

# ***Management Indicator Species Population and Habitat Trends***

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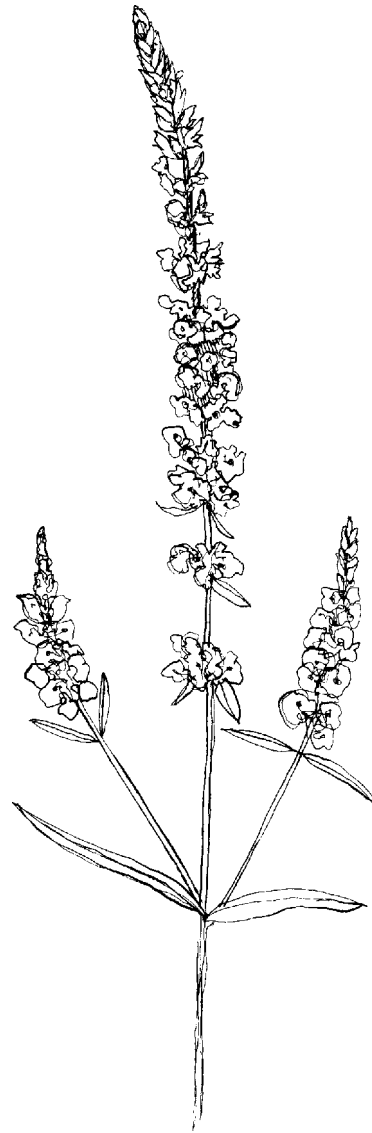
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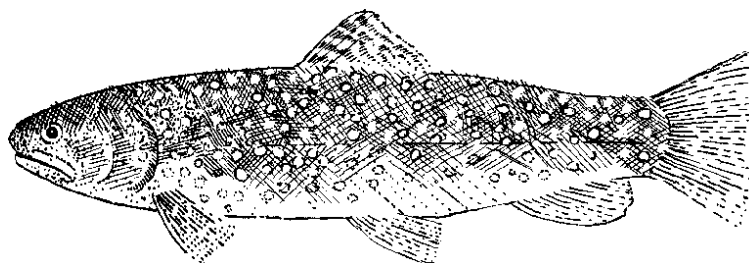


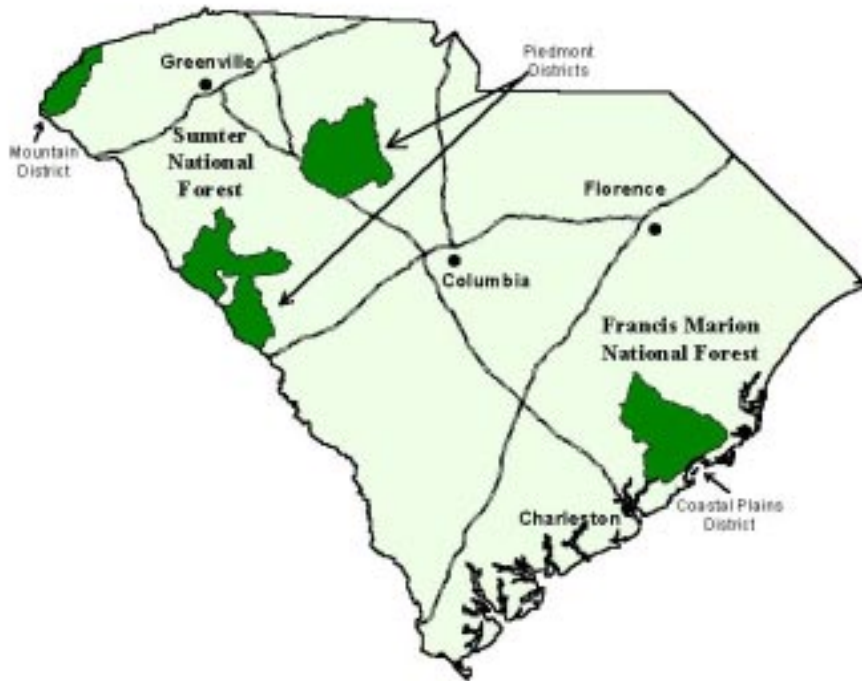
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# Introduction

To provide for a diversity of wildlife, fish, and plant habitats, the National Forests use management indicator species (MIS) as a tool for identifying specialized habitats, formulating habitat objectives and standards and guidelines. Additionally, they focus the analysis of effects to biological resources across the range of alternatives proposed during Forest and project planning. Management indicator species are used to address issues related to biological diversity, as well as management of wildlife and fish for commercial, recreational, or aesthetic values or uses (FSM 2621.1). This document summarizes population and habitat trends to date for MIS identified in both the Francis Marion (1996) and the Sumter (1985) *Land and Resource Management Plans* (LRMP) as required in the Planning Regulations (36 CFR 219.19), under which current Forest Plans were approved. Habitat and population trends are evaluated within the context of Forest Plans requirements, Forest Plan implementation or ongoing management and risks to the species, and the probability of species and habitat persistence, which is well distributed across the planning area. In cases where the data are either inclusive, or suggests that species or habitat are declining to a point that species persistence cannot be assured, recommendations are made to shift management emphasis or amend management or monitoring direction within the Forest Plans. This analysis offers a larger context for evaluation of biodiversity at the landscape scale, which can be used to strengthen project development, effects evaluation, and Sumter Forest Plan revision efforts.

## Documentation of Management Indicator Species Selection

When Forest Service regulations were developed to implement the National Forest Management Act, the concept of Management Indicator Species (MIS)

was incorporated into the direction. The MIS approach is designed to function as a means to provide some insight into effects of management direction on plant and animal communities. The concept of MIS is to identify a few species that represent many other species and evaluate management direction by the effects on habitats for MIS. Indicator species were to be selected from the pool of vertebrate species of wildlife that are known to occur on the Forest. The selection of MIS was based on the following criteria specified in the 1982 Planning Regulations:

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### S219.19 Fish and wildlife resources

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(a)(1) In the selection of management indicator species, the following categories shall be represented where appropriate: Endangered and threatened plant and animal species identified on the State and Federal lists for the planning area; species with special habitat needs that may be influenced significantly by planned management programs; species commonly hunted, fished, or trapped; non-game species of special interest; additional plant and animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.

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Initial species lists, developed in association with each Forest Plan, were comprised of species meeting the above criteria along with a species/habitat matrix to associate each MIS with major habitats, forest types, or age classes. Ecological indicators were selected for habitats not already represented. Using these criteria, a list of 33 MIS was developed for the Sumter National Forest (SNF) (1985), and a list of 35 MIS and 7 plant communities was developed for the Francis Marion

National Forest (FMNF) (1996). Additional specialized habitats, identified through the Southern Appalachian Planning process (ongoing), have been added to refine habitat relationships for some of the MIS at this time.

The following habitat matrix relates terrestrial MIS to forested age classes, forest type groups, and specialized habitats. Numbered habitat groups are related to forest types (when appropriate) in the following crosswalk.

Crosswalk between Habitat Group, Habitat #, and Forest Type		
HABITAT GROUP	HABITAT #	CISC FOREST TYPES CODES
Southern Pines	1	3,21,22,26,27,31,32
Upland Hardwood	2	50,53,54,56,57,58,59,60,69
Mixed Pine-Hardwood	3	10,11,12,13,14,44, 46,47,48,49
Bottomland Hardwood/Swamp	4	61,62,63,64,65,67,71,72,73,74
Basic Mesic Forests*	5	53,54,55,56
Mixed Mesic Forests	6	3,4,5,8,9,10,53,54, 55,56
Upland Savannas and Woodlands**	7	21,22,23,31,32,38, 39,12,15,20
Pocossins	8	18,36,40,68,99
Cypress-Tupelo Pond Forests	9	23
Seasonally Wet Savannas*	10	98
Maritime Forests	11	77
Rock Outcrops	12	NA
Springs and Seeps	13	NA
*Habitat identification based on understory communities		NA= Not Applicable
**Habitat identification based on fire regime or forest structure		

**Table 1. Management Indicators by Age Class and Habitat Group**

MIS	Nat. Forest	Grass-Forb (Age 0-5)	Shrub-Seedling (Age 5-20)	Sapling-Pole (Age 21-40)	Mature (Age 41-80)	Late Succession (80+ Pine;100+ Hardwood)
American Chaffseed	FM	1,7			1,7	1,7
American Wahoo	S				2,3,5,6	2,3,5,6
Am.Swallow-tailed Kite	FM	1,3,4,5,8, 10	1,3,4,5,8, 10	1,3,4,5,8,10	1,3,4,5,8,10	1,3,4,5,8,10
Awmed Meadow-beauty	FM	9,10			9,10	9,10
Bachman's Sparrow	FM	1,7,10			1,7,10	1,7,10
Bay-Swamp Pocossin	FM	8	8	8	8	8
Blackstem Spleenwort	S	12	12	12	12	12
Black-throated Green Warbler	FM			8	3,4,8	3,4,8
Brown-headed Nuthatch	S			1	1	1
Brown water snake	S			4	4	4
Calcareous Mesic Forest	FM				5,6,	5,6
Columbo	S				5,6	5,6
Eastern Bluebird	FM/S	1,7,10		1,7,10	1,7,10	1,7,10
Eastern fox squirrel				1,2,3,5,6,7,11	1,2,3,5,6,7,- 11	1,2,3,5,6,7,11
Eastern gray squirrel	S				2,3,4,5,6	2,3,4,5,6
Eastern king snake	S	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7
Eastern Wild Turkey	FM/S	1,2,3,4,5,6,7, 8,9, 10, 11,12,13		1,2,3,4,5,6,7, 8,9, 10,11, 12,13	1,2,3,4,5,6,- 7, 8,9,10,11, 12,13	1,2,3,4,5,6, 7,8,9,10, 11,12,13
Eastern woodrat	FM		3,4,5,8,9	3,4,5,8,9	3,4,5,8,9	3,4,5,8,9
Fraser's Loosestrife	S	1,2,3,4,7			1,2,3,4,7	1,2,3,4,7
Eastern woodrat	FM		3,4,5,8,9	3,4,5,8,9	3,4,5,8,9	3,4,5,8,9
Fraser's Loosestrife	S	1,2,3,4,7			1,2,3,4,7	1,2,3,4,7



**Table 1. Management Indicators by Age Class and Habitat Group (continued)**

<b>MIS</b>	<b>Nat. Forest</b>	<b>Grass-Forb (Age 0-5)</b>	<b>Shrub-Seedling (Age 5-20)</b>	<b>Sapling- Pole (Age 21-40)</b>	<b>Mature (Age 41-80)</b>	<b>Late Succession (80+ Pine; 100+Hrdwd)</b>
Ginseng	S				2,3,5,6	2,3,5,6
Grass-of-Parnassus	S				13	13
Great Crested Flycatcher	FM	1,2,3,4,5,6,7,8,9,10,11	1,2,3,4,5,6,7,8,9,10,11	1,2,3,4,5,6,7,8,9,10,11	1,2,3,4,5,6,7,8,9,10,11	1,2,3,4,5,6,7,8,9,10,11
Hooded Warbler	FM		2,4,8,9	2,4,8,9	2,4,8,9	2,4,8,9
Longleaf Woodland	FM	1,7	1,7	17	1,7	1,7
Mabee's salamander	FM	1,7,9,10	1,7,9,10	1,7,9,10	1,7,9,10	1,7,9,10
Maritime Forest	FM	2,5,6,11	2,5,6,11	2,5,6,11	2,5,6,11	2,5,6,11
Mountain Camellia	S				2,3,5,6	2,3,5,6
Great Crested Flycatcher	FM	1,2,3,4,5,6,7,-8,9,10,11	1,2,3,4,5,6,7,-8,9,10,11	1,2,3,4,5,6,7,8,9,10,11	1,2,3,4,5,6,7,8,9,10,11	1,2,3,4,5,6,7,8,9,10,11
Hooded Warbler	FM		2,4,8,9	2,4,8,9	2,4,8,9	2,4,8,9
Longleaf Woodland	FM	1,7	1,7	17	1,7	1,7
Mabee's salamander	FM	1,7,9,10	1,7,9,10	1,7,9,10	1,7,9,10	1,7,9,10
Maritime Forest	FM	2,5,6,11	2,5,6,11	2,5,6,11	2,5,6,11	2,5,6,11
Mountain Camellia	S				2,3,5,6	2,3,5,6
Northern Bobwhite	FM	1,7,10			1,7,10	1,7,10
Northern dusky salamander	S				4,5,6,13	4,5,6,13
Northern Parula	FM				2,4,5,6,8,9	2,4,5,6,8,9
Painted Bunting	FM		2,3,4,5,6,8,9,11	11	11	11

**Table 1. Management Indicators by Age Class and Habitat Group (continued)**

MIS	Nat. Forest	Grass-Forb (Age 0-5)	Shrub-Seedling (Age 5-20)	Sapling-Pole (Age 21-40)	Mature (Age 41-80)	Late Succession (80+ Pine; 100+Hrdwd)
Piedmont Strawberry	S				2,3,5,6	2,3,5,6
Pileated Woodpecker	FM/S				2,3,4,5,6,8,9,11	2,3,4,5,6,8,9,11
Pine and Pond Cypress Savanna	FM	1,7,9,10			1,7,9,10	1,7,9,10
Pine Woods treefrog	FM	1,7,9,10	1,7,9,10	1,7,9,10	1,7,9,10	1,7,9,10
Pondberry	FM	1,7,9,10			1,7,9,10	1,7,9,10
Pondspice	FM	1,7,9,10			1,7,9,10	1,7,9,10
Pond Cypress/Tupelo Pond	FM	1,7,9,10			1,7,9,10	1,7,9,10
Prairie Warbler	FM		1,2,3,5,6,7,8,10,11	7,8,10,11	7,8,10	7,8,10
Prothonotory Warbler	FM			4,9	4,9	4,9
Red-cockaded Woodpecker	FM/S				1,7	1,7
Red-headed Woodpecker	S				1,3,4	1,3,4
Small Whorled Pogonia	S				3,6	3,6
Smooth Coneflower	S	7			7	7
Southern chorus frog	FM				1,7,9,10	1,7,9,10
Southern Mixed Hardwood Forest	FM	2,6	2,6	2,6	2,6	2,6
Spoonflower	FM	8	8	8	8	8
Sun-facing Coneflower	S	4,7			4,7	4,7
Swainson's Warbler	FM			4,8,9	4,8,9	4,8,9
Umbrella Leaf	S				6,13	6,13
Webster's salamander	S				4,5,6	4,5,6
White-eyed Vireo	FM/S		1,2,3,4,5,6,7,8,9,11	1,2,3,4,5,6,7,8,9,11		
White-tailed deer	FM/S	All	All	All	All	All
Wild Coco	FM	1,7			1,7	1,7
Wood Thrush	FM			4,5,6,8,9	4,5,6,8,9,11	
Yellow-breasted Chat	FM/S		1,2,3,4,5,6,7,8,9,11	1,2,3,4,5,6,7,8,9,11		
Yellow-throated Warbler	FM				2,3,4,5,6,8,9,11	2,3,4,5,6,8,9,11

# Forestwide Management Indicator Species Habitat Monitoring and Evaluation

Both population and habitat data are used to monitor management indicator species on the Forests. Since habitat condition is one of the primary factors influencing population levels, assessment of trends in key habitat parameters is also important in estimating population trends and conditions.

Management indicator species can be grouped by preferred habitat groups in order to facilitate habitat monitoring, focus effects analysis, and develop management objectives, Forest standards and

guidelines, and minimum management requirements. The importance of habitats including early succession (forested age class 0-10), late successional pine (age 80+), late successional hardwood (age 100+), mixed pine-hardwood, and aquatics have been recognized in both the Francis Marion and Sumter Forest Plans. A greater variety of habitat groups are identified in the Francis Marion Plan (1996) compared to the Sumter Plan (1985). Even more can be recognized today. The following are management indicator species grouped by preferred habitat group.

Table 2 - Management Indicator Species Groupings	
Preferred Habitat Group	MIS
Early Succession	Eastern Bluebird, Northern Bobwhite, Prairie Warbler, Yellow-breasted Chat, White-tailed deer, White-eyed Vireo
Late Successional Pine	American Swallow-tailed Kite, Brown-headed Nuthatch, Red-cockaded Woodpecker
Late Successional Hardwood	Pileated Woodpecker
Mixed Pine-Hardwood	Eastern grey squirrel, Eastern Wild Turkey
Upland Savannas and Woodlands	American Chaffseed, Bachman's Sparrow, Eastern fox squirrel, Eastern king snake, Fraser's Loosestrife, Great Crested Flycatcher, Longleaf Pine Woodland Communities, Red-headed Woodpecker, Smooth Coneflower, Sun-facing Coneflower, Wild Coco, Wood Thrush
Rock Outcrops	Blackstem Spleenwort
Basic Mesic Forests	American Wahoo, Calcareous Mesic Forest Community, Columbo, Ginseng
Mixed Mesic Forests	Piedmont Strawberry, Small Whorled Pogonia, Southern Mixed Hardwood Forest, Webster's salamander
Maritime Forests	Maritime Forest Community, Painted Bunting
Pocossins	Bay-Swamp Pocossin Community, Spoonflower, Swainson's Warbler
Cypress-Tupelo Pond Forests	Pond Cypress/Swamp Tupelo Pond Forest Community, Mabee's salamander, Pine woods treefrog, Pondberry, Pondspice, Southern chorus frog
Seasonally Wet Savannas	Awmed Meadowbeauty, Pine and Pond Cypress Savanna Communities
Springs and Seeps	Grass-of-Parnassus, Umbrella Leaf
Streamside/Bottomland Hrdwd.Forests	Black-throated Green Warbler, Northern Parula, Yellow-throated Warbler, Prothonotory Warbler, Northern dusky salamander, Brown water snake, Mountain Camellia
Cold Water Streams	Brook Trout, Brown Trout, Rainbow Trout
Cool Water Streams	Redbreast Sunfish, Redeye Bass, Striped Jumprock
Warm Water Streams	Redbreast Sunfish, Striped Jumprock, Speckled Madtom
Warm Water Streams	Bluegill, Largemouth Bass
*Plant communities containing habitat for rare species were included as MIS per Regional Guidance at that time	

The primary tool for evaluating habitat conditions is the Continuous Inventory of Stand Conditions (CISC) data, compiled from periodic field inventories throughout the Forests. Other sources of data include the United States Department of Interior National Wetlands Inventory and plant community inventories (Porcher, 1994,1993,1982). Using this data, trends in forest types and baseline data on specialized habitats can be displayed.

### *Francis Marion*

A diversity of habitats occurs on the Francis Marion supporting a variety of plant and animal species and their habitats. The majority of the over 250,000-acre Forest is in loblolly pine forests, swamp forests, and longleaf pine forests and woodlands. By the year 2000, the Francis Marion had reached 106 percent of the 10-year Forest Plan objective for longleaf pine forest types and had achieved the objective for mixed pine-hardwood acres (FY1999 Monitoring and Evaluation Report, p.7). The Francis Marion still falls short of the 10-year Forest Plan objective for hardwood and mixed pine/hardwood forests, at 16 percent compared to 20 percent of the forested acres (Forest Plan, p.2-2). Bottomland hardwoods appear to be increasing, but upland hardwood forests are unchanged.

<b>Table 3. Forest Type Group Trends on the Francis Marion NF (percent of terrestrial acres)</b>			
FOREST TYPE GROUP	1996	2000	Trend
Loblolly/Slash Pine	46	37	- 9
Longleaf Pine/+Loblolly Mixtures	15	19	+ 4
Pond Pine Woodlands	3	2	- 1
Upland Hardwood Forests	1	1	0
Mixed Pine/Hardwood Forests	4	6	+ 2
Bottomland Hardwood Forests	7	9	+ 2
Swamp Hardwood/Cypress Forests	18	20	+ 2

Hurricane Hugo eliminated 60 percent of the forested canopy on the Francis Marion in 1989 creating an abundance of early successional conditions. Notable trends in age class distribution on the Francis Marion since 1996 include a decline in early-successional habitats (0-6), but an increase in fire-maintained savanna and woodland habitat. The FM Plan has an objective of 5,000-10,000 acres in the 0-3 age class (p.2-2). Stand data shows 12,780 acres in this age class, including sparsely stocked stands that have been burned twice or more since Hurricane Hugo.

<b>Table 4. Trends in Forested Age Classes on the Francis Marion NF (percent of terrestrial acres)</b>				
SUCCESSIONAL STAGE	Age Class	19-96	2000	Trend
Grass-Forb	0-6	5.2	1.0	-4.2 %
Shrub-Seedling	7-15	3.8	4.1	+0.3%
Sapling-Pole Pine	16-40	11.8	17.6	+5.8%
Sapling-Pole Hardwood	16-40	3.7	3.2	-0.5%
Mature Pine	41-80	14.5	14.1	-0.4%
Mature Hardwood	41-100	31.2	31.2	No change
Late Successional Pine	81+	1.6	3.1	+1.5%
Late Successional Hardwood	100+	.9	1.6	+0.7%

Additional specialized habitats on the Francis Marion include rare or threatened plant and animal communities, and aquatic habitats. Baseline acreages in these specialized habitats are displayed in Table 5. Savannas and woodlands refer to communities with an open forest structure, which support a dense herbaceous understory. As defined in the draft International Classification of Ecological Communities (1998), woodlands include “open stands of trees with crowns not usually touching (generally forming 25-60 percent cover).”

Fire-maintained pine woodlands are emphasized within a 160,000 Red-cockaded Woodpecker Habitat Management Area (HMA) on the Francis Marion. The Francis Marion Plan tiers to standards and guidelines outlined in the “Record of Decision (ROD) for Management of the Red-cockaded Woodpecker and its habitat on National Forests in the Southern Region” (Appendix A, 1995) requiring that the entire HMA be prescribed burned on a 5-year rotation. Due to smoke management problems at urban interfaces associated with fuel loading as a result of Hurricane Hugo, almost 2 percent of the HMA has not been prescribed burned in over ten years.

<b>Table 5. Baseline acreage of specialized habitats on the Francis Marion NF (as of 1/2001)</b>	
Pine Savannas and Woodlands (burned within 5 yrs.)	63,779
Longleaf Woodland (burned within 5 yrs.)	30,205
Bay-Swamp Pocossin	26,846
Calcareous Mesic Forests	72
Pond Cypress and Tupelo Pond Forests	3,419
Maritime Forest	233
Seasonally Wet Savanna	811
Southern Mixed Hardwood Forest	218
Ponds/Lakes/Impoundments	64
Warm Water Streams (miles)	275

*Sumter*

The Sumter National Forest occupies over 360,000 acres in South Carolina, including two districts within the Southern Appalachian Piedmont (the Enoree and Long Cane called piedmont districts), and one district in the Southern Appalachian Blue Ridge physiographic province (the Andrew Pickens).

Trends in forest type groups are displayed below for the Sumter as a whole, and for National Forest land occurring in each physiographic province

<b>Table 6. Forest Type Group Trends on the Sumter NF (percent of terrestrial acres), 1985-2000</b>				
Forest Type Group	1985*	1990	2000	Trend
Southern Yellow Pine	75	71	67	-7%
Upland and Cove Hardwoods	12	16	20	+8%
Bottomland Hardwoods	8	5	5	-3%
Mixed Pine/Hardwood	5	7	7	+2%
*calculated on suitable timber base only				

<b>Table 7. Forest Type Group Trends on the Andrew Pickens District (percent of terrestrial acres), 1985-2000</b>				
Forest Type Group	1985*	1995	2000	Trend
Southern Yellow Pine	56	46	38	-18%
Upland & Cove Hardwoods	28	29	41	+13%
Bottomland Hardwoods	-	-	-	No Change
Mixed Pine/Hardwood	17	25	20	+3%
*calculated on suitable timber base only				

**Table 8. Forest Type Group Trends on the Piedmont Districts (percent of terrestrial acres), 1985-2000**

Forest Type Group	1985*	1995	2000	Trend
Southern Yellow Pine	75	78	75	No Change
Upland & Cove Hardwoods	12	13	15	+3%
Bottomland Hardwoods	8	6	7	-1%
Mixed Pine/Hardwood	5	3	3	-2%
*calculated on suitable timber base only				

The Sumter National Forest is dominated by southern yellow pine, especially the piedmont districts, where this forest type is largely composed of planted loblolly pine. Between the years 1985 and 2000, the Sumter saw an increase in upland and cove hardwoods, and a decrease in southern yellow pine forests. On the Piedmont, this increase was due to efforts to be more accurate in hardwood classification and mapping.

The Sumter standard (Sumter Plan, p.IV-4) to “manage and maintain a hardwood component in hardwood stands, mixed stands, special areas, inclusions, key areas, and pine stands to provide an average of 65 pounds of mast per acre per year for 1000 acres” is not being met over much of the

piedmont. Efforts are being made to increase the hardwood component by favoring oaks and hickories in conjunction with thinning and forest regeneration activities.

Habitat diversity on the Sumter is enhanced by providing for a variety of age classes. Trends in forested age classes on the Sumter as a whole, and by physiographic province or district, are displayed in Tables 9 and 10

**Table 9. Trends in Forested Age Classes on the Sumter NF (percent of terrestrial acres), 1985-2000**

Successional Stage	Age Class	1985	1995	2000	Trend
Early Succession	0-10	8.8	13.3	6.4	-2.4%
Sapling-Pole	11-40	17.3	23.9	29.3	+12%
Mature Pine	41-80	28.2	29.0	30.0	+1.8%
Mature Hardwood	41-1-00	22.8	21.5	21.0	-1.8%
Late Successional Pine	81+	2.5	3.2	6.5	+4%
Late Successional Hardwood	100+	0	3.1	4.3	+4.3%

**Table 10. Trends in Forested Age Classes on Sumter NF, by District (% of terrestrial acres; AP = Andrew Pickens District, EN/LC = Piedmont Districts), 1985-2000**

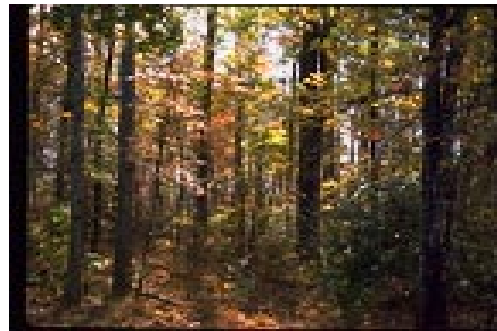
Successional Stage	Age Class	1985*		1995		2000		Trend	
		AP	EN/LC	AP	EN/LC	AP	EN/LC	AP	EN/LC
Grass-Forb	0-5	6.1	8.8	2.0	6.1	.7	1.7	- 5.4%	-7.1%
Late Successional Pine	81+	10.8	2.2	12.4	.6	24.2	1.5	+13.4	-7%
Late Successional Hardwood	100+	0	0	4.3	.4	18	.4	+18%	+4%
*calculated on the suitable timber base only									

The Sumter Plan objective is to have 42,000 acres or 12.6 percent of the suitable acres in the 0-10 age class. The amount of early successional habitat on the Sumter National Forest has declined since 1995, and is currently below Sumter Plan objectives and is decreasing. The acreage in late successional pine and hardwood forest on the Sumter National Forest is increasing and has met Sumter Plan objectives for late successional pine (5 percent in pine over 80 years), but is below objectives for late successional hardwood (5% in hardwood over 120 years). The majority of late successional habitats occur on the Andrew Pickens district.

Specialized habitats on the Sumter National Forest have been identified through the Southern Appalachian Planning process. These include a greater variety of hardwood communities, woodland communities maintained with prescribed fire, and non-forested habitats. Many of the basic mesic forest communities are included as proposed botanical areas through the Sumter Forest Plan revision process. Aquatic habitats, particularly trout habitats, were recognized and maintained in the 1985 Forest Plan (Sumter Plan, p. IV-3). Fire-maintained pine woodlands (see definitions on p.12) are emphasized in Management Area 8 on the Long Cane Ranger District (Sumter Plan, p. IV-43). Management Area 8 (3,444 acres) maintains pine woodland habitat for the Red-cockaded Woodpecker, by providing for open pine habitat managed on an 80-year rotation with prescribed burning on a 3-year rotation. Woodland habitats with Northern Bobwhite as a featured species are managed on both Piedmont districts. On the Andrew Pickens Ranger District, open woodlands are maintained for the endangered smooth coneflower and for table mountain and pitch pine communities. Baseline acreages in the following specialized habitats can be noted on the Sumter National Forest.

**Table 11. Baseline acreage of specialized habitats on Sumter NF as of 1/2001)**

Savannas and Woodlands	5,480
Basic Mesic Forests	4,780
Mixed Mesic Forests (AP only)	34,520
Rock Outcrops	5
Streamside Corridors/Springs and Seeps	74,000
Cold & Cool Water Streams	126
Ponds, Lakes, Impoundments	79
Warm Water Streams (miles)	1,091



# Forestwide Management Indicator Species Population Trend Monitoring and Evaluation by Habitat Group

Forestwide Management Indicator Species Population Trend Monitoring and Evaluation by Preferred Habitat Group, for Sumter National Forest (SNF), Francis Marion National Forest (FMNF) or both (FM&S NF)

## Early Succession Species

### Eastern bluebird (FM&S NF)

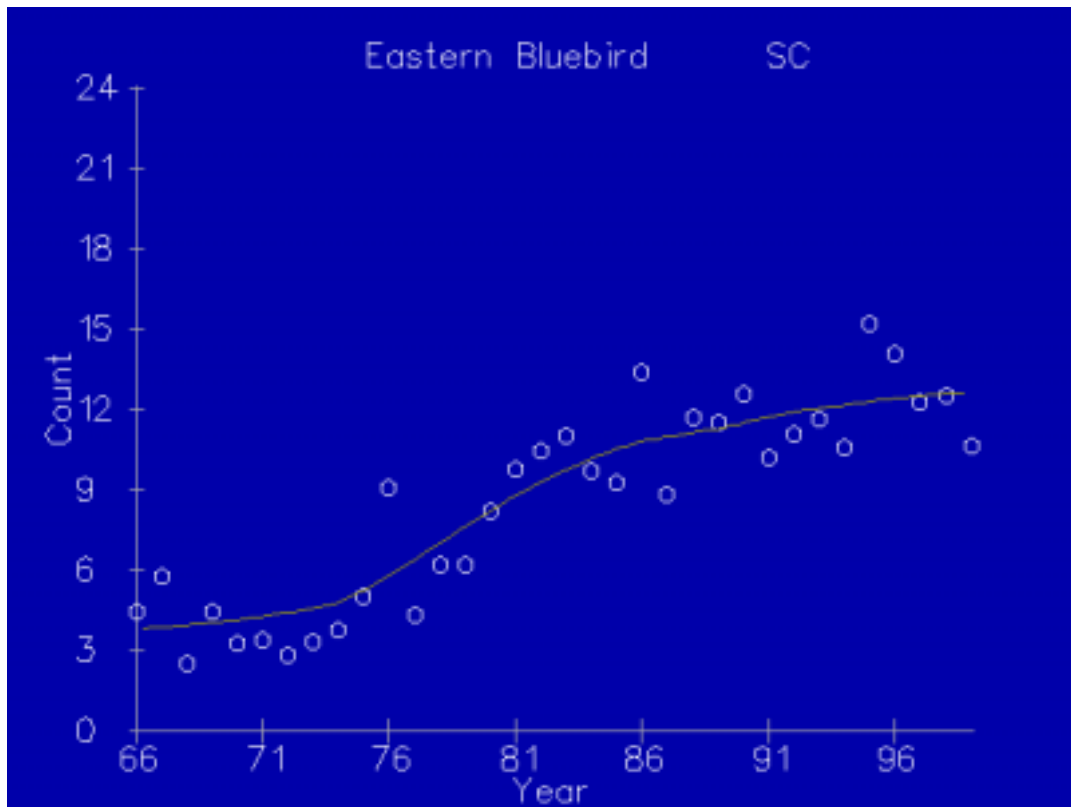
Eastern Bluebird, *Sialia sialis*, was identified as an MIS for both the Francis Marion and Sumter to serve as an ecological indicator for two habitat types: mature pine with open understories, and early successional habitats including the requirement for cavities in both habitat conditions (Francis Marion MIS selection process record). To monitor the effects of Plan implementation on these habitats, Appendix G of the Sumter Plan states that we will use CISC data to monitor vegetative conditions, rely on standards and guides for habitat distribution, and use bird surveys to monitor populations. The Francis Marion Monitoring and Evaluation Strategy states that we will collect point count data, calculate population trends and compare with habitat changes over time. Eastern Bluebird populations have been monitored through bird point counts that have been conducted on the Forest since 1994 using methods described in Hamel et al. (*A Land Manager's Guide to Point Counts of Birds in the Southeast*, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in Forest monitoring reports, published annually by the Forest Service for the Sumter since 1990.

The following sources of data and information were used in this analysis:

- ❑ Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- ❑ USDA Forest Service. Francis Marion and Sumter National Forest. Forest records (1979 – 2000) and annual bird point data (1994 – 2000)
- ❑ USDA Forest Service. Francis Marion and Sumter National Forest, Annual monitoring reports (1990 –2000)
- ❑ Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- ❑ Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

Eastern Bluebird is a bird of the open land, i.e., farmyards, roadsides, regeneration areas, and park like woodlands with scattered trees. Populations of Eastern Bluebird appear to have been steadily increasing (trend estimate 4.51;  $p = .00017$ ; Sauer et al., 2000) across South Carolina (Figure 1).





**Figure 1. Average number of Eastern Bluebirds per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

A total of 1138 bird point counts was conducted on the Sumter and 739 points on the Francis Marion from 1994 through 2000. There were 149 detections of Eastern Bluebird during 116 of the 1877-point counts.

Point counts conducted on the Sumter indicate Eastern Bluebird to be relatively common on the piedmont districts and the Francis Marion, and uncommon on the Andrew Pickens District (Figure 2). Collectively, Eastern Bluebird appears to have no long-term trends in abundance on the Forest (1994 – 2000; Figure 3), however it appears to be diminishing on the Andrew Pickens, with only one detection, in recent years (1997 – 2000). Bluebirds were abundant when regeneration and site preparation burning were common practices on the Andrew Pickens district (Shatley, Stewart; pers comm.).

Eastern Bluebird appears to be associated with grass/forb conditions on all districts (Figure 3a). Bluebirds occurred most frequently in pine forest types in grass/forb conditions in the piedmont and coastal plain (Figure 3c). Four out of five detections occurred in pine, grass/forb habitats. All forest types were used by bluebirds in the mountains, which may be more related to availability of suitable habitats than a lack of preference for habitat types.

On all districts, Eastern Bluebird occurred more frequently on upland sites (Figure 3c). There appears to be greater use of shrub/seedling, sapling/poletimber and mature habitats in the coastal plain which may be related to the repetitive burning, mid-story control and artificial cavity installation being done for Red-cockaded Woodpecker management.

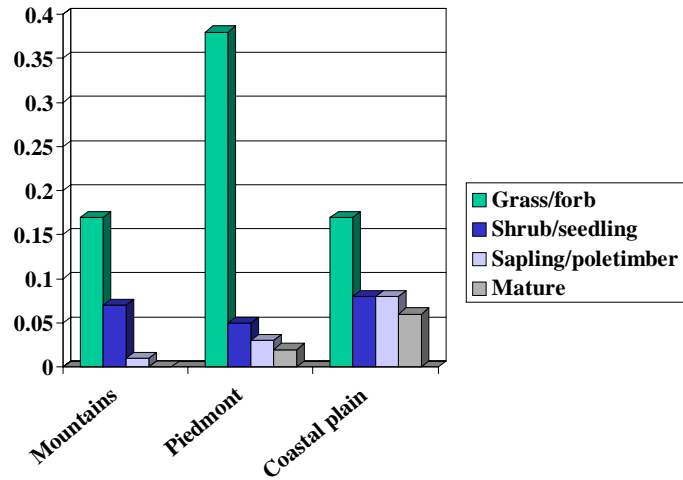


Figure 2. Percent occurrence of Eastern Bluebirds on point counts by District on the Francis Marion and Sumter National Forests, 1994 - 2000

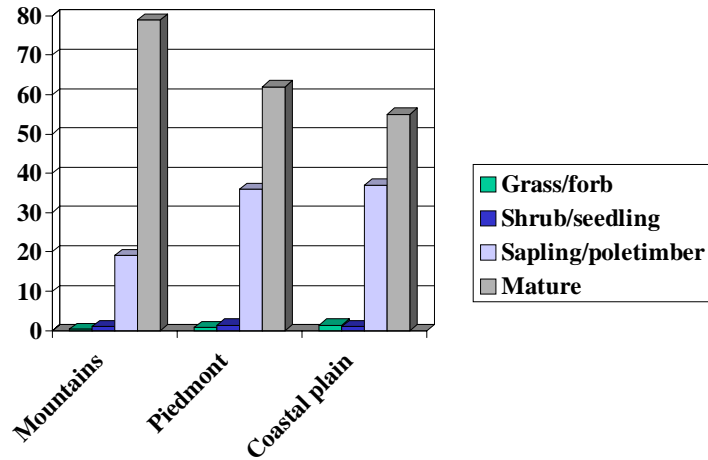


Figure 3. Percent occurrence of Eastern Bluebirds on point counts by successional stage on the Francis Marion and Sumter National Forests, 1994 - 2000

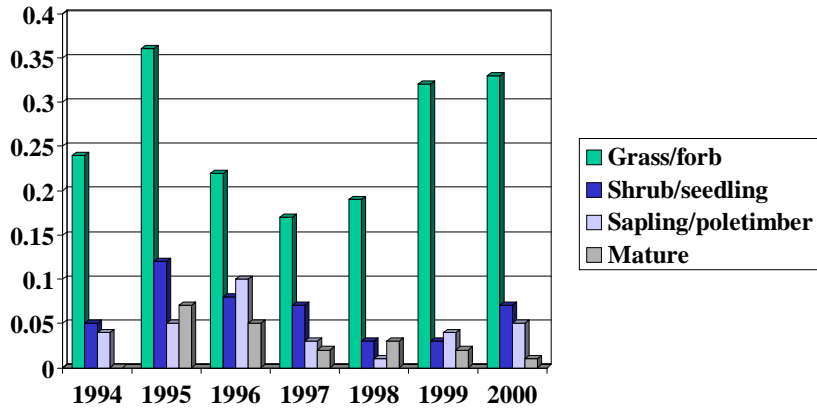


Figure 3a. Percent occurrence of Eastern Bluebirds on point counts by successional stage on the Francis Marion and Sumter National Forests, 1994 - 2000

Figure 3b. Percent occurrence of Eastern Bluebirds on point counts by hardwood, pine and mixed forest habitats on the Francis Marion and Sumter National Forests, 1994 - 2000

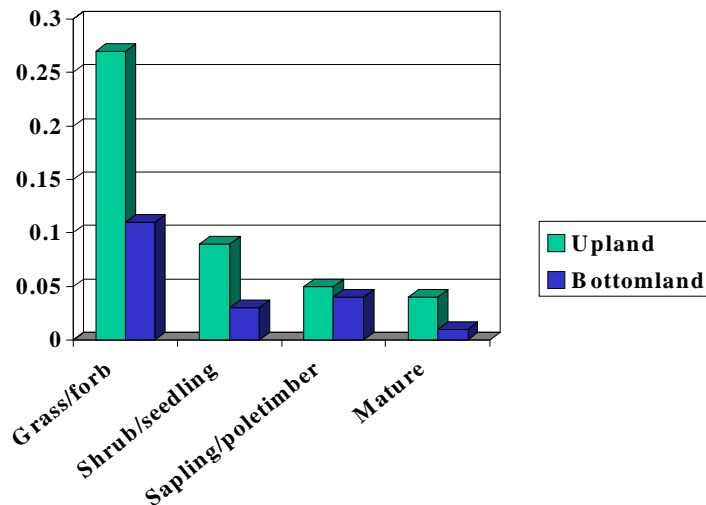
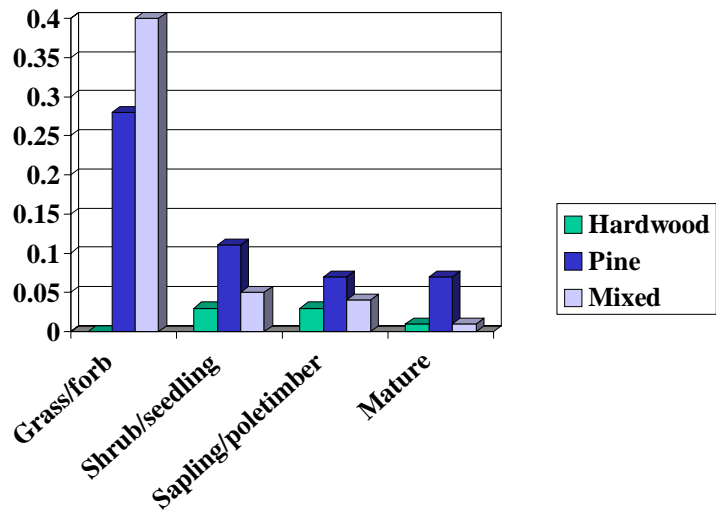
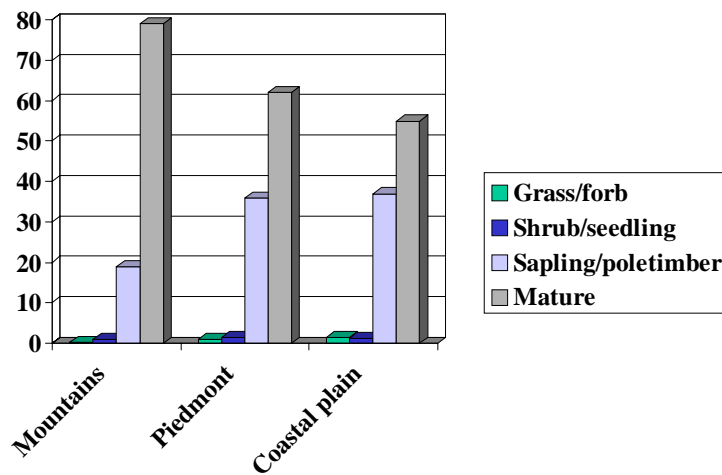


Figure 3c. Percent occurrence of Eastern Bluebirds on point counts in bottomland and upland habitats on the Francis Marion and Sumter National Forests, 1994 - 2000

## Effects of Management

Eastern Bluebird populations prefer open land, semi-open forest and open woods with an adequate supply of excavated cavities (Hamel 1992, p. 235). Regeneration, frequent burning in open forests, and maintenance of larger openings (greater than one hectare) benefit Eastern Bluebird. Preferred habitats for Eastern Bluebird on the Francis Marion and on the piedmont districts are being perpetuated and are distributed across the Forests (Figure 5). It is likely that populations of Eastern Bluebird will persist on the Francis Marion and in the piedmont on the Sumter National Forest.

In the mountains, suitable habitat conditions have been rapidly declining in abundance and distribution (Figure 4). Preferred habitats have been reduced to maintained wildlife openings, utility corridors, and roadside clearings. Consequently, it remains a question if a population of Eastern Bluebirds will persist on the Andrew Pickens for the foreseeable future. It is worthwhile to note that an accelerating prescribed burning program is in place on the Andrew Pickens (goal of 5,000 acres/year), and we believe prescribed burning will improve habitat conditions for Eastern Bluebirds in portions of the burn areas. There is a need to add bird monitoring points in the burn areas on the Andrew Pickens.



**Figure 4. Percent of acreage by forest successional stage on the Francis Marion and Sumter National Forests in 2000**

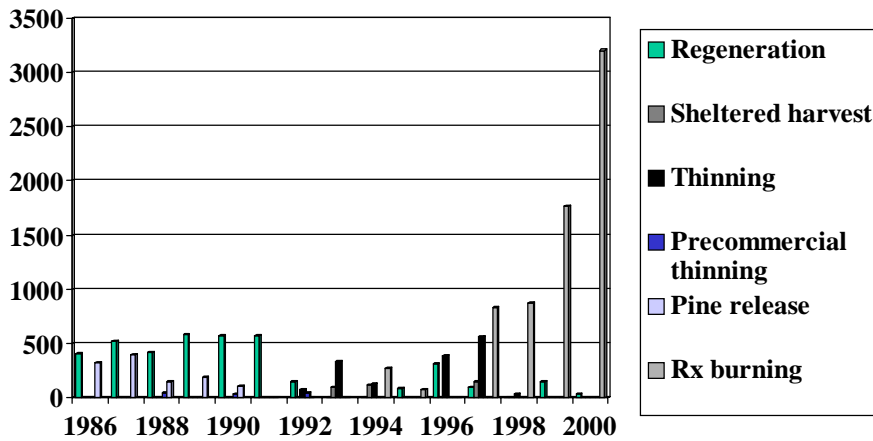


Figure 5a. Acres of prescribed burning, regeneration, thinning and release activities on the Sumter National Forest, mountain district, 1986--2000 (in acres)

Figure 5b. Acres of prescribed burning, regeneration, thinning, and release activities on the Sumter National Forest, piedmont districts, 1986--2000 (in acres)

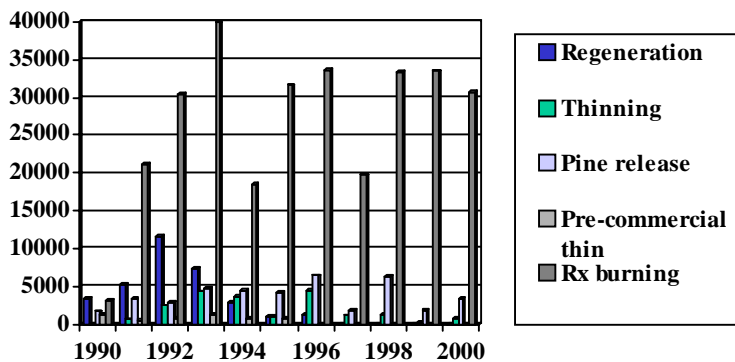
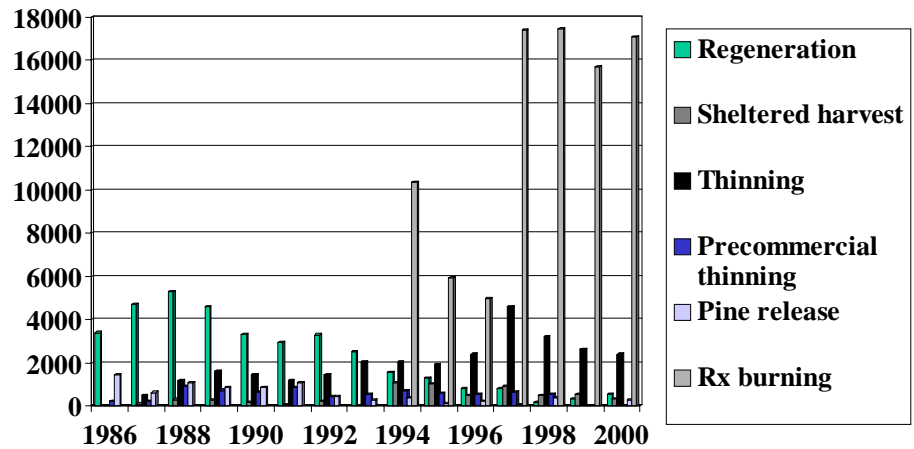


Figure 5c. Acres of prescribed burning, regeneration, thinning, and release activities on the Francis Marion National Forest, 1990--2000 (in acres)

## Northern Bobwhite (FMNF)

Northern Bobwhite, *Colinus virginianus*, was identified as an MIS for the Francis Marion for three reasons: 1) it is a high demand species throughout South Carolina, 2) it is declining significantly throughout its range in the Southeastern United States, and 3) it is responsive to management activities (Francis Marion MIS selection process record). To monitor the effects of Plan implementation on this species, Appendix B of the Francis Marion Plan states that we will collect quail call route data and calculate population trends over time. Northern Bobwhite populations have been monitored through South Carolina Department of Natural Resources (SCDNR) annual call counts (1979-present), and bird point counts that have been conducted on the Forest since 1994 using methods described in Hamel et al. (A Land Manager's Guide to Point Counts of Birds in the Southeast, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in Francis Marion monitoring reports, published annually by the Forest Service for the Francis Marion since 1994. Information on all districts of the Francis Marion and Sumter National Forests are provided for this species.

