- *Dendroica virens waynei* Black-throated green warbler was a common breeder heard singing on territory throughout the Non-riverine Swamp Forest/Bay Forest prior to mitigation activities. Confirmation of continued usage of these habitats on the CWMB should be made in the spring, as well as investigating the other swamp stream habitats on the CWMB.

- *Lithacodia* sp. 2 This bird dropping moth is found in dense pocosin-like habitats that have a high occurrence of switch cane as well as the shrubby edges of other pine habitats where switch cane is common.
- *Myotis austroriparius* Southeastern myotis utilizes larger dead trees with hollow cavities in close proximity to water and generally forages over open water. Potential roosting sites may now be found scattered throughout the CWMB with foraging opportunities present in scattered areas which experience extended periods of flooding.
- *Picoides borealis* Red cockaded woodpeckers habitat and mitigation opportunities are being evaluated under a separate agreement by J. Carter Associates. A report summarizing findings will be provided to NCDOT under separate cover.
- *Procambarus pluminanus* Croatan crayfish is likely present in permanent waters and temporary waters scattered throughout the site.

Observations of American bittern, double-crested cormorant, bald eagle, Mississippi kite, and northern harrier have occurred on the CWMB. No nesting habitat is present for northern harrier or American bittern, which may be present on the CWMB in suitable habitat during non-breeding season. CWMB may provide potential nesting habitat for Mississippi kite and bald eagle but no evidence of usage of the site for nesting has been observed. Double-crested cormorant has been observed in Long Lake but no nesting activity has been observed. However, potential nesting habitat is present.

Anhingas nested on the CWMB in 2007 and 2008. In May 2007 at least nine adults were observed with two confirmed on nests at the location noted on Figure 3; one nest and at least six adults were observed at the same location in May 2008. No effort was made to systematically investigate this colony due to concerns over disturbing nesting activities.

American alligator is widespread throughout the site in areas where permanent water occurs. Evidence of successful reproduction has been observed since the completion of mitigation activities in the areas identified as the Anhinga colony noted on Figure 3.

## 7.0 PETS Species and Potential Habitat Management Strategies

Various habitats associated with the proposed Havelock Bypass Alternative Corridors have been shown to support small occurrences of PETS species. As indicated previously, in an attempt to develop mitigation measures for possible loss of these occurrences preliminary surveys were undertaken to: 1) determine the presence and type of PETS habitats present throughout CWMB; 2) determine which habitats may be potentially suitable for PETS species, with specific emphasis on the species potentially affected directly or indirectly by the US 70 Havelock Bypass; and 3) evaluate existing habitats in CWMB as mitigation sites for Havelock Bypass PETS species. The subject for discussion now will involve the last point.

Two mapped vegetation units at CWMB are in the more youthful seral stages following clearing. These units are the wet scrub-shrub and wet grass-sedge variants of the Successional/Ruderal Habitat vegetation unit and are currently worthy of consideration for long-term management (Figure 3). These areas were planted in 2001-2002 with tree species mixes selected for targeted plant community restoration.

Habitats found at CWMB may be limited in their current capacity to support US 70 Havelock Bypass PETS species. The following points are important to consider with respect to the currently understood list of these species:

- Of the habitat types identified on the CWMB, the generalized savanna habitat included in the hydric Pine Savanna vegetation unit is the most important with respect to potential habitat for the largest number of PETS species. Savanna is a very general term and refers to vegetation forms consisting of a more or less continuous stratum of predominantly herbaceous species, but often with scattered shrub species, below an open or scattered canopy dominated by pines or occasionally pond cypress. Savannas form in wet, mesic (moist), and xeric (dry) environments and in a variety of soil types.
- Savanna habitats require burning for maintenance. Without fire, shrubs will quickly overtake open herbaceous vegetation, shading and blocking direct sunlight needed for optimum growth. The course of succession with fire can be highly variable depending on species compositions, soil characteristics and soil moisture conditions. Overlapping fire regimes can eventually create a broad patchwork of vegetation patterns, each holding particular affinities for a few or a set of fire-adapted plant species. Adaptation to fires by plants may take many forms. One such adaptation in pond pine, seed-bearing cones that begin to open only during periods of high heat, is considered specific to pocosin or savanna habitats in our area. Management surrogates sometimes used in place of fire, specifically mowing and bush-hogging, are intolerant of optimum soils conditions and produce their own set of secondary impacts in natural vegetation.

• Documentation of occurrences of rare plants is not always a process that can be accomplished over one or two growing seasons. Factors governing the appearance of plants from season to season may change depending on unknown variables in species and habitat ecology. A multitude of factors can limit the growth of plants. Such species as snowy orchid are prime examples of rare plants that may not reappear on a yearly basis.

It does not appear that savanna has been an important habitat type in the overall natural vegetation of CWMB for many years. This may mean that seed or diaspore sources for many savanna species are absent. Evidence of fire within the CWMB habitats is present, but it is not common or widespread. Management of habitat with fire, specifically those habitats which can develop into some sort of savanna, is the most effective tool available for maintaining a fire subclimax vegetation type. With the implementation of frequent fire, some occurrences of Successional/Ruderal Habitat, including wet shrub-scrub and wet grass-sedge variants, can be managed in the form of savanna habitat. These are the habitats considered potentially most valuable for management of many of the PETS species. However, most of the savanna types at CWMB would be wet with intermittent or seasonal standing water. Potential for mesic savanna with largely emergent soils at CWMB is limited. Specific areas of hydric Pine Savanna and Successional/Ruderal Habitat that should be assessed for potential restoration/management as Pine Savanna are identified in Figure 3.

Fire may also be an important tool in returning hydric Pine Flatwoods or transitional Pine Flatwoods to a fire sub-climax vegetation type. It appears that both of these habitats, especially hydric Pine Flatwoods have been deeply burned in the past, possibly during only a few events. Dominants in this habitat complex are widely scattered trees and an open tall shrub stratum quite capable of supporting several important rare species. The hydric Pine Flatwoods mapped at CWMB in the extreme northwestern portion of the mitigation site should be assessed carefully for potential restoration to Pine Savanna (Figure 3). Since this forest type will slowly change without recurrent fire, this tool should be considered in its management.

Recurrent fire anywhere through habitats in CWMB would produce unique and potentially important habitats that have long been absent from the larger landscape of eastern North Carolina and the CNF. A mitigation area dedicated to the preservation of fire sub-climax communities could be of value in understanding these long-stifled habitats and in providing potential habitat for a suite of PETS species.

#### 8.0 Summary

Sixteen broad vegetation categories were identified, preliminarily assessed, and described from field data gathered during an evaluation of the roughly 4,035-acre CWMB. These habitats were compared with the current list of PETS plant and animal species reported from the proposed US 70 Havelock Bypass study corridors. Comparisons with existing habitats were made to establish the potential existence of these species in CWMB and/or to assess the potential for mitigation of these species using the resources present in CWMB. Potential management of habitat for PETS species was also considered both for those species reported from the proposed Havelock Bypass as well as others listed for the CNF.

The possibility of finding all or most of the plant species in question within CWMB is low. Three PETS plants and two PETS animal species were identified on the CWMB during field investigations (Figure 3). Several additional PETS bird species have been observed on the CWMB, but nesting of these species has not been confirmed. A possible rare plant species find, swamp jessamine, can be verified in spring. This species is not currently on the USFS list of PETS species. Characteristics of the available habitats at CWMB currently favor mostly a few savanna-pocosin edge plant species.

The possibility of considering CWMB for management as a fire sub-climax mitigation area would allow for additional PETS species mitigation opportunities beyond those available on the CWMB without management. In general, those PETS species with a reasonable capability of using wet, currently unmanaged, savanna available in one habitat complex in the northern end and one complex near the southern end of CWMB could be expected to be present. Management of habitat using fire would increase the numbers of PETS species for which mitigation measures might be attempted. A few other species that utilize swamp forest habitats, both small stream and nonriverine/bay forest types, can be expected to be necessary for these species.

## 9.0 References Cited

- Environmental Services, Inc. 2002. Soil Map, Croatan Wetland Mitigation Bank, Craven County, North Carolina. Unpublished report prepared by Environmental Services, Incorporated under contract Consultant Project No. 00-ES-10 (TIP No. R1015 WM) for the North Carolina Department of Transportation, Raleigh, North Carolina.
- Goodwin, Jr. R.A. 1989. Soil Survey of Craven County, North Carolina. US Department of Agriculture, Soil Conservation Service. US Govt. Printing Office, Washington, DC.
- Franklin, M.A. and J.T. Finnegan. 2006. Natural Heritage Program List of Rare Plant Species of North Carolina. North Carolina Natural Heritage Program, Office of Conservation and Community Affairs, N. C. Department of Environment and Natural Resources. Raleigh.
- McQueen, C.B. and R.E. Andrus. 2007. Sphagnaceae Dumortier. <u>In:</u> Flora of North America Editorial Committee. Flora of North America, Volume 27 Bryophytes: Mosses, part 1. Oxford University Press. New York. 712p.
- Shafale, M.P. and A.S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health and Natural Resources. Raleigh.
- Soil Survey Staff. 1999. Soil Taxonomy. Agricultural Handbook Number 436, US Department of Agriculture, Natural Resources Conservation Service. Washington DC. Maps, 869 p.
- Weakley, A.S. 2007. Flora of the Carolinas, Virginia, Georgia and surrounding areas. UNC Herbarium, University of North Carolina at Chapel Hill. A working draft. [available at: http://www.herbarium.unc.edu/flora.htm]

Appendix 1



P:\GeoGra\Projects\2006\091\03\GIS\mxd\Fig1.mxd; 02/27/07; 3:40 pM



File: P./GeoGra/Projects/2006/091/03/GIS/mxd/Fig2V3.mxd Printed: 02/15/2008 3:00 pm



Appendix 2

PETS List Taxonomy Changes (December 2007)

Old Name	New Name
Sphagnum macrophyllum floridanum	Sphagnum cribosum
Carex willdenowii megarhyncha	Carex superata (Not a PETS species)
Arnoglossum ovatum	Arnoglossum ovatum lanceolatum
Oxypolis ternata	Oxypolis denticulata
Polygonum hirsutum	Persicaria hirsuta
Sagittaria graminea chapmanii	Sagittaria chapmanii
Sagittaria graminea weatherbiana	Sagittaria weatherbiana
Xyris difformis floridana	Xyris floridana
<i>Agrotis</i> n. sp. 1	Agrotis carolina
Phragmitiphila interrogans	Franclemontia interrogans
Corynorhinus rafinesquii	Corynorhinus rafinesquii macrotis
Neotoma floridana pop. 1	Neotoma floridana floridana

NCNHP is no longer tracking the subspecies of the following:

Lanius ludovicia migrans Rana capito capito **ATTACHMENT 5**
# 2008 USFS PETS SPECIES SURVEYS AND MITGATIVE MEASURES EVALUATION FOR THE US 70 HAVELOCK BYPASS ON THE CROATAN NATIONAL FOREST (CNF) CRAVEN AND CARTERET COUNTIES, NORTH CAROLINA

State Project N. 8.T170701

TIP R-1015

Federal Aid Project No. R-56-4(34)

Consulting Project No. 06-ES-03



THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION Project Development and Environmental Analysis Branch Natural Environment Unit

June 2009

# **Table of Contents**

1.0	Introduction	. 1
2.0	Areas Evaluated	. 1
3.0	Survey Results	. 1
3.1	Twining Screwstem (Bartonia paniculata paniculata)	. 2
3.2	Leconte's Thistle (Cirsium lecontei)	. 3
3.3	A Liverwort (Lejeunea bermudiana)	. 4
3.4	A Bird-dropping Moth (Lithacodia sp.)	5
3.5	Florida Adder's Mouth (Malaxis spicata)	5
3.6	Southeastern Myotis (Myotis austroriparius)	6
3.7	Mudbank Crown Grass (Paspalum dissectum)	7
3.8	A Liverwort (Plagiochila ludoviaciana)	7
3.9	Yellow Fringeless Orchid (Platanthera integra)	8
3.10	Snowy Orchid (Platanthera nivea)	. 9
3.11	Hooker's Milkwort (Polygala hookeri)	10
3.12	Short-bristled Beaksedge (Rhynchospora breviseta)	10
3.13	Georgia Nutrush (Scleria georgiana)	11
3.14	Fitzgerald's Peatmoss (Sphagnum fitzgeraldi)	12
3.15	Dusky Roadside Skipper (Amblyscirtes alternata)	13
3.16	Other PETS Species	14
4.0	Conclusions	14
5.0	References	17
Append	lix A: Figures	
Figur	e 1. Areas Evaluated	

Figure 2. Study	Results
-----------------	---------

Appendix B: NCNHP Element Occurrence Data Forms

Appendix C: Analysis of NCNHP Polygon Sub-element Occurrences

# List of Tables

Table 1.	New Occurrences of Targeted PETS Species Documented 2008-2009	2
Table 2.	New Occurrences of Non-targeted PETS Species Documented 2008-2009	14
Table 3.	Species Habitat Categories	15
	-r	

# 1.0 Introduction

Environmental Services, Inc., (ESI) has been assisting NCDOT with the evaluation of U.S. Forest Service (USFS) Proposed, Endangered, Threatened, or Sensitive (PETS) species for the US 70 Havelock Bypass project. Since the proposed project crosses U.S. Forest Service (USFS) property (Figure 1 in Appendix A), a special use permit from the USFS will be required. Prior to approving a special use permit for the project, the USFS requires that potential direct and indirect impacts to PETS species be evaluated and that mitigative measures to offset potential impacts to PETS species be identified.

This study serves as a part of the mitigative measures to assist NCDOT in obtaining a special use permit for the project. Specifically this study attempts to identify additional occurrences of specific PETS species of concern not previously documented by USFS or in North Carolina Natural Heritage Program (NCNHP) records. Also at the request of USFS, known occurrences of several potentially impacted PETS species were also reviewed to determine if they continued to exist. The results of this study are included in Section 3.0. Non-targeted PETS species identified during the course of the surveys are also included.

In addition, an areal analysis of direct and indirect PETS species impacts for the US 70 Havelock Bypass study corridor alternatives is included in Appendix B. This analysis provides areal impacts to individual polygons representing sub-element occurrences of element occurrences for these species as tracked by the NCNHP.

# 2.0 Areas Evaluated

The Croatan National Forest (CNF) outside of the areas being directly or indirectly impacted by the US 70 Havelock Bypass was included in this study and used as the basis for selecting the areas that were surveyed. Specific areas surveyed within the CNF were selected based on a combination of ecological factors including: soil type, vegetative community type, frequency of fire management, hydrology, slope aspect, forest age, and known occurrences of other rare species. Mapping depicting the areas evaluated as part of this study is included as Figure 2.

# 3.0 Survey Results

Surveys were initiated in July 2008 and continued through the end of the 2008 growing season, with a final survey conducted in May 2009. Twelve new PETS species occurrences, representing five targeted species, were documented (Table 1) during this period. Seven additional non-targeted PETS species occurrences, representing five species incidentally documented during this period; are presented in Section 3.16. Mapping depicting the locations of new occurrences of PETS species documented by this study is included in Figure 3.

Common Name	Scientific Name	USFS	Site Name <sup>a</sup>
		Status	
Twining screwstem	Bartonia paniculata paniculata	LR	Millis Swamp Rd A
Twining screwstem	Bartonia paniculata paniculata	LR	Hibbs Rd
Twining screwstem	Bartonia paniculata paniculata	LR	Powerline south of Lake Rd
Fitzgerald's peatmoss	Sphagnum fitzgeraldi	S	Camp Sam Hatcher Rd
Fitzgerald's peatmoss	Sphagnum fitzgeraldi	S	Powerline north of US 70
Hooker's milkwort	Polygala hookeri	S	Millis Swamp Rd A
A liverwort	Lejeunea bermudiana	LR	SW Prong Slocum Creek
A bird dropping moth	Lithacodia sp.	LR	FR 147
A bird dropping moth	Lithacodia sp.	LR	FR 169
A bird dropping moth	Lithacodia sp.	LR	Haywood Landing
A bird dropping moth	Lithacodia sp.	LR	FR 3046
A bird dropping moth	Lithacodia sp.	LR	Powerline @ Sunset Blvd

Table 1. New Occurrences of Targeted PETS Species Documented 2008-2009

<sup>a</sup> See figures 1 and 2.

# 3.1 Twining Screwstem (*Bartonia paniculata paniculata*)

Twining screwstem generally occurs in open wet areas over sandy or peaty soils in association with sphagnum moss. In the CNF these habitats are often found in powerline rights-of-way and open depressional areas within pine savannas, flatwoods, and pocosins. This species is sensitive to changes in hydrology.

Multiple locations throughout the CNF were investigated in order to search for new occurrences of this species. Areas searched included potentially suitable habitat identified within recently burned wet pine savannas and power line rights-of-way. During the course of this study three new occurrences of twining screwstem were documented on the CNF. This increases the total number of known occurrences of twining screwstem on the CNF to four. One previously documented occurrence (EO #25322) and one of the newly documented occurrences (EO # not yet assigned) of twining screwstem are located in areas subject to potential indirect impacts that could result from the US 70 Havelock Bypass. The the CNF unaffected by the US 70 Havelock Bypass.

The two occurrences of this species with potential indirect impacts are located in powerline easements that are subject to regular management through mowing. No change in management of the existing habitat is expected to result from project construction. Indirect impacts can be minimized through strict implementation of NCDOT BMPs for Construction and Maintenance Activities and other measures that consider the ecological requirements of this species, particularly managing open habitat and maintaining existing hydrology for its habitat. Due to the close proximity (less than 200 ft) of one of these occurrences (EO # 25322) to a shared section of

all three corridors and the close proximity (less than 200 ft) of another occurrence (EO# not yet assigned) to Corridor 2, special consideration should be made during the roadway design process to avoid alterations to surface and groundwater hydrology in these areas. In addition, appropriate restrictions should be placed and enforced during project construction to prevent these areas being used as construction staging areas. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats.

While two of these occurrences have potential indirect impacts, it is believed that the habitat for this species can be maintained if hydrological alterations are minimized. The habitat required by this species is fire-maintained, however the affected occurrences are located in areas that are currently being managed by mowing and construction of the US 70 Havelock Bypass is not expected to change management of these specific occurrences. No loss of viability is expected as a result of construction of the US 70 Havelock Bypass if potential indirect impacts are minimized through implementation of the measures identified.

# 3.2 Leconte's Thistle (*Cirsium lecontei*)

Leconte's thistle is a biannual herb that generally occurs in open pine flatwoods and savannas with moist to wet loamy or sandy soils. In the CNF these habitats are often found in power line rights-of-way. Frequent fire, especially during the growing season, is considered important to maintaining open habitat for this species.

To better understand the importance of occurrences of Leconte's thistle potentially impacted by the US 70 Havelock Bypass, ESI attempted to document the continued existence of a large occurrence documented in NCNHP records near Millis Road (EO # 24991) that if documented as thriving could potentially alleviate concerns regarding potential impacts to this species from project construction. It should be noted that the USFS conducted a controlled burn within this area during the winter of 2009.

ESI biologists David DuMond and Matt Smith reviewed the vicinity associated with this element occurrence on 21 July 2008 and 5 May 2009 and did not identify any individuals of Leconte's thistle. At the time of the investigation the habitat in the vicinity of this occurrence was composed of dense shrub cover with very limited open areas. No evidence of recent management through controlled burning was observed in 2008. This area was burned in the winter of 2009 and if this land management practice continues including controlled burns, further review of this area may potentially have greater success if the improved habitat conditions result in recolonization of this area.

One occurrence (EO # 25190) of this species will be directly affected by Corridor 1, and three occurrences (EO # 22758, 23163, 25190) of this species will each be directly affected by Corridor 2 and Corridor 3. Portions of each of these occurrences exist outside of the proposed impact area.

Direct impacts can be minimized through strict implementation of NCDOT BMPs for Construction and Maintenance Activities and other measures that consider the ecological requirements of this species, particularly for managing open habitat and maintaining proper hydrology for its habitat. Special consideration should be made during the roadway design process to minimize alterations to surface and groundwater hydrology in these areas. In addition, appropriate restrictions should be placed and enforced during project construction to prevent these areas being used as construction staging areas. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats.

Three of the occurrences (EO # 22758, 23163, 25190) of this species are fairly extensive and also have the potential for indirect impacts. These occurrences are located in powerline easements that are subject to regular management through mowing. No change in management of the existing habitat is expected to result from project construction. Indirect impacts can be minimized through strict implementation of NCDOT BMPs for Construction and Maintenance Activities and other measures that consider the ecological requirements of this species, particularly managing open habitat and maintaining existing hydrology for its habitat.

# **3.3** A Liverwort (*Lejeunea bermudiana*)

This liverwort generally occurs on the bark at the base of mature hardwood trees within swamp forests that flood on an infrequent basis. These swamp forests typically occur in areas with high topography and the presence of marl at or near the surface within the swamp forest may be important for producing suitable habitat and conditions for this species.

Multiple locations throughout the CNF were surveyed in order to search for new occurrences of this species. Areas searched included potentially suitable habitat identified in portions of Southwest Prong Slocum Creek, Otter Creek, Tucker Creek, Holston Creek, Hadnot Creek, Pettiford Creek, and others. One new occurrence of *Lejeunea bermudiana* (EO # not yet assigned) was identified in a portion of Southwest Prong Slocum Creek not previously surveyed. This increases the total number of known occurrences on the CNF to five.

One occurrence (EO # 25863) of this species will be directly impacted in a shared section of all three corridors and one additional occurrence (EO # 25862) will be directly impacted by Corridor 1 and Corridor 3.

Both occurrences (EO # 25862 and 25863) of this species with potential direct impacts are extensive and occupy large areas located in the Swamp Forest (large stream) community associated with Southwest Prong Slocum Creek. Due to the extensive nature of these two occurrences, the potential for indirect impacts was evaluated. Special consideration should be made during the roadway design process to avoid hydrological changes to Southwest Prong Slocum Creek. In addition, clearing within 200 feet of these occurrences should be avoided to

avoid increasing direct sunlight on this occurrence, which could adversely affect temperature and moisture conditions.

While two of the five occurrences have potential direct impacts, due to the extensive nature of the occurrences, only part of the occurrences will be directly impacted. For the remaining portions of the occurrences subject to indirect impacts, it is believed that the habitat for this species can be maintained if hydrological alterations and clearing limits are minimized and this species viability on the CNF will not be affected. The habitat required by this species is not fire-maintained, and construction of the US 70 Havelock Bypass is not expected to change USFS management of this habitat. No loss of viability as expected as a result of construction of the US 70 Havelock Bypass.

# **3.4** A Bird-dropping Moth (*Lithacodia* sp.)

This species of moth occurs in pine flatwoods and savannas with groundcover dominated by giant cane (*Arundinaria gigantea*). Habitat in the CNF is often found in powerline rights-of-way and open forested habitats dominated by giant cane.

During the course of this study, rare moth data were obtained from Dr. Bo Sullivan including five additional occurrences of this species on the CNF. This increases the total number of known occurrences on the CNF to seven.

The three occurrences (EO # not assigned) of this species with potential indirect impacts are located in a powerline right-of-way subject to regular management through mowing in close proximity to existing roads. No change in management of the existing habitat is expected to result from project construction. Appropriate restrictions should be placed and enforced during project construction to prevent these areas being used as construction staging areas. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats. No loss of viability is expected as a result of construction of the US 70 Havelock Bypass if potential indirect impacts are minimized through implement of the measures identified.

# 3.5 Florida Adder's Mouth (*Malaxis spicata*)

Florida adder's mouth occurs in higher areas subject to less frequent flooding within swamp forests. In general these areas have little competition from shrub and other herbaceous species.

An occurrence (EO # 2536) of Florida adder's mouth located at the intersection of Greenfield Heights Blvd and Southwest Prong Slocum Creek was evaluated on 22 July 2008 and 6 May 2009 to determine if it extends onto USFS property. This occurrence was determined to extend onto USFS property and is in an area subject to potential indirect impact. This is the only occurrence of this species potentially affected by the US 70 Havelock Bypass and one other

occurrence of this species is present on a portion of the CNF unaffected by the US 70 Havelock Bypass.

The one occurrence (EO # 2536) of this species with potential indirect impacts is located along the ecotone between the Swamp Forest (large stream) community and Pine Hardwood community associated with Southwest Prong Slocum Creek approximately 500 feet east of Alignment 2. Special consideration should be made during the roadway design process to avoid hydrological changes to Southwest Prong Slocum Creek. In addition, clearing within 200 feet of this occurrence should be avoided so that the current amount of available sunlight is maintained. It should be noted that the USFS thinned pine stands located within 200 feet of this occurrence in spring 2009.

The habitat required by this species is not fire-maintained, and construction of the US 70 Havelock Bypass is not expected to change USFS management of this habitat. No loss of viability is expected as a result of construction of the US 70 Havelock Bypass.

# 3.6 Southeastern Myotis (*Myotis austroriparius*)

Southeastern myotis is most often associated with old-growth bottomland hardwood swamp forests. The forest stand characteristic that is thought to be most important is the presence of a preponderance of large diameter trees with cavities.

NCDOT biologists conducted mist-netting for this species on the Croatan Wetland Mitigation Bank. Southeastern myotis was not documented during the mist-netting conducted but Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) was identified in this location. NCDOT plans to conduct additional surveys in the spring of 2009. ESI will provide NCDOT biologists with potential sampling locations identified during the 2008 surveys for use in NCDOT's 2009 surveys.

The one occurrence (EO #24788) of southeastern myotis with potential indirect impacts is located in the Swamp Forest (large stream) community associated with Southwest Prong Slocum Creek east of Corridor 2. Special consideration should be made during the roadway design process, specifically with the design of this bridge, to maintain connectivity between upstream and downstream habitats. The bridge should be designed to be low enough to allow for bats to fly over without being hit by traffic or high enough for bats to pass under easily. Consideration could be given to incorporating bat-roosting access into the bridge design, or attaching a bat house under or in close proximity to the bridge. In addition, clearing of trees within the Southwest Prong Slocum Creek floodplain should be minimized in proximity to the bridge in order to minimize impacts to the habitat for this species. No loss of viability is expected as a result of construction of the US 70 Havelock Bypass.

#### 3.7 Mudbank Crown Grass (Paspalum dissectum)

Mudbank crown grass is generally found in mud flats with little competition from other species. In the CNF this habitat is found along the margins of depressional areas that typically flood during the winter months and drawdown in the spring and summer.

Multiple locations throughout the CNF were surveyed to search for new occurrences of this species. Areas searched included potentially suitable habitat within wet depressions identified in powerline rights-of-way and pine flatwoods during the course of the field reviews. Most of the depressions investigated did not show evidence of recent periods of inundation. These areas exhibited evidence of water table drawdown likely due to the drier than normal conditions during the preceding year and included well established woody and herbaceous vegetation. No new occurrences of this species were identified during the course of this study. It is likely that drier than normal conditions during the growing season contributed to not finding new occurrences of this species.

Several attempts were also made to document the continued existence of the occurrence (EO # 21480) of this species potentially affected by the US 70 Havelock Bypass. The habitat in the area of this occurrence was found to be degraded by extended dry periods and encroachment by competing herbaceous and woody species. ESI biologists were not able to document the presence of this occurrence of this species. This species may be present in the area, but not fully vegetatively expressed due to site conditions; this species may become more apparent in this area when a return to normal hydrologic conditions occurs and regular inundation and draw-down events reoccur in these depressional pools. This occurrence is located in two distinct depressions separated by approximately 1400 ft of non-suitable habitat. One of these locations will be directed impacted by a shared section of Corridor 2 and Corridor 3. The other location has potential indirect impacts for all three Corridors.

This occurrence is located in a powerline easement that is subject to regular management through mowing. No change in management of the existing habitat is expected to result from project construction. Special consideration should be made during the roadway design process to avoid alterations to surface and groundwater hydrology in these areas. In addition, appropriate restrictions should be placed and enforced during project construction to prevent these areas being used as construction staging areas. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats.

# 3.8 A Liverwort (*Plagiochila ludoviaciana*)

This liverwort generally occurs on the bark at the base of mature hardwood trees within swamp forests that flood on an infrequent basis. These swamp forests typically occur in areas with high

topography and the presence of marl outcrops within the swamp forest may be an important part of the habitat for this species.

Multiple locations throughout the CNF were surveyed in order to search for new occurrences of this species. Areas searched included potentially suitable habitat identified within portions of Southwest Prong Slocum Creek, Otter Creek, Tucker Creek, Holston Creek, Hadnot Creek, Pettiford Creek, and others. No new occurrences of this species were identified during the course of this study. Currently only one occurrence of this species (EO # 25196) is known from the CNF.

The only occurrence (EO # 25196) of this species on the CNF will be directly affected by Corridor 1, based on the preliminary design. No impacts to this species are anticipated to result from the construction of either Corridor 2 or Corridor 3. If Corridor 1 is determined to be the preferred alternative for this project then the USFS may recommend that the alignment be shifted to avoid direct impacts to this species. Special consideration should be made during the roadway design process to avoid alterations to surface and groundwater hydrology in this area. In addition, appropriate restrictions should be placed and enforced during project construction to prevent this area being used as construction staging area. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats. No loss of viability is expected as a result of construction of the US 70 Havelock Bypass if either Corridor 2 or Corridor 3 are selected as the preferred alternative.

# **3.9** Yellow Fringeless Orchid (*Platanthera integra*)

Yellow fringeless orchid is a perennial herb that generally occurs in open pine flatwoods and savannas with wet loamy or sandy soils. In the CNF these habitats are often found in powerline rights-of-way. Frequent fire is considered important to maintaining open habitat for this species.

Multiple locations throughout the CNF were surveyed in order to search for new occurrences of this species. Areas searched included potentially suitable habitat identified within recently burned wet pine savannas and power line rights-of-way. No individuals of this species were identified during the surveys. However, the common small white fringed orchid (*Platanthera blephariglottis*) and yellow fringed orchid (*Platanthera ciliaris*) were observed at each location investigated. It is likely that drier than normal conditions during the growing season contributed to not finding new occurrences of this species.

The one occurrence (EO # 170) of this species with potential indirect impacts is located in a portion of the Pine Flatwoods (mesic) community that is currently managed by controlled burns. Further coordination with the USFS may be necessary to determine if a management strategy is available that does not adversely affect this occurrence for Corridor 1, 2, or 3 if it is determined that this area can no longer be managed by controlled burns. Indirect impacts can be minimized through strict implementation of NCDOT BMPs for Construction and Maintenance Activities and

other measures that consider the ecological requirements of this species, particularly for managing the open habitat and maintaining proper hydrology. Due to the close proximity (less than 200 ft) of this occurrence to Corridor 2, special consideration should be made during the roadway design process to avoid alterations to surface and groundwater hydrology in these areas. In addition, appropriate restrictions should be placed and enforced during project construction to prevent these areas being used as construction staging areas. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats. No loss of viability is expected as a result of construction of the US 70 Havelock Bypass if the habitat can continue to be maintained by burning or other suitable means, and if potential indirect impacts are minimized trough implementations of the measures identified.

### 3.10 Snowy Orchid (*Platanthera nivea*)

Snowy orchid is a perennial herb that generally occurs in open pine flatwoods and savannas with wet loamy or sandy soils. In the CNF these habitats are often found in powerline rights-of-way. Frequent fire is considered important to maintaining open habitat for this species.

Multiple locations throughout the CNF were surveyed in order to search for new occurrences of this species. Areas searched included potentially suitable habitat identified within recently burned wet pine savannas and power line rights-of-way. No individuals of this species were identified during the surveys. However, the common small white fringed orchid and yellow fringed orchid were observed at each location investigated. It is likely that drier than normal conditions during the growing season contributed to not finding new occurrences of this species.

Several attempts (September 2004, August 2007, July 2008, September 2008) were also made to document the continued existence of a historic occurrence (EO # 18805) of this species in an area subject to potential indirect impacts that could result from the US 70 Havelock Bypass. ESI biologists were not able to find evidence of the continued presence of this species at the historic occurrence location. The habitat in the vicinity of this occurrence is composed of dense shrub cover with very limited open areas. No evidence of recent management through controlled burning was observed. If land management practices change and controlled burns are conducted, further review of this area may potentially have greater success in documenting this species, if this species is still present but not vegetatively expressed due to current habitat conditions. The adjacent powerline corridor is too dry to support suitable habitat for this species.

It is recommended that this occurrence be removed from impact consideration for the US 70 Havelock Bypass project because no known occurrences will be directly impacted and the historic occurrence subject to consideration for indirect impacts may no longer exist. If the USFS does not concur with this recommendation then indirect impacts can be minimized through strict implementation of NCDOT BMPs for Construction and Maintenance Activities and other measures that consider the ecological requirements of this species, particularly for managing open

habitat and maintaining proper hydrology for its habitat. In addition, appropriate restrictions should be placed and enforced during project construction to prevent this area being used as a construction staging area. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats. No loss of viability is expected as a result of the construction of the US 70 Havelock Bypass.

# 3.11 Hooker's Milkwort (*Polygala hookeri*)

Hooker's milkwort generally occurs in open wet areas over sandy or peaty soils. In the CNF these habitats are often found in powerline rights-of-way and pine savannas. Frequent fires or mowing is important in maintaining the open character of this species habitat.

Multiple locations throughout the CNF were surveyed in order to search for new occurrences of this species. Areas searched included potentially suitable habitat identified within recently burned wet pine savannas and power line rights-of-way. One new occurrence of this species was identified in a recently burned wet pine savanna locate at the end of Millis Swamp Road. This increases the total number of known occurrences of Hooker's milkwort on the CNF to nine including two occurrences with potential indirect impacts.

The two occurrences (EO # 22925, 18855) of this species located in areas subject to indirect impacts are found in powerline rights-of-way subject to regular management through mowing. No change in management of the existing habitat is expected to result from project construction. Indirect impacts can be minimized through strict implementation of NCDOT BMPs for Construction and Maintenance Activities and other measures that consider the ecological requirements of this species, particularly managing open habitat and maintaining existing hydrology for its habitat. Due to the close proximity (less than 200 ft) of one of these occurrences (EO # 18855) to Corridor 2, special consideration should be made during the roadway design process to avoid alterations to surface and groundwater hydrology in these areas. In addition, appropriate restrictions should be placed and enforced during project construction to prevent these areas being used as construction staging areas. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats. No loss of viability is expected as a result of construction of the US 70 Havelock Bypass if potential indirect impacts are minimized through implementation of the measures identified.

# 3.12 Short-bristled Beaksedge (*Rhynchospora breviseta*)

Short-bristled beaksedge generally occurs in open wet areas over sandy or peaty soils. In the CNF these habitats are often found in powerline rights-of-way and pine savannas. Frequent fires or mowing is important in maintaining the open character of this species habitat.

Multiple locations throughout the CNF were surveyed in order to search for new occurrences of this species. Areas searched included potentially suitable habitat identified within recently burned wet pine savannas and powerline rights-of-way. No individuals of this species were identified during the surveys. It is likely that drier than normal conditions during the growing season contributed to not finding new occurrences of this species.

One occurrence (EO # 21978) of this species will be directly impacted in a shared section of all three corridors. The USFS may allow this impact to be offset through efforts to relocate the population outside the construction areas, or through efforts to use seeds from this occurrence for efforts to establish a new occurrence elsewhere. Conversely, the USFS may recommend that the preferred alignment be shifted to avoid direct impacts to this species.

The occurrences (EO # 21978, 22290) of this species with potential indirect impacts are located in a powerline right-of-way subject to regular management through mowing. No change in management of the existing habitat is expected to result from project construction. Special consideration should be made during the roadway design process to avoid alterations to surface and groundwater hydrology in these areas. In addition, appropriate restrictions should be placed and enforced during project construction to prevent these areas being used as construction staging areas. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats.

# 3.13 Georgia Nutrush (Scleria georgiana)

Georgia nutrush generally occurs in open wet areas over sandy or peaty soils. In the CNF these habitats are often found in powerline rights-of-way and pine savannas. Frequent fires or mowing is important in maintaining the open character of this species habitat.

This species is not currently listed as a species of concern by the NCNHP but is still included as a PETS species since the CNF is located near the northern extent of this species range. It should be noted that numerous occurrences of this species are present in southeastern North Carolina, many on protected lands. ESI biologists revisited two known occurrences of this species indirectly (EO # 2585, 23196) affected by the US 70 Havelock Bypass on 22 July 2008. The habitat at one of these occurrences (EO # 2585) was modified to the point that it no longer provided suitable habitat for the this species (a recently plowed fire break). ESI biologists reviewed the vicinity associated with the other occurrence (EO # 23196) and did not identify any individuals of Georgia nutrush despite the habitat appearing to remain suitable. It is possible that this species is still present as seeds dormant in the seed bank at this site but did not appear in 2008 due to drier than normal conditions during the growing season. It is possible that this occurrence may be expressed vegetatively and be more apparent in a year with normal rainfall.

The two occurrences (EO # 2585, 23196) of this species with potential indirect impacts for Corridor 1 are located in a powerline easement that is subject to regular management through

mowing. No change in management of the existing habitat is expected to result from project construction. These occurrences are both located approximately 2400 feet east of Corridor 1 and 200 feet west of Corridor 3. Indirect impacts can be minimized through strict implementation of NCDOT BMPs for Construction and Maintenance Activities and other measures that consider the ecological requirements of this species, particularly for managing open habitat and maintaining proper hydrology for its habitat. In addition, appropriate restrictions should be placed and enforced during project construction to prevent this area being used as a construction staging area. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats. No loss of viability is expected as a result of construction of the US 70 Havelock Bypass.

### 3.14 Fitzgerald's Peatmoss (Sphagnum fitzgeraldi)

Fitzgerald's peatmoss is generally found in shallow depressional areas within pine flatwoods and savannas.

Multiple locations throughout the CNF were surveyed in order to search for new occurrences of this species. Areas searched included potentially suitable habitat identified within recently burned wet pine savannas and powerline rights-of-way. During the course of this study two new occurrence of Fitzgerald's peatmoss were documented on the CNF. This increases the total number of known occurrences of Fitzgerald's peatmoss on the CNF to six. One additional occurrence is present on the state-owned CWMB within the CNF.

One occurrence (EO # not yet assigned) of Fitzgerald's peatmoss is located such that it will be directly affected by the US 70 Havelock Bypass and one additional occurrence (EO # not yet assigned) is located in an area subject to potential indirect impacts. Four occurrences are located in portions of the CNF or protected state-owned land within the CNF unaffected by the US 70 Havelock Bypass.

The occurrence directly affected by the US 70 Havelock Bypass is located in a powerline rightof-way subject to regular management through mowing within a shared section of all three alternatives. A portion of this occurrence will not be directly impacted, but is subject to potential indirect impacts. If indirect impacts can be minimized through implementation of the measures identified below, then the loss of this occurrence should not affect the overall viability of this species on the CNF. The other occurrence subject to potential indirect impacts is located in a powerline right-of-way that is subject to regular management through mowing in close proximity to Corridor 3. No change in management of the existing habitat is expected to result from project construction. Special consideration should be made during the roadway design process to avoid alterations to surface and groundwater hydrology in these areas. In addition, appropriate restrictions should be placed and enforced during project construction to prevent these areas being used as construction staging areas. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats.

# 3.15 Dusky Roadside Skipper (*Amblyscirtes alternata*)

Dusky roadside skipper is generally found in relatively open pine flatwoods and savannas with heavy coverage by wire grass (*Aristida stricta*).

This species was added to the PETS list subsequent to prior NCDOT PETS species investigations for the US 70 Havelock Bypass. As part of this present study ESI evaluated potential habitat within the US 70 Havelock Bypass and CWMB and identified potential areas of suitable habitat within portions of the CNF unaffected by the US 70 Havelock Bypass project. Portions of the CWMB identified in ESI's *Preliminary Habitat and PETS Species Evaluation for the Croatan Wetland Mitigation Bank* as Pine Savanna (hydric) may provide suitable habitat for this species if appropriate vegetation management is implemented. Within the US 70 Havelock Bypass study corridors, areas identified as Powerline Corridor (mesic) and Pine Flatwoods (mesic) in ESI's Natural Resources Technical Report may provide suitable habitat for this species if appropriate vegetation management is implemented.

One occurrence (EO # 25240) of this species was documented in 2007 by NCNHP biologists in an area east of Corridor 2 subject to potential indirect impacts for all three corridors. This is the only occurrence of this species within the CNF. Multiple butterfly surveys of the CNF by NCNHP biologists over multiple years have not identified additional occurrences of this species.

The one occurrence of this species with potential indirect impacts is located in a portion of the Pine Flatwoods (mesic) community to the east of Corridor 2 that is currently managed by controlled burns. Further coordination with the USFS may be necessary to determine if a management strategy is available that does not adversely affect this occurrence for Corridor 1, 2, or 3 if it is determined that this area can no longer be managed by controlled burns. Indirect impacts can be minimized through strict implementation of NCDOT BMPs for Construction and Maintenance Activities and other measures that consider the ecological requirements of this species, particularly for managing open habitat and maintaining proper hydrology for its habitat. Due to the close proximity of this occurrence to Corridor 2 (less than 200 ft), special consideration should be made during the roadway design process to avoid alterations to surface and groundwater hydrology in this area. In addition, appropriate restrictions should be placed and enforced during project construction to prevent this area being used as construction staging areas. The seeding mix used for road shoulder stabilization should contain native species and avoid using invasive species that could encroach into adjacent habitats. Dusky skipper is a minimally mobile animal species that should be able to remain viable if impacts to adjoining suitable habitat are avoided.

# **3.16 Other PETS Species**

During the course of the field surveys for targeted PETS species and other investigations, several occurrences of PETS species not specifically targeted in this study were documented at various locations within the CNF. Table 2 provides a summary of non-targeted PETS species identified on the CNF during the course of the 2008-2009 field surveys. Mapping depicting the locations of new occurrences of PETS species is included in Figure 3.

Common Name	Scientific Name	USFS	Site Name
		Status	
Shadow-witch	Ponthieva racemosa	LR	Goodwin Creek
Spoonflower	Peltandra sagittifolia	LR	Powerline south of Creek
			Rd
Venus flytrap	Dionaea muscipula	S	Camp Sam Hatcher Rd
Piedmont cowbane	Oxypolis denticulata	S	Millis Swamp Rd A
Piedmont cowbane	Oxypolis denticulata	S	Millis Swamp Rd B
Piedmont cowbane	Oxypolis denticulata	S	Powerline south of Lake
			Rd
Rafinesque's big-eared bat	Corynorhinus rafinesquii	S	CWMB

Table 2. New Occurrences of Non-targeted PETS Species Documented 2008-2009

None of these occurrences are in areas directly or indirectly affected by construction of the US 70 Havelock Bypass. Of these species, shadow-witch and piedmont cowbane are the only species for which other occurrences may be affected by the US 70 Havelock Bypass. Potential affects to individual occurrences of piedmont cowbane and shadow-witch is not expected to result in a loss of viability for these species as noted in previous documents.

# 4.0 Conclusions

This study provides the results of a surveys in 2008-2009 that attempted to identify new occurrences of fifteen USFS PETS species on the CNF. This survey effort serves as one mitigative measure to offset potential impacts to PETS species associated with the construction of the US 70 Havelock Bypass. In addition, this report discusses potential direct and indirect impacts to these fifteen PETS species and provides recommendations to minimize potential impacts and avoid a potential loss in viability for these species on the CNF.