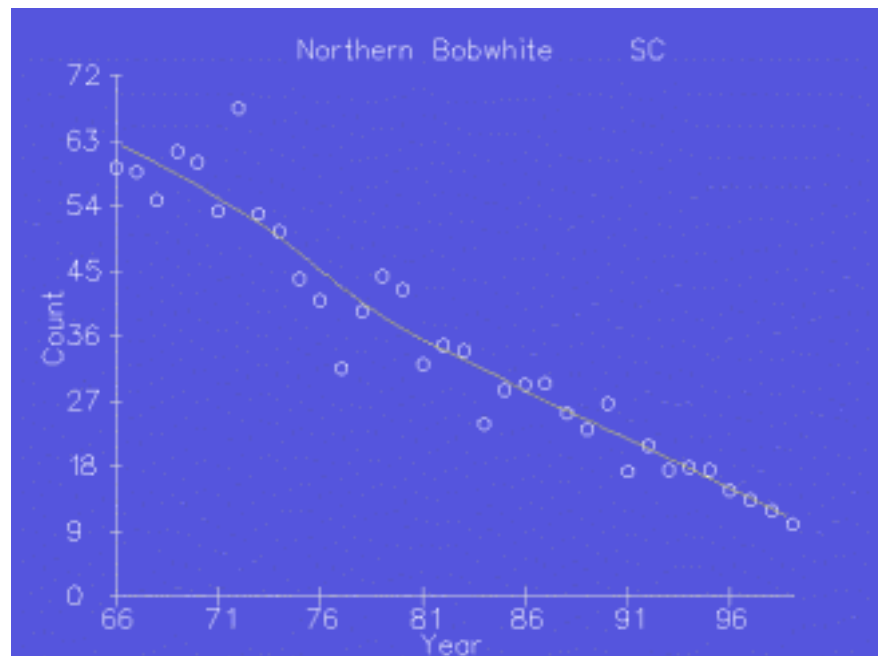
The following sources of data and information were used in this analysis:

- Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- USDA Forest Service.

Francis Marion and Sumter National Forest. Forest records and annual bird point data (1994 – 2000)

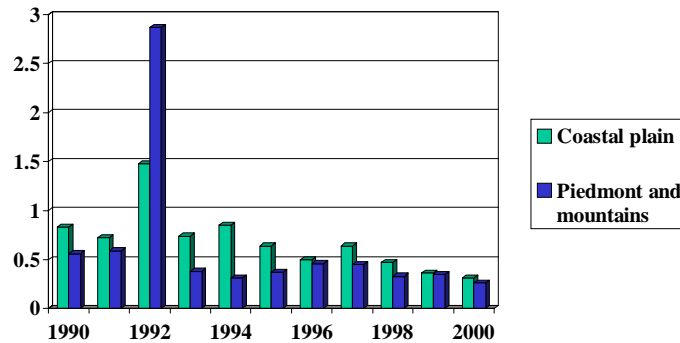
- USDA Forest Service. Francis Marion and Sumter National Forest, Annual monitoring reports (1990 –2000)
- SCDNR. Results of quail hunter surveys (1987 – 2000)

Northern Bobwhite is a species often associated with a landscape peppered with old home sites, i.e., small open fields, hedgerows, shrubby thickets, grass dominated understories and some trees. For the past 35 years, Northern Bobwhite have been on a steady decline range-wide. During that same time period the preponderance of small fields has dwindled, farming practices on remaining farmlands have changed and other factors have hastened the decline of quail. In South Carolina alone, Northern Bobwhite populations are currently 1/5 of the population that existed in 1966. Populations of Northern Bobwhite appear to have been steadily decreasing (trend estimate -4.42;  $p = .0000$ ; Sauer et al., 2000) across South Carolina (Figure 6).

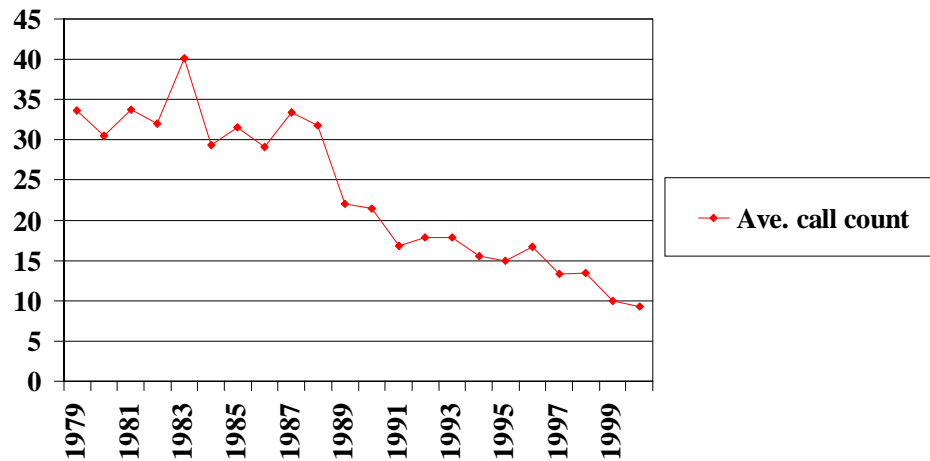


**Figure 6. Average number of Northern Bobwhite per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

Information collected through hunter surveys (Figure 7), and statewide quail census routes (Figure 7a) also show a gradual decline in quail populations in South Carolina.



**Figure 7. Statistical trends (coveys flushed/hr. a field) for Northern Bobwhite in South Carolina by ecoregions**



**Figure 7a. Average Northern Bobwhite census call count in South Carolina 1979 – 2000**

A total of 1138 bird point counts were conducted on the Sumter National Forest and 739 points on the Francis Marion from 1994 through 2000. There were 230 detections of Northern Bobwhite during 1877-point counts.

Point counts conducted on the Francis Marion indicate Northern Bobwhite to be relatively common. Northern Bobwhite populations appear to be

relatively stable on the Francis Marion (Figure 8) despite the long-term trend in abundance (suggested in Figure 6) in South Carolina..

Northern Bobwhite observations in the coastal plain are similar across all forest successional stages (Figure 9) with a preference for mixed forest types (Figure 9a). Upland sites appear to be utilized more frequently than bottomland sites on all districts (Figure 9b).

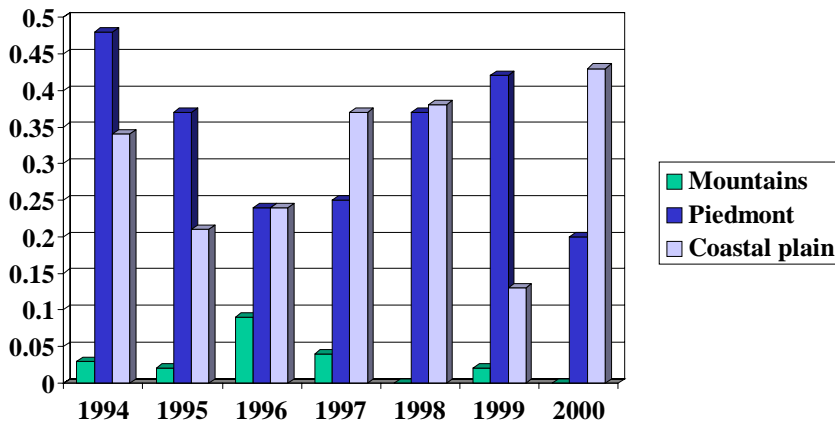


Figure 8. Percent occurrence of Northern Bobwhite on point counts by District on the Francis Marion and Sumter National Forests, 1994 - 2000

Figure 9. Percent occurrence of Northern Bobwhite on point counts by successional stage on the Francis Marion and Sumter National Forests, 1994-2000

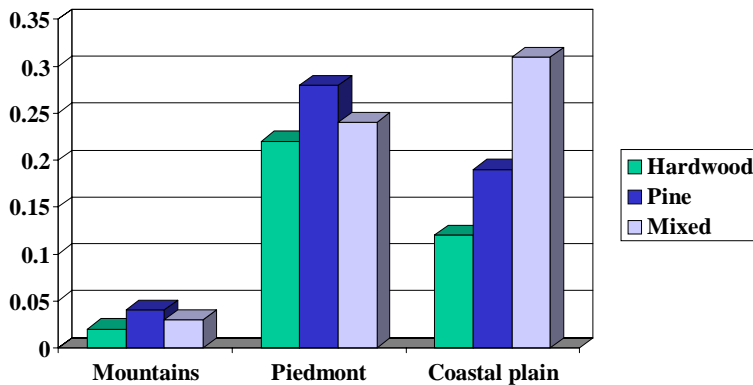
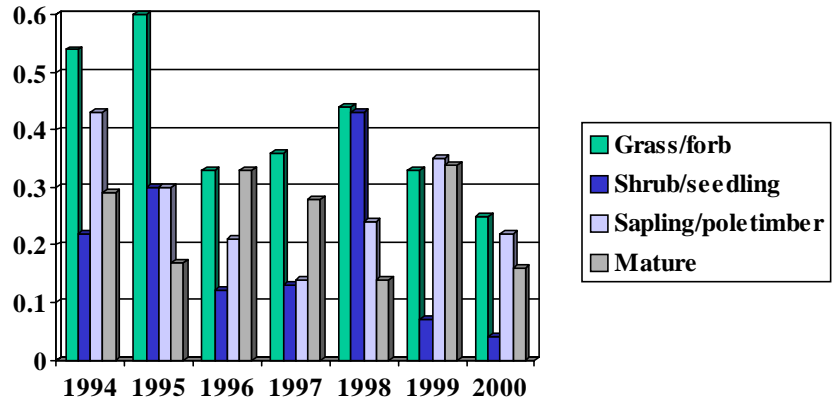
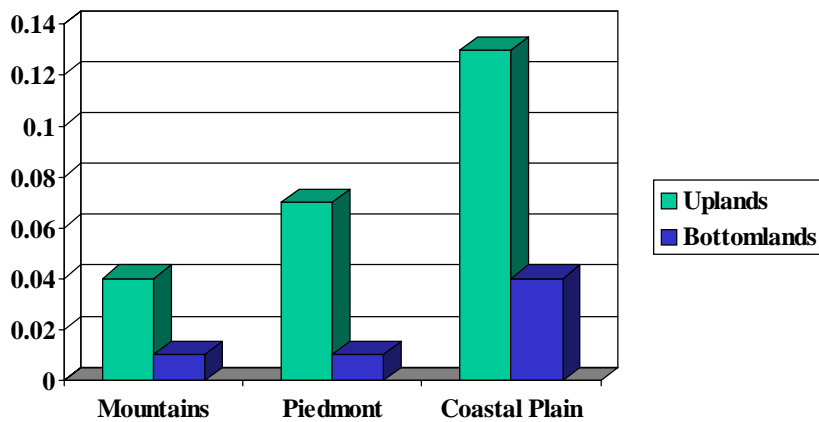


Figure 9a. Percent occurrence of Northern Bobwhite on point counts by hardwood, pine and mixed forest habitats on the Francis Marion and Sumter National Forests, 1994 - 2000





**Figure 9b. Percent occurrence of Northern Bobwhite on point counts in bottomland and upland habitats on the Francis Marion and Sumter National Forests, 1994 - 2000**

### Effects of Management

Northern Bobwhite favors abandoned fields and brushy areas such as woods margins, hedgerows, thickets and open woods (Hamel 1992, p. 137). Populations of Northern Bobwhite respond to frequent burning, heavy thinning, regeneration harvesting and any activity that scarifies the soil and creates grass/herbaceous ground cover in close association with shrubs, vines and young trees. Preferred habitats for Northern Bobwhite on the Francis Marion are being perpetuated and are distributed across both Forests. It is likely that populations of Northern Bobwhite will persist on the Francis Marion.

### Prairie Warbler (FMNF)

Prairie Warbler, *Dendroica discolor*, was identified as an MIS for the Francis Marion to serve as an ecological indicator of sapling stages of regenerating forests as well as open/shrubland habitat conditions (Francis Marion MIS selection process record). To monitor the effects of Forest Plan implementation on this species, Appendix B of the Francis Marion Plan states that we will monitor acres in grass-forb habitats, calculate population trends of associated MIS and compare with habitat changes over time. Bird point counts have been conducted on the Francis Marion since 1994 using methods described in Hamel et al. (*A Land Manager's Guide to Point Counts of Birds in the Southeast*, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in monitoring reports, published annually by the Forest Service for the Francis Marion since 1994.

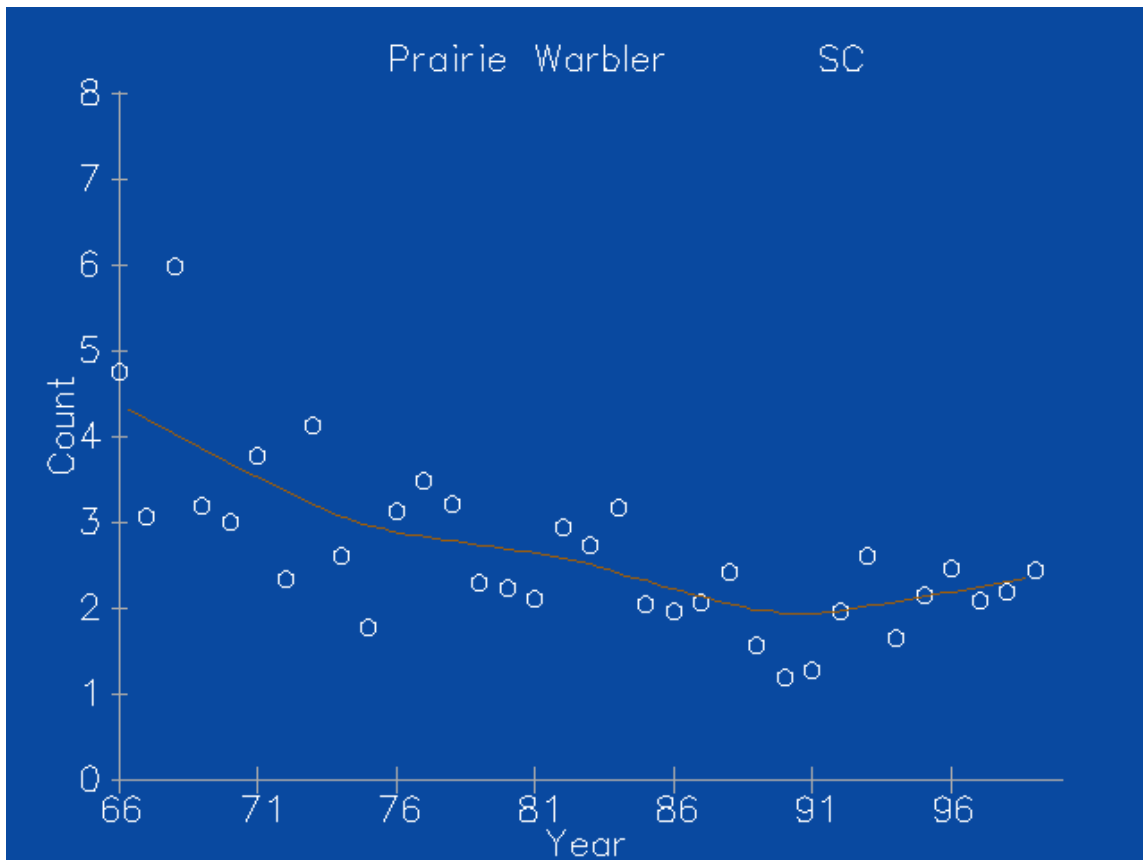
The following sources of data and information were used in this analysis:

- Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- USDA Forest Service. Francis Marion. Forest records and annual bird point data (1994 – 2000)
- USDA Forest Service. Francis Marion, Annual monitoring reports (1990 – 2000)
- Hamel, Paul B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.

- Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

The Prairie Warbler is a bird of the openings in a forested landscape. Despite the name, they are seldom found in agricultural dominated landscapes, or in extensive grassland areas in the Southeast. Populations of Prairie Warbler appear to have been steadily declining (trend estimate  $-2.27$ ;  $p = .34$ ; Sauer et al., 2000) across South Carolina (Figure 10). This decline however appears to have leveled off in the last 10 years (1990 – 1999) coincident with the recovery period following Hurricane Hugo.

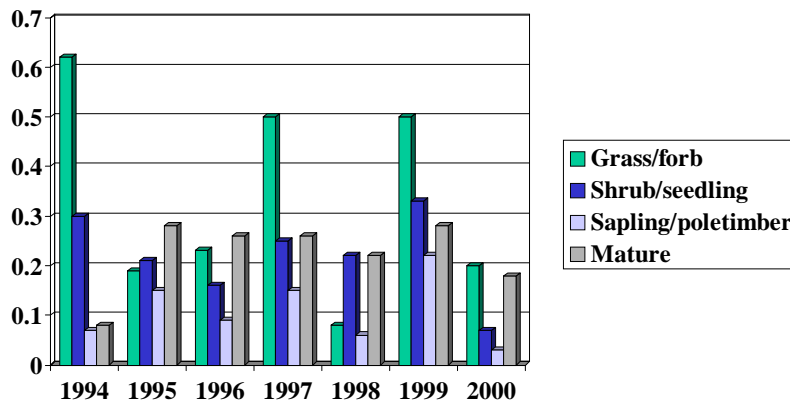
A total of 739 bird point counts were conducted on the Francis Marion from 1994 through 2000. There were 225 detections of Prairie Warbler during 144 of the 739 point counts.



**Figure 10. Average number of Prairie Warblers per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

Point counts conducted on the Francis Marion indicate Prairie Warblers to be relatively common, with no large trends in abundance apparent (Figure 11). Prairie Warblers appear to be associated with pine and mixed forest types (Figure 11b) in grass/forb, shrub/seedling and mature habitat conditions (Figure 11a). Prairie Warblers consistently occurred more frequently in pine or mixed forest types and although total number of occurrences is not a reliable measure of a population, 1 out of 3 points with Prairie Warblers were recorded in shrub/seedling conditions (Figure 11c). Nearly another third of the points with singing males were recorded in stands with mature trees. This result indicates understory regeneration in Hurricane Hugo damaged stands (approximately 2/3 of the Francis Marion) has been providing suitable habitat for Prairie Warbler.

Prairie Warblers appear to be highly variable in numbers from year to year; however, some consistent patterns and trends in habitat use are discernable. Prairie Warblers are noticeably absent from hardwood grass/forb habitats (Figure 11b), in low numbers in bottomland grass/forb conditions, and consistently occur more frequently in upland sites than in bottomland sites regardless of successional stage (Figure 11a).



**Figure 11. Percent occurrence of Prairie Warblers on point counts by successional stage on the Francis Marion National Forest, 1994 - 2000**

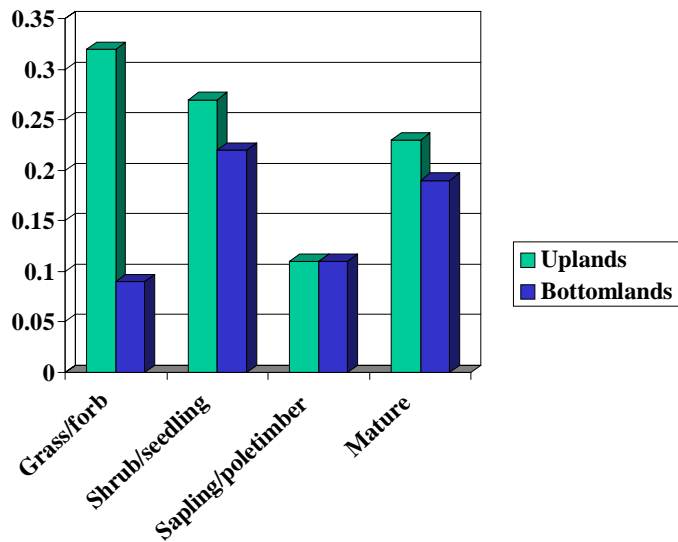


Figure 11a. Percent occurrence of Prairie Warblers on point counts in bottomland and upland habitats on the Francis Marion National Forest, 1994 - 2000

Figure 11b. Percent occurrence of Prairie Warblers on point counts in hardwood, pine and mixed forest habitats on the Francis Marion National Forest, 1994 - 2000

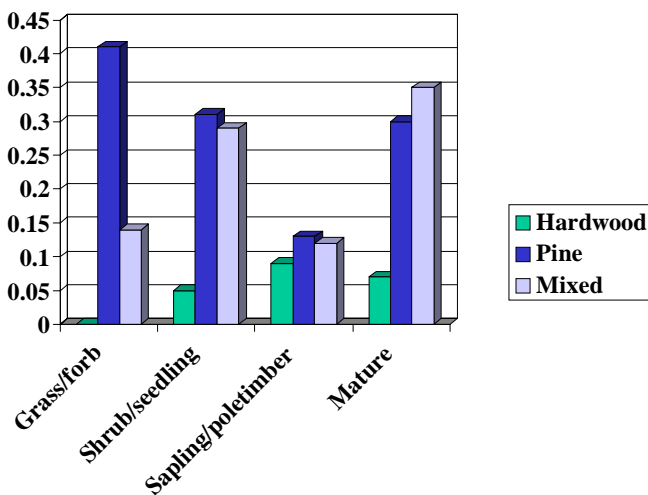
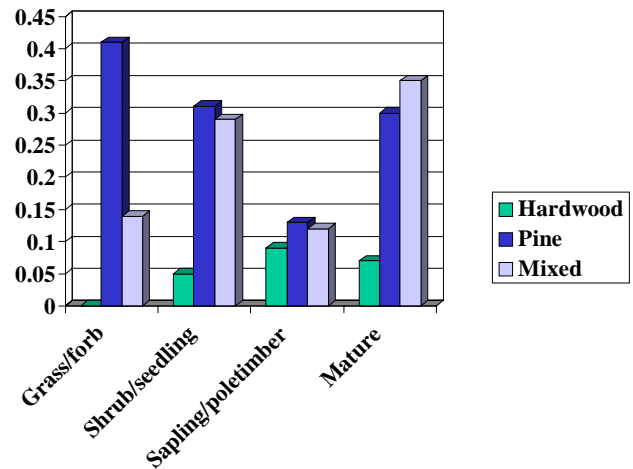


Figure 11c. Total # of detections (1994 - 2000) of Prairie Warbler on the Francis Marion National Forest by successional stage

## Effects of Management

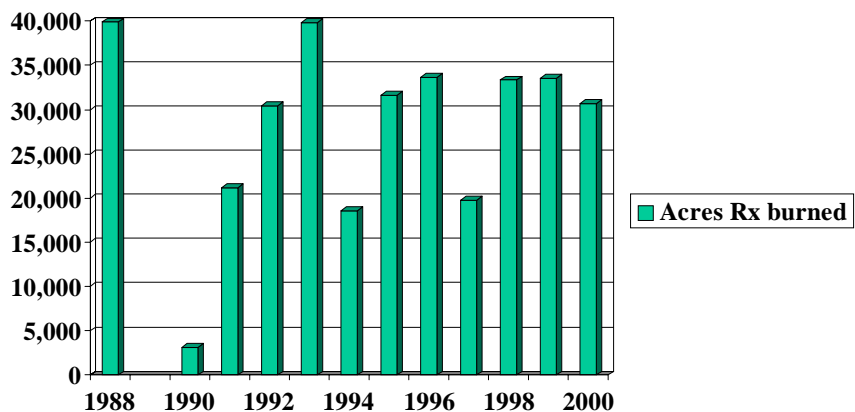
Prairie Warbler requires sapling stages of regeneration, reverting old fields or open shrubby conditions in a forested setting (Hamel 1992, p. 273). Populations of Prairie Warbler respond to regeneration or overstory removal activities 5 – 15 years following harvest treatments. Prairie Warbler also benefits from repetitive burning which promotes woodland conditions with a grassy ground cover. Timber management activities on the Francis Marion have declined in recent years from a peak of about 20,000 acres/year in 1992 to less than 5,000 acres in 2000 (Figure 5). During that same time period, prescribed burning has nearly reached pre-Hugo levels (Figure 12).

Prairie Warbler is widespread across the Francis Marion and there are no apparent trends in habitat utilization in terms of management activities at this time. From bird point counts, there does however

appear to be a gradual decline in frequency of occurrence in grass/forb and shrub/seedling habitats. This is probably due to a combination of a lack of timber management activity and declining habitat quality of these habitat conditions for Prairie Warbler as a result of the resurgence of vegetation following Hurricane Hugo.

Annual monitoring reports (1990 – 2000) indicate that Prairie Warbler populations are stable. Point count results indicate breeding Prairie Warblers are widely distributed across the Francis Marion and they occur in a variety of habitats that are abundant and well distributed. Given these results, we believe there is a high likelihood that populations of Prairie Warbler will persist on the Forest for the foreseeable future.

**Figure 12. Acres of prescribed burns on the Francis Marion National**



## White-tailed deer (FM&S NF)

White-tailed deer, *Odocoileus virginianus*, was selected as an MIS for both the Francis Marion and the Sumter National Forests because of its economic importance and its status as a big-game species (Francis Marion and Sumter MIS selection process record). To monitor the effects of Plan implementation on this species, Appendix G of the Sumter Plan states that we will use SCDNR hunt data and Hanson plot removal data to monitor populations. Appendix B of the Francis Marion Plan states that we will use annual hunt data and spotlight census data to calculate deer/acre and show trends over time. Habitat changes and estimated population trends have been documented over time in Forests monitoring reports.

The following sources of data and information were used in this analysis:

- ❑ USDA Forest Service. Francis Marion, Annual monitoring reports (1990–2000)
- ❑ South Carolina Department of Natural Resources (SCDNR). Annual deer harvest reports (1990 – 2000)

The white-tailed deer herd in South Carolina was reduced to a small remnant population in the low country about 100 years ago. Today, White-tailed deer are found in every county in the State and the herd continues to show signs of growing in numbers.

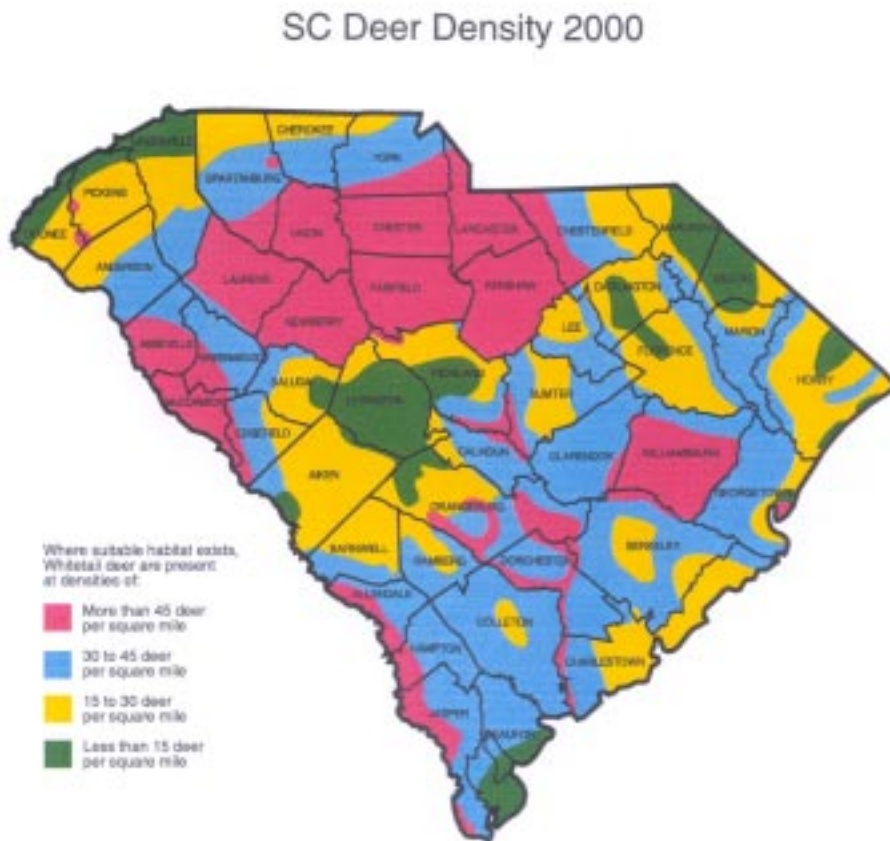
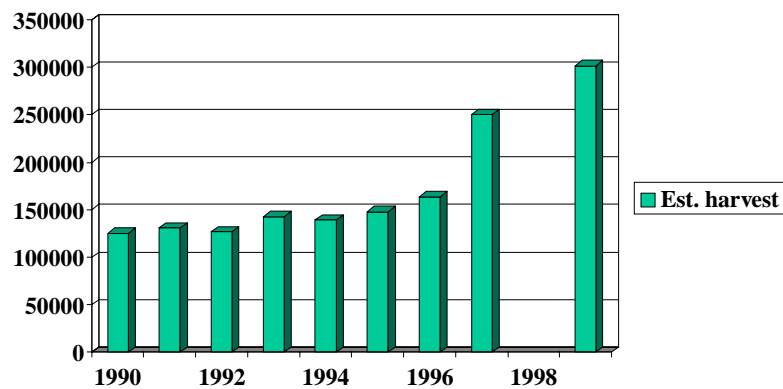


Figure 13. 2000 deer density in South

Deer harvest figures are a useful index in estimating deer populations. The deer harvest in South Carolina demonstrated nearly exponential growth during the period 1970-1995. Hanson plot removal surveys and spotlight census efforts were discontinued in the late 80s as a result of the ever-increasing deer herd in all regions of South Carolina. Biological check stations (body weights and sex ratio of harvest) were also discontinued in the mid 90s for similar reasons. Survey and data collection methods used to derive deer harvest numbers changed in 1997 to a system of random Deer Hunter Surveys utilizing both mail and telephone survey techniques. This change was from a historic system of mandatory check stations on Wildlife Management Areas (WMA) and on all lands in the 18 piedmont counties combined with cooperating hunt club data from the 28 coastal plain counties. Most recently, harvest estimates indicate a more stable deer population statewide. These estimates indicate that deer populations in parts of the state where

densities were very high in the late 1980s and early 1990's have moderated to some degree. This moderation appears to be a result of increased emphasis on population control through increased harvests of antlerless deer (female deer) and the fact that habitats are continually changing with respect to carrying capacity for White-tailed deer. An example of this habitat change can be found on the Sumter National Forest where the amount of early successional habitat has declined below the levels described in the Forest Plan. Less early successional habitat typically creates a situation under which deer populations decline. On the other hand, deer populations in other parts of the state appear to be increasing. Areas that are currently demonstrating increasing densities tend to be those parts of the state that historically had few deer. Together, this moderation of deer numbers in historic high-density areas combined with increased numbers in lower deer density areas resulted in a fairly stable state-wide population by the late 1990s. (C. Ruth, Pers. Comm)



**Figure 14. Estimated State-wide deer harvest in South Carolina**

## Effects of Management

White-tailed deer respond to adequate supplies of browse and escape cover a majority of the year and availability of hard mast in the fall and early winter. Timber harvest activities that promote hard mast production and produce a perpetual supply of dense shrubby growth distributed throughout the forests will provide high quality deer habitat. A high deer population can exert additional pressure on regeneration and may actually suppress it. Providing an increasing number of acres in early successional habitat provides an important buffer to deer over browsing understory vegetation and regeneration areas across the Forest. Continued emphasis on the importance of population management through adequate annual removal of deer (particularly females) is critical, therefore, providing opportunity for public hunting is important in preventing damage to the habitat which can impact multiple species.

A diversity of preferred habitats for deer on the Francis Marion and on the piedmont districts are being perpetuated and are distributed across the Forests (Tables 3-10). Given these factors, it is likely that populations of deer will persist on the Francis Marion and in the piedmont of the Sumter National Forest. In the mountains, suitable habitat conditions have been rapidly declining in quality, abundance and distribution. Due to their wide-ranging habitat requirements; however, it is likely that populations of deer will persist in the mountains for the foreseeable future.

## Need for Change

Since deer populations have stabilized in South Carolina (Ruth, pers. Com.) and use of Hansen Plots and biological check stations has been discontinued in the piedmont and mountains it is recommended to remove White-tailed deer from the MIS list for the Sumter Plan.





## White-eyed Vireo (FM&S NF)

White-eyed Vireo, *Vireo griseus*, was identified as a MIS for the Francis Marion and Sumter National Forests to serve as an ecological indicator for early successional habitats dominated by briar thickets, vine tangles, and tree seedlings (Francis Marion and Sumter MIS selection process record). To monitor the effects of Forest Plan implementation on this species, Appendix G of the Sumter Plan states that we will use CISC data to monitor vegetative conditions, rely on standards and guides for habitat distribution, and use bird surveys to monitor populations. Appendix B of the Francis Marion Plan states that we will monitor acres of grass-forb habitats, calculate population trends of associated MIS and compare with habitat changes over time. White-eyed vireo populations have been monitored through bird point counts that have been conducted on the Forest since 1994 using methods described in Hamel et al. (A Land Manager's Guide to Point Counts of Birds in the Southeast, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in Forest monitoring reports.

The following sources of data and information were used in this analysis:

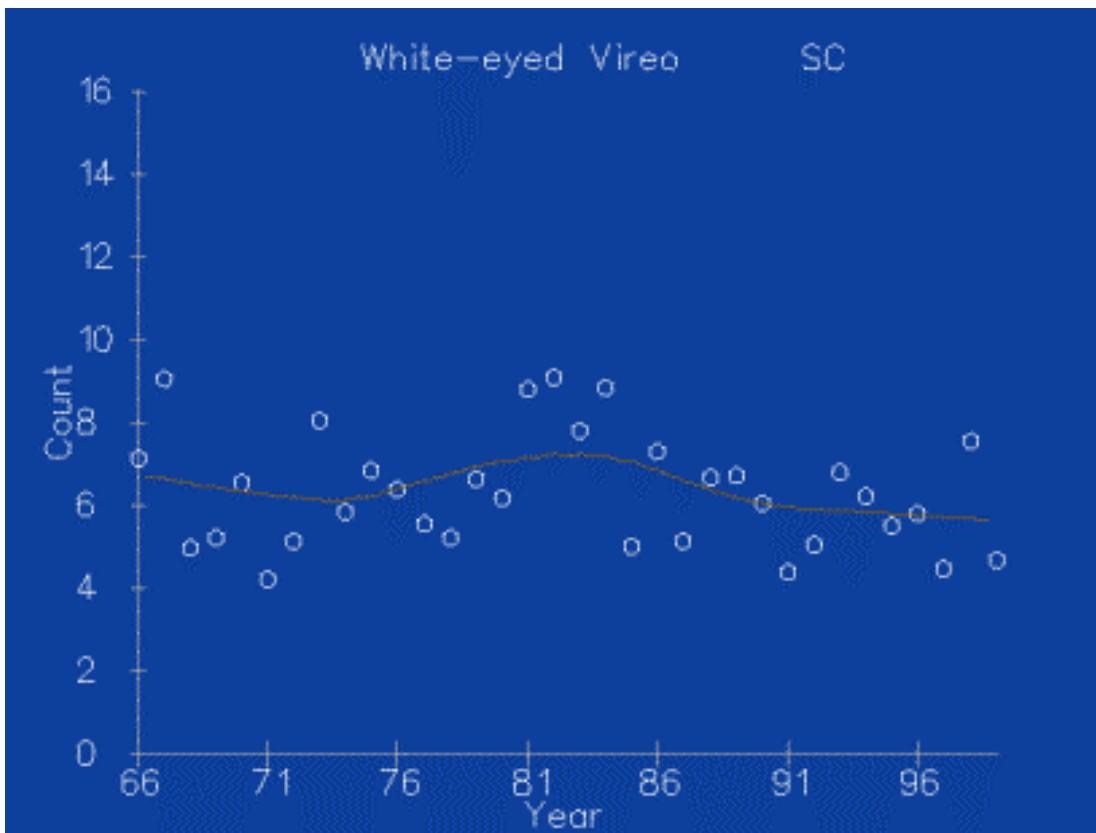
- ❑ Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- ❑ USDA Forest Service. Francis Marion. Forest records and annual bird point data (1994 – 2000)
- ❑ USDA Forest Service. Francis Marion, Annual monitoring reports (1990–2000)

- ❑ Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- ❑ Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

White-eyed Vireos are a bird of the edge. Woods and field borders with dense shrubs, particularly in streamside locations are favorite habitats for this species. Populations of White-eyed Vireo appear to have been on a slow decline (trend estimate  $-0.27$ ;  $p = .73$ ; Sauer et al., 2000) across South Carolina (Figure 15).

A total of 1138 bird point counts were conducted on the Sumter National Forest and 739 points on the Francis Marion from 1994 through 2000. There were 574 detections of White-eyed Vireo during 442 of the 1877-point counts.



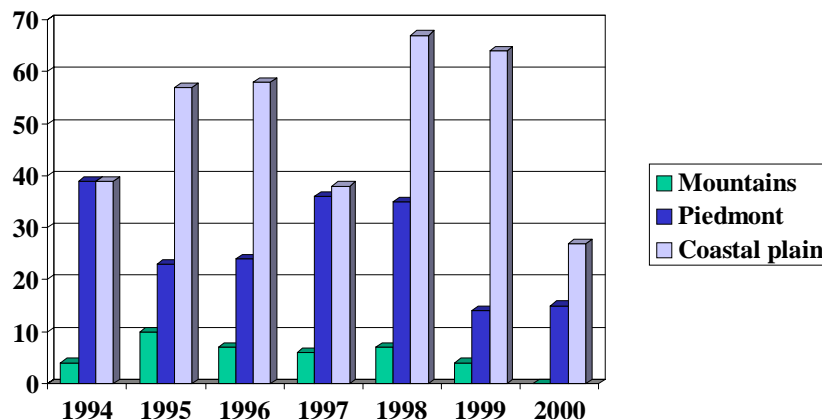


**Figure 15. Average number of White-eyed Vireos per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

Point counts conducted on the Sumter National Forest indicate White-eyed Vireo to be relatively common on Sumter (Figure 16). Collectively, White-eyed Vireo appears to have no long-term trends in abundance on the Sumter (1994 – 2000; Figure 17), however the abundance appears to be comparatively low in the mountains and gradually declining in the piedmont (Figure 16).

White-eyed Vireos appear to favor bottomland locations (Figure 17c) and hardwood forest types (Figure 17b). About two out of three observations were recorded on bottomland sites irrespective of forest type (pine, hardwood, mixed).

**Figure 16. Percentage occurrence of White-eyed Vireos on point counts by District on the Francis Marion and Sumter National Forests, 1994 - 2000**



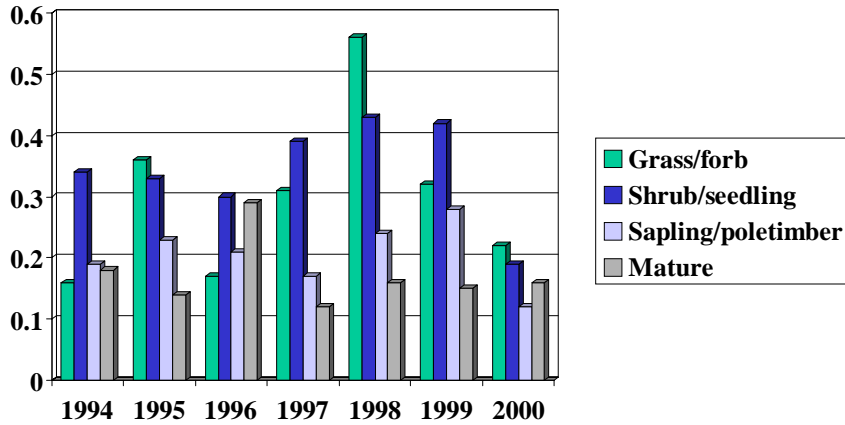


Figure 17. Percent occurrence of White-eyed Vireos on point counts by successional stage by year on the Francis Marion and Sumter National Forests, 1994 - 2000

Figure 17a. Percent occurrence of White-eyed Vireos on point counts by successional stage on the Francis Marion and Sumter National Forests, 1994 - 2000

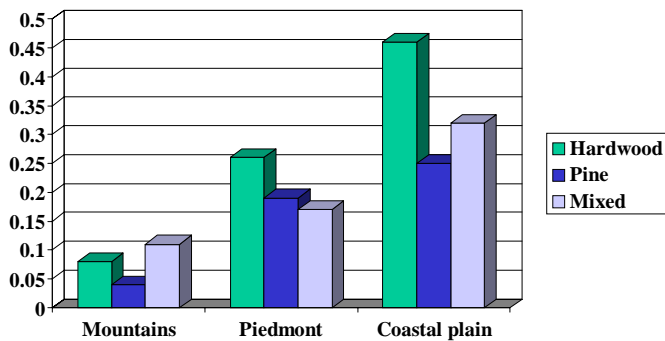
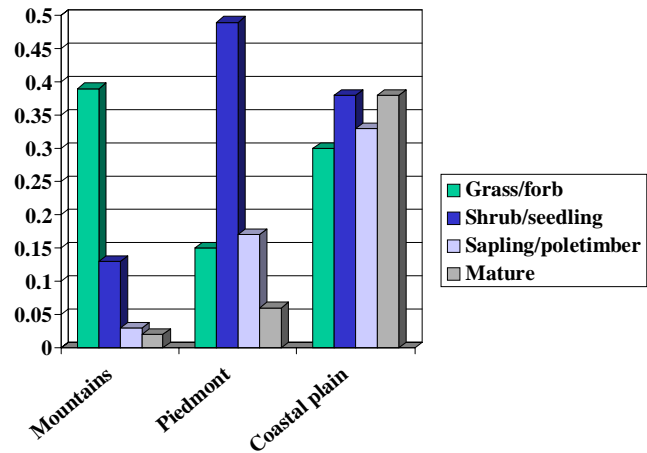
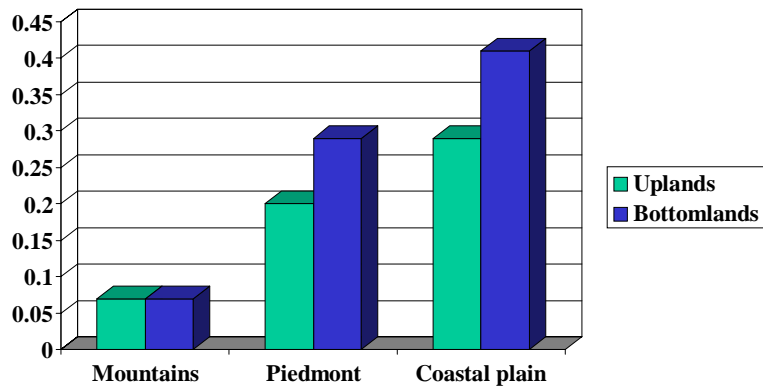


Figure 17b. Percent occurrence of White-eyed Vireos on point counts by hardwood, pine and mixed forest habitats on the Francis Marion and Sumter National Forests, 1994 - 2000



**Figure 17c. Percent occurrence of White-eyed Vireos on point counts in bottomland and upland habitats on the Francis Marion and Sumter National Forests, 1994 - 2000**

### Effects of Management

White-eyed Vireos are commonly found in thickets and dense shrubbery especially on moist sites in wood margins, swamp borders and stream sides (Hamel 1992, p. 249). Distribution of habitats preferred by White-eyed Vireos, however, is limited primarily by the amount and frequency of management activities, and somewhat by historical land use prior to Forest Service ownership. Management of bottomland forest types has been essentially suspended since Hurricane Hugo on the Francis Marion. However, habitats utilized by the White-eyed Vireo are abundant and well distributed across the Forests on the coast and in the piedmont. Consequently, it is likely that populations of White-eyed Vireo will persist on the Francis Marion and, on the piedmont districts of the Sumter National Forest. Abundance of White-eyed Vireo appears to be low on the Andrew Pickens, which may be due to the low amount of grass/forb and shrub/seedlings habitats available.



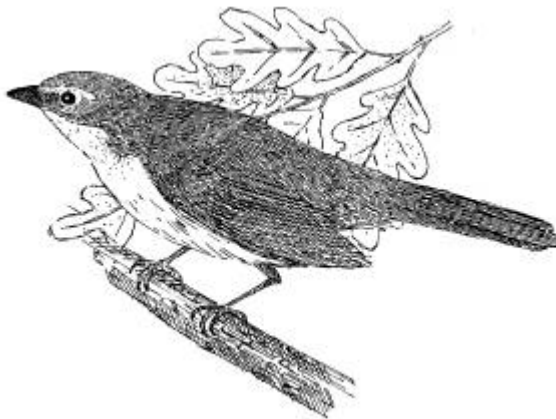
## Yellow-breasted Chat (FM&S NF)

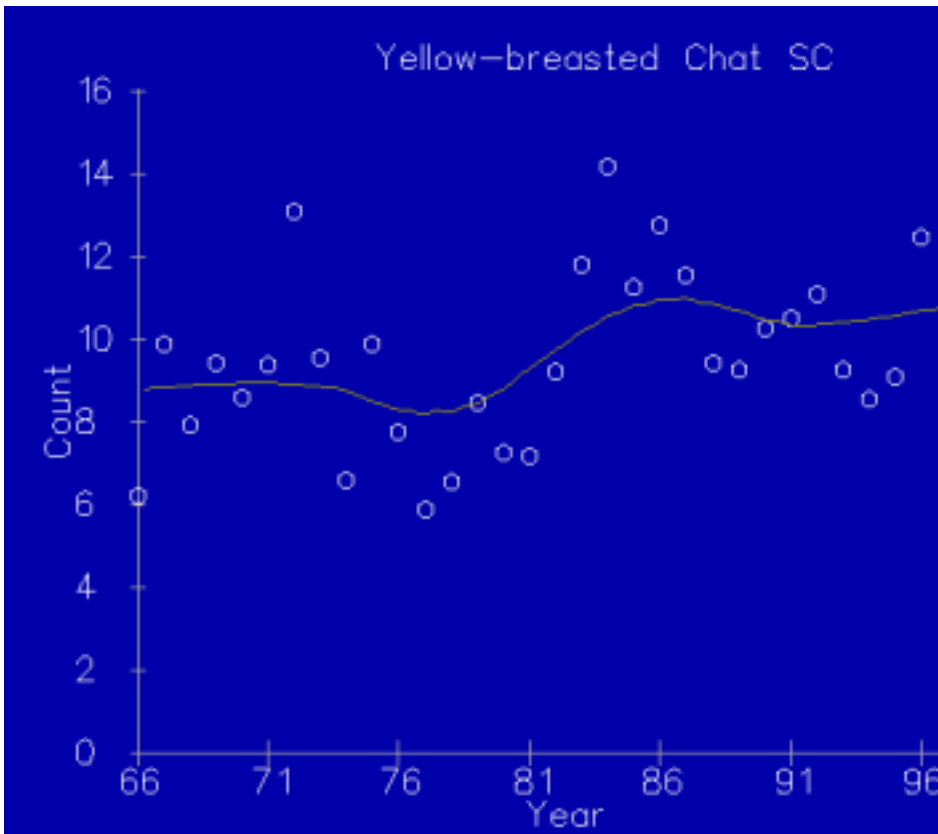
Yellow-breasted Chat, *Icteria virens*, was identified as an MIS for both the Francis Marion and Sumter National Forests. Chats were selected to serve as an ecological indicator for well-established shrub habitats in a forested landscape (Francis Marion MIS selection process record). To monitor the effects of Plan implementation on this species, Appendix G of the Sumter Plan states that we will on standards and guides for habitat distribution, and use bird surveys to monitor populations. Appendix B of the Francis Marion Plan states that we will monitor acres in grass-forb habitats, calculate population trends of associated MIS and compare with habitat changes over time. Yellow-breasted Chat populations have been monitored through bird point counts that have been conducted on the Forests since 1994 using methods described in Hamel et al. (A Land Manager's Guide to Point Counts of Birds in the Southeast, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in Forest monitoring reports, published annually by the Forest Service for the Sumter National Forest since 1990.

The following sources of data and information were used in this analysis:

- ❑ Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- ❑ USDA Forest Service. Francis Marion and Sumter National Forest. Forest records and annual bird point data (1994 – 2000)
- ❑ USDA Forest Service. Francis Marion and Sumter National Forest, Annual monitoring reports (1990 –2000)
- ❑ Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- ❑ Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

Yellow-breasted Chats are birds of the shrubs in old fields, young forests, and open woods with a patchy shrubby understory. Populations of Yellow-breasted Chat appear to have been steadily increasing (trend estimate 0.92;  $p = .29$ ; Sauer et al., 2000) across South Carolina (Figure 18).





**Figure 18. Average number of Yellow-breasted Chats per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

A total of 1138 bird point counts were conducted on the Sumter National Forest and 739 points on the Francis Marion from 1994 through 2000. There were 994 detections of Yellow-breasted Chat during 583 of the 1877-point counts.

Point counts conducted on the Sumter National Forest indicate Yellow-breasted Chat to be relatively common in the piedmont and coastal plain, and until 1998, common in the mountains (Figure 19). Collectively, Yellow-breasted Chat appears to have a gradual downtrend in abundance on all districts (1994 – 2000). Most noteworthy is this species has not been detected in recent years (1999 – 2000) in the mountains.

Chats appear to be associated with grass/forb and shrub/seedling habitats (Figure 20) with a strong preference for shrub/seedling conditions in the piedmont (Figure 20a). Although in much lower numbers, chats are consistently detected in sapling/poletimber and mature habitat conditions (Figure 19) most likely where a shrub layer is well established from past disturbance (overstory removal). Yellow-breasted Chats are found more frequently in upland sites (Figure 20c) and appear to utilize all forest types (Figure 20b).

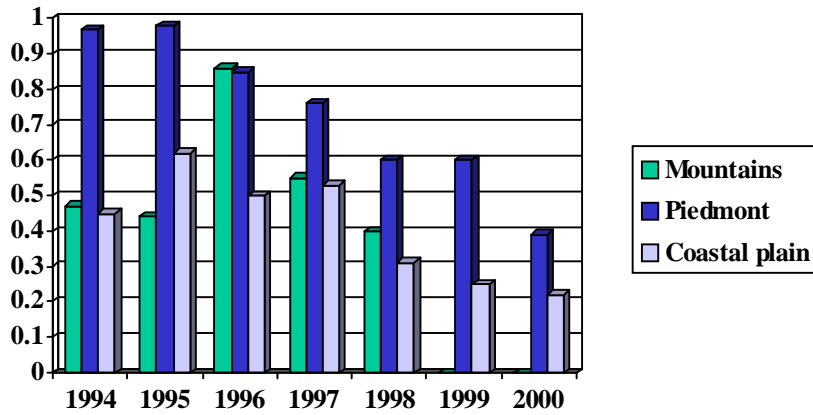


Figure 19. Percentage of occurrence of Yellow-breasted Chats on point counts by District on the Francis Marion and Sumter National Forests, 1994 - 2000

Figure 20. Percentage of occurrence of Yellow-breasted Chats on point counts by successional stage on the Francis Marion and Sumter National Forests, 1994 - 2000

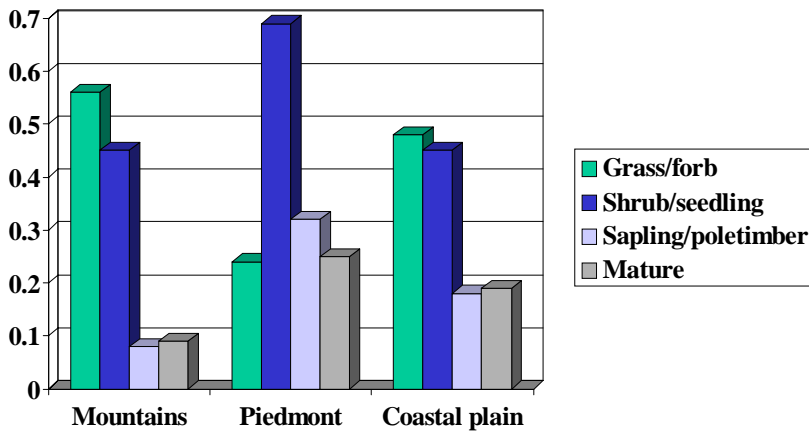
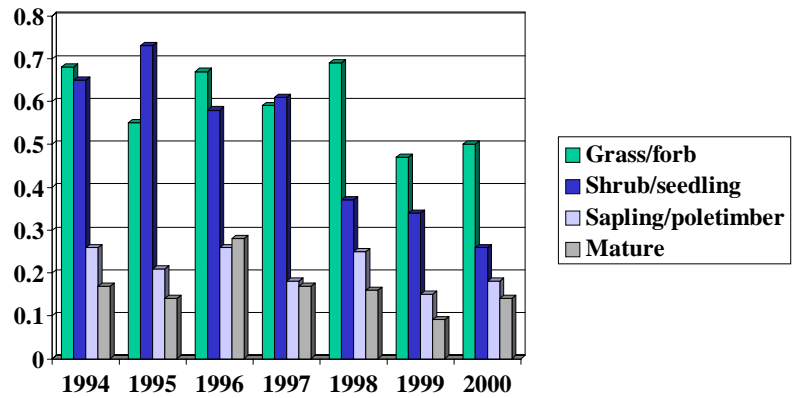
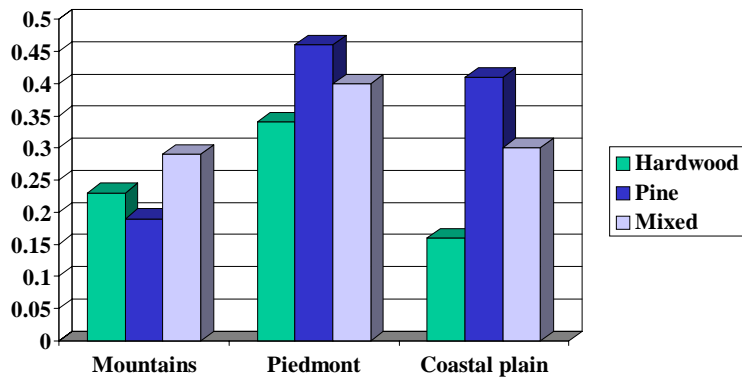
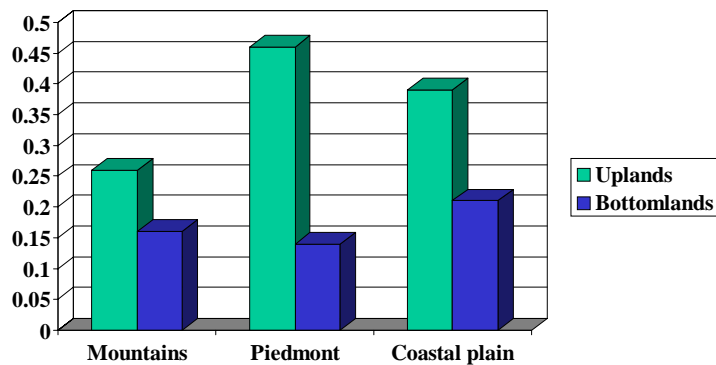


Figure 20a. Percentage of occurrence of Yellow-breasted Chats on point counts by successional stage on the Francis Marion and Sumter National Forests, 1994 - 2000



**Figure 20b. Percentage of occurrence of Yellow-breasted Chats on point counts by hardwood, pine and mixed forest habitats on the Francis Marion and Sumter National Forests, 1994 - 2000**

**Figure 20c. Percentage of occurrence of Yellow-breasted Chats on point counts in bottomland and upland habitats on the Francis Marion and Sumter National Forests, 1994 - 2000**



### Effects of Management

The Yellow-breasted Chat prefers overgrown fields, thickets, and wood margins particularly on dry sites (Hamel 1992, p. 290). This species responds to disturbance regimes 3 – 10 years following an event (hurricane, tornado, wildfire, or regeneration harvest) and prefer a well-developed shrub layer in old fields, or in open forest conditions. Preferred habitats for Yellow-breasted Chat on the Francis Marion and piedmont districts are being perpetuated and are distributed across the Francis Marion and Sumter National Forests (Figure 5). It is likely that populations of Yellow-breasted Chat will persist in the piedmont and on the coastal plain for the foreseeable future.

In the mountains, suitable habitat conditions have been rapidly declining in abundance and distribution. Preferred habitats have been reduced to maintained wildlife openings, utility corridors with shrubby vegetation, and roadside clearings. Consequently, it remains a question if a population of yellow-breasted chats will persist on the Andrew Pickens District for the foreseeable future. It is worthwhile to note that an accelerating prescribed burning program is in place on the Andrew Pickens District (goal of 5,000 acres/year), and we believe this will improve habitat conditions for Yellow-breasted Chats in portions of the burn areas.



## Late Successional Pine Forests

### American Swallow-tailed Kite (FMNF)

American Swallow-tailed Kite, *Elanoides forficatus*, was identified in the Francis Marion Plan as an MIS due to concerns for species persistence. Swallow-tailed Kites were selected to serve as an indicator for mature wet loblolly forest habitats (Francis Marion MIS selection process record). To monitor the effects of Forest Plan implementation on this species, Appendix B of the Francis Marion Plan states that we use specific monitoring methods designed for the species, compare populations with previous inventories, and if possible compare with habitat changes over time. Population information for American Swallow-tailed Kite was collected through 40 minute counts with two observers suspended 100 feet above ground at 28 survey locations selected through a stratified random sample. Habitat changes and estimated population trends have been documented over time in Francis Marion monitoring reports.

The following sources of data and information were used in this analysis:

- Cely, JE, and JA Sorrow, Jr. 1990. The American swallow-tailed Kite in South Carolina. SC Wildlife and Marine Res. Dept., NG-HT #1. 160 pp.
- Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- USDA Forest Service. Francis Marion, Forest records and annual monitoring reports (1990–2000)

- SCDNR, Swallow-tailed kite monitoring reports (1986–1995, 1997) and field observation notes (1998–2000)

One hundred years ago, American Swallow-tailed Kites had a much wider range that included parts of the midwest extending as far north as Minnesota. Over a 30-year period (1890–1920), Swallow-tailed Kites disappeared from approximately 75% of their range in the United States. Today American Swallow-tailed Kites are a bird of the high canopy pines in the swamps and wet bottomland forests of the coastal plain.

The Francis Marion provides the current northernmost nesting range for a population of Swallow-tailed Kites. Although there are confirmed sightings of individual nests in the Black River swamp, Big Pee Dee River swamp and Waccamaw River swamp, the Francis Marion harbors the largest kite concentration in South Carolina (Cely pers. comm.). Populations along the coastal plain (which includes the Francis Marion) appear to be on an upward trend (trend estimate 4.89;  $p = .027$ ; Sauer et al., 2000) throughout the Atlantic flyway, which includes the South Carolina coastal plain (Figure 21).

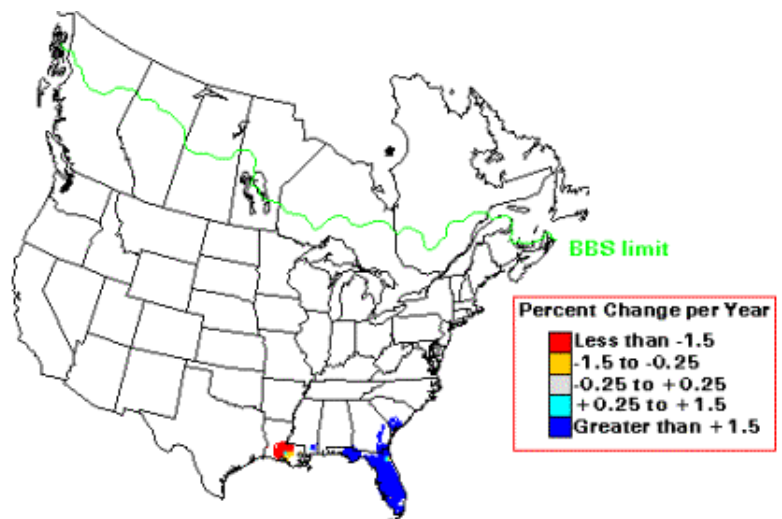
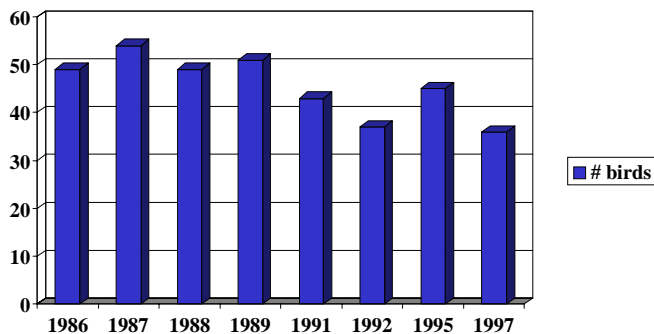


Figure 21. National breeding bird survey trend map for American Swallow-tailed Kite (1966–1996)

Acreage in 80+ year-old stands dominated by pine on the Francis Marion has increased by 1.5% since 1996 (Table 4). The Francis Marion as a whole however, remains far below the objective for habitat in mature forest habitat because of Hurricane Hugo. Kites are also known to use other tree species for nesting such as cypress, tupelo, sweetgum, and oak. The area of late successional hardwood forests where these tree species are commonly found has increased by 0.7% acres (Table 4).

In 1989, Hurricane Hugo provided an opportunity to evaluate large-scale effects of timber removal on Swallow-tailed Kites. Approximately 75 – 90% of kite nesting canopy on the Francis Marion was destroyed by the hurricane.

Swallow-tailed Kite numbers on the Francis Marion have remained fairly constant since Hurricane Hugo (Figure 22). Pre-Hugo counts of Swallow-tailed Kites on the Francis Marion averaged 59 birds and post-Hugo counts averaged 45 (SCDNR 1995). However, increased sighting reports in other parts of coastal South Carolina since the hurricane suggest no overall net loss of Swallow-tailed Kites in South Carolina.



**Figure 22. Number of Swallow-tailed Kites counted on the Francis Marion NF**

### Effects of Management

Swallow-tailed Kites prefer swamp forests and marsh habitats with mature trees (Hamel 1992, p. 112). Range-wide persistence is a concern for this

species and they are uncommon and localized in occurrence in South Carolina. The population on the Francis Marion however, appears to have adjusted to the drastic reduction in habitat from the hurricane, and seems to be relatively stable since Hugo (Cely, pers. comm.). In addition, the amount and distribution of preferred habitats is gradually increasing on the Francis Marion. Given these factors, we believe there is a high likelihood that populations of American Swallow-tailed Kite will persist on the Francis Marion for the foreseeable future.

### Brown-headed Nuthatch (SNF)

Brown-headed Nuthatch, *Sitta pusilla*, was identified as an MIS for the Sumter National Forest to serve as an ecological indicator for open mature pine forest habitats (Sumter MIS selection process record). To monitor the effects of Plan implementation on this species, Appendix G of the Sumter Plan states that we will use CISC data to monitor vegetative conditions, rely on standards and guides for habitat distribution, and use bird surveys to monitor populations. Brown-headed Nuthatch populations have been monitored through bird point counts that have been conducted on the Sumter since 1994 using methods described in Hamel et al. (*A Land Manager's Guide to Point Counts of Birds in the Southeast*, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in monitoring reports.

The following sources of data and information were used in this analysis:

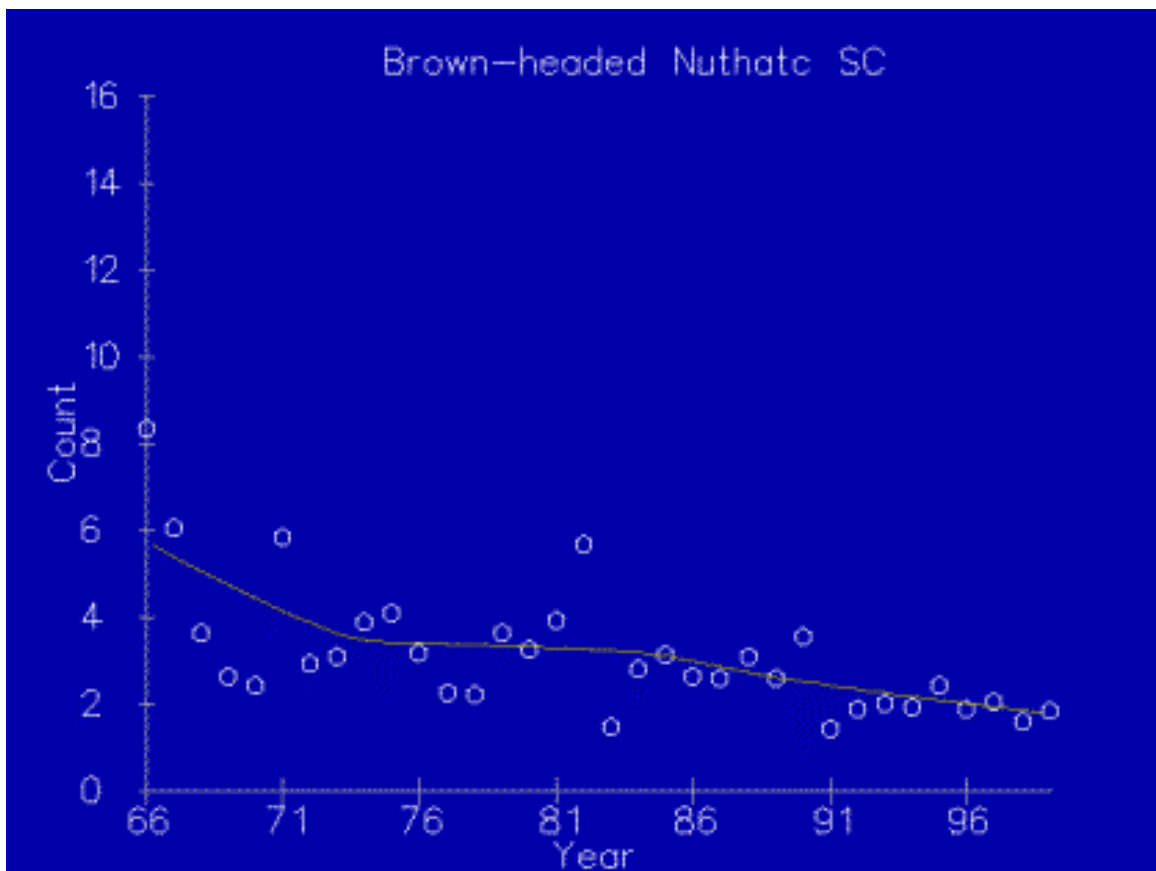
- ❑ Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- ❑ USDA Forest Service. Sumter National Forest. Forest records and annual bird point data (1994 – 2000)

- USDA Forest Service. Sumter National Forest, Annual monitoring reports (1990–2000)
- Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

The Brown-headed Nuthatch is a bird of the open pinewoods and pines in park-like habitat conditions such as golf courses with mature trees. Populations of Brown-headed Nuthatch appear to have been steadily decreasing (trend estimate  $-2.38$ ;  $p = .095$ ; Sauer et al., 2000) across South Carolina (Figure 23).

A total of 1138 bird point counts were conducted on the Sumter National Forest from 1994 through 2000. There were 75 detections of Brown-headed Nuthatch during 41 of the 1138 point counts.

Point counts conducted on the Sumter National Forest indicate Brown-headed Nuthatch to be relatively common on the Long Cane District, uncommon on the Andrew Pickens District (last recorded detection was in 1997) and undetected on the Enoree District (Figure 24). Nearly all observations of Brown-headed Nuthatch occurred in pine dominated stands (Figure 24a), and although the preference seems to be mature or grass/forb habitat conditions, this species has been detected in all successional stages on the Sumter (Figure 24b). Brown-headed Nuthatch is noticeably undetected or in very low numbers in hardwood or mixed forest stands in all successional stages.



**Figure 23. Average number of Brown-headed Nuthatch per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

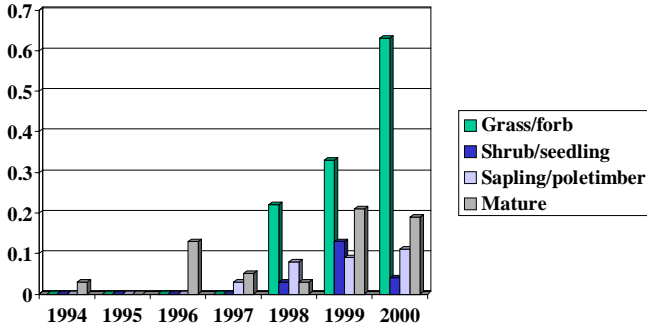


Figure 24. Total number of detections of Brown-headed Nuthatch on the Sumter National Forest, 1994 - 2000

Figure 24a. Percentage of occurrence of Brown-headed Nuthatch on point counts in hardwood, pine and mixed forest habitats on the Sumter National Forest, 1994 - 2000

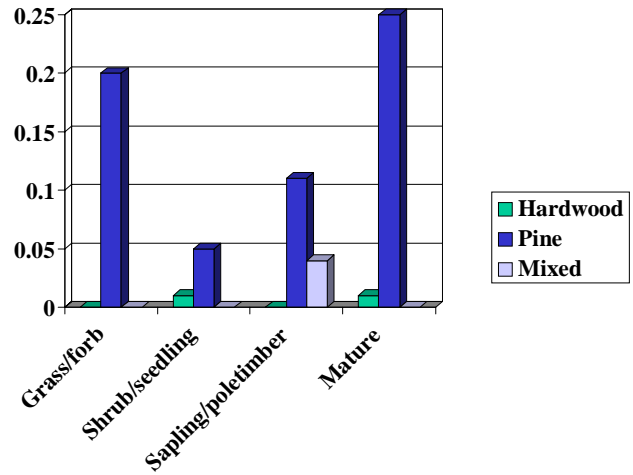


Figure 24b. Percentage of occurrence of Brown-headed Nuthatch on point counts in bottomland and upland habitats on the Sumter National Forest, 1994 - 2000

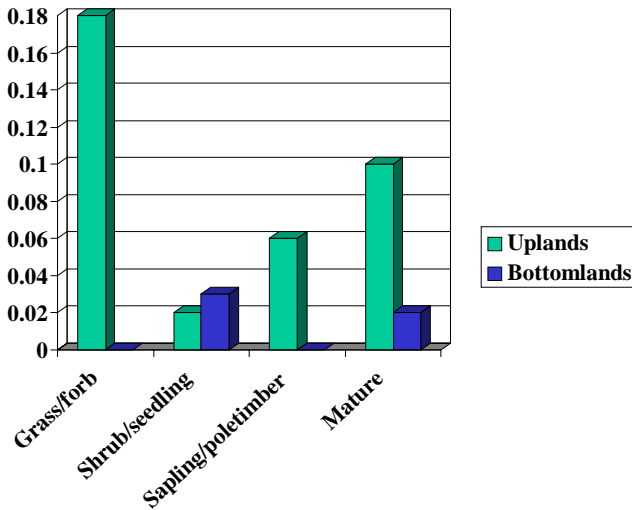
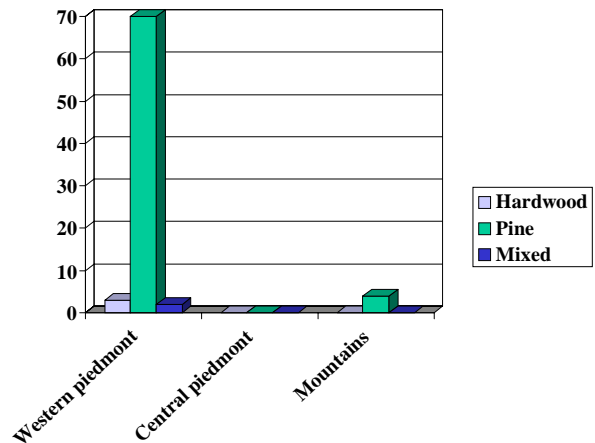


Figure 25. Total number of detections of Brown-headed Nuthatch on the Sumter National Forest (1994 - 2000) by forest type, by District



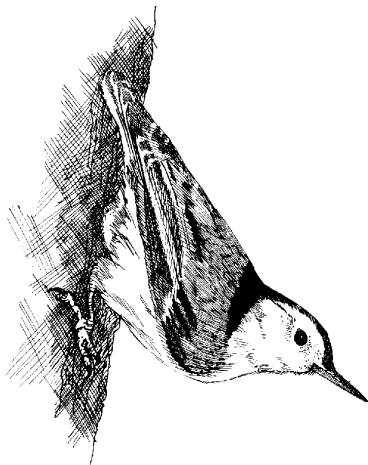
## Effects of Management

This species is found exclusively in pine stands with open crown characteristics: it is seldom found in dense stands of pine (Hamel 1992, p. 224). Brown-headed Nuthatch responds to availability of residual seed trees and snags, or overstory pine trees in moderately thinned to open woodland/savanna forest conditions.

Annual monitoring reports (1990–2000) indicate that Brown-headed Nuthatch populations on the Sumter are stable. Point count results indicate breeding Brown-headed Nuthatch is fairly common and found only in certain habitats that are abundant and well distributed across the Long Cane Ranger District. Given these factors, we believe there is a high likelihood that populations of Brown-headed Nuthatch will persist on the Long Cane District for the foreseeable future. Conversely, the lack of detections on the Andrew Pickens and Enoree Districts leaves a question of population existence in addition to the question of persistence into the foreseeable future.

## Need for Change

There is a need to add landbird monitoring points on the Andrew Pickens and Enoree Ranger Districts located in habitats likely to contain Brown-headed Nuthatch and to increase mature, pine habitats on Andrew Pickens and Enoree Ranger Districts.



## Red-cockaded Woodpecker (FM&S NF)

Red-cockaded Woodpecker (RCW), *Picoides borealis*, was identified as a MIS for the Francis Marion and Sumter National Forests because of concerns for species persistence. Red-cockaded Woodpeckers were given protection with the passage of the Endangered Species Act in 1973. They are also good indicators of mature, fire-maintained open pine woodlands. To monitor this species, Appendix B of the Francis Marion Plan states that we will determine trends in the number of active clusters and the number of groups nesting, it also states we will conduct group surveys (p.B-24). A cluster is an aggregation of cavity trees occupying at minimum 10 acres, whereas group refers to the social unit, which ranges in size from a breeding pair with one or more helpers, to a single bird. Approximately 25% of the Red-cockaded Woodpecker clusters are monitored annually on the Francis Marion and the results are extrapolated to the entire population. The following sources of data were used:

- Hooper, R. G., D. Krusac, D. Carlson, 1991. An Increase in a Population of Red-cockaded Woodpeckers. Wildlife. Soc. Bull. 19:277-286.
- USDA Forest Service. Annual status reports of Red-cockaded Woodpecker populations on the Francis Marions (1990–2000).

The Sumter Plan states we will monitor habitat and activity for the single cluster (p.G-6). The following sources of data were used:

- Annual Monitoring Reports for the Sumter National Forest (1985-Present)

Once abundant in pine forests of the southern United States, RCW populations plummeted during the 1900s. The preferred habitat for the RCW, open longleaf/wiregrass and longleaf/bluestem forests, declined across the South from over 24 million acres in the early 1800s to slightly less than 3 million acres

remaining today. Attempts at managing RCW and its habitat began in the mid-1960's however, population declines and extirpations continued throughout its range.

Prior to Hurricane Hugo, the RCW population on the Francis Marion was increasing. The estimated number of clusters increased from 427 in 1980-1981 to 470 in 1987-1988, an increase of 10%. In the fall of 1989, Hurricane Hugo dealt a devastating blow to RCW populations and habitat on the Francis Marion. An estimated 63% of the birds were killed outright by the storm, 87% of existing cavity trees, and 59% of the existing foraging habitat were destroyed. We have observed and monitored RCW for 11 breeding seasons since Hurricane Hugo. A total of 1528 artificial cavities have been installed on the Francis Marion since the hurricane.

Following the hurricane, RCW populations gradually increased; however, the RCW population on the Francis Marion has been declining since 1996. The decline is attributed to lack of suitable cavities and deteriorating midstory conditions due to a lack of prescribed burning (Taylor et. al. 1998). This 4-year downward trend began to reverse in 2000. The population increased from 314 breeding groups in 1999 to 336 groups in 2000 and; the percentage of groups attempting to nest (93%) was the highest since Hurricane Hugo. The number of single-bird groups in 2000 equaled the lowest number since Hugo and the number of unoccupied cavity clusters is decreasing. The number of potential breeders increased 7% and the effective population size (measured as the number of groups fledging young) increased 13% from 1999 to 2000. In addition, the total number of young fledged increased 8% over 1999.

The Francis Marion population is one of 15 designated core populations United States Fish and Wildlife Service (USFWS) (USFWS, 2000), each with an objective of 400-500 active clusters or 250 breeding groups. The long-term objective in the Francis Marion Plan is 450 active clusters (p.2-2).

At present, we are not far from meeting that objective, and the population on the Francis Marion continues to be the third largest in the country (USFWS, 2000).

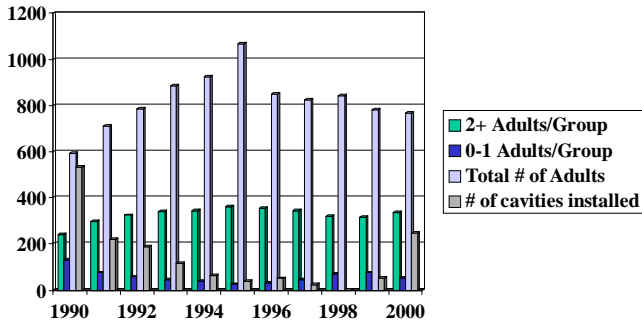
On the Sumter National Forest, two inactive colonies for the RCW occurred on the Edgefield district in 1985. Donny Ray and Oscar Stewart observed one pair with feeding young in 1978 and one start was found in 1979. No activity had been recorded there since 1976, and the colonies were officially declared inactive in 1981. The Sumter National Forest is not identified as having a role in the bird's recovery (USFWS, 2000).

### **Effects of Management**

Threats to the species include loss of the longleaf pine ecosystem, as a result of fire exclusion, and the number of older pines available as cavity trees (Walters, 1991; Hooper et.al., 1998; Taylor and Watson, 2000). Hardwood encroachment due to fire exclusion has been the leading cause of loss of woodpecker groups on both public and private lands (USFWS, 2000). The Francis Marion Plan tiers to standards and guidelines outlined in the Record of Decision (ROD) for management of the RCW and its habitat on national forests in the Southern Region (Appendix A, 1995). The Francis Marion supports a 160,000 acre habitat management area (HMA), within which burning on a five-year or less rotation is desirable. Smoke management problems near populated areas, coupled with fuel loading resulting from Hurricane Hugo, have prevented prescribed burning in about 20% of the HMA in over 10 years.

On the Francis Marion, reproduction and population increases appeared to be directly associated with installation of artificial cavities in years immediately following Hurricane Hugo and again in 1999 and 2000 (Figure 26; Taylor and Watson, 2000). The ROD requires that artificial cavities shall be used in any RCW population if suitable cavities are limited, i.e. less than four functional cavities per cluster. To offset the gradual deterioration of cavities over time, and the loss of natural cavities as a result of Hugo,

the Francis Marion installed 300 artificial cavities in 1999 and 2000 and is planning to install 175 artificial cavities/year until trees are of sufficient size and age to encourage natural cavity excavation.



**Figure 26. Numbers of adult Red-cockaded Woodpeckers and artificial cavities installed on the Francis Marion National Forest following Hurricane Hugo, 1990-2000**

Mechanical chipping and manual control of mid-story removal is reducing fuels near urban interfaces to reduce smoke production and facilitate restoring forest structure. During 1999 the Francis Marion controlled 344 acres of midstory in cluster sites and 1,600 acres of midstory were treated during fiscal year 2001.

Longleaf pine stands are being restored in suitable habitat on the Francis Marion. Approximately 48,000 acres is in longleaf pine or mixtures with loblolly pine; however, because of Hugo, fewer than 6,000 acres are currently late successional pine stands considered optimal for cavity excavation this acreage is slowly increasing on the Francis Marion (over 80 years old; Table 4), and many stands have scattered late successional pine trees suitable for artificial cavities.

The inactive RCW cluster on the Sumter National Forest was placed in Management Area 8 and managed on a 2-3 year burning and an 80-year timber rotation.

### Need for Change

The RCW should be removed from the Sumter MIS list since no birds currently occur there, and it is unlikely they will in the future. The habitat on the piedmont of the Sumter National Forest was not identified as playing a role in the birds' recovery in the Recovery Plan nor in the Southern Region's Recovery Strategy.

Consider adding a monitoring item to the Francis Marion Plan, which addresses the percentage of the RCW HMA which has been burned in the last 5 years.



## Late Successional Hardwood Forests

### Pileated Woodpecker (FM&S NF)

Pileated Woodpecker, *Dryocopus pileatus*, was identified as an MIS for both the Francis Marion and Sumter National Forests to serve as an ecological indicator for mature forest habitat with standing dead trees, and many other forest dwelling species that utilize cavities (Francis Marion and Sumter MIS selection process record). To monitor the effects of Plan implementation on this species, Appendix G of the Sumter Plan states that we will use CISC data to monitor vegetative conditions, rely on standards and guides for habitat distribution, and use bird surveys to monitor populations. Appendix B of the Francis Marion Plan states that we will collect point count data, calculate population trends and compare with habitat changes over time. Pileated Woodpecker populations have been monitored through bird point counts that have been conducted on the Forests since 1994 using methods described in Hamel et al. (*A Land Manager's Guide to Point Counts of Birds in the Southeast*, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in Forests monitoring reports, published annually by the Forest Service for the Sumter National Forest since 1990.

The following sources of data and information were used in this analysis:

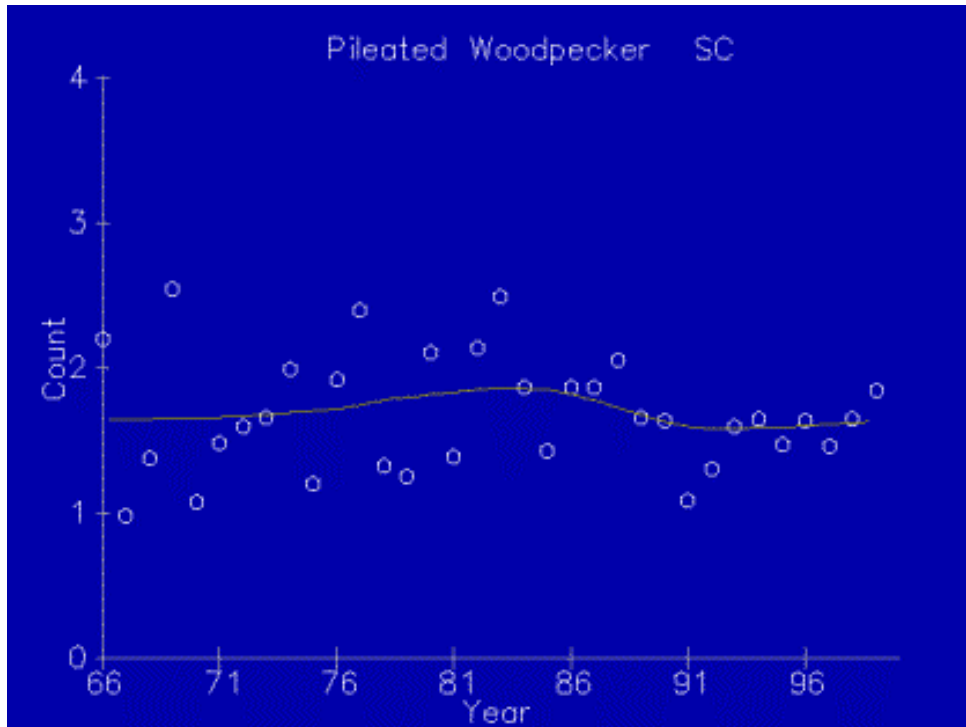
- ❑ Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- ❑ USDA Forest Service. Francis Marion and Sumter National Forest. Forest records and annual bird point data (1994 – 2000)
- ❑ USDA Forest Service. Francis Marion and Sumter National Forest, Annual monitoring

reports (1990 –2000)

- ❑ Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- ❑ Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

Pileated Woodpeckers are birds of the forest, they prefer large diameter trees and need up to 200 hundred acres of foraging habitat per nesting pair. Over the past century, Pileated Woodpecker (unlike their relative, the ivory-billed) have demonstrated the ability to adapt to human habitation and are common in managed forests, as well as in rural, suburban and urban park-like settings. Populations of Pileated Woodpecker appear to have been essentially stable (trend estimate 0.00;  $p = .99$ ; Sauer et al., 2000) across South Carolina (Figure 27).





**Figure 27. Average number of Pileated Woodpeckers per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

A total of 1,138-point counts were conducted on the Sumter and 739 points on the Francis Marion from 1994 through 2000. There were 117 detections of Pileated Woodpecker during 104 of the 1,877-point counts. Several hundred additional detections of Pileated Woodpecker were recorded during point counts. However, due to the robust call of pileated it is likely they were beyond 50 meters from the point location and consequently outside of the habitat where data was being collected.

Point counts conducted on the Sumter indicate Pileated Woodpecker to be common across the Sumter (Figure 29). Pileated Woodpecker appears to be gradually declining in abundance and distribu-

tion in the piedmont and in the coastal plain (1994 – 2000; Figure 28). Pileated Woodpeckers appear to have no long-term trends in abundance or distribution in the mountains. The spike in 2000 for the mountains (Figure 28) is the result of a family unit of pileated recorded on one point.

Pileated Woodpeckers appear to be quite versatile in utilizing forest habitats in all successional stages in all ecoregions (Figure 29). It is particularly interesting that in the mountains, there appears to be a high utilization of grass/forb habitat conditions. Pine stands (Figure 29b) and upland sites (Figure 29c) also appear to be utilized more frequently in the mountains than in the piedmont or coastal plain.

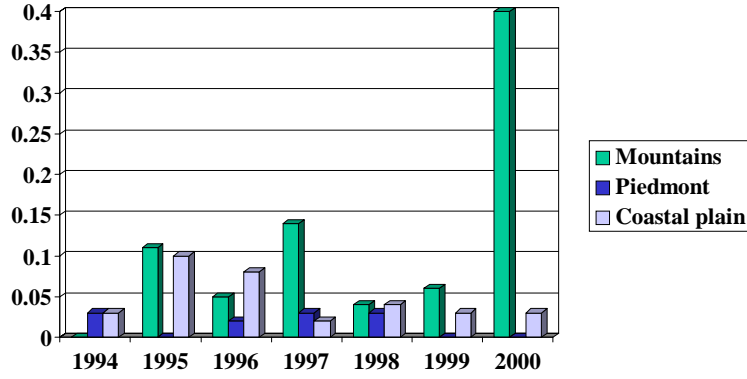


Figure 28. Percentage of occurrence of Pileated Woodpeckers on point counts by District on the Francis Marion and Sumter National Forests, 1994 - 2000

Figure 29. Percentage of occurrence of Pileated Woodpeckers on point counts by successional stage on the Francis Marion and Sumter National Forests, 1994 - 2000

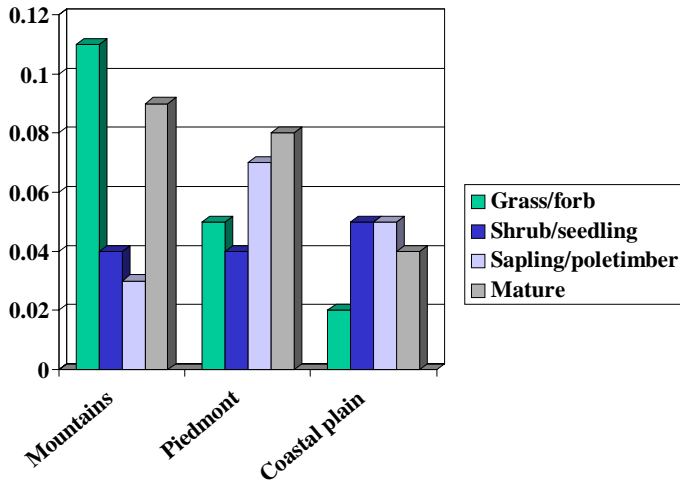
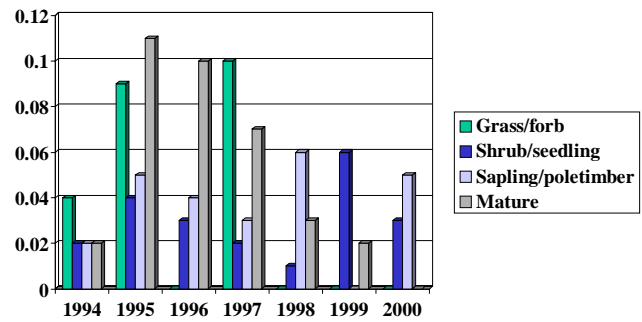
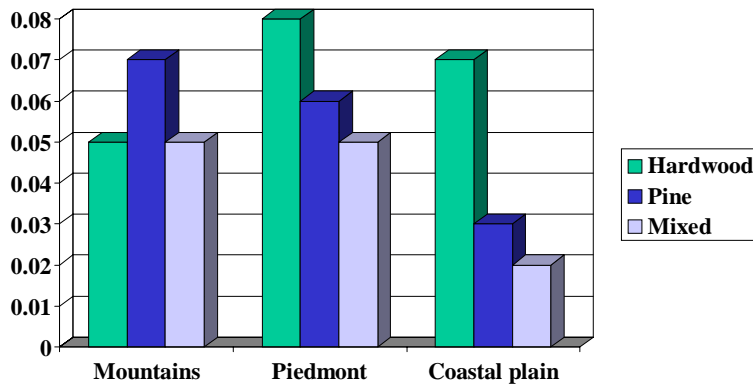


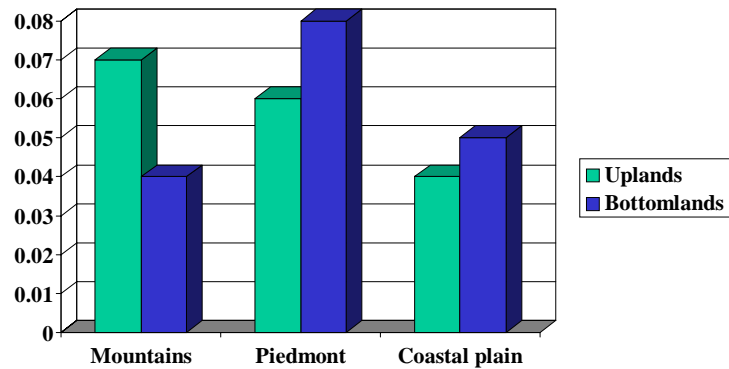
Figure 29a. Percentage of occurrence of Pileated Woodpeckers on point



counts by successional stage on the Francis Marion and Sumter National Forests, 1994 - 2000

**Figure 29b. Percentage of occurrence of Pileated Woodpeckers on point counts by hardwood, pine and mixed forest habitats on the Francis Marion and Sumter National Forests, 1994 - 2000**

**Figure 29c. Percentage of occurrence of Pileated Woodpeckers on point counts in bottomland and upland habitats on the Francis Marion and Sumter National Forests, 1994 - 2000**



### Effects of Management

Pileated Woodpeckers prefer mature deciduous forests in a variety of settings but can utilize virtually all available forest habitats for foraging (Hamel 1992, p.190). Suitable nesting trees, dead standing or down logs and rotting stumps for foraging provide suitable habitat. The amount of late successional hardwood habitat is below Sumter Plan objectives, especially on the Piedmont Districts, and below Francis Marion Plan objectives. However, it is likely that populations of Pileated Woodpecker will persist on all districts on the Francis Marion and Sumter National Forests due to the variety of habitats that exist on the forests.

## Mixed Pine-Hardwood Forests

### Eastern gray squirrel (S)

Eastern gray squirrel, *Sciurus carolinensis*, was identified as an MIS for the Sumter National Forest to serve as an ecological indicator for mast producing hardwoods in a forested landscape (Sumter MIS selection process record). To monitor the effects of Sumter Plan implementation on this species, Appendix G of the Sumter Plan states that we will use SCDNR hunt data and the acres of mast producing hardwoods over 40 years old. Habitat changes and estimated population trends have been documented over time in monitoring reports, published annually by the Forest Service for the Sumter National Forest since 1990.

The following sources of data and information were used in this analysis:

- USDA Forest Service. Sumter National Forest, Annual monitoring reports (1990 – 2000)
- SCDNR. Annual mast surveys (1993 – 2000)

Eastern gray squirrel is a forest dwelling species most often associated with mature and immature hardwood stands. Squirrels eat a wide variety of foods. Yet their reproductive potential fluctuates year to year based primarily upon the hard mast crop of the preceding year. Mast crop success is highly variable from year to year and influenced greatly by climatic events such as late frost and severe drought. Sampling of hard mast crops in the upstate since 1993 has provided an index to the quality of the mast crop. Repro-

duction potential for gray squirrel was predictably greatest in the spring of 2000 and least in the spring of 1996 (Figure 30).

### Effects of Management

Management that maintains, promotes, and improves mast production and mast producing potential of the forest benefits the Eastern gray squirrel. The Piedmont districts are below habitat objectives for hard mast. Only the Andrew Pickens district meets or exceeds mast requirements set in the Sumter Plan.

### Need for Change

Monitoring methods in the 1985 Plan have not been available for some time now. Eastern gray squirrel populations are well established throughout all districts. Population evaluations of Eastern gray squirrel are difficult to monitor and monitoring information provides inconclusive evidence of effects of forest management activities. Consequently, it is recommended that Eastern gray squirrel be removed from the Sumter MIS list.

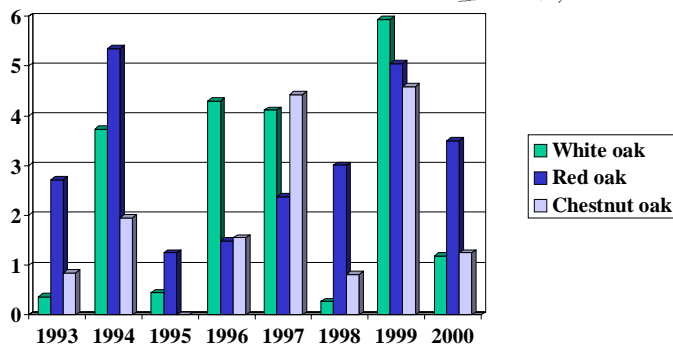


Figure 30. Mast index for the upstate in South Carolina by oak species

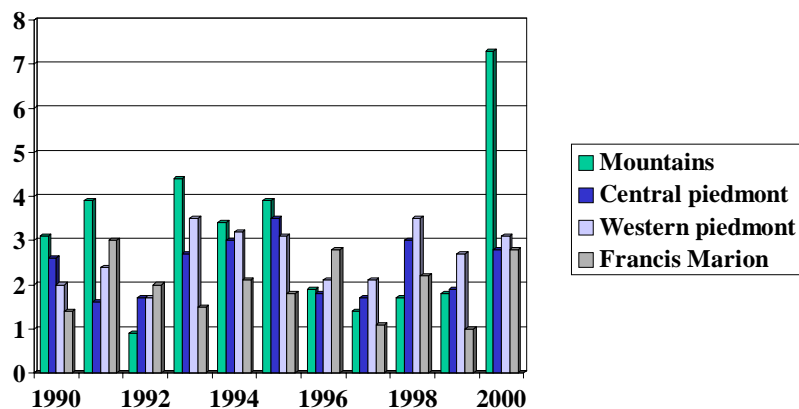
## Eastern Wild Turkey (FMS)

The Eastern Wild Turkey, *Meleagris gallopavo*, in South Carolina is a success story for recovery of wildlife populations. After being reduced to a remnant population in the coastal plain, Statewide restoration efforts over the last 50 years have resulted in wild turkey being in every county of the State. Eastern Wild Turkey was identified as a MIS for both the Francis Marion and Sumter National Forests because of its importance as a game species (Francis Marion MIS selection process record) and to serve as an ecological indicator for both over-mature pine and hardwood habitats (Sumter MIS selection process record). To monitor the effects of Forest Plan implementation on this species and its' habitat, Appendix G of the Sumter Plan states that we will use annual hunt data and SCDNR population surveys to monitor populations. The Francis Marion Plan states that we will use annual summer turkey brood survey to calculate turkey/per acre and display trends in population and poult to hen ratio. Estimated population trends have been documented over time in Forest monitoring reports, published annually by the Forest Service for the Francis Marion and Sumter National Forests since 1990.