The fifteen PETS species included in this study can be divided into two broad categories based on generalized habitat requirements for the purposes of discussing mitigative measures; 1) species that occur in open fire-maintained habitats; and 2) species that occur in mature swamp forest habitats.

<b>T</b> 1 1 0	a .	TT 1	a
Table 3.	Species Species	Habitat	Categories

Fire Maintained Habitats									
Twining screwstem	Hooker's milkwort								
Leconte's thistle	Short-bristled beaksedge								
A bird dropping moth	Georgia nutrush								
Mudbank crown grass	Fitzgerald's peatmoss								
Yellow fringeless orchid	Dusky roadside skipper								
Snowy orchid									
Swamp For	rest Habitats								
A liverwort ( <i>Lejeunea bermudiana</i> )	Southeastern myotis								
Florida adder's mouth	A liverwort (Plagiochila ludoviaciana)								

# Fire-Maintained Habitats: Measures to Minimize Indirect Impacts

- Avoid hydrological alterations that either increase or decrease surface and groundwater in the vicinity of the occurrence.
- Use a seed mix that contains only native species.
- Avoid placing staging areas within 200 ft of occurrences.
- Avoid heavy equipment access, especially during wet periods.
- Avoid herbicide use.

# Swamp Forest Habitats: Measures to Minimize Indirect Impacts

- Avoid clearing within 200 ft of occurrences.
- Avoid floodplain alterations that either increase or decrease the number, location, and velocity of overbank flooding events.
- Use a seed mix that contains only native species.
- Avoid herbicide use.

Those species currently located in powerline rights-of-way subject to frequent mowing are not anticipated to present a management concern to the USFS. In addition, species currently located in communities that are not fire maintained are not anticipated to present a management concern to the USFS. In general, it is recommended that power line rights-of-way and other open natural areas located adjacent to the proposed alignments not be used as staging areas to avoid indirect impacts and that native seed mixes be used whenever possible to avoid introduction of potentially invasive species.

Fifteen PETS species were evaluated as part of this study to identify new occurrences of each species in portions of the CNF unaffected by the US 70 Havelock Bypass as a mitigative measure to offset potential direct and indirect impacts to these fifteen species. In addition, potential indirect affects to each of these were presented along with mitigative measures that can be implemented to minimize indirect impacts. The viability on the CNF of the majority of the PETS species included in this study will not be adversely affected if the mitigative measures described above are implemented during the roadway design and construction process.

Five species, yellow fringeless orchid (*Platanthera integra*), Leconte's thistle (*Cirsium lecontei*), short-bristled beaksedge (*Rhynchospora breviseta*), dusky skipper (*Amblyscirtes alternata*), and a liverwort (*Plagiochila ludoviaciana*) have direct impacts and limited occurrences on the CNF. The occurrences of these species directly impacted by the project are all located in forested areas currently managed through controlled burns. Additional coordination with the USFS may be necessary to identify mitigative measures to offset impacts to these species and maintain the viability of these species on the CNF. Potential management strategies for yellow fringeless orchid, Leconte's thistle, and a liverwort could include a combination of relocation of affected populations to unaffected suitable habitat or collecting seeds or propagules from affected populations to use in establishing new populations in unaffected suitable habitat. Dusky skipper is a minimally mobile animal species that should be able to remain viable if impacts to adjoining suitable habitat are avoided.

#### 5.0 References

- Environmental Services, Inc. 2007. Natural Resources Technical Report: Us 70 Havelock Bypass DEIS.
- Environmental Services, Inc. 2008. Preliminary Habitat and PETS Species Evaluation for the Croatan Wetland Mitigation Bank.
- Environmental Services, Inc. 2008. USFS PETS Species Evaluation for the US 70 Havelock Bypass on the Croatan National Forest.
- Franklin, Misty A. and John T. Finnegan. 2006. Natural Heritage Program List of the Rare Plant Species of North Carolina. North Carolina Natural Heritage Program. Raleigh.
- LeGrand, Harry E. Jr., Sarah E. McRae, Stephen P. Hall, and John T. Finnegan. 2006. Natural Heritage Program List of the Rare Animal Species of North Carolina. North Carolina Natural Heritage Program. Raleigh.
- N.C. Natural Heritage Program. 2008. Element Occurrence Search Report: Croatan National Forest. Updated March 2008.
- Radford, A.E., H.E. Ahles, and C.R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. University of North Carolina Press, Chapel Hill, NC. 1183 pp.
- Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment, Health, and Natural Resources, Raleigh, NC. 325 pp.
- U.S. Department of Agriculture, Natural Resource Conservation Service. 1981. Soil Survey of Jones County, North Carolina.
- U.S. Department of Agriculture, Natural Resource Conservation Service. 1987. Soil Survey of Carteret County, North Carolina.
- U.S. Department of Agriculture, Natural Resource Conservation Service. 1989. Soil Survey of Craven County, North Carolina.
- United States Geological Survey. 1949a. Mansfield, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.

- United States Geological Survey. 1949b. Merrimon, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1949c. South River, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1949d. Williston, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1950a. Upper Broad Creek, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1975a. Jacksonville NE, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1975b. Jacksonville North, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1975c. Jacksonville NW, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1975d. Jacksonville South, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1975e. Kellum, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1980. Beaufort, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1980a. Core Creek, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1980b. Hadnot Creek, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1980c. Havelock, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1980d. Hubert, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.

- United States Geological Survey. 1980e. Masontown, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1980f. Swansboro, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1987a. Broad Creek, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1987b. Camp LeJeune, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1987c. Cherry Point, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1987d. Harkers Island, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1987e. Newport, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1987f. Oriental, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1987g. Phillips Crossroads, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1987h. Salter Path, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1988a. Arapahoe, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1988b. Catfish Lake, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1988c. Maysville, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1988d. New Bern, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.

- United States Geological Survey. 1988e. Pollocksville, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.
- United States Geological Survey. 1988f. Stella, North Carolina, 7 Topographic Quadrangle (7.5minute series). Reston: 1 sheet.
- United States Geological Survey. 1988g. Trenton, North Carolina, 7 Topographic Quadrangle (7.5-minute series). Reston: 1 sheet.

Appendix A: Figures

















Appendix C: Analysis of NCNHP Polygon Sub-element Occurrences

Cuminary Table for Cub clement Occu		513, 00 70 Have	OCK Dypass				Direct Impacts		acts				Indirect	t Impacts		
						1	ΔH	2	Δŀ	+ 3	ΔH	1	ΔI	1110000	Δι	1 3
		Total Area of		Total Area of	<u>^</u>		<u>All</u>		<u> </u>		<u>Au</u>	<u>.  </u>		. 2	<u>A</u>	<u></u>
Scientific Name	EO ID *	EO (acres)	Sub EO ID *	Sub EO (acres)	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Agalinis aphylla											2.50	100.0	2.50	100.0	2.50	100.0
Agalinis aphylla	†										2.61	100.0	2.61	100.0	2.61	100.0
Agalinis aphylla	†										1.14	100.0	1.14	100.0	1.14	100.0
Bartonia paniculata var. paniculata	†										3.39	100.0	3.39	100.0	3.39	100.0
Cirsium lecontei	†						1 93	22.9	1 90	22.6	8.42	100.0	5.90	70.1	5.90	70.1
Cirsium lecontei	†						1.00	LL.U	1.00	22.0	0.08	100.0	0.00	10.1	0.00	
											33.12	8.0	33 12	8.0	33 12	8.0
							1 03	22.0	1 00	22.6	8.42	100.0	5.00	70.1	5.00	70.1
							1.55	22.0	1.50	22.0	4.05	100.0	4.05	100.0	4.05	100.0
											4.05	100.0	4.03	100.0	4.05	100.0
											0.70	100.0	1 45	100.0	1 45	100.0
Laisunas kannudiana	ł				0.45	02.0					1.40	100.0	1.40	100.0	1.40	100.0
Lejeunea bermudiaria					0.45	93.8			0.02	5.0	0.54	100.0			0.40	04.4
									0.03	5.9	0.51	100.0			0.48	94.1
											0.48	100.0	0.40	100.0	0.48	100.0
2 States to the last	+						4.05	07.4	1.00	00.5	0.48	100.0	0.48	100.0	0.48	100.0
Oxypolis denticulata	+						1.35	27.1	1.32	26.5	4.98	100.0	0.13	2.6	0.13	2.6
Polygala nookeri	ł						0.00	05.4			0.48	100.0	0.48	100.0	0.48	100.0
Pontnieva racemosa	+						3.69	25.1			14.71	100.0	7.23	49.2	14.71	100.0
Rnynchospora scirpoides											0.78	40.4	0.78	40.4	0.78	40.4
Solidago verna	t										0.71	100.0	0.71	100.0	0.71	100.0
					1.73	73.6	1.73	73.6	1.73	73.6						
											0.17	100.0			0.17	100.0
											0.34	100.0				
											0.17	100.0				
											0.05	100.0			0.05	100.0
							0.05	100.0			0.05	100.0			0.05	100.0
							<0.01	100.0	<0.01	100.0	<0.01	100.0				
									0.06	100.0	0.06	100.0				
											0.23	100.0				
											<0.01	100.0	<0.01	100.0	<0.01	100.0
							0.13	14.6			0.89	100.0	40.01	100.0	0.89	100.0
							0.10	14.0			4.80	97.0	4 80	97.0	4.80	97.0
							0.60	100.0			0.60	100.0		01.0	0.60	100.0
							0.00	100.0			0.00	100.0			0.00	100.0
					0.13	52.0	0.12	48.0	0.13	52.0	0.11	100.0				
					0.10	02.0	0.12	40.0	0.10	02.0	0 17	100.0	0.17	100.0	0.17	100.0
							0.18	60.0	0.19	63.3	0.30	100.0	0.11	36.7	0.11	36.7
							0.10	00.0	0.10	00.0	0.12	100.0	0.11	00.1	0.12	100.0
									2.67	17.0	15 70	99.9			0.05	0.3
					0.13	10.4	0.14	11.2	0.13	10.4	1 12	89.6	1 12	89.6	1 12	89.6
					0.15	10.4	0.14	100.0	0.13	100.4	0.07	100.0	1.12	03.0	1.12	03.0
					I		0.07	100.0	0.07	100.0	0.01	100.0				
							0.46	0.2	0.01	100.0	5.02	100.0	4.56	00.8	5.02	100.0
					I		0.40	9.2			-0.02	100.0	4.00	30.0	5.0Z	100.0
					I		0.02	17.6	0.02	17.6	<0.01	100.0	<0.01	100.0	<0.01	100.0
					I		0.03	0.11	0.03	17.0	0.17	100.0	0.15	00.Z	0.15	88.Z
									0.02	25.0	80.0	100.0				

Summary Table for Sub-element Occurrence Impacts, US 70 Havelock Bypass

Page 1 of 3

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000

Summary Table for Sub-element Occ	differice impar	cis, 05 70 Havei	оск Буразз				Direct I	mpacts					Indirect	Impacts		
					Alt	. 1	Alt	t. 2	Alt	t. 3	Alt	. 1	Alt	t. 2	Al	t. 3
		Total Area of		Total Area of												
Scientific Name	EO ID *	EO (acres)	Sub EO ID *	Sub EO (acres)	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
							0.11	01 7	0.12	100.0	0.51	100.0			0.51	100.0
							0.11	91.7	0.12	100.0	0.12	100.0	0.42	100.0	0.42	100.0
											< 0.01	100.0	< 0.01	100.0	< 0.01	100.0
											0.23	100.0				
											1.93	100.0	1.93	100.0	1.93	100.0
											<0.01	100.0				
											0.38	100.0	0.38	100.0	0.38	100.0
											0.01	100.0	0.01	100.0	0.01	100.0
									0.45	02.9	0.05	100.0				
									0.45	93.0	0.40	100.0				
				-	0.03	100.0			0.03	100.0	0.15	100.0				
1											0.37	100.0	0.37	100.0	0.37	100.0
							0.02	28.6	0.02	28.6	0.07	100.0	0.05	71.4	0.05	71.4
											0.05	100.0			0.05	100.0
											0.20	100.0	0.20	100.0	0.20	100.0
				-							0.86	93.5	0.86	93.5	0.86	93.5
											0.12	100.0			0.08	100.0
											0.08	100.0			0.08	100.0
											0.01	100.0			0.01	100.0
							<0.01	100.0			< 0.01	100.0			< 0.01	100.0
											0.17	100.0			0.17	100.0
											<0.01	100.0				
											12.45	100.0			12.45	100.0
											0.05	100.0	0.05	100.0	0.05	100.0
							0.04	100.0	0.02	0.2	10.28	100.0			0.04	100.0
							0.04	100.0			0.04	100.0			0.04	100.0
				-							0.33	100.0	0.33	100.0	0.33	100.0
											0.17	100.0				
									0.14	77.8	0.18	100.0				
					0.49	100.0			0.47	95.9					0.02	4.1
							5.42	51.9	5.86	56.1	10.44	100.0	4.11	39.4	3.55	34.0
				-					5.70	56.7	9.88	98.3			3.85	38.3
					2 38	34.7			2 38	34.7	0.84	65.3			0.84	65.3
					2.00	04.7			2.00	04.7	<0.01	4.8	<0.01	48	<0.01	4.8
									0.05	100.0	0.05	100.0				
											0.17	100.0				
									0.01	100.0	0.01	100.0				
									2.56	70.5	3.63	100.0			0.12	3.3
									0.02	100.0	0.02	100.0				
											0.72	100.0			0.72	100.0
											0.17	100.0			0.17	100.0
					1						2.29	100.0				

Summary Table for Sub-element Occurrence Impacts, US 70 Havelock By

Page 2 of 3

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000

#### Summary Table for Sub-element Occurrence Impacts, US 70 Havelock Bypass

					Direct Impacts											
					Alt	. 1	Alt	. 2	Alt	. 3	Alt	. 1	Alt	. 2	Alt	. 3
		Total Area of		Total Area of												
Scientific Name	EO ID *	EO (acres)	Sub EO ID *	Sub EO (acres)	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
			25373_SA	1.20					0.90	75.0	1.20	100.0				
			25373_SC	0.23							0.23	100.0				
			25373_SD	0.01			0.01	100.0			0.01	100.0			0.01	100.0
			25373_TA	0.01			0.01	100.0			0.01	100.0			0.01	100.0
			25373_TC	<0.01							< 0.01	100.0				
			25373_TD	0.65			0.48	73.8			0.65	100.0	0.17	26.2	0.65	100.0
			25373_UA	0.01							0.01	100.0				
			25373_UC	4.86					1.27	26.1	4.86	100.0				
			25373_UD	0.20							0.20	100.0			0.20	100.0
			25373_VA	0.72	0.31	43.1					0.41	56.9				
			25373_VC	0.03							0.03	100.0				
			25373_VD	1.93							1.93	100.0	1.93	100.0	1.93	100.0
			25373_WA	<0.01							< 0.01	100.0				
			25373_WB	13.43							13.43	100.0	13.43	100.0	13.43	100.0
			25373_WC	0.01							0.01	100.0				
			25373_WD	0.01							0.01	100.0			0.01	100.0
			25373_XA	0.16	0.15	93.8										
			25373_XB	0.73	0.60	82.2	0.60	82.2	0.60	82.2						
			25373_XC	0.17							0.17	100.0				
			25373_XD	0.10							0.10	100.0	0.10	100.0	0.10	100.0
			25373_YA	2.72	1.90	69.9					0.67	24.6				
			25373_YC	0.17							0.17	100.0				
			25373_YD	0.47			0.47	100.0			0.47	100.0			0.47	100.0
			25373_ZB	0.03	0.03	100.0	0.03	100.0	0.03	100.0						
			25373_ZC	0.04							0.04	100.0				
			25373_ZD	0.40	0.34	85.0			0.03	7.5						
			Other SubEOs	37.17												
Sphagnum cribrosum	(101)	0.44	101_A	0.44	0.15	34.1	0.15	34.1	0.15	34.1	0.14	31.8	0.14	31.8	0.14	31.8

Bank acres/percentage indicates no impact Two Eos have additional subEOs not affected directly or indirectly (*Rhychospora scirpoides* 25866 and *Solidago verna* EO 25373); additional subEOs cumulatively shown as "Other SubEOs"

ATTACHMENT 6


ENVIRONMENTAL SERVICES, INC. P.O. Box 2181 Wilmington, North Carolina 28402 910-520-0784 / Facsimile 910-383-6049 www.environmentalservicesinc.com

# **MEMORANDUM**

TO:	Ken Burleson
FROM:	Matt Smith
DATE:	16 July 2010
RE:	US 70 Havelock Bypass (R-1015) Task Order #8 (Rough-leaved Loosestrife Survey Update). ER03-134.02

Environmental Services, Inc., (ESI) has completed an update of surveys for rough-leaved loosestrife (*Lysimachia asperulaefolia*) for the US 70 Havelock Bypass in Carteret and Craven Counties, North Carolina. This evaluation was completed for the preliminary design limits plus 10 feet outside the stake limits for alignments 1, 2, and 3 (Figure 1).

At the time the Natural Resource Technical Report (NRTR) was completed for this project (May 2007), the federally Endangered rough-leaved loosestrife was listed by the U.S. Fish and Wildlife Service (USFWS) for Carteret County, but not Craven County. Habitat evaluations and surveys in suitable areas were completed in July 2004 for the portions of the project study area located in Carteret County, as well for the U.S. Forest Service (USFS) property in Craven County as part of the USFS Proposed, Endangered, Threatened, and Sensitive (PETS) species evaluation; potentially suitable habitat on private lands in Craven County was not surveyed at the time since the species was not listed by USFWS for Craven County. Based on the addition of rough-leaved loosestrife to the USFWS Craven County list and length of time elapsed since the last survey, a rough-leaved loosestrife survey was conducted in all suitable habitat identified throughout the study area.

Nine major plant community types were identified in the project study area (ESI NRTR May 2007). Potentially suitable habitat for rough-leaved loosestrife was identified in portions of the tree-dominated and shrub-dominated streamhead pocosin, hydric powerline corridor, and portions of the rural/urban modification that are adjacent to the streamhead pocosins vegetative community.

Prior to the initiation of the field investigation, ESI biologists reviewed a reference population of roughleaved loosestrife located within the Croatan National Forest to confirm the flowering status of this species (date of reference site review: 24 June 2010). The reference population was in the late stages of flowering and individuals in the reference population not in flower at the time of the review were readily identifiable from vegetative characteristics. Surveys for rough-leaved loosestrife were conducted within the study area by ESI biologists during the period of 24-30 June 2010.

The following summary is based on current NCDOT guidelines and templates for Natural Resource Technical Reports. Additional comments are provided following this summary to assist in incorporating this information into the Draft Environmental Impact Statement (DEIS).

## **Rough-leaved** loosestrife

USFWS optimal survey window: mid May-June

Habitat Description: Rough-leaved loosestrife, endemic to the Coastal Plain and Sandhills of North and South Carolina, generally occurs in the ecotones or edges between longleaf pine uplands and pond pine pocosins in dense shrub and vine growth on moist to seasonally saturated sands and on shallow organic soils overlaying sand (spodosolic soils). Occurrences are found in such disturbed habitats as roadside depressions, maintained power and utility line rights-of-way, firebreaks, and trails. The species prefers full sunlight, is shade intolerant, and requires areas of disturbance (*e.g.*, clearing, mowing, periodic burning) where the overstory is minimal. It can, however, persist vegetatively for many years in overgrown, fire-suppressed areas. Blaney, Gilead, Johnston, Kalmia, Leon, Mandarin, Murville, Torhunta, and Vancluse are some of the soil series that occurrences have been found on.

Biological Conclusion: May Affect - Not Likely to Adversely Affect

Suitable habitat for rough-leaved loosestrife is present in the study area within areas identified as streamhead pocosin and powerline corridor, as well as portions of areas identified as rural/urban modification adjacent to the streamhead pocosin vegetative community. These plant communities occur throughout the study area, but suitable habitat is generally more prevalent in the southern portion of the study area where the soil mapping units present are sandier and soils remain saturated for longer periods of the year providing habitat more consistent with sites known to support rough-leaved loosestrife. Surveys were conducted by ESI biologists during the period of 24-30 June 2010. Prior to the initiation of the field investigation, ESI biologists reviewed a reference population of rough-leaved loosestrife located within the Croatan National Forest to confirm the flowering status of this species (date of reference site review: 24 June 2010). The reference population was in the late stages of flowering and individuals in the reference population not in flower at the time of the review were readily identifiable from vegetative characteristics. Surveys were conducted by walking pedestrian transects throughout areas of suitable habitat. No individuals of rough-leaved loosestrife were observed. A review of N.C. Natural Heritage Program (NCNHP) records, updated 23 April 2010, indicates no known occurrences within 1.0 mile of the study area.

#### **DEIS Changes Identified**

No changes have been identified in DEIS Section 3.5.4.3 as a result of this update. The species description provided above is the standardized description developed by NCDOT in May 2008 for use in all NRTRs. The species description used in DEIS Section 3.5.4.3 is based on the NRTR completed in May 2007. No change in the existing species description text in DEIS Section 3.5.4.3 is recommended to maintain consistency with the format of the other species descriptions used in the DEIS. Table 3.18 in the DEIS had been previously updated to reflect the addition of Craven County for rough-leaved loosestrife and should list "Ca, Cr" in the "County Present" column.

This update will result in two changes identified within DEIS Section 4.1.9.3. Table 4.8 had previously been updated to reflect the addition of Craven County for rough-leaved loosestrife, but the Biological Conclusion for this species should be updated from "No Effect" to "Not Likely to Adversely Affect" in the last column of the table. The Biological Conclusion section from the summary above, including the change in Biological Conclusion from "No Effect" to "Not Likely to Adversely Affect", should be substituted in place of the text previously presented for rough-leaved loosestrife in DEIS Section 4.1.9.3.

Environmental Services, Inc., appreciates this opportunity to provide you with our services. If you have any questions or comments, or need any additional information, please feel free to contact me at (910) 520-0784.

# To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



ENVIRONMENTAL SERVICES, INC. 524 S. New Hope Road Raleigh, North Carolina 27610 (919) 212-1760 (919) 212-1707 FAX www.environmentalservices/inc.com Project Location US 70 Havelock Bypass Rough-Leaved Loosestrife Update Havelock, Craven and Carteret Counties, North Carolina T.I.P. No. R-1015

Project:	ER06134.02
Date:	Jul 2010
Drwn/Ch	kd: KT/MKS
Figure:	1

-P:\GeoGra\Projects\ER03134\Update\_2010July\hav\_loc.dgn; 07/09/10; 2:00 PM ATTACHMENT 7



ENVIRONMENTAL SERVICES, INC. 524 South New Hope Road Raleigh, North Carolina 27610 919-212-1760 / Facsimile 919-212-1707 www.environmentalservicesinc.com

# **MEMORANDUM**

TO:	Rachelle Beauregard
FROM:	Matt Smith
DATE:	21 December 2012
RE:	US 70 Havelock Bypass (R-1015) P.O. No. 6300030960 Address USFS Comments on DEIS and PETS Analysis: Summary of Evaluation for Spring-flowering Goldenrod ( <i>Solidago verna</i> ) ESI Project No. ER10-060.08

## **Background**

In their review of the Draft Environmental Impact Statements (DEIS) for the US 70 Havelock Bypass project, the U.S. Forest Service (USFS) identified the need for additional information on project-related impacts for spring-flowering goldenrod (*Solidago verna*) to more fully assess potential viability concerns resulting from project implementation. Spring-flowering goldenrod is state listed as Threatened and is also designated as a Federal Species of Concern (FSC) by the U.S. Fish and Wildlife Service (USFWS). Based on these listings, the USFS is required to assess potential impacts to the species resulting from actions by the USFS, such as granting an easement for the US 70 Havelock Bypass, to determine whether the action threatens the viability of the species on National Forest System (NFS) lands in the Croatan National Forest (CNF).

Environmental Services, Inc., (ESI), has been asked by the North Carolina Department of Transportation (NCDOT) to complete a detailed evaluation of impacts to spring-flowering goldenrod associated with Alternative 3 of the proposed US 70 Havelock Bypass (R-1015) (Figure 1). The study area for Alternative 3 is referred to as the Alt. 3 study area in this evaluation (see "Methods for Assessment" below for description of impact areas evaluated). The evaluation presented here utilizes data obtained from the N.C. Natural Heritage Program (NCNHP) in April of 2012. A summary of the evaluation presented here will be incorporated into Chapter 4 of the Final Environmental Impact Statement (FEIS).

Spring-flowering goldenrod is a perennial aster that flowers in the spring and is found in the Coastal Plain of North and South Carolina in habitats including pine savannas, open pine flatwoods, and pine barrens.<sup>i</sup> Managing for these habitats through seasonal mowing of powerline rights-of-way and prescribed burning of forest habitats is important to maintaining open habitat for this species. On the CNF the USFS undertakes prescribed burns on NFS lands in accordance with the Forest Management Plan for the

Croatan National Forest. Powerline rights-of-way are generally managed by mowing by the powerline easement holder.

The scope of work for the spring-flowering goldenrod evaluation is the result of meetings with NCDOT and the USFS and evaluates direct effects on spring-flowering goldenrod occurrences in the Alt. 3 study area as well as indirect effects that may result from the US 70 Havelock Bypass. There are 36 NCNHP Element Occurrences (EOs) on NFS lands within the CNF (Figure 2). The different alternatives evaluated for the US 70 Havelock Bypass study area (referred to as the Alternatives study area in this evaluation) include portions of twelve EOs: 4267, 4897, 8404, 9935, 11682, 15571, 25210, 25211, 25223, 25297, 25300, and 25373. Alternative 3 impacts portions of seven of these EOs. Each of the EOs consists of one to several discreet occupied habitat polygons.

Previous estimates of the spring-flowering goldenrod population on NFS lands in the CNF have incorporated different techniques used by different evaluators at different times for estimating occurrence boundaries and the number of individuals present within an occurrence. The estimates for these occurrences appear to have generally been based on a cursory count or general estimate focusing on flowering individuals. The number of plants for most occurrences does not appear to have been determined by systematic surveys or direct counts. In addition, occurrence boundaries depicted in the NCNHP database reflect different methods of determination and accuracy.

The variability in precision associated with the area and number of individuals present for occurrences of spring-flowering goldenrod on NFS lands in the CNF makes a comparison of potential impacts from the US 70 Havelock Bypass to the overall population on the CNF problematic. Previous estimates for NFS lands in the CNF range from 5,663 to 14,738 individual plants within 320.2 acres of occupied habitat on NFS lands, with approximately 1,855 individual plants estimated within 138 acres of occupied habitat within the Alternatives study area. For this study, a more systematic approach to estimating population size of spring-flowering goldenrod was requested of NCDOT by USFS to better evaluate potential impacts that may result from the US 70 Havelock Bypass.

# Methods for Assessment

The initial step in the evaluation was to determine the area of occupied habitat in the Alt. 3 study area, directly affected by Alternative 3 and indirectly affected by Alternative 3. Boundaries for NFS lands were provided by the USFS for use in this evaluation. Direct impacts are based on the tree clearing limits (slope stake limits plus 15 feet) plus an additional 25 feet. Indirect impacts include those polygon areas located on NFS lands between Alternative 3 and existing US 70. The areas considered for indirect impacts will be isolated from contiguous NFS lands by the project and may be subject to different post-project management techniques by USFS. Occupied habitat within the Alternatives study area had been delineated during previous investigations and represented by discrete polygons in GIS format. Thirty discrete occupied habitat polygons were identified as impacted wholly or in part by Alternative 3 and were included in the present evaluation (see Table 1); two of the occupied habitat polygons are connected by a narrow linkage, resulting in 29 occupied habitat polygons for this evaluation.

Boundaries of individual occupied habitat polygons directly affected by Alternative 3 that appeared to be truncated at Alternatives study area boundaries were reviewed to determine if the actual occurrence limits

should be extended beyond the limits of the original survey. The occurrence boundaries for springflowering goldenrod in the Alternatives study area were originally established by previous NCDOT studies by walking concentric transects around individual plants until no additional plants were encountered. These boundaries were then flagged and general limits mapped using GPS. For the present evaluation, transects were walked adjacent to the occurrence boundaries to determine if spring-flowering goldenrod plants were present outside the polygon boundaries. No occupied habitat polygon boundary extensions were determined to be required. The next step in the evaluation was to determine the density, estimated number of individuals, and area impacted for occupied habitat polygons impacted by Alternative 3. Occupied habitat polygons were divided into forested and powerline rights-of-way areas and sampled separately.

Each polygon directly affected by Alternative 3 was evaluated in the field to confirm continued presence of spring-flowering goldenrod and to undertake sampling to obtain population estimates and density of spring-flowering goldenrod plants. Surveys and evaluations for spring-flowering goldenrod were undertaken on June 6-7, June 11-14, and July 12-13, 2012. The surveys and evaluations were conducted by an experienced team of biologists led by Matt Smith with support from either Kevin Markham or Jeff Benton. Individual spring-flowering goldenrod plants were identified across a range of growth stage, including basal rosettes and plants in all stages of flowering, including individuals in various stages of seed maturity. The majority of plants observed consisted of basal rosettes with no evidence of flowering during the 2012 season.

Sampling for each occupied habitat polygon consisted of one of two survey methods: 1) full survey coverage within small occupied habitat polygons; or 2) use of subsamples along transects for large occupied habitat polygons. Full survey coverage consisted of two biologists walking transects to provide 100% coverage within the smaller occupied habitat polygons. Transect surveys for subsampling larger occupied habitat polygons consisted of establishing transects using a tape measure and counting all spring-flowering goldenrod plants located within 3 feet of either side of the tape. Transect start and finish points were approximated using GPS as depicted in Figure 3. The number of transects established for each larger occupied habitat polygon was based on size of the polygon, habitat variability, and observed variability in the distribution of the target species. The data collected were utilized to estimate the number and density of spring-flowering goldenrod plants present within the polygon sampled.

#### **Results for Assessment**

The results of sampling were analyzed to estimate the number of plants per acre for the habitat types assessed (Table 1). For this study 1,174 individual plants were counted within 4.8 acres of occupied habitat directly sampled. The areas directly sampled were used to estimate the number of individuals present within the Alternatives study area.

Polygon #	Transect ID	Habitat Type <sup>a</sup>	Transect length (ft)	Transect Width (ft)	Surveyed Area (ac)	Total Plants Counted	Estimated Plants/ Acre	
1	NA	OW	NA	NA	0.73	49	67	
2	NA	OW	NA	NA	0.03	6	226	
3	A	OW	196	6	0.03	9	333	
3	B	OW	221	6	0.03	2	66	
4	NA	OW	NA	NA	0.07	2	27	
5	NA	OW	NA	NA	0.17	15	86	
6	NA	OW	NA	NA	0.00	0	0	
7	NA	OW	NA	NA	0.07	20	269	
8	Α	PL	77	6	0.01	41	3.866	
9	А	OW	492	6	0.07	6	89	
9	В	OW	85	6	0.01	1	85	
9	С	OW	200	6	0.03	3	109	
9	D	OW	103	6	0.01	14	987	
10	NA	OW	NA	NA	0.12	0	0	
11	А	PL	227	6	0.03	74	2,367	
11	А	OW	100	6	0.01	0	0	
11	В	PL	235	6	0.03	122	3,769	
11	В	OW	175	6	0.02	11	456	
11	С	PL	130	6	0.02	68	3,798	
11	С	OW	300	6	0.04	9	218	
11	D	PL	132	6	0.02	1	55	
11	D	OW	159	6	0.02	10	457	
11	Е	PL	132	6	0.02	8	440	
11	Е	OW	71	6	0.01	0	0	
13	NA	OW	NA	NA	0.05	3	62	
14	А	OW	279	6	0.04	17	442	
14	В	OW	348	6	0.05	3	63	
14	С	OW	246	6	0.03	12	354	
14	D	OW	78	6	0.01	1	93	
15	А	OW	226	6	0.03	9	289	
15	В	OW	408	6	0.06	2	36	
15	В	PL	72	6	0.01	83	8,369	
15	C	OW	422	6	0.06	16	275	
15	С	PL	125	6	0.02	24	1,394	
15	D	OW	47	6	0.01	0	0	
15	D	PL	115	6	0.02	10	631	
15	E	PL	34	6	0.00	0	0	
15	Е	OW	164	6	0.02	16	708	
16	NA	OW	NA	NA	0.97	7	7	
16	NA	PL	NA	NA	0.23	74	324	
17	NA	OW DD	NA	NA	0.01	1	141	
18	NA	PP	NA 170	NA	0.08	0	0	
12/19	AA	PP	1/9	6	0.02	2	81	
12/19	BB		119	6	0.02	1	61	
12/19	A	OW	396	6	0.05	0	0	
12/19	В	OW	2/8	6	0.04	2	52	
12/19			203	0	0.03	2	72	
12/19			03	6	0.01	0	0	
12/19			97	0	0.01	0	823	
12/19			193	0	0.03	1	0	
20		OW/	220 NA		0.03	1	32	
20	INA NA	OW OW	INA NA	INA NA	0.02	2	44	
21	INA	UW	INA	INA	0.00	۷ ک	34	

**Table 1.** Spring-flowering goldenrod survey results for Alternative 3.

Table 1 continues.

Polygon #	Transect ID	Habitat Type <sup>a</sup>	Transect length (ft)	Transect Width (ft)	Surveyed Area (ac)	Total Plants Counted	Estimated Plants/ Acre for Survey Areas
22	NA	OW	NA	NA	0.01	15	1,165
23	NA	OW	NA	NA	0.48	2	4
24	NA	OW	NA	NA	0.18	16	89
25	А	OW	66	6	0.01	2	220
25	В	OW	59	6	0.01	0	0
26	А	OW	110	6	0.02	1	66
26	В	OW	159	6	0.02	2	91
27	А	OW	393	6	0.05	91	1,681
27	В	OW	445	6	0.06	3	49
27	С	OW	234	6	0.03	99	3,072
27	D	OW	394	6	0.05	109	2,008
27	E	OW	337	6	0.05	35	754
28	NA	OW	NA	NA	0.03	0	0
29	А	DW	156	6	0.02	0	0
29	В	DW	102	6	0.01	0	0
29	С	PL	NA	NA	0.14	27	191
30	А	PL	39	6	0.01	1	186
30	В	PL	40	6	0.01	0	0
30	С	PL	40	6	0.01	0	0
		Totals:			4.83	1,174	$Av\sigma_{c} = 243$

Table 1 continued.

<sup>a</sup> OW = Open Woods, PP = Pine Plantation, DW = Dense Woods, PL = Powerline Right-of-Way.

There are 29 occupied habitat polygons for spring-flowering goldenrod that will be directly affected by Alternative 3, at least in part. Each of these polygons was sampled to estimate the density, estimated number of individuals, and area impacted. Four polygons were divided into forested area and powerline area habitats and sampled separately. Eighteen small polygons were surveyed to provide 100% coverage and 11 larger polygons were subsampled via transects. A total of 4.83 acres was systematically covered by spring-flowering goldenrod surveys to count individuals (stems and basal rosettes) representing 8% of the total 59.90 acres of occupied habitat polygons impacted by Alternative 3. A total of 1,174 individual plants were counted in the 4.83 acres covered during the survey effort.

Table 2 presents a summary for the overall estimated number and density of spring-flowering goldenrod plants for the forested and powerline portions of the occupied habitat polygons impacted by Alternative 3. Forested habitat types (open woods, pine plantation, dense woods) were treated together based on overall lower density estimates compared to powerline habitat, and based on general overlap of density values among the forested habitat types.

	Table 2. Estimated densit	y of spring nowering goldenroe in powerine and forested nabilats.				
Habitat Toma	Occupied Habitat Polygons (29 Polygons) Impacted by Alternative 3					
Habitat Type		Acres	Estimated # Plants	# Plants / Acre		
	Forested Area	49.93	19,300	387		
	Powerline Area	9.97	20,683	2,074		
	Total:	59.90	39,984	Avg. = 668		

Table 2. Estimated density of spring-flowering goldenrod in powerline and forested habitats.<sup>a</sup>

<sup>a</sup> Based on a weighted average using estimated density per polygon and polygon size. Includes portions of occupied habitat polygons that extend off NFS lands.

#### **Analysis of Impacts**

In meetings with NCDOT and the USFS the USFS expressed a desire to see separate population and population density estimates for spring-flowering goldenrod in lower density and higher density habitat

areas. Table 2 provides an estimate of the density and total number of spring-flowering goldenrod plants within the forested (low population density) and powerline (high population density) habitats of the occupied habitat polygons directly impacted at least in part by Alternative 3.

Anticipated impacts to spring-flowering goldenrod are presented in Table 3. The estimated number and density of spring-flowering goldenrod within each occupied habitat polygon are presented by forested habitat and powerline habitat.

Polygon #	Habitat	Estimated #Plants/	Polygon	Estimated #Plants/	Polygon Area Direct	Estimated #Plants	Polygon Area Indinost	Estimated #Plants
#	гуре	acre	Area (AC)	Polygon	Impact <sup>a</sup>	Impact	Impact <sup>a</sup>	Impact
1	Forested	67	0.73	49	0.53	36	0	0
2	Forested	226	0.03	6	0.03	7	0	0
3	Forested	200	2.35	468	1.58	315	0.02	4
4	Forested	27	0.07	2	0.07	2	0	0
5	Forested	86	0.17	15	< 0.01	0	0.17	15
6	Forested	0	< 0.01	0	< 0.01	0	0	0
7	Forested	269	0.07	20	0.01	3	0.07	19
8	Powerline	3,866	0.30	1,154	0.12	464	0.18	696
9	Forested	317	10.44	3,314	5.01	1,590	4.11	1,305
10	Forested	0	0.12	0	0.12	0	0	0
11	Powerline	2,086	8.02	16,720	1.23	2,565	0	0
11	Forested	226	7.69	1,739	1.15	260	0.08	18
13	Forested	62	0.05	3	0.05	3	0	0
14	Forested	283	3.63	863	2.09	498	0.17	40
15	Forested	262	3.82	1,000	0.91	238	0	0
15	Powerline	2,599	1.04	2,692	0.21	546	0	0
16	Forested	7	0.97	7	0.96	7	0	0
16	Powerline	324	0.23	74	0.20	65	0	0
17	Forested	141	0.01	1	0.01	1	0	0
18	Forested	0	0.08	0	0	0	0	0
12/19	Forested	272	10.05	1328	4.82	394	4.35	903
20	Forested	44	0.02	1	0.02	1	0	0
21	Forested	34	0.06	2	0.06	2	0	0
22	Forested	1,165	0.01	15	0.01	12	0	0
23	Forested	4	0.48	2	0.41	2	0	0
24	Forested	89	0.18	16	0.11	10	0	0
25	Forested	110	0.40	45	0.27	30	0	0
26	Forested	79	0.49	38	0.49	39	0	0
27	Forested	1,513	6.85	10,365	2.86	4,327	3.99	6,036
28	Forested	0	0.03	0	0.03	0	0	0
29	Forested	0	1.11	0	0.08	0	1.03	0
29	Powerline	191	0.14	27	0	0	0.14	27
30	Powerline	62	0.25	15	0.07	4	0	0
Ind. <sup>b</sup>	Powerline	NA	NA	NA	0	0	7.67	15,908
Ind. <sup>b</sup>	Forested	NA	NA	NA	0	0	41.55	16,088
Te	otals:	Avg. = 668	59.90	39,984	23.51	11,419	63.53 <sup>b</sup>	43,415 <sup>b</sup>

 Table 3. Impacts to spring-flowering goldenrod for Alternative 3.

<sup>a</sup> Only includes the occupied habitat polygon area located on NFS lands.

<sup>b</sup> Includes 49.22 acres and estimated 31,996 additional spring-flowering goldenrod plants within occupied habitat polygons that may be indirectly impacted by Alternative 3, but are not directly impacted by Alternative 3; these additional polygons were not included in the 2012 sampling but numbers were estimated based on averages per habitat type summarized in Table 2.

The powerline habitats were generally found to have a higher density of spring-flowering goldenrod plants per acre in comparison to the forested habitat areas. This is likely due to the regular maintenance

that results in reduced competition from woody shrubs and trees. The forested habitats were generally found to have a lower density of spring-flowering goldenrod plants per acre. This is likely due to increased competition from woody shrubs and trees. Several forested polygons were found to have small areas with a generally higher density than the surrounding areas where the sampling transects encountered small openings in the forest. Spring-flowering goldenrod density within surveyed areas was characterized as relatively low, medium, or relatively high based on the distribution of plants.

- Polygon 1 (Figure 3B) is located in a forested area that has been recently thinned resulting in woody debris covering large areas within the polygon. The survey covering the full extent of this polygon indicates this polygon has a relatively low density of spring-flowering goldenrod.
- Polygon 2 (Figure 3B) is a small polygon located in a forested area that has been recently thinned resulting in woody debris covering large areas within the polygon. The survey covering the full extent of this polygon indicates spring-flowering goldenrod is present throughout the polygon at a medium density.
- Polygon 3 (Figure 3B) is located in a forested area that has been recently thinned resulting in woody debris covering large areas within the polygon. The survey consisted of two transects through the polygon. The survey and site observations indicate spring-flowering goldenrod is present throughout the polygon mostly at a medium density, but at a relatively lower density in the southwestern portion of this polygon.
- Polygon 4 (Figure 3D) is a small polygon located in a forested area. The survey covering the full extent of this polygon indicates this polygon has a relative low density of spring-flowering goldenrod.
- Polygon 5 (Figure 3D) is a small polygon located in a forested area. The survey covering the full extent of this polygon indicates this polygon has a relative low density of spring-flowering goldenrod.
- Polygon 6 (Figure 3D) is a small polygon located in a forested area. No spring-flowering goldenrod was found in the survey covering the full extent of this very small polygon (<0.01 acre). Spring-flowering goldenrod may persist in this area but in numbers too low and difficult to detect under present habitat conditions.
- Polygon 7 (Figure 3D) is located in a forested area adjacent to a road and powerline right-of-way. This polygon included generally open habitat and the survey covering the full extent of this polygon indicates spring-flowering goldenrod is present throughout the polygon at a medium density.
- Polygon 8 (Figure 3D) is located in a powerline right-of-way that is frequently maintained. This area is dominated by a dense covering of wire grass (*Aristida stricta*). The survey consisted of a transect through the polygon. The survey and site observations indicate spring-flowering goldenrod is present throughout the polygon at a relatively high density.
- Polygon 9 (Figure 3D) is located in a forested area that has areas of low dense shrubs interspersed with areas that are more open associated with tree falls, fire breaks, and other disturbances. The survey consisted of four transects through different sections of the polygon. The survey and site observations indicate spring-flowering goldenrod is present at a relatively low density across most of the polygon. The species is present at relatively higher densities in more open areas present in the south-central and northeastern portions of the polygon. Most of these more open areas were characterized as supporting medium densities of spring-flowering goldenrod,

increasing to relatively high density along the edge of the polygon to the northeast, outside the Alt. 3 study area.

- Polygon 10 (Figure 3D) is a small polygon located in a forested area. No spring-flowering goldenrod was found in the survey covering the full extent of this polygon. Spring-flowering goldenrod may persist in this area but in numbers too low and difficult to detect under present habitat conditions.
- Polygon 11 (Figure 3D) includes powerline right-of-way areas and forested areas. The survey consisted of five transects through the polygon. The survey and site observations indicate the northern portion of this polygon includes some of the highest densities of spring-flowering goldenrod identified during this evaluation, with density diminishing toward the southern portions of the polygon. The high density areas are located outside the Alt. 3 study area. The survey and site observations for the portion of the polygon within the Alt. 3 study area indicates spring-flowering goldenrod is present at a medium density within the powerline right-of-way in this area, and at a low density in the adjacent forested portion of the polygon.
- Polygon 12/19 is located in a forested area that includes a portion that is managed as pine plantation and has areas of low dense shrubs interspersed with areas that are more open associated with tree falls, fire breaks, and other disturbances. The survey consisted of seven transects through different sections of the polygon. The survey and site observations indicate spring-flowering goldenrod is found mostly at low densities throughout most of the polygon, with relatively greater densities, characterized as medium density, in the southeastern and southwestern portions of the polygon where more open areas were encountered.
- Polygon 13 (Figure 3E) is a small polygon located in a forested area separated by small strips of habitat from adjacent Polygon 12. No spring-flowering goldenrod was found in the survey covering the full extent of this polygon. Spring-flowering goldenrod may persist in this area but in numbers too low and difficult to detect under present habitat conditions.
- Polygon 14 (Figure 3E) is located in a forested area at the intersection of Sunset Drive and a forest road. The survey consisted of four transects through the polygon. The survey and site observations indicate that spring-flowering goldenrod is present throughout most of the interior of this polygon at relatively low densities, with relatively greater densities along the forest road edge. The northwestern portion of the polygon adjacent to the forest road is characterized as having a relatively high density of spring-flowering goldenrod. The highest density areas are outside of the Alt. 3 study area.
- Polygon 15 (Figure 3E) includes powerline right-of-way and forested areas. The survey consisted of five transects through the polygon. The survey and site observations indicate that the western portion of this polygon located in the powerline contains relatively higher densities of spring-flowering goldenrod than the forested areas of the polygon. The southern portion of the powerline area of the polygon contains a relative high density of spring-flowering goldenrod, with density diminishing to the north away from Sunset Road. Spring-flowering goldenrod densities were characterized as medium density throughout most of the interior of the forested part of this polygon, with densities increasing and mostly characterized as medium density along the forest edges with the powerline right-of-way to the west and roads along the eastern and southern borders of the polygon.

- Polygon 16 (Figure 3E) includes powerline right-of-way areas and forested areas. The survey covering the full extent of this polygon indicates that spring-flowering goldenrod is present at a medium density in the powerline right-of-way and at a low density in the adjacent forested areas.
- Polygon 17 (Figure 3E) is a small polygon located in a forested area. The survey covering the full extent of this polygon indicates that spring-flowering goldenrod is present throughout the polygon at a density characterized as medium.
- Polygon 18 (Figure 3E) is a small polygon located in a pine plantation area along the western edge of the Alt. 3 study area. No spring-flowering goldenrod was found in the survey covering the full extent of this polygon. Spring-flowering goldenrod may persist in this area but in numbers too low and difficult to detect under present habitat conditions.
- Polygon 20 (Figure 3F) is a small polygon located in a forested area that has been recently thinned resulting in woody debris covering areas within the polygon. The survey covering the full extent of this polygon indicates that spring-flowering goldenrod is present throughout the polygon at a relative low density.
- Polygon 21 (Figure 3F) is a small polygon located in a forested area that has been recently thinned resulting in woody debris covering areas within the polygon. The survey covering the full extent of this polygon indicates that spring-flowering goldenrod is present throughout the polygon at a relative low density.
- Polygon 22 (Figure 3F) is a small polygon located in a forested area that has been recently thinned, and the polygon is located along the edge of an old skidder trail. The survey covering the full extent of this polygon indicates that spring-flowering goldenrod is present throughout the polygon at a density characterized as medium.
- Polygon 23 (Figure 3F) is a small polygon located in a forested area that has been recently thinned resulting in woody debris covering large areas within the polygon. The survey covering the full extent of this polygon indicates that spring-flowering goldenrod is present throughout the polygon at a relative low density.
- Polygon 24 (Figure 3F) is a small polygon located in a forested area that has been recently thinned resulting in woody debris covering large areas within the polygon. The survey covering the full extent of this polygon indicates that spring-flowering goldenrod is present throughout the polygon at a relative low density.
- Polygon 25 (Figure 3G) is located in a forested area that has been recently thinned resulting in woody debris covering areas within the polygon. The survey consisted of two transects across the polygon. The survey and site observations indicate that spring-flowering goldenrod is present throughout the polygon, with low densities characterizing the northern portion of the polygon increasing to medium density in the southern portion of the polygon.
- Polygon 26 (Figure 3G) is located in a forested area that has been recently thinned resulting in woody debris covering areas within the polygon. The survey consisted of two transects across the polygon. The survey and site observations indicate that spring-flowering goldenrod is present throughout the polygon, with low densities characterizing the northern portion of the polygon increasing to medium density in the southern portion of the polygon.
- Polygon 27 (Figure 3G) is located in a forested area. The survey consisted of five transects through the polygon. The survey and site observations indicate that spring-flowering goldenrod is present throughout the polygon with relatively greater densities in the northern and western portions of the polygon and densities diminishing towards the southern portions of the polygon.

The high density areas were generally observed to include a larger number of flowering individuals and young plants as evidence of recent recruitment. This forested area has experienced recent growing season prescribed burns and recent thinning resulting in reduced competition from woody shrubs and trees and a relatively open canopy and subcanopy allowing substantial light penetration to the ground layer. The portion of the polygon within the Alt. 3 study area is mostly characterized by low to medium densities, but part of the high density area of spring-flowering goldenrod extends into the Alt. 3 study area.

- Polygon 28 (Figure 3G) is a small polygon located in a forested area. No spring-flowering goldenrod was found in the survey covering the full extent of this polygon. Spring-flowering goldenrod may persist in this area but in numbers too low and difficult to detect under present habitat conditions.
- Polygon 29 (Figure 3H) consists mostly of a forested area characterized as dense woods and a small part of the polygon extends into the adjacent powerline right-of-way. The survey consisted of two transects through the dense forested area, and a survey covering the full extent of the powerline right-of-way portion. The dense shrub cover present in the woods resulted in conditions in which no spring-flowering goldenrod were found in the sampling. Spring-flowering goldenrod may persist in this area but in numbers too low and difficult to detect under present habitat conditions. The survey and site observations indicate that spring-flowering goldenrod is present throughout the powerline right-of-way portion of the polygon at a density characterized as medium.
- Polygon 30 (Figure 3H) is located in a narrow powerline right-of-way area that has not been maintained in recent years. The survey consisted of three transects across the polygon. The survey and site observations indicate that spring-flowering goldenrod is scarce in this polygon in comparison to other powerline right-of-way areas sampled. The extensive coverage by woody shrubs and young trees represent competition for spring-flowering goldenrod and also create shaded conditions that may not be suitable for spring-flowering goldenrod. Spring-flowering goldenrod was not observed in most of the polygon, but may persist in these areas in numbers too low and difficult to detect under present habitat conditions.

#### **Summary of Analysis**

- NCNHP records, which have been updated to include NCDOT's pre-2012 survey efforts, indicated spring-flowering goldenrod is known from 36 EOs that cover 320.2 acres of occupied habitat documented on NFS lands in the CNF. Recent data provided by the USFS shows that 6 of these occurrences (mapped as covering 4 acres) have not been relocated during recent survey attempts. Previous estimates for NFS lands in the CNF range from 5,663 to 14,738 individual plants within an estimated 320.2 acres of occupied habitat (Figure 2). Occurrences on NFS lands outside of the Alternatives study area have not been systematically surveyed, but based on the results of the present evaluation the actual number of individuals would be likely higher than previous estimates if these occurrences were evaluated using systematic surveys.
- Within the Alternatives study area evaluated for the Havelock Bypass, there are 115 occupied habitat polygons identified in the NCNHP database that total 138 acres. The Alternatives study area includes the study corridors for all three alternatives as well as the areas between these corridors and the existing US 70 facility. Using the average densities for forested areas and

powerline areas presented in Table 2, there are an estimated 94,026 individual spring-flowering goldenrod plants in the Alternatives project study area (Figure 3). Due to variations in soils, hydrology, land management, and survey methodology for occurrences outside of the Alternatives study area it is not possible to apply the results of this study to occurrences outside of the Alternatives study area.

- Alternative 3 directly affects 23.51 acres of occupied habitat on NFS lands and estimated 11,419 individual spring-flowering goldenrod plants. This impact represents approximately 17% of occupied habitat within NFS lands within the Alternatives study area and 12% of the estimated population within NFS lands within the Alternatives study area.
- An additional 63.53 acres of occupied habitat is in areas that may be indirectly affected by Alternative 3 that include an estimated 43,415 individual spring-flowering goldenrod plants. This impact represents approximately 46% of occupied habitat within NFS lands within the Alternatives study area and 46% of the estimated population within NFS lands within the Alternatives study area. Mitigative measures previously proposed by NCDOT regarding management agreements with USFS for the potential indirect impact areas would reduce the likelihood for adverse effects to these areas. Mitigative measures discussed include:
  - Allowing for the temporary closure of the bypass to allow the USFS to conduct period prescribed burns;
  - o Avoid planting of aggressive non-native species for re-vegetation;
  - Avoid placing staging areas within 200 ft of PETS plant species occurrences, where practicable;
  - o Avoiding heavy equipment access, especially during wet periods;
  - o Minimizing the use of herbicides and pesticides; and
  - Collecting seeds to establish new populations on NFS lands.

# **Potential Mitigation Site Identification**

Spring-flowering goldenrod generates from seeds under suitable habitat conditions.<sup>i</sup> Direct affects to this species may be mitigated through a combination of relocation of affected populations to unaffected suitable habitat or collecting seeds or propagules from affected populations to use in establishing new populations in unaffected suitable habitat. NCDOT is proposing to collect seeds from the areas to be affected by Alternative 3 and distributing the seeds into an area of the CNF where the species does not currently occur but where there is appropriate habitat. On-site mitigation in the vicinity of the RCW foraging partition north of Sunset Rd and west of Alternative 3 is proposed in a report, <u>Recommended mitigation plan for *Solidago verna* in Craven Co., North Carolina; Havelock Bypass, R-1015,<sup>ii</sup> prepared by Dr. Jon Stucky and Miranda Fleming for NCDOT in 2006. The on-site area proposed for establishing spring-flowering goldenrod is identified as the Wolf Pit Branch Road Area on Figure 4.</u>

As part of the present evaluation, additional areas with mitigation potential for use in establishing new populations on NFS lands of spring-flowering goldenrod were reviewed outside of the Alternatives study area in case additional mitigation areas would be requested by the USFS to help offset project related impacts. As part of the mitigation effort, seeds were collected from several occupied habitat polygons sampled within Alternative 3 in addition to seed collection completed by NCDOT personnel in 2011 and

2010. Seeds were collected in accordance with the USFS seed collection permit issued to NCDOT for this purpose.

Potential sites were identified based on USFS land ownership, potential suitability of soils, potential suitability of hydrology, and proximity to the impacted areas (Figure 4). Proximity to red-cockaded woodpecker cavity trees was also considered as this indicates an increased likelihood that periodic prescribed burns will be conducted. Soils considered were those identified by Stucky and Fleming (2006) as having greater than 50% overall survivability of transplanted individuals, as well as soils not evaluated by Stucky and Fleming but upon which spring-flowering goldenrod has been documented as occurring in the CNF. These soils include Craven silt loam, Leaf silt loam, and Lenoir silt loam (evaluated by Stucky and Fleming), as well as Rains fine sandy loam and Onslow fine sandy loam (other soils supporting spring-flowering goldenrod). Several areas identified along Middle Little Road and South Little Road may have potential to be utilized as offsite mitigation areas for establishing spring-flowering goldenrod. These Little Road Areas are located off Catfish Lake Road (SR 1100) west of the Alt. 3 study area. Suitable soils and hydrologic conditions are expected to be present within portions of the 770 acres preliminarily identified.

It may also be feasible to establish spring-flowering goldenrod where suitable soils and hydrologic conditions occur along selected roadsides and mesic inclusions present within the Croatan Mitigation Bank (CMB). More information on site conditions for the CMB is provided in a report commissioned by NCDOT.<sup>ii</sup> Although not currently NFS lands, the NCDOT and USFS are planning the development, use, and management of the CMB with planning directed at conveyance of the CMB to the USFS for inclusion in the CNF. Long-term management of the CMB parcel, including land uses and practices consistent with the mitigation objectives, is outlined in a Memorandum of Understanding among the U.S. Army Corps of Engineers, NCDOT, and USFS.<sup>iii</sup>

Mitigation measures will be coordinated with USFS and finalized before NCDOT's FEIS is complete.

# **Cumulative Impacts**

One other activity proposed by NCDOT on NFS lands has the potential to affect occupied habitat for spring-flowering goldenrod resulting in cumulative impacts. NCDOT is proposing improvements to US 17 (R-1514B, C, D) from south of the Town of Belgrade to north of the Jones/Craven County line. The proposed improvements include bypasses of the Towns of Maysville and Pollocksville with a widening section that connects the bypasses. The widening section includes approximately 108 acres of NFS lands on the Croatan National Forest. The NFS lands affected by the project include part of the existing US 17 facility.

One spring-flowering goldenrod occurrence occupies a total of 13.0 acres within the US 17 project area, including areas located on NFS lands within the CNF and areas located within the existing US 17 rightof-way adjacent to private property. Approximately 12.8 acres of this spring-flowering goldenrod occurrence will be directly affected as a result of this project, which includes approximately 9.9 acres (98%) of the 10.1 acres of habitat occupied on NFS lands in the CNF. This occurrence is estimated to include approximately 4,700 individual plants and it is estimated that approximately 3,584 individual plants may be directly impacted on NFS lands and an additional 1,050 individual plants may be directly impacted within the US 17 right-of-way adjacent to private property.

NCDOT proposes to mitigate spring-flowering goldenrod impacts on NFS lands resulting from the US 17 Improvements project by establishing new populations on NFS lands in areas identified as potentially suitable based on favorable soil and hydrology conditions. NCDOT is in the process of identifying appropriate candidate sites and mitigation measures will be coordinated with USFS before NCDOT's FEIS is complete. As part of the mitigation effort, seeds were collected from the US 17 impact area in 2012, 2011, and 2010 by NCDOT personnel in accordance with the USFS seed collection permit issued to NCDOT for this purpose.

## **Conclusions and Recommendations**

The US 70 Havelock Bypass (R-1015) Alternative 3 will result in unavoidable direct impacts to spring-flowering goldenrod and additional areas occupied by spring-flowering goldenrod may be subject to indirect impacts. The direct impacts for Alternative 3 are not likely to result in a loss of viability on NFS lands within the CNF, but with the inclusion of indirect impacts represent an impact to a significant portion of the overall population on the CNF, particularly for the population within the Alternatives study area, that may result in viability concern on NFS lands within the CNF. Cumulative impacts associated with US 17 (R-2514B, C, and D) further increase the concern for maintaining viability on NFS lands.

Mitigation measures are needed to reduce the threat for a loss of viability for spring-flowering goldenrod on NFS lands within the CNF. Implementation of mitigation measures agreed to between NCDOT and USFS would minimize viability concerns resulting from indirect impacts. These mitigation measures include allowing for the closure of the bypass to allow for periodic prescribed burns to be conducted; avoiding use of aggressive, non-native vegetation in the ROW; avoiding placing staging areas within 200 feet of spring-flowering goldenrod occurrences, where practicable; avoiding heavy equipment access, especially during wet periods; and minimizing the use of herbicides and pesticides. Additional mitigation measures agreed to between NCDOT and USFS would offset viability concerns resulting from direct impacts. These mitigation measures include collecting seeds from the impact areas for establishing new populations on NFS lands in areas identified as potentially suitable based on favorable soil and hydrology conditions.

With the implementation of mitigation measures the US 70 Havelock Bypass (R-1015) Alternative 3 project is not likely to cause a trend towards federal listing or a loss of viability for spring-flowering goldenrod on NFS lands within the CNF.

<sup>&</sup>lt;sup>i</sup> Center for Plant Conservation website.

http://www.centerforplantconservation.org/Collection/CPC\_ViewProfile.asp?CPCNum=4050 accessed 7 December 2012.

<sup>&</sup>lt;sup>ii</sup> Stucky, J.M. and M. Fleming, 2006. Recommended mitigation plan for *Solidago verna* in Craven Co., North Carolina; Havelock Bypass, R-1015. Research project conducted for NCDOT, No. HWY-0733.

<sup>&</sup>lt;sup>ii</sup> EcoScience Corporation and Axiom Environmental, Incorporated. 2009. Croatan Mitigation Bank

Addendum to the NCDOT UMBI. Report prepared for NCDOT, January 2009. 16 pp + appendices.

<sup>iii</sup> U.S. Army Corps of Engineers (USACE), N.C. Department of Transportation (NCDOT), and U.S. Forest Service (USFS). 2003. Memorandum of Understanding between the U.S. Army Corps of Engineers, State of North Carolina Department of Transportation, and the United States Forest Service for the Disposition and Management of the Croatan Wetland Mitigation Bank in Craven County, North Carolina. Agreement No. 02-MU-11081100-034. 5pp.



		species, the s not shown on act: 919-707-6000
Alternative 3 Study Area Alternative 3 Study Area Alternatives Study Area National Forest System Lands Boundary NCNHP Spring-flowering Goldenrod Element C	Occurrence Polygons mated by ESI. and was not prepared for, and is not yreview and is intended for use only by a ew. Copyrigh	t© 2011 National Geographic Society, i-cubed Project: ER10060.08
ab: P\GeoGmProjectsi2010060/01/GIS/mxdFig.SOVElocation.mxd Date: 12/21/2012 954:11 AM	Project Location - Spring-flowering Goldenrod <b>US 70 Havelock Bypass (R-1015)</b> Craven and Carteret Counties, North Carolina	Project         ER100b0.08           Date:         Dec 2012           Drwn/Chkd:         KT/MKS           Figure:         2

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



Spring-flowering Goldenrod Assessment Overview US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina Project: ER10060.08 Date: Dec 2012 Drwn/Chkd: CD/MS Figure: **3** 

Path: P:\GeoGra\Projects\2010/060\01\GIS\mxd\Fig\_SOVEOverview.mxd Date: 9/19/2012 11:01:37 AM



Spring-flowering Goldenrod Assessment US 70 Havelock Bypass (R-1015)

Craven and Carteret Counties, North Carolina



 $\mathbf{S}$ 

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



Spring-flowering Goldenrod Assessment US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina 
 Project:
 ER10060.08

 Date:
 Dec 2012

 Drwn/Chkd:
 CD/MS

 Figure:
 3B

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



Spring-flowering Goldenrod Assessment US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina 
 Project:
 ER10060.08

 Date:
 Dec 2012

 Drwn/Chkd:
 CD/MS

 Figure:
 3C



# To protect the viability of protected/rare species, the exact location of species occurrences is not shown in this memo. For more information, contact: John Conforti, REM NCDOT Project Development & Environmental Analysis Unit 919-707-6015 jgconforti@ncdot.gov



Spring-flowering Goldenrod Assessment US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina

1 2 2

Project: ER10060.08 Date: Dec 2012 Drwn/Chkd: CD/MS Figure: **3E** 

picted on this figure is for

Path: P:\GeoGra\Projects\2010\060\01\GIS\mxd\Fig\_SOVESheets\_Density.mxd Date: 12/7/2012 11:08:03 AM



1 1

jgconforti@ncdot.gov



Spring-flowering Goldenrod Assessment US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina

Project: E	R10060.08
Date:	Dec 2012
Drwn/Chkd	: CD/MS
Figure:	3F

To protect the viability of protected/rare species, the exact location of species occurrences is not shown in this memo. For more information, contact: John Conforti, REM NCDOT Project Development & Environmental Analysis Unit 919-707-6015

gconforti@ncdot.gov



H H

 Project:
 ER10060.08

 Date:
 Dec 2012

 Drwn/Chkd:
 CD/MS

 Figure:
 3G

Path: P:\GeoGra\Projects\2010\060\01\GIS\mxd\Fig\_SOVESheets\_Density.mxd Date: 12/7/2012 11:08:03 AM

Spring-flowering Goldenrod Assessment US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina To protect the viability of protected/rare species, the exact location of species occurrences is not shown in this memo. For more information, contact: John Conforti, REM NCDOT Project Development & Environmental Analysis Unit 919-707-6015



Spring-flowering Goldenrod Assessment US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina 
 Project:
 ER10060.08

 Date:
 Dec 2012

 Drwn/Chkd:
 CD/MS

 Figure:
 3H







Spring-flowering Goldenrod Assessment US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina

Project:	ER10060.08
Date:	Dec 2012
Drwn/Chk	d: CD/MS
Figure:	3J

To protect the viability of protected/rare species, the exact location of species occurrences is not shown in this memo. For more information, contact: John Conforti, REM NCDOT Project Development & Environmental Analysis Uni 919-707-6015



Potential Spring-flowering Goldenrod Mitigation Areas US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina

1	Project:	ER10060.08
l	Date:	Dec 2012
	Drwn/Ch	kd: KT/MS
	Figure:	4

Copyright:© 2011 National Geographic Society, i-cubed

P:\GeoGra\Projects\2010\060\01\GIS\mxd\Fig\_US70Mit.mxd Date: 12/21/2012 10:00:04 AM

ATTACHMENT 8



ENVIRONMENTAL SERVICES, INC. 524 South New Hope Road Raleigh, North Carolina 27610 919-212-1760 / Facsimile 919-212-1707 www.environmentalservicesinc.com

# **MEMORANDUM**

TO:	Rachelle Beauregard
FROM:	Matt Smith
DATE:	18 January 2013
RE:	US 70 Havelock Bypass (R-1015) P.O. No. 6300030960 Address USFS Comments on DEIS and PETS Analysis: Summary of Revised USFS Rare Species Surveys Evaluation ESI Project No. ER10-060.08

Environmental Services, Inc., (ESI), has been asked by the North Carolina Department of Transportation (NCDOT) to assist in updating information contained in the Draft Environmental Impact Statement (DEIS). This memorandum summarizes updates to the U.S. Forest Service (USFS) rare species analysis presented in Chapter 3 and Chapter 4 of the DEIS. The USFS rare species analysis includes species federally listed as Proposed, Endangered, or Threatened (PET) under the Endangered Species Act, species designated as Sensitive (S) by USFS Region 8, and species considered to be Locally Rare (LR) or Forest Concern (FC) on the Croatan National Forest. The updated PETS species analysis is being presented in a format that can be directly incorporated into Chapter 3 and Chapter 4 of the Final Environmental Impact Statement (FEIS). Section headings, table numbers, and figure numbers included in this memorandum refer to Chapter 3 and Chapter 4 of the DEIS. The USFS rare species figure included in the DEIS was also updated.

Additional surveys were completed during 2012 for USFS rare plant species identified as having suitable habitat within Alternative 3. No additional surveys were completed in 2012 for Alternative 1 or Alternative 2 nor were additional surveys conducted for USFS rare animal species within any of the alternates. The updated PETS species analysis incorporates the evaluation completed for species added to

the USFS rare species lists provided in 2012 and includes presentation of updated potential direct affects, indirect affects, cumulative effects, and proposed mitigative measures for the Alternative 1, Alternative 2, and Alternative 3 of the proposed US 70 Havelock Bypass (R-1015) for proposed incorporation into the FEIS.

Boundaries for National Forest System (NFS) lands were provided by the USFS for use in this analysis. The analysis for USFS rare species is based on the tree clearing limits (slope stake limits plus 15 feet) plus an additional 25 feet.

If you have any questions please feel free to contact me at 910-520-0784. We appreciate the opportunity to have provided assistance to NCDOT with this important project.
# Chapter 3

#### 3.5.4.3.3. U.S. Forest Service Rare Species

In addition to plant and animal species receiving protection under the Endangered Species Act, the U.S. Forest Service (USFS) maintains a list of USFS rare species for the Croatan National Forest (CNF) and considers these species when determining impacts to National Forest System (NFS) lands. The USFS rare species analysis includes species federally listed as Proposed, Endangered, or Threatened (PET) under the Endangered Species Act, species designated as Sensitive (S) by USFS Region 8, and species considered to be Locally Rare (LR) or Forest Concern (FC) on the CNF. Since all of the study alternatives cross NSF lands, a special use permit from the USFS will be required to provide the lands for the proposed project. Prior to approving a special use permit for the project, the USFS requires that the project study area be evaluated for USFS rare species. The North Carolina Department of Transportation (NCDOT), Division of Highways, Planning and Environmental Analysis Branch, Natural Environment Section, coordinated with the USFS to determine which USFS rare species were to be evaluated. The surveys and evaluations were conducted by Environmental Services, Inc. and reviewed by NCDOT and the USFS.

Throughout the evaluation, the USFS has been amending and revising its list of rare species as new scientific data regarding species distributions on the CNF becomes available. The USFS identified 30 rare species with a high probability of occurring that were to be evaluated in the Environmental Assessment for the proposed project in 1996. At that time the USFS indicated that 73 USFS rare species were listed for consideration on the CNF. When additional detailed evaluations were initiated in 2002 that list was amended to include 175 species. In January 2005, September 2007, May 2008, October 2010, and February 2012 the USFS further amended the USFS rare species list removing species and requesting that additional species be incorporated into the project analysis. Initial habitat assessments, including field evaluations for the USFS rare species were conducted in 2004 for the species listed at that time. Species surveys requested by the USFS were conducted during the 2005 growing season and results of these surveys were provided to the USFS in December 2006. An evaluation of additional USFS rare species was completed in May 2008 for species added to the USFS rare species lists.

The USFS rare species evaluation presented here includes all of the 198 species on the most recently updated USFS rare species lists provided by USFS in early 2012. These 198 species have been evaluated to determine if suitable habitat is present in the study area. Habitat assessments utilized the detailed habitat descriptions presented in Chapter 3, Section 3.5.2.1 to determine if habitat is present in the study

area. The results of field surveys completed during the 2012 growing season for species determined to have suitable habitat in the study area are presented in Chapter 4, Section 4.1.9.3.3.

Table 3.21a presents the 108 plant species (February 2012 list update) that are currently being evaluated as USFS rare species, and Table 3.21b presents the 90 animal species (February 2011 list update) that are currently being evaluated as USFS species for the CNF. Tables 3.21a and 3.21b list all the evaluated USFS rare species, habitat information for each species, and the potential for suitable habitat in the study area. Species have been assigned a number (1 through 198) to facilitate tracking throughout this analysis.

# Table 3.21a. USFS PETS Rare Plant Species for the Croatan National Forest (February 2011 ListUpdate)

ies ber	Scientific Name	Common Name	USFS Status <sup>a</sup>	Habitat Present	
Spec					(Study Area)
1	Aeschynomene virginica	Sensitive jointvetch	Т	Tidally influenced marshes and creeks and ditches	No
2	Agalinis virgata	Branched gerardia	LR	Savannas and depression ponds	Yes
3	Agrostis altissima	Tall bentgrass	LR	Wet savannas	Yes
4	Andropogon mohrii	Bog bluestem	LR	Wet savannas	Yes
5	Arenaria lanuginosa var. lanuginosa	Spreading sandwort	LR Maritime grasslands and forests, sandy sites		No
6	Arnoglossum ovatum	Savanna milkweed	LR	Wet savannas	Yes
7	Asclepias pedicellata	Stalked milkweed	LR	Dry savanna and moist flatwoods	Yes
8	Asplenium heteroresiliens	Carolina spleenwort	S	Marl, coquina limestone outcrops	No
9	Calopogon multiflorus	Many-flower grass pink	S	Savannas and sandhills	Yes
10	Campylopus carolinae	Savanna campylopus	S	Savanna	Yes
11	Cardamine longii	Long's bittercress	S	Tidal marshes, tidal cypress-gum forests	No
12	Carex basiantha	Widow sedge	LR	Marl, mesic forests and bottomlands over calcareous rocks	Yes
13	Carex calcifugens	Calcium-fleeing sedge	LR	Evergreen maritime forest, calcareous bluff forest	Yes
14	Carex emmonsii	Emmon's sedge	LR	Moist woods	Yes
15	Carex lupuliformis	Hop-like sedge	LR	Mesic bottomlands, especially in calcareous or mafic areas	Yes
16	Cirsium lecontei	LeConte's thistle	LR	Savannas	Yes
17	Cladium mariscoides	Twig-rush	LR	Bog marshes, brackish fens, sandhill seeps	No
18	Cleistesiopsis bifaria (=Cleistes bifaria)	Small spreading pogonia	S	Savannas, dry meadows	Yes
19	Clematis catesbyana	Coastal virgin's-bower	LR	Dunes, maritime forest edge, dolomite	No
20	Corallorhiza wisteriana	Spring coral-root	LR	Moist to dry nutrient-rich forests, especially over limestone, mafic rocks or shell-rich sands	Yes
21	Coreopsis helianthoides	Beadle's coreopsis	LR	Swamp, peaty wetlands	Yes
22	Crocanthemum carolinianum	Carolina sunrose	LR	Sandhills pinelands and dry savannas	Yes
23	Cylindrocolea rhizantha	A liverwort	S	Marl outcrops	No
24	Cystopteris tennesseensis	Tennessee bladder-fern	LR	Marl, calcareous rock outcrops	No
25	Dichanthelium fusiforme	Spindle-fruited witch grass	LR	Sandy pine or pine-oak forests	Yes
26	Dichanthelium hirstii	Hirst's panic grass	S	Cypress savannas	No
27	Dichanthelium sp. 9	Hidden-flowered witch grass	LR	Pocosins, wet meadows, ditchlines	Yes
28	Dichanthelium spretum	Eaton's witch grass	LR	Wet sands and peaty bogs, savannas	Yes
29	Dionaea muscipula	Venus flytrap	S	Savannas, seepage bogs, pocosin edges with little competition	Yes

# Table 3.21a. Continued

Species Number	Scientific Name	Common Name	USFS Status <sup>a</sup>	Habitat Type	Habitat Present (Study Area)
30	Eleocharis parvula	Littlespike spikerush	LR	Tidal brackish and freshwater marshes	No
31	Eleocharis robbinsii	Robbin's spikerush	LR	Ponds, lakes, Carolina bays	No
32	Eleocharis rostellata	Beaked spikerush	LR	Tidal brackish and freshwater marshes	No
33	Elymus virginicus var. halophilus	Terrell grass	LR	Brackish marsh, maritime forest	No
34	Eriocaulon aquaticum	Seven-angled pipewort	LR	Pond or lake margins	Yes
35	Eurybia spectabilis	Showy aster	LR	Pine barrens, woodland borders	No
36	Fissidens hallii	Hall's pocket moss	S	On bark in cypress-gum swamps	Yes
37	Frullania donnellii	A liverwort	S	Ilex bark in marshes	No
38	Hibiscus aculeatus	Comfortroot	LR	Bay forests, sand ridges, roadsides	Yes
39	Isoetes microvela	Quillwort	S	Emergent or calcareous riverbanks	No
40	Lachnocaulon beyrichianum	Southern bogbutton	S	Sandhills	No
41	Leersia lenticularis	Catchfly cutgrass	LR	Low moist woods	Yes
42	Lejeunea bermudiana	A liverwort	LR	On marl outcrops and on decaying logs in blackwater swamps	Yes
43	Lejeunea dimorphophylla	A liverwort	S	On bark in maritime forests	No
44	Litsea aestivalis	Pondspice	S	Limesink ponds and other pools	Yes
45	Lobelia boykinii	Boykin's lobelia	S	Depression ponds, meadows, clay-based cypress savannas	Yes
46	Ludwigia alata	Winged seedbox	LR	Freshwater to brackish marshes	No
47	Ludwigia linifolia	Flaxleaf seedbox	LR	Limesink ponds	No
48	Ludwigia ravenii	Raven's seedbox	S	Savannas, swamps, marshes, wet open areas	Yes
49	Ludwigia sphaerocarpa	Globe-fruit seedbox	LR	Boggy areas, pools, ditches, marshes	Yes
50	Lysimachia asperulaefolia	Rough-leaved loosestrife	E	Pocosin/savanna ecotones	Yes
51	Lysimachia loomisii	Loomis's loosestrife	S	Moist to wet savannas and pocosin ecotones	Yes
52	Macbridea caroliniana	Birds-in-a-nest (Carolina bogmint)	S	Blackwater swamps, savannas	Yes
53	Malaxis spicata	Florida adder's mouth	LR	Maritime swamp forest, calcareous mucky outer coastal plain swamps	Yes
54	Metzgeria unicigera	A liverwort	S	On bark in maritime forests	No
55	Minuartia godfreyi	Godfrey's sandwort	S	Tidal freshwater marshes	No
56	Myriophyllum laxum	Loose watermilfoil	S	Limesink ponds, natural lakes	No
57	Nuphar sagittifolia	Narrowleaf cowlily	S	Blackwater streams, rivers, and lakes	Yes
58	Oplismenus hirtellus ssp. setarius	Shortleaf basket grass	LR	Maritime forests, bottomlands	Yes
59	Oxypolis ternata	Piedmont cowbane	S	Pine savannas, sandhill seeps	Yes
60	Parietaria praetermissa	Large-seed pellitory	S	Shell middens, disturbed sites, maritime forest	No
61	Parnassia caroliniana	Carolina grass-of- parnassus	S	Wet savannas	Yes
62	Paspalum dissectum	Mudbank crown grass	LR	Mudbanks, open wet areas, wet ditches	Yes
63	Peltandra sagittifolia	Spoonflower	LR	Pocosins, wet peat-dominated sites	Yes

# Table 3.21a. Continued

Species Number	Scientific Name	Common Name	USFS Status <sup>a</sup>	Habitat Type	Habitat Present (Study Area)
64	Persicaria hirsuta	Hairy smartweed	LR	Limesink ponds, clay-lined Carolina bays, blackwater stream edges	Yes
65	Pinguicula pumila	Small butterwort	LR	Savannas	Yes
66	Plagiochila ludoviaciana	A liverwort	LR	On bark in swamps and maritime forests	Yes
67	Plagiochila miradorensi var. miradorensis	A liverwort	LR	On bark in maritime forests and swamps	Yes
68	Plantago sparsiflora	Pineland plantain	S	Wet savannas	Yes
69	Platanthera integra	Yellow fringeless orchid	S	Savannas	Yes
70	Platanthera nivea	Snowy orchid	LR	Wet savannas	Yes
71	Polygala hookeri	Hooker's milkwort	S	Savannas	Yes
72	Ponthieva racemosa	Shadow-witch	LR	Blackwater forests and swamps over calcareous rock (marl)	Yes
73	Pycnanthemum setosum	Awned mountain-mint	LR	Blackwater swamps	Yes
74	Quercus austrina	Bluff oak	LR	Bluff or basic mesic forest	No
75	Quercus minima	Dwarf live oak	LR	Pine flatwoods, coastal fringe sandhills	Yes
76	Rhexia aristosa	Awned meadow-beauty	S	Clay-lined Carolina bays, limesink ponds	No
77	Rhynchospora alba	Northern white beaksedge	LR	Limesink ponds, pocosin openings	No
78	Rhynchospora breviseta	Short-bristled beaksedge	S	Wet savannas, may colonize disturbed areas/roadsides	Yes
79	Rhynchospora harperi	Harper's beaksedge	LR	Limesink ponds and cypress savannas	No
80	Rhynchospora macra	Southern white beaksedge	S	Seepage or sphagnum bogs in frequently burned streamhead pocosins	Yes
81	Rhynchospora microcarpa	Southern beaksedge	LR	Limesink ponds, maritime grasslands, clay-lined Carolina bays	No
82	Rhynchospora pleiantha	Coastal beaksedge	S	Sandy margins of limesink ponds	No
83	Rhynchospora thornei	Thorne's beaksedge	S	Wet savannas	Yes
84	Sagittaria chapmanii	Chapman's arrowhead	S	Limesink ponds with drawdown	No
85	Sagittaria weatherbiana	Grassleaf arrowhead	S	Fresh to slightly brackish marshes, swamps and ponds	Yes
86	Schoenoplectus etuberculatus	Canby's bulrush	LR	On peat in depression ponds, in flowing blackwater streams	Yes
87	Scirpus lineatus	Drooping bulrush	LR	Low rich swamp forests over coquina limestone	Yes
88	Scleria baldwinii	Baldwin's nutrush	LR	Wet savannas associated with longleaf pine, pond pine, and pondcypress	Yes
89	Solidago leavenworthii	Leavenworth's goldenrod	LR	Savannas, clay-based Carolina bays, peaty seeps, pocosin borders	Yes
90	Solidago pulchra	Carolina goldenrod	S	Savannas	Yes
91	Solidago tortiflora	Twisted-leaf goldenrod	LR	Dry savannas and moist flatwoods	Yes
92	Solidago verna	Spring-flowering goldenrod	S	Moist pine savannas, lower slopes in sandhills, roadsides in pinelands	Yes
93	Solidago villosicarpa	Coastal goldenrod	S	Maritime, edge of coastal fringe evergreen forest in outer coastal plain	No

# Table 3.21a. Continued

Species Number	Scientific Name	Common Name	USFS Status <sup>a</sup>	Habitat Type	Habitat Present (Study Area)
94	Sphagnum cribrosum (=S. macrophyllum var. floridanum)	Florida peatmoss	S	Blackwater streams, ditches	Yes
95	Sphagnum fitzgeraldii	Fitzgerald's peatmoss	S	Pocosins and savannas	Yes
96	Sphagnum torreyanum	Giant peatmoss	LR	Millponds, beaver ponds	Yes
97	Spiranthes eatonii	Eaton's ladies'-tresses	LR	Wet savannas	Yes
98	Spiranthes lacinata	Lace-lip ladies'-tresses	LR	Wet savannas	No
99	Spiranthes longilabris	Giant spiral orchid	S	Wet savannas	Yes
100	Sporobolus pinetorum	Carolina dropseed	S	Wet savannas	No
101	Stylisma pickeringii var. pickeringii	Pickering's dawnflower	LR	Dry sandy roadbanks, sandhills	Yes
102	Teloschistes flavicans	Sunrise lichen	S	Maritime forest	No
103	Thalictrum macrostylum	Piedmont meadowrue	S	Bogs, wet woods, tidal freshwater marshes, associated with circumneutral soils and mafic outcrops over olivine	Yes
104	Tofieldia glabra	Carolina asphodel	S	Wet pine savannas and sandhill seeps, savanna-pocosin ecotones	Yes
105	Tridens chapmanii	Chapman's redtop	LR	Roadside, loamy sands of disturbed longleaf pine woodlands	Yes
106	Utricularia olivacea	Dwarf bladderwort	LR	Limesink ponds, beaver ponds	Yes
107	Xyris floridana (=X. difformis var. floridana)	Florida yellow-eyed grass	LR	Savannas	Yes
108	Xyris stricta	A yellow-eyed grass	LR	Savannas, depression ponds, depressional meadows, ditches	Yes

# Table 3.21b. USFS PETS Rare Animal Species for the Croatan National Forest (February 2012 List Update)

a.	Scientific Name	Common Name	USFS Status <sup>b</sup>	Habitat Type	Habitat Procont
Species Number			Status		(Study Area)
		M	AMMATS		
109	Condulura cristata	Star-nosed mole	FC	Moist meadows bogs swamps	No <sup>c</sup>
10,	pop. 1	(coastal plain population)		bottomlands	110
110	Corynorhinus rafinesquii macrotis	Rafinesque's big-eared bat	FC	Abandoned structures, caves, hollow trees, loose bark trees near wooded areas	Yes
111	Lasiurus intermedius	Northern yellow bat	FC	Roosts in Spanish moss and other thick vegetation near water, often in longleaf pine habitats	Yes
112	Myotis austroriparius	Southeastern myotis	FC	Roosts in buildings and hollow trees, forages near water	Yes
113	Neotoma floridana floridana	Eastern woodrat (coastal plain population)	FC	Lowland deciduous forest with dense palmetto cover, low wet areas, marsh	Yes
114	Puma concolor couguar	Eastern cougar	Е	Extensive forests and remote areas	No <sup>d</sup>
115	Sorex sp. 1	An undescribed shrew	FC	Early successional fields, possibly low pocosin	No <sup>c</sup>
116	Trichechus manatus	West Indian manatee	E	Warm waters of estuaries and river mouths	No
			BIRDS		
117	Ammodramus henslowii susurrans	Eastern Henslow's sparrow	FC	Clearcut pocosins, damp weedy fields	Yes
118	Botaurus lentiginosus	American bittern	FC	Freshwater or brackish marshes, lake and pond edges with emergent vegetation	No
119	Charadrius melodus	Piping plover	Т	Sandy upper beaches	No
120	Circus cyaneus	Northern harrier	FC	Marshes, meadows, grasslands	No
121	Dendroica virens waynei	Black-throated green warbler (coastal plain population)	FC	Nonriverine wetland forests, especially where white cedar or cypress are mixed with hardwoods	Yes
122	Falco peregrinus	Peregrine falcon	S	Cliffs, bay, sound, tidal flats, river mouth, herbaceous wetland	No
123	Gelochelidon nilotica	Gull-billed tern	FC	Coastlines, salt marshes, estuaries, sand flats on maritime islands	No
124	Haliaeetus leucocephalus	Bald eagle	S	Large bodies of water with mature trees for perching	Yes
125	Himantopus mexicanus	Black-necked stilt	FC	Fresh or brackish ponds	Yes

<sup>a</sup> Species numbering continued from Table 3.21a.
<sup>b</sup> E – Endangered; FC – Forest Concern; S – Sensitive; T – Threatened; T(S/A) – Threatened due to similarity of appearance.
<sup>c</sup> No documented occurrence in Craven, Carteret, or Jones Counties per USFS 2010, not carried forward for further evaluation.
<sup>d</sup> Eastern cougar is extirpated from North Carolina, not carried forward for further evaluation.