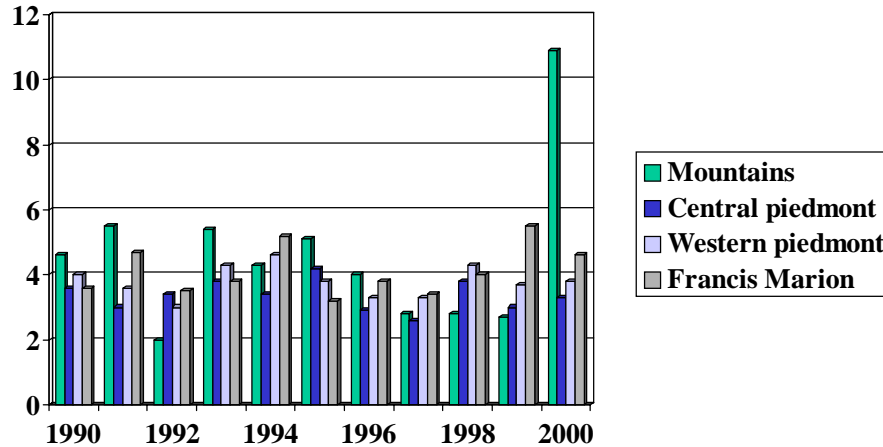
The following sources of data and information were used in this analysis:

- ❑ USDA Forest Service. Francis Marion and Sumter National Forests, Annual monitoring reports (1990 –2000)
- ❑ Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- ❑ SCDNR. Annual summer brood survey data, 1990 - 2000

The Eastern Wild Turkey is a bird of the forest and open land. During different times of the year these birds use dense shrubby areas close to forest openings for nesting, open grassy areas for bugging, hardwood stands for mast and patches of trees for roosting. With the exception of the spring of 2000 (an exceptional reproduction year due to extended dry conditions during nesting and brood rearing periods and an exceptional mast crop in the fall of 1999), turkey populations in the mountains are on a gradual decline (Figure 31a). Populations of wild turkey on the Francis Marion National Forest, although fluctuating from year to year seem to be relatively stable (Figure 31). Populations of Eastern Wild Turkey in the central and western piedmont appear to be somewhat cyclic and relatively stable.



**Figure 31. Eastern Wild Turkey summer brood survey data (total recruitment ratio) for South Carolina**

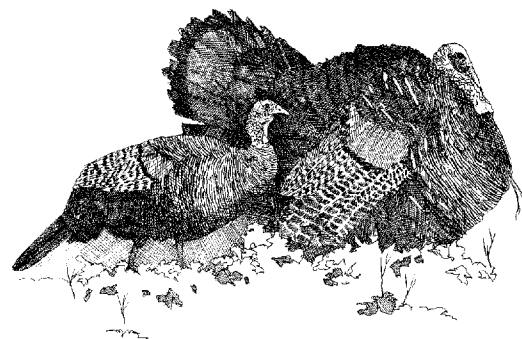


**Figure 31a. Eastern Wild Turkey summer brood survey data (average brood size) for South Carolina, 1990-2000**

One of the factors contributing to the slow decline of turkey in the mountains is the lack of early successional habitat well distributed across the Andrew Pickens. With the gradual loss of well distributed forest openings resulting from a lack of timber harvest activities, preferred nesting habitats have been reduced to road margins, edges of maintained wildlife openings and forest boundaries adjacent to non-forest land uses. The existing concentration of preferred nesting habitat increases the likelihood of predation and nest failure from disturbance.

One possible factor contributing to the highly variable numbers of turkey on the Francis Marion National Forest is the dense understory developed during the rapid recovery from the effects of Hurricane Hugo. Large areas of the Francis Marion National Forest are rapidly achieving poletimber size classes with dense stands and a closed canopy. Increasing pulpwood thinning, prescribed burning, establishing and maintaining additional wildlife openings provide some distribution of good nesting across the Francis Marion. Additional positive factors include an increasing amount of mid-story

control for Red-cockaded Woodpecker, and longleaf pine restoration activities. Eastern Wild Turkey will respond as long as these programs continue, but we will not see significant improvement in overall habitat conditions for a long time (10 years or more).

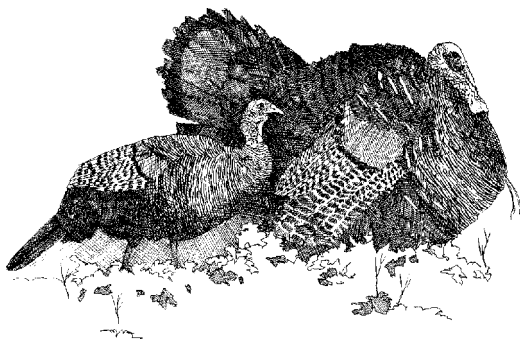


## Effects of Management

The weather during nesting and brood rearing seasons each year is a major influence on Eastern Wild Turkey populations. Dry warm springs seem to increase survival of young turkeys. Maintenance of forest openings, availability of preferred nesting cover, adequate supplies of winter foods, primarily hard mast, and managing access, seem to benefit reproduction and survival of Eastern Wild Turkey.

Preferred habitats for Eastern Wild Turkey on the Francis Marion, and on the Piedmont districts are being perpetuated (although in low amounts except for prescribed burn acres) and are distributed across the Forests (Figure 5). Given these factors, it is likely that populations of Eastern Wild Turkey will persist on the Francis Marion and in the Piedmont on the Sumter National Forest.

In the mountains, suitable habitat conditions have been rapidly declining in quality, abundance and distribution. Preferred nesting and brood rearing habitats have been reduced to maintained wildlife openings, utility corridors, and roadside clearings. Nonetheless, it is likely that populations of Eastern Wild Turkey will persist for the foreseeable future. It is worthwhile to note that an accelerating prescribed burning program is in place on the Andrew Pickens District (goal of 5,000 acres/year). We believe this will improve habitat conditions for Eastern Wild Turkey.



## Upland Savanna and Woodland Species

### American Chaffseed (FM)

American Chaffseed, *Schwalbea americana*, was chosen as a MIS for the Francis Marion National Forest due to concerns for species persistence. The Francis Marion Plan states that we will monitor the approximate size and vigor of rare plant populations, including American Chaffseed, (p.B-36). Sources of data and information we used in this analysis are:

- ❑ South Carolina State Heritage Data (BCD), 2001
- ❑ Peters, D. 1994. American Chaffseed, *Schwalbea americana* Recovery Plan – Technical/Agency Draft. U.S. Fish and Wildlife Service, R05, Hadley, Mass.
- ❑ Porcher, R. 1994. Transplant Study of Pondberry, *Lindera melissifolia* and Monitoring Study of American Chaffseed, *Schwalbea americana*. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Glitzenstein, J. and D. Streng. 1999. Census of *Schwalbea americana* in the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Glitzenstein, J. and D. Streng. 1998. Census of *Schwalbea americana* in the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.

American Chaffseed is a perennial herbaceous plant, listed as Federally-endangered in September 1992. Known primarily from the coastal plain of the Atlantic and Gulf coasts, historic locations range from Massachusetts to Florida and Louisiana. As of 1994, when the recovery plan was released, 71 extant locations were known with the largest numbers of occurrences known from South and

North Carolina (Peters, 1994). On the Francis Marion National Forest, intensive monitoring of American Chaffseed populations has been conducted by Richard Porcher (1993-1994), and also by Jeff Glitzenstein and Donna Streng (1999). U.S.D.A. Forest Service employees Danny Carlson, Robin Roecker, Eddie Taylor, and Craig Watson have conducted both population and habitat monitoring of at least a subset of the occurrences.

The State Biological Conservation Database (2001) shows 16 occurrences for American Chaffseed on the Francis Marion National Forest. Based on their distribution, these occurrences can be considered as 7 distinct population locations. The following are trends in the number of plants measured at each of the seven population locations:

<b>Table 12. Numbers of AmericanChaffseed plants on the Francis Marion National Forest, 1990-1999</b>					
<b>Population Name</b>	<b>1990</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1999</b>
Ballfield	200+	nm	nm	200	9
Bethera	5	126	878	898	467
Cordesville	0	nm	4+	67	10
French Quarter	5	15	15	15	47
Halfway Creek	nm	nm	nm	98	364
Hwy.41	1	27	44	69	3
Lethcoe	nm	13	25	34	35
<b>Total Known</b>	<b>211</b>	<b>167</b>	<b>947</b>	<b>1356</b>	<b>995</b>
(not monitored=nm)					

### Effects of Management

Inventories for new populations of American Chaffseed are conducted as part of the biological evaluation process. Conservation measures are developed in conjunction with the U.S. Fish and Wildlife Service as necessary to conserve and recover the species.

In South Carolina, American Chaffseed occurs in fire-maintained (or mowed), dry, well-drained longleaf pine flatwoods in association with grasses, sedges, herbs, and shrubs such as dwarf huckleberry, Goat's rue, black-root, and colicroot (Porcher, 1994). Most known populations on the Francis Marion National Forest are near roadsides located in proximity to longleaf pine flatwoods. They have likely been maintained historically by roadside mowing. As our knowledge of the species response to prescribed fire has increased (Kirkman, 1998; Porcher, 1994; Bates, 1994), the National Forest has actively used prescribed fire to maintain and increase population size and vigor.

Although some of the population locations have shown an increase in plants, declines have occurred since 1994 at four populations located along State Highways– Ballfield, Bethera, Cordesville, and Hwy. 41. Urban interfaces such as these have been extremely difficult to burn following Hurricanesince Hugo struck the Forest in 1989. Heavy downed fuels created by Hugo have increased the production of smoke during prescribed fires, which settles along highways. Smoke has been responsible for several automobile accidents in the past. The parameters under which the Francis Marion can burn these sites safely have become more limiting. The American Chaffseed populations occur in Management Area 26, with the objective of restoring the fire-maintained longleaf pine ecosystem using prescribed fire on a 2-3 year rotation (Francis Marion Plan, p.4-12). As of 1999, only 33% of Management Area 26 had been burned due to problems with smoke management at urban interfaces.

In 1996, a portion of the Bethera population was inadvertently sprayed with herbicides by an agency outside the Forest Service, killing at least 50 plants (letter to Forest Service files dated 6/6/97). This incident was broughtdrawn to the attention of the U.S. Fish and Wildlife Service, and signs were posted on either side of roadside locations stating that winter mowing only would be allowed.



In 2000, hand control of vegetation was conducted to supplement prescribed burning and reduce control woody competition at the Ballfield site. All sites will be re-monitored in 2001.

## Need for Change

Due to the vulnerability of this species to encroachment with woody vegetation and the endangered status, habitat and population monitoring should be conducted more regularly. Mid-story should be controlled at population sites using prescribed fire or hand tools on a 2-3 year rotation.

## Bachman's Sparrow (FM)

Bachman's Sparrow, *Aimophila aestivalis*, was identified as a MIS for the Francis Marion National Forest to serve as an indicator for grassy, herbaceous understories in open pine stands and to provide a means to measure effects of frequent burning on ground dwelling species (Francis Marion MIS selection process record). To monitor this species, Appendix B of the Francis Marion Plan states that we use specific monitoring methods designed for the species, compare populations with previous inventories, and if possible compare with habitat changes over time. Bachman's Sparrow was monitored using bird point counts that have been conducted on the Francis Marion since 1994 using methods described in Hamel et al. (A Land Manager's Guide to Point Counts of Birds in the Southeast, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in monitoring reports, published annually by the Forest Service for the Francis Marion National Forest since 1990.

The following sources of data and information were used in this analysis:

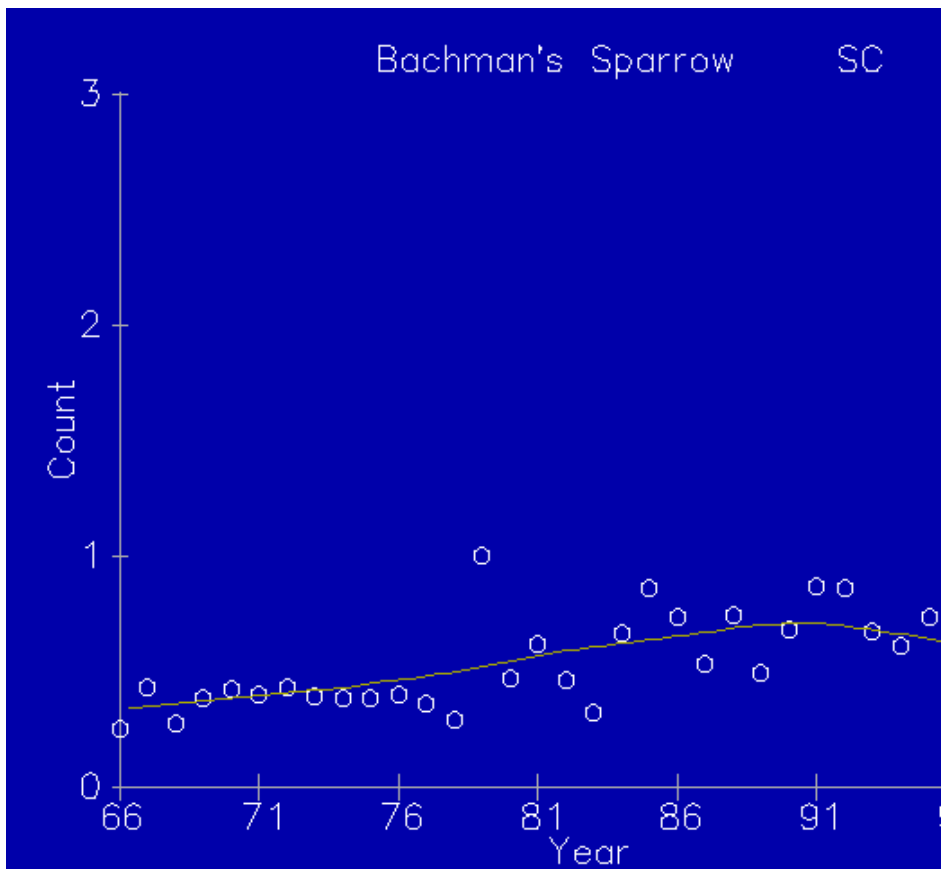
- Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD

- USDA Forest Service. Francis Marion National Forest. Forest records (1979 – 2000) and annual bird point data (1994 – 2000)
- USDA Forest Service. Francis Marion National Forest, Annual monitoring reports (1990 – 2000)
- Hamel, P. B. 1992. *Land manager's guide to the birds of the South. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.*
- Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds. The Charleston Museum.*
- USDA Forest Service. Francis Marion National Forest, Annual monitoring reports (1990 – 2000)

Bachman's Sparrow is historically associated with old growth southern pine woodlands that are subject to frequent burning. In the last century, wildfire was reduced to incidental occurrences in the coastal plain due to settlement and agriculture. In the last quarter century, prescribed fire began to grow in popularity as the interest in managing pine forest types grew. Prescribed burning on the coast was suspended for one year after Hurricane Hugo, but has increased due to tremendous fuel loads. Post-Hugo burning on the coast is about to the level of where it was before to the hurricane (Figure 12).

Populations of Bachman's Sparrow appear to have been steadily increasing (trend estimate 3.80;  $p = .43$ ; Sauer et al., 2000) across South Carolina (Figure 32). This increase, however, appears to have leveled off in the last 10 years (1990 – 1999) coincident with the recovery period following Hurricane Hugo.

Annual landbird monitoring conducted on the Francis Marion National Forest has recorded only one singing male in 7 years of data collection and is currently unusable as a means to assess population abundance or frequency of occurrence on the Francis Marion National Forest.



**Figure 32. Average number of Bachman's Sparrows per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

### Effects of Management

In the coastal plain Bachman's Sparrow prefer open pine woodlands particularly where grasses or saw palmetto are prevalent (Hamel 1992, p. 303). Bachman's Sparrow populations respond to prescribed burning and the establishment and maintenance of grassy understories and grass dominated forest openings. Bachman's Sparrow populations dwindle rapidly in the absence of fire or periodic overstory removal that stimulates a grassy understory. Under the accelerating prescribed burning program on the Francis Marion, habitat for Bachman's Sparrow is improving, and there is a high likelihood that populations of Bachman's Sparrow will respond.

### Need for Change

Due to its inherent rarity and difficulty of detection in bird points, this species should be removed from the Francis Marion MIS list.

### Eastern fox squirrel (FM)

Eastern fox squirrel, *Sciurus niger*, was identified as an MIS for the Francis Marion National Forest to serve as an ecological indicator for longleaf pine ecosystem in the coastal plain (Francis Marion MIS selection process record). The goal of the Francis Marion Plan is to support a stable to increasing population of Eastern fox squirrel on the Francis Marion. To monitor the effects on this species, the Francis Marion Plan states that we will use the casual sighting surveys conducted by the SCDNR.

Habitat changes and estimated population trends have been documented over time in monitoring reports, published annually by the Forest Service for the Sumter National Forest since 1990.

Casual observations have been made for the past 8 years and compiled every other year. Little can be drawn as far as a population trend is concerned for this species; however there appears to be a reduction in the number of sightings in Berkeley County (Figure 33). This may be due to factors not related to population trends such as denser vegetation along roads as stands recover from Hugo and participation of observers over a long period of time.

Statewide, the survey conducted in 1996 revealed 977 individual Eastern fox squirrel sightings in 28 different counties across the state. Habitat types in which the sightings occurred were pine sawtimber (23.8%), pine/hardwood >50 years old (11.2%), pine/hardwood <30 years old (9.1%), and other sites (7.4%).

Transition forests with oak are important components of Eastern fox squirrel habitat on the Francis Marion. Populations appear to be stable on the Francis Marion (Carlson, pers. comm.).

The area of suitable habitat for this species has remained constant since Hurricane Hugo hit in 1989 and is actually increasing slightly with fire dependant ecosystem restoration and hardwood initiative activities. Given these factors, it is likely that populations of eastern fox squirrel will persist on the Francis Marion for the foreseeable future.

### Need for Change

Eastern fox squirrel populations are extremely difficult to monitor. Therefore it is recommended that this species be removed from the MIS list.

### Eastern king snake (S)

The Eastern king snake, *Lampropeltis getulus*, was included as an MIS on the Sumter National Forest as an ecological indicator of early successional habitat. The Sumter Plan states that we will monitor habitat for Eastern king snake, using data from CISC regarding the amount and distribution of early successional habitat (Sumter Plan, p.G-5). Additional sources of population and habitat data and information used in the analysis are as follows:

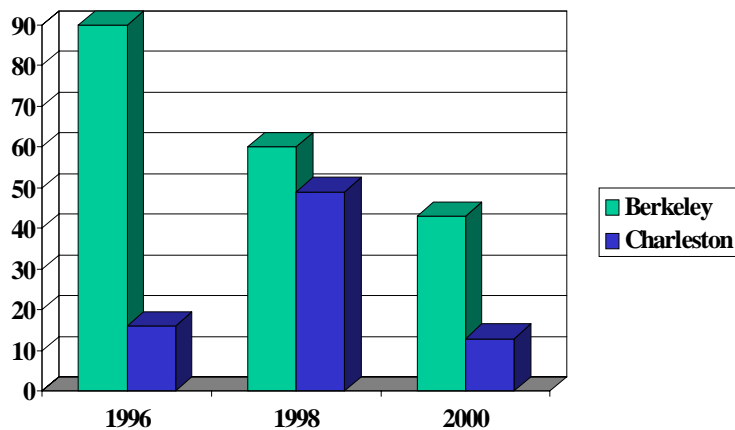


Figure 33. Number of sightings of Eastern fox squirrel by county 1996 – 2000

- ❑ Bruce, R., P. Livingston, C. Spencer, and B. Stuart. 1995. Amphibian and Reptile Survey of the Chattooga River Watershed – A Preliminary Report. Highlands Biological Station, Highlands, NC
- ❑ Museum Records compiled by the South Carolina GAP Project, SCDNR, Columbia, SC
- ❑ Wilson, L. 1995. *Land Managers Guide to the Amphibians and Reptiles of the South*. The Nature Conservancy, Chapel Hill, NC and the U.S. Forest Service, Atlanta, GA
- ❑ Data collected by the Savannah River Ecology Lab under Challenge Cost Share Agreement with the U.S. Forest Service, 2000-Present
- ❑ Platt, S. et.al. 1999. Distribution and Conservation Status of Selected Amphibians and Reptiles in the Piedmont of South Carolina. *Jour. Elisha Mitchell Scientific Society*, 115(1): 8-19

Eastern king snake is a common species that which occurs in a wide variety of habitats. Based on Wilson (1995), optimal habitats include edges of floodplains, bushy stream and swamp margins, and open canopied woods or fields with abundant refuges, such as stumps and surface cover. Eastern king snakes typically occur below 2280 ft. in elevation and are most common on the coastal plain. Eastern king snake, although common throughout most of its range, has declined significantly in the Florida peninsular based on Wilson (1995).

Monitoring populations of Eastern king snakes has proven to be extremely difficult to obtain due to the secretive nature of this species. A compilation of museum records in association with the South Carolina Gap project (2000), revealed 43 Eastern king snakes collected from 1929-1972, including 2 in McCormick County and 1 in Union County. Bruce et.al. (1995) in a survey of amphibians and reptiles of the Chattooga River Watershed, 2 Eastern king snakes at about 1,520 feet were collected. In an inventory of amphibians and reptiles on the Sumter National Forest, initiated in 1999 and

being conducted by individuals from the Savannah River Ecology Lab, no Eastern king snakes have been found to date. Herpetofaunal surveys, conducted by individuals from Clemson University from 1992-1996 (Platt et.al., 1999), revealed no Eastern king snakes. The following is a summary of Eastern king snake records by decade as indicated by museum records compiled by the SC Gap project.

**Table 13 . Eastern king snake Occurrences in South Carolina by Decade Records on or Adjacent to Sumter NF in bold**

Decade	Numbers of New Occurrences
1920's	4
<b>1930's</b>	<b>4</b>
1940's	3
1950's	24
1960's	1
<b>1970's</b>	<b>4</b>
1980's	1
<b>1990's</b>	<b>2</b>

## Effects of Management

The habitat trend analysis presented earlier in this document (Tables 9 and 10) suggests that early successional habitat availability is at moderate levels and below objectives in the Sumter Plan. However, increases in the prescribed burning program on the Sumter National Forest should indirectly improve habitat quality, by increasing the abundance of lizards, birds, small mammals, and other snakes on which this species preys.

Based on comparison of distribution records, habitat availability, the opinion of species experts for Eastern king snake in South Carolina, we believe populations for Eastern king snake have remained stable in the state throughout the life of the Sumter Plan. However, due to the secretive nature of Eastern king snake, documentation of occurrence has been rare we are able to collect very little data on the species. A compilation of records suggests that the species is much more abundant in the Coastal Plain as opposed to than in the Piedmont and Blue Ridge physiographic provinces typical of the Sumter National Forest. Therefore, this species is marginally suited for serving as a MIS for the Sumter National Forest.

### Need for Change

Snakes are not a useful tool for monitoring species responses to forest management activities because they are extremely difficult to monitor. This fact is demonstrated by the lack of Eastern king snakes documented in sampling on the Sumter National Forest by the Savannah River Ecology Lab. The Eastern king snake should be removed from the MIS list for the Sumter National Forest or replaced as an indicator of early successional habitats during revision of the Sumter Plan.

### Fraser's Loosestrife (S)

Fraser's Loosestrife, *Lysimachia fraseri*, was included as an MIS for the Sumter National Forest due to concerns for species persistence. The Sumter Plan states that we will field review populations and habitat for Fraser's Loosestrife (Sumter Plan, p.G-8). The following are the sources of data and information used in this analysis we use:

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Southeastern Wildlife Services Incorporated. 1980. *Inventory of Threatened or Endangered Plants on the Sumter National Forest*. Athens, GA

- ❑ Gaddy, C. 1981. *Inventory of Species, Community, and Habitat Diversity in the Proposed Persimmon Mountain Wilderness Area*. Contract with the U.S. Forest Service, Columbia, SC
- ❑ Bates, M. 1997-1998 *Status Survey of Fraser's Loosestrife, Lysimachia fraseri Duby – Final Report*. North Carolina Plant Conservation Program in conjunction with the U.S. Fish and Wildlife Service, Asheville, NC
- ❑ Roecker, R. 1996. *Conservation Assessment for Lysimachia fraseri Duby*. Fraser's Loosestrife on the Sumter National Forest. Unpublished document, Francis Marion and Sumter National Forests, Columbia, SC
- ❑ Shatley, P. 1999, 1995. *Monitoring of Fraser's Loosestrife on the Andrew Pickens Ranger District*. Unpublished data. Andrew Pickens Ranger District, Mountain Rest, SC

Fraser's Loosestrife is a perennial herbaceous plant which is abundant in the vicinity of the Andrew Pickens Ranger District, where it occurs along roadsides, power-line rights-of-way, stream sides, and other habitats which are maintained in an open condition either by natural or human disturbances. Known from 86 locations across southern Illinois to northern Georgia, Fraser's loosestrife has a G3 global rank and is on the Forest Service Sensitive species list for the Southern Region (list last updated in 1996). As a result of extensive survey and monitoring work conducted during the 1994-1995 growing season, and again during 1997-1999, our knowledge of Fraser's Loosestrife population distribution on the Sumter has increased greatly. In 1994, Perry Shatley, Biological Technician on the Andrew Pickens Ranger District, documented 36 locations containing over 1,700 plants in the vicinity of the Andrew Pickens Ranger District. In 1997 and 1998, Moni Bates, working with the Endangered Species Field Office of the U.S. Fish and Wildlife Service, visited every Fraser's Loosestrife population known throughout the range of the species, documenting number of plants, population area, and habitat characteristics including associated species and natural/plant community. Shatley

revisited known sites for Fraser’s Loosestrife in the vicinity of the Sumter National Forest in 1999. Of those sites identified, only 21 are on lands managed by the Forest Service; the others are under the jurisdiction of county, public utility, or state agencies.

The following table shows changes in the number of documented occurrences for Fraser’s Loosestrife occurring on the Andrew Pickens only, as well as changes in the number of plants:

<b>Table 14. Fraser’s Loosestrife Trends on the Sumter NF, 1980-1999</b>		
<b>Years Monitored</b>	<b>Numbers of Occurrences Monitored (Known)</b>	<b>Numbers of Plants</b>
1980-1981	2 (3)	167
1994-1995	11 (13)	988
1997-1998	16 (20)	2079
1999	10 (21)	1375

### Effects of Management

Fraser’s Loosestrife is evaluated and conserved through the biological evaluation process, through which new locations are discovered and existing ones are maintained. A standard in the Sumter Plan states that we will manage ecosystems containing sensitive plants to maintain or increase these populations (Sumter Plan, p. IV-3).

Although several new locations for Fraser’s Loosestrife have been discovered throughout the Sumter and adjacent state, electric company, and county lands, habitat monitoring suggests that this species is vulnerable to roadside or right-of-way maintenance activities, such as herbicide use, road grading and road widening, and competition with successional vegetation (Shatley, 1999, 1994; Roecker, 1996). Of the 21 occurrences identified on National Forest

land, 71% occur on roadsides or trails, 24% occur along or in the Chattooga River, and one occurs in a wildlife opening maintained as permanent early successional habitat (Bates, 1998). Range wide, Bates (1998) found 55% of the extant occurrences associated with roadsides, 35% with rock outcrops/riparian areas/or slopes, and 10% with openings created by clear cuts.

The largest population on the Andrew Pickens occurs in a wildlife opening, which was cut and has been plowed annually since 1985. Once the Fraser’s Loosestrife plants were discovered in 1994, the Forest Service switched to a winter mowing schedule. At this site, the population has increased from 500 plants, when it was first discovered, to over 1,000 plants today.

The Forest Service has made efforts to coordinate with the South Carolina and Oconee County Departments of Transportation, Haywood Electric, and Blue Ridge Electric Company, to maintain populations of Fraser’s Loosestrife along adjacent roadside and power line rights-of-way, avoiding road grading and herbicide use at population locations. Agencies are encouraged to practice a winter mowing regime. Given the large number of known Fraser’s Loosestrife plants on the Sumter, and the increasing numbers of plants identified between 1994-1995 and 1997-1998 censusing efforts, we concluded that Fraser’s loosestrife is stable to increasing at this time.



## Great Crested Flycatcher (FM)

The Great Crested Flycatcher, *Myiarchus cinerascens*, was identified as an MIS for the Francis Marion National Forest to serve as an ecological indicator for snags in a wide range of forested habitats. Monitoring of these species would provide some insight into effects of plan implementation in terms of snag resources on the Francis Marion (Francis Marion MIS selection process record). To monitor the effects on this species, the Francis Marion Plan states that we will collect point count data, calculate population trends and compare with habitat changes over time. Bird point counts have been conducted on the Francis Marion since 1994 using methods described in Hamel et al. (A Land Manager's Guide to Point Counts of Birds in the Southeast, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in monitoring reports.

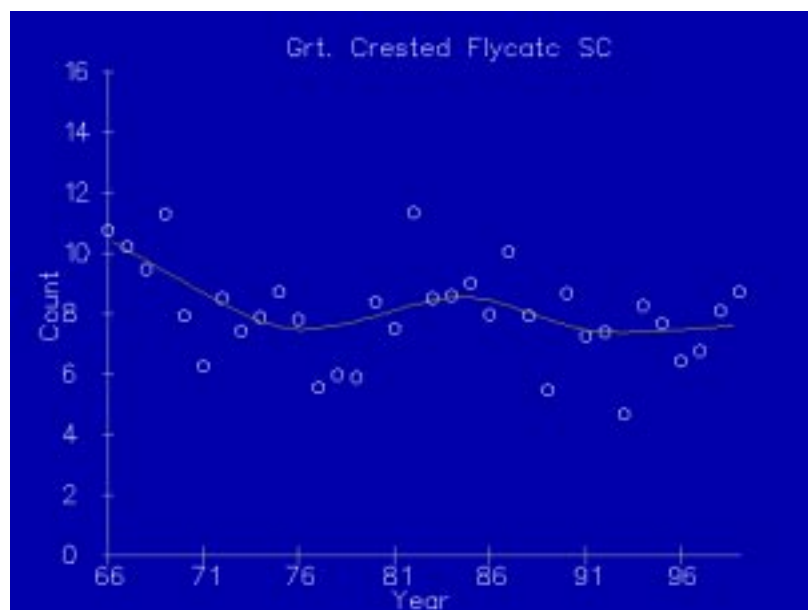
The following sources of data and information were used in this analysis:

- Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results*

and Analysis 1966 - 1999. Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD

- USDA Forest Service. Francis Marion National Forest. Forest records and annual bird point data (1994 – 2000)
- USDA Forest Service. Francis Marion National Forest, Annual monitoring reports (1990 –2000)
- Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

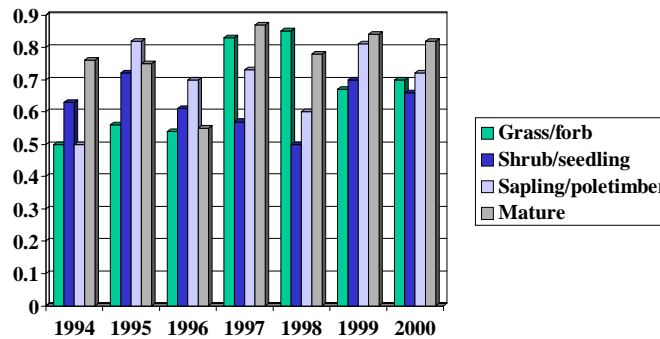
Great Crested Flycatchers are secondary cavity nesters found in medium-growth to somewhat open woodlands and forests with cavities, and seldom in dense forest stands. Populations of Great Crested Flycatcher appear to have been steadily declining (trend estimate  $-0.21$ ;  $p = .86$ ; Sauer et al., 2000) across South Carolina (Figure 34).



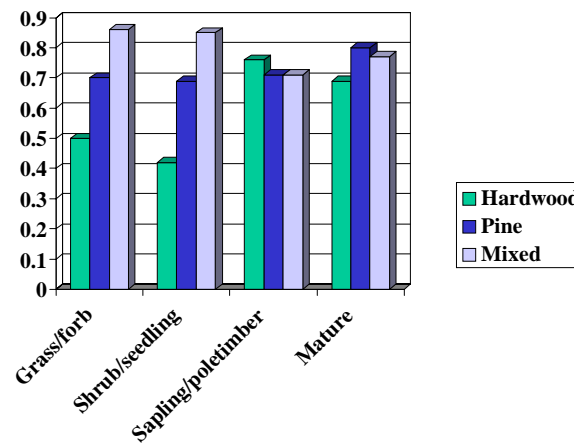
**Figure 34. Average number of Great Crested Flycatchers per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

A total of 739 bird point counts were conducted on the Francis Marion National Forest from 1994 through 2000. There were 870 detections of Great Crested Flycatcher during 508 of the 739 point counts.

Point counts conducted on the Francis Marion National Forest indicate Great Crested Flycatchers to be common, with no large trends in abundance apparent (Figures 35). Great Crested Flycatchers appear to be associated slightly more with pine and mixed forest types, than with hardwoods (Figure 36a), and are using bottomland and upland sites at about the same frequency (Figure 36b).

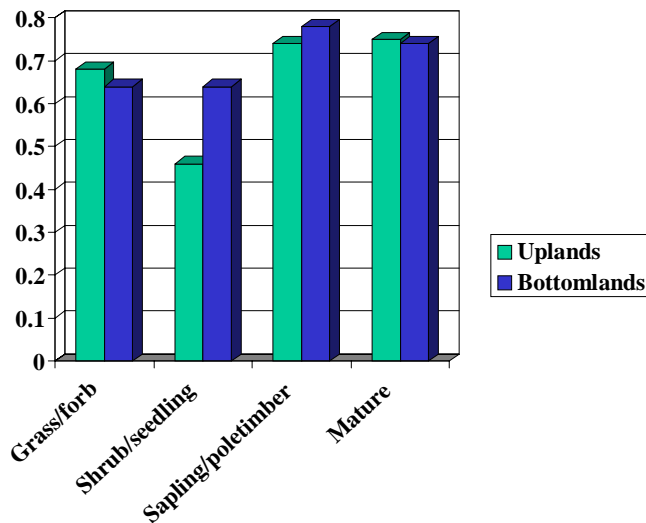


**Figure 35. Percent occurrence of Great Crested Flycatcher on point counts by successional stage on the Francis Marion National Forest, 1994 - 2000**



**Figure 36a. Percent occurrence of Great Crested Flycatcher on point counts in hardwood, pine and mixed forest habitats on the Francis Marion National Forest, 1994 - 2000**





**Figure 36b. Percent occurrence of Great Crested Flycatcher on point counts in bottomland and upland habitats on the Francis Marion National Forest, 1994 - 2000**

### Effects of Management

Great Crested Flycatchers require relatively open forests or woodlands with suitable cavities for nesting (Hamel 1992, p.201). Great Crested Flycatcher appears to be widespread on the Francis Marion, and there are no apparent trends in habitat utilization or frequency of occurrence in terms of management activities. There is a slight overall increase in frequency of occurrences (1994 – 2000) which may reflect the preponderance of snags left by Hurricane Hugo, and the placement of 994 red-cockaded woodpecker artificial cavities since 1990 combined with an increasing number of standing RCW cavity trees that are now dead from lightning strikes or other causes.

Annual monitoring reports (1990 – 2000) indicate that Great Crested Flycatcher populations on the Francis Marion are stable. Point count results indicate breeding Great Crested Flycatchers are widely distributed across the Francis Marion and they occur in a variety of habitats that are abundant and well distributed. Given these results, an adequate supply of cavity trees exists on the Francis Marion and we believe there is a high likelihood that populations of Great Crested Flycatcher will persist for the foreseeable future.

### Longleaf Pine Woodland Communities (FM)

Longleaf pine woodland communities were identified as an MIS for the Francis Marion National Forest due to concerns for native biodiversity. Fire-maintained longleaf pine is an endangered ecosystem. It has declined to 3% of its original size and extent throughout the southeast, and harbors a variety of threatened, endangered, and sensitive species.

The Francis Marion Plan states that we will determine the baseline acreage for fire-maintained longleaf pine woodland communities on the Francis Marion National Forest (Francis Marion Plan, p. B-38). The following sources of data were used:

- The Continuous Inventory of Stand Conditions (CISC) for the Francis Marion National Forest
- Prescribed and wildfire burning history on the Francis Marion National Forest

Before Hurricane Hugo (1989), which destroyed 60% of the forest canopy, the Francis Marion contained 36,100 acres in longleaf pine (14%). Today 47,944 acres (19%) are in longleaf pine or mixtures, which are suitable for restoration. The long-term objective is to place longleaf on all suitable soil types; this amounts to 53,500 acres. Therefore, longleaf pine ecosystem restoration will be emphasized in Management Area 26, which consists of fairly dry sandy soils supporting flatwoods, savanna, and woodland communities.

Longleaf pine woodlands are fire-dependent communities, requiring frequent low intensity fires to reduce woody mid-story growth and encourage a diverse herbaceous understory that supports a variety of plants and animals. The prescribed burning program became firmly established in the 1950s. From 1960 to September 1989, an average of 40,000 acres were burned annually. Due to

smoke management problems associated with the fuels created by Hurricane Hugo, the program has declined to an average of 29,000 acres/annually since 1990. Growing season burning, initiated in 1991, has occurred on 3,200 acres/annually since 1990.

## **Effects of Management**

Efforts in the near future will focus on thinning stands, which regenerated following Hurricane Hugo. These thinning will favor the longleaf forest type, and will also reduce fuels so that they will be easier to burn.

Although the Francis Marion has met overall prescribed burning objectives as set in the Francis Marion Plan, the location of prescribed fire activities has not been well distributed. Fuels left by Hugo smolder when burned and have created smoke management problems at urban interfaces. The Francis Marion has to more carefully burn these areas to ensure public safety.

A standard in the Francis Marion Plan indicates that Management Area 26, which has the goal of restoring, expanding, and maintaining the longleaf pine ecosystem and related fire-dependent communities, should be burned every 2-3 years to maintain the longleaf ecosystem.

Post-hugo forests are becoming extremely dense as they surpass 10 years of age without any prescribed fire, rendering them more difficult to burn. The Francis Marion conducted hand clearing of 348 acres of mid-story control in 1999, and 1,600 acres of mid-story control in 2000 to reduce fuel size and create the desired woodland structure in areas difficult to burn. If funding and adequate resources are available, prescribed burning will occur following chipping to ensure that this structure is maintained. More of this work is scheduled in the future.

A Forest Plan object (p.2-2) is to restore the role of growing-season fires on 16,000 acres of longleaf pine forest types in the next 10 years. The Francis Marion is currently below that objective.

However, Glitzenstein and Streng (1995) found relatively minor effects of season of burn on groundcover vegetation. Burning frequency rather than burning season is the single most important factor necessary to restore and maintain longleaf pine-dominated habitats (Glitzenstein and Streng, 1995; Waldrop et.al.,1992).

## **Need for Change**

Add monitoring items to the Francis Marion Plan, which include 1.) the percentage of the longleaf pine forest type which has been burned in the last 5 years 2.) the percentage of longleaf pine forest in Management Area 26 which has been burned in the last 2-3 years. Consider modification of O-5, decreasing the emphasis on growing season burning to address instead of a high frequency of burning (at least every 3-5 years) within the longleaf and loblolly forest types.

## **Red-headed Woodpecker (S)**

Red-headed Woodpecker, *Melanerpes erythrocephalus*, was identified as a MIS for the Sumter National Forest to serve as an ecological indicator for open understories in pine, and tree cavity requirements (Sumter MIS selection process record). To monitor the effects of Sumter Plan implementation on this species, the Sumter Plan states that we will use CISC data to monitor vegetative conditions, rely on standards and guides for habitat distribution, and use bird surveys to monitor populations. Red-headed Woodpecker populations have been monitored through bird point counts that have been conducted on the Sumter since 1994 using methods described in Hamel et al. (*A Land Manager's Guide to Point Counts of Birds in the Southeast*, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in monitoring reports.

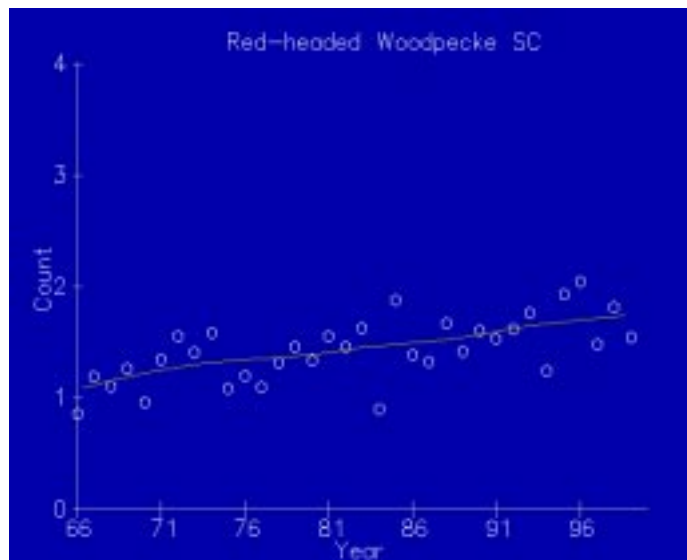
The following sources of data and information were used in this analysis:

- ❑ Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999*. Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD
- ❑ USDA Forest Service. Sumter National Forest. Forest records and annual bird point data (1994 – 2000)
- ❑ USDA Forest Service. Sumter National Forest, Annual Monitoring Reports (1990 – 2000)
- ❑ Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- ❑ Post, W., S. Gauthreaux, Jr. 1989. Status and Distribution of South Carolina Birds. The Charleston Museum.

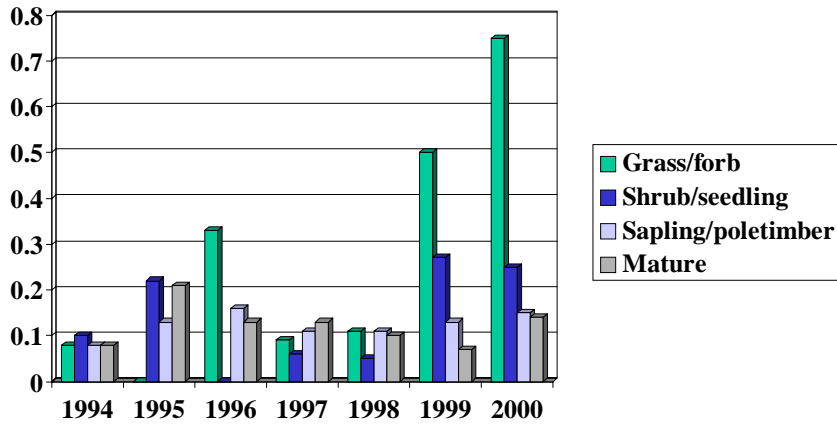
The Red-headed Woodpecker is a bird of the open woodlands and park-like habitat conditions in locations where there are some standing dead trees. Populations of Red-headed Woodpecker appear to have been steadily increasing (trend estimate 2.60;  $p = .24$ ; Sauer et al., 2000) across South Carolina (Figure 37).

A total of 1,138 bird point counts were conducted on the Sumter National Forest from 1994 through 2000. There were 122 detections of Red-headed Woodpecker during 102 of the 1,138-point counts.

Point counts conducted on the Sumter National Forest indicate Red-headed Woodpecker to be relatively common on the Long Cane District, less common on the Andrew Pickens and uncommon on the Enoree. A Forest Plan objective (p.2-2) is to restore the role of growing-season fires on 16,000 acres of longleaf (Figure 38). Collectively, Red-headed Woodpecker appears to have no long-term trends in abundance on the Sumter (1994 – 2000). It is interesting to note however the appearance of an upward trend in recent years (1999 – 2000) which may have been influenced by the amount and distribution of shelterwood and seed tree harvesting in the 90's in the piedmont. Red-headed Woodpeckers appear to be associated most often with pine grass/forb conditions (Figure 38a) on upland sites (Figure 38b), but are found in all habitats, except bottomland hardwood or mixed forest grass/forb conditions. The prevalence of occurrences in young stands (grass/forb, shrub/seedling and sapling/poletimber) may be primarily because of the presence of exposed boles of residual overstory trees and standing snags. Two out of three Red-headed Woodpecker observations occurred in grass/forb, shrub/seedling or sapling/poletimber habitats.

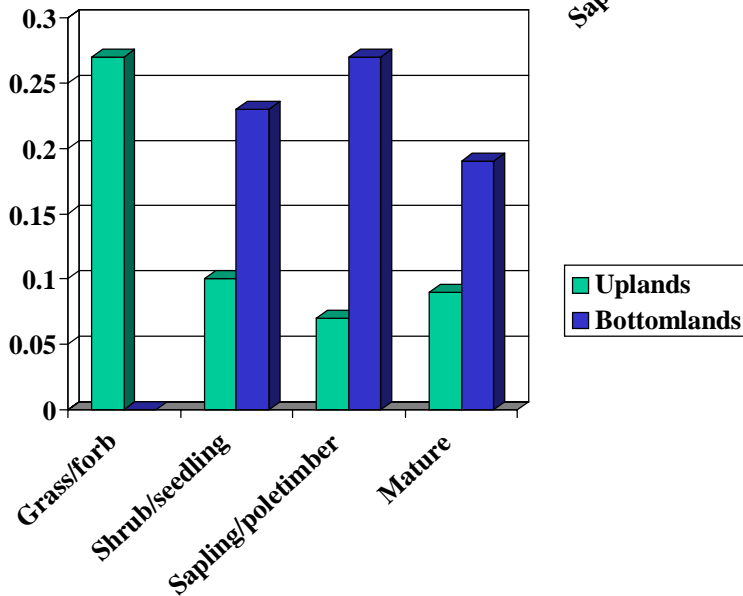
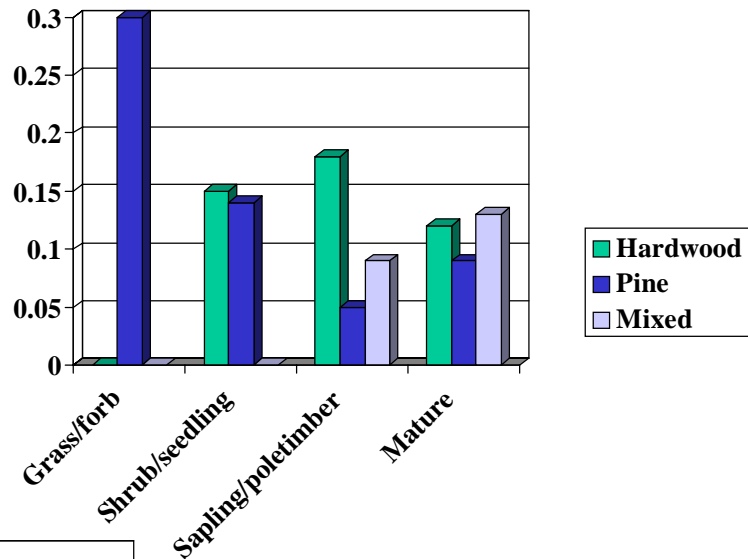


**Figure 37. Average number of Red-headed Woodpeckers per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

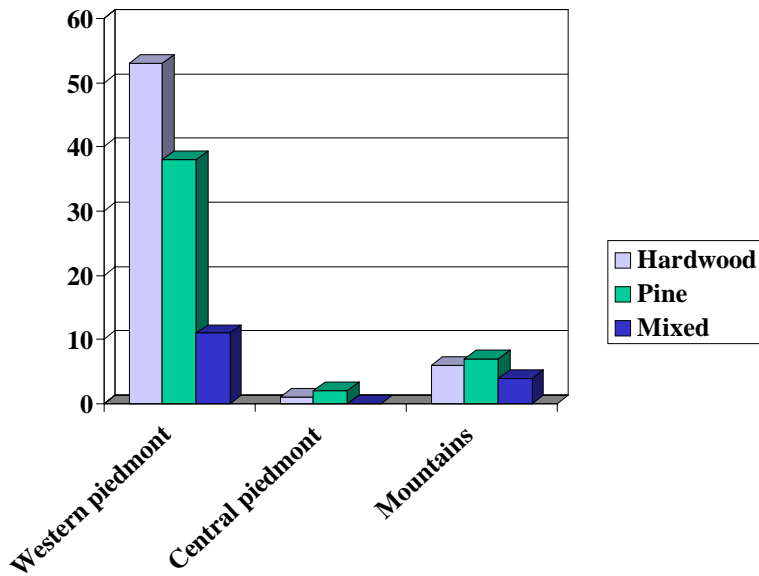


**Figure 38. Percentage occurrence of Red-headed Woodpeckers on point counts by successional stage on the Sumter National Forest, 1994 - 2000**

**Figure 38a. Percentage occurrence of Red-headed Woodpeckers on point counts in hardwood, pine and mixed forest habitats on the Sumter National Forest, 1994 - 2000**



**Figure 38b. Percentage occurrence of Red-headed Woodpeckers on point counts in bottomland and upland habitats on the Sumter National Forest, 1994 - 2000**



**Figure 39. Total number of detections of Red-headed Woodpecker on the Sumter National Forest (1994 – 2000) by forest type, by District**

### Effects of Management

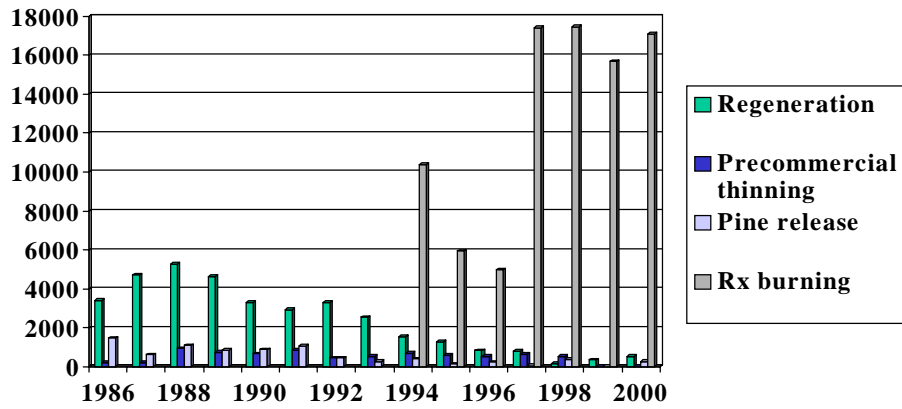
Red-headed Woodpeckers prefer open mature woods and open conditions that frequently occur in parks, swamps, and pasture-like settings (Hamel 1992, p. 182). Red-headed Woodpeckers respond to the presence of open canopies in forested, wetland or rural landscapes with free flight paths to boles of standing trees and snags. Standards that retain standing trees and snags in regeneration areas and management activities that provide wide spaces between residual standing trees (Shelterwood, seed-tree harvest) offer preferred habitat to Red-headed Woodpecker. Management activities on the Sumter have changed since the Sumter Plan was implemented in 1985 (Figure 40).