# Table 3.21b. Continued

	Scientific Name	ntific Name Common Name USFS Habitat Type						
er <sup>a</sup>			Status <sup>b</sup>	Present				
eci					(Study			
Sp Un					Area)			
~								
126	Hydroprogne caspia	Caspian tern	FC	Seacoasts, bays, estuaries, lakes,	No <sup>c</sup>			
120	11 jul oprogne cuspiu	Cuspian term	10	marshes, and rivers	110			
127	Laterallus jamaicensis	Black rail	FC	Salt, brackish, and freshwater marshes:	No			
	Zarer annus famaneenisis	2	10	pond borders, wet meadows, grassy	110			
				swamps				
128	Mycteria americana	Wood stork	Е	Freshwater or brackish marshes, swamps,	No <sup>c</sup>			
			_	lagoons, ponds, flooded fields, nests in				
				trees over water or on islands				
129	Passerina ciris ciris	Eastern painted bunting	FC	Maritime shrub thickets, forest edges	No			
130	Peucaea aestivalis	Bachman's sparrow	FC	Open pine woods with grassy cover	Yes			
	(=Ammodramus			of the first water with grand for the				
	aestivalis)							
131	Phalacrocorax auritus	Double-crested cormorant	FC	Lakes, ponds, rivers, lagoons, swamps,	No			
_			_	and coastal bays with scattered trees for				
				nesting				
132	Picoides borealis	Red-cockaded	Е	Pine savannas	Yes			
		woodpecker						
133	Plegadis falcinellus	Glossy ibis	FC	Forests or thickets on maritime islands	No			
134	Porphyrio martinica	Purple gallinule	FC	Freshwater ponds and rivers with floating	No			
	1 2	1 0		vegetation				
135	Sterna dougallii	Roseate tern	Е	Seacoasts, bays, estuaries, sand flats on	No			
				maritime islands				
		<b>REPTILES</b>	AND AMPI	HIBIANS				
136	Alligator	American alligator	T (S/A)	Fresh and brackish marshes, ponds, lakes,	Yes			
	mississippiensis			rivers, swamps				
137	Ambystoma tigrinum	Eastern tiger salamander	FC	Breeds in fish-free semi-permanent	No <sup>c</sup>			
				ponds; forages adjacent sandy pinelands				
138	Crotalus adamanteus	Eastern diamondback	FC	Pine flatwoods, savannas, pine-oak	Yes			
		rattlesnake		sandhills				
139	Eurycea	Dwarf salamander	FC	Pocosins, Carolina bays, pine flatwoods,	No <sup>c</sup>			
	quadridigitata			savannas, wetland habitats				
140	Heterodon simus	Southern hognose snake	FC	Sandy woods, particularly pine-oak	Yes			
				sandhills				
141	Lampropeltis getula	Outer Banks kingsnake	FC	Maritime forests, thickets, and grasslands	No			
	sticticeps			on the Outer Banks				
142	Malaclemys terrapin	Northern diamondback	FC	Coastal marshes, tidal flats, coves,	No <sup>c</sup>			
		terrapin		estuaries, lagoons				
143	Micrurus fulvius	Eastern coral snake	FC	Pine-oak sandhill, sandy flatwoods,	No <sup>c</sup>			
				maritime forests				
144	Necturus lewisi	Neuse River waterdog	S	Rivers and large streams in Neuse and	No			
				Tar drainages				
145	Nerodia sipedon	Carolina salt marsh	S	Seaside, estuaries	No			
<u> </u>	williamengelsi	snake						
146	Ophisaurus mimicus	Mimic glass lizard	S	Pine savannas	Yes			

<sup>a</sup> Species numbering continued from Table 3.21a.
<sup>b</sup> E – Endangered; FC – Forest Concern; S – Sensitive; T – Threatened; T(S/A) – Threatened due to similarity of appearance.
<sup>c</sup> No documented occurrence in Craven, Carteret, or Jones Counties per USFS 2010, not carried forward for further evaluation. <sup>d</sup> Eastern cougar is extirpated from North Carolina, not carried forward for further evaluation.

# Table 3.21b. Continued

es er <sup>a</sup>	Scientific Name	Common Name	non Name USFS Habitat Type Status <sup>b</sup>					
Speci Numb					(Study Area_			
147	Pituonhis	Northern pine snake	FC	Dry and sandy woods mainlyin pine/oak	Vas			
147	r uuopnis melanoleucus	Normern pine snake	гC	sandbills	105			
	melanoleucus			Suitemins				
148	Rana capito	Carolina gopher frog	S	Dry turkey oak-pine associations, sandy areas in pine savannas	Yes			
149	Rana sylvatica pop.3	Wood frog (coastal plain population)	FC	Mesic to moist hardwood forests	No			
150	Seminatrix pygaea	Black swamp snake	FC	Lush vegetation of ponds, ditches, sluggish streams	Yes			
		]	INSECTS					
151	Acronicta perblanda	Cypress daggermoth	FC	Cypress swamps	Yes			
152	Agrotis carolina	A dart moth	FC	Open longleaf pine or longleaf pine-oak savanna with pyxie-moss	Yes			
153	Amblyscirtes alternata	Dusky roadside skipper	FC	Open grassy pine flatwoods, savannas, sandhill ridges	Yes			
154	Amercaenis ridens	A mayfly	FC	Black River	No			
155	Apamea mixta	A noctuid moth	FC	Savannas, wet meadows	No <sup>c</sup>			
156	<i>Apantensis</i> sp. 1 nr. <i>carlotta</i>	A tiger moth	FC	Savannas and sandhill seeps	Yes			
157	Atrytone arogos arogos	Arogos skipper	S	Mesic to boggy reedgrass savannas	Yes			
158	Atrytonopsis loammi	Loammi skipper	S	Grassy areas near the coast, host plants presumed to be Andropogon grasses	Yes			
159	Atrytonopsis sp. 1	An undescribed skipper	FC	Dunes and sandy flats	No			
160	Baetopus trishae	A mayfly	FC	No locality data available	No			
161	Beraea gorteba	A caddisfly	FC	No locality data available	No			
162	Calephelis virginiensis	Little metalmark	FC	Grassy fields, savannas, marshes	Yes			
163	Callophrys irus	Frosted elfin	FC	Grassy openings or burn scars in barrens and savannas, ROW and powerlines	Yes			
164	Chlorochroa dismalia	Dismal swamp stink bug	FC	Canebrakes	Yes			
165	Cicindela lepida	Ghost tiger beetle	FC	Sand dunes along northern coast	No			
166	Eotettix pusillus	Little eastern grasshopper	FC	Sandhills (wet swales?)	Yes			
167	Erynnis martialis	Mottled duskywing	FC	Upland woods and wooded edges; host plant – New Jersey tea	Yes			
168	Euphyes berryi	Berry's skipper	FC	Wet prairies, marshes, savannas with pitcher plants	Yes			
169	Euphyes bimacula	Two-dotted skipper	FC	Wet savannas, bogs, sedge areas near wet woods	Yes			
170	Euphyes dukesi	Duke's skipper	S	Sedge patches in forested swamps, shaded ditches, woods edge	Yes			
171	Faronta aleada	A noctuid moth	FC	Maritime grasslands	No			

<sup>a</sup> Species numbering continued from Table 3.21a.
<sup>b</sup> E – Endangered; FC – Forest Concern; S – Sensitive; T – Threatened; T(S/A) – Threatened due to similarity of appearance.
<sup>c</sup> No documented occurrence in Craven, Carteret, or Jones Counties per USFS 2010, not carried forward for further evaluation.

<sup>d</sup> Eastern cougar is extirpated from North Carolina, not carried forward for further evaluation.

# Table 3.21b. Continued

Species Number <sup>a</sup>	Scientific Name	Common Name	USFS Status <sup>b</sup>	Habitat Type	Habitat Present (Study Area)
172	Hemipachnobia subporphyrea	Venus flytrap cutworm moth	S	Large stands of Venus flytraps in wet pine savannas, around pocosins	Yes
173	Hesperia attalus slossonae	Dotted skipper	S	Xeric natural communities on sterile white sands (or disturbances within)	No
174	Hydroperla phormidia	A stonefly	FC	Lumber River and Pee Dee River	No
175	Hypomecis buchholzaria	Buchholz's gray	FC	Fire-maintained glades and pine barrens, xeric scrub-oak	No
176	Melanoplus attenuatus	Slender-bodied melanoplus	S	Wet swales in pine woods	Yes
177	Melanoplus nubilus	A short-winged melanoplus	S	Flatwoods, savannas, sandhill seeps	Yes
178	Papilio cresphontes	Giant swallowtail	FC	Primarily coastal in maritime forests or thickets	No
179	Perlesta bjostadi	A stonefly	FC	Little River near Lillington	No
180	Perlesta leathermani	A stonefly	FC	Little River, Lumber River, Jordan Creek	No
181	Plauditus cestus	A mayfly	FC	No locality data	No
182	Pteronarcy comstocki	Spiny salmonfly	FC	No locality data	No
183	Pyreferra ceromatica	Anointed sallow moth	FC	Flatwoods and pocosins, ecotones between mesic woodland and bottomlands	Yes
184	Spartiniphaga carterae	Carter's noctuid moth	S	Pine barren reed grass, edges of pocosins and wet wiregrass savannas	Yes
185	Triacanthagyna trifida	Phantom darner	FC	Slow-flowing streams	Yes
		FRESHWATER FISH, M	OLLUSKS,	AND CRUSTACEANS	
186	Acipenser brevirostrum	Shortnose sturgeon	E	Brackish water of large rivers and estuaries; spawns in freshwater areas	No
187	Acipenser oxyrhynchus	Atlantic sturgeon	S	Coastal waters, estuaries, large rivers	No
188	Ambloplites cavifrons	Roanoke bass	FC	Streams in Neuse and Tar systems	No
189	Ferrissia hendersoni	Blackwater ancylid	FC	Mainly margins of Carolina Bay lakes	No <sup>c</sup>
190	Fundulus confluentus	Marsh killifish	FC	Fresh to brackish waters along coast	No
191	Fundulus luciae	Spotfin killifish	FC	Ponds and pools along coast	No
192	Lampetra aepyptera	Least brook lamprey	FC	Tar and Neuse drainages	No <sup>c</sup>
193	Lasmigona subviridus	Green floater	S	Tar, Neuse, and Cape Fear systems	No <sup>e</sup>
194	Lynceus gracilicornis	Graceful clam shrimp	FC	Temporary ponds, pools, and ditches	Yes
195	Notropis bifrenatus	Bridle shiner	FC	Stream near lower Neuse River	Yes
196	Noturus furiosus	Carolina madtom	S	Tar and Neuse drainages, small to medium rivers	No
197	Sphaerium simile	Grooved fingernail clam	FC	White Oak River	No
198	Strophitus undulatus	Creeper	FC	Tar. Neuse, Cape Fear, and other systems	No <sup>e</sup>

<sup>a</sup> Species numbering continued from Table 3.21a.
 <sup>b</sup> E – Endangered; FC – Forest Concern; S – Sensitive; T – Threatened; T(S/A) – Threatened due to similarity of appearance.
 <sup>c</sup> No documented occurrence in Craven, Carteret, or Jones Counties per USFS 2010, not carried forward for further evaluation.

<sup>d</sup> Eastern cougar is extirpated from North Carolina, not carried forward for further evaluation.

There are 73 USFS rare plant species and 39 USFS rare animal species for which potentially suitable habitat was identified in at least one of the detailed study corridors or within the NFS lands that will be isolated from contiguous NFS lands by a corridor. Potential effects to these species are discussed in Chapter 4, Section 4.1.9.3.

#### **Chapter 4. Environmental Consequences**

#### 4.1 Direct Effects

#### 4.1.9.3 Protected Species

#### 4.1.9.3.3 U.S. Forest Service Rare Species

Since all the detailed study alternatives cross National Forest System (NFS) lands, a special use permit from the U.S. Forest Service (USFS) will be required to provide the lands for the proposed project. The USFS must consider impacts to USFS rare species before granting a special use permit for Croatan National Forest (CNF) lands to be converted to highway use. There are 35 USFS rare plant species and 51 USFS rare animal species included on the USFS rare species list (see Tables 3.21a and 3.21b) that were dropped from consideration because no suitable habitat (sandhills, marl outcrops, ocean beach, tidal swamps and marshes, maritime forest, etc.) is present within or in close proximity to any of the study alternatives. No documented occurrences of these species are present within or in close proximity to any of the study alternatives. Table 4.9a lists the 73 USFS rare plant species and Table 4.9b lists the 39 USFS rare animal species that have documented occurrences or for which potential general habitat type is present in at least one of the alternatives.

							Potent	ial Effec	ts		
			nal rds	-			Docur	nented o	n NFS		
а			Lar NF	Docu	mented of	on NFS	Lar	nds betw	een	ct	act
ber		s p	an ]		s within Iternativ	Project	Proje	ct Alterr	native	npa	du
nm		tatu	OH COH	1			and E	xisting U	S 70 °	ct Ir	set I
s N	Common Name	SS	e Ci	-	7	33	-	7	33	hired	dire
scie		JSF	ente yste i the	ive	ive	ive	ive	ive	ive	al D	1 In
Spe			umo st S thir	mat	nat	mat	mat	mat	mat	ntia	ntia
			Joc Tore Wi	ulter	ulter	ulter	ulter	ulter	ulter	Pote	otei
			II	A	₹	A	₹	₹	₹	_	4
50	Rough-leaved loosestrife	Е	Yes	No	No	No	No	No	No	No	No
9	Many-flower grass pink	S	Yes	No	No	No	No	No	No	No	No
10	Savanna campylopus	S	No	No	No	No	No	No	No	No	No
18	Small spreading pogonia	S	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
29	Venus flytrap	S	Yes	No	No	No	No	No	No	No	No
36	Hall's pocket moss	S	Yes	No	No	No	No	No	No	No	No
44	Pondspice	S	Yes	No	No	No	No	No	No	No	No
45	Boykin's lobelia	S	No	No	No	No	No	No	No	No	No
48	Raven's seedbox	S	Yes	No	No	No	No	No	No	No	No
51	Loomis's loosestrife	S	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
52	Birds-in-a-nest (Carolina bogmint)	S	No	No	No	No	No	No	No	No	No
57	Narrowleaf cowlily	S	No	No	No	No	No	No	No	No	No
59	Piedmont cowbane	S	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
61	Carolina grass-of-parnassus	S	No	No	No	No	No	No	No	No	No
68	Pineland plantain	S	No	No	No	No	No	No	No	No	No
69	Yellow fringeless orchid	S	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes
71	Hooker's milkwort	S	Yes	No	No	No	Yes	Yes	Yes	No	Yes
78	Short-bristled beaksedge	S	Yes	No	No	No	Yes	Yes	Yes	No	Yes
80	Southern white beaksedge	S	Yes	No	No	No	No	No	No	No	No
83	Thorne's beaksedge	S	No	No	No	No	No	No	No	No	No
85	Grassleaf arrowhead	S	No	No	No	No	No	No	No	No	No
90	Carolina goldenrod	S	Yes	No	No	No	Yes	Yes	Yes	No	Yes
92	Spring-flowering goldenrod	S	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
94	Florida peatmoss	S	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No <sup>d</sup>	Yes
95	Fitzgerald's peatmoss	S	Yes	Yes	Yes	Yes	No	No	No	Yes	No
99	Giant spiral orchid	S	Yes	No	No	No	No	No	No	No	No
103	Piedmont meadowrue	S	Yes	No	No	No	No	No	No	No	No
104	Carolina asphodel	S	Yes	No	No	No	No	No	No	No	No
2	Branched gerardia	LR	Yes	No	No	No	No	No	No	No	No
3	Tall bentgrass	LR	Yes	No	No	No	No	No	No	No	No
4	Bog bluestem	LR	Yes	No	No	No	Yes	Yes	Yes	No	Yes
6	Savanna milkweed	LR	No	No	No	No	No	No	No	No	No
7	Stalked milkweed	LR	Yes	No	No	No	No	No	No	No	No
12	Widow sedge	LR	Yes	No	No	No	No	No	No	No	No
13	Calcium-fleeing sedge	LR	No	No	No	No	No	No	No	No	No
14	Emmon's sedge	LR	Yes	No	No	No	No	No	No	No	No
15	Hop-like sedge	LR	Yes	No	No	No	No	No	No	No	No
16	LeConte's thistle	LR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
20	Spring coral-root	LR	No	No	No	No	No	No	No	No	No

# Table 4.9a. USFS Rare Plant Species for which Potential General Habitat Type Present

<sup>a</sup> Species number corresponds with species number presented in Chapter 3, Table 3.21a. <sup>b</sup> USFS Status: E – Endangered; LR – Locally Rare; S – Sensitive; T – Threatened; T S/A – Threatened due to Similarity of Appearance. <sup>c</sup> Documentation based on data provided by USFS, NCNHP, and occurrences documented during field surveys. <sup>d</sup> The occurrence within the project alternatives is not directly affected based on bridging of the occurrence.

Table 4.9a. Continued.

							Poten	tial Effec	ets		
			nal ids	-			Documented on NFS				
63			Lar NFI	Docu	mented of	on NFS	La	nds betw	een	ct	act
ber		P P	an ]		s within Iternativ	Project	Proje	ect Alterr	native	npa	du
um		tatu	OT OT	1			and E	xisting U	JS 70 °	t Ir	ct I
N S	Common Name	SS	e Ci	1	2	3	-	2	3	irec	dire
ecie		JSF	ente yst	ive	ive	ive	ive	ive	ive		l In
Sp			um st S thir	nat	nat	nat	nat	nat	nat	antia	ntia
			ore vie vi	lter	lteı	lteı	lteı	lteı	lteı	Pote	oteı
			цц	A	A	A	A	A	A	I	Р
21	Beadle's coreopsis	LR	No	No	No	No	No	No	No	No	No
22	Carolina sunrose	LR	Yes	No	No	No	No	No	No	No	No
25	Spindle-fruited witch grass	LR	No	No	No	No	No	No	No	No	No
27	Hidden-flowered witch grass	LR	Yes	No	No	No	No	No	No	No	No
28	Eaton's witch grass	LR	Yes	No	No	No	Yes	No	Yes	No	Yes
34	Seven-angled pipewort	LR	Yes	No	No	No	No	No	No	No	No
38	Comfortroot	LR	Yes	No	No	No	No	No	No	No	No
41	Catchfly cutgrass	LR	No	No	No	No	No	No	No	No	No
42	Lejeunea bermudiana (a liverwort)	LR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
49	Globe-fruit seedbox	LR	No	No	No	No	No	No	No	No	No
53	Florida adder's mouth	LR	Yes	No	No	No	Yes	Yes	Yes	No	Yes
58	Shortleaf basket grass	LR	No	No	No	No	No	No	No	No	No
62	Mudbank crown grass	LR	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
63	Spoonflower	LR	Yes	No	No	No	No	No	No	No	No
64	Hairy smartweed	LR	Yes	No	No	No	No	No	No	No	No
65	Small butterwort	LR	Yes	No	No	No	No	No	No	No	No
66	Plagiochila ludoviaciana (a liverwort)	LR	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes
67	Plagiochila miradorensis var. miradorensis (a liverwort)	LR	No	No	No	No	No	No	No	No	No
70	Snowy orchid	LR	Yes	No	No	No	Yes	Yes	Yes	No	Yes
72	Shadow-witch	LR	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes
73	Awned mountain-mint	LR	Yes	No	No	No	No	No	No	No	No
75	Dwarf live oak	LR	Yes	No	No	No	No	No	No	No	No
86	Canby's bulrush	LR	Yes	No	No	No	No	No	No	No	No
87	Drooping bulrush	LR	Yes	No	No	No	No	No	No	No	No
88	Baldwin's nutrush	LR	Yes	No	No	No	No	No	No	No	No
89	Leavenworth's goldenrod	LR	Yes	No	No	No	No	No	No	No	No
91	Twisted-leaf goldenrod	LR	No	No	No	No	No	No	No	No	No
96	Giant peatmoss	LR	Yes	No	No	No	No	No	No	No	No
97	Eaton's ladies'-tresses	LR	Yes	No	No	No	Yes	Yes	Yes	No	Yes
101	Pickering's dawnflower	LR	No	No	No	No	No	No	No	No	No
105	Chapman's redtop	LR	No	No	No	No	No	No	No	No	No
106	Dwarf bladderwort	LR	No	No	No	No	No	No	No	No	No
107	Florida yellow-eyed grass	LR	No	No	No	No	No	No	No	No	No
108	A yellow-eyed grass	LR	Yes	No	No	No	No	No	No	No	No
	Total Species:	73	51	8	11	9	19	17	19	11	19

<sup>a</sup> Species number corresponds with species number presented in Chapter 3, Table 3.21a. <sup>b</sup> USFS Status: E – Endangered; LR – Locally Rare; S – Sensitive; T – Threatened; T S/A – Threatened due to Similarity of Appearance. <sup>c</sup> Documentation based on data provided by USFS, NCNHP, and occurrences documented during field surveys. <sup>d</sup> The occurrence within the project alternatives is not directly affected based on bridging of the occurrence.

							Poten	tial Effec	ets		
			onal inds	Dem		NEC	Docur	nented o	n NFS		t
er a		٩	Natio DLa	Land	mented of s within	Project	La	nds betw	een	pact	Ipac
umbe		atus	om N NFS oatar	A	lternativ	/e <sup>c</sup>	Proje and E	ct Alterr	iative IS 70 °	t Imj	t Im
s Nu	Common Name	S Sta	d fro em () Cro			-	und E	aisting c		irect	lirec
ecie		JSF	ente yste i the	ve 1	ve 2	ve 3	ve 1	ve 2	ve 3	al D	l Inc
Sp			cumo est S ithir	nati	nati	nati	nati	nati	nati	entia	ntia
			Doc Fore W	Alter	Alter	Alter	Alter	Alter	Alter	Pot	Pote
			Mar	nmole	7	7	7	'	`		
110	<b>R</b> afinesque's hig-eared hat <sup>d</sup>	FC	Yes	Ves	Ves	Ves	Ves	Ves	Ves	Ves	Ves
111	Northern vellow bat	FC	No	No	No	No	No	No	No	No	No
112	Southeastern myotis	FC	Yes	No	No	No	Yes	Yes	Yes	No	Yes
113	Eastern woodrat (coastal plain	FC	No	No	No	No	No	No	No	No	No
	population)	ПС	INO DE	nda	NU	NO	NU	NU	NU	NO	NO
132	Red-cockaded woodpecker <sup>e</sup>	F	Ves	Ves	Ves	Ves	Ves	Ves	Vos	Ves	Ves
124	Bald eagle	S	Yes	No	No	No	No	No	No	No	No
117	Eastern Henslow's sparrow	FC	Yes	No	No	No	No	No	No	No	No
121	Black-throated green warbler (coastal	FC	N7	¥7.	¥7.		\$7		<b>X</b> 7	<b>X</b> 7	<b>X</b> 7
	plain population)	FC	Yes	Yes	Yes	Yes	Y es	Y es	Yes	Yes	Yes
125	Black-necked stilt	FC	No	No	No	No	No	No	No	No	No
130	Bachman's sparrow	FC	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
120			leptiles and	l Amphi	bians						
130	American alligator	(S/A)	Yes	No	No	No	No	No	No	No	No
146	Mimic glass lizard	S	Yes	No	No	No	No	No	No	No	No
148	Carolina gopher frog	S	Yes	No	No	No	No	No	No	No	No
138	Eastern diamondback rattlesnake	FC	Yes	No	No	No	No	No	No	No	No
140	Southern hognose snake	FC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
147	Northern pine snake	FC	No	No	No	No	No	No	No	No	No
150	Black swamp snake	FC	Yes	No	No	No	No	No	No	No	No
167		~	Ins	sects							
157	Arogos skipper	S	Yes	No	No	No	No	No	No	No	No
138	Duke's skipper	5	No No	No No	No No	No	No No	No	No No	N0 No	N0 No
172	Venus flytran cutworm moth	5	NO Vec	No	No	No	No	No	No	No	No
172	Slender-bodied melanoplus	S	No	No	No	No	No	No	No	No	No
178	A short-winged melanoplus	S	No	No	No	No	No	No	No	No	No
184	Carter's noctuid moth	S	No	No	No	No	No	No	No	No	No
151	Cypress daggermoth	FC	No	No	No	No	No	No	No	No	No
152	Agrotis carolina (a dart moth)	FC	Yes	No	No	No	No	No	No	No	No
153	Dusky roadside skipper	FC	Yes	No	No	No	Yes	Yes	Yes	No	Yes
156	Apantensis sp. 1 nr. carlotta (a tiger moth)	FC	Yes	No	No	No	No	No	No	No	No
162	Little metalmark	FC	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes
163	Frosted elfin	FC	No	No	No	No	No	No	No	No	No
164	Dismal swamp stink bug	FC	Yes	No	No	No	No	No	No	No	No
166	Little eastern grasshopper	FC	No	No	No	No	No	No	No	No	No

### Table 4.9b. USFS Rare Animal Species for which Potential General Habitat Type Present

<sup>a</sup> Species number corresponds with species number presented in Chapter 3, Table 3.21b. <sup>b</sup> USFS Status: E – Endangered; FC – Forest Concern; S – Sensitive; T – Threatened; T (S/A) – Threatened due to Similarity of Appearance.

<sup>c</sup> Documentation based on data provided by USFS, NCNHP, and occurrences documented during field surveys.

<sup>d</sup> Occurrence on NFS lands based on NCNHP record for an unspecified observation in Craven County.

<sup>e</sup> Potential direct effects for red-cockaded woodpecker only to foraging habitat, no cavity trees affected.

Table 4.9b. Continued.

							Potent	ial Effec	ets		
Number <sup>a</sup>	Courses North	Status <sup>b</sup>	rom National (NFS) Lands roatan NF °	Doct	umented o ls within Alternativ	on NFS Project /e <sup>c</sup>	Docur Lar Proje and E	nented o nds betw ct Alterr xisting U	n NFS een native JS 70 <sup>c</sup>	ct Impact	ect Impact
Species 1	Common Name	USFS 5	Documented f Forest System within the C	Alternative 1	Alternative 2	Alternative 3	Alternative 1	Alternative 2	Alternative 3	Potential Dire	Potential Indir
167	Mottled duskywing	FC	No	No	No	No	No	No	No	No	No
168	Berry's skipper	FC	Yes	No	No	No	Yes	Yes	Yes	No	Yes
169	Two-dotted skipper	FC	Yes	No	No	No	No	No	No	No	No
183	Anointed sallow moth	FC	Yes	No	No	No	No	No	No	No	No
185	Phantom darner	FC	No	No	No	No	No	No	No	No	No
	F	Freshwate	er Fish, Mo	llusks,	& Crusta	aceans					
194	Graceful clam shrimp	FC	No	No	No	No	No	No	No	No	No
195	Bridle shiner	FC	Yes	No	No	No	No	No	No	No	No
	Total Species:	39	25	4	6	5	8	8	9	6	9

<sup>a</sup> Species number corresponds with species number presented in Chapter 3, Table 3.21b.

<sup>b</sup> USFS Status: E – Endangered; FC – Forest Concern; S – Sensitive; T – Threatened; T (S/A) – Threatened due to Similarity of Appearance.

<sup>c</sup> Documentation based on data provided by USFS, NCNHP, and occurrences documented during field surveys.

<sup>d</sup> Occurrence on NFS lands based on NCNHP record for an unspecified observation in Craven County.

<sup>e</sup> Potential direct effects for red-cockaded woodpecker only to foraging habitat, no cavity trees affected.

Potential effects to the three species listed under the Endangered Species Act, rough-leaved loosestrife, red-cockaded woodpecker, and American alligator, have been discussed previously under Federally-Protected Species in Chapter 4, Section 4.1.9.3.1 and are not addressed separately here.

There are 61 of the 73 USFS rare plant species and 33 of the 39 USFS rare animal species included in Tables 4.9a and 4.9b due to the presence of potential habitat identified for these species in at least one of the alternates, but for which no documented occurrences of these species are present in any of the alternates, or in many cases on NFS lands. The field surveys conducted in 2003-2004 included a floristic inventory that documented several new plant species records for the CNF, however, no occurrences of these 61 USFS rare plant species were identified at that time. Animal surveys that included light trapping for moths, mist netting for bats, and terrestrial surveys for reptiles, amphibians, and birds were conducted in 2005 and did not document any occurrences of these 33 USFS rare animal species. Additional surveys were completed during 2012 for USFS rare plant species identified as having suitable habitat within Alternative 3. No additional surveys were completed in 2012 for Alternative 1 or Alternative 2 nor were additional surveys conducted for USFS rare animal species within any of the alternates. The amount of affected potentially suitable habitat for these species is very small in comparison to the amount of potentially suitable habitat available on the CNF. It is unlikely that the loss of habitat as a result of

constructing any of the alternates will result in a loss of viability for these 61 USFS rare plant and 33 USFS rare animal species on the CNF.

Twelve USFS rare plant species and six USFS rare animal species have documented occurrences in at least one of the alternates and are being evaluated for potential direct effects (Table 4.10). The number of documented occurrences on NFS lands is also presented. Documented occurrences of USFS rare species are derived from data provided by the USFS and the N.C. Natural Heritage Program (NCNHP), supplemented by ESI survey data for species not tracked by NCNHP. Occurrences of rare species tracked in the NCNHP database are referred to as Element Occurrences (EOs).

	Common Name	USFS Status <sup>b</sup>	National Forest		Direct Effects								
Species Number <sup>a</sup>			System (NFS) Lands within the Croatan NF		Alternative 1			Alternative 2			Alternative 3		
			Number of Occurrences	Occurrence coverage <sup>d</sup> (acres)	Potential Habitat <sup>c</sup> (acres)	Number of Occurrences	Occurrence Coverage <sup>d</sup> (acres)	Potential Habitat <sup>c</sup> (acres)	Number of Occurrences	Occurrence Coverage <sup>d</sup> (acres)	Potential Habitat <sup>c</sup> (acres)	Number of Occurrences	Occurrence Coverage <sup>d</sup> (acres)
Plants													
18	Small spreading pogonia	S	4	NA	107	1	NA	132.9	1	NA	154.9	1	NA
51	Loomis's loosestrife	S	>50	NA	117.3	1 <sup>e</sup>	NA	144.5	1 <sup>e</sup>	NA	165.2	1 <sup>e</sup>	NA
59	Piedmont cowbane	S	4	5.0	4.9	0	0	7.9	1	1.1	7.9	1	1.1
69	Yellow fringeless orchid	S	8	4,781.3	4.9	0	0	7.9	1	< 0.1	7.9	0	0
92	Spring-flowering goldenrod	S	36	320.2	168.8	6	8.1	191.8	8	9.4	220.3	7	23.5
94	Florida peatmoss	S 3 Bridging planned for the area of the occurrence crossed by all 3 alternatives would result in no direct impacts anticipated.											
95	Fitzgerald's peatmoss	S	11	NA	4.9	1	NA	7.9	1	NA	7.9	1	NA
16	LeConte's thistle	LR	12	28.0	4.9	1	0.2	7.9	3	1.9	7.9	3	1.9
42	Lejeunea bermudiana (a liverwort)	LR	8	623.5	6.6	3	0.8	4.1	1	0.5	9.4	3	0.6
62	Mudbank crown grass	LR	4	5.9	1.1	0	0	2	2	1.7	2.1	2	1.7
66	Plagiochila ludoviaciana (a liverwort)	LR	2	0.1	6.6	1	0.1	4.1	0	0	9.4	0	0
72	Shadow-witch	LR	10	125.4	6.6	0	0	4.1	1	2.5	9.4	0	0
					Mammal	s							
110	Rafinesque's big-eared bat	FC	1	64,914.0	6.6	1	6.6	4.1	1	4.1	9.4	1	9.4
Birds													
132	Red-cockaded woodpecker	E Direct effects for red-cockaded only to foraging habitat, no cavity trees affected. A detailed analysis of affects to red-cockaded woodpecker is presented in Section 4.1.9.3.1 (Federally Protected Species).											
121	Black-throated green warbler (coastal plain population)	FC	7	4,323.0	26.7	1	13.7	32.3	1	13.7	30.3	1	13.7
130	Bachman's sparrow	FC	18	797.7	102.1	0	0	125	2	1.1	147	2	0.9
Reptiles and Amphibians													
140	Southern hognose snake	FC	4	11,111.0	65.3	1	13.0	87.3	1	22.4	113.8	1	17.9
Insects													
162	Little metalmark	FC	7	2,936.0	4.9	0	0	7.9	1	1.6	7.9	0	0
	Total Number of Occurrences <sup>f</sup>	:	>186			17			26			24	

Table 4.10. Summary of USFS Rare Species Directly Affected

<sup>a</sup> Species number corresponds with species number presented in Chapter 3, Tables 3.21a and 3.21b. <sup>b</sup> USFS Status: E – Endangered; FC – Forest Concern; LR – Locally Rare; S – Sensitive.

<sup>c</sup> Potential habitat based on vegetative communities presented in Chapter 3, Section 3.5.2.1.

<sup>d</sup> Occurrence coverage area based on NCNHP data base records and/or additional information provided by USFS.

<sup>e</sup> One or more EO's not defined, dependably found in suitable habitat.

<sup>e</sup> Exclusive of red-cockaded woodpecker, which is treated under a separate analysis.

Twelve USFS rare plant species and six USFS rare animal species have documented occurrences in at least one of the alternates. Potential effects to red-cockaded woodpecker have been addressed previously under Federally-Protected Species in Chapter 4, Section 4.1.9.3.1 and are not addressed separately here. Direct effects to these twelve USFS rare plant species and remaining five USFS rare animal species are discussed below. Seven of the USFS rare plant species and none of the USFS rare animal species are listed as Sensitive (S) on NFS lands, and the remaining five USFS rare plant species and five USFS rare animal species as listed as Locally Rare (LR) or Forest Concern (FC) on NFS lands.

#### Small Spreading Pogonia (Cleistesiopsis bifaria [=Cleistes bifaria]) - S

This species is known from four occurrences documented on NFS lands in the CNF. These occurrences each consist of a few widely scattered individuals but areas of occupied habitat have not been established for these occurrences. This species is not tracked by NCNHP and occurrence data were not available from the USFS so the distribution of this species on NFS lands within the project alternatives is based on surveys conducted by ESI. One occurrence of this species would be directly affected by all three alternatives.

#### Loomis's Loosestrife (Lysimachia loomisii) - S

This species is known from more than 50 occurrences on NFS lands in the CNF (personal communication, G. Kauffman, USFS). This species is not tracked by NCNHP and specific occurrence data were not available from the USFS so the distribution of this species on NFS lands within the CNF is based on the habitat evaluation conducted by ESI. No documented occurrences of this species are mapped within any of the three alternatives. However, incidental observations of this species within the powerline corridors, wet pine flatwoods, and open areas within the streamhead pocosins during the 2003-2004 field surveys indicate that this species is relatively common and is presumed present in suitable habitat within all three alternatives. This species was not evaluated as a USFS rare species at that time and detailed locations and population estimates are not available.

#### Piedmont Cowbane (Oxypolis ternata) – S

This species is known from nine occurrences documented on NFS lands in the CNF. This species is not tracked by NCNHP and occurrence data were not available from the USFS so the distribution of this species on NFS lands within the project alternatives is based on surveys conducted by ESI. One occurrence would be directly affected by Alternative 2 and Alternative 3. Population estimates are not available for this occurrence. This occurrence covers approximately 5.0 acres and approximately 1.1 acre of this occurrence would be directly affected by Alternative and Alternative 3. Alternative 1 would not directly affect this species.

#### Yellow Fringeless Orchid (Platanthera integra) - S

This species is known from eight occurrences documented on NFS lands in the CNF, but USFS reports that one roadside occurrence is apparently extirpated and one other may be extirpated from a disturbed borrow site in a savanna. One occurrence of this species would be directly affected by Alternative 2. This occurrence is mapped as covering approximately 6.6 acres and is estimated to have approximately 21

individual plants distributed within two mapped polygons that are 1.9 acres and 4.6 acres in size. One mapped polygon (1.9 acres) would be directly affected by Alternative 2. Less than 0.1 acre (<0.1%) of this occurrence would be directly affected by Alternative 2. Neither Alternative 1 nor Alternative 3 directly affects this species.

#### Spring-flowering Goldenrod (Solidago verna) - S

NCNHP records, which have been updated to include NCDOT's pre-2012 survey efforts, indicated spring-flowering goldenrod is known from 36 EOs that are mapped as covering approximately 320.2 acres of occupied habitat documented on NFS lands in the CNF. Recent data provided by the USFS shows that 6 of these occurrences (mapped as covering 4 acres) have not been relocated during recent survey attempts. Previous estimates for NFS lands in the CNF range from 5,663 to 14,738 individual plants within an estimated 320.2 acres of occupied habitat.

A detailed evaluation was completed in 2012 for spring-flowering goldenrod in mapped polygons that would be directly affected by Alternative 3. For this study 1,174 individual plants were counted within 4.8 acres of occupied habitat directly sampled. The areas directly sampled included portions of occupied habitat in powerline rights-of-way and roadsides, as well as in forested habitats. The results of the direct counts from the sampled areas were used to estimate the number of individuals present within the US 70 Havelock Bypass study area. Within the US 70 Havelock Bypass study area, there are 138 acres of occupied habitat that include an estimated 94,000 individual spring-flowering goldenrod plants.

- Alternative 1 would directly affect 8.1 acres of occupied habitat on NFS lands and estimated 5,400 individual spring-flowering goldenrod plants. This impact represents approximately 6% of occupied habitat within NFS lands within the Alternatives study area and 6% of the estimated population within NFS lands within the Alternatives study area.
- Alternative 2 would directly affect 9.4 acres of occupied habitat on NFS lands and estimated 6,300 individual spring-flowering goldenrod plants. This impact represents approximately 7% of occupied habitat within NFS lands within the Alternatives study area and 7% of the estimated population within NFS lands within the Alternatives study area.
- Alternative 3 would directly affect 23.5 acres of occupied habitat on NFS lands and estimated 11,400 individual spring-flowering goldenrod plants. This impact represents approximately 17% of occupied habitat within NFS lands within the Alternatives study area and 12% of the estimated population within NFS lands within the Alternatives study area.

#### Florida Peatmoss (Sphagnum cribrosum) - S

This species is known from three occurrences documented on NFS lands in the CNF. The 2012 evaluation documented that the occurrence of this species crossed by all three alternatives extends outside the study area and is more extensive upstream of the alternatives study area. It is not anticipated that any of the alternatives would directly affect the occurrence crossed by the alternatives based on bridging proposed in the area of the ditch in which it occurs and no hydrological alterations proposed for the ditch.

#### Fitzgerald's Peatmoss (Sphagnum fitzgeraldii) - S

This species has been recently relocated by USFS in some historical sites as well as new sites across the CNF and is likely more common than previously determined. This species is known from eleven occurrences documented on NFS lands in the CNF. One occurrence of this species would be directly affected by all three alternatives. Areal extent and population estimates are not available for this occurrence.

#### LeConte's Thistle (Cirsium lecontei) - LR

There are a total of 12 occurrences recorded by NCNHP for this species on NFS lands in the CNF, of which one is an occurrence encompassing seven of the other documented EOs. A field review of these EOs during the 2012 growing season determined that four EOs are considered to be historic occurrences either with no suitable habitat present or vague location descriptions that may not be on NFS lands. The remaining eight distinct EOs were observed to support suitable habitat for this species and LeConte's thistle was observed to be present associated with four of these EOs. One occurrence would be directly affected by all three alternatives in its entirety. This occurrence is mapped as covering approximately 0.2 acre and approximately 31 individual stems were observed distributed within three occupied habitat polygons in 2005. No individuals were observed within these three polygons during the 2012 field review. One separate additional occurrence that is composed of two polygons would be directly affected by Alternative 2 and Alternative 3. Alternative 1 would not directly affect this occurrence. This occurrence is mapped as covering a total of approximately 8.5 acres and approximately 21 individual stems were observed in 2009 distributed within two polygons that are mapped as approximately 8.4 acres and 0.1 acre in size, and 8 individual stems were observed within these polygons during the 2012 field review. Approximately 1.7 acres (20%) of the 8.4 acre polygon would be directly affected by Alternative 2 and Alternative 3.

#### A Liverwort (Lejeunea bermudiana) - LR

NCDOT surveys in 2012 resulted in documentation of two new occurrences for this species on NFS lands in the CNF, including one representing a new watershed, Island Creek. This species is now known from eight occurrences documented within four watersheds (Deep Swamp, Island Creek, Tucker Creek, and Southwest Prong Slocum Creek) on NFS lands in the CNF. This species was observed in three watersheds during a field review during the 2012 growing season. The occurrence in Deep Swamp is a vague historic record that could not be verified and may not be on NFS lands. One occurrence in the Tucker Creek watershed would be directly affected in its entirety by all three alternatives. Approximately 0.5 acre of habitat identified for this occurrence, with a total coverage by this species consisting of a few square inches on individual tree bases, would be directly affected within the Tucker Creek watershed. One separate additional occurrence in the Southwest Prong Slocum Creek watershed would be directly affected by Alternative 1. This occurrence similarly includes several trees over an area of approximately 0.5 acre, with a total coverage by this species consisting of a few square inches on individual tree bases. Approximately 0.3 acre (60%) of this occurrence would be directly affected by Alternative 1. Neither alternative 2 nor Alternative 3 directly affect this occurrence. One separate additional occurrence in the Southwest Prong Slocum Creek watershed would be directly affected by Alternative 3. This occurrence is approximately 1.0 acre and is composed of two occupied habitat polygons each approximately 0.5 acre in size that include coverage by this species of a few square inches on the bases of several trees. Approximately 0.1 acre (20.0%) of one of the 0.5-acre occupied habitat polygons within this occurrence would be directly affected by Alternative 3. This represents an impact to approximately 20% of the affected polygon and 5% of the occurrence. Neither Alternative 1 nor Alternative 2 would directly affect this occurrence.

#### Mudbank Crown Grass (Paspalum dissectum) - LR

This species is known from seven ponds mapped as three separate occurrences documented by NCNHP on NFS lands in the CNF, which along with another occurrence on private lands are also combined by NCNHP into a single EO. This species was observed at each of the three NFS occurrences during a field review of these EOs during the 2012 growing season. One occurrence would be directly affected by Alternative 2 and Alternative 3. This occurrence consists of two polygons that are mapped as covering a total of approximately 3.9 acres. Alternative 2 and Alternative 3 would directly impact approximately 1.7 acres (90%) of the total 1.9 acres within one of these polygons. All seven culms observed in 2012 within this polygon are in the area that would be directly affected. The other polygon within this occurrence would not be directly affected and was observed to include two culms in 2012. The other two NFS occurrences with larger observed populations of mudbank crown grass, estimated at over 1,070 culms in

2012 for these two occurrences, would not be directly affected by Alternative 2 or Alternative 3. Alternative 1 does not directly affect this species.

#### A Liverwort (Plagiochila ludoviciana) - LR

This species is now known from two occurrences documented within the Southwest Prong Slocum Creek watershed on NFS lands in the CNF, including one new occurrence documented by the 2012 survey. One occurrence of this species that is mapped as covering approximately 0.1 acre and includes multiple trees with a total coverage by this species of approximately one square foot on the tree bases would be directly affected in its entirety by Alternative 1. Neither Alternative 2 nor Alternative 3 would directly affect this species.

#### Shadow-witch (Ponthieva racemosa) - LR

This species is known from 10 occurrences documented on NFS lands in the CNF. One occurrence of this species would be directly affected by Alternative 2. This occurrence is mapped as covering approximately 14.7 acres and includes an estimated 800 individual plants. Approximately 2.5 acres (17.0%) of this occurrence would be directly affected by Alternative 2. During field reviews on 22 July 2008 and 6 May 2009 the highest concentration of individuals within this occurrence was observed in the northeast corner of this occurrence adjacent to Greenfield Heights Blvd. This portion of the occurrence would directly affected by Alternative 1 nor Alternative 3 would directly affect this species.

#### Rafinesque's Big-eared Bat (Corynorhinus rafinesquii) - FC

This species is known from one potential occurrence on NFS lands in the CNF. The occurrence of this species would be directly affected by all three alternatives. NCNHP has designated the accuracy of this occurrence as very low. A very low accuracy occurrence characterization is described by NHP as one with less than 5 percent of the area occupied. NCNHP records state that this occurrence is based on an observation of this species at an unspecified location in Craven County. There are approximately 6.6 acres of potential occupied habitat within Alternative 1, 4.1 acres of potentially occupied habitat within Alternative 3.

#### Bachman's Sparrow (Aimophila aestivalis) – FC

This species is known from 18 occurrences documented as EOs in NCNHP records for NFS lands in the CNF. Two NCNHP documented occurrences of this species would be directly affected by Alternative 2 and Alternative 3. These occurrences are mapped as covering approximately 23.2 acres in total and

represent the identification of one singing bird in the location of each occurrence. These occurrences are composed of three occupied habitat polygons that are each 7.7 acres. Approximately 1.1 acres (4.7%) of one occupied habitat polygon within these occurrences would be affected by Alternative 2 and approximately 0.9 acre (3.9%) of one occupied habitat polygon within these occurrences would be affected by Alternative 3.