Habitat for Red-headed Woodpecker is rapidly declining in abundance and distribution on the Andrew Pickens. Consequently, it remains a question if a population of Red-headed Woodpeck-

ers will persist on the Andrew Pickens for the foreseeable future. It is worthwhile to note that an accelerating prescribed burning program is in place on the Andrew Pickens (goal of 5,000 acres/year), and we believe this program will improve habitat conditions for Red-headed Woodpeckers in portions of the burn areas.

Preferred habitats for Red-headed Woodpecker on the Piedmont districts are being perpetuated and are distributed across the Sumter.

### Piedmont Districts



### Mountain District

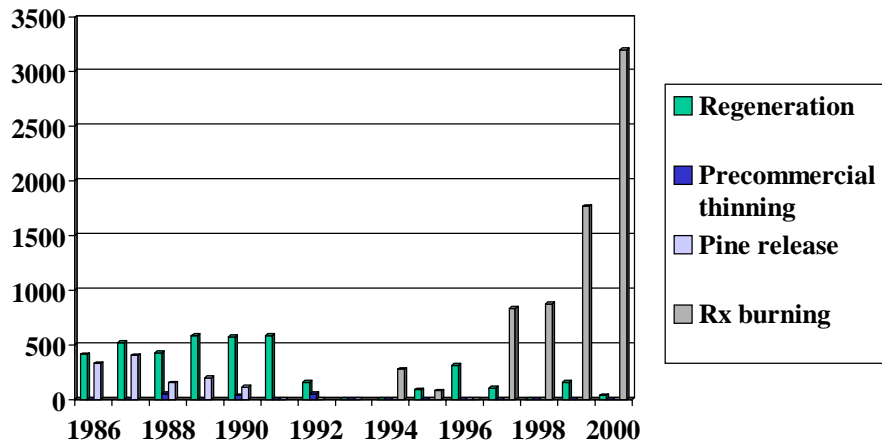


Figure 40. Acres of prescribed burning, regeneration, thinning, and release activities on the Sumter National Forest, 1986 – 2000

## Smooth Coneflower (S)

Smooth Coneflower, *Echinacea laevigata*, was included on the MIS list for the Sumter due to concerns for species persistence. The Sumter Plan states that we will field review populations and habitat for Smooth Coneflower (p.G-9). The following are the sources of data and information we used:

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Southeastern Wildlife Services Incorporated. 1980. *Inventory of Threatened or Endangered Plants on the Sumter National Forest*, Athens, GA
- ❑ Emanuel, K. 1996. *Silvicultural Options for Recovering the Endangered Smooth Coneflower Echinacea laevigata* (Boynotn & Beadle)Blake. MS Thesis, Clemson University, Clemson
- ❑ Gaddy, C. 1991. The Status of *Echinacea laevigata* (Boynotn & Beadle) Blake. Cooperative Agreement between U.S. Fish and Wildlife Service and NC Natural Heritage Program
- ❑ Hill, S. 1993. Final Report – Botanical Survey, Andrew Pickens Ranger District, Sumter National Forest. Challenge Cost Share Agreement with the U.S.D.A. Forest Service, SC
- ❑ Huffman, R. 2000. Status Report for Smooth Coneflower. 2000. Challenge Cost Share with the Francis Marion & Sumter NF, Columbia, SC
- ❑ Murdock, N. 1995. Recovery Plan for Smooth Coneflower. U.S. Fish and Wildlife Service, Asheville, NC.
- ❑ Waldrop, T. and J. Walker. 1996. Habitat Manipulation for the Recovery of Declining Colonies of *Echinacea laevigata* (Boynt.and Beadle) Blake. Unpublished data, Southern Research Station, Clemson, SC

Smooth Coneflower is a rootlike perennial herb, which was federally listed as endangered in October

1992. Although historically known from 26 counties in 8 states ranging from Pennsylvania to Arkansas, it is now known only in Virginia, North Carolina, South Carolina, and Georgia. In South Carolina, it occurs primarily in the Southern Blue Ridge of the Sumter National Forest, where 9 populations and more than 1,200 plants were confirmed during the year 2000. The following is a summary of changes in the number of occurrences and number of Smooth Coneflower plants occurring on the Andrew Pickens Ranger District.

**Table15. Smooth Coneflower Population Trends on the Sumter NF, 1980-2000**

Years Monitored	Numbers of Populations Monitored (Known)	Numbers of Plants
1980	6 (6)	248
1991	6 (7)	353
1993	8 (8)	1047
2000	8 (8)	1283

Southeastern Wildlife Services, with the aid of Perry Shatley first identified six populations on the Sumter National Forest in 1980 during an inventory of threatened and endangered plants on the Sumter National Forest. During that survey, the species was noted to occur in “open, disturbed habitats,” and all of the populations identified were found in roadside habitats.

Additional inventorying and monitoring for the species were conducted in 1991 in conjunction with the species status report (Gaddy, 1991), in 1993 by the Southern Research Station in conjunction with Clemson University (Emanuel, 1996), and by Earth Design (Huffman, 2000). Dr. Steve Hill identified a new coneflower site while conducting botanical surveys on the district in 1993. Both Perry Shatley

and Robin Roecker, with the Forest Service, have conducted additional habitat and population monitoring.

### Effects of Management

Inventories for Smooth Coneflower are conducted during the biological evaluation process. Appropriate mitigation, as needed, is identified in cooperation with the U.S. Fish and Wildlife Service in order to conserve populations in association with projects.

The association of Smooth Coneflower with open habitats was confirmed as additional locations continued to be found in association with open, roadside habitats. The Sumter National Forest conducted the first experimental management for this species using fire during 1979, following clearing of woody vegetation from the site. The number of flowering stems quadrupled in the year following the burn (Murdock, 1995). In an adjacent stand, which was burned without canopy removal, the response was a 10 fold increase in the number of Smooth Coneflower rosettes.

Research on effects of both prescribed burning and canopy removal on species response are ongoing (Waldrop and Walker, 1996), but the benefits of disturbance which decreases competition with woody species, is demonstrated by the vigor of populations which have been either logged or burned. One of the first roadside populations discovered on the Andrew Pickens, which has been logged and burned since it was discovered in 1980, had 8 plants in 1980, and has increased to 350 plants today. Another population location, which had been logged and burned in 1982, and burned 3 more times since, has increased from 150 plants in 1991 to 657 plants in 2000.

Coordination with associated road and utility companies is ongoing to limit road grading and herbicide use in proximity to known population locations.

### Need for Change

Although the two Smooth Coneflower populations, which we are actively managing, are increasing, some others are showing declines. More active management is needed to perpetuate Smooth Coneflower, which is well distributed throughout the Andrew Pickens.

As with Fraser's Loosestrife, additional needs include creating and maintaining permanent openings such as prairies, savannas, and woodlands throughout the Sumter and adjacent to existing populations through the use of selective logging and prescribed fire.

A standard in the Sumter Plan (p.IV-3) states to "manage identified ecosystems containing sensitive plant and animal populations to maintain or increase these populations." At minimum, successional vegetation needs to be controlled at the site of individual population locations.

### Sun-facing Coneflower (S)

The Sumter Plan states that we will field review populations and habitat for Sun-facing Coneflower, *Rudbeckia heliopsidis*, (p.G-8). Sun-facing Coneflower was listed as an MIS for the Sumter National Forest due to concerns for species persistence. The following are sources of data and information we used:

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Southeastern Wildlife Services Incorporated. 1980. *Inventory of Threatened or Endangered Plants on the Sumter National Forest*. Athens, GA
- ❑ Hill, S. 1993. Final Report – Botanical Survey, Andrew Pickens Ranger District, Sumter National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Jones, S. and B. Dunn. Distribution of *Rudbeckia heliopsidis* in South Carolina. Bull. SC Acad. Science (41):58-59



- Roecker, R. 1997. Habitat and Population Monitoring. Unpublished data, Francis Marion and Sumter NF, Columbia, SC

Sun-facing Coneflower is a perennial, herbaceous plant, which readily reproduces from short woody rootstalks, which form basal offshoots from the parent plant. Although known from widely scattered locations, ranging from the coastal plain and piedmont of North Carolina and Virginia, to the ridge and valley region of Alabama and Georgia, the species is locally common around Lake Cherokee and the adjacent National Forest land. This is the only area the species can be found on the Sumter National Forest, and in the state of South Carolina.

Southeastern Services first discovered the plant in 1979 during an inventory of threatened and endangered species on the Sumter. At that time, one location with over 4,000 plants was thriving along the margin of cutover woods (Steve Smith, Clemson University). Subsequent groups of plants were located within the same area by Dr. Steven Hill, formerly of Clemson University, in 1993 while conducting a botanical survey under contract with the Forest Service.

The following is a summary of populations known to date occurring on the Andrew Pickens Ranger:

<b>Table 16. Sun-facing Coneflower Population Trends on the Sumter, 1979-1996</b>		
<b>Year Monitored</b>	<b>Numbers of Populations Monitored (Known)</b>	<b>Number of Colonies (Plants)</b>
1979	1(1)	1 (4000+)
1992-3	4(5)	32-52 (unknown)
1996	3(5)	Unknown (1900)

## **Effects of Management**

Inventories for Sun-facing Coneflower are conducted in association with the biological evaluation process. Appropriate mitigation, as needed, is identified to conserve populations in association with projects.

Habitat for Sun-facing Coneflower can be characterized as open roadsides, road banks, and power line rights-of-way that are frequently mowed (Hill, 1993; Southeastern Services, 1980). Although most of the sites are a dry habitat, one population can be found in the disturbance zone associated with a floodplain (Hill, 1993).

Sun-facing Coneflower is locally common on the Andrew Pickens, but only in the vicinity of Lake Cherokee, where it occurs in extensive colonies. The clonal nature of this plant appears to render it fairly resistant to maintenance activities. In 1996, a population occurring within the utility right-of-way was inadvertently sprayed with herbicide. The affected populations were monitored in 1996, and an estimate of 10-20% mortality (20-40% uncertain) was made at that time. Hundreds of healthy stems were remaining (Roecker, 1997). Sun-facing Coneflower is likely to be stable at this time, due to the extensive, clonal nature of the populations where they occur.

## **Need for Change**

Research is needed to determine why the species is limited in distribution on the Andrew Pickens. Monitoring of Sun-facing Coneflower sites on the Sumter should be conducted at least every 5 years to ensure population persistence. Due to the restricted distribution of this species, it is recommended that it be removed from the MIS list for the Sumter National Forest.

## Wild Coco (FM)

Wild Coco, *Pteroglossapsis ecristata*, was chosen as an MIS for the Francis Marion National Forest due to concerns for species persistence. The Francis Marion Plan states that we will monitor the approximate size and vigor of rare plant populations, including Wild Coco. The following are the sources of data we used:

- ❑ South Carolina State Heritage Data (BCD), 2001
- ❑ Townsend, J. 2000. Unpublished data associated with the Status Report for *Pteroglossapsis ecristata*. U.S. Fish and Wildlife Service, Asheville, NC
- ❑ Glitzenstein, J. and D. Streng. 2001. Survey for Rare Plant Species (including PETS) in Proposed Mid-Story Control Areas in the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Porcher, R. 2000. Final Report, Rare Plant Survey along Proposed Palmetto Trail Extension. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Porcher, R. 1993. Botanical Inventory of the Francis Marion National Forest. Under contract with the U.S. Forest Service.

Wild Coco is a terrestrial orchid, which has a tall, flowering stalk that grows out of an inconspicuous, basal rosette most often in August or early September. Like most orchids, flowering may not occur every year, particularly when habitat conditions such as drought are unfavorable for flowering and subsequent reproduction. Wild Coco is found in numerous habitats on the coastal plain from North Carolina south through Florida and west to Louisiana. It is also found in Cuba (Bridges, 1986).

As a result of recent survey efforts, 11 sites of Wild Coco are known on the Francis Marion, although no plants have been seen in two of the sites for almost 20 years. The following is a summary of occurrences, by year they were discovered, and number of plants.

**Table 17. Wild Coco Trends on the Francis Marion NF, 1972-2000**

Year Discovered	Number of Known Occurrences	Numbers of Plants
1972-1973	2	Unknown; 0 in 1993
1999-2000	9	28

## Effects of Management

Inventories for Wild Coco are conducted in association with the biological evaluation process. Appropriate mitigation, as needed, is identified to conserve populations in association with projects.

Increases in the number of occurrences of Wild Coco on the Francis Marion are likely to be related to increased efforts to inventory the species. On the Francis Marion National Forest, Wild Coco has been demonstrated to occur in open longleaf pine woodland, savannas, or “flatwoods,” generally open with a herbaceous or shrubby understory. The Element Stewardship Abstract (1986) states that

“[t]he major requirement seems to be for a somewhat open area, with at least filtered sunlight and no dense shrub competition... Pines are always present.” This habitat is well distributed on the Francis Marion National Forest, though it may be threatened by fire suppression at urban interfaces.

Wild Coco, like most orchids, generally occurs in small, dispersed populations, and low population numbers are considered quite normal (Bridges, 1986). Although the species is difficult to monitor, the increased number of occurrences known on the Francis Marion, suggests that populations are stable.

## Need for Change

Populations for Wild Coco need to be monitored at least every 2 years to ensure population persistence. Due to the small population size, and restricted distribution it is recommended that this species be removed from the MIS list for the Francis Marion.

## Wood Thrush (FM)

Wood Thrush, *Hylocichla mustelina*, was identified as a MIS for the Francis Marion National Forest to serve as an ecological indicator for deciduous and mixed forests with well-developed understory conditions (Francis Marion MIS selection process record). To monitor the effects on this species, Appendix B of the Francis Marion Plan states that we will collect point count data, calculate population trends and compare with habitat changes over time. Bird point counts have been conducted on the Francis Marion since 1994 using methods described in Hamel et al. (A Land Manager's Guide to Point Counts of Birds in the Southeast, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in monitoring reports.

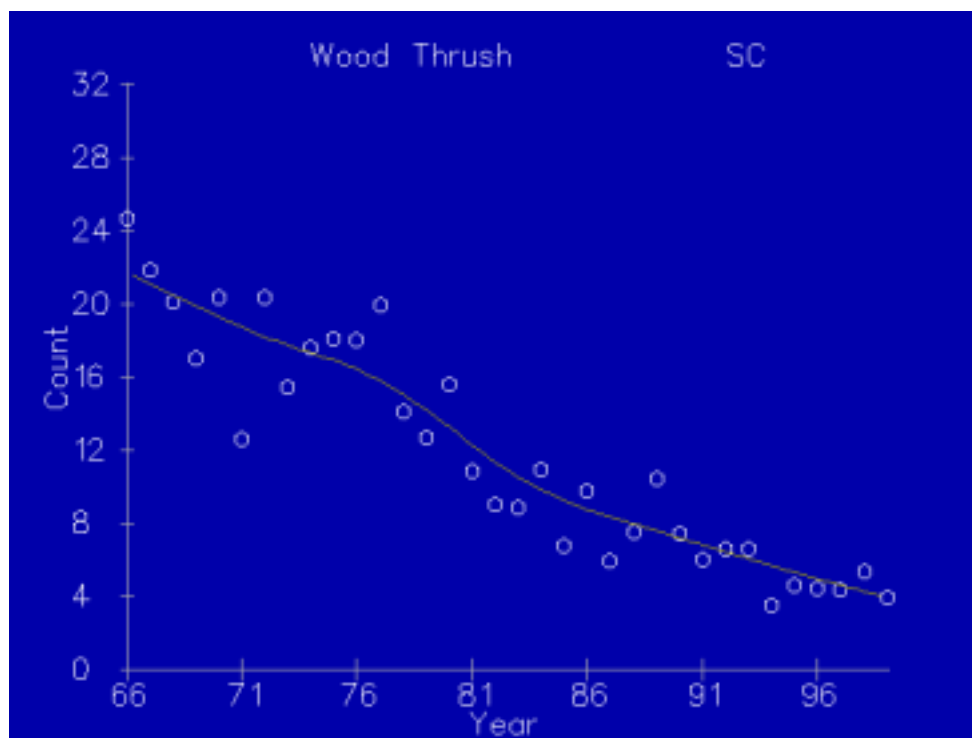
The following sources of data and information were used in this analysis:

- Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North*

*American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD*

- USDA Forest Service. Francis Marion National Forest. Forest records and annual bird point data (1994 – 2000)
- USDA Forest Service. Francis Marion National Forest, Annual monitoring reports (1990 –2000)
- Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

The Wood Thrush is a bird of the brushy woodlands with a deciduous but fairly open understory. Populations of Wood Thrush appear to have been steadily declining (trend estimate  $-5.07$ ;  $p = .00$ ; Sauer et al., 2000) across South Carolina (Figure 41)

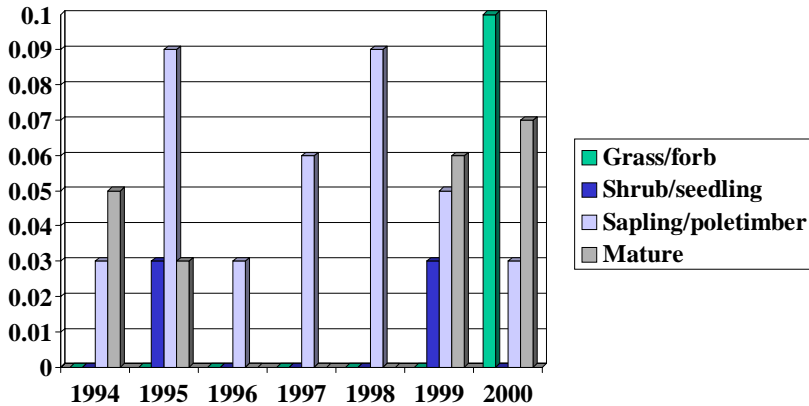


**Figure 41. Average number of Wood Thrush per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

A total of 739 bird point counts were conducted on the Francis Marion National Forest from 1994 through 2000. There were 35 detections of Wood Thrush during 26 of the 739 point counts.

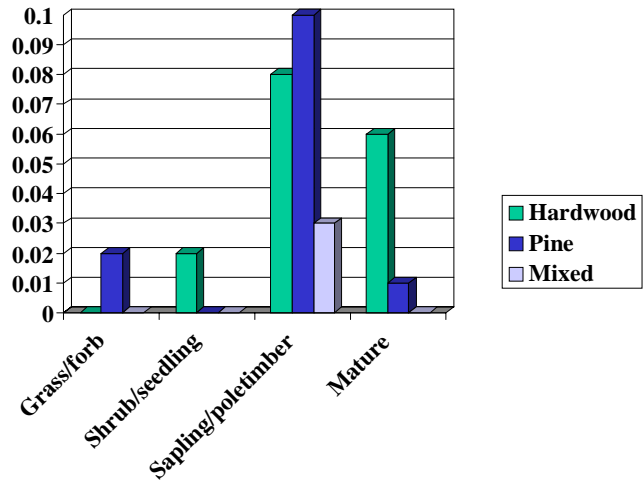
Point counts conducted on the Francis Marion indicate Wood Thrush is not common and has no

large trends in abundance apparent (Figure 42). In the coastal plain, Wood Thrush appears to be associated primarily with sapling/poletimber habitat conditions (Figure 42a) on both bottomland and upland sites (Figure 42b). Three out of four observations occurred in sapling/poletimber stands.

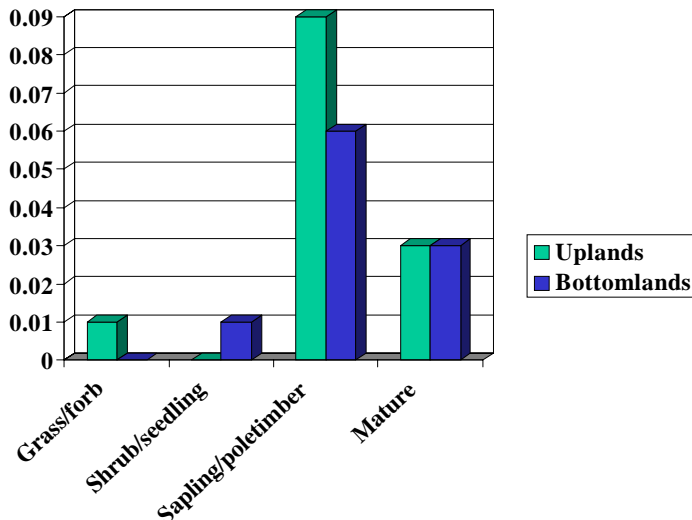


**Figure 42. Percentage occurrence of Wood Thrush on point counts by successional stage on the Francis Marion National Forest, 1994 - 2000**

**Figure 42a. Percentage occurrence of Wood Thrush on point counts in hardwood, pine and mixed forest habitats on the Francis Marion National Forest, 1994 - 2000**



**Figure 42b. Percentage occurrence of Wood Thrush on point counts in bottomland and upland habitats on the Francis Marion National**



## Effects of Management

Wood Thrush prefers deciduous or mixed forests with a deciduous understory especially on moist sites in the bottoms or elsewhere (Hamel 1992, p. 239). Wood Thrush responds to the presence of structure at understory and low midstory levels in a forested setting. Removal of shrubs, suppressed tree stems or shade tolerant vegetation reduces habitat quality for Wood Thrush. Overstory treatments, such as thinnings, enhance habitats by promoting growth of understory vegetation. Wood Thrush is widespread across the Francis Marion, and there are no apparent trends in habitat utilization or frequency of occurrence in terms of management activities at this time. It is interesting to note the upward trend in frequency of occurrence and the utilization of a wider variety of habitat conditions in recent years (1999 – 2000).

Annual monitoring reports (1990 – 2000) indicate that Wood Thrush populations on the Francis Marion are stable. Point count results indicate breeding Wood Thrush are not common and found only in certain habitats that are abundant and well distributed. One exception is hardwood grass/forb conditions. Given these factors, we believe there is a high likelihood that populations of Wood Thrush will persist on the Francis Marion for the foreseeable future.



## Rock Outcrops

### Blackstem Spleenwort (S)

Blackstem Spleenwort, *Asplenium resiliens*, was identified as an MIS for the Sumter National Forest due to concerns for species persistence (1985). The Sumter Plan states that we will monitor habitat and populations for Blackstem Spleenwort (p.G-8). The following sources of data and information were used:

- ❑ Forest ARCVIEW data, 2001
- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Southeastern Wildlife Services Incorporated. 1980. *Inventory of Threatened or Endangered Plants on the Sumter National Forest*. Athens, GA
- ❑ Forest Monitoring Reports, 1990-1999

Blackstem Spleenwort is a widespread fern known from southern Pennsylvania to Illinois, west to Missouri and Oklahoma, and south to tropical America. Blackstem Spleenwort is ranked G5 by the Nature Conservancy (demonstrably secure throughout the range) and S1S2 by the State Heritage Program (imperiled in the state). Although 4 populations are shown on the State Heritage Database, only 2 have been relocated in the last 20 years. Blackstem Spleenwort is no longer on the Regional Forester's sensitive species list, due to the security of the species range wide.

Monitoring of Blackstem Spleenwort has been conducted by Chick Gaddy, Doug Raynor, and by Southeastern Wildlife Services.

### Effects of Management

Inventories for Blackstem Spleenwort are conducted during the biological evaluation process. Mitigation is incorporated into project decisions to conserve populations as needed.

Blackstem Spleenwort inhabits moist to dry calcareous sedimentary or metamorphic rocks, mostly at low to moderate elevations (Weakley, 2000). On the Andrew Pickens Ranger District, these habitats are limited to the Brevard Geologic Belt. Three of the known locations for Blackstem Spleenwort occur in proposed botanical areas, including Poor Mountain, Tamassee Knob, and Tamassee Creek, and one occurs in the Chauga Scenic Area. These locations are generally protected from management, although Poor Mountain is prescribed burned to promote regeneration of the table mountain/pitch pine communities that occur there. Fire would not likely affect this species, since the vegetative fuel needed to carry a fire is limited on rock outcrops.

Habitat for Blackstem Spleenwort appears to be stable where it occurs on the Andrew Pickens. Efforts to identify rock outcrop habitats are ongoing, though this habitat type is relatively rare on the Sumter National Forest.

### Need for Change

Blackstem Spleenwort populations need to be monitored at least every 5 years to ensure population persistence.

## Basic Mesic Forests

### American Wahoo (S)

American Wahoo, *Euonymus atropurpureus*, was listed as an MIS in the Sumter Plan (1985) due to concerns for species persistence. The species was considered sensitive in 1985, although it no longer meets the criteria for sensitive. The Nature Conservancy ranks the species a G5, demonstrably secure throughout the range, but the State Heritage Program ranks it S1, critically impaired in the state. The Sumter Plan states that we will field review populations and habitat for American Wahoo (p.G-9). The following sources of data and information were used:

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Nelson, J. 2000. Botanical Survey in the Little Mountain Analysis Area. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Southeastern Wildlife Services Incorporated. 1980. *Inventory of Threatened or Endangered Plants on the Sumter National Forest*. Under contract with the U.S. Forest Service, Columbia, SC
- ❑ Foster, J. and R. Roecker. Miscellaneous habitat surveys and population searches.

American Wahoo is an erect shrub known from the mountains and piedmont of North Carolina, South Carolina, and Virginia, and the coastal plain of Virginia. Although two sites for American Wahoo are identified for the Sumter National Forest in the State's database (BCD, 2001), the occurrences have not been observed in years. No new occurrences for the species have been discovered, despite numerous survey efforts to identify rare, threatened, and endangered species on the Sumter National Forest (Raynor, 1996, 2000; Horn, 1996, 2000; Nelson, 1996, 2000; Hill, 1993, 1996; Gaddy, 1991; various Forest Service personnel).

The site on the Andrew Pickens is along Cedar Creek and was identified in 1938. The site on the Long Cane Ranger District was located in 1980 by

Southeastern Wildlife Services, at which time 48 plants were identified. Despite numerous visits to the site (Foster and Roecker; Nelson, 2000), and despite habitat protection efforts, the species has not been relocated.

### **Effects of Management**

American Wahoo is an uncommon species on slopes over mafic or calcareous rock (Weakley, 1999), otherwise called basic mesic communities (Roecker, 2000). Both of the historic sites for American Wahoo on the Sumter National Forest occur in proposed botanical areas, within which neither timber management nor road building are being practiced. As part of the Sumter Plan Revision process, Basic Mesic Forest communities have been identified as rare communities and have been the focus of botanical area designation. On the Sumter 4,420 acres on the Andrew Pickens, and 360 acres on the piedmont are designated as botanical zoological areas that support basic mesic-forested communities. Efforts to identify additional examples of high quality basic mesic communities are ongoing.

Although a concern for viability of American Wahoo may exist at the state level, the species is thought to be stable throughout the existing range to merit a G5 ranking by the Nature Conservancy. It is possible that the species is overlooked during survey efforts, due to its similarity to the more common strawberry bush, *Euonymus americanus*. Habitat for the species appears to be stable on the Sumter.

### **Need for Change**

Based on lack of occurrences on the Sumter National Forest, the security of the species range wide, and the protection of habitat, which is currently being practiced, we suggest American Wahoo be removed from the MIS list due to the low management risk to the species. Given the importance of American Wahoo habitat to meeting biodiversity objectives, we suggest that another indicator of these plant communities be used in the future.

### **Calcareous Mesic Forest Communities (FM)**

Calcareous Mesic Forests were identified as a MIS in the Francis Marion Plan due to concerns for community diversity. The Francis Marion Plan states that we will collect baseline data on the occurrence and extent of these communities on the Francis Marion (p. B-38). The following sources of data and information were used:

- Porcher, R. 1982. Inventory of Unique Natural Areas of the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- Roecker, R. and B. Pittman, State Botanist. Habitat Monitoring at Guilliard Lake Research Natural Area and Sewee Shell Mound

Calcareous Mesic Forests are similar to southern mixed hardwood forests, but differ in that they occur over soils which are neutral to slightly basic in pH, have high levels of calcium and magnesium, and often occur in association with marl or limestone outcroppings. Diagnostic species include Redbud, Paw Paw, Nutmeg Hickory, and Bloodroot. Rare or uncommon species include Carolina Spleenwort, Blackstem Spleenwort, American Wahoo, and Ginseng.

Primary locations for calcareous mesic forests on the Francis Marion include Guilliard Lake Natural Area (18 acres) and Sewee Shell Mound (approximately 10 acres). Disturbed examples of calcareous communities may occur in the vicinity of the Santee Experimental Forest in association with nutmeg hickory.

### **Effects of Management**

Both Guilliard Lake Research Natural Area and Sewee Shell Mound are in scenic areas within Management Area 8, which is designated unsuitable for timber production. These communities have been highly threatened range wide by historically

logging (Weakley, 1998). They are also threatened by invasive exotics, which out compete the native flora. The calcareous communities that we have identified on the Francis Marion National Forest are stable at this time. The Forest Service is cooperating with the SC Heritage Trust in a more comprehensive inventory of calcareous communities throughout the South Carolina coastal plain.

### **Need for Change**

Greater effort needs to be placed on the inventory and restoration of these communities on the Francis Marion.

### **Columbo (S)**

Columbo, *Frasera caroliniensis*, was identified as an MIS in the Sumter Plan, due to a concern for species persistence. This species is no longer considered sensitive. Columbo has a G5 ranking by the Nature Conservancy, which means that it is demonstrably abundant throughout the range and S1 ranking, critically imperiled in South Carolina. The Sumter Plan states that we will monitor populations and habitat (p.G-9, formerly *Swertia caroliniensis*). The following sources of data and information are used:

- South Carolina State Heritage Data (Biological Conservation Database), 2001.
- Horn, C. 1997. An Ecological Study of *Frasera caroliniensis* in South Carolina. *Castanea* 62:185-193.
- Roecker, R. 2000, J. Foster 1999, and J. Crooks 1992, FS personnel. Population and Habitat Monitoring.
- Sumter Forest Monitoring Reports (1990-1999)
- Southeastern Wildlife Services (1980)

Columbo is a widely distributed perennial plant, known from New York to southern Wisconsin, and south to Georgia, Mississippi, and Arkansas. Horn (1997) described 7 Columbo populations in South Carolina, all located on the piedmont. Three of these occur on the Sumter: two on the Long Cane and one on the Enoree.

Columbo populations on the Sumter are currently protected from management and appear to be thriving. An extensive population along Dry Creek has over 10,000 plants (Horn, 1997), and Foster (1999) counted over 12,000. Other populations include John's Creek (1,000 plants) and a population near the Enoree River (200-300 plants).

### **Effects of Management**

Horn (1997) found that typical habitat for Columbo in South Carolina was mixed mesic hardwood forests, although it has been noted to occur in association with calcareous substrates. Columbo populations on the Sumter appear to be restricted to basic mesic forest communities and occur in those areas currently proposed for botanical area designation (1999). One of the sites was prescribed burned in 2000, and one occurred at the edge of a stand, which was clearcut in the early 1990s. Although the prescribed burn did not harm the plant (Roecker, personal observation) the high light conditions created by the clearcut resulted in a loss of some individuals. However, it did not appear to harm population viability (Crooks, Roecker, personal observations).

Columbo populations, although restricted to basic mesic forest communities in the piedmont, appear to be abundant and healthy where they occur. Given the protection currently afforded these sites, and the large size of the known populations, it is concluded that columbo is stable on the Sumter.



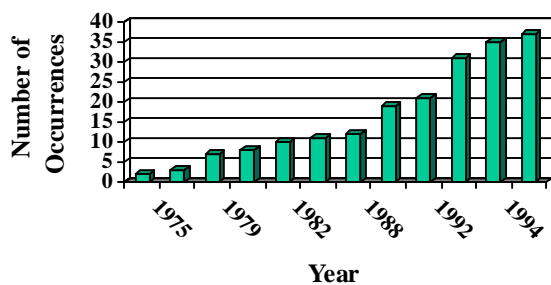
## Ginseng (S)

Ginseng, *Panax quinquefolius*, is a medicinal plant which was identified as a MIS for the Sumter National Forest due to concerns for species persistence reflected in a sensitive species status. The Sumter Plan states that populations and habitat for Ginseng will be monitored (p.G-8). The following are the sources of data and information used:

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001.
- ❑ Foster, J., R. Roecker, and P. Shatley. Miscellaneous habitat and population monitoring.
- ❑ Sumter Forest Monitoring Reports (1990-1999)
- ❑ Southeastern Wildlife Services (1980)

Ginseng is no longer considered sensitive by the Regional Forester but is considered rare within the state of South Carolina. Ginseng is a widely distributed plant, having been observed in at least 32 states (Southeastern Wildlife Services, 1980), as well as in the provinces of Quebec, Ontario, and Manitoba.

Several occurrences for the plant are known from the Sumter. Most of our known populations occur on the Andrew Pickens (28), 8 occur on the Long Cane, and 1 historic site is known from the Enoree. Southeastern Wildlife Services first documented this plant on the Sumter National Forest in 1980. New occurrences for the species have been discovered



**Figure 43. Cumulative Numbers of Occurrences for Ginseng on the Sumter National Forest, 1975-1995**

on the forest since then, as a result of several inventories for rare, threatened, and endangered species (Raynor, 1996; Hill, 1993; Gaddy, 1991), and by district personnel (Chuck Andrews, former employee).

## Effects of Management

Ginseng is strongly associated with basic mesic hardwood forests found on north-facing and lower slopes on the Sumter. Suitable habitats occur in older, deciduous forests, in habitat that is scattered throughout the forest, particularly near streams.

Special use permits authorizing the collection of Ginseng are not issued on the Sumter. Illegal collecting is undoubtedly the largest threat to Ginseng viability throughout the range of the species. In 1980, populations occurring in the piedmont were larger than those in the mountains, most likely because the plant was less heavily collected in the piedmont, as compared to the mountains. (SE Services, 1980). Southeastern Services identified 180 plants in a single population (now 5 occurrences) on the Long Cane, and 72 in another. More recent monitoring by Foster (1999) located 43 at the first site, though the entire drain was not searched, and 13 at the other. No plants were found at two other sites visited. These numbers suggest a decline in the vigor of Ginseng populations occurring on the piedmont. In 1980, the populations on the Andrew Pickens typically ranged from 1-4 individuals, though one site supported 15.

Ginseng populations are well distributed on the Andrew Pickens, but occur much less commonly on the piedmont. This is probably the result of historic land clearing and subsequent erosion that occurred extensively throughout the piedmont before Forest Service acquisition.

Based on the increased number of occurrences on the Sumter, but the lack of more information specific to each occurrence or population and the likely vulnerability of this species to over collecting, we are unable to determine the status of Ginseng on the Sumter at this time.

## Need for Change

More frequent or intensive monitoring is needed to ensure that populations are large enough to be maintained into the foreseeable future and that illegal collecting does not jeopardize the species viability. We recommend a system of permanent monitoring plots.

## Mixed Mesic Forests

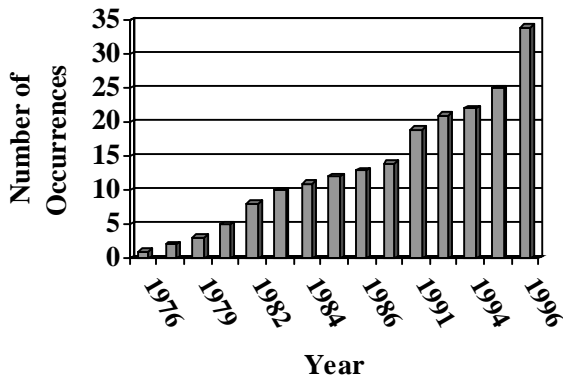
### Piedmont Strawberry (S)

Piedmont Strawberry, *Waldsteinia lobata*, was identified as an MIS for the Sumter National Forest due to its status as sensitive and thus concerns for species persistence. The Sumter Plan states that we will field review populations and habitat for Piedmont Strawberry (p.G-9). The following sources of data and information are used:

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Shatley, P., District Biological Technician. Miscellaneous habitat and population monitoring
- ❑ Sumter Monitoring Reports (1990-1999)

Piedmont Strawberry is a perennial, herbaceous plant in the rose family, which commonly occurs on the Andrew Pickens where it forms large, extensive colonies. A Southern Appalachian endemic, the plant is known only from the mountains of North and South Carolina. On the Sumter, 34 occurrences are known from low-moderate elevations (750-1750 ft.), on the southern half of the Andrew Pickens. New populations for the species have been discovered as a result of several inventories for rare, threatened, and endangered species (Raynor, 1996; Hill, 1993; Gaddy, 1991), and by district personnel (Chuck Andrews, former employee). Some of the populations are very large and extensive, containing as many as 5,000 stems (Perry Shatley, personal comment).

The following are trends in the number of total known occurrences for Piedmont Strawberry on the Andrew Pickens, by year:



**Figure 44. Cumulative Numbers of Occurrences for Piedmont Strawberry on the Sumter National Forest, 1976-1996**

### Effects of Management

Piedmont Strawberry occurs in mixed mesic hardwood forests, often associated with north-facing slopes along streams and an understory of mountain laurel or rhododendron. Few projects on the Sumter have adversely impacted individual Piedmont Strawberry plants or associated habitats, since most projects occur in drier ridgetop communities in association with pine. Through the biological evaluation process, population viability for Piedmont Strawberry is maintained if the plant is encountered in association with projects. Site visits by Forest personnel suggest that populations are stable as well.

### Small Whorled Pogonia (S)

The Sumter Plan states that we will field review populations and habitat for Small Whorled Pogonia, *Isotria medeoloides*, (p.G-8). Small Whorled Pogonia was included as an MIS species for the Sumter National Forest due to concerns for species persistence. The following sources of monitoring data and information are used:

- South Carolina State Heritage Data (Biological Conservation Database), 2001.
- Gaddy, C. 1985. The Status of *Isotria medeoloides* in South Carolina. SC Wildlife and Marine Resources, Columbia, SC
- Oettingen, S. 1992. Small Whorled Pogonia Recovery Plan – First Revision. U.S. Fish and Wildlife Service – R05, Newton Corner, MA
- Roecker, R., Forest Botanist. Population Data collected in 1995, 1998, 2000

Small Whorled Pogonia is a terrestrial orchid listed as Federally endangered in 1982, and down-listed to Federally-threatened in November, 1994. It is widely distributed, with a primary range extending from southern Maine and New Hampshire to northern Georgia and southeastern Tennessee. It occurs on the Andrew Pickens only, where 8 occurrences for the plant are known. Populations are very small in size, and some appear to have disappeared. The following are trends in the number of Small Whorled Pogonia plants at each of the 8 locations.

**Table 18. Population trends for Small Whorled Pogonia on the Sumter National Forest 1982-2000**

Location	Number of Plants by Year								
	1982	1985	1987	1988	1989	1991	1995	1998	2000
Lower King	8	12	10	13	14	14	6	0	0
Upper King	8	6	6	6	6	3	2	0	0
Middle King	nk	10	3	0	5	0	nf	nf	nm
Upper Crane	nk	1	1	0	0	0	0	0	nm
Old Burrell's	nk	4	2	1	1	1	nf	nf	nm
Indian Camp	nk	nk	nk	nk	nk	nk	45	21	13
Bone Camp	nk	nk	nk	nk	nk	nk	nk	7	2
Spoonauger	2	0	0	0	0	0	0	0	nm
Total Known	18	33	22	20	26	18	53	28	15
nm= not monitored; nf=not found; nk=not known									

## Effects of Management

Inventories for Small Whorled Pogonia are conducted during the biological evaluation process. Appropriate mitigation, as needed, is identified in cooperation with the U.S. Fish and Wildlife Service to conserve populations associated with projects.

The Sumter Plan (p.IV-3) has a specific guideline to “protect the existing colony of *Isotria medeoloides*, within the general forest area, by placing a 50 ft. buffer, no harvest zone around it,” and all of the known Small Whorled Pogonia populations have been protected from timber management since 1985. The largest population, Indian Camp, was discovered in 1995 and occurs in Ellicott Wilderness. Habitat for Small Whorled Pogonia is mixed-deciduous or mixed deciduous-coniferous forest, generally second or third growth. Most sites have sparse to moderate ground cover, are mesic, have relatively open understory canopy and are near streams or old roadbeds (Oettingen, 1992; Gaddy,

1985). Many of the sites show evidence of past human disturbance. Gaddy (1985) noted the presence of white pine, *Pinus strobus* at each of the sites visited.

Small Whorled Pogonia may require management to modify light levels. In Maine and in New Hampshire, the removal of woody vegetation as well as herbaceous and shrub cover in the vicinity of Small Whorled Pogonia, has increased the number of Small Whorled Pogonia plants. The Sumter working with the Fish and Wildlife Service is proposing to conduct tree girdling (of larger trees), or tree removal of small trees and shrubs, in the vicinity of Small Whorled Pogonia sites which have exhibited declines this year.

The abundance of Small Whorled Pogonia on the Sumter peaked at 53 plants in 1995, following the discovery of a large population at Indian Camp in the Ellicott Rock Wilderness. However all populations of Small Whorled Pogonia on the Sumter are exhibiting declines, and some seem to have disappeared. These declines could be normal population fluctuations, typical of many orchids. They may be related to an increase in the amount of vegetation surrounding individual plants. These declines could be due to other threats such as plant eating animals or over collecting.

### Need for Change

Research is needed to ensure that we are managing this species appropriately, including habitat manipulation followed by close monitoring. Due to the small population size, and restricted distribution, it is recommended that this species be removed from the MIS list.



### Southern Mixed Hardwood Forest (FM)

The Southern Mixed Hardwood Forest was listed as an MIS in the Francis Marion Plan due to concerns for community diversity. The Francis Marion Plan states to collect baseline information on the abundance and distribution of this type (p.B-38). Sources of data and information include:

- ❑ Porcher, R. 1982. Inventory of Unique Natural Areas of the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Porcher, R. 1991. Final Report on Post-Hugo Study on Ecological Status of Natural Areas on the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ FM Forest CISC data, 2000

Southern mixed hardwood forests occur on the coastal plain on sites that are sheltered by topography and moisture from fire, mesic upland areas, small isolated ridges surrounded by swamps, north-facing slopes, and protected slopes above floodplains. They are typically uneven-aged and dominated by a variety of hardwood species including Beech, Tulip Poplar, Florida Maple, Wild Olive, and various species of oaks. Spruce Pine is a rare occurrence in these communities. Common shrub species include Horse Sugar and Witch Hazel, with Christmas Fern, Southern Lady Fern, Partridgeberry, and a variety of spring wildflowers in the understory of undisturbed sites. Unusual species include Spruce Pine, Three Birds Orchid, Huguenot Fern, and Southern Adder's Tongue.

Richard Porcher identified seven areas in southern mixed hardwood forest, totaling 200 acres, as unique natural areas on the Francis Marion National Forest during inventories in 1982. The beech-magnolia forest type, using CISC data, occurs on 17 acres. Other remnants of the southern mixed hardwood forest, which was once widespread in the southeast in the absence of fire, occur as inclusions throughout the forest, especially when surrounded by swamps and other wetlands that would burn on

an infrequent basis, or have otherwise escaped human disturbance. Likely places to encounter southern mixed hardwood forests on the Francis Marion including bluffs along the Santee River, Nicholson and Huger Creeks, in the vicinity of Echaw Road, and in compartments 85 and 176.

### Effects of Management

The southern mixed hardwood forests identified as natural areas are protected from timber harvesting and other management that would modify the natural biodiversity. However, in 1989 Hurricane Hugo destroyed many of the canopy dominants in at least 6 of the 7 natural areas, which has led to a profusion of early successional and weedy species. In Porchers' post-Hugo report, he recommends that fire be excluded from these areas so that succession can proceed at a natural rate. Research is needed to understand the historic distribution and abundance of Southern Mixed Hardwoods on the Francis Marion, and their role in biological diversity.

### Webster's salamander (S)

Webster's salamander, *Plethodon websteri*, was added to the MIS list for the Sumter Plan (1985) due to concerns for species persistence. Considered endangered by the state, it is ranked G4 by the Nature Conservancy, suggesting that it is relatively secure range wide. The Sumter Plan (p.G-7) states that we will field review populations and habitat for Webster's salamander in conjunction with SCDNR. Unfortunately SCDNR is not conducting any monitoring for this species. The Forest Monitoring Handbook recommends that all sites (6 at that time) be visited during wet weather, noting significant ground disturbance within 100 ft. of the stream and recording numbers of Webster's salamanders by turning logs, bark, and raking leaf litter within ½ chain of stream or drainage. The following sources of data and information are used for this report:

- ❑ South Carolina State Heritage Data Biological Conservation Database (BCD, 2001).
- ❑ Semlitsch, R. and C. West. 1983. Aspects of the Life History and Ecology of Webster's Salamander, *Plethodon websteri*. *Copeia* (2):339-346.
- ❑ Gibbons, W. and D. Scott. 1993. A study to investigate the occurrence of a state endangered species (Webster's salamander, *Plethodon websteri*) on GS Roofing Products Company, Inc. property in McCormick County, SC. Unpublished Report.
- ❑ Foster, J., District Biological Technician. Habitat and population monitoring data collected during 1990-1999.
- ❑ Gibbons, W., J. Greene, R. Semlitsch, and B. Metts. Population monitoring conducted on March 1, 2001. Unpublished data.

Webster's salamander is known primarily from east central Alabama and west central Georgia, with disjunct populations occurring in south central Mississippi, southern Alabama, and southwestern South Carolina. In South Carolina, Webster's salamander occurs in the Savannah River drainage, and is known from Turkey, Stevens, and Cuffeytown Creek watersheds on the Long Cane (BCD, 2001).

The State BCD shows 46 occurrences for Webster's salamander in South Carolina and 25 occurrences on National Forest land, mostly restricted to moist, mixed hardwood slopes with rocky outcrops. The following are trends in the number of known occurrences, by year, in the Sumter National Forest.

Ray Semlitch conducted the most intensive population monitoring for Webster's salamander on the Sumter National Forest during 1980 and 1981. From January 1980 through June 1981, Semlitsch collected a total of 746 Webster's salamanders from 2 sites on the Sumter.

**Table 19. Cumulative Numbers of Occurrences for Webster's salamander on the Sumter National Forest (1980-1995)**

Date Discovered	# of Occurrences
1980	2
1981	3
1982	4
1983	11
1984	12
1991	13
1992	17
1994	20
1995	25

Foster (1990-1999) conducted site-specific monitoring annually in all known Webster's salamander sites from 1989-1992, and annually in 1/3 of all sites from 1993 to present, noting the number of Webster's salamanders found at 15-minute intervals, and any evidence of habitat disturbance. During this time, she captured and released 59 Webster's salamanders, only sampling at 15-minute intervals. She also documented several new locations for the species.

Gibbons and Scott documented 22 Webster's salamanders from two sites on the Sumter when sampling during November and December of 1993. Gibbons and others collected 57 Webster's salamanders during 3-person hours in March 2001.

### Effects of Management

Optimal habitat for Webster's salamander is mesic, mixed hardwood forests on north-facing slopes with rock outcrops on or near the surface (Wilson, 1995). On the Long Cane Ranger District, it occurs adjacent to perennial streams within the Turkey, Stevens, and Cuffeytown Creek watersheds. Here,

Webster's salamanders typically live in or under moist debris, including logs in various stages of decay and a well-developed leaf or humus layer. A canopy maintained over known sites provides the necessary moisture regime within the forested interior.

Monitoring of Forest-level activities in and around Webster's salamanders sites, suggests that little disturbance has occurred there (Monitoring Reports – 1990-1999). The monitoring reports note that in 1994, one of the sites was prescribed burned, and in 1997, a timber sale occurred in proximity to a known site. Post-activity monitoring suggests that in both cases, no visible signs of disturbance to Webster's salamander habitat were evident.

Two of the 25 known Webster's salamander sites occurred in the Stevens/Turkey Creek Scenic Area (Sumter Plan, 1985), where little cutting is practiced, and 9 occurred in a corridor being considered for Wild and Scenic River designation (Sumter plan revision process, ongoing). Although Webster's salamander does not currently meet the criteria for sensitive as defined by the Forest Service, state endangered animals are protected from "take" by state legislation. Current practice is to maintain at least a 66-foot no-cut buffer zone around known sites (Foster, personal comment).

Based on conclusions drawn from the Forest Monitoring reports (1990-1999), management activities overall don't appear to be affecting Webster's salamander habitat on the Sumter. Based on the increasing number of occurrences for Webster's salamander which have been identified on the Sumter since 1980, and the large numbers of Webster's salamanders collected in a relatively short time by Semlitsch (1980-1981) Foster (1990-1999), and Gibbons and Scott (1993; 2001), it is concluded that Webster's salamander populations are stable on the Sumter. Although Webster's salamander appears to be restricted to three watersheds on the Long Cane Ranger District, it is abundant there.

## Maritime Forests

### Maritime Forest Communities (FM)

Maritime Forests were listed as MIS in the Francis Marion Plan due to concerns for biological diversity and representation of this uncommon plant and animal community. The Francis Marion Plan states that we will determine baseline acreage for this community type (p. B-38). The following sources of data and information were used:

- ❑ Forest Continuous Stand Inventory data (CISC) for the Francis Marion National Forest
- ❑ Porcher, R. 1993. Botanical Inventory of the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.

Maritime forests occur on barrier islands and the outer coastline from South Carolina to mid-Florida. A high diversity of plant species can be found in the canopy and shrub layers typically including live oak, laurel oak, southern magnolia, cabbage palmetto, red bay, wild olive, buckthorn, and wax myrtle. Maritime forests occur at elevations ranging from 5 to 15 ft. above sea level, often with a water table from 2-3 feet below the surface. They may be found in close association with wetland marsh and maritime shrub-dominated swamps. On the Francis Marion, maritime forest occur on an estimated 233 acres and this acreage is increasing if one includes recent acquisitions near Cape Romain Wildlife Refuge.

Most of the forested upland communities of Tibwin, located east of Highway 17, were severely damaged by Hurricane Hugo, especially those inland from the salt marsh. An upland community with a mix of maritime and oak-hickory species can still be found along the upper reaches of Tibwin Creek, and the maritime communities along Tibwin Creek and the Intracoastal Waterway were not severely impacted (Porcher, 1993). In a floristic survey of South Tibwin, Richard Porcher documented 210 species in August 1993.

### Effects of Management

Maritime forests are threatened regionally by coastal development, including highway construction, subdivision development, and associated recreational impacts. Fire appears to be an important component of maritime forest ecology (Bellis, 1995); however, due to their proximity to State Hwy. 17, the maritime forests on the Francis Marion National Forest are difficult to burn.

The maritime forests on the Francis occur in Management Area 26, with the goal to restore, expand, and maintain the longleaf ecosystem and related fire-dependent communities. This goal does not preclude the maintenance of a mosaic of plant communities, which are associated with fire-maintained ecosystems. Forest Objective #14 is to “identify and maintain existing acreage in ...southern Atlantic maritime forests.”

The existing maritime forests that occur on the Francis Marion appear to be stable at this time, but conserved examples are uncommon. The continued acquisition of this resource into the National Forest system is encouraged as is more extensive inventory and careful mapping across the Francis Marion.

### Painted Bunting (FM)

Painted Bunting, *Passerina ciris*, was identified as an MIS for the Francis Marion National Forest to serve as an ecological indicator for maritime shrub/scrub and forest edge habitats in the coastal plain (Francis Marion MIS selection process record). To monitor the effects of Plan implementation on this species, Appendix B of the Francis Marion Plan states that we will collect point count data, calculate population trends and compare with habitat changes over time. Bird point counts have been conducted since 1994 using methods described in Hamel et al. (*A Land Manager's Guide to Point Counts of Birds in the Southeast*, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in monitoring reports.

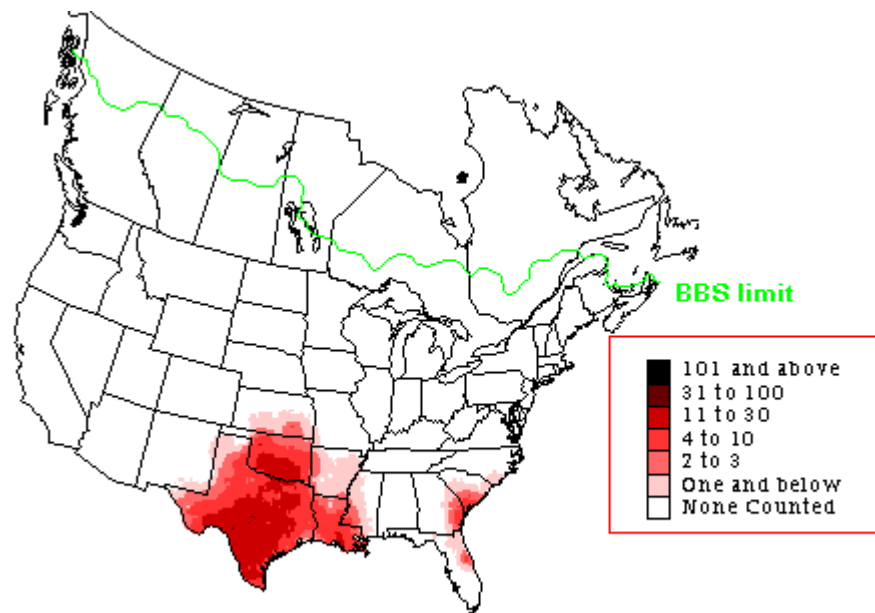


The following sources of data and information were used in this analysis:

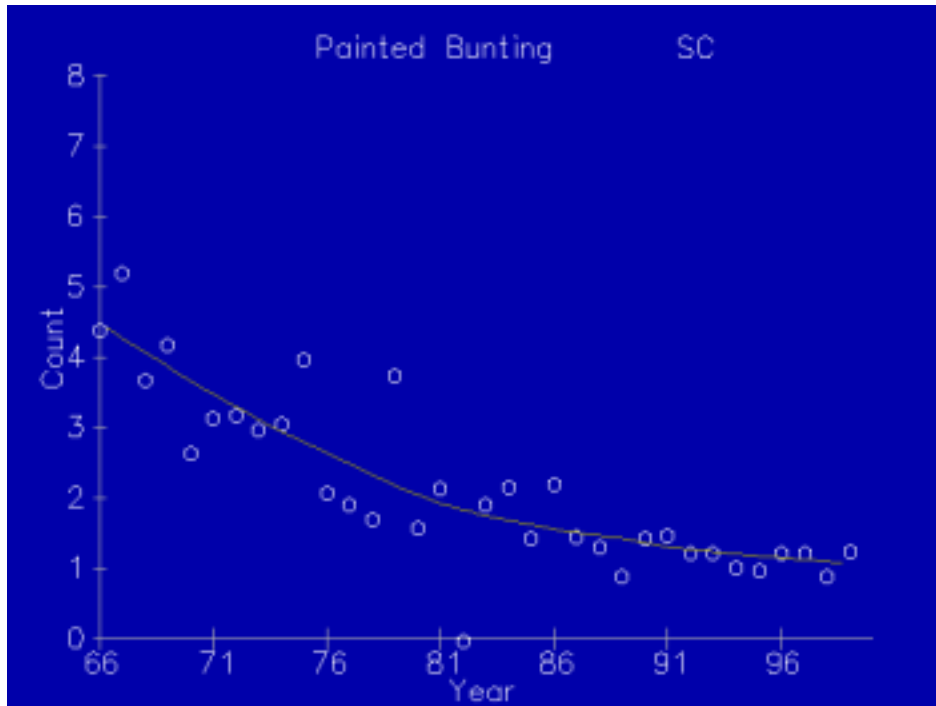
- Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- USDA Forest Service. Francis Marion National Forest. Forest records and annual bird point data (1994 – 2000)
- USDA Forest Service. Francis Marion National Forest, Annual monitoring reports (1990 –2000)
- Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

Painted Buntings are a bird of the edge habitats and transition zones between forested areas and grass/shrub habitats. They are commonly found in swampy thickets, woodland edges and hedgerows primarily in coastal regions, and in association with marine maritime scrub shrub habitats.

There are two distinct populations of Painted Bunting in the United States. The Francis Marion is in the Atlantic coast regional population (Figure 45). Painted Buntings have the highest concern score (Partners in Flight) of any species in the South Atlantic Coastal Plain except for federally listed endangered species. Populations of Painted Bunting appear to have been steadily declining (trend estimate  $-5.17$ ;  $p = .065$ ; Sauer et al., 2000), across South Carolina (Figure 46).



**Figure 45. Distribution of Painted Bunting breeding populations in the continental United States, 1966 – 1996**



**Figure 46. Average number of Painted Buntings per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

Annual landbird monitoring on the Francis Marion has recorded 2 singing males in 6 years of data collection and is currently unusable as a means to assess population abundance or frequency of occurrence on the Francis Marion. Both detections occurred in upland hardwood forest types.

Marine maritime shrub/scrub habitats on the Francis Marion are grouped into a forest type collectively labeled “oak hammock.” The area of this forest type has remained constant on the Francis Marion since Hurricane Hugo at approximately 233 acres.

**Effects of Management**

Painted Buntings prefer dense thickets, wood margins and other dense shrubby areas such as the borders of second-growth woods (Hamel 1992, p. 299). While buntings can be found frequently in close proximity to human residences and urban situations, the principle threat to the species is habitat loss. Based on the index of population trends provided by the National Breeding Bird

Survey compared to the small amount of suitable habitat, it remains a question if populations of Painted Bunting will persist on the Francis Marion for the foreseeable future.

**Need for Change**

There is a need to add landbird monitoring points to the annual landbird monitoring program located in habitats likely to contain Painted Bunting, i.e., marine maritime shrub/scrub, and forest edges near suitable habitats. Making maritime and oak hammock habitats should also be a high priority for land acquisition on the Francis Marion. Due to its extremely limited distribution on the forest, however, we recommend removing Painted Bunting from the Francis Marion MIS list.

## Pocossins

### Bay-Swamp Pocossin Communities (FM)

Bay-swamp pocossin (low pocossin) was included as an MIS for the Francis Marion National Forest due to concerns for maintaining biological diversity. The Francis Marion Plan states that we will collect baseline data on the abundance and distribution of this community (p. B-38). The following sources of data and information were used:

- ❑ Porcher, R. 1982. Inventory of Unique Natural Areas of the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Porcher, R. 1993. Botanical Inventory of the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Forest ARCVIEW data, 2001

Pocossins can be found on the Atlantic Coastal Plain from Virginia to Georgia. Pocossins are deep, peat-filled Carolina bays or domed depressions with poor natural drainage, characterized by the accumulation of peat *Sphagnum* sp., nutrient-poor, acidic conditions, a dense shrub layer including Titi, *Cyrilla racemosa*, Honeycup, *Zenobia pulverulenta*, and Fetterbush, *Lyonia lucida*, and widely scattered stunted pond pine and evergreen bay trees such as Sweet Bay, Red Bay, and Loblolly Bay. Extensive pocossins may be found interspersed within flat upland areas along sandy ridgelines, or at stream heads surrounded by fire-maintained vegetation. Bay-swamp pocossins (low pocossins) are the least productive of the pocossin communities, representing the extreme in peat depth (greater than 1 meter) and wetness so that plant roots may never reach mineral soil. Pools or openings supporting herbaceous vegetation may be interspersed throughout these communities.

### Effects of Management

Severe fires may occur periodically under natural conditions (every 10-30 years) within the interior of low pocossins. Species diversity is generally higher after a fire as root sprouting results in the rapid recovery of the evergreen shrubs and small trees. Pocossin edges which support high pocossin (greater predominance of pond pine and shallower peat) will burn on a more frequent basis due to the spread of fire from the more xeric landscapes. Low pocossins on the Francis Marion are prescribed burned periodically.

Pocossins have a long history of human use including logging, peat mining, and drainage. Pocossins on the Francis Marion are typically not generally productive for timber harvesting. In the past, road building and gas line construction have occurred through some of the pocossins. These past activities do not appear to have harmed the integrity of the communities or associated plants.

An objective in the Francis Marion Plan (O-14) is to “identify and maintain existing acreage in...bay swamp pocossin...”

Due to the large number of estimated acreage in low pocossin habitat (26,850 acres), these communities appear to be stable on the Francis Marion.

## Spoonflower (FM)

Spoonflower, *Peltandra sagittifolia*, was identified in the Francis Marion Plan as a MIS due to concerns for species persistence. The Francis Marion Plan states that we will monitor the approximate size, vigor, location, and abundance of rare plant populations (p. B-26; B-36). The following sources of data and information were used:

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Porcher, R. 1982. Inventory of Unique Natural Areas of the Francis Marion National Forest. Contract with the U.S. Forest Service.
- ❑ Porcher, R. 1993. Botanical Inventory of the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Glitzenstein, J., and D. Streng. 2000. Botanical inventory of the Steed Creek Road Right-of-Way on the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.

Spoonflower is a perennial herbaceous plant endemic to the Southeastern Coastal Plain, ranging from eastern North Carolina south to central peninsular Florida and west to southeastern Louisiana. Spoonflower is ranked G3G4 by the Nature Conservancy, vulnerable to demonstrably secure, and an S? by the State Heritage Program (status unknown), though in a revision of the South Carolina List of Rare Plants for Coastal Counties (1998), Porcher recommended a status of state threatened for spoonflower. Spoonflower was removed from the Regional Forester's sensitive species list in 1996, due to its relative range wide security. On the Francis Marion, spoonflower is known from four occurrences, first identified by Richard Porcher and Danny Carlson. Two of the largest populations occurring near Steed Creek Road were remonitored by Glitzenstein and Streng (2000).

## Effects of Management

Spoonflower occurs in openings within low, wet pocossins dominated by ericaceous shrubs, Sphagnum species, and scattered pond pine. Although a road dissects two of the pocossins harboring spoonflower, the populations appear to be thriving (Glitzenstein and Streng, 2000). Another population is dissected by a gas line right-of-way that is mowed about every three years (Carlson, personal comment), and it appears to be stable. Prescribed burning influences all populations, which likely increases the vigor of these rare plant populations.

One of the pocossins harboring the spoonflower is a Natural Area first identified by Richard Porcher (1982) and designated in the Francis Marion Plan (1996). Within this botanical area, Plan direction is to "preserve the unique values...for biological diversity." An objective in the Plan is to "identify and maintain existing acreage in ...bay swamp pocossin.." Habitat for this species is likely to be stable on the Francis Marion (see discussion for bay-swamp pocossin). Due to the inaccessibility of pocossin habitats, spoonflower is likely to be overlooked on the Francis Marion and more common than it appears.

## Need for Change

Due to the restricted distribution of this plant, and since Bay-swamp pocossin habitat is already represented, it is recommended that this species be removed from the MIS list for the Francis Marion.

## Swainson's Warbler (FM)

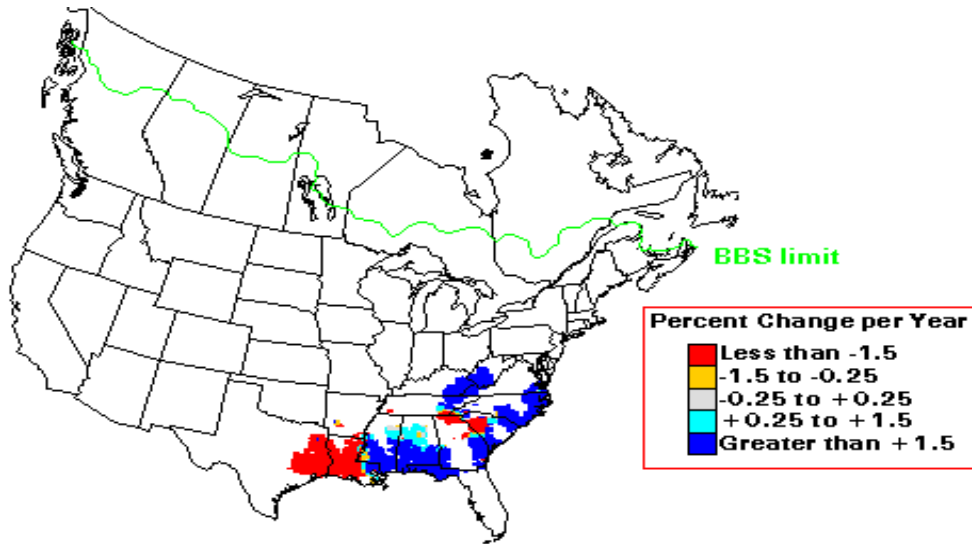
Swainson's Warbler, *Limnothlypis swainsonii*, was identified as a MIS for the Francis Marion National Forest to serve as an ecological indicator for dense understory growth in bottomland hardwoods due to its high concern score (Partners in Flight), and its preference for habitats utilized by Bachman's Warbler (Francis Marion MIS selection process record). To monitor the effects of Plan implementation on this species, Appendix B of the Francis Marion Plan states that we will collect point count data, calculate population trends and compare with habitat changes over time. Bird point counts have been conducted on the Forest since 1994 using methods described in Hamel et al. (*A Land Manager's Guide to Point Counts of Birds in the Southeast*, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in Forest monitoring reports, published annually by the Forest Service for the Francis Marion National Forest since 1990.

The following sources of data and information were used in this analysis:

- Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999*. Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD
- USDA Forest Service. Francis Marion National Forest. Forest records and annual bird point data (1994 – 2000)
- USDA Forest Service. Francis Marion National Forest, Annual monitoring reports (1990 –2000)

- Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

Coastal populations of Swainson's Warbler are birds of the dense and often impenetrable thickets with little to no ground cover such as, extensive stands of cane. National breeding bird survey information for Swainson's Warbler populations in the coastal plain of South Carolina is unavailable. However, throughout the coastal plain (which includes the Francis Marion) Swainson's Warbler populations are exhibiting an upward trend (Figure 47). Populations of Swainson's Warbler also appear to have been steadily rising (trend estimate 2.38;  $p = .11$ ; Sauer et al., 2000) across the Eastern region of the breeding bird survey (includes South Carolina).

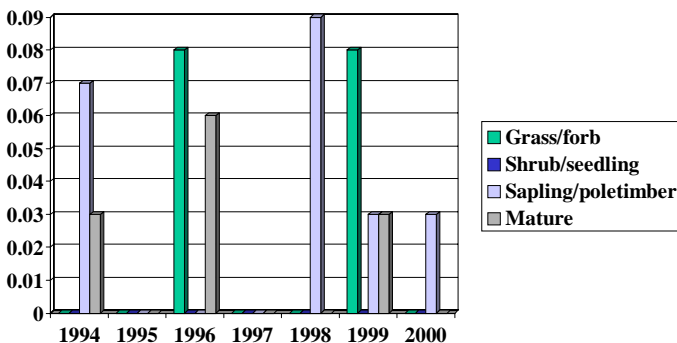


**Figure 47. National breeding bird survey trend map for Swainson's Warbler 1966 – 1996**

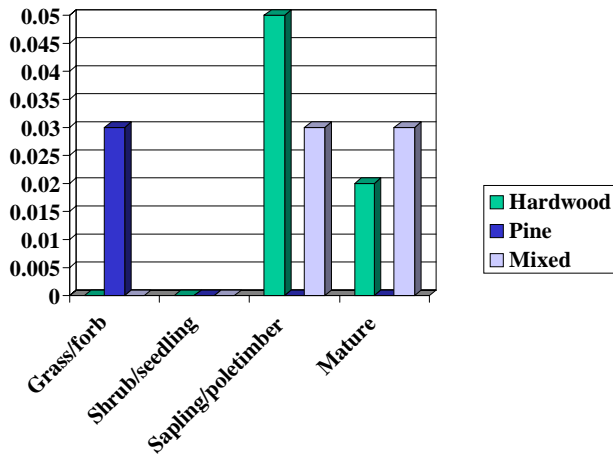
A total of 739 bird point counts were conducted on the Francis Marion National Forest from 1994 through 2000. There were 14 detections of Swainson's Warbler during 14 of the 739 point counts.

Numbers of Swainson's Warblers detected on the Francis Marion are highly variable from year to year. Point counts conducted on the Francis Marion indicate Swainson's Warblers are not abundant, appear to be limited to specific habitat conditions, and no trends in abundance are apparent (Figure

48). Swainson's Warbler appears to be associated with sapling/poletimber and mature habitat conditions in hardwood and mixed forest types (Figure 47a), primarily in bottomland sites. Swainson's Warblers are recorded in only one other habitat type – upland pine grass/forb. They are conspicuously absent from all other successional stages of pine stands and absent from seedling/sapling conditions in all forest types.

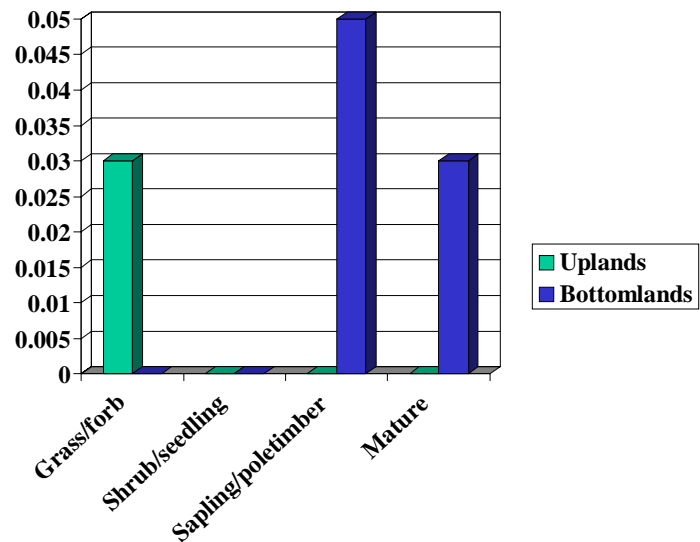


**Figure 48. Percentage occurrence of Swainson's Warbler on point counts by successional stage on the Francis Marion National Forest, 1994 - 2000**



**Figure 48a. Percentage occurrence of Swainson's Warbler on point counts in hardwood, pine and mixed forest habitats on the Francis Marion National Forest, 1994 - 2000**

**Figure 48b. Percentage occurrence of Swainson's Warbler on point counts in bottomland and upland habitats on the Francis Marion National Forest, 1994 - 2000**



### Effects of Management

In the coastal plain, Swainson's Warblers prefer bottomland hardwoods and pocossins on moist sites with a relatively dense stand of cane (Hamel 192, p. 280). Acres of bottomland hardwoods on the Francis Marion have remained essentially constant since Hurricane Hugo. There are over 25,000 acres of pocossin habitat on the Francis Marion. Management of bottomland hardwoods has been suspended since Hugo. Distribution of habitats preferred by Swainson's Warbler is limited primarily by landform and somewhat by historical land use before to Forest Service ownership. Swainson's Warbler is widespread and there is no apparent association between habitat utilization and frequency of occurrence in terms of management activities at this time.

Annual monitoring reports (1990 – 2000) indicate that Swainson's Warbler populations on the Forest are stable. Point count results indicate breeding Swainson's Warblers are found only in certain habitats that are abundant and well distributed across the Francis Marion, with the exception of upland pine grass/forb conditions. Given these results, we believe there is a high likelihood that populations of Swainson's Warbler will persist for the foreseeable future.

## Pond Cypress/Swamp Tupelo Pond Forests

### Pond Cypress/Tupelo Pond Communities (FM)

Pond Cypress/Swamp Tupelo Pond Forests were identified as MIS due to concerns for biological diversity on the Francis Marion National Forest. The Francis Marion Plan states that we will determine baseline acreage in this community type (p. B-38). The following sources of data were used:

- ❑ ARCVIEW Inclusion Layer for the Witherbee Ranger District
- ❑ Porcher, R. 1982. Inventory of Unique Natural Areas of the Francis Marion National Forest. Unpublished Report.
- ❑ Porcher, R. 1993. Botanical Inventory of the Francis Marion National Forest. Unpublished Report.
- ❑ Glitzenstein, J, D. Streng, R. Porcher, D. Carlson, and R. Roecker. 2000. Meeting to identify unique communities and associated rare species on the Francis Marion National Forest.
- ❑ Porcher, R. 1993. Plant Community Inventory in the Harleston Dam Ecosystem. Unpublished Report.

Pond cypress and swamp tupelo pond forests are small, ephemeral wetlands, which occur as limesink complexes, Carolina bays, or other upland depressions within the fire-maintained ecosystems of the outer coastal plain. These habitats are known to support a high species diversity, especially of plants and amphibians. Pond vegetation is often a complex of zones, grading outward from a permanently flooded center supporting wetland plants including scattered pond cypress or swamp tupelo, towards a dense zone of shrubs and vines including Gallberry, *Ilex glabra*, Sweet Pepperbush, *Clethra alnifolia*, and Greenbrier, *Smilax laurifolia*, and Pitcher Plant/Sphagnum Bogs which form the transition zone with fire-maintained upland habitats.

Forested pond cypress and swamp tupelo pond forests occur on approximately 3,419 acres throughout the Francis Marion. Collection of baseline data is ongoing, since these communities may occur as only small inclusions within the fire-maintained ecosystem.

### Effects of Management

Pond cypress-tupelo ponds are typically protected from timber harvest and road building activities. A Plan Objective (O-14) is to “identify and maintain existing acreage in ...forested pond cypress/swamp tupelo ponds.” Forest-wide standards (FW-106 and FW-116), limit the use of mechanical equipment near water bodies and are incorporated into timber sale and mechanical mid-story contracts to maintain the integrity of pond cypress-tupelo pond communities and associated species.

Prescribed fires are allowed to burn into the shrubby transition zones between forested pond cypress/swamp tupelo ponds and pine-dominated uplands, improving habitat for a variety of herbaceous plant species such as pitcher plants. These transition zones support a very high diversity of herbaceous plants and should be protected from mechanical disturbance or the alteration of their characteristic hydrology such as may occur from mechanical disturbance.

Due to the large number of forested pond forest communities including ongoing protection efforts, we conclude they are relatively stable on the Francis Marion National Forest.



## Mabee's salamander (S)

The Francis Marion Plan states that we will maintain populations of native amphibians and the habitat to support them (p.B-37) Mabee's salamander, *Ambystoma mabeei*, was identified in the Francis Marion Plan as a MIS as an indicator species of ephemeral wetlands (pond cypress/swamp tupelo ponds and pond cypress savannahs). The following are sources of data we used:

- ❑ Moulis, R. 1998. Survey of Flatwoods Salamander (*Ambystoma cingulatum*) within proposed railroad corridors at Daniel Island, South Carolina.
- ❑ Conant, R. and J. Collins. 1991. A Field Guide to Reptiles and Amphibians, Eastern/Central North America. Houghton Mifflin Co. Boston, MA. 450p.
- ❑ Wilson, L. 1995. Land Manager's Guide to the Amphibians and Reptiles of the South. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 360 p.
- ❑ Fauth, J. 1997 to present. Survey Data for Amphibians from various locations within the Francis Marion National Forest. Unpublished Data.

The Mabee's salamander is a small mole salamander ranging from uncommon to locally common throughout its range (from the coastal plain of South Carolina to extreme southeastern Virginia). Wilson (1995) and Bennett (personal comment, 2001) describe Mabee's salamander status as stable to common in the Carolinas. Prior to the selection of the Mabee's salamander as an MIS, little was known regarding abundance and distribution of the species on the Francis Marion. Recently (since 1991), the Mabee's salamander has been observed from 13 locations. These observations are a result of inventories conducted by the Forest Service, the College of Charleston (Dr. John E. Fauth), and Savannah Ogeechee Museum and Nature Center (Robert Moulis and Gerald Williamson). Inventories have

shown that approximately 4% to 12% of natural ponds surveyed during the breeding season were utilized by Mabee's salamanders (this includes data collected by the College of Charleston and the Savannah Ogeechee Museum). For monitoring the Francis Marion Plan we have used data collected by the College of Charleston (Dr. John E. Fauth) because their research projects conducted by the College of Charleston are ongoing long-term projects that will enable the Forest Service to monitor trends over time. It should be noted that during dry years monitoring of amphibians is difficult as much of the breeding habitat is not suitable for breeding by amphibians. In recent years (especially 1998, 1999 and 2000), the Francis Marion National Forest has suffered drought conditions. The following table shows data collected by the College of Charleston for the past 4 years.

**Table 20. Percentage Utilization of Monitored Natural Sites by Mabee's Salamander on the Francis Marion NF, 1997-2000**

Year Data Collected	# of sites Sampled	# of sites Species Observed	Individuals Observed		% of sites Utilized
			Adults	Juv.	
1997	23	1	00	01	004.0%
1998	27	0	00	00	000.0%
1999 *	09	0	NR*	NR*	000.0%
2000	15	2	NR*	NR*	013.0%
*Not Recorded					

## Effects of Management

Mabee's salamander has been described from pine flatwoods, hardwood river bottoms, and cypress ponds and tupelo/cypress bottoms in pinelands. On the Francis Marion National Forest, the species has usually been observed in and around ephemeral wetlands (cypress/tupelo ponds, pond cypress savannas and roadside ditches) without fish and under downed logs in the vicinity of longleaf pine flatwoods habitats. The Mabee's salamanders stay underground in the pine flatwoods most of their

lives, migrating during the breeding season (late fall through early spring) to breeding habitat (shallow cypress or gum ponds).

Since ponds with fish appear unfavorable to this species (Wilson, 1995), effort should be made to avoid fireline or road construction which could lead to the migration of fish into these habitats during times of high rainfall.

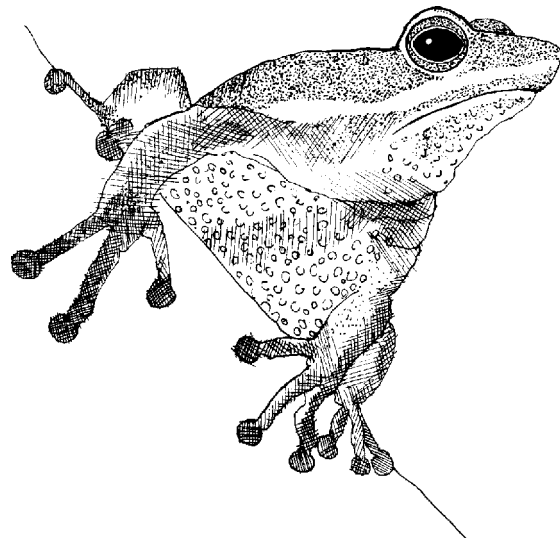
Breeding habitat for the Mabee's salamander is protected during management activities. In the Francis Marion Plan standards and guidelines for soil and water (FW-105, FW-106, FW-111 and FW-115), and O-14 regarding the maintenance of forested pond cypress/tupelo ponds and wet savannas, should adequately maintain suitable habitat for the Mabee's salamander.

The upland habitats, where the species is found outside the breeding season (late spring through early fall) are actively managed. These management activities are often accomplished during dry periods at approximately 10-year intervals and basal area is not reduced below 40 sq. ft. per acre. Much of the upland habitat for Mabee's salamander is located in Management Area 26. The goal of Management Area 26 is to restore, expand and maintain the longleaf pine ecosystem and associated fire dependent communities. Frequent prescribed fire with emphasis on growing season burns would likely improve and maintain both upland and breeding habitat for the Mabee's salamander. There are some concerns that dormant season prescribed fire may impact individuals, because Mabee's salamanders are more active during winter. During the growing season Mabee's salamander will likely be underground.

Management in and around habitat for Mabee's salamander appears to be benefiting or at least supporting Mabee's salamanders where they have been sampled.

## Need for Change

Amphibians such as Mabee's salamander are difficult to monitor due to their large population fluctuations in relation to weather patterns and their fossorial nature. Long-term monitoring (10-20 years) within single ponds is needed in order to determine population fluctuations while filtering out year-to-year variations due to unpredictable environmental noise such as rainfall fluctuations (Steve Bennett, personal communication). The use of amphibians as indicators of forest management activities may be limited unless we commit to monitoring a system of permanent plots over the long-term. We recommend amending the Francis Marion Plan to remove at least two of the three MIS which are amphibians. The three were selected as indicators of similar habitat conditions, and they are difficult to use to assess the effects of forest management activities in the short-term.



## Pine woods treefrog (FM)

The Francis Marion Plan states that we will maintain populations of native amphibians and the habitat to support them. The Pine woods treefrog, *Hyla femoralis*, was identified in the Francis Marion Plan as a MIS as an indicator of ephemeral wetlands (p.B-37). The following are sources of data we used:

- Moulis, R. 1998. Survey of Flatwoods Salamander (*Ambystoma cingulatum*) within proposed railroad corridors at Daniel Island, South Carolina.
- Conant, R. and J. Collins. 1991. A Field Guide to Reptiles and Amphibians, Eastern/Central North America. Houghton Mifflin Co. Boston, MA. 450p.
- Wilson, L. 1995. Land Manager's Guide to the Amphibians and Reptiles of the South. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 360 pages.
- Fauth, J. 1997 to present. Survey Data for Amphibians from various locations within the Francis Marion National Forest. Unpublished Data.
- Estes, W. 1990-1995. Observations of Herptiles from various locations in the Coastal Plain of South Carolina. Unpublished Data.

The Pine woods treefrog is a very common treefrog throughout the coastal plain (Wilson, 1995; Bennett 2001, personal comment) and has been observed from many locations on the Francis Marion. A large number of recorded occurrences suggest that the species is fairly common throughout the Francis Marion. From 1990 through 1995 William M. Estes (an amateur observer) has recorded 12 occurrences within or adjacent to the Francis Marion National Forest. Data collected by the College of Charleston (Dr. John Fauth) in 1997 thru 1998 recorded 32 observations with population estimates of < 10,000 individuals in 1997 and 34 in 1998. The reasons for the low numbers in 1998 can be attributed to extremely dry conditions, which resulted in most of the College's study sites being dry during the breed-

ing season. Also, in 1998 the Savannah Ogeechee Museum (Robert A. Moulis) while surveying for flatwoods salamander observed Pine woods treefrogs from 3 locations within or near the Francis Marion. For monitoring the Francis Marion Plan we have used data collected by the College of Charleston (Dr. John Fauth) because their research projects are ongoing long-term projects that will enable the Forest Service to monitor trends over time. In recent years (especially 1998, 1999 and 2000), the Francis Marion National Forest has experienced abnormal weather patterns that have resulted in severe drought conditions. These drought conditions have made monitoring trends of amphibian populations difficult. The following table shows data collected by the College of Charleston for the past four years.

Year Data Collected	# of sites Sampled	# of sites Observed	Individuals Observed		% of Sites Utilized
			Adults*	Juv.**	
1997	23	23	10000	89	100.0%
1998	27	09	89	00	034.0%
1999	09	02	NR***	NR***	022.0%
2000	27	25	NR***	NR***	093.0%

\* Number of calling males \*\* Number of tadpoles captured  
\*\*\* Not recorded

## Effects of Management

The Pine woods treefrog has been described primarily from pine habitats in the proximity of ponds. This frog requires pine flatwoods habitat near ephemeral ponds or ditches for breeding, which occurs from March into summer. Other requirements for the species are pine snags and fallen pine logs that provide shelter during daytime hours and over winter.

Breeding habitat for the pine woods tree frog is protected during management activities. In the Francis Marion Plan standards and guidelines for

soil and water (FW-105, FW-106, FW-111 and FW-115), wildlife and fisheries (FW-151) and fire (FW-14) and (O-14) the maintenance of forested pond cypress/tupelo ponds and wet savannas, should adequately maintain breeding habitat for the pine woods tree frog.

The upland habitats, where the species is found outside the breeding season (late spring through early fall) are actively managed. Much of the pine habitat utilized by Pine woods treefrogs is located in Management Area 26. The goal of Management Area 26 is to restore, expand and maintain the longleaf pine ecosystem and associated fire dependent communities. Frequent prescribed fire with an emphasis on growing season burns would likely enhance breeding habitat for the Pine woods treefrog by maintaining a grass/shrub habitat along the edges of ephemeral ponds. Likewise, prescribed burning would continue to maintain suitable pine habitat for the species as well. However, prescribed burning may reduce pine snags and pine logs necessary for concealment during the daytime hours or over wintering.

It is concluded that habitat for Pine woods treefrog on the Francis Marion is being maintained.

### Need for Change

Amphibians such as pine woods tree frog are difficult to monitor due to their large population fluctuations in relation to weather patterns and their fossorial nature. Long-term monitoring (10-20 years) within single ponds is needed in order to determine population fluctuations while filtering out year-to-year variations due to unpredictable environmental noise such as rainfall fluctuations (Steve Bennett, personal comment). The use of amphibians as indicators of forest management activities may be limited unless we commit to monitoring a system of permanent plots over the long-term. It is recommended that the Francis Marion Plan be amended to remove at least 2 of the three MIS which are amphibians, since they were selected as indicators of similar habitat conditions and due to the difficulties in using them to assess the effects of forest management activities in the short-term.

### Pondberry (FM)

Pondberry, *Lindera melissifolia*, was listed as an MIS in the Francis Marion Plan due to concerns for species viability. The Francis Marion Plan states that we will monitor the approximate size, vigor, location, and abundance of rare plant populations (pp.B-26; B-36). The following sources of data were used:

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Porcher, R. 1982. Inventory of Unique Natural Areas of the Francis Marion National Forest. Under contract with the U.S. Forest Service.
- ❑ Porcher, R. 1993. Botanical Inventory of the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Porcher, R. 1994. Transplant Study of Pondberry (*Lindera melissifolia*) and Monitoring Study of American Chaffseed (*Schwalbea americana*). Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Porcher, R. 1982. Final Report on Post-Hugo Study on Ecological Status of Natural Areas on the Francis Marion National Forest and Listing of Additional Natural Areas.
- ❑ Glitzenstein, J., D. Streng, R. Porcher, D. Carlson, and R. Roecker. 2000. Meeting to identify unique communities and associated rare species on the Francis Marion National Forest.
- ❑ Roecker, R., and T. Thatcher. 1998. Pondberry Monitoring at Honey Hill and Resulting Monitoring Plan. Unpublished document.
- ❑ Roecker, R. Pondberry monitoring in 1995 and 1997.
- ❑ Raynor, D. 1988. Honey Hill Limesinks. Challenge Cost Share Agreement between the S.C. Heritage Trust, the Nature Conservancy, and the U.S. Forest Service.

Pondberry is a stoloniferous shrub, which was Federally-listed as endangered in July, 1986. The species is scattered in distribution throughout the southern United States, including southeastern North Carolina, eastern South Carolina, southwestern Georgia, southwest Alabama, and southeastern Missouri. The Francis Marion supports 11 occurrences, including 2, which have been started from transplanted clumps (Porcher, 1994). Table 22 shows the status of Pondberry as of 1997.

The highest concentrations of Pondberry have historically been noted to occur within the limesinks at Honey Hill (Raynor, 1988; EO#2 and #8). Monitoring since 1988 has shown that the colonies occurring there have declined, and are now weak in vigor (Roecker, 1998). Tables 23 and 24 show Pondberry trends at Honey Hill.

<b>Table 22. Pondberry status on the Francis Marion National Forest (1997 data)</b>				
<b>EO Code</b>	<b>Area</b>	<b># Stems</b>	<b>Vigor/Reproduction</b>	<b>Plant Community</b>
*001	Unknown	Unknown	Unknown	Unknown
*002	1x5m	11-25	Weak, no reproduction	Cypress Pond
*003	1x5m	6 Colonies	Unknown	Tupelo Savanna
*004	5x10m	51-100	Normal, no reproduction	Cypress-Tupelo Pond
*005	100m x 1ha	201-1000	Normal, no reproduction	Pine Savanna
*006	Not found	-	-	Cypress Pond
*007	5x10m	26-50	Weak, no reproduction	Cypress-Tupelo Pond
*008	100m x 1ha	>1000	Weak, no reproduction	Cypress Pond
*009	100m x 1ha	>1000	Normal, no reproduction	Cypress-Tupelo Pond
*010	100m x 1ha	201-1000	Vigorous, reproduction	Pine Savanna
*011	Unknown	Unknown	Unknown	Cypress Savanna

**Table 23. Trends in Pondberry vigor at Honey Hill, 1988-1997**

Vigor*	# of Colonies		
	1988	1995	1997
Weak	25	41	24
Normal	27	-	-
Vigorous	4	-	-
*Weak-stems ,18"tall, no reproduction;			
Normal-stems 18"-4'tall, healthy w/ little or no reproduction;			
Vigorous-stems 3'-6' tall, healthy w/some reproduction.			

**Table 24. Trends in Pondberry Stem Number at Honey Hill, 1988-1997**

Range in Stem #	# of Colonies		
	1988	1995	1997
0	na*	18	32
1-10	4	6	11
11-25	12	5	4
26-50	8	4	4
51-100	14	4	4
101-200	10	0	0
201-1000	8	4	2
TOTAL	56	23	25
*na=not applicable			

### Effects of Management

Inventories for new populations of Pondberry are conducted as part of the biological evaluation process and site-specific mitigation is developed in conjunction with the U.S. Fish and Wildlife Service as necessary to conserve the species.

Eight Pondberry populations occur in botanical areas designated as Management Area 8, which has the goal of preserving unique values for biological diversity. Prescribed burning is generally the main management tool used in Pondberry sites; however, hand mid-story control and commercial thinning are also used in an attempt to create the opened conditions, which appear to be preferred by Pondberry.

The Honey Hill Limesink Area is a proposed Research Natural Area, which had been protected from fire for several years (EO#2 and EO#8). Given the decline of Pondberry observed at Honey Hill, prescribed fire, hand mid-story control, and forest thinning are being used in order to improve habitat and reverse declines.

### Need for Change

Given the risk associated with this species, more frequent monitoring of individual populations is needed. Research is needed to determine reasons for decline of Pondberry at Honey Hill and the appropriate management regime.

## Pondspice (FM)

Pondspice, *Litsea aestivalis*, was identified in the Francis Marion Plan as a MIS due to concerns for species persistence. The Francis Marion Plan states that we will monitor the approximate size, vigor, location, and abundance of rare plant populations (pp.B-26; B-36). The following sources of data and information were used:

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Porcher, R. 1982. Inventory of Unique Natural Areas of the Francis Marion National Forest. Unpublished Report.
- ❑ Porcher, R. 1993. Botanical Inventory of the Francis Marion National Forest. Unpublished Report.
- ❑ Glitzenstein, J., D. Streng, R.Porcher, D.Carlson, and R.Roecker. 2000. Meeting to identify unique communities and associated rare species on the Francis Marion National Forest.

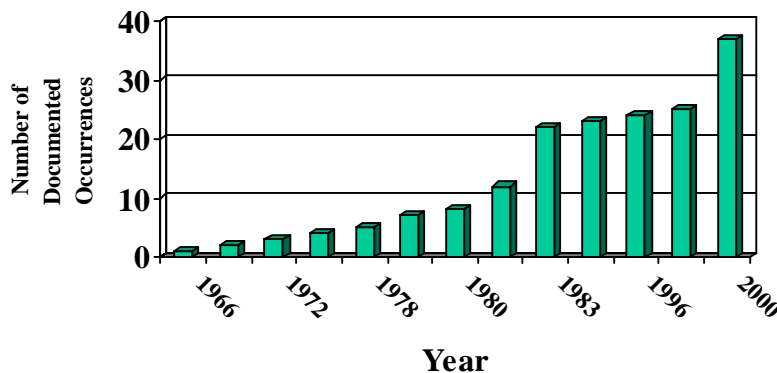
Pondspice is a deciduous shrub and endemic to southeastern coastal plain, ranging from eastern Maryland and southeastern Virginia, south to northern Florida and western Louisiana. It is ranked G3 by the Nature Conservancy and S3 by the State Heritage Program, suggesting that the taxon is vulnerable throughout the range and in the state. Inventories conducted by Richard Porcher

(1982,1993) and Danny Carlson (1982-2000), District Biological Technician, have documented 37 locations for pondspice on the Francis Marion. The following figure (Figure 49) displays trends in the number of occurrences known on the Francis Marion, by year.

## Effects of Management

Inventories for new populations of pondspice are conducted as part of the biological evaluation process, and site-specific mitigation is developed to conserve the species in conjunction with projects as necessary.

Pondspice is known to occur within the deeper margins of ephemeral depressions, including pond cypress and swamp tupelo ponds, Carolina bays and limesinks. These habitats are typically protected from timber harvesting. Most of the known pondspice locations occur in Management Area 26, and 10 occur in Management Area 8. The goal of Management Area 8 is “to preserve the unique values of specific botanical areas for biological diversity,” and follow management recommendations included within the document by which they were recommended (Porcher, 1993, 1982). Specific management recommendations include avoiding draining or otherwise altering the hydrology, and logging within or immediately adjacent to ponds harboring the species.



**Figure 49. Cumulative Number of Occurrences for Pondspice on the Francis Marion NE, 1966-2000**

The goal of Management Area 26 is to restore, expand, and maintain the longleaf ecosystem and related fire-dependent communities. Both frequent prescribed burning (every 2-3 years) and growing season burning are emphasized in the uplands, and fires are allowed to burn across different habitats within the landscape. Pondspice resprouts readily in response to prescribed burning, and would be favored by a disturbance regime, which decreases competition with other woody, less fire tolerant species.

A standard in the Plan is to “identify and maintain existing acreage in..forested pond cypress/swamp tupelo ponds....”

Habitat for pondspice on the Francis Marion appears to be stable.

### Need for Change

All sites for pondspice need to be revisited on a periodic basis to ensure population persistence. Since habitat for this species (pond cypress/Swamp tupelo pond communities) is already represented it is recommended that pondspice be removed from the MIS list for the Francis Marion.