#### Black-throated Green Warbler (Coastal Plain Population) (Dendroica virens waynei) - FC

This species is known from seven occurrences documented as EOs in NCNHP records for NFS lands in the CNF. One NCNHP mapped occurrence of this species would be directly affected by all three alternatives. This occurrence is mapped as covering approximately 45.9 acres and represents the identification of three singing male birds in the location of the occurrence. Approximately 13.7 acres (29.8%) of this occurrence would be directly affected by the three alternatives.

#### Southern Hognose Snake (Heterodon simus) - FC

This species is known from four occurrences documented on NFS lands in the CNF. One occurrence of this species would be directly affected by all three alternatives. This is an historic occurrence that NCNHP has designated as low in accuracy. A low accuracy occurrence characterization is described by NHP as one with between 5% and 20% of the area occupied. There are approximately 65.3 acres of potentially occupied habitat within Alternative 1, 87.3 acres of potentially occupied habitat within Alternative 2, and 113.8 acres of potentially occupied habitat within Alternative 3. These areas of potentially occupied habitat are characterized predominately as mesic pine flatwoods, mesic pine plantations, and mesic powerline corridors. However, these communities may be considered to provide low probability of occurrence compared to the dry pine-oak woodlands that this species typically inhabits.

#### Little Metalmark (Calephelis virginiensis) - FC

This species is known from seven occurrences documented on NFS lands in the CNF. One occurrence of this species would be directly affected by Alternative 2. This occurrence is mapped as covering approximately 17.9 acres and represents the observation of one adult butterfly. Approximately 1.6 acres (8.9%) of this occurrence will be directly affected by Alternative 2. Neither Alternative 1 nor Alternative 3 would directly affect this species.

Excluding red-cockaded woodpecker, which has been evaluated separately, in terms of the number of USFS rare species that would be directly affected, Alternative 1 would directly affect 10 USFS rare species, Alternative 2 would directly affect 15 USFS rare species, and Alternative 3 would directly affect

12 USFS rare species. Alternate 1 would directly affect the least number of known occurrences with 17, while Alternate 2 would directly affect the most with 26, and Alternate 3 would directly affect 24. Excluding red-cockaded woodpecker foraging habitat, Alternate 1 contains the least amount of mapped USFS rare species occurrence coverage with 42.5 acres that would be directly affected, Alternate 2 contains 60.1 acres that would be directly affected, and Alternate 3 contains the most mapped USFS rare species occurrence coverage with 70.7 acres that would be directly affected. Indirect and cumulative effects to USFS rare species are addressed in Section 4.3.3.

#### 4.3 Indirect and Cumulative Effects – Natural Environment

#### 4.3.3 Indirect Effects – USFS Rare Species

The indirect effect evaluation includes USFS rare species that have documented occurrences and/or unoccupied suitable habitat located on NFS lands between an alternative and existing US 70. These areas would be isolated from contiguous NFS lands by the project. Such isolation increases the difficulty of managing these areas using periodic prescribed burns and will be considered an indirect effect by the USFS if the use of periodic prescribed burns cannot be continued. Some USFS rare species included in the indirect effects evaluation occur in mature swamp forest and peatland forest communities that are not managed using periodic prescribed burns. Other potential indirect effects could result from NCDOT management of the project right-of-way. NCDOT applies herbicides within the right-of-way to assist in the management of turf grasses and the control of weeds and non-native invasive plant species. Herbicide usage within the right-of-way has the potential to affect populations of USFS rare plant species and wildlife that feed on those plants.

Each of the alternatives would result in separation of parcels of NFS land from contiguous NFS lands. Alternative 2 has the potential to isolate the least amount of NFS lands with 712 acres. Alternative 1 and Alternative 3 have the potential to isolate greater amounts of NFS lands with 1,877 acres and 1,239 acres, respectively. Alternative 1 and Alternative 3 each have the potential to indirectly affect 28 USFS rare species, while Alternative 2 has the potential to indirectly affect 25 USFS rare species (Table 4.11).

USFS rare species with potential indirect effects can be divided into two broad categories based on generalized habitat requirements for discussing potential for indirect effects and possible minimization measures: 1) species that occur in open fire-maintained habitats; and 2) species that occur in mature swamp forest and/or peatland forest habitats (Table 4.11).

	u			Indirect Effects				
Habitat Group	Species Number <sup>4</sup>	Common Name	USFS Status <sup>b</sup>	Alternative 1	Alternative 2	Alternative 3		
	18	Small spreading pogonia	S	Yes	Yes	Yes		
	51	Loomis's loosestrife	S	Yes	Yes	Yes		
	59	Piedmont cowbane	S	Yes	Yes	Yes		
	69	Yellow fringeless orchid	S	Yes	Yes	Yes		
	71	Hooker's milkwort	S	Yes	Yes	Yes		
	78	Short-bristled beaksedge	S	Yes	Yes	Yes		
	90	Carolina goldenrod	S	Yes	Yes	Yes		
	92	Spring-flowering goldenrod	S	Yes	Yes	Yes		
	4	Bog bluestem	LR	Yes	Yes	Yes		
Fire	16	LeConte's thistle	LR	Yes	Yes	Yes		
Maintained	28	Eaton's witch grass	LR	Yes	No	Yes		
	62	Mudbank crown grass	LR	Yes	Yes	Yes		
	70	Snowy orchid	LR	Yes	Yes	Yes		
	97	Eaton's ladies'-tresses	LR	Yes	Yes	Yes		
	130	Bachman's sparrow	FC	Yes	No	Yes		
	132	Red-cockaded woodpecker	Е	Yes	Yes	Yes		
	140	Southern hognose snake	FC	Yes	Yes	Yes		
	153	Dusky roadside skipper	FC	Yes	Yes	Yes		
	162	Little metalmark	FC	Yes	Yes	Yes		
	188	Berry's skipper	FC	Yes	Yes	Yes		
	94	Florida peatmoss	S	Yes	Yes	Yes		
	42	<i>Lejeunea bermudiana</i> (A liverwort)	LR	Yes	Yes	Yes		
Swamp	53	Florida adder's mouth	LR	Yes	Yes	Yes		
Forest / Peatland	66	Plagiochila ludoviciana (A liverwort)	LR	Yes	No	Yes		
Forest	72	Shadow-witch	LR	Yes	Yes	Yes		
	110	Rafinesque's big-eared bat	FC	Yes	Yes	Yes		
	112	Southeastern myotis	FC	Yes	Yes	Yes		
	121	Black-throated green warbler	FC	Yes	Yes	Yes		

Table 4.11. Summary of USFS Rare Species Indirectly Affected

<sup>a</sup> Species number corresponds with species number presented in Chapter 3, Tables 3.21a and 3.21b.

<sup>b</sup> USFS Status: E – Endangered; FC – Forest Concern; LR – Locally Rare; S – Sensitive.

The most important consideration for minimizing indirect effects to USFS rare species that occur in firemaintained habitats would be to allow for the temporary closure of the bypass to allow prescribed burns to be conducted. NCDOT has agreed to allow the US 70 Havelock Bypass to be closed under general conditions outlined with USFS to allow the USFS to conduct prescribed burns within these isolated areas. Based on continued prescribed burning in these areas, potential indirect effects from this project would be minimal. Additional measures that will minimize indirect effects include avoiding planting of aggressive non-native species for re-vegetation, avoiding placing staging areas within 200 ft of plant species occurrences where practicable, avoiding heavy equipment access, especially during wet periods, and minimizing the use of herbicides and pesticides.

The swamp forest and peatland forest habitats do not rely on fire to the same extent for habitat management. The main considerations in these areas would be to minimize alterations to light penetration and hydrology. Clearing will be avoided within 200 ft of plant species occurrences where practicable. Additional measures that will minimize indirect effects include avoiding the planting of aggressive non-native species for re-vegetation and minimizing the use of herbicides and pesticides.

Habitat fragmentation can affect plant and animal populations in both fire maintained and swamp forest/ peatland communities through isolation of plant populations and less mobile animal populations. More mobile animal species may experience increased mortality associated with crossing roadways.

Isolation of populations caused by habitat conversion, habitat fragmentation, wildlife exclusion fencing and traffic reduces gene flow, leading to inbreeding and other deleterious effects, including a reduced ability to adapt/evolve to changing conditions. Isolated populations are more subject to local extirpation due to fluctuating demographics or catastrophic environmental events (such as drought), since they cannot be bolstered or repopulated from adjacent organisms. These effects may be minimized at the large bridge crossings, which will allow for wildlife passage beneath the bypass.

Secondary growth along existing roads in the project vicinity may further exacerbate fragmentation and isolation of populations. Fragmentation, population isolation, forest edge effects and wildlife mortality due to vehicle collisions may be less pronounced for Alternative 2 than for Alternative 1 or 3, due to Alternative 2's proximity to the Town of Havelock and the edge of NFS land. Additional information on habitat fragmentation is found in Section 4.1.8.1 Biotic Communities and Wildlife.

#### 4.3.4 Cumulative Effects

#### **USFS Rare Species**

Other activities proposed on NFS lands have the potential to affect USFS rare species directly affected by the US 70 Havelock Bypass. These activities include the improvements to US 17 (STIP project R-2514) and timber management projects for various compartments on the CNF.

The USFS has recently completed or is proposing various timber management projects in the vicinity of the US 70 Havelock Bypass alternatives. The USFS provided NCDOT with a list of recent and proposed projects for the period 2008-2014 within a 2-mile radius of the US 70 Havelock Bypass alternatives. These timber management projects are generally located in areas of mesic to hydric pine flatwoods and focus on thinning activities which will reduce midstory and canopy coverage in these areas. Several timber management projects are located adjacent to swamp forest communities and will alter the canopy and midstory density along the edges of these communities. These timber management projects have the potential to affect known occurrences and potentially suitable habitat for USFS rare species that are also being directly affected by the US 70 Havelock Bypass project.

- Rafinesque's big-eared bat may occur in swamp forest communities associated with 18 timber management projects (identified by USFS as FID numbers 1, 4, 6, 7, 15, 18, 23, 24, 25, 34, 35, 36, 37, 38, 39, 40, 41, and 46) that are crossed by at least one project alternative. No negative effects are anticipated to this species from these forest management activities provided that timber management activities avoid swamp forest communities and no roosting trees are removed.
- Spring-flowering goldenrod occurs in open pineland communities associated with 13 timber management projects (identified by USFS as FID numbers 7, 15, 23, 24, 25, 34, 35, 36, 37, 38, 39, 40, and 41) that are crossed by at least one project alternative. Thinning activities in these communities may result in positive effects on the habitat for this species by creating openings in denser woodlands and reducing competition from woody species.
- Southern hognose snake occurs in xeric open pineland communities associated with eight timber management projects (identified by USFS as FID numbers 15, 18, 23, 24, 25, 35, 37, and 38) that are crossed by at least one project alternative. Thinning activities in these communities may result in positive effects on the habitat for this species by creating openings in denser woodlands.
- Yellow fringeless orchid occurs in open pineland communities associated with one timber management project (identified by USFS as FID number 15) that is crossed by Alternative 2. Thinning activities in these communities may result in positive effects on the habitat for this species by creating openings in denser woodlands and reducing competition from woody species.
- Little metalmark occurs in open pineland communities associated with one timber management project (identified by USFS as FID number 18) that is crossed by Alternative 2. Thinning activities in these communities may result in positive effects on the habitat for this species by creating openings in denser woodlands.
- Shadow-witch occurs in swamp forest communities associated with one timber management

project (identified by USFS as FID number 38) that is crossed by Alternative 2. Thinning activities adjacent to the swamp forest communities may result in minor effects to the habitat for this species by increasing light penetration and altering the swamp forest ecotones within the adjacent swamp forest communities.

NCDOT is proposing improvements to US 17 (R-1514B, C, D) from south of the Town of Belgrade to north of the Jones/Craven County line. The proposed improvements include bypasses of the Towns of Maysville and Pollocksville with a widening section that connects the bypasses. The widening section includes approximately 108 acres of NFS lands on the Croatan National Forest. The NFS lands affected by the project include part of the existing US 17 facility. One USFS rare plant species would be directly affected by the US 17 improvements project, spring-flowering goldenrod. This occurrence occupies a total of 13.0 acres, including areas located on USFS lands within the CNF and areas located within the existing US 17 right-of-way adjacent to private property. Approximately 12.8 acres of this spring-flowering goldenrod occurrence would be directly affected as a result of this project, which includes approximately 9.9 acres (98%) of the 10.1 acres of habitat occupied on USFS lands in the CNF. This occurrence is estimated to include over 4,700 individual plants and it is estimated that approximately 3,584 individual plants may be directly impacted on NFS lands and an additional 1,050 individual plants may be directly impacted with the US 17 right-of-way adjacent to private property.

NCDOT is the current landowner and steward for an approximately 4,035-acre property containing the Croatan Mitigation Bank (CMB) (formerly known as the Croatan Wetland Mitigation Bank). In addition to providing compensatory wetlands and stream mitigation the CMB would also have a beneficial cumulative effect by reducing fragmentation of NFS lands in the CNF, as well as increasing the acres of available USFS rare species habitat and the number of USFS rare species occurrences in the CNF once the land transfer occurs. This property is located within the CNF in close proximity to the proposed US 70 Havelock Bypass project. In 2008, NCDOT completed a preliminary evaluation of the CMB to assess the potential for current use by, and potential to provide habitat opportunity for, USFS rare species. Restoration of the wetland and stream systems on this property was completed during 2001 and 2002 and wetland restoration success criteria monitoring was completed in 2007. The wetland and stream credits generated by the CMB are expected to provide compensatory mitigation for wetland impacts associated with the US 70 Havelock Bypass and other NCDOT projects.

The CMB Mitigation Banking Instrument (MBI) states that the NCDOT will manage the property through completion of the monitoring period and approved closeout of the mitigation components.

NCDOT intends to transfer the 4,035-acre property containing the CMB to the USFS to offset the loss and fragmentation of NFS lands by the US 70 Havelock Bypass. The NCDOT has developed a Memorandum of Understanding (MOU) with the U.S. Army Corps of Engineers (USACE) and USFS (Agreement No. 02-MOU-11081100-034) that requires that the USFS preserve all natural areas, and prohibit all use of the property inconsistent with its use as a mitigation property, including any activity that would materially alter the biological integrity or functional and educational value of wetlands within the Bank site, consistent with the mitigation plan. Maintenance of the CMB would be assumed by the USFS after the site is transferred from the NCDOT to the USFS, which is expected to occur following release of the available credits and final certification of the site by the Interagency Review Team (EcoScience and Axiom Environmental 2009).<sup>i</sup> Maintenance of roadways, culverts, habitat, and forest stands for fire risk will occur as prescribed in the MOU as well as consistent with the USFS Forest Plan. The CMB property provides opportunity to increase the number of known USFS rare species occurrences on NFS lands in the CNF when the property in transferred to the USFS. Transfer of this property would also provide the opportunity for USFS to manage appropriate portions of the property for USFS rare species habitat provided the management activities are consistent with the MOU and the LRMP.

#### Mitigation Measures

In addition to measures described to avoid and minimize potential affects to USFS rare species, mitigative measures may be needed for some species to offset direct and indirect effects associated with the US 70 Havelock Bypass. Proposed mitigative measures include measures to facilitate prescribed burns on fragmented NFS lands, manage herbicide use for right-of-way maintenance, and for the USFS rare species that may be directly or indirectly affected, identify new populations that are on protected lands not impacted by the project or that can be protected. If no other mitigation measures are available the loss of individuals may be mitigated by the relocation of affected populations to protected sites.

Each alternative would fragment NFS lands that are currently being managed using periodic prescribed burns. Fragmentation may affect the use of prescribed burning as a management tool on NFS lands. The USFS has previously stated that the US 70 Havelock Bypass will need to be closed in order to maintain prescribed burning for NFS lands between the US 70 Havelock Bypass and existing US 70. NCDOT has agreed to close the US 70 Havelock Bypass under general conditions outlined with USFS to accommodate prescribed burning.

NCDOT has initiated efforts to begin mitigating the potential impacts to USFS rare species through efforts to identify new populations of USFS rare species on NFS lands and other areas within the CNF that can be protected.

In 2008 NCDOT conducted a preliminary habitat and USFS rare species evaluation of the Croatan Mitigation Bank (CMB), an in-holding located within the boundaries of the CNF to assess the potential for current use by, and as potential mitigation for USFS rare species. The topography of the CMB is essentially flat with minimal slope to the north that is more prominent at the northern end of the site. A few very low ridges generally parallel the main access road maintained through the site. Soils on the CMB can be divided into two basic classes, loamy soils with substantial amounts of clay in their lower horizons and organic soils with profiles formed in accumulations of decayed plant material. Soil series mapped for the CMB include: Bayboro, Croatan, Dare, Dorovan, Goldsboro, Leaf, Leon, Lynchburg, Masontown, Muckalee, Murville, Pantego, and Rains. Thirteen general vegetative communities were identified on the CMB including: swamp forest (small stream), pine flatwoods (hydric, mesic, transitional), successional/ruderal habitat (grass-sedge, shrub-scrub), powerline corridor (hydric), non-riverine wet hardwood forest, non-riverine swamp/bay forest, lake ridge pine forest, pond, hydric pine plantation, hydric pine savanna, upland hardwood forest, pine/hardwood forest, rural/urban modifications.

It does not appear that savanna has been an important habitat type in the overall natural vegetation of the CMB for many years. This may mean that seed or diaspore sources for many savanna species are absent. Evidence of fire within the CMB habitats is present, but it is not common or widespread. Management of habitat with fire, specifically those habitats which can develop into some sort of savanna, is the most effective tool available for maintaining a fire sub-climax vegetation type. With the implementation of frequent fire, some occurrences of Successional/Ruderal Habitat, including wet shrub-scrub and wet grass-sedge variants, can be managed in the form of savanna habitat. The approximately 355 acres of these habitats are considered potentially most valuable for management of many of the USFS rare species. However, most of the savanna types at the CMB would be wet with intermittent or seasonal standing water. Potential for mesic savanna with largely emergent soils at the CMB is limited.

Fire may also be an important tool in returning hydric Pine Flatwoods or transitional Pine Flatwoods to a fire sub-climax vegetation type. It appears that the hydric Pine Flatwoods have been deeply burned in the past, possibly during only a few events. Dominants in this habitat complex are widely scattered trees and an open tall shrub stratum quite capable of supporting several important rare species. The hydric Pine Flatwoods mapped at the CMB in the extreme northwestern portion of the mitigation site total

approximately 37 acres and should be assessed carefully for potential restoration to Pine Savanna. Since this forest type will slowly change without recurrent fire, this tool should be considered in its management.

The possibility of considering the CMB for management as a fire sub-climax mitigation area would allow for additional USFS rare species mitigation opportunities beyond those available on the CMB without management. In general, those USFS rare species with a reasonable capability of using wet, currently unmanaged, savanna available in one habitat complex in the northern end and one complex near the southern end of the CMB could be expected to be present. Management of habitat using fire would increase the numbers of USFS rare species for which mitigation measures might be attempted. A few other species that utilize swamp forest habitats, both small stream and nonriverine/bay forest types, can be expected to utilize or continue to utilize the CMB; active management of these habitats is not expected to be necessary for these species.

Four USFS rare species with potential direct affects associated with the proposed project have been documented on the CMB. These species are Florida peatmoss, Loomis's loosestrife, Rafinesque's bigeared bat, and black-throated green warbler. Two additional USFS rare species, American alligator and southeastern bat are also present on the CMB. Bald eagle has been observed on the CMB, but nesting of this species has not been confirmed.

During the 2008 growing season, surveys were undertaken within portions of the CNF not affected by the US 70 Havelock Bypass project to attempt to identify additional occurrences of specific USFS rare species of concern not previously documented by USFS or in NCNHP records. Non-targeted USFS rare species identified during the course of the surveys were also documented. Also at the request of USFS, known occurrences of several potentially affected USFS rare species were also reviewed to determine if they continued to exist. Specific areas surveyed within the CNF for new occurrences of USFS rare species were selected based on a combination of ecological factors including: soil type, vegetative community type, frequency of fire management, hydrology, slope aspect, forest age, and known occurrences of other rare species.

During the course of these 2008 surveys two new occurrences of Fitzgerald's peatmoss, one new occurrence of Hooker's milkwort, one new occurrence of shadow-witch, one new occurrence of Venus flytrap, and three new occurrences of Piedmont cowbane were identified. Additional occurrences of twining screwstem (*Bartonia paniculata paniculata*) and a bird dropping moth (*Lithacodia* sp.), species

that have since been removed from the USFS rare species list for the CNF, were also identified during these surveys.

During the 2012 growing season, surveys were undertaken within portions of the CNF not directly affected by the US 70 Havelock Bypass project to attempt to identify additional occurrences of a liverwort (*Lejeunea bermudiana*). Specific areas surveyed within the CNF were selected based on a combination of ecological factors including: soil type, vegetative community type, frequency of fire management, hydrology, slope aspect, forest age, and known occurrences of other rare species. Non-targeted USFS rare species identified during the course of the surveys were also documented. During the course of these 2012 surveys two new occurrences of a liverwort (*Lejeunea bermudiana*) and one new occurrence of a liverwort (*Plagiochila ludoviciana*) were identified.

Additional mitigative measures will be implemented by NCDOT to minimize effects from management activities. Where practicable, NCDOT will avoid planting of aggressive non-native species for revegetation and erosion control. Centipede grass (*Eremochloa ophiuroides*) is the preferred species for roadside planting since it reduces the frequency of mowing and the need to apply herbicides. For sensitive areas located on National Forest System (NFS) lands NCDOT will coordinate with the USFS to identify native species and non-aggressive non-natives that can be utilized for erosion control, revegetation, and interchange plantings. One of the species being considered is wire grass (*Aristida stricta*), a clumping grass native to the fire maintained pine lands in the vicinity of the project. Additional species being considered include savanna hairgrass (*Muhlenbergia expansa*), short-bearded plume grass (*Saccharum brevibarbe*), and creeping little bluestem (*Schizachyrium scoparium*).

Brush control within the highway right-of-way will be necessary for the long-term maintenance of roadside shoulders and medians. Brush control along the bypass will be conducted with either herbicide or mechanical means. Herbicide usage is anticipated to be an important and necessary part of right-of-way maintenance and will be conducted in accordance with USFS-approved methods to minimize potential effects to USFS rare plant species on NFS lands crossed by the project.

NCDOT personnel will follow strict guidelines for the use of herbicides on NFS lands crossed by the project. For all areas of NFS lands crossed by the project, herbicides will be used according to manufacturer's label direction for rates, concentrations, exposure times, and application methods. Only formulations approved for aquatic use would be applied in or adjacent to jurisdictional wetlands and streams, in accordance with label directions.

Additional precautions will be implemented for herbicide use in close proximity to USFS rare plant species occurrences to minimize the potential for herbicide drift. Buffers will be established extending 60 feet from known USFS rare plant occurrences. Management within USFS rare species buffers will be primarily through mowing. If herbicide application is determined to be necessary within USFS rare plant species buffers, plants will be flagged or otherwise identified to minimize accidental exposure while conducting spot treatments. The potential for herbicide drift will be greatly reduced with spot treatments (relative to broad-scale or aerial application). Techniques that could be used include spraying foliage using a hand-held wand or backpack sprayer, basal bark and stem treatments using spraying or painting (wiping) methods, cut surface treatments (spraying or wiping), and woody stem injections.

Additional measures that can be implemented:

- All guidelines and mitigation measures presented in Forest Manual 2150, *Pesticide-Use Management and Coordination*, and Forest Service Handbook 2109.14, *Pesticide Use Management and Coordination Handbook*, would be followed.
- 2) Equipment, boots, and clothing would be cleaned thoroughly before moving from treatment sites to ensure that seeds or other propagules are not transported to other sites.
- 3) Fueling or oiling of mechanical equipment would occur away from aquatic habitats.
- Application of herbicides adjacent to stream edges and banks will be directed away from the stream and will be conducted using a hand sprayer.
- 5) Retain native vegetation and limit soil disturbance as much as possible.
- 6) Following treatments, exposed soils would be promptly revegetated to avoid colonization by nonnative invasive plants or potential soil erosion. Only approved seed mixtures and weed seed-free mulch would be used.

If general efforts to mitigate for the loss of individual USFS rare plant species are not feasible, then an alternative mitigation option may be considered for establishing new occurrences in appropriate habitat using seeds, propagules, or transplanting of individual plants at the request of the USFS.

- Loomis's loosestrife, small spreading pogonia, piedmont cowbane, yellow fringeless orchid, shadow-witch, Fitzgerald's peatmoss, and mudbank crowngrass are not anticipated to require specific mitigation; however, if specific mitigation for these species is required then NCDOT will work with the USFS to develop appropriate mitigation strategies.
- Spring-flowering goldenrod generates from seeds under suitable habitat conditions.<sup>i</sup> Direct

affects to this species may be mitigated through a combination of relocation of affected populations to unaffected suitable habitat or collecting seeds or propagules from affected populations to use in establishing new populations in unaffected suitable habitat. NCDOT is proposing to collect seeds from the areas to be affected by Alternative 3 and distributing the seeds into an area of the CNF where the species does not currently occur but where there is appropriate habitat. On-site mitigation in the vicinity of the RCW foraging partition north of Sunset Rd and west of Alternative 3 is proposed in a report, Recommended mitigation plan for Solidago verna in Craven Co., North Carolina; Havelock Bypass, R-1015,<sup>ii</sup> prepared by Dr. Jon Stucky and Miranda Fleming for NCDOT in 2006. The on-site area proposed for establishing springflowering goldenrod is identified as the Wolf Pit Branch Road Area. Additional areas with mitigation potential for use in establishing new populations on NFS lands of spring-flowering goldenrod were reviewed outside of the Alternatives study area in case additional mitigation areas would be requested by the USFS to help offset project related impacts. Several areas identified along Middle Little Road and South Little Road may have potential to be utilized as offsite mitigation areas for establishing spring-flowering goldenrod. These Little Road Areas are located off Catfish Lake Road (SR 1100) west of the Alt. 3 study area. Suitable soils and hydrologic conditions are expected to be present within portions of the 770 acres preliminarily identified. It may also be feasible to establish spring-flowering goldenrod where suitable soils and hydrologic conditions occur along selected roadsides and mesic inclusions present within the Croatan Mitigation Bank (CMB). Mitigation measures will be coordinated with USFS prior to implementation.

- LeConte's thistle is a biennial member of the aster family that occurs in open pine savannas.<sup>iii</sup> Managing for open savanna habitat through seasonal mowing of powerline rights-of-way and prescribed burning of forest habitats is important to maintaining suitable open habitat for this species. Implementation of measures agreed to between NCDOT and USFS would minimize viability concerns resulting from indirect impacts that could arise from construction and/or maintenance activities. If additional mitigation is required by USFS for direct impacts, a measure agreed to between NCDOT and USFS to offset viability concerns could include collecting seeds from viable EOs for use in supplementing existing EOs where suitable habitat occurs but numbers of individuals are low or individuals have not been recently documented.
- The remaining USFS rare plant species include two species of liverwort (*Lejeunea bermudiana* and *Plagiochila ludoviaciana*) that are directly affected. The likelihood of successfully establishing these species through the collection of individual plants or propagules from areas directly affected and transplanting them to sites in unaffected suitable habitat is not well known.

NCDOT surveys have resulted in documentation of additional occurrences on NFS lands in the CNF that would not be directly affected by the project. NCDOT will coordinate with the USFS to develop appropriate mitigation measures for these species if needed.

Impacts to USFS rare animal species are not likely to be direct loss of individuals, but rather the loss of occupied habitat and habitat fragmentation. Mitigating the loss of occupied habitat may be achieved through measures to minimize habitat impacts and through improvement of other habitat areas.

- Rafinesque's big-eared bat is most often associated with old-growth bottomland hardwood swamp forests. The forest stand characteristic that is thought to be most important is the presence of a preponderance of large diameter trees with cavities. The direct loss of habitat (Swamp Forest, Large Stream) by each alternative is small in comparison to the available habitat on NFS lands. In addition, clearing of trees within the Southwest Prong Slocum Creek floodplain should be minimized in proximity to the bridge in order to minimize effects to the habitat for this species.
- Black-throated green warbler is a summer resident generally found in non-riverine swamp forests, bay forests, pond pine woodlands, and less frequently streamhead pocosins with mature overstory. The severe wetness of the soils in these habitats results in these areas being subjected to fires less frequently than the adjacent pine flatwoods and pine savannas. The direct loss of habitat by each alternative is small in comparison to the available habitat on NFS lands.
- Bachman's sparrow is a summer resident in open to moderately open pine flatwoods with dense covering of grasses and sparse shrub and understory vegetation. Southern hognose snake generally occurs in dry pine-oak woodlands with xeric areas of sand or porous sandy loams (Braswell and Palmer, 1995). Little metalmark is a small butterfly that generally occurs in open pine flatwoods and savannas with a diversity of grasses and herbs. In the CNF these habitats are often found in powerline rights-of-way and frequently burned pinelands. Continued use of fire and mowing for habitat management is important in maintaining the open character of the habitat for these species and allowing individuals displaced by project construction to disperse into unoccupied suitable habitat.

#### Conclusions

<u>USFS Rare Species</u> - Since all the detailed study alternatives cross National Forest System (NFS) lands, a special use permit from the U.S. Forest Service (USFS) will be required to provide the lands for the
proposed project. The USFS must consider impacts to their list of rare species before granting a special use permit for Croatan National Forest (CNF) lands to be converted to highway use. Potential affects summarized here are based on the clearing limits (slope stake limits plus 15 feet on each side) for the alternative alignment plus an additional 25 feet to each side.

#### Alternative 1

Excluding red-cockaded woodpecker, which has been evaluated separately, Alternative 1 would directly affect approximately 42.5 acres mapped for 17 known occurrences of 10 USFS rare species. Alternative 1 has the potential to indirectly affect 1,877 acres of NFS lands through fragmentation and the reduction in the ability to manage the land by periodic prescribed burns. The indirectly affected NFS lands contain known occurrences for 28 USFS rare species.

Four Sensitive species may have at least one occurrence directly affected by Alternative 1. Construction of Alternative 1 may impact individuals or occupied habitat for four Sensitive plant species, Fitzgerald's peatmoss, Loomis's loosestrife, small spreading pogonia, and spring-flowering goldenrod, but with implementation of the minimization measures proposed and appropriate mitigation measures, if required, is not likely to lead to loss of viability for these species on NFS lands.

Six Locally Rare or Forest Concern species have at least one occurrence that would be directly affected by Alternative 1. One Locally Rare liverwort species, *Plagiochila ludoviciana*, is only known from two occurrences on NFS lands in the CNF and one of these occurrences would be directly affected in its entirety by Alternative 1. Construction of Alternative 1 would cause the elimination of one of these occurrences and in the absence of appropriate mitigation measures would result in a loss of viability for this species on NFS lands in the CNF. Alternative 1 may also affect another liverwort, *Lejeunea bermudiana*, based on impacts to the limited number of known occurrences this impact may result in a loss of viability for this species on NFS lands in the CNF. An additional occurrence documented in 2012 within the Island Creek watershed on NFS lands reduces the potential for a loss of viability for this species. NCDOT would continue to coordinate with the USFS to develop appropriate mitigation to avoid loss of viability this species. Construction of Alternative 1 may also impact individuals or occupied habitat for four additional Locally Rare or Forest Concern species, Leconte's thistle, Rafinesque's bigeared bat, black-throated green warbler, and southern hognose snake, but with implementation of the minimization measures proposed and appropriate mitigation measures, if required, would not be likely to lead to loss of viability for these species on NFS lands in the CNF.

For the USFS rare species that would be indirectly affected by this alternative, implementation of the minimization measures proposed and appropriate mitigation measures, if required, would not likely lead to loss of viability for these species.

#### Alternative 2

Excluding red-cockaded woodpecker, which has been evaluated separately, Alternative 2 would directly affect approximately 60.1 acres mapped for 26 known occurrences of 15 USFS rare species. Alternative 2 has the potential to indirectly affect 712 acres of NFS lands through fragmentation and the reduction in the ability to manage the land by periodic prescribed burns. The indirectly affected NFS lands contain known occurrences for 25 USFS rare species.

Six Sensitive species may have at least one occurrence directly affected by Alternative 2. Construction of Alternative 2 may impact individuals or occupied habitat for Six Sensitive plant species, Fitzgerald's peatmoss, Piedmont cowbane, small spreading pogonia, Loomis's loosestrife, yellow fringeless orchid, and spring-flowering goldenrod, but with implementation of the minimization measures proposed and appropriate mitigation measures, if required, is not likely to lead to loss of viability for these species on NFS lands.

Nine Locally Rare or Forest Concern species have at least one occurrence that would be directly affected by Alternative 2. Alternative 2 may affect the liverwort, *Lejeunea bermudiana*, based on impacts to the limited number of known occurrences this impact may result in a loss of viability for this species on NFS lands in the CNF. An additional occurrence documented in 2012 within the Island Creek watershed on NFS lands reduces the potential for a loss of viability for this species. NCDOT would continue to coordinate with the USFS to develop appropriate mitigation to avoid loss of viability this species. Construction of Alternative 2 may also impact individuals or occupied habitat for eight additional Locally Rare species, Leconte's thistle, mudbank crown grass, shadow-witch, Rafinesque's big-eared bat, Bachman's sparrow, black-throated green warbler, southern hognose snake, and little metalmark, but with implementation of the minimization measures proposed and appropriate mitigation measures, if required, would not be likely to lead to loss of viability for these species on NFS lands in the CNF.

For the USFS rare species that would be indirectly affected by this alternative, implementation of the minimization measures proposed and appropriate mitigation measures, if required, would not likely lead to loss of viability for these species.

#### Alternative 3

Excluding red-cockaded woodpecker, which has been evaluated separately, Alternative 3 would directly affect approximately 60.1 acres mapped for 24 known occurrences of 12 USFS rare species. Alternative 3 has the potential to indirectly affect 1,239 acres of NFS lands through fragmentation and the reduction in the ability to manage the land by periodic prescribed burns. The indirectly affected NFS lands contain known occurrences for 28 USFS rare species.

Five Sensitive species have at least one occurrence directly affected by Alternative 3. Construction of Alternative 3 may impact individuals or occupied habitat for five Sensitive plant species, Fitzgerald's peatmoss, Piedmont cowbane, small spreading pogonia, Loomis's loosestrife, and spring-flowering goldenrod, but with implementation of the minimization measures proposed and appropriate mitigation measures, if required, is not likely to lead to loss of viability for these species on NFS lands.

Seven Locally Rare or Forest Concern species have at least one occurrence that would be directly affected by Alternative 3. Alternative 3 may affect the liverwort, *Lejeunea bermudiana*, based on impacts to the limited number of known occurrences this impact may result in a loss of viability for this species on NFS lands in the CNF. An additional occurrence documented in 2012 within the Island Creek watershed on NFS lands reduces the potential for a loss of viability for this species. NCDOT would continue to coordinate with the USFS to develop appropriate mitigation to avoid loss of viability this species. Construction of Alternative 3 may also impact individuals or occupied habitat for six additional Locally Rare species, Leconte's thistle, mudbank crown grass, Rafinesque's big-eared bat, Bachman's sparrow, black-throated green warbler, and southern hognose snake, but with implementation of the minimization measures proposed and appropriate mitigation measures, if required, would not be likely to lead to loss of viability for these species on NFS lands in the CNF.

For the USFS rare species that would be indirectly affected by this alternative, implementation of the minimization measures proposed and appropriate mitigation measures, if required, would not likely lead to loss of viability for these species.

- <sup>i</sup> EcoScience Corporation and Axiom Environmental, Incorporated. 2009. Croatan Mitigation Bank Addendum to the NCDOT UMBI. Report prepared for NCDOT, January 2009. 16 pp + appendices.
- <sup>ii</sup> Stucky, J.M. and M. Fleming, 2006. Recommended mitigation plan for *Solidago verna* in Craven Co., North Carolina; Havelock Bypass, R-1015. Research project conducted for NCDOT, No. HWY-0733.
- <sup>iii</sup> Radford, A.E., H.E. Ahles, and C.R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. University of North Carolina Press, Chapel Hill, NC. 1183 pp.

ATTACHMENT 9



ENVIRONMENTAL SERVICES, INC. 524 South New Hope Road Raleigh, North Carolina 27610 919-212-1760 / Facsimile 919-212-1707 www.environmentalservicesinc.com

# **MEMORANDUM**

TO:	Mary Frazer
FROM:	Matt Smith
DATE:	29 August 2013
RE:	US 70 Havelock Bypass (R-1015) P.O. No. 6300030960 Address USFS Comments on DEIS and PETS Analysis: Summary of Evaluation for Mudbank Crowngrass ( <i>Paspalum dissectum</i> ) ESI Project No. ER10-060.08

# **Background**

In their review of the Draft Environmental Impact Statement (DEIS) for the US 70 Havelock Bypass project (Figure 1), the U.S. Forest Service (USFS) identified the need for additional information on project-related impacts for mudbank crowngrass (*Paspalum dissectum*) to more fully assess potential viability concerns resulting from project implementation (Figure 2).

Mudbank crowngrass is listed as a Sensitive species by the USFS, is state listed as Endangered, and does not have a designation by the U.S. Fish and Wildlife Service (USFWS). Based on these listings, the USFS is required to assess potential impacts to the species resulting from actions by the USFS, such as granting an easement for the US 70 Havelock Bypass, to determine whether the action threatens the viability of the species on National Forest System (NFS) lands in the Croatan National Forest (CNF).

Environmental Services, Inc., (ESI), has been asked by the North Carolina Department of Transportation (NCDOT) to complete an evaluation of impacts to this species associated with Alternative 3 of the proposed US 70 Havelock Bypass (R-1015) (Figure 1). The study area for Alternative 3 is referred to as the Alt. 3 study area in this evaluation. The area encompassed by all the alternatives for the US 70 Havelock Bypass is referred to as the Alternatives study area in this evaluation (Figure 2).

The impact assessment for this species is based on the following:

• The evaluation presented here utilizes Element Occurrence (EO) data obtained from the N.C. Natural Heritage Program (NCNHP) in April 2012, supplemented by site evaluations conducted by ESI in 2012.

- Boundaries for NFS lands were provided by the USFS for use in this evaluation. Only EOs, or portions of EOs, on NFS lands are of concern for the viability determination for NFS lands on the CNF.
- Direct impacts are based on the tree clearing limits (slope stake limits plus 15 feet) plus an additional 25 feet.
- Indirect impacts were considered for EO areas located on NFS lands between Alternative 3 and existing US 70 based on consideration that different post-project habitat management techniques may be required by USFS for areas isolated from larger, contiguous NFS lands by the project. Additional concerns identified for consideration of indirect impacts include construction or maintenance actions by NCDOT in the vicinity of rare plants EOs on NFS lands that could have negative impacts on the rare plants or the suitability of their habitat. These actions could include the type of roadside vegetation proposed for use by NCDOT in the project right-of-way, location of construction staging areas, soil compaction or rutting caused by heavy equipment resulting in localized changes in hydrology, and use of herbicides and pesticides.
- Cumulative impacts were considered for identified actions on NFS lands that could affect this species. Because the USFS concern for this species is for maintaining continued viability on NFS lands in the CNF, actions off NFS lands were not considered for determining whether an action will affect the viability of this species on NFS lands. Actions proposed on NFS lands are subject to independent review by USFS to assess potential effects to the continued viability of this species on NFS lands in the CNF. No other NCDOT projects have been identified that would directly or indirectly impact this species on NFS lands. One project has been identified with potential for cumulative effects; a project proposed by Duke Energy Progress for replacing the overhead ground wire and selected poles within an existing transmission line corridor right-ofway located along approximately five miles of NFS lands in the CNF. The Duke Energy Progress project right-of-way includes occurrences for this species and the proposed actions have the potential to affect this species. This project is currently being evaluated to determine the effects to this species, which are expected to be minimal based on the types of activities being proposed. No other actions being considered by USFS on NFS lands have been identified that would directly or indirectly impact this species. As such, no significant cumulative impacts were identified for this species.

A summary of the evaluation presented here will be incorporated into Chapter 4 of the Final Environmental Impact Statement (FEIS).

#### Mudbank Crowngrass (Paspalum dissectum)

Mudbank crowngrass is a perennial grass that occurs colonially in shallow water, marshy areas, and wet open places. Seed heads are produced on stems referred to as culms. This species is most prevalent in muds or peats of ponds after water levels recede during dry periods.<sup>i</sup> On the CNF this species has been documented in ephemeral ponds located within powerline rights-of-way. Powerline rights-of-way are managed by a combination of mowing by the powerline easement holder and prescribed burns conducted by the USFS. Management for this species, including mowing, that minimizes competition from woody species appears to be important in maintaining open habitat for this species. Sites that are mowed in the late spring and early summer prior to the sites being inundated with water may provide more open habitat conditions.

All the known occurrences of mudbank crowngrass within the limits of the CNF are encompassed by a single parent EO (11 on Figure 2) designated by the NCNHP. This parent EO consists of four other EOs, each with a unique identifying EO number assigned by NCNHP. Three of these EOs are located wholly or in part on NFS lands within the CNF (7, 12, and 13 on Figures 2 and 3) and one EO on private lands (10 on Figures 2 and 3). The scope of work for the mudbank crowngrass evaluation is the result of meetings with NCDOT and the USFS and evaluates direct and indirect impacts on mudbank crowngrass occurrences in the Alt. 3 study area for the US 70 Havelock Bypass.

#### Methods for Assessment

Each of the four EOs within the parent EO was visited in an attempt to document the continued presence of suitable habitat and individuals of mudbank crowngrass within each area. This information will be used to assist in the evaluation of the direct and indirect impacts associated with Alternative 3 of the US 70 Havelock Bypass on the viability of mudbank crowngrass on NFS lands within the CNF.

The initial step in the evaluation was to determine the number of unique polygons identified in NCNHP files that make up the different assigned EOs. Four discrete polygons were identified wholly or partially on NFS lands within the CNF. One additional polygon not on NFS lands but in close proximity to the sites on NFS lands was also evaluated because it is included in the parent EO. Each polygon was evaluated in the field to confirm continued presence of mudbank crowngrass and to obtain population estimates and density of culms. Surveys for mudbank crowngrass were undertaken on October 1, 2012. The surveys were conducted by an experienced team of biologists led by Matt Smith with support from David DuMond. At the time of the evaluation the ephemeral ponds were inundated and culms were identified by the presence of seed heads emergent from the water.

Surveys of each polygon consisted of two biologists walking transects within the habitat encompassed by NCNHP EO polygons. Individual stems of mudbank crowngrass were counted in areas with small areas of coverage by colonies of this species. In areas with large coverage by colonies of this species, individual stem counts were not undertaken but approximate population size was estimated based on the size of the areas covered by the colonies.

#### Results of Assessment

The results of the surveys of EOs identified by NCNHP are presented in Table 1 along with a summary of NCNHP data for the most recent observations of each EO. All the known mudbank crowngrass occurrences in the CNF, including those on private lands are part of a single parent EO (11 on Figure 3). Because other EO numbers have been assigned as well to individual polygons encompassed by this parent EO, including two polygons comprising a single EO (7 on Figure 3), each individual polygon identified in NCNHP records has been assigned a number (Polygon #) for this evaluation to facilitate tracking and analysis. Because the parent EO includes polygons on private lands as well as NFS lands, and the polygons are all in the same general area, the results of the assessment also include the observations for the polygons, or portions of polygons, on private lands as well as NFS lands.

NCNHP Data				ESI 2012 Survey Results				
EO #		EO Status	Last Observed	# Plants (Last Observed)	Polygon #	# Plants Observed		Habitat Quality
						NFS Lands	Private Lands	
	7	extant	extant 10/8/2010	275	7a	7	NA	Open maintained powerline ROW
					7b	2	NA	Open maintained powerline ROW
11 <sup>a</sup>	10	extant	10/8/2010	375	10 <sup>b</sup>	NA	0	Open maintained powerline ROW
	12	extant	10/14/2010	50	12	1,000 <sup>c</sup>	NA	Open maintained powerline ROW
	13	extant	10/14/2010	30	13	70 °	930 °	Open maintained powerline ROW
	•	•	•	Total: 730		Total:	Total:	
						1,079	930	
						(approx.)	(approx.)	

Table 1. Results of Mudbank Crowngrass Surveys.

<sup>a</sup> EO 11 includes EO # 7, 10, 12, 13 2.

<sup>b</sup> Polygon is not located on NFS lands.

<sup>C</sup> The number of plants reported is an estimate based on the size of the coverage areas of the large, dense colonies observed.

EOs on the CNF were reviewed during the 2012 flowering season to document if suitable habitat is present and if individuals of mudbank crowngrass still occur within the EO boundaries.

- EO 7 consists of two polygons (Polygon 7a and Polygon 7b on Figure 3) located within depressions within a maintained powerline right-of-way on NFS lands.
  - Polygon 7a was inundated at the time of evaluation and the vegetation present was dominated by woody species. Seven individual seed heads of mudbank crowngrass were observed along the sides of vehicular ruts that crossed the depressions that were generally free of other competing vegetation.
  - Polygon 7b was inundated at the time of evaluation and the vegetation present was dominated by woody species. Two individual seed heads of mudbank crowngrass were observed along the sides of vehicular ruts that crossed the depressions that were generally free of other competing vegetation.
- EO 10 consists of a single polygon (Polygon 10 on Figure 3) located in a powerline right-of-way on private property in close proximity to NF lands boundaries. Several depressions were observed that were inundated at the time of the field evaluation. These depressions were composed of a mix of shrubby vegetation with infrequent areas dominated by herbaceous vegetation, primarily along vehicle ruts. No individuals of mudbank crowngrass were observed

during this evaluation. However, it is possible that this species is still present in low numbers since the habitat is still present and previous reviews have identified this species at this location.

- EO 11 is a parent EO and was not evaluated separately since it is made up of EOs 7, 10, 12, and 13 which are being evaluated separately.
- EO 12 consists of a single polygon (Polygon 12 on Figure 3) located in a powerline right-of-way on NFS lands. A large depression is present at this site with large areas of open habitat not vegetated by woody species. At the time of the field evaluation this area was inundated with water depths in some areas exceeding 4 feet. Mudbank crowngrass was observed as a number of large colonies with emergent seed heads present. The colonies ranged in area from a few square feet up to over 1,000 square feet. Based on the difficulty in counting individual stems in the dense colonies, the population size was estimated based on the overall coverage of the colonies, and was estimated at approximately 1,000 individuals.
- EO 13 consists of a single polygon (Polygon 13 on Figure 3) located in a powerline right-of-way. A small portion of the polygon, approximately 7%, is on NFS lands, with the remainder, approximately 93%, extending onto private property. Large depressions are present at this site with large areas of open habitat not vegetated by woody species. At the time of the field evaluation this area was inundated with water depths in some areas exceeding 4 feet. Mudbank crowngrass was observed as a number of large colonies with emergent seed heads present on both the NFS portion of the polygon and on the private lands portion. The colonies ranged in area from a few square feet up to over 1,000 square feet. Based on the difficulty in counting individual stems in the dense colonies, the population size was estimated based on the overall coverage of the colonies, and was estimated at approximately 1,000 individuals. Because the plants were present on both the NFS lands and private lands portions of the polygon and appeared to be relatively evenly distributed throughout, the estimated number of culms on NFS lands was based on the polygon occurring on NFS lands.

There are four polygons (Polygons 7a, 7b, 12, and 13 on Figure 3) recorded for mudbank crowngrass wholly or partially on NFS lands within the CNF. This species was confirmed as present within all four of these polygons during the 2012 survey season. One additional polygon (Polygon 10 on Figure 3) on private lands within close proximity to these polygons on NFS lands was also reviewed. Polygon 10 was found to contain suitable habitat for this species but no individuals of mudbank crowngrass were observed. The habitat areas reviewed for this species is located in maintained powerline rights-of-way that are subject to management by a combination of mowing by the powerline easement holder and periodic prescribed burns conducted by the USFS. The timing of management and seasonal rainfall variations that restrict woody vegetation development and extend periods of inundation may affect the expression of this species within these polygons. It is likely that larger areas of mudbank crowngrass coverage are observable in years that do not favor the growth of competing woody vegetation.

Summary of Impacts

• This evaluation indicates that mudbank crowngrass is still present in 4 polygons on NFS lands. A total of 1,079 individual mudbank crowngrass plants were estimated as present on NFS lands during the 2012 survey within these polygons. These four polygons collectively cover 5.8 acres of occupied habitat documented on NFS lands in the CNF.

- Alternative 3 directly affects EO 7. EO 7 consists of two polygons that total 3.9 acres. Alternative 3 will directly impact approximately 1.7 acres of the total 1.9 acres within Polygon 7a of this EO. All seven culms observed within Polygon 7a are in the area that will be directly affected. The other polygon (7b) within this EO will not be directly affected.
- An additional 4.2 acres of occupied habitat on NFS lands are in areas subject to indirect impact consideration for Alternative 3 including an additional 2.2 acres of EO 7. This includes Polygons 7b and 12 in their entirety, and approximately 7% of Polygon 13. The 2012 survey estimated that approximately 1,072 culms are present on NFS lands that may be subject to indirect impacts. These culms were observed within the powerline right-of-way which is currently being managed by a combination of mowing by the utility company operating the lines within the right-of-way and periodic prescribed burns conducted by the USFS. No changes in management of the powerline right-of-way by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through measures previously proposed by NCDOT regarding management agreements with USFS for the areas subject to potential indirect impacts. Measures discussed to reduce the likelihood for adverse effects to these areas include:
  - Allow for the temporary closure of the bypass to allow the USFS to conduct periodic prescribed burns;
  - Prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction;
  - Avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable;
  - Avoid placing heavy equipment within powerline corridors outside of the project's direct impact area without prior approval from the USFS;
  - Require contractors to pressure wash all off-road equipment prior to being brought into the CNF construction areas;
  - Prior to construction NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species for removal during construction;
  - o Avoid planting of aggressive non-native species for re-vegetation;
  - o Utilize rolled matting for erosion control and revegetation on NFS lands;
  - o Avoid use of broadcast sprays for herbicides and pesticides on NFS lands; and
  - Minimize the use of herbicides and pesticides.

# Conclusions and Recommendations

The US 70 Havelock Bypass (R-1015) Alternative 3 will result in unavoidable direct impacts to mudbank crowngrass and has the potential for indirect impacts. Alternative 3 directly affects approximately 1.7 acres and 7 culms of mudbank crowngrass identified within one occupied habitat polygon. An additional 4.2 acres and 1,072 culms estimated during the 2012 survey are located on NFS lands in areas subject to indirect impact consideration. A project proposed by Duke Energy Progress has a study area that includes occurrences for this species and has the potential to affect this species. This project is currently being

evaluated to determine the effects this species. The cumulative impacts for this project are not available at this time but are expected to be minimal based on the types of activities proposed. No additional cumulative impacts from other USFS or NCDOT projects on NFS lands on the CNF have been identified.

Based on the limited direct impact to this species for Alternative 3, the direct impacts are not likely to result in a loss of viability on NFS lands within the CNF. The area subject to consideration for indirect impacts represents the remainder of the population and areal extent of mudbank crowngrass known to occur on NFS lands in the CNF. However, the project is not expected to result in changes that would prevent the utility company from continued mowing to maintain the powerline right-of-way and measures are in place to allow the USFS to continue conducting prescribed burns in the areas in which these EOs are found, reducing the threat for indirect impacts. Other potential concerns for indirect impacts that could result from project construction and maintenance activities can be minimized through appropriate measures.

Implementation of measures agreed to between NCDOT and USFS would minimize viability concerns resulting from indirect impacts that could arise from construction and/or maintenance activities. These measures include: allow for the temporary closure of the bypass to allow the USFS to conduct periodic prescribed burns; prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction; avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable; avoid placing heavy equipment within powerline corridors outside of the project's direct impact area without prior approval from the USFS; require contractors to pressure wash all off-road equipment prior to being brought into the CNF construction areas; prior to construction NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species for removal during construction; avoid planting of aggressive non-native species for revegetation; Utilize rolled matting for erosion control and revegetation on NFS lands; avoid use of broadcast sprays for herbicides and pesticides on NFS lands; and minimize the use of herbicides and pesticides. If mitigation is required by USFS for direct impacts, a measure agreed to between NCDOT and USFS to offset viability concerns could include collecting seeds from viable EOs for use in supplementing existing EOs where suitable habitat occurs but numbers of individuals are low or individuals have not been recently documented.

With the implementation of appropriate measures to reduce concerns for indirect impacts, the US 70 Havelock Bypass (R-1015) Alternative 3 project is not likely to cause a loss of viability for mudbank crowngrass on NFS lands in the CNF.

<sup>&</sup>lt;sup>i</sup> Godfrey, G.K., and J.W. Wooten. 1979. Aquatic and Wetland Plants of the Southeastern United States: Monocotyledons. The University of Georgia Press, Athens, GA. 712 pp.





To protect the viability of protected/rare species, the exact location of species occurrences is not shown of this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-600



Mudbank Crowngrass Assessment - Occurrences US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina

Project:	ER10060.08
Date:	Aug 2013
Drwn/Chl	kd: KT/MS
Figure:	3

P:\GeoGra\Projects\2010\060\01\GIS\mxd\Paspalum\Fig\_Paspalum\_Occurr.mxd Date: 8/13/2013 9:43:59 AM

**ATTACHMENT 10** 



ENVIRONMENTAL SERVICES, INC. 524 South New Hope Road Raleigh, North Carolina 27610 919-212-1760 / Facsimile 919-212-1707 www.environmentalservicesinc.com

# **MEMORANDUM**

TO:	Mary Frazer
FROM:	Matt Smith
DATE:	29 August 2013
RE:	US 70 Havelock Bypass (R-1015) P.O. No. 6300030960 Address USFS Comments on DEIS and PETS Analysis: Summary of Evaluation for Summer Species: LeConte's thistle ( <i>Cirsium lecontei</i> ), short-bristled beaksedge ( <i>Rhynchospora breviseta</i> ), and yellow fringeless orchid ( <i>Platanthera integra</i> ) ESI Project No. ER10-060.08

# **Background**

In their review of the Draft Environmental Impact Statement (DEIS) for the US 70 Havelock Bypass project (Figure 1), the U.S. Forest Service (USFS) identified the need for additional information on project-related impacts for LeConte's thistle (*Cirsium lecontei*), short-bristled beaksedge (*Rhynchospora breviseta*), and yellow fringeless orchid (*Platanthera integra*) to more fully assess potential viability concerns resulting from project implementation (Figure 2).

LeConte's thistle is listed as a Locally Rare species by the USFS, is state listed as Significantly Rare - Peripheral, and does not have a designation by the U.S. Fish and Wildlife Service (USFWS). Shortbristled beaksedge is listed as a Sensitive species by the USFS, is state listed as Significantly Rare – Peripheral, and does not have a designation by the USFWS. Yellow fringeless orchid is listed as a Sensitive species by the USFS, is state listed as Threatened, and does not have a designation by the USFWS. Based on these listings, the USFS is required to assess potential impacts to the species resulting from actions by the USFS, such as granting an easement for the US 70 Havelock Bypass, to determine whether the action threatens the viability of the species on National Forest System (NFS) lands in the Croatan National Forest (CNF).

Environmental Services, Inc., (ESI), has been asked by the North Carolina Department of Transportation (NCDOT) to complete an evaluation of impacts to each of these species associated with Alternative 3 of the proposed US 70 Havelock Bypass (R-1015) (Figure 1). The study area for Alternative 3 is referred to as the Alt. 3 study area in this evaluation.

Impact assessments for these three species were based on the following:

- The evaluations presented here utilize Element Occurrence (EO) data obtained from the N.C. Natural Heritage Program (NCNHP) in April 2012, supplemented by site evaluations conducted by ESI in 2012.
- Boundaries for NFS lands were provided by the USFS for use in this evaluation. Only EOs, or portions of EOs, on NFS lands are of concern for the viability determination for NFS lands on the CNF.
- Direct impacts are based on the tree clearing limits (slope stake limits plus 15 feet) plus an additional 25 feet.
- Indirect impacts were considered for EO areas located on NFS lands between Alternative 3 and existing US 70 based on consideration that different post-project habitat management techniques may be required by USFS for areas isolated from larger, contiguous NFS lands by the project. Additional concerns identified for consideration of indirect impacts include construction or maintenance actions by NCDOT in the vicinity of rare plants EOs on NFS lands that could have negative impacts on the rare plants or the suitability of their habitat. These actions could include the type of roadside vegetation proposed for use by NCDOT in the project right-of-way, location of construction staging areas, soil compaction or rutting caused by heavy equipment resulting in localized changes in hydrology, and use of herbicides and pesticides.
- Cumulative impacts were considered for identified actions on NFS lands that could affect these species. Because the USFS concern for these species is for maintaining continued viability on NFS lands in the CNF, actions off NFS lands were not considered for determining whether an action will affect the viability of these species on NFS lands. Actions proposed on NFS lands are subject to independent review by USFS to assess potential effects to the continued viability of these species on NFS lands in the CNF. One project has been identified with potential for cumulative effects for all species included in this analysis; a project proposed by Duke Energy Progress for replacing the overhead ground wire and selected poles within an existing transmission line corridor right-of-way located along approximately 5 miles of NFS lands in the CNF. The Duke Energy Progress project right-of-way includes occurrences for all of the species included in this analysis and the proposed actions have the potential to affect these species. This project is currently being evaluated to determine the effects to these species, which are expected to be minimal based on the types of activities being proposed. One additional action has been identified with consideration for cumulative effects to yellow-fringeless orchid, a wildlife improvement project completed in the summer of 2003 and subsequent damage from ATV's that resulted in a loss of habitat and number of individuals observed to one EO (EO 7) for yellowfringeless orchid. No other NCDOT projects have been identified that would directly or indirectly impact these species on NFS lands. No other actions being considered by USFS on NFS lands have been identified that would directly or indirectly impact these species. As such, no significant cumulative impacts were identified for these species.

A summary of the evaluations presented here will be incorporated into Chapter 4 of the Final Environmental Impact Statement (FEIS).

## LeConte's Thistle (Cirsium lecontei)

LeConte's thistle is a biennial member of the aster family that occurs in open pine savannas.<sup>i</sup> Managing for open savanna habitat through seasonal mowing and prescribed burning of powerline rights-of-way and prescribed burning of forest habitats is important to maintaining suitable open habitat for this species. On the CNF the USFS undertakes prescribed burns on NFS lands in accordance with the Forest Management Plan for the Croatan National Forest. Powerline rights-of-way are managed by a combination of mowing by the powerline easement holder and prescribed burns conducted by the USFS. Under favorable habitat conditions biennial plants spend their first year in a vegetative state and in their second year they will flower and set seed followed by the death of the plants.<sup>ii</sup> If habitat conditions are not favorable individual plants may not flower or set seed during its two-year life cycle. If a population does not set seed then this species may not persist at a given location. If population sizes are small and/or all of the plants present in a population are part of the same two-year life cycle it is possible to not find plants at a site where plants were found in the previous year based on the difficulty of detecting non-flowering individuals under dense herbaceous or shrub growth habitat conditions. If suitable habitat is still present it is possible that seeds may be persistent at these sites.

The scope of work for the LeConte's thistle evaluation is the result of meetings with NCDOT and the USFS and evaluates direct and indirect impacts on LeConte's thistle occurrences in the Alt. 3 study area for the US 70 Havelock Bypass. There are 12 EOs tracked by NCNHP on NFS lands within the CNF, including four EOs that represent historic records and one EO that is a parent EO (Figure 3). The parent EO (28) incorporates EOs 5, 24, 26, and 27 in their entirety and is not evaluated separately. The different alternatives evaluated for the US 70 Havelock Bypass project area (referred to as the Alternatives study area in this evaluation) includes portions of 5 EOs: 5, 24, 26, 27, and 29. Alternative 3 directly impacts portions of EOs 26 and 29. Each of the EOs consists of one to several discreet polygons. Several of these polygons would have been considered occupied habitat polygons at the time of discovery and reporting to NCNHP, but several mapped EOs are attempts to encompass general areas identified in historic records but without detailed location information.

# Methods for Assessment

There are a total of 11 EOs (excluding 1 parent EO) for this species on NFS lands within the CNF, but recent surveys reportedly have failed to relocate this species within several of these EOs (Gary Kauffman, personal communication, 8 February 2012). Each of the 11 EOs was visited in an attempt to re-document the presence of suitable habitat and individuals of LeConte's thistle within the EO. This information will be used to assist in the evaluation of the direct and indirect impacts associated with Alternative 3 of the US 70 Havelock Bypass on the viability of LeConte's thistle on NFS lands within the CNF.

The initial step in the evaluation was to determine the number of unique polygons identified in NCNHP files that make up the eleven EOs. Seventeen discrete polygons were identified on NFS lands within the CNF. Each polygon was evaluated in the field to confirm continued presence of LeConte's thistle and to obtain population estimates and density of individual plants. Surveys for LeConte's thistle were undertaken on July 16-18 and August 6, 2012. The surveys were conducted by an experienced team of biologists led by Matt Smith with support from David DuMond. Individual plants were identified across a range of growth stages, including non-flowering immature plants and plants in all stages of flowering,

including individuals in various stages of seed maturity. The majority of plants observed consisted of plants with evidence of flowering during the 2012 season.

Surveys of each polygon consisted of two biologists walking transects within the habitat encompassed by NCNHP EO polygons. Individual stems of LeConte's thistle were counted to determine the number of plants present within each polygon. Sub-polygons were approximated using GPS to estimate coverage of LeConte's thistle (shown as "clusters" on Figures 3a - 3g) within each occupied habitat polygon surveyed.

## Results of Assessment

The results of the surveys of EOs identified by NCNHP are presented in Table 1 along with a summary of NCNHP data for the most recent observations of each EO. Because several EOs include multiple mapped polygons, each individual polygon identified in NCNHP records has been assigned a number (Polygon #) for this evaluation to facilitate tracking and analysis.

NCNHP Data				ESI 2012 Survey Results			
EO #	EO Status	Last Observed	# Plants (Last Observed)	Polygon #	# Plants Observed	Habitat Quality	
5 <sup>b</sup>	Historic	7/19/1958	1 <sup>a</sup>	5	0	Maintained roadside	
8	Historic	10/17/1975	1 <sup>a</sup>	8	0	Dense pine plantation	
12	Extant	9/4/1995	1	12	0	Open maintained powerline ROW, very wet	
17	Extant	8/26/2009	0	17a	0	Pine forest with dense shrubs	
			2	17b	0	Open pine forest with scattered	
					(1 outside polygon)	shrubs	
20	Historic	8/9/1939	1 <sup>a</sup>	20	0	Maintained roadside, pocosin	
23	Historic	8/4/1949	2	23	0	Vague historic record, insufficient data to locate specific occurrence reported	
24 <sup>b</sup>	Extant	9/1/2005	55	24a	11 (4 outside polygon)	Open maintained powerline ROW	
				24b	6 (7 outside polygon)	Open maintained powerline ROW	
				24c	25	Open maintained powerline ROW	
26 <sup>b</sup>	Extant	8/11/2009	21	26a	0 (3 outside polygon)	Open maintained powerline ROW	
				26b	5	Open maintained powerline ROW	
27 <sup>b</sup>	Extant	7/15/2004	5	27	0	Open maintained powerline ROW	
29	Extant	8/23/2005	2	29a	0	Open maintained powerline ROW	
			17	29b	0	Open maintained powerline ROW	
			12	29c	0	Open maintained powerline ROW	
32	Extant	9/5/2005	1	32	1 <sup>b</sup>	Open maintained powerline ROW	
			Total: 121		Total: 63		

Table 1. Results of LeConte's Thistle Surveys.

<sup>a</sup> NCNHP records state that the species was documented but location referenced is non-specific.

<sup>b</sup> Based on survey records provided by John Fussell on April 10, 2013

<sup>c</sup> NCNHP records include the Parent EO 28 that includes EOs 5, 24, 26, and 27 in their entirety. The parent EO 28 is not evaluated separately.

EOs on the CNF were reviewed during the 2012 flowering season to document if suitable habitat is present and if individuals of LeConte's thistle still occur within the EO boundaries.

- EO 5 is an historic record with a non-specific location reference along US 70 (Figure 3). Suitable habitat was not determined to be present within the limited extent of NFS lands contained within this EO (Figure 3e). No LeConte's thistle plants were observed within or near this EO.
- EO 8 is an historic record along Catfish Lake Road (Figure 3). Suitable habitat was not determined to be present within this EO. No LeConte's thistle plants were observed within or near this EO.
- EO 12 is located in a powerline right-of-way adjacent to Catfish Lake Rd (Figure 3b). No LeConte's thistle plants were observed within or near this EO. The habitat in the vicinity of this EO appears to be too wet to support suitable habitat for LeConte's thistle. NCNHP records indicate one plant was observed in 1995 at this location. There is low probability that LeConte's thistle is still present at this site based on current habitat conditions and only one plant previously documented for this EO.
- EO 17 is composed of two polygons (Figure 3a). One polygon (Polygon 17a) has a dense shrub component and is unlikely to support suitable habitat for this species. No LeConte's thistle plants were observed within or near Polygon 17a. The other polygon (Polygon 17b) is located in an area of open pine flatwoods that has been recently burned. No LeConte's thistle plants were observed within Polygon 17b but ESI observed one LeConte's thistle plant in close proximity to Polygon 17b (identified as Cluster N on Figure 3a).
- EO 20 is an historic record with a non-specific location reference (Figure 3). Suitable habitat was not determined to be present within this EO.
- EO 23 is an historic record with a non-specific location reference (Figure 3). This EO is described as generally being from a "location east of Newport" where two specimens were collected in 1949. Based on the ambiguity of the exact location, NCNHP files depict this EO as a large polygon with a low probability of occurrence within any given portion of the polygon. Only a small amount of NFS lands are contained in the northeastern portion of this general location polygon. Due to the non-specific location reference, limited extent of NFS lands along the margin of the large EO polygon, low probability that this EO is on NFS lands, and the age of the record, ESI did not attempt to survey this EO for continued presence of LeConte's thistle.
- EO 24 is composed of three occupied habitat polygons (Figure 3c). Eleven LeConte's thistle plants were observed within Polygon 24a (identified as Clusters C, D, E, and F on Figure 3c) and an additional 4 were observed outside of the boundaries of this polygon (identified as Cluster P on Figure 3c). Six LeConte's thistle plants were observed within Polygon 24b (identified as Clusters G and L on Figure 3c) and an additional seven plants were observed outside of the boundaries of this polygon (identified as Clusters J, K, and M on Figure 3c). Twenty-five LeConte's thistle plants were observed within Polygon 24c (identified as Clusters H and I on Figure 3c).
- EO 26 is composed of two polygons (Figure 3d). No LeConte's thistle plants were observed within Polygon 26a, but 3 plants were observed outside of the boundaries for Polygon 26a (Cluster B on Figure 3d). Five LeConte's thistle plants were observed within Polygon 26b (identified as Cluster A on Figure 3d).
- EO 27 is located in a powerline right-of-way (Figure 3e). No LeConte's thistle plants were observed within or near EO 27. NCNHP records indicate five LeConte's thistle plants were

observed scattered across the powerline right-of-way in 2004. The site appears to contain suitable habitat and it is possible that LeConte's thistle is still present at this site but were not flowering and not detected during the 2012 survey.

- EO 29 is located in a powerline right-of-way with suitable habitat appearing to be present (Figure 3f). No LeConte's thistle plants were observed within or near this EO. The species was last observed at this site in 2005. While plants may not have been observed during the 2012 survey effort, suitable habitat is present within this EO and it is possible that this biennual species could be observed in future alternate years.
- EO No. 32 is located in a powerline right-of-way with suitable habitat appearing to be present (Figure 3g). This site was heavily disturbed in 2003 in order to create a wildlife food plot with restoration efforts implemented soon after. One Leconte's thistle plant was observed by John Fussell in 2012 (as reported to NCDOT in 2013) within this EO. Suitable habitat is present within this EO and it is possible that greater numbers could be observed in alternate years.

There are a total of 11 EOs (excluding 1 parent EO) recorded for LeConte's thistle on NFS lands within the CNF. Four EOs are considered to be historic occurrences with unsuitable habitat present for three of these (EOs 5, 8, and 20) and one historic record (EO 23) described from a vague location that may not be on NFS lands. It is unlikely that this species is present within the historic EOs that could be identified as being on NFS lands based on absence of suitable habitat. One additional EO (12) appears to be too wet to provide suitable habitat for this species and it is unlikely that this species is still present within this EO. Two EOs (27 and 29) include suitable habitat for this species but no individuals were observed during the 2012 survey effort. The remaining four EOs (17, 24, 26, and 32) have suitable habitat and individuals of LeConte's thistle were observed within or near the boundaries of the EO. Based on the 2012 evaluation, it appears that four of the 11 EOs for LeConte's thistle on NFS lands within the CNF have been confirmed as still extant and may be considered viable based on evidence of reproduction. Suitable habitat conditions were identified for two of the EOs in which no LeConte's thistle plants were observed in 2012. This biennial species could still be extant in these three EOs but not detected in the 2012 evaluation due to possible off-year flowering cycle, which is supported by documentation in two of these areas in recent alternate years.

#### Summary of Impacts

- This evaluation indicates that LeConte's thistle is still present in four EOs (17, 24, 26, and 32) and may still occur in low numbers in an additional two EOs (27 and 29) containing suitable habitat. A total of 63 individual LeConte's thistle plants were observed during the 2012 survey within four of these EOs. These six areas collectively cover 24.8 acres of occupied or potentially occupied habitat documented on NFS lands in the CNF.
- Alternative 3 directly affects EO 26 and EO 29. EO 26 is composed of two polygons that total 8.5 acres. One polygon will not be affected. Approximately 1.7 acres of the other polygon will be directly affected. Individual LeConte's thistle plants observed within this polygon occur to the north and south of the area to be directly impacted but no plants were observed within the direct impact area. EO 29 is composed of three polygons that total 0.2 acre and Alternative 3 will impact it in its entirety. No individuals of LeConte's thistle were observed within this EO during the 2012 survey, however, 31 individuals of this biennual species were observed in 2005 and this

occurrence may comprise individuals that flower in alternate years. Direct impacts to the habitat of the EOs may be able to be mitigated by collecting seeds to supplement existing populations on NFS lands. Seed collection will be conducted in coordination with the USFS in accordance with a seed collection permit for this species issued to NCDOT. Although no individual plants of LeConte's thistle were documented within the direct impact area during the 2012 surveys, seed collection may be possible from plants within EOs (including 24, 26, and 29) where the population size is large enough to support seed collection efforts.

- An additional 13.4 acres of reported occurrence are in areas subject to indirect impact consideration for Alternative 3 including an additional 6.0 acres of EO 26. The entire 5.9 acres of EO 24 are in an area subject to indirect impact consideration. The 2012 survey documented 8 individual plants in the area of EO 26 that may be subject to indirect impacts and 53 individual plants in the area of EO 24 that may be subject to indirect impacts. These individual plants were observed within the powerline right-of-way which is currently being managed by a combination of mowing by the utility company operating the lines within the right-of-way and periodic prescribed burns conducted by the USFS. No changes in management of the powerline right-of-way by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through measures previously proposed by NCDOT regarding management agreements with USFS for the areas subject to potential indirect impacts. Measures discussed to reduce the likelihood for adverse effects to these areas include:
  - Allow for the temporary closure of the bypass to allow the USFS to conduct periodic prescribed burns;
  - Prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction;
  - Avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable;
  - Avoid placing heavy equipment within powerline corridors outside of the project's direct impact area without prior approval from the USFS;
  - Require contractors to pressure wash all off-road equipment prior to being brought into the CNF construction areas;
  - Prior to construction NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species for removal during construction;
  - o Avoid planting of aggressive non-native species for re-vegetation;
  - Utilize rolled matting for erosion control and revegetation on NFS lands;
  - o Avoid use of broadcast sprays for herbicides and pesticides on NFS lands; and
  - Minimize the use of herbicides and pesticides.

#### Conclusions and Recommendations

The US 70 Havelock Bypass (R-1015) Alternative 3 will result in unavoidable direct impacts to LeConte's thistle habitat and has the potential for indirect impacts. Alternative 3 directly affects

approximately 1.9 acres of two mapped LeConte's thistle EOs, but no individual plants were observed during the 2012 survey in the habitat area directly impacted. However, because this species is a biennual and part of the population may be difficult to detect during non-flowering years, direct impacts may be assumed based on presence of plants of this species elsewhere within the mapped EOs and presence of suitable habitat within the portion of the EOs in the direct impact area. An additional 13.4 acres and 61 individual plants observed during the 2012 survey are located in areas subject to indirect impact consideration.

The total population on NFS lands in the CNF is difficult to determine based on a single year survey due to the biennual nature of this species. The 63 individual plants of LeConte's thistle documented on NFS lands in the 2012 survey (61 in the Alternatives study area, 2 elsewhere) represent the minimum population size. A larger number of individual plants (110) have been documented in EOs on NFS lands in recent years (2005 and/or 2009) in areas that appear to contain suitable habitat, including one EO where none were documented as flowering in 2012. The EO (24) with the largest documented number of individual LeConte's thistle in both the 2012 survey (53 individuals) and a previous survey in 2009 (55 individuals), is not directly impacted by Alternative 3, but is in an area subject to consideration for indirect impacts. A project proposed by Duke Energy Progress has a study area that includes occurrences for this species and has the potential to affect this species. This project is currently being evaluated to determine the effects to this species. The cumulative impacts for this project are not available at this time but are expected to be minimal based on the types of activities proposed. No cumulative impacts from other USFS or NCDOT projects on NFS lands on the CNF have been identified.

Based on the limited direct impact to habitat within existing EOs, and no known direct impact to individuals of this species, the direct impacts for Alternative 3 are not likely to result in a loss of viability on NFS lands within the CNF. The area subject to consideration for indirect impacts represents a relatively large percentage of the population and areal extent of Leconte's thistle recently documented as extant or potentially extant on NFS lands in the CNF. However, the project is not expected to result in changes that would prevent the utility company from continued mowing to maintain the powerline right-of-way and measures are in place to allow the USFS to continue conducting prescribed burns in the areas in which these EOs are found, reducing the threat for indirect impacts. Other potential concerns for indirect impacts that could result from project construction and maintenance activities can be minimized through appropriate measures.

Implementation of measures agreed to between NCDOT and USFS would minimize viability concerns resulting from indirect impacts that could arise from construction and/or maintenance activities. These measures include: allow for the temporary closure of the bypass to allow the USFS to conduct periodic prescribed burns; prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction; avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable; avoid placing heavy equipment within powerline corridors outside of the project's direct impact area without prior approval from the USFS; require contractors to pressure wash all off-road equipment prior to being brought into the CNF construction areas; prior to construction, with the USFS, will locate and flag areas of non-native invasive plant species for removal during construction; avoid planting of aggressive non-native species for re-

vegetation; Utilize rolled matting for erosion control and revegetation on NFS lands; avoid use of broadcast sprays for herbicides and pesticides on NFS lands; and minimize the use of herbicides and pesticides. As mitigation for direct impacts to offset viability concerns, NCDOT has agreed to collect seeds from viable EOs for use in supplementing existing EOs where suitable habitat occurs but numbers of individuals are low or individuals have not been recently documented.

With the implementation of appropriate measures to reduce concerns for indirect impacts, the US 70 Havelock Bypass (R-1015) Alternative 3 project is not likely to cause a loss of viability for LeConte's thistle on NFS lands in the CNF.

### Short-bristled Beaksedge (Rhynchospora galeana)

Short-bristled beaksedge is a perennial sedge in the genus *Rhynchospora* that occurs in open pine savannas.<sup>i</sup> Managing for open savanna habitat through seasonal mowing and prescribed burning of powerline rights-of-way and prescribed burning of forest habitats is important to maintaining suitable habitat for this species. On the CNF the USFS undertakes prescribed burns in accordance with the Forest Management Plan for the Croatan National Forest. Powerline rights-of-way are managed by a combination of mowing by the powerline easement holder and prescribed burns conducted by the USFS. Confirmation of species within this genus requires presence of mature fruiting structures (nutlets).

The scope of work for the short-bristled beaksedge evaluation is the result of meetings with NCDOT and the USFS and evaluates direct and indirect impacts on short-bristled beaksedge occurrences in the Alt. 3 study area for the US 70 Havelock Bypass. There are 7 EOs on NFS lands within the CNF. Alternative 3 has the potential to affect EO 27, which is mapped by NCNHP as two polygons (Figure 4). One mapped polygon, the southern polygon on Figure 4, would have direct impacts associated with Alternative 3 as well as potential for indirect impacts. The other polygon, the northern polygon on Figure 4, is located in an area subject to indirect impact consideration for Alternative 3. The USFS has identified a viability concern for this species based on only 7 EOs on NFS lands in the CNF and EO 27 is the largest EO on NFS lands in the CNF. Additional evaluation of this EO was completed to determine if impacts to this EO will have a detrimental effect on the viability of this species on the CNF.

#### Methods and Results of Assessment

ESI reviewed NCNHP records to obtain information about past documentation for the affected EO. NCNHP records indicate that EO 27 was documented in August 2005 and reported by John Fussell. This EO is currently represented by two polygons in NCNHP files and the southern polygon is crossed by Alternative 3. The validity and status of the southern polygon for EO 27 came under doubt based on a recent email communication between John Fussell and NCDOT (22 August 2012, personal communication) in which John Fussell indicated that he had not observed this species in the southern polygon area and that to his recollection this area does not seem to support suitable habitat for this species. The site visits on 16-18 July 2012 and 6 August 2012 by ESI biologists Matt Smith and David DuMond confirmed that the area occupied by the southern polygon for the mapped EO does not appear to support suitable habitat for this species.

ESI met with Suzanne Mason, NCNHP, on 10 September 2012 to review the files for the short-bristled beaksedge occurrence (EO 27) that is in the NCNHP database. After reviewing the source report from

John Fussell and the two polygons associated with this EO in the database it appears that this EO may need to be revised in NCNHP files. The original report submitted by John Fussell that is the data source for this EO describes finding 850 individuals within the powerline right-of-way adjacent to FSR 3086 within the Havelock Station Flatwoods and Powerline Corridor Natural Heritage Area which generally correlates with the northern polygon (Figure 4). The report does not make reference to observing shortbristled beaksedge in the vicinity of the powerline crossing and Scott Road, the location corresponding to the southern polygon in NCNHP files for this EO (Figure 4). This is consistent with the recent communication from John Fussell where he indicates that he did not believe this area supports suitable habitat for this species and that he had not identified short-bristled beaksedge in this area. It appears that in the absence of mapping provided for the reported occurrence, NCNHP interpreted the original source report to include all of the powerline rights-of-way on NFS land within the Havelock Station Flatwoods and Powerline Natural Area. Based on NCNHP's review of the original source report and John Fussell's communications with NCDOT, NCNHP determined that the southern polygon was not part of the original reported occurrence and should be corrected in the NCNHP database. Coordination among NCNHP, NCDOT and John Fussell is ongoing to confirm the southern polygon is invalid and will be corrected in NCNHP files. Based on this file correction, there would be no direct impacts to short-bristled beaksedge from Alternative 3. The northern polygon for this EO is in an area subject to indirect impact consideration.

The northern polygon for EO 27 is located in a maintained powerline right-of-way. Habitat conditions were unusually shrubby at the time of the 2012 field evaluation since the powerline right-way had not been mowed recently. Under these conditions, as well as droughty conditions early in the growing season, short-bristled beaksedge may only be present in a non-reproductive, vegetative state this year. No flowering or fruiting individuals of short-bristled beaksedge were observed, however, vegetative material from the genus *Rhynchospora* was observed throughout the northern polygon. Based on the 2012 field evaluation this species is likely persisting in the northern polygon based on the recent record (2005) and is more likely to be confirmable in a year when mowing occurs prior to the flowering season for this species, reducing competition, and allowing individual plants to successfully produce inflorescences and nutlets. This species was subsequently observed within the northern polygon during field surveys conducted by ESI biologists in July 2013.

#### Summary of Impacts

No direct impacts to short-bristled beaksedge are now expected to occur based on the anticipated correction to NCNHP files for the August 2005 record documenting EO 27. This corrected EO is in an area subject to indirect impact consideration. The impact assessment for indirect impacts is based on the 2005 NCNHP records for this species.

• Approximately 44.2 acres (100% of the northern polygon) of this EO are in an area subject to indirect impact consideration for Alternative 3. This EO contains an estimated 850 individual short-bristled beaksedge plants, the largest known population on NFS lands in the CNF. No changes in management of the powerline right-of-way by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Potential indirect impacts that could result from construction or maintenance activities can be minimized through measures previously proposed by NCDOT regarding management agreements

with USFS for the areas subject to potential indirect impacts. Measures discussed to reduce the likelihood for adverse effects to these areas include:

- Allow for the temporary closure of the bypass to allow the USFS to conduct periodic prescribed burns;
- Prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction;
- Avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable;
- Avoid placing heavy equipment within powerline corridors outside of the project's direct impact area without prior approval from the USFS;
- Require contractors to pressure wash all off-road equipment prior to being brought into the CNF construction areas;
- Prior to construction NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species for removal during construction;
- Avoid planting of aggressive non-native species for re-vegetation;
- Utilize rolled matting for erosion control and revegetation on NFS lands;
- o Avoid use of broadcast sprays for herbicides and pesticides on NFS lands; and
- Minimize the use of herbicides and pesticides.

# Conclusions and Recommendations

With correction of NCHNP's record for short-bristled beaksedge EO 27, the US 70 Havelock Bypass (R-1015) Alternative 3 will not result in direct impacts to short-bristled beaksedge but has the potential to result in indirect impacts. A project proposed by Duke Energy Progress has a study area that includes occurrences for this species and has the potential to affect this species. This project is currently being evaluated to determine the effects to this species. The cumulative impacts for this project are not available at this time but are expected to be minimal based on the types of activities proposed. No cumulative impacts from other USFS or NCDOT projects on NFS lands in the CNF have been identified.

The project is not expected to result in changes that would prevent the utility company from continued mowing to maintain the powerline right-of-way in which EO 27 is found, reducing the threat for indirect impacts. Other potential concerns for indirect impacts that could result from project construction and maintenance activities can be minimized through appropriate measures. Implementation of measures agreed to between NCDOT and USFS would minimize viability concerns resulting from indirect impacts that could arise from construction and/or maintenance activities. These measures include: allow for the temporary closure of the bypass to allow the USFS to conduct periodic prescribed burns; prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction; avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable; avoid placing heavy equipment within powerline corridors outside of the project's direct impact area without prior approval from the USFS; require contractors to pressure wash all off-road equipment prior to being brought into the CNF construction areas; prior to construction NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species for removal during construction; avoid planting of aggressive non-native species for re-vegetation; utilize rolled

matting for erosion control and revegetation on NFS lands; avoid use of broadcast sprays for herbicides and pesticides on NFS lands; and minimize the use of herbicides and pesticides.

With the implementation of appropriate measures to reduce concerns for indirect impacts, the US 70 Havelock Bypass (R-1015) Alternative 3 project is not likely to cause a loss of viability for short-bristled beaksedge on NFS lands in the CNF.

## Yellow Fringeless Orchid (Platanthera integra)

Yellow-fringeless orchid is a perennial that occurs in open pine savannas.<sup>i</sup> Managing for open savanna habitat through seasonal mowing and prescribed burning of powerline rights-of-way and prescribed burning of forest habitats is important to maintaining suitable habitat for this species. On the CNF the USFS undertakes prescribed burns in accordance with the Forest Management Plan for the Croatan National Forest. Powerline rights-of-way are managed by a combination of mowing by the powerline easement holder and prescribed burns conducted by the USFS.

The scope of work for the yellow fringeless orchid evaluation is the result of meetings with NCDOT and the USFS and evaluates direct and indirect impacts on yellow fringeless orchid occurrences in the Alt. 3 study area for the US 70 Havelock Bypass. There are 7 NCNHP EOs on NFS lands within the CNF (Figure 4). The US 70 Havelock Bypass Alternatives study area includes EO 23 which is composed of two polygons (Figure 4). This EO is not directly impacted by Alternative 3. However, this EO is located within an area subject to indirect impact consideration for Alternative 3.

## Methods and Results of Assessment

ESI reviewed NCNHP records to obtain information about past documentation for the affected EO. NCNHP records indicate that EO 23 was last observed in August 2007 by John Fussell and 21 individual plants were reported at that time within a powerline right-of-way. This EO was visited by ESI biologists Matt Smith and David DuMond on 6 August 2012 to assess the habitat and to document the distribution and density of individuals within this EO.

The two polygons for EO 23 are located within a powerline right-of-way with scattered dense areas of woody shrubs. Approximately 1 person-hour of search time was spent within the northern polygon and 2 person-hours of search time were spent within the southern polygon. No yellow fringeless orchid plants were observed in either polygon. Habitat conditions for both polygons were unusually shrubby at the time of the field evaluation since the powerline right-way had not been mowed this season. It is possible that this species is present within these polygons in low numbers or not expressed vegetatively because of dense shrub vegetation or droughty conditions during the early part of the growing season. Updated population estimates were not able to be conducted since the habitat has not been recently mowed and the density of shrubs has likely caused this species to lie dormant this season.

# Summary of Impacts

No direct impacts will occur to EO 23. This EO is in an area subject to indirect impact consideration.

• No changes in management of the powerline right-of-way by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued.

Potential indirect impacts that could result from construction or maintenance activities can be minimized through measures previously proposed by NCDOT regarding management agreements with USFS for the areas subject to potential indirect impacts. Measures discussed to reduce the likelihood for adverse effects to these areas include:

- Allow for the temporary closure of the bypass to allow the USFS to conduct periodic prescribed burns;
- Prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction;
- Avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable;
- Avoid placing heavy equipment within powerline corridors outside of the project's direct impact area without prior approval from the USFS;
- Require contractors to pressure wash all off-road equipment prior to being brought into the CNF construction areas;
- Prior to construction NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species for removal during construction;
- Avoid planting of aggressive non-native species for re-vegetation;
- Utilize rolled matting for erosion control and revegetation on NFS lands;
- o Avoid use of broadcast sprays for herbicides and pesticides on NFS lands; and
- Minimize the use of herbicides and pesticides.