### Southern chorus frog (FM)

The Francis Marion Plan states that we will maintain viable populations of native amphibians and the habitat to support them. The Southern chorus frog, *Pseudacris nigrita*, was identified in the Francis Marion Plan as an MIS as an indicator of ephemeral wetlands (p. B-37). The following are sources of data we use.

- ❑ Conant, R. and J. Collins. 1991. A Field Guide to Reptiles and Amphibians, Eastern/Central North America. Houghton Mifflin Co. Boston, MA. 450p.
- ❑ Wilson, L. 1995. Land Manager’s Guide to the Amphibians and Reptiles of the South. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 360 pages.
- ❑ Fauth, J. 1997 to present. Survey Data for Amphibians from various locations within the Francis Marion National Forest. Unpublished Data.

The Southern chorus frog is considered abundant throughout the lower coastal plain. Recorded occurrences on the Francis Marion are limited as most surveys and studies being conducted on the Francis Marion occur during the spring breeding season when the species is not easily detected. The Southern chorus frog begins breeding in winter and continues into early spring before to optimum periods for monitoring spring breeding amphibians. Data collected by the College of Charleston has recorded low incidences of occurrence for the Southern chorus frog presumably due to drought conditions and time of year monitoring (mid-late spring) occurred. For monitoring the Francis Marion Plan we have used data collected by the College of Charleston (Dr. John Fauth) as research projects being conducted by the College of Charleston are ongoing long-term projects that should enable the Forest Service to monitor trends over time. As noted for the other MIS amphibians, drought conditions on the Francis Marion National Forest have inhibited collection of data on breeding population for the selected species. Hopefully, these



drought conditions will end and weather patterns will become more normal in the future so that adequate data can be collected and analyzed. The following table shows data collected by the College of Charleston for the past 4 years.

**Table 25. Percentage Utilization of Monitored Natural Sites by Southern chorus frogs on the Francis Marion National Forest**

Year Data Collected	# of sites Sampled	# of Sites Species Observed	Individuals Observed		% of sites Utilized
			Adults*	Juv.**	
1997	23	09	27-180	00	039.0%
1998	27	00	00	00	000.0%
1999	09	01	NR***	NR***	011.0%
2000	15	05	NR***	NR***	033.0%
*Number of calling males ** Number of tadpoles captured ***Not Recorded					

**Effects of Management**

The Southern chorus frog is usually associated with small pond cypress/swamp tupelo ponds throughout slash, *Pinus eliottii*, and longleaf, *Pinus palustris*, pine flatwoods and is found in or near open ponds, small potholes and ditches with grassy margins or emergent vegetation.

Generally, breeding habitat for the species is protected during management activities. However, the pine flatwoods surrounding these breeding habitats are actively managed. These management activities adhere to the standards and guidelines listed in the Francis Marion Plan. Specifically, standards and guidelines for soil and water (FW-105, FW-106, FW-111 and FW-115) and fire (FW-14) would apply. In fact, it has been suggested that prescribed burning and selective cutting are suitable activities that would enhance and maintain suitable habitat for the species.

Much of the pine flatwoods habitat on the Francis Marion is located in Management Area 26. The goal of Management Area 26 is to restore, expand and maintain the longleaf pine ecosystem and associated fire dependent communities. Frequent

prescribed fire with an emphasis on growing season burns would likely maintain or create the required open pine flatwoods and grassy habitat around breeding ponds required by the Southern chorus frog.

It is concluded that habitat for Southern chorus frog is stable on the Francis Marion and is expected to increase, as the implementation of the Francis Marion Plan will continue to maintain and improve habitat for the species.

**Need for Change**

Amphibians such as Southern chorus frog are difficult to monitor because their population fluctua-

tions in relation to weather patterns and their fossorial nature. Long-term monitoring (10-20 years) within single ponds is needed in order to determine population fluctuations while filtering out year-to-year variation due to unpredictable environmental factors such as rainfall fluctuations (Steve Bennett, personal communication). The use of amphibians as indicators of forest management activities may be limited unless the Forest commits to monitoring a system of permanent plots over the long-term. It is recommended that the Francis Marion Plan be amended to remove at least 2 of the 3 MIS, which are amphibians, since they were selected as indicators of similar habitat conditions, they are difficult to use to assess the effects of management activities in the short-term.

## Seasonally Wet Savannas

### Pine and Lake Cypress Savanna Communities (FM)

Pine and Lake cypress savannas were identified as a MIS communities in the Francis Marion Plan due to concerns for biological diversity. The Francis Marion Plan states that we will collect baseline acreage in this community type (p. B-38). The following sources of data and information were used:

- ❑ Continuous Inventory of Stand Conditions (CISC) for the Francis Marion National Forest
- ❑ Porcher, R. 1982. Inventory of Unique Natural Areas of the Francis Marion National Forest. Contract with the U.S. Forest Service.
- ❑ Porcher, R. 1993. Botanical Inventory of the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Glitzenstein, J., D.Streng, R.Porcher, D.Carslon, and R.Roecker. 2000. Meeting to identify unique communities and associated rare species on the Francis Marion National Forest.
- ❑ Porcher, R. 1994. Plant Community Inventory in the Harleston Dam Ecosystem. Challenge Cost Share Agreement with the U.S. Forest Service.

Seasonally wet pine and Lake cypress savannas occur on low, flat terraces of the outer coastal plain from northwestern Florida to the southeast corner of Virginia. Characterized by scattered pines or Lake cypress with an understory of mixed grasses and forbs, wet savannas are known for their high floristic diversity including a variety of carnivorous plants and orchids. Diagnostic species occurring in the understory include Muhly Grass, *Muhlenbergia expansa*, Toothache Grass, *Ctenium aromaticum*, Dropseed, *Sporobolus* sp., and Yellow Fringeless Orchid, *Platanthera integra*. These communities depend on a combination of flooding and fire to

maintain the open canopy structure. Seasonally wet pine and Lake cypress savannas are highly threatened regionally by fire suppression. Alterations in hydrology and forest structure because of planting with slash pine or agricultural production methods also threaten pine savannas.

On the Francis Marion, wet savannas occur in transitional zones between Lake cypress-tupelo Lakes and pocossins and fire-maintained uplands, in clay-based Carolina bays, and on upland sandy flats on soils which tend to be strongly acidic and poorly drained with a subsurface organic or clay hardpan that restricts water percolation.

Approximately 811 acres in seasonally wet savannas have been identified on the Francis Marion National Forest, though the restoration potential is likely much higher.

#### Effects of Management

Seasonally wet savannas are typically protected from timber harvest and road building activities. The most notable known seasonally wet savannas (675 acres) occur in Plan-designated Natural Areas (1996). A Plan Objective (O-14) is to “identify and maintain existing acreage in ...pine and pond cypress savanna.” Efforts to map pine and Lake cypress savannas on the Francis Marion are ongoing. Forest-wide standards (FW-106 and FW-116), limit the use of mechanical equipment near water bodies and are incorporated into timber sale and mechanical mid-story contracts.

The primary threat to the integrity of pine and Lake cypress savannas on the Francis Marion National Forest is fire suppression. Seasonally wet savannas should be burned on a regular basis (every 1-5 years).

#### Need for Change

Opportunities to restore seasonally wet savannas on the Francis Marion should be identified based on the presence of characteristic soils or understory plants. Transitional zones adjacent to Lake or pocossin

habitats should continue to be protected from the use of heavy machinery associated with logging or fireline construction.

Natural areas containing seasonally wet savannas, and other good examples of seasonally wet savannas, should be monitored periodically to ensure that the characteristic structure and composition are being maintained. More extensive mapping efforts are needed to identify additional acreage.

### **Awned Meadow-beauty (FM)**

Awned Meadow-beauty, *Rhexia aristosa* was listed as a MIS in the Francis Marion Plan due to concerns for species viability. The Francis Marion Plan states that we will monitor the approximate size, vigor, location, and abundance of rare plant populations (p.B-26; B-36). The following sources of data were used:

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Porcher, R. 1982. Inventory of Unique Natural Areas of the Francis Marion National Forest. Contract with the U.S. Forest Service.
- ❑ Porcher, R. 1993. Botanical Inventory of the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Glitzenstein, J., D. Streng, R. Porcher, D. Carlson, and R. Roecker. 2000. Meeting to identify unique communities and associated rare species on the Francis Marion National Forest.
- ❑ Glitzenstein, J., and D. Streng. 2000. Botanical inventory of the Steed Creek Road Right-of-Way on the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.
- ❑ Crowell, W. 1996. Element Stewardship Abstract for *Rhexia aristosa*. TNC, Chapel Hill, NC.
- ❑ Glitzenstein, J. and D. Streng. 2000. Botanical inventory of the Steed Creek Road Right-of-Way on the Francis Marion National Forest. Challenge Cost Share Agreement with the U.S. Forest Service.

Awned Meadow-beauty is a Southern Region sensitive species (list last updated in 1996), known to occur in ephemeral wetlands along the Atlantic Coast from New Jersey south to Alabama, with the exception of Florida (Crowell, 1996). On the Francis Marion, the species is known from 26 occurrences within clay-based Carolina bays with Lake cypress savanna vegetation, and also in roadside ditches (Glitzenstein and Streng, 2000). Where it occurs, often hundreds of plants are present.

### **Effects of Management**

All of the Awned Meadow-beauty occurrences are in Management Area 26, with the goal to “restore, expand and maintain the longleaf pine ecosystem and related fire-dependent communities.” This Management Area is exposed to frequent (every 1-3 years) prescribed fires, including growing season fires. Fire within the normally moist environment where Awned Meadow-beauty is found reduces competition with woody species and likely benefits the plant.

Plant communities containing Awned Meadow-beauty is found are typically protected from timber harvesting and road building activities. A standard in the Plan states that to “identify and maintain existing acreage in pine and Lake cypress savanna....”

Awned Meadow-beauty, while documented primarily along one forest road, is likely to be fairly common on the Francis Marion (Porcher, personal comment). The plant could be easily overlooked due to similarities in appearance with other *Rhexia* species. Occurrences for Awned Meadow-beauty need to be monitored periodically to ensure species persistence over time.

## Springs and Seeps

### Grass-of-Parnassus (S)

Bigleaf Grass-of-pannassus, *Parnassia grandifolia*, was identified as a MIS for the Sumter National Forest due to concerns for species viability. The Sumter Plan states that we will field review populations and habitat for *Parnassia grandifolia*.

The following data were used:

- ❑ Sumter Forest CISC data, 2000
- ❑ Forest Monitoring Reports, 1990-1999
- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001

Bigleaf Grass-of-Parnassus ranges from the mountains of North and South Carolina and Virginia, and the coastal plain of North Carolina. Restricted to fens or gravelly seepages, over calcareous, mafic or ultramafic rocks, no populations are known on the Sumter. Based on the Sumter Plan one population was once located adjacent to the National Forest, but this was likely destroyed by a beaver flooding the site. No mention is made of any populations on the Sumter, and none can be found on the SC Heritage database as occurring on National Forest land (2001).

Another closely related species, Kidney-leaved Grass-of-pannassus, *Parnassia asarifolia*, is relatively common on the Andrew Pickens, with 8 populations occurring in acidic habitats along streams.

### Effects of Management

Habitat for Bigleaf Grass-of-pannassus could occur along the Brevard Escarpment, which is known to support calcareous geology, especially along the streams and rivers which dissect the area such as the Chauga River, Tamassee Creek, and Brasstown Creek. However, surveys in these areas have not located the species (Hill, 1993; Gaddy, 1991).

The habitat in the vicinity of the Chauga River, Tamassee Creek, and Brasstown Creek are in

proposed Sumter Forest Botanical areas, and the Chauga River has a Scenic area designation (Sumter Plan, 1985). A wildlife opening near Tamassee Creek has been maintained with annual plowing for several years, but no Bigleaf Grass-of-pannassus plants are known to occur there. Based on the ongoing protection of basic mesic forest communities along the Brevard Escarpment, it is concluded that habitat for the species is stable on the Sumter.

### Need for Change

Due to the lack of occurrences for Big-leaf Grass-of-pannassus on the Sumter, the protection of habitat which is being practiced, and the security of the species rangewide, it is recommended that the Sumter Plan be amended to remove this species from the MIS list.

### Umbrella Leaf (S)

Umbrella Leaf, *Diphylleia cymosa* was listed as a Sumter MIS (1985) due to concerns for species viability. The Sumter Plan states that we will monitor habitat and populations for Umbrella Leaf (p. G-9). The following sources of data was used:

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Southeastern Wildlife Services Incorporated. 1980. Inventory of Threatened or Endangered Plants on the Sumter National Forest. Athens, GA
- ❑ Forest Monitoring Reports, 1990-1999

Umbrella Leaf occurs infrequently in the mountains of North Carolina, South Carolina, Virginia, Georgia, and Tennessee. On the Sumter National Forest, it is known from 4 locations, all in the Ellicott Wilderness. Umbrella Leaf is ranked G4 by the Nature Conservancy (demonstrably secure across the range), and S1 by the SC Heritage Program (critically imperilled in the state). Due to the species security range-wide, it is no longer on the Southern Region sensitive species list.

## Effects of Management

Umbrella Leaf is known from seepages and brook banks at moderate to high elevations (Weakley, 2000). This species is sensitive to canopy removal, which would result in the modification of the light and moisture regimes typical of high elevation seeps. On the Sumter, Umbrella Leaf occurs in Ellicott Rock Wilderness, where little or no forest management occurs. Despite numerous botanical surveys, the species has not been located in other areas of the Sumter. Known habitat for the species appears to be very stable on the Sumter. Site visits by Forest Service personnel suggest that Umbrella Leaf populations are stable as well.

## Streamside/Bottomland Hardwood Forests

### Wayne's Black-throated Green Warbler (FM)

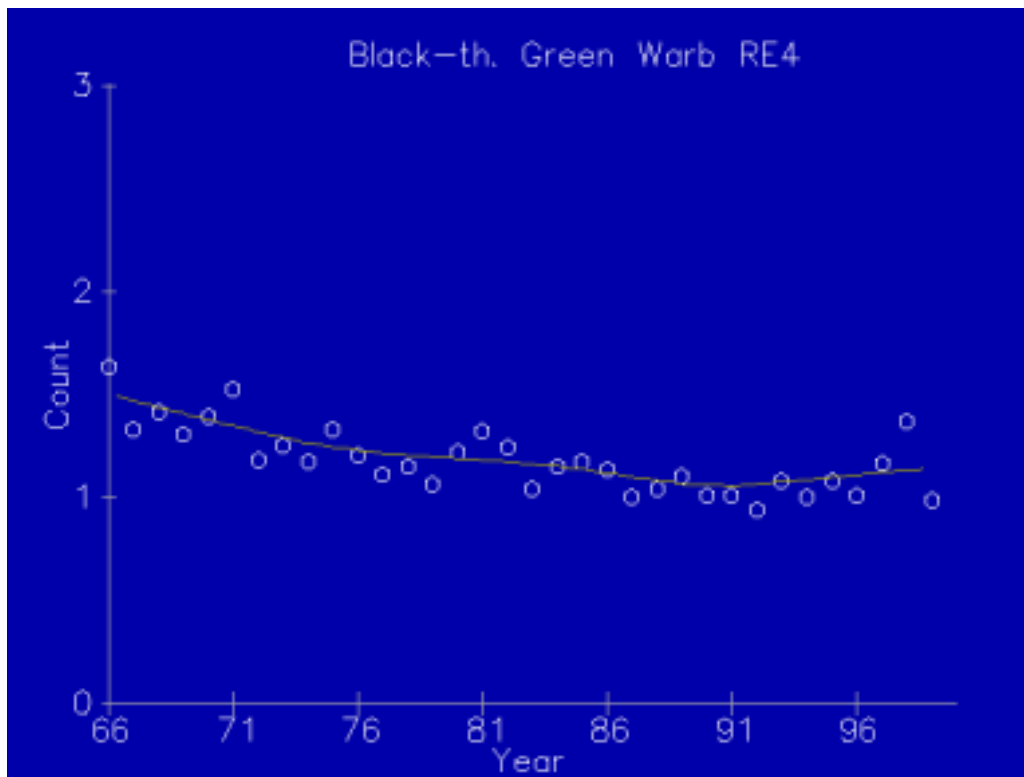
Wayne's Black-throated Green Warbler, *Dendroica virens*, is a race of this species that occurs as a disjunct population in the coastal plain. It was identified as an MIS for the Francis Marion to serve as an ecological indicator for swamp hardwoods and cypress stands (Francis Marion MIS selection process record). To monitor this species, Appendix B of the Francis Marion Plan states that we will collect point count data, calculate population trends and compare with habitat changes over time. Bird point counts have been conducted since 1994 using methods described in Hamel et al. (A Land Manager's Guide to Point Counts of Birds in the Southeast, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in monitoring reports.

The following sources of data and information were used in this analysis:

- ❑ Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- ❑ USDA Forest Service. Francis Marion National Forest. Forest records and annual bird point data (1994 – 2000)
- ❑ USDA Forest Service. Francis Marion National Forest, Annual monitoring reports (1990 –2000)
- ❑ Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- ❑ Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

Breeding bird survey data are unavailable for this species because of its limited distribution and difficulty to detect during breeding bird routes (Hunter, pers. comm.). It is thought however that much of the remaining habitat in South Carolina for the Wayne's race is found on the Francis Marion National Forest.

Populations of Black-throated Green Warbler appear to have been steadily declining (trend estimate  $-0.89$ ;  $p = .77$ ; Sauer et al., 2000) across the Southeast (Figure 50). This decline however appears to have leveled off in the last 10 years (1990 – 1999) coincident with the recovery period following Hurricane Hugo



**Figure 50. Average number of Black-throated Green Warblers per route for Breeding Bird Survey routes in the Southeast, 1966-1999**

Annual landbird monitoring conducted on the Francis Marion National Forest has recorded two observations of Black-throated Green Warbler over a seven-year period (1994–2000) and is currently unusable as a means to assess population abundance or frequency of occurrences. Both detections occurred in hardwood stands.

The oldest observation recorded on the Francis Marion was during the nesting season in 1973 (Gauthreaux, 1989). Range-wide, the Wayne’s race appears to be declining since hurricane Hugo but definitive numbers are unavailable (Hunter pers. comm.). Black-throated Green Warblers have been observed on the Francis Marion consistently since Hugo (1990 - 2000). Black-throated Green Warblers are still being detected in preferred habitats, but are not as widespread and, were more abundant before to Hurricane Hugo, (Carlson, pers. comm.).

### Effects of Management

In the coastal plain, Black-throated Green Warblers prefer swamps and bottomlands with cypress or, in pure stands of hardwoods or mixed pine hardwoods (Hamel 1992, p. 269). Even though there is little known of the Wayne’s race of Black-throated Green Warbler in South Carolina there are sufficient records to support the statement that a population exists and is persistent. Given the amount and distribution of preferred habitats, it is likely that populations of this species will persist into the foreseeable future.

### Need for Change

There is a need to add landbird monitoring points to the annual landbird monitoring program located in habitats likely to contain Wayne’s race of Black-throated Green Warbler. Due to its limited distribution on the forest it is recommended that Black-throated Green Warbler be removed from the Francis Marion MIS list.

## Brown Water Snake (S)

Brown water snake, *Nerodia taxispilota*, was identified as an MIS for the Sumter Plan as an indicator of riparian and aquatic habitat. The Sumter Plan (p.G-6) states that we will monitor habitat according to the minimum management requirements (p.L-2) regarding forest regeneration (if conducted), more than 20 chains along perennial streams, and only on one side of the stream, basal area retention, and unavoidable road construction. The following sources of data were used:

- ❑ Sumter Forest Monitoring Reports, 1990-1999
- ❑ Museum records compiled by the South Carolina GAP Project, SCDNR, Columbia, SC

The Brown water snake, *Nerodia taxispilota*, is a riparian-associated reptile (USDA Forest Service 1995). It is abundant in the coastal plain of South Carolina, but Wilson (1995) restricts its distribution to east of the Fall Line. The Brown water snake ranges from Virginia south into Florida and west into Alabama (Wilson 1995).

Museum records compiled in association with the SC GAP project, show 105 records for Brown water snake in South Carolina, all from the coastal plain with the exception of 2 from Aiken County. According to Dr. Whit Gibbons of the Savannah River Ecology Laboratory, and Steve Bennett, with the SCDNR, the Sumter is outside the range of the Brown water snake since it is primarily a coastal plain species.

### Effects of Management

SC Best Management Practices relating to the protection of water quality are implemented on the Sumter. Also, standards and guidelines in the Land and Resource Management Plan for the Sumter provide protection to Forest waters from erosion and pesticide use (p.IV-4). More recent policy (letter from Regional Forester dated May 15, 2000) expands our definition of riparian influence specifying

minimum widths “to ensure that riparian ecosystems will be managed to maintain and restore their many functions and values.” Since 1993, little or no forest regeneration has occurred adjacent to perennial streams and minimum management requirements (MMR’s) appear to have been met (Monitoring Reports, 1993-1999).

### Need for Change

Since the Sumter is located only on the edge of the range for Brown water snake, and since snakes are extremely difficult to monitor, it is recommended that the Brown water snake be removed as an indicator of aquatic and riparian habitats on the Sumter.

## Eastern Wood Rat (FM)

Eastern wood rat, *Neotoma floridana*, was selected as an MIS for the Francis Marion National Forest as an indicator of fire-maintained vegetative communities between pine upland habitats and bottomland or swamp forest habitats. The Francis Marion Plan does not specifically address monitoring methods for Eastern wood rat, but does address citations and habitat for other small mammals and associated habitat such as fox squirrels (p.B-33). The following sources of data were used.

- ❑ South Carolina State Heritage Data (Biological Conservation Database), 2001
- ❑ Knowles, T. W. 2000. Distribution and Population Estimates of the Eastern wood rat (*Neotoma floridana*) in the Francis Marion National Forest. Unpublished Research submitted to the USDA Forest Service.

Eastern wood rat is a widely distributed mammal ranging from the southeastern and south central United States, extreme western and southeastern North Carolina south to Florida, and west to eastern Colorado and eastern Texas (Knowles, 2000). Although Eastern wood rat is demonstrably secure in the southeast as a whole, distribution is patchy. Occurrence records indicate that the species has been observed on the Francis Marion sporadically

since 1937 with only 5 recorded observations (1937, 1979, 1994 and 2001). Of these observations both male and female specimens were captured as well as three nests being observed. The following table displays these observations.

**Table 26. Eastern wood rat Population Data from the Francis Marion National Forest**

Year of Observation	Description of Observation	Approximate Location
1937	Captured one male	I'on Swamp near Wythewood canal
1979	Captured one female	Coffee Creek Swamp
1994	Observed 2 Eastern wood rat nests	200 meters from Guilliard Lake Campground
2001	Captured 2 individuals	Along Wambaw Creek

From the known occurrences it has been determined that habitat for the Eastern wood rat occurs in Management Area 2, 8, and 27 listed in the Francis Marion Plan. Management Area 2 is designated “Wilderness Area” where no active management is planned and are set aside to preserve examples of large relatively undisturbed hardwood swamp ecosystems. Management Area 8 is designated “Special Area” where management will be directed to maintain and improve the area for the specific unique characteristics to ensure perpetuation of the unique value. Management Area 27 is designated as Loamy ridges, flats and river/creek bottoms with an emphasis to expand, maintain and enhance mixed pine/hardwood stands, transition zones, hard mast production and to increase the quantity and quality of the hardwood timber resource. Active management will occur within areas designated Management Area 27. These management activities will likely maintain suitable habitat for the Eastern wood rat.

**Effects of Management**

The Eastern wood rat is described from a variety of habitats in coastal areas, including mesic bottomland hardwoods, bottomland hardwood swamps, hardwood/pine ecotones, etc. with open-understories (Wiley, 1980; Knowles, 2000). Dwarf Palmetto, *Sabal minor* has been identified as a possible important understory species.

Present management on the Francis Marion generally does not directly affect the bottomland and swamp hardwood areas with one exception. Landscape style prescribed burning allows prescribe fire to enter into these bottomlands these habitats were generally protected before this landscape style of management. However, adhering to standards and guidelines in the Francis Marion Plan should adequately protect and maintain suitable habitat. Specific standards and guidelines that would apply are FW-14, FW-105, FW-106, FW-115.

Presently, the Francis Marion is attempting to improve its knowledge for the Eastern wood rat and associated habitats through a Challenge Cost Share Project with Francis Marion University (Knowles, 2000). Since three of the four observations recorded for the Francis Marion National Forest are located in Management Areas 2 and 8, where no active management is expected, habitat for Eastern wood rats on the Francis Marion National Forest appears to be relatively stable.





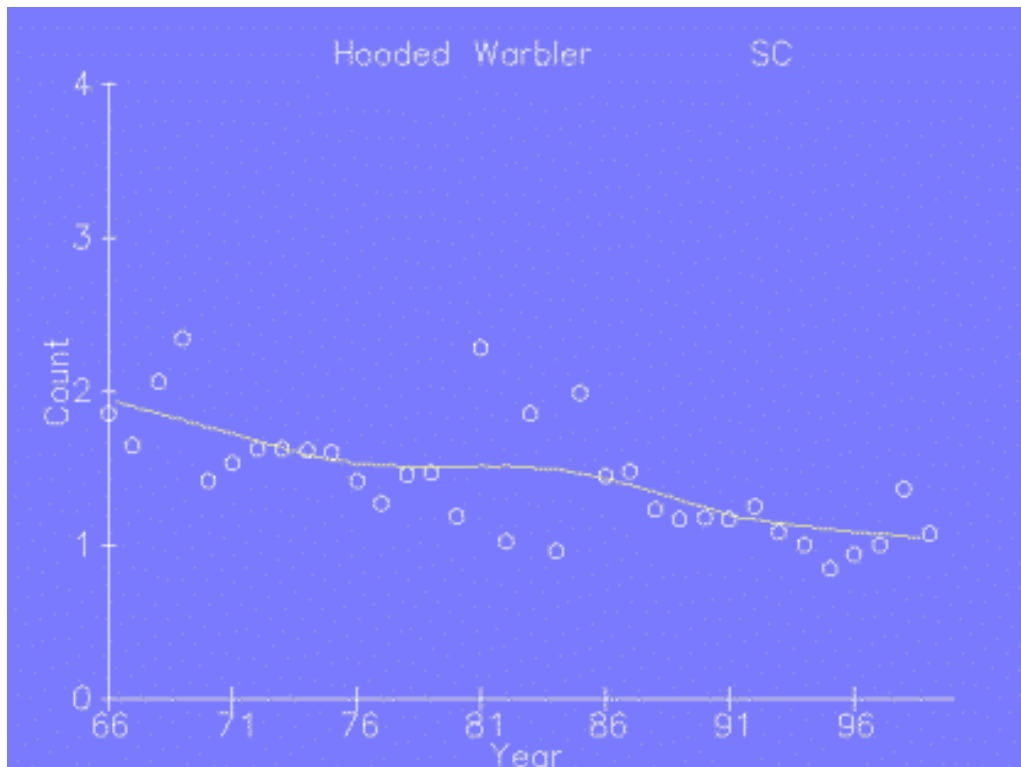
## Hooded Warbler (FM)

Hooded Warbler, *Wilsonia citrina*, was identified as a MIS for the Francis Marion to serve as an ecological indicator of sapling stages of regenerating forests as well as open/shrubland habitat conditions (Francis Marion MIS selection process record). To monitor the effects of Plan implementation on this species, Appendix B of the Francis Marion Plan states that we will collect point count data, calculate population trends and compare with habitat changes over time. Bird point counts have been conducted on the Forest since 1994 using methods described in Hamel et al. (A Land Manager's Guide to Point Counts of Birds in the Southeast, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in Forest monitoring reports, published annually by the Forest Service for the Francis Marion since 1990.

The following sources of data and information were used in this analysis:

- Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- USDA Forest Service. Francis Marion National Forest. Forest records and annual bird point data (1994 – 2000)
- USDA Forest Service. Francis Marion National Forest, Annual monitoring reports (1990 –2000)
- Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

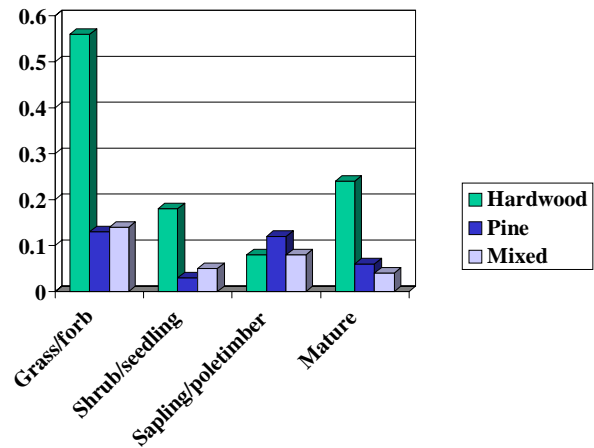
The Hooded Warbler is a bird of deciduous and mixed forests that contain a relatively dense understory. Populations of Hooded Warbler appear to have been on a gradual decline (trend estimate is  $-1.26$ ;  $p = 0.69$ ; Sauer et al., 2000) in South Carolina (Figure 51).



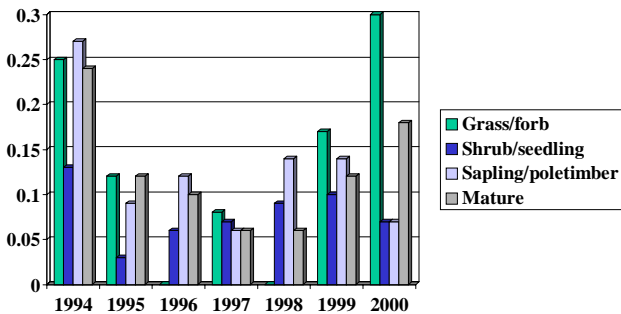
**Figure 51. Average number of Hooded Warblers per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

A total of 739 bird point counts were conducted on the Francis Marion from 1994 through 2000. There were 104 detections of Hooded Warbler during 86 of the 739 point counts.

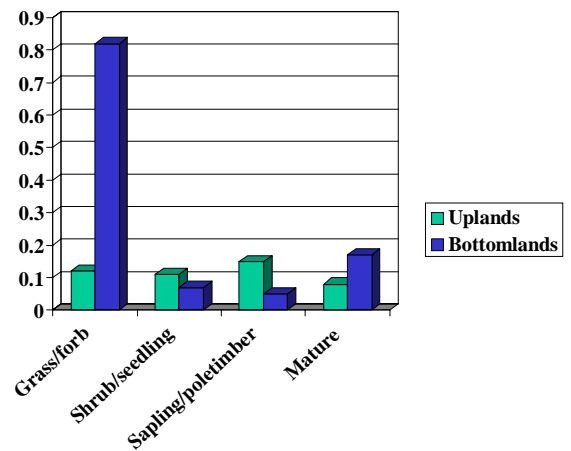
Hooded Warbler numbers detected are highly variable from year to year. Point counts conducted on the Francis Marion indicate Hooded Warblers to be fairly common. Annual occurrences suggest a slight upward trend in abundance in recent years (1997 – 2000; Figure 52). Hooded Warblers appear to be associated with grass/forb habitat conditions in hardwood forest types (Figure 52a) primarily on bottomland sites (Figure 52b). Although total number of detections is not a reliable measure of population abundance, it is interesting that Hooded Warblers were recorded consistently more in all successional stages of hardwood stands than in pine or mixed forest stands, particularly in mature habitat conditions (Figure 52c). This suggests that well-developed understory vegetation is present in all successional stages, which is probably the result of the resurgence of vegetation from the effects of Hurricane Hugo.



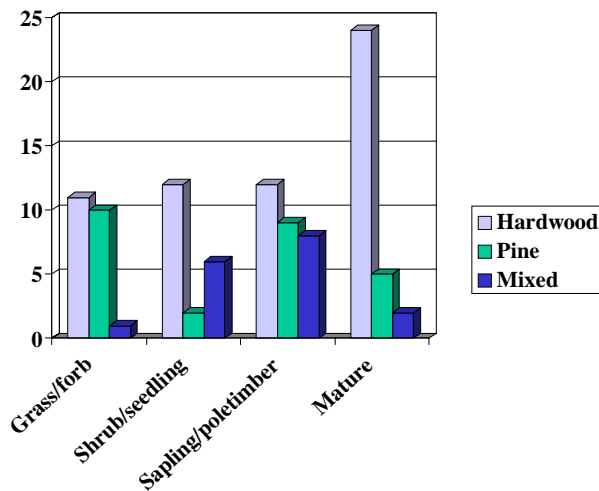
**Figure 52a. Percentage occurrence of Hooded Warblers on point counts in hardwood, pine and mixed forest habitats on the Francis Marion National Forest, 1994 - 2000**



**Figure 52. Percentage occurrence of Hooded Warblers on point counts by successional stage on the Francis Marion National Forest, 1994 - 2000**



**Figure 52b. Percentage occurrence of Hooded Warblers on point counts in bottomland and upland habitats on the Francis Marion National Forest, 1994 - 2000**



**Figure 52c. Total number of detections of Hooded Warbler (1994 – 2000) on the Francis Marion National Forest by successional stage**

### Effects of Management

Hooded Warblers nest and feed primarily in shrubs within 15 feet of the ground (Hamel 1992, p. 287). Hooded Warblers respond to the presence of a well-developed shrub layer particularly in hardwood stands with moist soil conditions. Hardwood acres on the Francis Marion National Forest have remained relatively constant since Hugo and management of bottomland hardwood stands has virtually been suspended on the Forest since the hurricane. Hooded Warbler is widespread across the Forest and there is no apparent association between habitat utilization and frequency of occurrence in terms of management activities at this time.

Annual monitoring reports (1990 – 2000) indicate that Hooded Warbler populations are stable. Point count results indicate breeding Hooded Warblers are widely distributed, and they occur in a variety of habitats that are abundant and well distributed. Given these results, we believe there is a high likelihood that populations of Hooded Warbler will persist for the foreseeable future.

### Mountain Camellia (S)

Mountain Camellia, *Stewartia ovata*, was identified as a Sumter MIS due to concerns for species persistence (1985). The Sumter Plan states that we will monitor populations and habitat (p.G-9). The following sources of data and information were used:

- South Carolina State Heritage Data (Biological Conservation Database), 2001
- Southeastern Wildlife Services Incorporated. 1980. Inventory of Threatened or Endangered Plants on the Sumter National Forest. Athens, GA
- Forest Monitoring Reports, 1990-1999

Mountain Camellia is a small tree or shrub, known from the mountains and adjacent piedmont of Kentucky, Tennessee, North and South Carolina, Georgia and Alabama, with two disjunct populations in the coastal plain of Virginia. It is most abundant in the Cumberland Plateau of Kentucky and Tennessee (Weakley, 2000), ranked G4 by the Nature Conservancy (demonstrably abundant throughout the range) and S2 by the State of South Carolina (imperiled in the state). On the Andrew Pickens, Mountain Camellia is known at 11 locations. Southeastern Wildlife Services identified most of these in 1979. Mountain Camellia was removed from the Southern Regions Sensitive Species list in 1996 due to a demonstrated lack of range-wide viability problems. Monitoring efforts have identified at least 124 plants at 11 locations on the Sumter.

### Effects of Management

Mountain Camellia is strongly associated with small stream valleys in the mountains and upper piedmont, where it is found on steep slopes and streamside flats (SE Wildlife Services, 1980). It is known to occupy mesic forests and acidic bluffs, often associated with openings in Rhododendron thickets. On the Sumter, Mountain Camellia is known primarily from the Chattooga and Chauga watersheds, and the majority of sites are protected from general forest management. Of the 11 sites known on the Sumter, 2 occur in the Chattooga Wild and Scenic

River Corridor, 3 occur in Ellicott Rock Wilderness, 3 occur in the proposed Cedar Creek Botanical Area, and 1 occurs in White Rock Scenic Area.

Given that protective status of lands occupied by Mountain Camellia on the Sumter, habitat for Mountain Camellia is stable at this time. Site visits by Forest personnel suggest that populations for Mountain Camellia are stable as well.

## Northern dusky salamander (S)

Northern dusky salamander, *Desmognathus fuscus*, was chosen as a management indicator for the Sumter to represent habitats in riparian zones including springs, seepages, and woody ravines with ground structures of rotten logs and rocks in or directly adjacent to the streams (Stewart, 1985). The following sources of data and information are used:

- ❑ Data collected by the Savannah River Ecology Lab under Challenge Cost Share Agreement with the U.S. Forest Service, 2000-Present
- ❑ Sumter Forest Monitoring Reports, 1990-1999
- ❑ Museum Records compiled by the South Carolina GAP Project, SCDNR, Columbia, SC
- ❑ Bruce, R. P. Livingston, C. Spencer, and B. Stuart. 1995. Amphibian and Reptile Survey of the Chattooga River Watershed – a Preliminary Report. Highlands Biological Station, Highlands, NC

The Northern dusky salamander is a stream dwelling salamander, occurring east of the Mississippi from northern Maine and Canada to the panhandle of Florida, but absent from the Coastal Plain of Georgia and the Carolinas. Northern dusky salamander is thought to be common to abundant, where it occurs (Wilson, 1995). Monitoring on the Sumter has primarily focused on habitat, though records for Northern dusky salamander are known to occur. In museum records for Northern dusky salamander

compiled by the SCDNR and the Savannah River Ecology Lab (SREL), 81 occurrences for this species were noted from 1947 and 1952. Most of these were collected from the sand hills and lower piedmont physiographic regions, and only two near the Sumter in McCormick County. In an inventory of amphibians and reptiles of the Chattooga River watershed (1995), no Northern dusky salamanders were found, though other species in the genus (*Desmognathus monticola*, *D. ochrophaeus*, *D. quadramaculatus*, *D. aeneus*, and *D. marmoratus*) were noted to be common. In a comparison of herpetofaunal communities in unimpacted streams and beaver-impounded streams on the Clemson Experimental Forest, Metts, et.al. captured 309 Northern dusky salamanders including only four from beaver Lakes. In an effort to monitor amphibians and reptiles on the Sumter, the Savannah River Ecology lab identified nine Northern dusky salamanders, including eight on the Enoree, and one on the Long Cane. No specimens of *Desmognathus fuscus* were located on the Andrew Pickens, though 33 *D. monicola* and 35 *D. ocoee* were identified. This was the result of sampling once/month for a year at 14 sites on the Sumter.

## Effects of Management

Minimum management requirements (MMRs) were incorporated into the Sumter Plan (See Sumter Plan, p. L-2) to ensure that habitat for Northern dusky salamander was being maintained. As part of implementation monitoring, districts were to document whether or not areas had been cut on one side of stream only, length of regeneration area adjacent to the stream, percentage of dominant and codominate trees within 100 feet of streams 4 feet or wider, average distance of regeneration area adjacent to streams 4 feet and wider, shade present within 20 feet of streams less than 4 feet, and percent of bare soil due to logging disturbance within 20 feet of stream (Sumter Monitoring Handbook, 1987).

Results from implementation monitoring (1990-1999), taken from Monitoring Reports, suggest that during 1990-1993, compliance with the minimum management requirements were good. From 1994-1999, either no regeneration was occurring in bottomland hardwood forests in the vicinity of perennial streams, or MMRs were being met.

Common practice on the Sumter is to adhere to the SC Best Management Practices (BMPs), and standards in the Sumter Plan prevent erosion and ensure the protection of water resources (p. IV-4). More recent direction (letter from Regional Forester dated May 15, 2000) expands our definition of riparian influence specifying minimum widths “to ensure that riparian ecosystems will be managed to maintain and restore their many functions and values.”

Habitat for Northern dusky salamander is likely stable on the Sumter given that State BMPs and Forest standards regarding protection of riparian zones are being met. However, amphibian populations are difficult to monitor in response to forest management activities in the short-term.

### **Need for Change**

Amphibians such as Northern dusky salamander are difficult to monitor because of their large population fluctuations in relation to weather patterns and their fossorial nature. Long-term monitoring (10-20 years) along single stream sections is needed to determine population fluctuations while filtering out year-to-year variation caused by unpredictable environmental factors such as rainfall fluctuations (Steve Bennett, personal communication). The use of amphibians as indicators of forest management activities is limited unless the Forest commits to monitoring a system of permanent plots over the long-term.

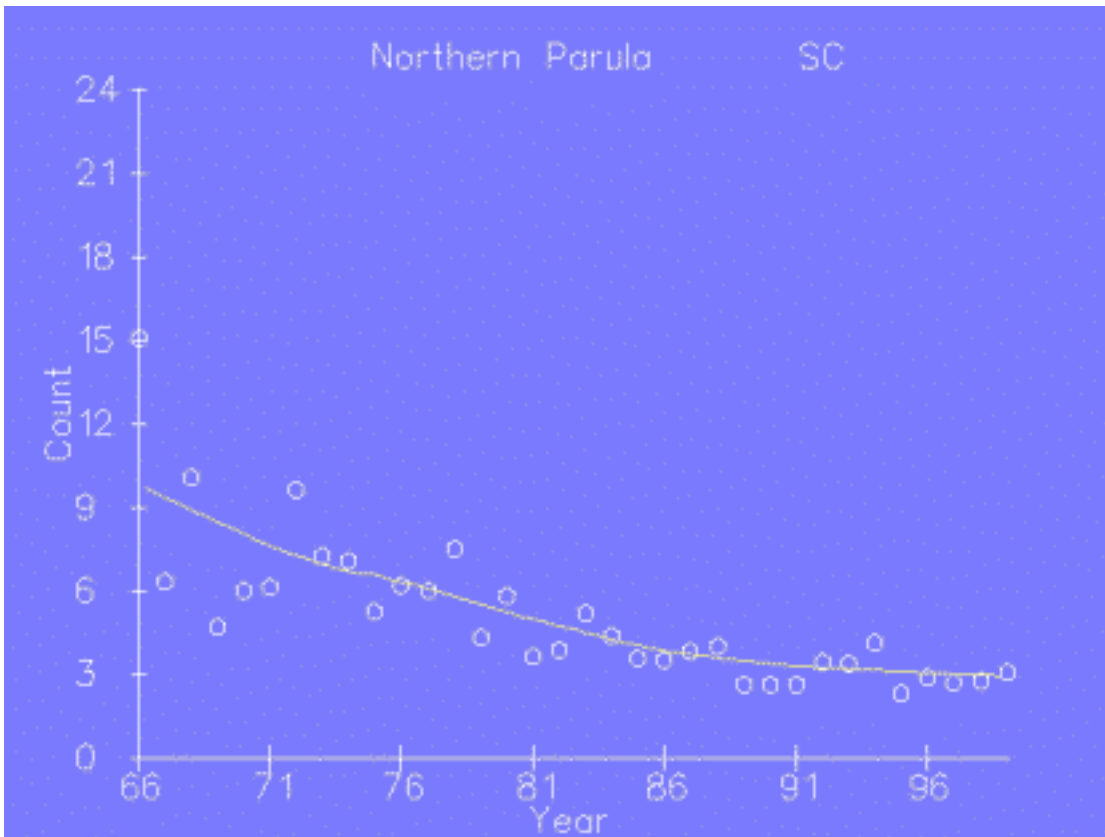
### **Northern Parula (FM)**

Northern Parula, *Parula Americana* was identified as a MIS for the Francis Marion National Forest to serve as an ecological indicator for mature forest habitats in swamps and bottomland hardwoods as well as forested areas in mixed pine/hardwood forest types (Francis Marion MIS selection process record). Appendix B of the Francis Marion Plan states that we will collect point count data, calculate population trends and compare with habitat changes over time. Bird point counts have been conducted since 1994 using methods described in Hamel et al. (*A Land Manager's Guide to Point Counts of Birds in the Southeast*, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in monitoring reports.

The following sources of data and information were used in this analysis:

- ❑ Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- ❑ USDA Forest Service. Francis Marion National Forest. Forest records and annual bird point data (1994 – 2000)
- ❑ USDA Forest Service. Francis Marion National Forest, Annual monitoring reports (1990 –2000)
- ❑ Hamel, P. B. 1992. *Land manager's guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- ❑ Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

In the Southeast, Northern Parula is primarily associated with swampy woods, riverfront and wet streamside forests, either pine, hardwood or mixed where moss-like lichens or Spanish moss are commonly found. Populations of Northern Parula appear to have been steadily declining (trend estimate  $-3.68$ ;  $p = .00049$ ; Sauer et al., 2000) across South Carolina (Figure 53).



**Figure 53. Average number of Northern Parula per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

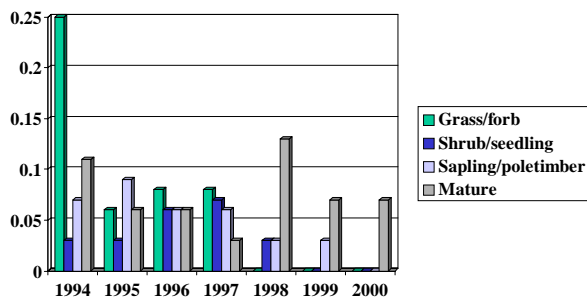
A total of 739 bird point counts were conducted on the Francis Marion from 1994 through 2000. There were 54 detections of Northern Parula during 40 of the 739 point counts.

Point counts conducted on the Francis Marion indicate Northern Parula are not common, and appear to be limited to specific habitat conditions with what appears to be a declining trend in occurrence and distribution (1994 – 2000; Figure 54).

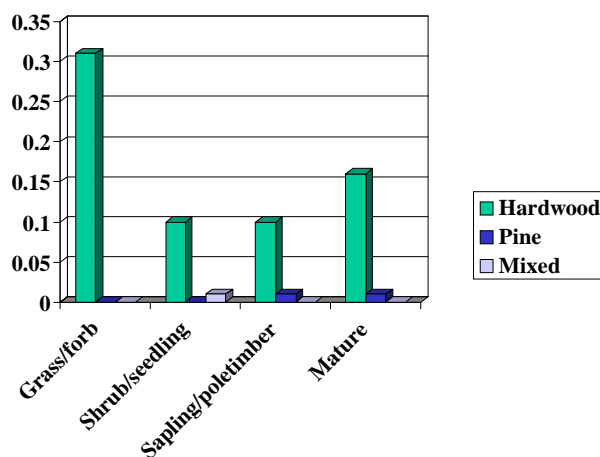
Northern Parula appears to consistently be associated with mature habitat conditions in hardwood forest types (Figure 54a), primarily in bottomland sites (Figure 54b). An interesting contrast in occurrences is evident for this species between mature forest conditions and grass/forb conditions. Northern Parula are recorded in bottomland hardwood grass/forb habitat conditions from 1994 – 1997 at an equal or greater frequency than in mature habitats, but have gone undetected in grass/forb habitats

from 1998 – 2000. A similar trend is also evident in shrub/seedling as well as sapling/poletimber habitat conditions. Apparently, forested stands recovering from Hurricane Hugo in grass/forb, shrub/seedling and sapling/poletimber conditions were providing suitable habitat for the Northern Parula in the early 90s. Northern Parula are conspicuously in low numbers in all successional stages of mixed forest and pine forest types, and on all upland sites.