## Conclusions and Recommendations

The US 70 Havelock Bypass (R-1015) Alternative 3 will not result in direct impacts to yellow fringeless orchid. One EO (23) is located in an area subject to consideration for indirect impacts. A project proposed by Duke Energy Progress has a study area that includes EO 23 for this species and has the potential to affect this EO. This project is currently being evaluated to determine the effects to this species. The cumulative impacts for this project are not available at this time but are expected to be minimal based on the types of activities proposed. A wildlife habitat improvement project completed in the summer of 2003 in the Little Road savanna population (EO 7) resulted in a loss of habitat and individuals of this species within EO 7. Mitigation measures at the site have since restored the habitat but the number of individuals is still low (approximately 10) compared to earlier counts that were as high as 200 individuals. No cumulative impacts from other USFS or NCDOT projects on NFS lands in the CNF have been identified.

The project is not expected to result in changes that would prevent the utility company from continued mowing to maintain the powerline right-of-way or to interfere with the ability of the USFS to conduct periodic prescribed burns in the area in which EO 23 is found, reducing the threat for indirect impacts. Other potential concerns for indirect impacts that could result from project construction and maintenance activities can be minimized through appropriate measures. Implementation of measures agreed to between NCDOT and USFS would minimize viability concerns resulting from indirect impacts that could arise from construction and/or maintenance activities. These measures include: allow for the temporary closure of the bypass to allow the USFS to conduct periodic prescribed burns; prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the

project construction limits and put up protective orange fencing to be removed after completion of construction; avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable; avoid placing heavy equipment within powerline corridors outside of the project's direct impact area without prior approval from the USFS; require contractors to pressure wash all off-road equipment prior to being brought into the CNF construction areas; prior to construction NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species for removal during construction; avoid planting of aggressive non-native species for re-vegetation; Utilize rolled matting for erosion control and revegetation on NFS lands; avoid use of broadcast sprays for herbicides and pesticides on NFS lands; and minimize the use of herbicides and pesticides.

With the implementation of appropriate measures to reduce concerns for indirect impacts, the US 70 Havelock Bypass (R-1015) Alternative 3 project is not likely to cause a loss of viability for yellow fringeless orchid on NFS lands in the CNF.

<sup>&</sup>lt;sup>i</sup> Radford, A.E., H.E. Ahles, and C.R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. University of North Carolina Press, Chapel Hill, NC. 1183 pp.

<sup>&</sup>lt;sup>ii</sup> Harris, J.G. and M.W. Harris. 1997. Plant Identification Terminology: An illustrated Glossary. Spring Lake Publishing, Spring Lake, UT. 197 pp.





ath: P:\GeoGra\Projects\2010\060\01\GIS\mxd\SummerSpec\_ThistleOrchidBksedge\Fig\_CILElocation.mxd Date: 8/6/2013 9:53:46 A





120

**V**URBE

Citate Copy Earlings

 Project:
 ER10060.08

 Date:
 Aug 2013

 Drwn/Chkd:
 KT/MKS

 Figure:
 3

LeConte's Thistle Assessment Overview US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



Tanga antilary at Math # 1991 Manada Say

LeConte's Thistle Assessment - NCNHP Element Occurrences US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina Project: ER10060.08 Date: Aug 2013 Drwn/Chkd: KT/MKS Figure: **3a** 

Path: P/\GeoGra\Projects\2010\0660\01\GIS\mxd\SummerSpec\_ThistleOrchidBksedge\Fig\_CILE\_2A.mxd\_Date: 8/13/2013 10:22:33 AM

regulatory re

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



Longs edition of 1995 Onto

Project: ER10060.08 Date: Aug 2013 Drwn/Chkd: KT/MKS Figure: **3b** 

LeConte's Thistle Assessment - NCNHP Element Occurrences US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina

Path: P:\GeoGra\Projects\2010\060\01\GIS\mxd\SummerSpec\_ThistleOrchidBksedge\Fig\_CILE\_2b\_2G.mxd Date: 8/13/2013 10:05:04 AM


And the second sec

LeConte's Thistle Assessment - NCNHP Element Occurrences US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina Project: ER10060.08 Date: Aug 2013 Drwn/Chkd: KT/MKS Figure: **3c** 

e misterillo e

Path: P:\GeoGra\Projects\2010/060\01\GIS\mxd\SummerSpec\_ThistleOrchidBksedge\Fig\_CILE\_2b\_2G.mxd Date: 8/13/2013 10:05:04 AM

regulatory review.



LeConte's Thistle Assessment - NCNHP Element Occurrences

Project: ER10060.08 Date: Aug 2013 Drwn/Chkd: KT/MKS Figure: 3d

Path: P:\GeoGra\Projects\2010/060\01\GIS\mxd\SummerSpec\_ThistleOrchidBksedge\Fig\_CILE\_2b\_2G.mxd Date: 8/13/2013 10:05:04 AM

US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina



bestajo ostantinego o Longo en m A Julianensk. Corporation © 101 (i NApro) © A

 Project:
 ER10060.08

 Date:
 Aug 2013

 Drwn/Chkd:
 KT/MKS

 Figure:
 3e

LeConte's Thistle Assessment - NCNHP Element Occurrences US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina

Path: P:\GeoGra\Projects\2010/060\01\GIS\mxd\SummerSpec\_ThistleOrchidBksedge\Fig\_CILE\_2b\_2G.mxd Date: 8/13/2013 10:05:04 AM

regulatory review



LeConte's Thistle Assessment - NCNHP Element Occurrences US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina

Project:	ER10060.08
Date:	Aug 2013
Drwn/Chł	d: KT/MKS
Figure:	3f

Path: P:\GeoGra\Projects\2010\060\01\GIS\mxd\SummerSpec\_ThistleOrchidBksedge\Fig\_CILE\_2b\_2G.mxd\_Date: 8/13/2013 10:05:04 AM

POA

763

PROPERTY AND

1000

- 32.00

13

A AN



LeConte's Thistle Assessment - NCNHP Element Occurrences US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina

Project:	ER10060.08
Date:	Aug 2013
Drwn/Chk	d: KT/MKS
Figure:	3g

Path: P:\GeoGra\Projects\2010\060\01\GIS\mxd\SummerSpec\_ThistleOrchidBksedge\Fig\_CILE\_2b\_2G.mxd Date: 8/13/2013 10:05:04 AM



Project: E	R10060.08
Date:	Aug 2013
Drwn/Chkd	: KT/MKS
Figure:	4

Yellow Fringeless Orchid and Short-bristled Beaksedge Assessment Overview **US 70 Havelock Bypass (R-1015)** Craven and Carteret Counties, North Carolina

1.38

Path: P:\GeoGra\Projects\2010\060\01\GIS\mxd\SummerSpec\_ThistleOrchidBksedge\Fig\_ShortBB.mxd\_Date: 8/6/2013 11:20:56 AM

**ATTACHMENT 11** 



## ENVIRONMENTAL SERVICES, INC. 524 South New Hope Road Raleigh, North Carolina 27610 919-212-1760 / Facsimile 919-212-1707 www.environmentalservicesinc.com

# **MEMORANDUM**

TO:	Mary Frazer
FROM:	Matt Smith
DATE:	14 October 2013
RE:	US 70 Havelock Bypass (Rare Plant Species Mitigative Measures Support) Non-native Invasive species Analysis T.I.P. No. R-1015 Consulting P. O. 63000033859 ESI Project No. ER12-050.06

Environmental Services, Inc., (ESI), has been asked by the North Carolina Department of Transportation (NCDOT) to assist in completing an analysis for Alternative 3 of the US 70 Havelock Bypass (R-1015) of Non-Native Invasive Plant Species (NNIS) listed by the U.S. Forest Service (USFS) as occurring or potentially occurring within the Croatan National Forest (CNF). The analysis for potential NNIS plant effects was confined to a study area defined as the proposed tree clearing limits (slope stake limits plus 15 feet) plus an additional 25 feet. This area covers those areas proposed for disturbance that may be susceptible to new infestiations of NNIS plants and those areas adjacent to the study area that may act as a source of infestation. This analysis will assist in addressing concerns for indirect effects that could result from growth of these species along the proposed bypass project. Mitigation measures proposed by NCDOT to minimize potential indirect effects are also included.

### Methods

The NNIS plant evaluation was conducted in accordance with protocols provided by the USFS. ESI visited the study area for Alternative. 3 in September 2013 to identify infestations of NNIS species. Infestations identified for species listed in Tables 1 and 2 were recorded using a GPS device. Infestation of less than or equal to 10x10 meters in area are represented by a point. Larger infestations (those exceeding 10x10 m) are represented by a polygon. The percent cover, or aerial extent, of each invasive exotic plant has been estimated within each mapped infestation.

Not all non-native naturalized plant species, such as dandelion (*Taraxacum officinale*) or ox-eye daisy (*Leucanthemum vulgare*), are tracked by the USFS. Most USFS previous surveys have concentrated on those non-native plants known to be invasive in the Piedmont or coastal plain and those species that can be successfully controlled on the CNF. As such *Microstegium vimineum*, the most abundant NNIS previously recorded in other portions of the CNF is not currently being tracked. Table 1 includes species considered by the USFS to be present in the Piedmont or Coastal Plain and invasive across the Croatan National Forest that are currently being recorded. Table 2 includes NNIS plant species known to occur adjacent to the CNF which have the potential to spread to the CNF from nearby infestations. The list of NNIS plant species is subject to change as new plant threats are identified by the USFS.

Scientific Name	Common Name		
Lespedeza cuneata	Sericea Lespedeza		
Lespedeza bicolor	Bicolor Lespedeza		
Albizia julibrissin	Mimosa		
Ligustrum sinense	Chinese Privet		
Rosa multiflora	Multiflora Rose		
Ailanthus altissima	Tree-of-Heaven		
Miscanthus sinensis	Chinese Silver Grass		
Lonicera maacki or morrowii	Amur or Morrow's Honeysuckle		
Lonicera japonica	Japanese Honeysuckle		
Sorghum halepense	Johnson Grass		
Arthraxon hispidus	Basket Grass		
Elaeagnus umbellata	Autumn Olive		
Pueraria montana var. lobata	Kudzu		
Hedera helix var. helix	English Ivy		
Vinca minor	Periwinkle		
Kummerowia striata	Japanese-clover		
Youngia japonica	Asiatic Hawk's-beard		
Wisteria sinensis	Chinese Wisteria		
Verbena brasiliensis	Brazilian Vervain		

 Table 1. Croatan National Forest – NNIS plant species.

Table 2.	NNIS	plant s	species	infestations	near the	Croatan	National	Forest.
----------	------	---------	---------	--------------	----------	---------	----------	---------

Scientific Name	Common Name		
Lung angele and in duite a	Coron Cross		
Imperata cylinarica	Cogon Grass		
Persicaria perfoliata	Mile-a-minute		
Cayratia japonica	Bushkiller		
Pyrus calleryana	Bradford Pear		
Solanum viarum	Tropical Soda Apple		
Centaurea stoebe ssp. micranthos	Spotted Knapweed		
Commelina communis	Common Dayflower		

### **Existing Conditions**

Surveys for NNIS plant species were undertaken in September 2013 for the species listed in Tables 1 and 2. Figures 2a-2l depict the locations of NNIS plants observed in the study area. Ten species considered to be invasive by the USFS were found to occur on NFS lands on the CNF within the study area. Table 3 lists NNIS infestations identified for the study area for Alt. 3.

Scientific Name	Common Name	Site No.	Figure Number	Community Type <sup>a</sup>	Percent Cover	Area (acres)	Total Area
		1	2;	M PCm	75	0.77	(acres)
		2	21 2h	PFm	75	0.02	-
		3	2π 2σ	M	75	0.02	-
		4	2 <u>5</u> 2σ	M	75	0.00	-
		5	2 <u>5</u> 2g	M	25	<0.02	
		6	2 <u>5</u> 2g	M	75	0.09	
		7	2g	M	75	0.33	
		8	2f	M. PCm	75	0.36	-
		9	2e	M	75	0.15	1
Lespedeza	Sericea	10	2d	M	75	0.21	
cuneata	Lespedeza	11	2i	М	75	0.20	4.66
	1	12	21	М	50	0.80	
		13	2k	М	50	< 0.02	
		14	2k	М	25	< 0.02	
		15	2k	PFm, M, PCm	75	0.43	
		16	2k	М	50	0.68	
		17	2a	М	50	< 0.02	
		18	2a	M, PCm	50	< 0.02	-
		19	2a	М	75	0.09	
		1	2g	PFm, M	75	1.86	
T	Bicolor Lespedeza	2	2g	PFm, M	75	0.47	
Lespedeza		3	2g	M, PCm	75	0.44	2.81
bicolor		4	2f	M, PCm	50	0.02	
		5	2k	М	50	< 0.02	
		1	2g	М	75	< 0.02	
		2	2d	PFm	75	< 0.02	
		3	2d	М	50	< 0.02	
		4	2d	М	50	< 0.02	
		5	21	М	50	0.02	
Albizia	Mimosa	6	21	М	50	< 0.02	0.24
julibrissin	winnosa	7	21	М	50	< 0.02	0.24
		8	21	М	50	< 0.02	
		9	21	М	50	< 0.02	
		10	2k	М	50	< 0.02	
		11	2a	M, PFm	75	< 0.02	
		12	2a	М	75	< 0.02	
		1	2g	PFm	75	0.06	
Ligustrum	Chinese Privet	2	2g	М	50	< 0.02	
sinense	Chinese I fivet	3	2g	М	75	< 0.02	0.66
		4	2g	PFm, M	75	0.09	
		5	2g	М	50	< 0.02	

**Table 3.** NNIS plant species infestations identified in the study area for Alternative 3.

Scientific Name	Common Name	Site No.	Figure Number	Community Type <sup>a</sup>	Percent Cover	Area (acres)	Total Area (acres)
		6	2d	М	25	< 0.02	
		7	2d	М	25	< 0.02	
		8	21	М	50	< 0.02	
		9	2k	М	75	< 0.02	
		10	2k	М	75	0.02	
		11	2k	М	75	< 0.02	
		12	2k	М	50	0.02	
		13	2c	PFh	75	0.12	
		14	2c	PFh	50	0.09	
		15	2c	М	50	0.02	
		16	2a	М	50	< 0.02	
		17	2a	М	50	< 0.02	
		18	2a	М	50	< 0.02	
		19	2f	М	75	< 0.02	
		1	2g	М	50	< 0.02	
		2	2g	PFm	50	< 0.02	
Rosa	Multiflora	3	2g	PFm	50	< 0.02	0.12
multiflora	Rose	4	2g	PFm	50	< 0.02	0.12
-		5	21	PFh	25	< 0.02	
		6	2k	М	50	< 0.02	
		1	2k	М	50	< 0.02	
		2	2k	М	50	< 0.02	0.16
		3	2k	М	50	< 0.02	
Lonicera	Japanese Honeysuckle	4	2k	М	50	0.02	
japonica		5	2k	М	50	< 0.02	
		6	2c	PFh	50	< 0.02	
		7	2c	М	50	< 0.02	
		8	2a	М	50	< 0.02	
Sorghum halepense	Johnson Grass	1	2g	М	75	< 0.02	< 0.02
Hedera helix var. helix	English Ivy	1	21	М	50	<0.02	< 0.02
		1	21	PFh	50	< 0.02	1.21
Wistoria	Chinese	2	21	М	75	0.04	
sinansis	Wisteria	3	2k	PFh	75	0.84	
sinensis	vv isteria	4	2k	PFh	75	0.29	
		5	2k	М	75	< 0.02	]
		1	2b	М	75	< 0.02	-
		2	2a	М	75	< 0.02	
		3	2a	М	75	< 0.02	
		4	2a	М	75	< 0.02	
Verbena	Brazilian	5	2a	М	75	< 0.02	0.57
brasiliensis	Vervain	6	2b	М	75	< 0.02	
		7	2b	М	50	< 0.02	
		8	2e	М	75	0.14	
		9	2g	М	50	0.27	1
		10	2a	М	50	< 0.02	1

<sup>a</sup> Community Types: M = Rural/Urban Modifications; PFh = Pine Flatwoods, hydric; PFm = Pine Flatwoods, mesic; SR = Successional/Ruderal Habitat; PCm = Powerline Corridor, mesic

Multiple infestations were documented for eight of the ten species of USFS listed NNIS plant species identified in the study area, with single infestations documented for the remaining two species. The NNIS plant species with the most numerous infestations encountered were serice lespedeza (*Lespedeza cuneata*) and Chinese privet (*Ligustrum sinense*) with 19 infestations documented for each species, mimosa (*Albizia julibrissin*) with 12, and Brazilian vervain (*Verbena brasiliensis*) with 10. The remaining six species each had between one and eight infestations documented within the study area.

Sericea lespedeza infestations represent the greatest coverage by a single species (4.66 acres) followed by bicolor lespedeza *(Lespedeza bicolor)* (2.81 acres) and Chinese wisteria *(Wisteria sinensis)* (1.21 acres). The remaining species were encountered as smaller infestations, with cumulative infestations of the other seven species totaling less than 1.0 acre each.

All ten of these NNIS plant species were observed primarily in existing disturbed habitats on NFS lands along woodland borders adjacent to roads and bordering NFS lands boundaries adjacent to disturbed habitats. Since many of the NFS lands, including powerline rights-of-way, in the study area are subjected to frequent prescribed burns the number of infestations outside of roads and other boundary areas is greatly diminished. However, several species were found to have spread into adjacent habitats, most notably Chinese privet, multiflora rose (*Rosa multiflora*), and Chinese wisteria, and to a lesser extent sericea lespedeza, bicolor lespedeza, mimosa, and Japanese honeysuckle (*Lonicera japonica*).

The sites within the study area with the largest incidence of NNIS plants were along Sunset Rd (Figure 2g) and in the vicinity of the solid waste transfer facility (Figure 2k). Smaller infestations were noted on forest service roads (Figures 2d, 2e, 2f, 2i, and 2j), along US 70 south of Havelock (Figures 2a-2c), and adjacent to residential properties bordering NFS lands (Figures 2h and 2l).

One large infestation of bicolor lespedeza adjacent to Sunset Rd (Site 1, Figure 2g) represents the largest coverage area of a single NNIS plant species in the study area (1.86 acres) and appears to be spreading. The Chinese wisteria infestation (Site 3, Figure 2k) in the vicinity of the solid waste transfer facility (0.84 acre) is large in size and in close proximity to additional infestations (Sites 4 and 5, Figure 2k) of this species with a high potential for spreading.

### Effects of Alternative 3 on Invasive Plant Species

Without intervention, these NNIS plant species are expected to increase in the study area. It is expected that with no control efforts along the existing road shoulders and other existing disturbed habitats the infestations will continue to spread within these areas and potentially into adjacent natural areas. While some of these areas may eventually be controlled with prioritized forest-wide NNIS plant species control work, there is nothing proposed within the vicinity of the study area in the foreseeable future.

The proposed action will construct US 70 Havelock Bypass Alternative 3 on new location across NFS lands. Ground disturbance and the increased light conditions resulting from road construction may increase the amount of area suitable for NNIS plant species in the study area (Trombulak and Frissell 2000). The areas disturbed by road construction as well as the future road shoulders and maintained

ROW of the completed project cound serve as potential areas for spread of NNIS plant species on NFS lands.

In coordination with the USFS, NCDOT has developed mitigation measures to minimize the spread of NNIS plant species on NFS lands within the CNF associated with the construction and maintenance of the US 70 Havelock Bypass.

- To prevent the spread of non-native invasive plant species on NFS lands, NCDOT will require contractors to pressure wash all off-road equipment, including cranes, graders, pans, excavators, and loaders, prior to being brought in the CNF construction areas.
- To control the spread of non-native invasive plant species on NFS lands, NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species within the study area for Alt, 3 of the US 70 Havelock Bypass. If any of these areas are within areas of proposed fill, those areas will be cleared and grubbed, and the material disposed of outside the limits of the CNF. If non-native invasive plant species are located in areas of proposed cuts then the material and actual thickness of root mat or other defined amount will be disposed of outside the limits of the CNF.
- In consultation with the USFS, seed mixes of native grasses and forbs or non-aggressive, non-natives will be used on NFS lands for erosion control and revegetation.
- NCDOT will utilize rolled matting for erosion control and revegetation on NFS lands.
- NCDOT will coordinate with the USFS on a landscaping plan for NFS lands. The plan will detail appropriate native seeding mixes for erosion control and site specific control methods for invasive species, including a suite of acceptable herbicides for the corridor and adjacent natural habitats. The plan will also outline a plan for ongoing coordination between NCDOT and USFS personnel to maintain vegetation diversity and ensure no long-term impacts to rare species along the bypass corridor.

With the implementation of the mitigation measures developed by NCDOT, in coordination with the USFS, the threat of spread of NNIS plants on NFS lands associated with the construction and maintenance of the US 70 Havelock Bypass is expected to be minimimal.

Trombulak, S.C. and C.A. Frissell, 2000. Review of the Ecological Effects of Roads on Terrestrial and Aquatic Communities. Conservation Biology, Vol. 14(1), 18-30.



P:\GeoGra\Projects\2012\050\06\fig\_loc.mxd Date: 10/3/2013 2:43:48 PM





P:\GeoGra\Projects\2012\050\06\NNIS\GIS\Fig\_detail.mxd Date: 10/11/2013 11:13:04 AM





P:\GeoGra\Projects\2012\050\06\NNIS\GIS\Fig\_detail.mxd Date: 10/11/2013 11:13:04 AM



















ATTACHMENT 12



ENVIRONMENTAL SERVICES, INC. 524 South New Hope Road Raleigh, North Carolina 27610 919-212-1760 / Facsimile 919-212-1707 www.environmentalservicesinc.com

# **MEMORANDUM**

TO:	Mary Frazer
FROM:	Matt Smith
DATE:	27 November 2013
RE:	US 70 Havelock Bypass (R-1015) Consulting P.O. No. 6300030960 / 63000033859 Address USFS Comments on DEIS and PETS Analysis: Summary of Evaluation for Bryophyte Species: Two liverworts ( <i>Lejeunea</i> <i>bermudiana</i> and <i>Plagiochila ludoviciana</i> ) and Florida peatmoss ( <i>Sphagnum</i> <i>cribrosum</i> ) ESI Project No. ER10-060.08 / ER12-050.06

## **Background**

In their review of the Draft Environmental Impact Statements (DEIS) for the US 70 Havelock Bypass project (Figure 1), the U.S. Forest Service (USFS) identified the need for additional information on project-related impacts for *Lejeunea bermudiana* (a liverwort) and Florida peatmoss (*Sphagnum cribrosum*) to more fully assess potential viability concerns resulting from project implementation (Figure 2). A third bryophyte, *Plagiochila ludoviciana* (a liverwort), was not identified in USFS comments as requiring additional information but is included here based on documentation in 2012 and 2013 in the direct impact and indirect impact areas that was not previously known or considered for impacts from the US 70 Havelock Bypass project at the time of the DEIS (see Figure 2).

- *Lejeunea bermudiana* (a liverwort) is listed as Locally Rare by the USFS and is state listed as Significantly Rare Peripheral, but does not have a designation by the U.S. Fish and Wildlife Service (USFWS).
- *Plagiochila ludoviciana* (a liverwort) is listed as Locally Rare by the USFS and is state listed as Significantly Rare Peripheral, but does not have a designation by the USFWS.
- Florida peatmoss is listed as a Sensitive species by the USFS and is state listed as a Watch List (W7) species, but does not have a designation by the USFWS.

Based on these listings, the USFS is required to assess potential impacts to the species resulting from actions by the USFS, such as granting an easement for the US 70 Havelock Bypass, to determine whether the action threatens the viability of the species on National Forest System (NFS) lands in the Croatan National Forest (CNF).

Environmental Services, Inc. (ESI), has been asked by the North Carolina Department of Transportation (NCDOT) to complete an evaluation of impacts to each of these species associated with Alternative 3 of the proposed US 70 Havelock Bypass (R-1015) (Figure 1). The study area for Alternative 3 is referred to as the Alt. 3 study area in this evaluation. The area encompassed by all the alternatives for the US 70 Havelock Bypass is referred to as the Alternatives study area in this evaluation (Figure 2). The Alternatives study area is noted on Figure 2 to demonstrate the extent of area that has been relatively extensively surveyed by biologists for NCDOT for these rare bryophytes for the Havelock Bypass project, which has resulted in documentation for a substantial number of the occurrences now known on NFS lands in the CNF.

Impact assessments for these three bryophyte species were based on the following:

- The evaluations presented here utilize Element Occurrence (EO) data obtained from the N.C. Natural Heritage Program (NCNHP) in April 2012 with updates through October 2013, supplemented by additional liverwort surveys conducted by ESI biologists David DuMond and Matt Smith in 2012 and 2013. The evaluation for Florida peatmoss includes data obtained from the USFS and ESI surveys because this species is not tracked in the NCNHP database.
- Boundaries for NFS lands were provided by the USFS for use in this evaluation. Only occurrences or portions of occurrences on NFS lands are of concern for the viability determination for NFS lands on the CNF.
- Direct impacts are based on the tree clearing limits (slope stake limits plus 15 feet) plus an additional 25 feet.
- Potential indirect impacts were evaluated for occurrence areas located on NFS lands between Alternative 3 and existing US 70 based on consideration that different post-project habitat management techniques may be required by USFS for areas isolated from larger, contiguous NFS lands by the project. Additional concerns identified for consideration of indirect impacts include construction or maintenance actions by NCDOT in the vicinity of rare plant occurrences on NFS lands that could have negative impacts on the rare plants or the suitability of their habitat. These actions could include the type of roadside vegetation proposed for use by NCDOT in the project right-of-way, location of construction staging areas, soil compaction or rutting caused by heavy equipment resulting in localized changes in hydrology, and use of herbicides and pesticides. In addition, potential indirect impacts considered for bryophytes included the potential for changes in light and wind penetration resulting in increased desiccation in a zone outside the ROW adjacent to areas where tree clearing will create forest canopy openings inside the ROW.
- Cumulative impacts were considered for identified actions on NFS lands that could affect these species. Because the USFS concern for these species is for maintaining continued viability on NFS lands in the CNF, actions off NFS lands were not considered for determining whether an action will affect the viability of these species on NFS lands. Actions proposed on NFS lands are subject to independent review by USFS to assess potential effects to the continued viability of these species on NFS lands in the CNF. One project identified for consideration for cumulative effects for Florida peatmoss included in this analysis is a project proposed by Duke Energy Progress for replacing the overhead ground wire and selected poles within an existing transmission line corridor right-of-way located along approximately 5 miles of NFS lands in the CNF. Based on the assessment conducted for the Duke Energy Progress project, the Florida

peatmoss occurrence will be avoided by utility project activities. Based on avoidance of impacts, none of the bryophyte species included in the present evaluation will be affected by the utility project and there will be no contribution to cumulative effects on these three species. The potential future widening of the Atlantic and East Carolina Railroad from a single track to multiple tracks may result in cumulative impacts to Florida peatmoss Site #1 in the ditches adjacent to the railway, should the widening occur. Potential affects to Florida peatmoss would need to be evaluated as part of the planning process for the railway project. Other projects considered for potential cumulative effects include thinning operations completed by the USFS adjacent to Southwest Prong Slocum Creek and Tucker Creek in the vicinity of occurrences of Lejeunea bermudiana and Plagiochila ludoviciana. The results of these thinning operations were reviewed in the field in 2013 to evaluate potential for indirect effects from increased light and wind penetration in a zone adjacent to the action areas. These thinning operations were determined to have not resulted in effects that would contribute to additional significant adverse effects to the bryophyte occurrences of concern. No other NCDOT projects have been identified that would directly or indirectly impact these species on NFS lands. No other actions being considered by USFS on NFS lands have been identified that would directly or indirectly impact these species. As such, no significant cumulative impacts were identified for these species at this time.

A summary of the evaluations presented here will be incorporated into Chapter 4 of the Final Environmental Impact Statement (FEIS).

### A Liverwort (Lejeunea bermudiana)

*Lejeunea bermudiana* is a rare species of leafy liverwort documented from North Carolina in only two areas in the outer Coastal Plain. Croatan National Forest (CNF) in Craven and Jones Counties is the only recently verified location for this species in the state, where it reaches its northern-most natural distribution limit. Liverworts are nonvascular, nonflowering plants that are small to tiny, requiring microscopic analysis for species confirmation. Liverworts typically occur closely attached to soil, rock, bark or rotten wood substrates in moist habitats that are often heavily shaded. Surveys for this species conducted on the CNF indicate that *Lejeunea bermudiana* typically occurs on the bark at the base of mature hardwood trees within a narrow zone on the edges of swamp forest communities that flood on an infrequent basis.

Prior to the present evaluation, there were five NCNHP EOs, comprising three populations, known to occur, or possibly occur, on NFS lands within the CNF (Figure 2), associated with three stream systems.

- Deep Creek. EO 2 is an historic occurrence last observed in 1953 and described as the "base of trees in Deep Swamp approximately 1-2 miles south of Harlowe, NC and 1 mile west of NC 101" in the southeastern portion of the CNF. This occurrence could not be confirmed in 2012. The general location of this historic occurrence was visited, but the potential habitat area could not be accessed due to the presence of gated and posted private property. Based on level of accuracy identified by NCNHP mapping for the EO, and review of mapping for NFS land boundaries, this occurrence, if still extant, may not occur on NFS lands.
- Southwest Prong Slocum Creek. There are three EOs (4, 5, and 6) identified in the Southwest Prong Slocum Creek watershed (Figure 2-3), which collectively comprise a single population.

EO 4 consists of two separate mapped sample locations with confirmed *Lejeunea bermudiana*, while EOs 5 and 6 each consist of single confirmed sample locations. Two additional sample locations within this watershed with confirmed *Lejeunea bermudiana* were identified in 2012 between the two mapped sample locations constituting EO 4.

• Tucker Creek. There is one EO (8) in the Tucker Creek watershed (Figure 2-2). Two additional sample locations within this watershed with confirmed *Lejeunea bermudiana* were identified in 2013 south of the mapped sample location constituting EO 8.

Alternative 3 directly affects the populations of *Lejeunea bermudiana* in the Southwest Prong Slocum Creek and Tucker Creek watersheds. The scope of work for the present *Lejeunea bermudiana* evaluation is the result of meetings with NCDOT and the USFS. The present evaluation considers direct effects on *Lejeunea bermudiana* occurrences in the Alt. 3 study area as well as indirect effects that may result from the US 70 Havelock Bypass project and potential cumulative effects resulting from other applicable projects on the CNF, as well as factors in the results of additional surveys conducted by NCDOT for this species in 2012-2013.

### Methods for Assessment

Prior to 2012, there were only two populations of this species recently documented as occurring on NFS lands within the CNF and one additional EO that represents an historic occurrence that could not be confirmed and may not be on NFS lands. As a result, there were basically two watersheds with occurrences of *Lejeunea bermudiana* confirmed on NFS lands in the CNF, both of which would have direct impacts associated with Alternative 3 (Figure 2). As a mitigative measure for reducing the relative impacts to this species on NFS lands within these stream systems, USFS requested that NCDOT consider an effort to see if new occurrences could be found on NFS lands within relatively unstudied areas of the CNF outside the Alternatives study area.

The initial step in the evaluation was to identify areas on NFS lands in the CNF that have potentially suitable habitat. Surveys were conducted in 2012 in seven watersheds that were identified as potentially providing suitable habitat based on a desktop evaluation of general watershed characteristics. These areas include Island Creek, Black Swamp Creek, Hunter's Creek, Hadnot Creek, Holston Creek, an unnamed tributary to Tucker Creek, and several tributaries to Brice's Creek. Surveys were also conducted in 2013 in ten additional watersheds including Mill Creek, West Prong Mortens Mill Pond, King Creek, Gum Branch, Still Gut Creek, Little John Creek, Cahooque Creek, Pettiford Creek, Northwest Prong Newport River, and Southwest Prong Newport River.

Each of these areas was evaluated in the field and liverwort samples were collected from several areas for detailed evaluation. When the site evaluations identified liverwort assemblages containing the suspected target species or known or presumed associated species, samples were taken from selected trees for laboratory identification. GPS data were recorded for sample locations.

### Results of Assessment

The areas reviewed in seven watersheds (Hunter's Creek, Hadnot Creek, Holston Creek, Brice's Creek, Mill Creek, Northwest Prong Newport River, and Southwest Prong Newport River) were determined to not provide suitable habitat due to a combination of factors including recent prescribed burns, lack of

mature hardwood trees, presence of open canopy, and/or evidence of frequent flooding and inundation or saline influences. Potentially suitable habitat was identified as present in Island Creek, Black Swamp Creek, the unnamed tributary to Tucker Creek, West Prong Mortens Mill Pond, King Creek, Gum Branch, Still Gut Creek, Little John Creek, Cahooque Creek, and Pettiford Creek. No *Lejeunea bermudiana* was present in samples evaluated from Black Swamp Creek, the unnamed tributary to Tucker Creek, West Prong Mortens, the unnamed tributary to Tucker Creek, West Prong Mortens, the unnamed tributary to Tucker Creek, West Prong Mortens, the unnamed tributary to Tucker Creek, West Prong Mortens, the unnamed tributary to Tucker Creek, West Prong Mortens Mill Pond, Little John Creek, and Gum Branch.

*Lejeunea bermudiana* was confirmed present in samples collected in Island Creek (Figure 2-1), an unnamed tributary to Cahooque Creek (Figure 2-4), Still Gut Creek (Figure 2-4), King Creek (Figure 2-5) and Pettiford Creek (Figure 2-6) watersheds. These five watersheds represent new locations documented by NCDOT for this species in 2012-2103 and result in five new EOs on NFS lands in the CNF, all of which are outside the Alternatives study area. Documentation for these new occurrences will be submitted to NCNHP, which is expected to designate these sites with new EO numbers.

In addition, the 2012-2013 surveys resulted in *Lejeunea bermudiana* confirmed from additional sample locations in the two watersheds in which it was previously known. During the 2012 field surveys this species was also identified from two liverwort samples collected to confirm the continued presence of *Lejeunea bermudiana* within the area evaluated for potential indirect impacts associated with Alternative 3; these two new confirmed sample locations are situated between the two mapped sample locations comprising EO 4 (Figure 2-3). During the 2013 field surveys this species was also identified from two liverwort samples collected to confirm the continued presence of *Lejeunea bermudiana* adjacent to the area recently thinned by the USFS in the Tucker Creek watershed. These two new confirmed *Lejeunea bermudiana* sample locations are situated south of the mapped sample location comprising EO 8 (Figure 2-2).

The forested uplands to the east of the documented sites in the Tucker Creek watershed (Figure 2-2) have been thinned by the USFS as part of forest management for these stands. This area was evaluated during the 2013 surveys to determine if these activities had altered suitable habitat in this watershed. Thinning within these stands occurred within 250 feet of occupied sites and has resulted in increased light penetration for the large trees located along the edge of the floodplain that provide both occupied and potentially suitable habitat for this species. Within a zone adjacent to the thinned stands, the bryophyte assemblages appeared to be somewhat diminished compared to previous conditions and the effects of the increased light and wind penetration may be expected to result in further diminishment until increased shading results from regrowth of denser vegetation in the thinned areas. However, because the bryophyte assemblages were noted as persisting though diminished, the zone of influence did not appear to extend more than 250 feet beyond the thinned edge, and because the bryophyte assemblages in this zone have persisted through previous timbering and thinning operations in the adjacent stands, these thinning operations were determined to have not resulted in effects that would contribute to additional significant adverse effects to the bryophyte occurrences of concern. The existing US 70 roadway is located approximately 350 feet east of these *Lejeunea bermudiana* occurrences.

The forested uplands adjacent to Gray Road and Sunset Road in the Slocum Creek watershed (Figure 2-3) have been managed by the USFS using a combination of thinning and prescribed burning in recent years, with prescribed burning occurring in 2013. This area was evaluated during the 2013 surveys to determine

if these activities had altered suitable habitat in this watershed. Neither the thinning or prescribed burns affected habitat within 250 feet of the large trees located along the edge of the floodplain that provide both occupied and potentially suitable habitat for this species. However, apparent drying of bryophyte flora was observed on trees along the south side of the creek during surveys in 2012. It is not clear if this is the result of recent droughts or a combination of other factors. The effects of the thinning operations in the stands adjacent to this area are expected to be temporary as the thinned forest regenerates.

The results of an evaluation of habitat conditions for Lejeunea bermudiana at the locations where this species has now been documented on NFS lands in the CNR indicate that the occurrences of Lejeunea bermudiana appear to be strongly associated with three major landscape features within the CNF: 1) well developed palustrine forests along streams, 2) incised floodplains paralleled by erosion scarps with relatively abrupt topographic gradients, 3) colluvial/alluvial loamy organic soils likely adjacent to exposed or unexposed occurrences of marine limestone (marl) deposits. Other important parameters influencing where *Lejeunea bermudiana* may be found appear to involve atmospheric humidity, substrate moisture, light penetration and air movement through the forest. These characteristics may all be relative to functions of stem density, degree of canopy closure and stream flow variables. Also noted in the watersheds of occupied sites is the presence of two vascular plant species that seem to connote surface or near-surface presence of limestone. These species are dwarf palmetto (Sabal minor) in mucky areas of the flood plain and umbrella tree (Magnolia tripetala) along upland slopes. Additionally, since Lejeunea bermudiana was only found at the bases of the largest trees, roughly 2 to 4 feet DBH (diameter at breast height, or 4.5 feet above the ground), and not on younger or smaller trees during the surveys conducted for this project, the age and basal configurations of substrate trees are also assumed to be of importance. Based on surveys conducted in the CNF, the presence of large trees (old trees) appears to be important to the presence of Lejeunea bermudiana in occupied habitat. Although the relationship between occupation by Lejeunea bermudiana and age /size of substrate species has not been numerically defined, the loss of large trees from an occupied habitat system, even without removal of other habitat characteristics, potentially could affect the suitability of the habitat to support this species, resulting in potential indirect effects.

Along many of the streams where *Lejeunea bermudiana* has been documented on the CNF, there is a substantial bluff system paralleling sides of a floodplain, as can be seen in the LiDAR base mapping in Figures 2-1 through 2-6. This bluff system has been created as debris and flowing water slowly carved downward into marine deposits that now constitute the bulk of the upland landscape. Organic and other materials are deposited, sorted, and moved along these floodplain channels. Alluvium combined with colluvial materials from side slopes has contributed to a mixture of sediments along the lower portions of the side slopes as well as within active stream channels. The side slopes consist of a mix of sands, organic silts and minerals dissolved by groundwater from exposed or unexposed limestone formations. Margins of most streams supporting *Lejeunea bermudiana* on the CNF do not have outcrops of marl. However, at Island Creek outcrops of limestone can be seen along portions of the channel. Based on the sample locations on which it has been found in the CNF, *Lejeunea bermudiana* appears to require largely permanent surface exposure on basal bark of living trees above the zone subject to frequent flooding. Below the point along a flooding gradient where bald cypress (*Taxodium distichum*) and/or swamp black gum (*Nyssa biflora*) become dominant species, *Lejeunea bermudiana* was not found during site surveys, and the species was not found on cypress stems during the surveys. Hydrologic changes that affect

current fluvial geomorphological processes in an occupied habitat system could result in habitat losses and potential indirect effects.

Substrate occupied by *Lejeunea bermudiana* in the CNF seems to exist in two optimum forms. Along portions of Southeast Prong Slocum Creek substrate occurs most abundantly where exposed major roots of tulip poplar (*Liriodendron tulipifera*) seem to provide optimum habitat. These tulip poplar root systems were found to occur on trees generally in excess of 20 inches DBH from which large exposed roots often extend laterally several yards from the bases of the trees. All portions of this exposed root system, including the base of the tree, often support substantial growths of *Lejeunea bermudiana* along with numerous other species of liverworts and mosses. These exposed lateral roots of tulip poplars occur lower along the topographic (and moisture) gradient. Tulip poplar root habitat occurs extensively along both north and south sides of Southwest Prong Slocum Creek and extends generally from the Alt. 3 study area downstream (eastward) to Greenfield Heights Boulevard between Sunset Road and Gray Road (Figure 2-3).

In addition to occupying extensively exposed tulip poplar root substrate, *Lejeunea bermudiana* was also found to occupy cork or bark substrates that may often be found slightly more up slope. Bases of some species of hardwood trees with considerable size appear to offer somewhat more limited areas of optimum substrate. Such substrate has been noted mostly on large trees with fluted bases. Species which can apparently supply such substrate are swamp chestnut oak (*Quercus michauxii*), tulip poplar, sweet gum (*Liquidambar styraciflua*), swamp black gum, and white oak (*Quercus alba*). Generally, occupied trees were also of large size (20 to 40 in DBH). Organic debris at the base of trees, where bark and soil begin to mix, can also support growths of *Lejeunea bermudiana* under ideal growing conditions.

### Summary of Impacts

- With the documentation of the presence of *Lejeunea bermudiana* in Island Creek, Pettiford Creek, Still Gut Creek, an unnamed tributary of Cahooque Creek, and King Creek, this evaluation indicates that *Lejeunea bermudiana* has now been confirmed as present in seven watersheds (Tucker Creek, Southwest Prong Slocum Creek, Cahooque Creek, Still Gut Creek, King Creek, Pettiford Creek, and Island Creek) on NFS lands in the CNF. An additional historic occurrence documented in 1953 in Deep Swamp could not be verified and may not be on NFS lands. The US 70 Havelock Bypass project would result in impacts to only two of the seven watersheds with known occurrences of this species on NFS lands in the CNF.
- Alternative 3 directly affects two watersheds that include EOs for this species.
  - Within the Tucker Creek watershed, Alternative 3 directly affects EO 8 in its entirety, including the new confirmed sample locations documented in 2013. The occurrences in this watershed have been impacted by recent forest management activities (thinning) resulting in increased light penetration, but because the Havelock Bypass project would result in presumed loss of this population, the forest management activities would not contribute to significant adverse cumulative effects.
  - Within the West Prong Slocum Creek watershed, Alternative 3 directly affects a portion of the population. The portion of the population represented by EO 4 could be directly affected by removal of one tree with confirmed occurrence, as well as other trees not

sampled within the ROW clearing limits that could potentially harbor this species. The documented distribution of this species within this watershed extends approximately 3,000 feet upstream and 3,400 feet downstream of the potential impact to EO 4 associated with Alt. 3; however, the distribution of this species within this watershed is limited to suitable trees in appropriate hydrologic zones and is likely discontinuous. The portions of the population represented by EOs 5 and 6 are not directly affected. The proposed project could result in loss of a portion of this population, but is not expected to result in a complete loss of the population in the West Prong Slocum Creek watershed from direct impacts.

Within the West Prong Slocum Creek watershed, Alternative 3 may result in indirect effects to a portion of the population. Indirect effects from clearing of forest canopy in the ROW may be expected to extend up to 250 feet outside the ROW, which could result in effects to additional occupied habitat within the portion of the population represented by EO 4, including the two new confirmed sample locations documented in 2012. The portions of the population represented by EOs 5 and 6 are outside the zone considered for potential indirect effects from increased light penetration. Other potential indirect impacts that could result from construction or maintenance activities can be avoided or minimized through measures previously proposed by NCDOT for the areas subject to potential indirect impacts.

### Conclusions and Recommendations

The US 70 Havelock Bypass (R-1015) Alternative 3 will result in unavoidable direct impacts to *Lejeunea bermudiana* and additional areas occupied by *Lejeunea bermudiana* are subject to consideration for indirect impacts. The direct impacts for Alternative 3 may lead to a loss of the population in Tucker Creek and a portion of the population in Southwest Prong Slocum Creek. With appropriate measures to minimize threats from indirect impacts, the US 70 Havelock Bypass project is not expected to result in loss of the remaining portion of the population in Southwest Prong Slocum Creek. No significant adverse cumulative impacts from other projects were identified.

Because the loss of one of two populations and partial loss of the second population known prior to 2012 on NFS lands in the CNF resulting from the US 70 Havelock Bypass project could lead to viability concerns, mitigation measures were required to reduce the threat for a loss of viability for *Lejeunea bermudiana* on NFS lands in the CNF. Because this species is cryptic and not widely studied or easily documented, the identification of new populations of this species in secure locations elsewhere on NFS lands is considered by the USFS to be an important mitigation measure. Five new populations of *Lejeunea bermudiana* have been identified in 2012-2013 on behalf of USFS by NCDOT on NFS lands in the CNF. These newly discovered occurrences are located in stream systems well outside the area affected by the US 70 Havelock Bypass project.

Implementation of additional mitigation measures agreed to between NCDOT and USFS would minimize potential for loss of the remaining portion of the Southwest Prong Slocum Creek from indirect impacts. These mitigation measures include:

• Prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction;
- Avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable;
- Avoid placing heavy equipment within powerline corridors outside of the proposed slope stakes without prior approval from the USFS;
- Require contractors to pressure wash all off-road equipment prior to being brought into the CNF construction areas;
- Prior to construction NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species for removal during construction;
- Avoid planting of aggressive non-native species for re-vegetation;
- Utilize rolled matting or weed free mulch for erosion control and revegetation on NFS lands;
- o Avoid use of broadcast sprays for herbicides and pesticides on NFS lands;
- o Minimize the use of herbicides and pesticides; and
- NCDOT Division 2 forces will work with USFS staff on a periodic basis to control the presence of priority species of non-native plants along the Havelock bypass easement on CNF. NCDOT will also work on adjacent NCDOT ROW to prevent the encroachment of priority non-natives on to CNF. In turn, USFS will work cooperatively with NCDOT to identify and effectively control prioritized non-native invasive plant species.

With the identification of five new populations by NCDOT on NFS lands in the CNF in watersheds not subject to effects by the US 70 Havelock Bypass project and the implementation of the additional mitigation measures to minimize potential for indirect effects to the remaining portion of the population in Southwest Prong Slocum Creek, the US 70 Havelock Bypass (R-1015) Alternative 3 project may result in loss of one population (Tucker Creek) and partial loss of one population (Southwest Prong Slocum Creek), but is not likely to cause a loss of viability for *Lejeunea bermudiana* on NFS lands in the CNF.

#### A liverwort (Plagiochia ludoviciana)

*Plagiochila ludoviciana* is a liverwort that has been reported across all three provinces (mountains, piedmont, and coastal plain) of North Carolina. Recent taxonomic decisions may result in this species more properly being referred to as *Plagiochila ruddiana* by the scientific community, but to avoid confusion with past evaluations for the US 70 Havelock Bypass project, the name *Plagiochila ludoviciana* will continue to be used for the present evaluation. The presence of this species on NFS in the CNF was confirmed during surveys by NCDOT of the Alternatives study area. This species has been documented in areas as a frequent habitat associate of *Lejeunea bermudiana* on NFS lands in the CNF and general habitat conditions are described under the section for that species.

Prior to 2012, there was only one NCNHP EO (17) documented on NFS lands within the CNF (Figure 2-3), resulting from surveys conducted by NCDOT. This EO is in the Southwest Prong Slocum Creek watershed west of Alternative 3. At the time the DEIS was issued, no direct or indirect effects were anticipated for this occurrence based on the selection of Alternative 3 as the preferred alternative. However, the 2012 and 2013 field surveys to determine the extent of potential direct and indirect effects to *Lejeunea bermudiana* resulted in identifying new occurrences of *Plagiochila ludoviciana* in the CNF, including in areas subject to both direct and indirect effect consideration as well as in a new watershed not subject to effects from the project. *Plagiochila ludoviciana* has now been documented on NFS lands from 5 liverwort samples collected within three separate watersheds on the CNF (Figure 2). The new occurrences documented in the 2012 and 2013 surveys have not yet been assigned EO numbers by NCNHP.

- Southwest Prong Slocum Creek. This watershed contains the original EO (17) documented on the CNF. This original documented occurrence was not in an area subject to direct impacts and was well outside the area of consideration for indirect impacts. During the 2012 field surveys this species was identified from two liverwort samples collected within the area evaluated for potential indirect impacts associated with Alternative 3 while confirming the presence of *Lejeunea bermudiana* (Figure 2-3). These new documented sample locations for *Plagiochila ludoviciana* are located downstream from the Alt. 3 study area and are approximately 4,000 feet northeast of the original EO for this species on NFS lands in the CNF, and would be considered part of the same population. It is likely that this species is present on additional trees that provide suitable habitat within the Southwest Prong Slocum Creek watershed that have not been sampled.
- Tucker Creek. *Plagiochila ludoviciana* was documented in 2013 from a liverwort sample collected within the Tucker Creek watershed (Figure 2-2) while assessing the area for potential indirect impacts to *Lejeunea bermudiana* associated with a USFS thinning project. The site documented within the Tucker Creek watershed is located in an area evaluated for direct impacts and represents new information not previously considered for impacts for associated with Alternative 3. The documented sample location for the Tucker Creek site is represented by a single tulip poplar that has recently been hit by lightning and is in the process of sloughing of large areas of bark. This tree may not survive this lightning strike. Based on distribution of *Lejeunea bermudiana* within this watershed, *Plagiochila ludoviciana* is anticipated to be similarly distributed.
- Pettiford Creek. During the 2013 field surveys this species was documented from liverwort samples collected within Pettiford Creek watershed (Figure 2-6) as part of the mitigation measures surveys for *Lejeunea bermudiana*. This occurrence will not be directly or indirectly affected by the US 70 Havelock Bypass project.

Alternative 3 may directly or indirectly affect the populations of *Plagiochila ludoviciana* in the Southwest Prong Slocum Creek and Tucker Creek watersheds. The present evaluation considers direct effects on *Plagiochila ludoviciana* occurrences in the Alt. 3 study area as well as indirect effects that may result from the US 70 Havelock Bypass project and potential cumulative effects resulting from other applicable projects on the CNF.

#### Methods for Assessment

New surveys targeting Plagiochila ludoviciana were not conducted in 2012-2013, but this species was found incidental to surveys for *Lejeunea bermudiana*. Based on co-occurrences of *Plagiochila ludoviciana* with *Lejeunea bermudiana* at sites where *Plagiochila ludoviciana* has been documented so far, it is likely that *Plagiochila ludoviciana* may also be found in association with *Lejeunea bermudiana* at other sites in the CNF where *Lejeunea bermudiana* was documented in 2012-2013. Because *Plagiochila ludoviciana* occupies similar habitat and is expected to be similarly distributed, the assessment of effects to *Plagiochila ludoviciana* is based on the assessment presented for *Lejeunea bermudiana*.

#### Results of Assessment

*Plagiochila ludoviciana* has now been documented from three watersheds on NFS lands within the CNF, Southwest Prong Slocum Creek, Tucker Creek, and Pettiford Creek. In each case it was found in similar habitat and in several cases co-occurring with *Lejeunea bermudiana*. Based on known occurrences and habitats, it is likely that *Plagiochila ludoviciana* would be found in association with *Lejeunea bermudiana* at other sites in the CNF. In addition to Pettiford Creek (Figure 2-6), where *Plagiochila ludoviciana* was documented co-occurring with *Lejeunea bermudiana*, *Plagiochila ludoviciana* is also expected to be present but undetected by the 2012-2013 surveys that documented *Lejeunea bermudiana* in the other watersheds unaffected by the US 70 Havelock Bypass, including Island Creek (Figure 2-1), an unnamed tributary to Cahooque Creek (Figure 2-4), Still Gut Creek (Figure 2-4), and King Creek (Figure 2-5) watersheds. Effects to *Plagiochila ludoviciana* are expected to be similar to effects described for *Lejeunea bermudiana*.

#### Summary of Impacts

- Alternative 3 directly affects one watershed that includes a documented sample location containing this species. Within the Tucker Creek watershed, Alternative 3 directly affects this occurrence in its known entirety. This occurrence is located on a tree that has been damaged by a recent lightning strike and is sloughing off large areas of bark, with the tree expected to succumb to the lightning damage. However, this species may occur on other suitable, unsampled trees present in the direct impact area. The occurrence in this watershed also has been impacted by recent forest management activities (thinning) resulting in increased light penetration, but because the Havelock Bypass project would result in presumed loss of this population, the forest management activities would not contribute to significant adverse cumulative effects.
- Occupied habitat in the form of mature hardwood trees within the West Prong Slocum Creek watershed is in an area that is subject to consideration for indirect effects by Alternative 3. Patches of this species were observed on tree trunks within the area under consideration for indirect effects. Potential indirect impacts that could result from construction or maintenance activities can be minimized through measures previously proposed by NCDOT for the areas subject to potential indirect impacts.

#### Conclusions and Recommendations

The US 70 Havelock Bypass (R-1015) Alternative 3 will result in unavoidable direct impacts to *Plagiochila ludoviciana* and an additional area occupied by *Plagiochila ludoviciana* is subject to consideration for indirect impacts. The direct impacts for Alternative 3 may lead to a loss of the population in Tucker Creek and Alternative 3 may result in indirect effects to the population in Southwest Prong Slocum Creek. With appropriate measures to minimize threats from indirect impacts, the US 70 Havelock Bypass project is not expected to result in loss of the population in Southwest Prong Slocum Creek. No significant adverse cumulative impacts from other projects were identified.

Mitigation measures would reduce the threat for a loss of the occurrence of *Plagiochila ludoviciana* in the Southwest Prong Slocum Creek watershed on NFS lands in the CNF. Implementation of mitigation

measures agreed to between NCDOT and USFS would minimize viability concerns that could result from indirect impacts. These mitigation measures include:

- Prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction;
- Avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable;
- Avoid placing heavy equipment within powerline corridors outside of the proposed slope stakes without prior approval from the USFS;
- Require contractors to pressure wash all off-road equipment prior to being brought into the CNF construction areas;
- Prior to construction NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species for removal during construction;
- Avoid planting of aggressive non-native species for re-vegetation;
- Utilize rolled matting or weed free mulch for erosion control and revegetation on NFS lands;
- o Avoid use of broadcast sprays for herbicides and pesticides on NFS lands;
- Minimize the use of herbicides and pesticides; and
- NCDOT Division 2 forces will work with USFS staff on a periodic basis to control the presence of priority species of non-native plants along the Havelock bypass easement on CNF. NCDOT will also work on adjacent NCDOT ROW to prevent the encroachment of priority non-natives on to CNF. In turn, USFS will work cooperatively with NCDOT to identify and effectively control prioritized non-native invasive plant species.

The identification of new populations of this species in secure locations on NFS lands is an important mitigation measure and one new population of *Plagiochila ludoviciana* has already been identified on behalf of USFS by NCDOT on NFS lands in the CNF in a watershed unaffected by the US 70 Havelock Bypass project. This new, unaffected occurrence was documented in 2013 in the Pettiford Creek watershed in association with *Lejeunea bermudiana*. Based on co-occurrences of *Plagiochila ludoviciana* with *Lejeunea bermudiana* at sites where *Plagiochila ludoviciana* has been documented so far, it is likely that *Plagiochila ludoviciana* may also be found in association with *Lejeunea bermudiana* at other sites in the CNF where *Lejeunea bermudiana* was documented in 2012-2013.

With the implementation of appropriate measures to reduce indirect impacts, the US 70 Havelock Bypass (R-1015) Alternative 3 project is not likely to cause a loss of viability for *Plagiochila ludoviciana* on NFS lands in the CNF.

### Florida Peatmoss (Sphagnum cribrosum)

Florida peatmoss has been documented in eight counties in the coastal plain of North Carolina, including all three counties of the CNF based on updated information provided by the USFS for the CNF. Florida peatmoss is found along the margins of acidic lakes and cypress-gum ponds as well as wet depressions in pine flatwoods and savannas.<sup>i, ii</sup> This species may also be found in ditches and utility rights-of-way adjacent to these habitats and slowly meandering, shallow, black water streams.

There are 11 documented occurrences of Florida peatmoss on NFS lands in the CNF that represent 6 populations (Gary Kaufman personal communication, 2013). One of these populations occurs in the vicinity of the US 70 Havelock Bypass and consists of three individual sites with documented presence of Florida peatmoss. One additional site within the area, not on NFS lands, has been documented on NCDOT's Croatan Wetland Mitigation Bank near Havelock. These Havelock sites are depicted in Figure 2. The other populations on NFS lands occur along Little Road (multiple sites), Hunter Holston Road, Hadnot Road, and Catfish Lake Road.

In the vicinity of the US 70 Havelock Bypass Alternatives study area, only one Florida peatmoss site (Site #1 on Figure 2) is in the Alt. 3 study area and subject to consideration for direct impacts as well as indirect impacts. One Florida peatmoss site (Site #2 on Figure 2) is located in a depression in a maintained powerline ROW outside the area of potential direct impact, but within the area for consideration for indirect impacts. The third Florida peatmoss site in the project vicinity (Site #4 on Figure 2) is located in a depression in a maintained powerline ROW approximately 600 feet south of the Alt. 3 study area and is outside the area considered for direct or indirect effects.

The scope of work for the Florida peatmoss evaluation is the result of meetings with NCDOT and the USFS. The present evaluation considers direct effects on Florida peatmoss occurrences in the Alt. 3 study area as well as indirect effects that may result from the US 70 Havelock Bypass and potential cumulative effects resulting from other applicable projects on the CNF.

#### Methods for Assessment

The present assessment focused on determining potential direct and indirect effects to Florida peatmoss Site #1, potential indirect effects to Florida Peatmoss Site #2, as well as potential cumulative effects to this species on the CNF.

The only occurrence in the Alt. 3 study area (Florida Peatmoss Site #1) is in a ditch adjacent to a railroad corridor that is proposed to be bridged by Alternative 3 (Figure 3). This area is subject to consideration for direct effects from construction, as well as indirect effects. The additional portion of this occurrence in the ditch downstream of the Alt. 3 study area is located in an area also subject to consideration for indirect effects by Alternative 3. The previous limits of this occurrence were established at the boundaries of the Alternatives study area during previous NCDOT surveys for this project. To better understand the impact to this occurrence, USFS requested that NCDOT consider resurveying this occurrence to determine the full extent of this occurrence outside the Alt. 3 study area. This occurrence was reinvestigated in the field on 16 July 2012 by ESI biologists Matt Smith and David DuMond. The survey consisted of walking adjacent to the ditch upstream and downstream of the Alt. 3 study area until no Florida peatmoss was observed.

#### Results of Assessment

Florida Peatmoss Site #1 is located in a ditch adjacent to a railroad ROW (Figure 3). The railroad ROW appears to be maintained by a combination of periodic mowing and annual application of herbicides. The ditch adjacent to the railroad is gradually sloped and the water was observed to flow from the southeast to the northwest through the Alt. 3 study area. The 2012 survey documented that Florida peatmoss is present within the ditch (Florida Peatmoss Site #1) for approximately 2,500 feet upstream of the Alt. 3

study area (Figure 3), expanding the known extent of this occurrence and reducing the relative proportion of this occurrence within the Alt. 3 study area. Florida peatmoss becomes increasingly dense in the ditch to the southeast of the powerline right-of-way with the greatest densities observed upstream of the Alt. 3 study area. This species also becomes increasingly uncommon and eventually disappears from the ditch moving downstream from the powerline right-of-way towards Creek Rd approximately 580 feet downstream of the Alt. 3 study area (Figure 3). It appears that the Florida peatmoss observed in the ditch within the Alt. 3 study area is associated with a larger population located in the pocosin southeast of the Alt. 3 study area.

Although Florida Peatmoss Site #1 is being bridged, bridge construction will likely result in a direct impact to the portion of this occurrence located within the Alt. 3 study area. Construction of the new bridges may necessitate access roads and temporary track crossings on both sides of the embankment to provide an area for crane set-up. Structure recommendations for this bridge crossing show future tracks on either side of the existing track. If additional track is built, it may result in cumulative impacts in and adjacent to the bridge crossing, but the likelihood of track expansion is not reasonably foreseeable at this time. The railroad's annual vegetation spraying program extends up to 20 feet out in each direction from the centerline of the track. The spraying program has likely had some cumulative effects over time and will continue to do so, but the continued occurrence of the Florida peatmoss in spite of the spraying seems to indicate that the effects have not been significantly adverse.

The powerline ROW containing Florida Peatmoss Site #2 is managed by a combination of mowing by the powerline easement holder and prescribed burns conducted by the USFS. One project identified for consideration for cumulative effects for Florida peatmoss included in this analysis is a project proposed by Duke Energy Progress for replacing the overhead ground wire and selected poles within the existing transmission line corridor ROW that includes Florida Peatmoss Site #2. Based on the assessment conducted for the Duke Energy Progress project, the Florida peatmoss occurrence will be avoided by utility project activities. There were no cumulative effects identified for Florida peatmoss based on avoidance of impacts to Site #2 by the Duke Energy Progress project, and no other foreseeable projects identified that significantly affect other Florida peatmoss occurrences.

#### Summary of Impacts

- This evaluation indicates that the occurrence of Florida peatmoss within the Alt. 3 study area (Florida Peatmoss Site #1) is more extensive upstream above the impact area than previously documented and that the majority of this occurrence occurs in an area that is neither directly nor indirectly affected by Alternative 3 (Figure 3).
- Alternative 3 directly affects a portion of one occurrence of Florida peatmoss (Site #1). Approximately 0.03 acre of Florida Peatmoss Site #1 is located within approximately 466 feet of ditch adjacent to the railroad where the Alt. 3 study area crosses the ditch and railroad with a bridge. An additional 0.11 acre of this occurrence is located upstream of the Alt. 3 study area will not be affected by Alternative 3.
- Two occurrences are located in areas subject to consideration for potential indirect impacts associated with Alternative 3. This species was confirmed present in these occurrences;

individual plant counts are not practicable for bryophyte species and total population was not determined.

- Approximately 0.04 acre of Florida Peatmoss Site #1 is located in an area for consideration of potential indirect effects by Alternative 3. Potential indirect effects include shading associated with the bridge crossing.
- An additional occurrence (Florida Peatmoss Site #2) is located in another area subject to consideration for indirect impacts by Alternative 3. Florida Peatmoss Site #2 is not anticipated to be affected by Alternative 3 due to its distance (approximately 3,300 feet east) from the Alt. 3 study area, with no changes in management of the powerline right-of-way in which it occurs expected to occur as a result of the project or as a result of the proposed Duke Energy Progress overhead ground wire replacement project. The proposed Duke Energy Progress project avoids impacts to Site #2 and would not contribute to cumulative effects.
- If additional railroad track is built in the future at Florida Peatmoss Site #1, it may result in cumulative impacts. Track expansion is not foreseeable at this time, however.
- The railroad's annual vegetation spraying program has probably had some cumulative effects at Florida Peatmoss Site #1 but the effects do not seem significantly adverse.
- NCDOT commissioned an assessment of the potential for Croatan Wetland Mitigation Bank (CWMB) habitats to support USFS rare species in 2007 which resulted in the documentation of a previously unknown occurrence of Florida peatmoss (Florida Peatmoss Site #3 on Figure 2). The planned transfer by NCDOT to USFS of the tract occupied by the CWMB would add this occurrence to NFS lands.
- Measures previously proposed by NCDOT for areas subject to consideration for potential indirect impacts would reduce the likelihood for adverse effects to these areas.

#### Conclusions and Recommendations

The US 70 Havelock Bypass (R-1015) Alternative 3 will result in unavoidable direct impacts to Florida peatmoss as a result of the proposed bridging of the railroad ditch where this species occurs in the Alt. 3 study area (Florida Peatmoss Site #1 on Figure 3). The portion of this occurrence in the ditch downstream from the proposed ROW is subject to consideration for indirect impacts. The documented extent of this occurrence on NFS lands was substantially expanded by the NCDOT survey in 2012. With the new documentation that the majority of this occurrence extends a considerable distance farther upstream of Alternative 3, only approximately 0.03 acre of the 0.21-acre known extent for Florida Peatmoss Site #1 is being directly impacted and approximately 0.04 acre of this occurrence is in the ditch downstream of the ROW and subject to consideration for indirect impacts. Cumulative impacts associated with the potential future widening of the Atlantic and East Carolina Railroad from a single track to multiple tracks may occur at Florida peatmoss Site #1 if railway construction alters the ditches adjacent to the railway. Potential affects to Florida peatmoss will need to be evaluated as part of the planning process for the railway project, should it occur. Currently it the rail expansion is not reasonably foreseeable. No cumulative impacts from the Duke Energy Progress project, USFS, or NCDOT projects

on NFS lands in the CNF have been identified for this occurrence of for any of the other five known occurrences on NFS lands in the CNF.

The project is not expected to result in changes that would prevent the utility company and/or railroad from continued mowing to maintain the right-of-way in which these occurrences are found, reducing the threat for indirect impacts. Other potential concerns for indirect impact that could result from project construction and maintenance activities can be minimized through appropriate measures. Implementation of measures agreed to between NCDOT and USFS would minimize from the potential for adverse indirect impacts. These measures include:

- Prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction;
- Avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable;
- Avoid placing heavy equipment within powerline corridors outside of the proposed slope stakes without prior approval from the USFS;
- Require contractors to pressure wash all off-road equipment prior to being brought into the CNF construction areas;
- Prior to construction NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species for removal during construction;
- Avoid planting of aggressive non-native species for re-vegetation;
- Utilize rolled matting or weed free mulch for erosion control and revegetation on NFS lands;
- Avoid use of broadcast sprays for herbicides and pesticides on NFS lands;
- Minimize the use of herbicides and pesticides; and
- NCDOT Division 2 forces will work with USFS staff on a periodic basis to control the presence of priority species of non-native plants along the Havelock bypass easement on CCNF. NCDOT will also work on adjacent NCDOT ROW to prevent the encroachment of priority non-natives on to CNF. In turn, USFS will work cooperatively with NCDOT to identify and effectively control prioritized non-native invasive plant species.

One new occurrence of Florida peatmoss (Site #3) was identified on the CWMB as part of a previous evaluation by NCDOT in 2007. When this tract is transferred to the USFS from NCDOT, then it would add an additional occurrence to the existing occurrences known from NFS lands on the CNF and could be considered a mitigative measure.

Based on the occurrence of six populations of Florida peatmoss on NFS lands in the CNF, potential direct impacts to approximately 14 percent of the only population in the proposed Alt. 3 ROW, no direct effects to any of the other five populations, implementation of mitigation measures to minimize potential for indirect effects to the populations in or near the US 70 Havelock Bypass (R-1015) Alt. 3 study area, and no foreseeable or significantly adverse cumulative effects identified at this time, the project is not likely to cause a loss of viability for Florida peatmoss on NFS lands in the CNF.

<sup>&</sup>lt;sup>i</sup> Anderson, L.E., A.J. Shaw, and B. Shaw. 2009. Peat Mosses of the Southeastern United States. New York

Botanical Garden Press, New York. 110 pp. <sup>ii</sup> Duke University Herbarium. <u>http://biology.duke.edu/bryology/raremoss2005/raremoss\_files/page0018.htm</u> accessed October 2012.



To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000

> Rare Bryophyte Occurrences Across the Croatan National Forest US 70 Havelock Bypass (R-1015) Craven and Carteret Counties, North Carolina

Project: ER12050.06 Date: Nov 2013 Drwn/Chkd: KT/MKS Figure: 2



To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



Lejeunea bermudiana Assessment - Island Creek Drainage

US 70 Havelock Bypass (R-1015)

Craven and Carteret Counties, North Carolina

1	Project:	ER12050.06			
I	Date:	Oct 2013			
I	Drwn/Ch	kd: KT/MS			
	Figure:	2 - 1			

P:\GeoGra\Projects\2012\050\06\Lej\_Update\GIS\Fig\_lej\_detail.mxd Date: 11/11/2013 4:20:26 PM

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



Lejeunea bermudiana Assessment - Tucker Creek Drainage

US 70 Havelock Bypass (R-1015)

Craven and Carteret Counties, North Carolina

Project:ER12050.06Date:Oct 2013Drwn/Chkd:KT/MSFigure:2 - 2

P:\GeoGra\Projects\2012\050\06\Lej\_Update\GIS\Fig\_lej\_detail.mxd Date: 11/11/2013 4:20:26 PM



Craven and Carteret Counties, North Carolina

Figure:

2-3

P:\GeoGra\Projects\2012\050\06\Lej\_Update\GIS\Fig\_lej\_detail\_1000.mxd Date: 11/11/2013 4:22:06 PM





Lejeunea bermudiana Assessment - Still Gut and Cohoogue Creek Drainage

# US 70 Havelock Bypass (R-1015)

Craven and Carteret Counties, North Carolina

 Project:
 ER12050.06

 Date:
 Oct 2013

 Drwn/Chkd:
 KT/MS

 Figure:
 2-4

P:\GeoGra\Projects\2012\050\06\Lej\_Update\GIS\Fig\_lej\_detail\_1000.mxd Date: 11/11/2013 4:22:06 PM

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



Lejeunea bermudiana Assessment - King Creek Drainage

US 70 Havelock Bypass (R-1015)

 Project:
 ER12050.06

 Date:
 Oct 2013

 Drwn/Chkd:
 KT/MS

 Figure:
 2 - 5

Craven and Carteret Counties, North Carolina

P:\GeoGra\Projects\2012\050\06\Lej\_Update\GIS\Fig\_lej\_detail.mxd Date: 11/11/2013 4:20:26 PM





Lejeunea bermudiana Assessment - Pettiford Creek Drainage

US 70 Havelock Bypass (R-1015)

 Project:
 ER12050.06

 Date:
 Oct 2013

 Drwn/Chkd:
 KT/MS

 Figure:
 2 - 6

Craven and Carteret Counties, North Carolina

P:\GeoGra\Projects\2012\050\06\Lej\_Update\GIS\Fig\_lej\_detail.mxd Date: 11/11/2013 4:20:26 PM

To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



Rare Bryophyte Occurrences - Sphagnum cribrosum

US 70 Havelock Bypass (R-1015)

Craven and Carteret Counties, North Carolina

][	Project:	ER	12050.06		
	Date:		Oct 2013		
l	Drwn/Chl	kd:	KT/MS		
	Figure:		3		

P:\GeoGra\Projects\2012\050\06\Lej\_Update\GIS\Fig\_3\_peatmoss.mxd Date: 11/11/2013 4:25:38 PM

ATTACHMENT 13



ENVIRONMENTAL SERVICES, INC. 524 South New Hope Road Raleigh, North Carolina 27610 919-212-1760 / Facsimile 919-212-1707 www.environmentalservicesinc.com

## **MEMORANDUM**

TO:	Mary Frazer
FROM:	Matt Smith
DATE:	26 June 2014
RE:	US 70 Havelock Bypass (R-1015) P.O. No. 6300036892 Rare Plant Mitigation Measures: Summary of Evaluation for Awned Mountain- mint ( <i>Pycnanthemum setosum</i> ) ESI Project No. ER12-050.13

#### **Background**

In their review of the Biological Evaluation Report (BE) for the US 70 Havelock Bypass project, the U.S. Forest Service (USFS) identified the need for additional information on project-related impacts for Awned Mountain-mint (*Pycnanthemum setosum*) to more fully assess potential viability concerns resulting from project implementation.

Awned Mountain-mint is listed as a Locally Rare species by the USFS for the Croatan National Forest (CNF), is listed as Significantly Rare – Throughout by the North Carolina Natural Heritage Program (NCNHP), and does not have a designation by the U.S. Fish and Wildlife Service (USFWS). Based on the Locally Rare listing for the CNF, the USFS is required to assess potential impacts to the species resulting from actions by the USFS, such as granting an easement for the US 70 Havelock Bypass, to determine whether the action threatens the viability of the species on National Forest System (NFS) lands in the CNF.

Environmental Services, Inc., (ESI), has been asked by the North Carolina Department of Transportation (NCDOT) to complete an evaluation of impacts to this species associated with three alternatives considered for the proposed US 70 Havelock Bypass (R-1015) (Figure 1). The area encompassed by all three alternatives for the US 70 Havelock Bypass is referred to as the Alternatives study area in this evaluation. The scope of work for the Awned Mountain-mint evaluation is the result of meetings between NCDOT and the USFS.

Impact assessments for this species were based on the following:

- The evaluations presented here utilize Element Occurrence (EO) data obtained from the N.C. Natural Heritage Program (NCNHP) in April 2014, supplemented by site evaluations conducted by ESI in June 2014.
- Boundaries for NFS lands were provided by the USFS for use in this evaluation. Only EOs, or portions of EOs, on NFS lands are of concern for the viability determination for NFS lands on the CNF.
- Direct impacts for each alternative are based on the tree clearing limits (slope stake limits plus 15 feet) plus an additional 25 feet.
- Indirect impacts were considered for EO areas located on NFS lands between the alternative direct impact areas and existing US 70 based on consideration that different post-project habitat management techniques may be required by USFS for areas isolated from larger, contiguous NFS lands by the project. Additional concerns identified for consideration of indirect impacts include construction or maintenance actions by NCDOT in the vicinity of rare plants EOs on NFS lands that could have negative impacts on the rare plants or the suitability of their habitat. These actions could include the type of roadside vegetation proposed for use by NCDOT in the project right-of-way, location of construction staging areas, soil compaction or rutting caused by heavy equipment resulting in localized changes in hydrology, and use of herbicides and pesticides.
- Cumulative impacts were considered for identified actions on NFS lands that could affect this species. Because the USFS concern for this species is for maintaining continued viability on NFS lands in the CNF, actions off NFS lands were not considered for determining whether an action will affect the viability of this species on NFS lands. Actions proposed on NFS lands are subject to independent review by USFS to assess potential effects to the continued viability of this species on NFS lands in the CNF. No NCDOT projects have been identified that would directly or indirectly impact this species on NFS lands. No actions being considered by USFS on NFS lands have been identified that would directly or indirectly impact this species. As such, no significant cumulative impacts were identified for this species.

A summary of the evaluation presented here will be incorporated into Chapter 4 of the Final Environmental Impact Statement (FEIS) and the BE.

#### Awned Mountain-mint (Pycnanthemum setosum)

Awned Mountain-mint is a perennial member of the mint family that occurs in damp to wet fields, old fields, clearings, and forest borders in sandy soils.<sup>i</sup> These areas are often in associated with openings in blackwater swamps.<sup>ii</sup> On the CNF this species has been documented from two locations (Figure 2a): a powerline right-of-way near the proposed US 70 Havelock Bypass western interchange with existing US 70 (EO 5); and a bluff adjacent to Holston Creek in the western portion of the CNF (EO 3). The habitat associated with each of these differs, however both sites are located in association with blackwater swamps.

#### Methods and Results of Assessment

There are two EOs reported for Awned Mountain-mint on NFS lands within the CNF, but recent surveys have failed to relocate this species within one of these EOs (EO 3) (Gary Kauffman, personal communication, 19 February 2014). Each of the three alternatives evaluated for the US 70 Havelock

Bypass project area include a portion of EO 5, possibly the only extant occurrence of this species reported from NFS lands in the CNF. This evaluation focuses on the EO (EO 5) that is located in the Alternatives study area, to determine the approximate boundaries of this EO for purposes of determining direct and indirect impacts, and to estimate the number of individual plants that are located within the direct and indirect impact areas; no projects were identified that would contribute to cumulative impacts to this species on NFS lands in the CNF. Awned Mountain-mint EO 5 is located in an area with a project footprint common to all three alternatives; therefore impacts for each alternative will be the same and separate detailed analyses are not provided for each alternative.

Surveys for Awned Mountain-mint were undertaken on 3 June 2014 by an experienced team of biologists led by Matt Smith with support from Kevin Markham. Surveys consisted of two biologists walking transects within the habitat encompassed by the NCNHP EO polygon, as well as adjacent areas on NFS lands with similar habitat conditions.

Individual Awned Mountain-mint plants were identified across a range of growth stages, including nonflowering immature plants and plants in all stages of flowering. Although typically not expected to be in full flower until late June, two plants were noted in flower on the survey date and numerous others were noted as budding and appeared ready to begin flowering.

The extent of habitat occupied by Awned Mountain-mint was approximated using GPS to delineate the concentrations of plants encountered. Five discrete concentrations of plants were identified, separated by breaks in habitat in which no Awned Mountain-mint was identified. Each of these five areas is identified as a sub-polygon of EO 5 on Figure 2b.

Stem counts for Awned Mountain-mint were made in areas with limited number of individual plants, and in larger areas with sparse densities of scattered individuals. To avoid trampling plants in larger and more densely populated occupied habitat, counts were made for a subsample which was then applied to visually assess the remaining extent of areal coverage to estimate the number of plants present.

The results of the survey are presented in Table 1 along with a summary of NCNHP data for the most recent observations of the EO. Because several sub-polygons were identified outside of the EO and areas where no plants were identified within portions of the NCNHP EO, each individual polygon identified by ESI has been assigned a number (Sub-polygon #) for this evaluation to facilitate tracking and analysis (Figure 2b).

NCNHP Data				June 2014 Survey Results				
EO #	EO Status	Last Observed	Area (acres)	# Plants (Last	Sub- Polygon #	Area (acres)	# Plants Observe	Habitat Quality
				Observed)			d	
5	Extant	7/2012	2.06	250	1	0.09	50 °	Open maintained powerline ROW, wet
5	Extant	//2012	2.00	250	2	1.30 <sup>b</sup>	1,020 <sup>b,c</sup>	Open maintained powerline ROW, wet
NA <sup>a</sup>					3	0.02	11	FS Road ditch bank
NA <sup>a</sup>					4	0.76	3,200 °	Open maintained powerline ROW, wet
NA <sup>a</sup>					5	0.01	12	FS Road ditch bank
			2.06	Total: 250		2.18	Total: 4,300 <sup>c</sup>	

Table 1. Results of the June 2014 Awned Mountain-mint Survey.

<sup>a</sup> Sub-polygon is located outside of the area of the mapped NCNHP EO but likely close enough to be considered part of this occurrence.

<sup>b</sup> Estimated 800 plants identified within an area of approximately 0.26 acre with higher density than the surrounding occupied habitat, as depicted in Figure 2b; remaining estimated 220 plants at lower density in remainder of delineated area.

<sup>c</sup> Estimated.

The powerline in the vicinity of EO 5 includes a mix of hydrological conditions ranging from very wet areas dominated by sedges (*Carex* spp.) to much drier habitats with a mix of species including White Colic Root (*Aletris farinosa*) and Leopard's-bane (*Arnica acaulis*). Awned Mountain-mint was generally observed in mesic to wetter areas located between these extremes. The survey resulted in the identification of five sub-polygons delineated for Awned Mountain-mint in the vicinity of the EO including three sub-polygons north and west of the boundaries of the original EO (Figure 2b). These five sub-polygons total approximately 2.18 acres and include an estimated approximately 4,300 individual plants.

#### Summary of Impacts

- This evaluation indicates that Awned Mountain-mint EO 5 covers a slightly larger area and includes a larger number of plants than previously estimated and that the distribution of plants extends farther outside of the area being considered for direct and indirect effects than previously depicted. The five sub-polygons identified in June 2014 total approximately 2.18 acres and include an estimated approximately 4,300 plants.
- EO 5 is directly affected by a shared portion of Alternative 3, Alternative 2, and Alternative 1. Approximately 0.52 acre of occupied habitat (including 0.15 acre identified with higher density concentration) that includes an estimated 500 individual plants that will be directly affected. Direct impacts to this EO may be able to be mitigated by collecting seeds to establish new populations or supplement existing populations on NFS lands. Seed collection will be conducted in coordination with the USFS in accordance with a seed collection permit for this species issued to NCDOT.

An additional 0.10 acre of EO 5 containing an estimated 50 individual plants is located in an area subject to indirect impact consideration for a shared portion of Alternative 3, Alternative 2, and Alternative 1.

These individual plants were observed within the powerline right-of-way which is currently being managed by a combination of mowing by the utility company operating the lines within the right-of-way and periodic prescribed burns conducted by the USFS. No changes in management of the powerline right-of-way by mowing are expected to result from project implementation, reducing the concerns for indirect impacts. However, the ability for the USFS to conduct periodic prescribed burns in these powerline areas will need to be continued. Implementation of mitigation measures agreed to between NCDOT and USFS for rare plants would minimize viability concerns that could result from indirect impacts. These mitigation measures include:

- Allow for the temporary closure of the bypass to allow the USFS to conduct periodic prescribed burns;
- Prior to construction, NCDOT will coordinate with the USFS to identify occurrences of USFS rare plant species near the project construction limits and put up protective orange fencing to be removed after completion of construction;
- Avoid placing staging areas within 250 feet of USFS rare plant species occurrences, where practicable;
- Avoid placing heavy equipment within powerline corridors outside of the proposed slope stakes without prior approval from the USFS;
- Minimize the use of herbicides; and
- NCDOT Division 2 forces will work with USFS staff on a periodic basis to control the presence
  of priority species of non-native plants along the Havelock bypass easement on CNF. NCDOT
  will also work on adjacent NCDOT ROW to prevent the encroachment of priority non-natives on
  to CNF. In turn, USFS will work cooperatively with NCDOT to identify and effectively control
  prioritized non-native invasive plant species. If spraying herbicides to control non-native
  invasive plant species within 10 feet of awned mountain mint, place barriers, such as an
  appropriately sized cardboard sheet adjacent to the mountain mint

In coordination with the USFS, NCDOT has developed mitigation measures to minimize the spread of NNIS plant species on NFS lands within the CNF associated with the construction and maintenance of the US 70 Havelock Bypass.

- To prevent the spread of non-native invasive plant species on NFS lands, NCDOT will require contractors to pressure wash all off-road equipment, including cranes, graders, pans, excavators, and loaders, prior to being brought in the CNF construction areas.
- To control the spread of non-native invasive plant species on NFS lands, NCDOT, in coordination with the USFS, will locate and flag areas of non-native invasive plant species within the study area for Alternative 3 of the US 70 Havelock Bypass. If any of these areas are within areas of proposed fill, those areas will be cleared and grubbed, and the material disposed of outside the limits of the CNF. If non-native invasive plant species are located in areas of proposed cuts then the material and actual thickness of root mat or other defined amount will be disposed of outside the limits of the CNF.
- In consultation with the USFS, seed mixes of native grasses and forbs or non-aggressive, nonnatives will be used on NFS lands for erosion control and revegetation.
- NCDOT will utilize rolled matting or weed-free mulch for erosion control and revegetation on NFS lands.

NCDOT will coordinate with the USFS on a landscaping plan for NFS lands. The plan will detail
appropriate native seeding mixes for erosion control and site specific control methods for
invasive species, including a suite of acceptable herbicides for the corridor and adjacent natural
habitats. The plan will also outline a plan for ongoing coordination between NCDOT and USFS
personnel to maintain vegetation diversity and ensure no long-term impacts to rare species along
the bypass corridor.

With the implementation of the mitigation measures developed by NCDOT, in coordination with the USFS, the threat of spread of NNIS plants on NFS lands associated with the construction and maintenance of the US 70 Havelock Bypass is expected to be minimal.

#### Conclusions and Recommendations

Awned Mountain-mint has been reported from two EOs on NFS lands within the CNF. One EO (EO 5) is affected by the US 70 Havelock Bypass (R-1015) and the other EO (EO 3) is not affected by the project but has not been relocated during recent surveys.

The June 2014 survey resulted in refinement and expansion of the known area occupied by Awned Mountain-mint in the vicinity of EO 5, including addition of an area on NFS lands covering approximately 0.76 acre containing a dense concentration estimated at approximately 3,200 plants located outside the areas subject to direct or indirect impacts. In addition, two smaller roadside areas totaling approximately 0.03 acre and containing 23 plants were also identified on NFS lands outside the areas subject to direct or indirect. The June 2014 survey resulted in documentation of a total of approximately 4,300 Awned Mountain-mint plants dispersed in varying densities and covering an area of approximately 2.18 acres of occupied habitat within five sub-polygons comprising the expanded EO 5.

The US 70 Havelock Bypass (R-1015) Alternative 3, Alternative 2, and Alternative 1 will result in the same unavoidable direct impacts to Awned Mountain-mint and the project has the potential for the same indirect impacts for each alternative. Approximately 0.52 acre (including 0.15 acre identified with higher density concentration) containing an estimated 500 individual plants will be directly affected. This represents approximately 24 percent of the occupied habitat identified for this EO, but only approximately 12 percent of the individual plants within this EO. An additional 0.10 acre containing an estimated 50 individual plants is located in an area subject to indirect impact consideration, which represents less than 5 percent of the areal coverage and approximately 1 percent of the estimated number of plants. The majority of the individual plants documented in June 2014, approximately 3,750 plants or 87 percent of the plants estimated to comprise this EO, are located outside the areas identified as subject to direct or indirect impacts. No cumulative impacts from other USFS or NCDOT projects on NFS lands on the CNF have been identified.

Based on the direct impact to occupied habitat and loss of individuals associated with EO 5, the direct impacts for the project are a concern based on this EO possibly being the only extant occurrence of this species on NFS lands in the CNF. However with the documentation in June 2014 of additional areas and large numbers of plants on NFS lands in the CNF outside the direct impact area and area subject to indirect impacts, and implementation of seed collection from the impacted occurrence to help establish new populations or supplement existing populations as mitigation for the direct impact, the direct impact

resulting from the project is not likely to result in a loss of viability on NFS lands within the CNF. The area subject to consideration for indirect impacts represents a relatively small percentage of the population and areal extent of Awned Mountain-mint documented as extant on NFS lands in the CNF. The project is not expected to result in changes that would prevent the utility company from continued mowing to maintain the powerline right-of-way and measures are in place to allow the USFS to continue conducting prescribed burns in the areas in which this EO is found, reducing the threat for indirect impacts. Other potential concerns for indirect impacts that could result from project construction and maintenance activities can be minimized through appropriate measures.

Implementation of measures agreed to between NCDOT and USFS would minimize viability concerns resulting from indirect impacts that could arise from construction and/or maintenance activities. As mitigation for direct impacts to offset viability concerns, NCDOT has agreed to collect seeds from the direct impact area for use in supplementing existing populations or establishing new populations where suitable habitat occurs on NFS lands.

With the implementation of appropriate measures to reduce concerns for indirect impacts, neither implementation of Alternative 3, Alternative 2, nor Alternative 1 of the proposed US 70 Havelock Bypass (R-1015) project is likely to cause a loss of viability for Awned Mountain-mint on NFS lands in the CNF.

<sup>&</sup>lt;sup>i</sup> The Flora of Virginia Project. Digital Atlas of the Virginia Flora. <u>http://vaplantatlas.org/index.php?do= start</u> (Accessed 13 June 2014).

<sup>&</sup>lt;sup>ii</sup> Finnigan, J.T. 2012. Natural Heritage Program List of Rare Plant Species of North Carolina 2012. N.C. Natural Heritage Program, Raleigh, NC. 134 pp.





To protect the viability of protected/rare species, the exact location of species occurrences is not shown on this exhibit. For more information, contact: NCDOT Natural Environmental Section 919-707-6000



Awned Mountain-mint Assessment - NCNHP EO# 5 US 70 Havelock Bypass Croatan National Forest, North Carolina T.I.P. R-1015

Project:	ER12050.13
Date:	June 2014
Drwn/Ch	kd: KT/MKS
Figure:	2b