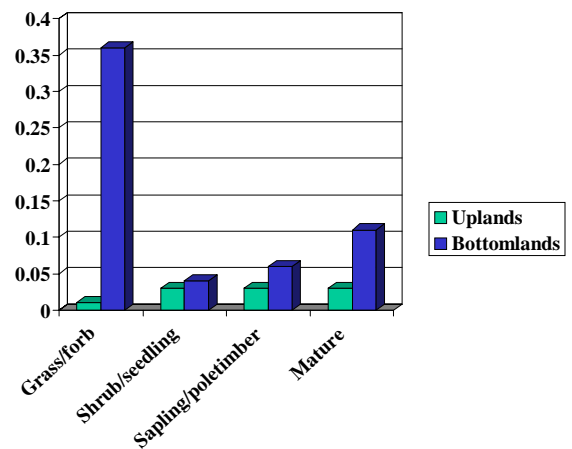
**Figure 54. Percentage occurrence**



**of Northern Parula on point counts by successional stage on the Francis Marion National Forest, 1994 - 2000**



**Figure 54a. Percentage occurrence of Northern Parula on point counts in hardwood, pine and mixed forest habitats on the Francis Marion National Forest, 1994 - 2000**

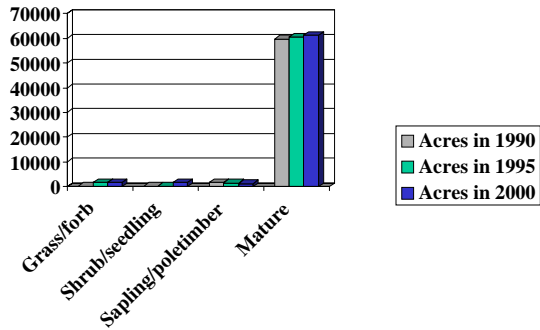


**Figure 54b. Percentage occurrence of Northern Parula on point counts in bottomland and upland habitats on the Francis Marion National Forest, 1994 - 2000**

### Effects of Management

Northern Parula requires bottomland or swamp hardwood forest conditions preferably with Spanish moss or *Usnea* present (Hamel 1992, p. 261). Acres of bottomland hardwoods on the Francis Marion have remained essentially constant since Hurricane Hugo (Figure 55). Management of bottomland hardwoods has been essentially suspended since Hugo. Distribution of habitats preferred by Northern Parula is limited primarily by landform and somewhat by historical land use before Forest Service ownership. Although there is a trend in diversity of habitats used and frequency of occurrences for this species, Northern Parula is widespread and there is no apparent association between management activities and abundance at this time.

Annual monitoring reports (1990 – 2000) indicate that Northern Parula populations are stable. Results of annual point counts indicate breeding Northern Parula are found only in certain habitats and have declined in frequency and distribution of occurrences (1994 – 2000). This may be attributable to mature bottomland hardwood habitats being abundant and well distributed, and bottomland hardwood grass/forb, shrub/seedling, and sapling/poletimber conditions being in short supply.



**Figure 55. Trends of bottomland forest habitats on the Francis Marion National Forest**

### Prothonotary Warbler (FM)

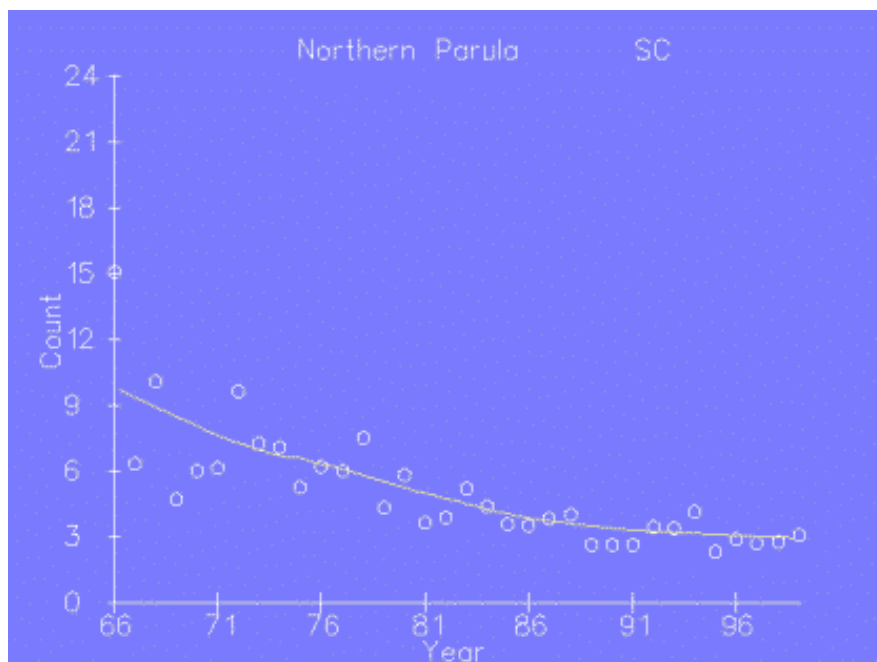
Prothonotary Warbler, *Protonaria citrea*, was identified as a MIS for the Francis Marion National Forest to serve as an ecological indicator for cavities over standing water (Francis Marion MIS selection process record). Appendix B of the Francis Marion Plan states that we will collect point count data, calculate population trends and compare with habitat changes over time. Bird point counts have been conducted since 1994 using methods described in Hamel et al. (A Land Manager’s Guide to Point Counts of Birds in the Southeast, USDA Forest

Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in Forest monitoring reports.

The following sources of data and information were used in this analysis:

- Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- USDA Forest Service. Francis Marion National Forest. Forest records and annual bird point data (1994 – 2000)
- USDA Forest Service. Francis Marion National Forest, *Annual monitoring reports (1990 – 2000)*
- Hamel, P. B. 1992. *Land manager’s guide to the birds of the South. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.*
- Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

In the Southeast, Prothonotary Warbler is primarily associated with swampy woods, Carolina bays, riverfront, or lake and Lake margins where there are suitable cavities for nesting. Populations of Prothonotary Warbler appear to have been steadily increasing (trend estimate 2.30;  $p = .0026$ ; Sauer et al., 2000) across South Carolina (Figure 56).



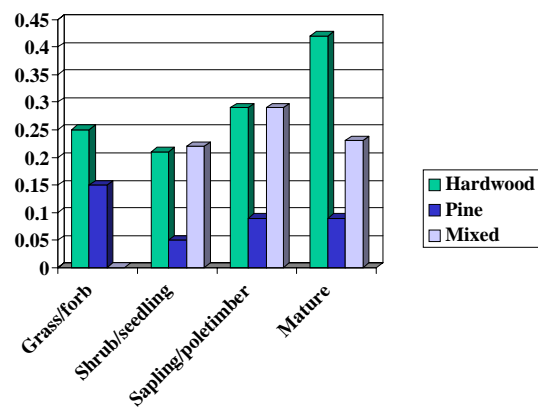
**Figure 56. Average number of Prothonotary Warblers per route for Breeding Bird Survey routes in South Carolina, 1966-1999**



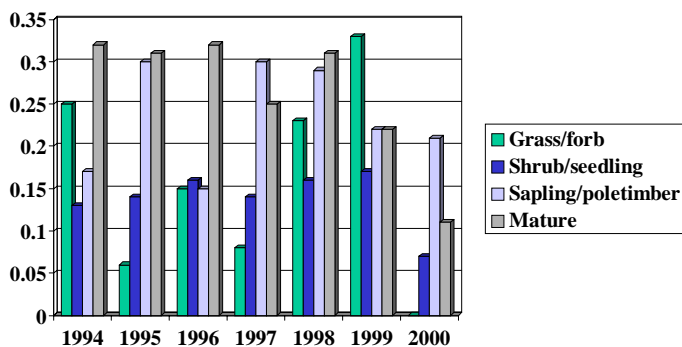
A total of 739 bird point counts were conducted on the Francis Marion from 1994 through 2000. There were 214 detections of Prothonotary Warbler during 162 of the 739 point counts.

Point counts conducted on the Francis Marion indicate Prothonotary Warblers are relatively common, with no large trends in abundance apparent (Figure 57). Prothonotary Warbler appears to consistently be associated with hardwood and mixed forest types (Figure 57a), primarily in bottomland sites (Figure 57b). Prothonotary Warblers are conspicuously absent in bottomland grass/forb habitat conditions, in low numbers in all successional stages of pine forest types, and on all upland sites.

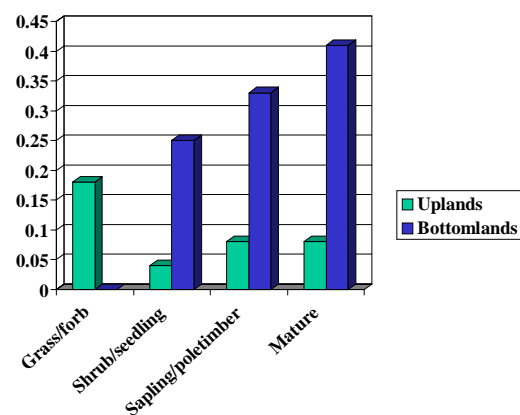
Although total number of occurrences is not a reliable measure of a population, approximately five out of six Prothonotary Warblers detected (1994 – 2000) were utilizing bottomland habitats (Figure 57c).



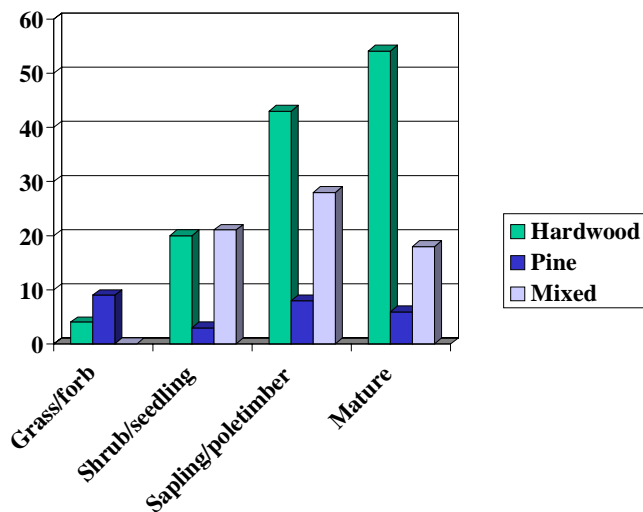
**Figure 57a.** Percentage occurrence of Prothonotary Warblers on point counts in hardwood, pine and mixed forest habitats on the Francis Marion National Forest, 1994 - 2000



**Figure 57.** Percentage occurrence of Prothonotary Warblers on point counts by successional stage on the Francis Marion National Forest, 1994 - 2000



**Figure 57b.** Percentage occurrence of Prothonotary Warblers on point counts in bottomland and upland habitats on the Francis Marion National Forest, 1994 - 2000



**Figure 57c. Total number of detections (1994 – 2000) of Prothonotary Warbler on the Francis Marion National Forest by successional stage**

### Effects of Management

Prothonotary Warbler requires bottomland, swamp hardwood forest, or willow thickets with dead stumps near water (Hamel 1992, p. 278). Acres of bottomland hardwoods have remained essentially constant on the Francis Marion since Hurricane Hugo (Figure 55) and, management of bottomland hardwoods has been essentially suspended since Hugo. The distribution of habitats preferred by Prothonotary Warbler is limited primarily by land-form and somewhat by historical land use before Forest Service ownership. Prothonotary Warbler is widespread and there is no apparent association between habitat utilization and frequency of occurrence in terms of management activities at this time.

Annual monitoring reports (1990–2000) indicate that Prothonotary Warbler populations are stable. Results of annual point counts indicate breeding Prothonotary Warbler are widely distributed and they occur in a variety of habitats that are abundant and well distributed but, the species may actually be declining in overall occurrences. This may be attributable to mature bottomland hardwood habitats

being abundant and well distributed, but other bottomland hardwood successional conditions being in short supply.

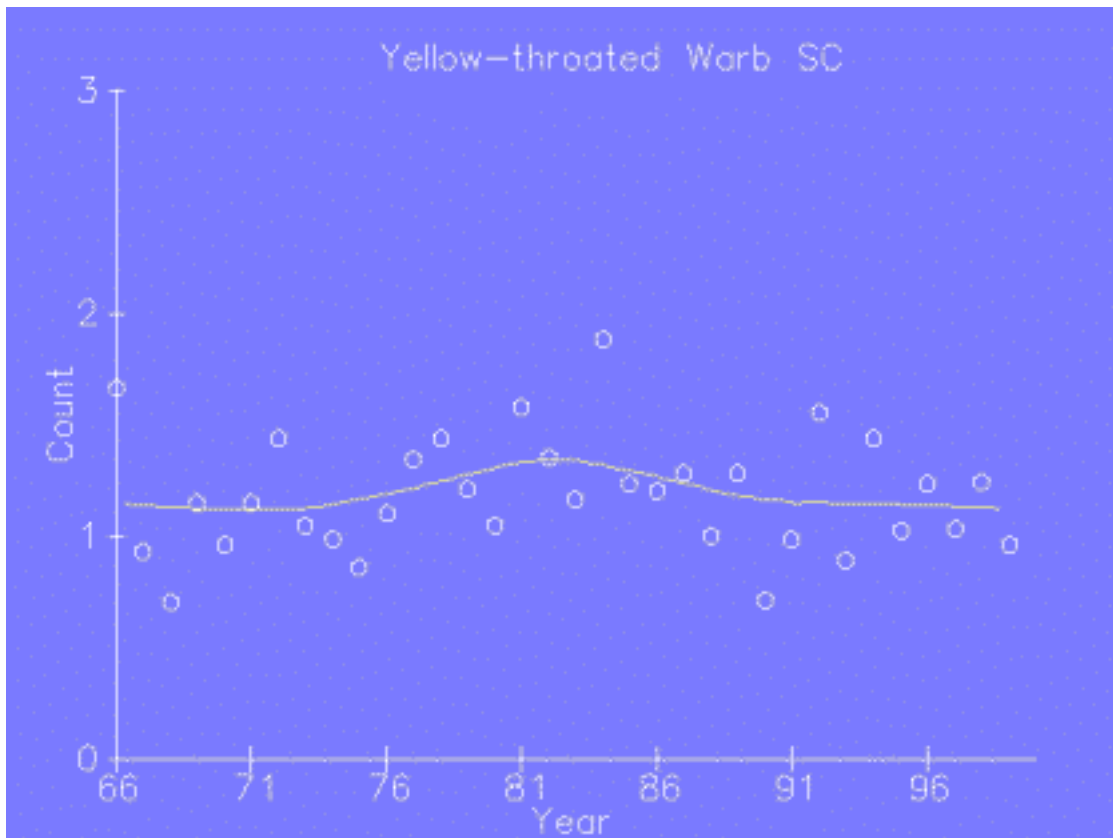
### Yellow-throated Warbler (FM)

Yellow-throated Warbler, *Dendroica dominica*, was identified as a MIS for the Francis Marion National Forest to serve as an ecological indicator for mature bottomland forests (Francis Marion MIS selection process record). To monitor the effects of Plan implementation on this species, Appendix B of the Francis Marion Plan states that we will collect point count data, calculate population trends and compare with habitat changes over time. Bird point counts have been conducted since 1994 using methods described in Hamel et al. (A Land Manager’s Guide to Point Counts of Birds in the Southeast, USDA Forest Service, GTR-120, 1996). Habitat changes and estimated population trends have been documented over time in monitoring reports.

The following sources of data and information were used in this analysis:

- ❑ Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1*, USGS Patuxent Wildlife Research Center, Laurel, MD
- ❑ USDA Forest Service. Francis Marion National Forest. Forest records and annual bird point data (1994 – 2000)
- ❑ USDA Forest Service. Francis Marion National Forest, Annual monitoring reports (1990 –2000)
- ❑ Hamel, P. B. 1992. *Land manager’s guide to the birds of the South*. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 p.
- ❑ Post, W., S. Gauthreaux, Jr. 1989. *Status and Distribution of South Carolina Birds*. The Charleston Museum.

In the coastal plain, Yellow-throated Warblers are a bird of the forest canopy particularly where broad leaf evergreens, cypress or bottomland hardwoods are present. Populations of Yellow-throated Warbler appear to have been fairly stable (1966- 1999) but with a slight downward trend since about 1984 (trend estimate -0.97;  $p = .70$ ; Sauer et al., 2000) across South Carolina (Figure 58)



**Figure 58. Average number of Yellow-throated Warblers per route for Breeding Bird Survey routes in South Carolina, 1966-1999**

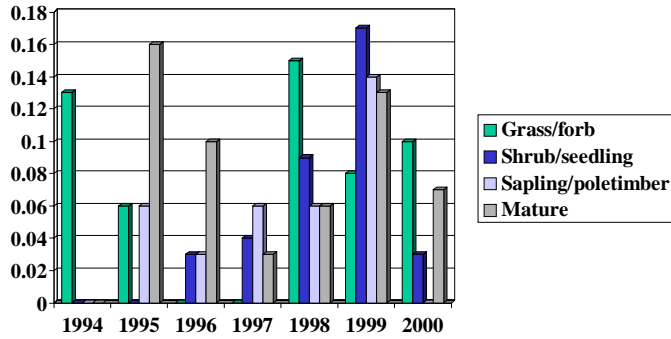
A total of 739 bird point counts were conducted on the Francis Marion from 1994 through 2000. There were 51 detections of Yellow-throated Warbler during 46 of the 739 point counts.

Point counts conducted on the Francis Marion indicate Yellow-throated Warblers are not common, occur in a variety of habitats, and have no large

trends in abundance apparent (1994 - 2000).

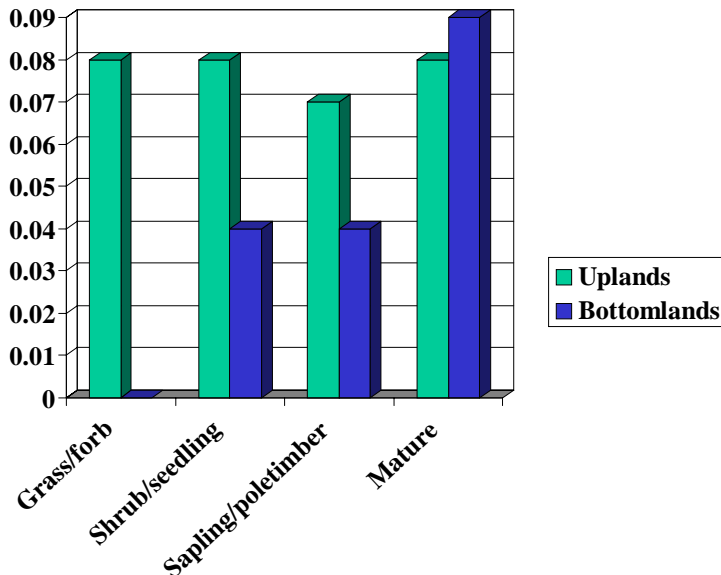
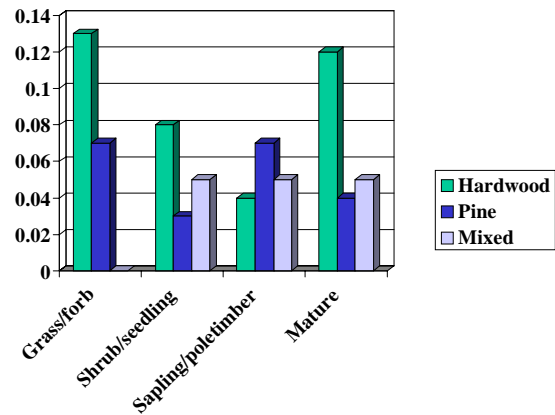
Although Yellow-throated Warbler numbers appear to be highly variable from year to year, there appears to be an overall increase in occurrences (Figure 59). In addition, detections were recorded in an increasing number of successional stages in the latter years of the survey. Yellow-throated Warblers appear to be using upland sites and hardwood

stands at about twice the frequency of bottomland sites, and pine or mixed forests (Figures 59a, 59b) Yellow-throated Warblers are conspicuously absent from grass/forb conditions in mixed forests (Figure 59a).



**Figure 59.** Percentage occurrence of Yellow-throated Warblers on point counts by successional stage on the Francis Marion National Forest, 1994 - 2000

**Figure 59a.** Percentage occurrence of Yellow-throated Warblers on point counts in hardwood, pine and mixed forest habitats on the Francis Marion National Forest, 1994 - 2000

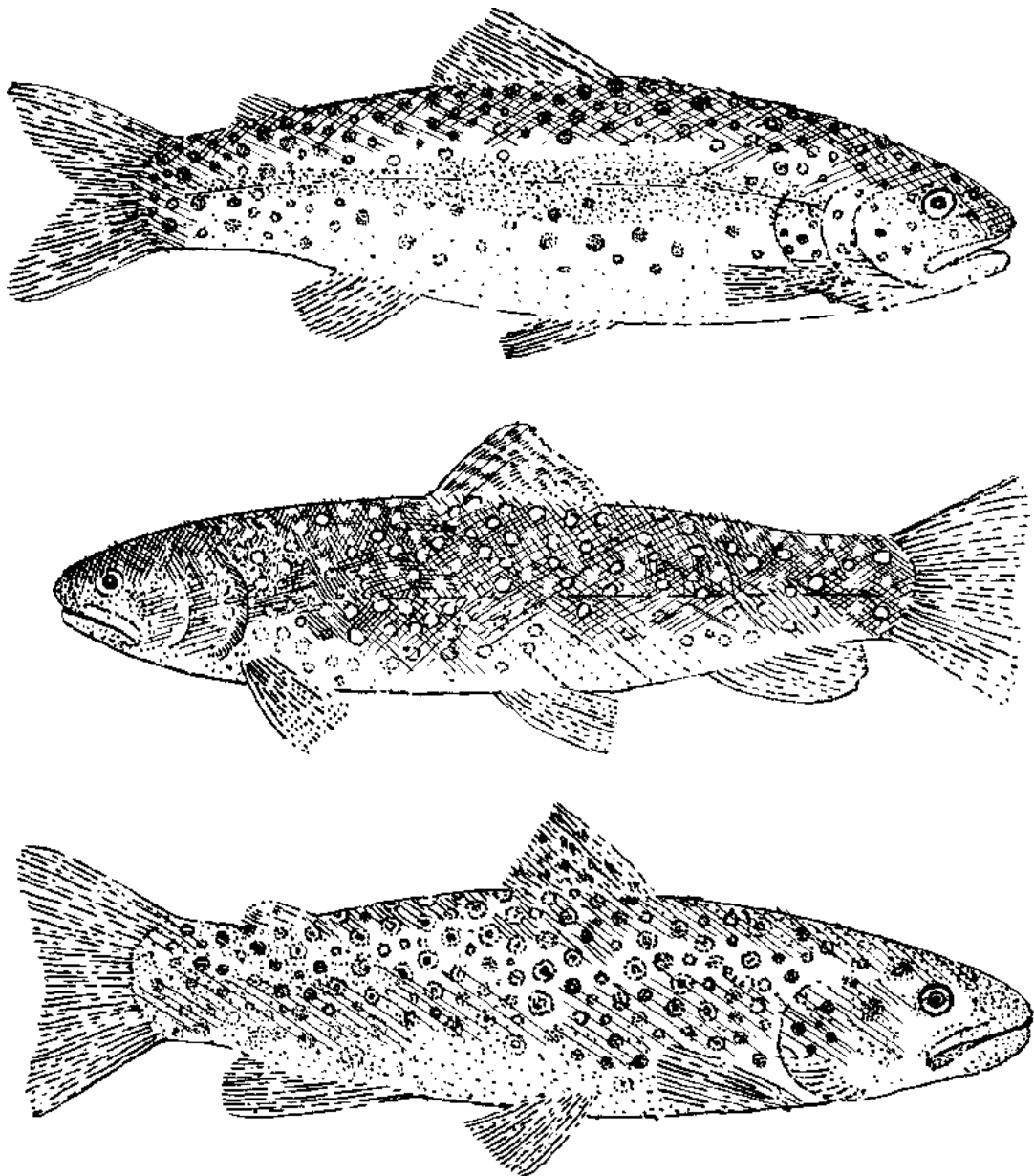


**Figure 59b.** Percentage occurrence of Yellow-throated Warblers on point counts in bottomland and upland habitats on the Francis Marion National Forest, 1994 - 2000

## Effects of Management

Yellow-throated Warblers prefer broadleaf evergreen woods or bottomland forests particularly where Spanish moss is present (Hamel 1992, p. 271). Yellow-throated Warbler is widespread and there is no apparent association between habitat utilization and frequency of occurrences of management activities now. Although it is interesting to note the increase of frequency of occurrence from 1997 – 1999 and a falling off in 2000 mimics the trend of timber management activities that occurred on the Forest from 1990 – 1993 approximately 6 years later.

Annual monitoring reports (1990 – 2000) indicate that Yellow-throated Warbler populations are stable. Point count results indicate breeding Yellow-throated Warblers are widely distributed and they occur in a variety of habitats that are abundant and well distributed. Given these results, we believe there is a high likelihood that populations of Yellow-throated Warbler will persist for the foreseeable future.



## Aquatic Ecosystems

<b>Table 27. Aquatic Management Indicator Species of the Francis Marion and Sumter NFs</b>		
<b>Aquatic Habitats</b>	<b>Forest Ranger District</b>	<b>Watershed</b>
<b>Cold Water Streams</b>		
Brook Trout, <i>Salvelinus fontinalis</i>	S-AP	Savanna
Rainbow Trout, <i>Oncorhynchus mykiss</i>	S-AP	Savanna
Brown Trout, <i>Salmo trutta</i>	S-AP	Savanna
Cool Water Streams		
Redeye Bass, <i>Micropterus coosae</i>	S-AP	Savanna
Redbreast Sunfish, <i>Lepomis auritus</i>	S-AP	Savanna
Striped Jumprock, <i>Moxostoma rupriscartes</i>	S-AP	Savanna
<b>Warm Water Streams</b>		
Redbreast Sunfish, <i>Lepomis auritus</i>	S-EN, LC; FM	Savanna, Saluda, Broad, Santee
Striped Jumprock, <i>Moxostoma rupriscartes</i>	S-EN, LC	Savanna, Saluda, Broad
Speckled Madtom, <i>Noturus leptcanthus</i>		Santee
<b>Warm Water Impoundments</b>		
Largemouth Bass, <i>Micropterus salmoides</i>	S-AP, EN, LC; FM	Savanna, Saluda, Broad, Santee
Bluegill, <i>Lepomis macrochirus</i>	S-AP, EN, LC; FM	Savanna, Saluda, Broad, Santee
S = Sumter National Forest, FM = Francis Marion National Forest, AP = Andrew Pickens Ranger District, EN = Enoree Ranger District, LC = Long Cane Ranger District.		

## Cold Water Streams

- ❑ Chattooga River Fisheries Coalition. Unpublished data collected from the Chattooga River watershed. 1986-2000.
- ❑ Etnier, D.A and W.C. Starnes. 1993. The fishes of Tennessee. The University of Tennessee Press, Knoxville, Tennessee. 681 pp.
- ❑ Geddings, W.R. 1978. Trout stream ecological studies. South Carolina Wildlife and Marine Resource Department, Columbia, South Carolina. 66 pp.
- ❑ Geddings, W.R. and D.M. Rankin. 1999. Fisheries investigations in lakes and streams. District 1 Annual Progress Report F-63-4-1 for period July 1, 1998 through June 30, 1999. South Carolina Department of Natural Resources, Freshwater Fisheries Section, Columbia, South Carolina. 109 pp.
- ❑ Guffey, S.Z. 1995. Allozyme genetics of South Carolina brook trout. Department of Ecology and Evolutionary Biology, The University of Tennessee, Knoxville, Tennessee. 29 pp.
- ❑ Lee, D.S., C.R. Gilbert, C.H. Hocutt, R.E. Jenkins, D.E. McAllister, and J.R. Stauffer, Jr. 1980. Atlas of North American freshwater fishes. North Carolina Biological Survey, Publication #1980-12. 867 pp.
- ❑ Moore, S.E., B.L. Ridley, and G.L. Larson. 1981. Changes in standing crop of brook trout concurrent with removal of exotic trout species, Great Smoky Mountains National Park. U. S. Dept. Interior, National Park Serv., Research/Resources Mgmt. Rpt. 37:1-87.
- ❑ Rankin, Dan (Fisheries Biologist, South Carolina Department of Natural Resources) 2001. Personal communications with Jeanne Riley, Fisheries Biologist, USDA Forest Service Sumter and Francis Marion National Forests, Supervisors Office, Columbia, SC.
- ❑ Rhode, F.C., R.G. Arndt, D.G. Lindquist, and J.F. Parnell. 1994. Freshwater fishes of the Carolinas, Virginia, Maryland, and Delaware. The University of North Carolina Press. Chapel Hill, North Carolina. 222 pp.
- ❑ USDA Forest Service. 1985. Process record for the selection of indicator species and their management needs, Sumter National Forest. 58 pp.

Brook trout, rainbow trout and brown trout were selected as a MIS for the Sumter cold-water streams due to the water quality requirements of these three species (USDA Forest Service 1985).

There are 66 designated trout streams totaling 126 stream miles on the Andrew Pickens in the Sumter. This represents approximately 40% of the total trout streams in South Carolina. Trout occur at the southern edge of their range in South Carolina and are limited by elevation and water temperature (Rhode et al. 1994). Brook trout are the only native salmonid in the southeast (Etnier and Starnes 1993).

### Brook Trout

Brook trout occur in the extreme northwest corner of the state. Its range is Canada south into a restricted band along the Appalachian Mountain chain into northern Georgia (Lee et al. 1980). Brook trout are usually confined to first and second order streams in the Appalachian Mountains and competition for food and habitat is great where rainbow trout have encroached (Moore et al. 1981). Brook trout are more temperature sensitive than brown or rainbow trout (Rhode et al. 1994).

In 1995, there were 12 known, self-sustaining populations of brook trout in South Carolina, 7 of which occur in the Sumter National Forest. A

genetic study in 1995 revealed that one population of the native southern Appalachian strain of brook trout exists on the Sumter National Forest (Guffey 1995). The remaining streams contain populations of southern and northern mixed brook trout.

According to Dan Rankin, SCDNR Biologist, three of the populations are stable due to their allopatric status, one population is unstable due to the introduction of brown trout, and the remaining three populations are of questionable status pending surveys to determine if brown trout have been introduced into the streams.

### Rainbow Trout and Brown Trout (S)

Rainbow trout are native to the western United States. Introduction of this species has expanded its range to the east from Canada and south through the Appalachian Mountains into northern Georgia (Lee et al. 1980).

Brown trout are native to Europe. This species is now widespread across the country and extends into

north Georgia along the Appalachian Mountain chain (Lee et al. 1980). Brown trout usually reach a larger size than other resident trout species. They are more tolerant of higher water temperatures and fishing pressure (Etnier and Starnes 1993).

The Chattooga River Fisheries Coalition has monitored the main channel of the Chattooga River since 1986 with the purpose of giving special emphasis to protection and enhancement of fishery resources, water quality, and overall biological health of the Chattooga River and its watershed. This group consists of cooperators including the Forest Service, SCDNR, North Carolina Wildlife Resources Commission, Georgia Department of Natural Resources, and Trout Unlimited. Seven sampling sites have been electrofished alternately since 1986 (Geddings and Rankin 1999). Figure 60 illustrates the population trend in biomass of brown trout at three of these sites. The average total trout biomass for trout streams in South Carolina is 20 kg/ha (Dan Rankin, pers.com). Brown trout populations appear to be in stable condition in the Chattooga River.

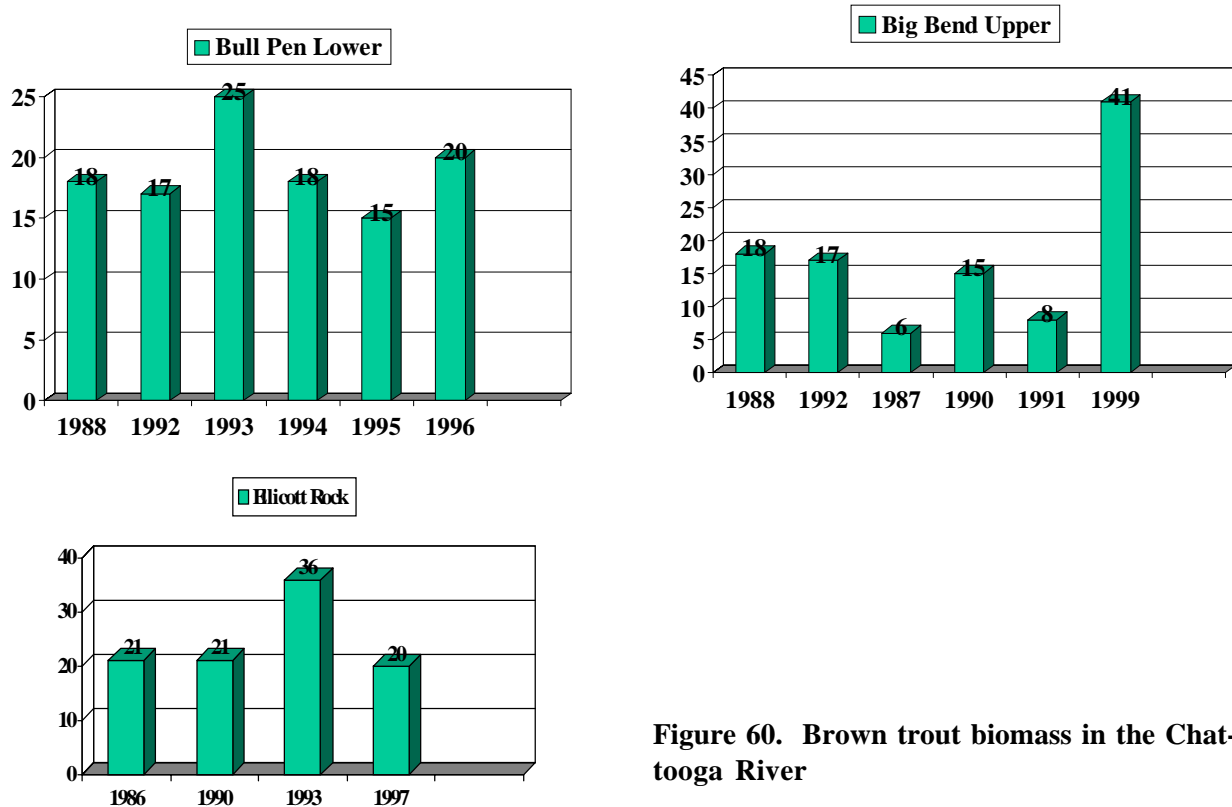


Figure 60. Brown trout biomass in the Chattooga River



To support the purpose of the Chattooga River Fisheries Coalition, fall surveys from three monitoring stations on the East Fork Chattooga River were conducted annually from 1993 to 1996. Rainbow trout biomass ranged from 7.16 kg/ha to 40.7 kg/ha. Brown trout biomass for this period ranged from 29.85 kg/ha to 252.8 kg/ha.

From 1970 to 1974, quantitative surveys were conducted annually in the Cheohee Creek watershed by the SCDNR to study the population dynamics of productive, self-sustaining trout populations in a Southern Appalachian stream (Geddings 1978). In the headwaters, rainbow trout biomass ranged from 5.86 to 11.24 kg/ha with a mean of 9.42 kg/ha. Further downstream, where brown trout were also present, total trout biomass ranged from 4.12 to 25.7 kg/ha with a mean of 15.24 kg/ha. At lower elevations where the fish community was more diverse, brown and rainbow trout biomass and density decreased. In 1995, the headwater section of Cheohee Creek was again sampled. Rainbow trout biomass was 15.25 kg/ha, which is higher than the upper range figures from 1970 to 1974.

The Chattooga River Fisheries Coalition conducted a voluntary creel survey from 1991 to 1998 on the Chattooga River. Rainbow trout catch per hour remained constant over this period, ranging from 0.8 to 1.3 catch per hour. Catch per hour for brown trout ranged from 1.1 to 1.9 fish.

### **Effects of Management**

SC Best Management Practices relating to the protection of water quality are implemented on the Sumter National Forest. Also, standards and guidelines in the Land and Resource Management Plan for the Sumter National Forest (1985) provide protection to Forest waters from erosion and herbicide use. More recent policy (letter from Regional Forester dated May 15, 2000) expands the definition of riparian influence specifying minimum widths “to ensure that riparian ecosystems will be managed to maintain and restore their many functions and values.”

The past management practice of stocking non-native trout in brook trout waters has been attributed to the decrease in brook trout range. Opportunities for the restoration of brook trout populations should be explored in cooperation with SCDNR.

### **Need For Change**

Using a community monitoring approach, population and habitat monitoring efforts should be implemented to assess management activities in known brook trout waters and in other unstocked trout waters on the Andrew Pickens Ranger District. Brook trout, rainbow trout and brown trout are fairly representative of a coldwater stream community in the Southern Appalachians. However, non-game species that inhabit trout streams are important components of the community. Blacknose dace, for example, have proved to be more acid sensitive than brook trout and therefore could determine management needs in an aquatic system before complete degradation occurs in that system.

## **Cool Water Streams**

- ❑ Chattooga River Fisheries Coalition. Unpublished data collected from the Chattooga River watershed. 1986-2000.
- ❑ Durniak, J.P. 1989. A fisheries survey of the upper Chattooga River. Georgia Department of Natural Resources Game and Fish Division, Atlanta, GA. 68 pp.
- ❑ Geddings, W.R. 1978. Trout stream ecological studies. South Carolina Wildlife and Marine Resource Department, Columbia, South Carolina. 66 pp.
- ❑ Geddings, W.R. 1967. Stream population studies in the Chauga River drainage. South Carolina Wildlife and Marine Resources Department. Columbia, South Carolina. 37 pp.

- Lee, D.S., C.R. Gilbert, C.H. Hocutt, R.E. Jenkins, D.E. McAllister, and J.R. Stauffer, Jr. 1980. Atlas of North American freshwater fishes. North Carolina Biological Survey, Publication #1980-12. 867 pp.
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The redeye bass, redbreast sunfish and striped jumprock represent aquatic habitats that transition from cold water to warm water streams (cool water habitats) on the Andrew Pickens in the mountain region of South Carolina. Redeye bass were chosen as MIS because they are found in small gravelly headwater streams where no other species of bass are present (USDA Forest Service 1985). Redbreast sunfish were chosen as MIS because they are found in a wide variety of habitats ranging from the sandy bottom acidic streams to rocky gravelly headwaters and are occasionally abundant in lakes (USDA Forest Service 1985). These two species also represent an important recreational fisheries to anglers (USDA Forest Service 1985). Striped jumprock represent a different component of the fisheries community. This sucker is not a sought after game fish and is representative of a more diverse community.

## **Redeye Bass (S)**

The redeye bass inhabits coolwater small to medium sized streams. In South Carolina, this fish occupies waters in the extreme northwest section of the state (Rhode et al. 1994). It ranges from South Carolina to the west and south into a small section of Tennessee, northern Georgia, and northeast Alabama (Lee et al. 1980).

Redeye bass occur below Big Bend Falls on the Chattooga River, where they replace trout as the dominant sport fish (Durniak 1989). It is known to occur in the Chauga River system in both marginal trout waters and non-trout waters (Geddings 1967). In 2000, redeye bass were surveyed in the Whitewater River watershed in a stream adjacent to recently acquired Forest Service lands (Rankin 1998).

## **Redbreast Sunfish (S)**

The redbreast sunfish occurs in a variety of habitats from small creeks to rivers and reservoirs. It has a statewide distribution in South Carolina (Rhode et al. 1994). The redbreast sunfish is distributed along the east coast and west into Kentucky, Tennessee, Georgia and Alabama (Lee et al. 1980).

Redbreast sunfish occur below Big Bend Falls on the Chattooga River, where the fish community becomes more diverse with the warmer water temperatures (Chattooga River Fisheries Coalition unpublished data). It also occurs in Cheohee Creek (Geddings 1978) and the Chauga River (Geddings 1967). In 2000, redbreast sunfish were surveyed in the Whitewater River watershed in a stream adjacent to recently acquired Sumter National Forest Service lands.

## Striped Jumprock (S)

The striped jumprock is typically found in small to medium sized warm water streams but also occurs in cool water streams it is known to occur in trout streams in the Chattooga River watershed in North Carolina. Its distribution across South Carolina is in the mountain and piedmont streams (Rhode et al. 1994). The species range covers the piedmont and mountain regions of the Santee, Savannah, Altamaha and Chattahoochee river systems in North Carolina, South Carolina, and Georgia (Lee et al. 1980).

Striped jumprock are known to occur in the Chattooga River and some of its tributaries (Chattooga River Fisheries Coalition unpublished data), the Cheohee Creek watershed, (Geddings 1978) and the Chauga River watershed (Geddings 1967).

### Effects of Management

SC Best Management Practices relating to the protection of water quality are implemented on the Sumter. Also, standards and guidelines in the Sumter Plan (1985) provide protection to Forest waters from erosion and herbicide use. More recent policy (letter from Regional Forester dated May 15, 2000) expands the definition of riparian influence specifying minimum widths “to ensure that riparian ecosystems will be managed to maintain and restore their many functions and values.”

### Need For Change

Present monitoring techniques focus on the response of one or two individual species to management activities or natural events. The population size or distribution of one or two species does not reflect the overall status or health of a community. All biological components should be considered when assessing the ecological integrity of a system. These biological components can be used to assess habitat condition and detect changes caused by management activities. The presence of species that are intolerant to habitat or water quality degradation

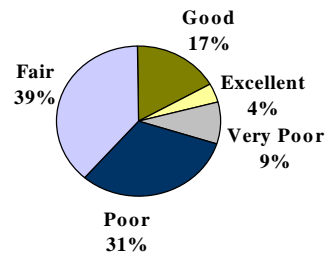
suggests minimal stream impacts whereas occurrence of those species tolerant to these changes increases as disturbance levels increase.

The redbreast sunfish and redeye bass represent game fish in cool water habitats. While the striped jumprock represents a different component of the fisheries community, it does not begin to reflect the cool water fisheries diversity. Monitoring efforts should be directed at the cool water community as a whole, instead of representing individual species. Efforts are being expanded beyond the Chattooga River Samples.

## Warm Water Streams

- ❑ Ahle, Ron. (Environmental Project Manager, South Carolina Department of Natural Resources) 2001. Personal communications with Jeanne Riley, Fisheries Biologist, USDA Forest Service Sumter and Francis Marion National Forests, Supervisors Office, Columbia, SC.
- ❑ Bulak, J.S. 1990. Distribution of fishes in South Carolina. Study completion Report WC-8. South Carolina Wildlife and Marine Resources Department, Columbia, South Carolina. 206 pp.
- ❑ Dean, J.M., M. Reichert, and M. Cameron. 1995. A report to the United States Forest Service on an analysis of the Francis Marion National Forests streams using a fish community modified index of biotic integrity. Belle W. Baruch Institute for Marine Biology and Coastal Research and the Center for Environmental Policy, University of South Carolina, Columbia, South Carolina. 27 pp.
- ❑ Hansbarger, J. and J.M. Dean. 1994. Fish communities of headwater coastal streams in the Francis Marion Nation Forest. Belle W. Baruch Institute for Marine Biology and Coastal Research, University of South Carolina, Columbia, South Carolina. 76 pp.

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- USDA Forest Service. 1995. Management indicator species record, Francis Marion LRMP.



**Figure 61. IBI ranking for Piedmont streams.**

### Redbreast Sunfish

The redbreast sunfish also represents warm water streams in the piedmont on the Sumter and in the coastal streams of the Francis Marion. The redbreast sunfish was chosen as a MIS on the Francis Marion because it is commonly fished, readily sampled and monitored and occurs in the larger third and fourth order streams (USDA Forest Service 1995).

The SCDNR is in the process of developing an Index of Biotic Integrity (IBI) for stream health assessment across the piedmont region of South Carolina. The major component of this index is fish community diversity. Streams are given a score based on diversity and then ranked in categories of very poor, poor, fair, good and excellent. To date, 54 piedmont streams have been surveyed. Figure 60 illustrates that the majority of stream scores are ranked in the poor (31%) and fair (39%) categories. Eight streams that have been sampled in the study occur in the piedmont on Forest Service lands. However, due to disjunct land ownership, these streams are influenced by private land management. Five of these streams received a Fair score, while two were ranked Poor and one was ranked Good. The IBI is still in stages of development. Some of the scores may change with more sampling, which could in turn change the rank of streams.

The redbreast sunfish was surveyed in 24 streams on the Enoree Ranger District and 57 streams on the Long Cane Ranger District from 1965 to 1999 (USDA Forest Service unpublished data). In Bulak 1990, redbreast sunfish are distributed in all of the sampled counties, which places this fish in every state watershed. Hansbarger and Dean (1994) reported the presence of redbreast sunfish in 6 out of 53 first and second order streams on the Francis Marion National Forest. Dean et.al. (1997) sampled eighteen second and third order streams on the Francis Marion National Forest and found redbreast present in 4 of these.

## Striped Jumprock (S)

The striped jumprock was surveyed in 22 streams across the piedmont districts from 1965 to 1999 (USDA Forest Service unpublished data). It was found in 10 streams on the Enoree Ranger District and 12 streams on the Long Cane. According to Bulak 1990, striped jumprock occurrences are common across the mountain and piedmont regions. According to Ron Ahle, SCDNR Biologist, both redbreast sunfish and striped jumprock are common across their ranges in South Carolina.

## Speckled Madtom (FM)

The speckled madtom was chosen as a MIS because it is habitat specific, occurring in first and second order streams, and fairly easy to monitor (USDA Forest Service 1995). It is most abundant in small to medium sized rivers but also occurs in small to large streams (Metee et al. 1996). It ranges in Atlantic and Gulf drainages from the Edisto River in South Carolina and south and east into Louisiana (Metee et al. 1996). Bulak (1990) and Rhode (1994) places this madtom in the ACE (Ashepoo, Combahee and Edisto) Basin in the Coastal Plains. The southwest portion of the Forest drains to the Ashley-Cooper River sub-basin within the ACE Basin. This sub-basin flows to the Atlantic just north of the Edisto River sub-basin. No speckled madtom occurrences were located on the Francis Marion National Forest in these publications. Hansbarger and Dean (1994) captured no speckled madtom in fifty-three first and second order streams on the Francis Marion National Forest. Dean et.al. (1997) sampled eighteen second and third order streams and found no speckled madtom.

### Effects of Management

SC Best Management Practices relating to the protection of water quality are implemented on the Francis Marion and Sumter. Also, standards and guidelines in the Land and Resource Management Plan for the Sumter (1985) and the Revised Land and Resource Plan for the Francis Marion (1996) provide protection to waters from erosion and

herbicide use. More recent policy (letter from Regional Forester dated May 15, 2000) expands the definition of riparian influence specifying minimum widths “to ensure that riparian ecosystems will be managed to maintain and restore their many functions and values.”

### Need For Change

The focus on limited community representation is also applied to the Forest piedmont and Coastal waters in warm water stream habitats. The incorporation of the SCDNR IBI for piedmont streams along with habitat surveys should begin to fill the gap of monitoring data on warm water streams.

It is highly unlikely that the speckled madtom occurs on the Francis Marion. The northern range for this species is in a watershed outside forest boundaries. It is recommended that the speckled madtom be removed from the MIS list and that a community based monitoring technique be implemented for coastal waters.

## Warm Water Impoundments

- ❑ Lee, D.S., C.R. Gilbert, C.H. Hocutt, R.E. Jenkins, D.E. McAllister, and J.R. Stauffer, Jr. 1980. Atlas of North American freshwater fishes. North Carolina Biological Survey, Publication #1980-12. 867 pp.
- ❑ Rhode, F.C., R.G. Arndt, D.G. Lindquist, and J.F. Parnell. 1994. Freshwater fishes of the Carolinas, Virginia, Maryland, and Delaware. The University of North Carolina Press. Chapel Hill, North Carolina. 222 pp.
- ❑ USDA Forest Service. 1985. Process record for the selection of indicator species and their management needs, Sumter National Forest. 58 pp.
- ❑ USDA Forest Service. 1995. Management indicator species record, Francis Marion LRMP.

Largemouth bass and bluegill represent MIS in warm water impoundments on both the Francis Marion and Sumter. These species were chosen as MIS on the Sumter due to their popularity as games fishes (USDA Forest Service 1985). They were chosen for the Francis Marion because they are commonly fished, they are good ecological indicators and are easy to monitor (USDA Forest Service 1995). The largemouth bass inhabits slow moving waters, particularly larger streams and lakes. The bluegill is an inhabitant of both streams and lakes, but is most abundant in lakes and ponds. In South Carolina, both of these species are distributed state wide in abundance (Rhode 1994). They range throughout the United States, with introduced populations occurring in the West and in the northern Atlantic slope for the bluegill (Lee et al. 1980).

Fish populations in most Forest Service impoundments have been surveyed periodically in cooperation with SCDNR to determine the strength of the recreational fishery. When populations of largemouth bass and bluegill are out of balance, measures are implemented to improve species composition and balance and thus the fishery.

### Effects of Management

SC Best Management Practices relating to the protection of water quality are implemented on the Francis Marion and Sumter. Also, standards and guidelines in the Land and Resource Management

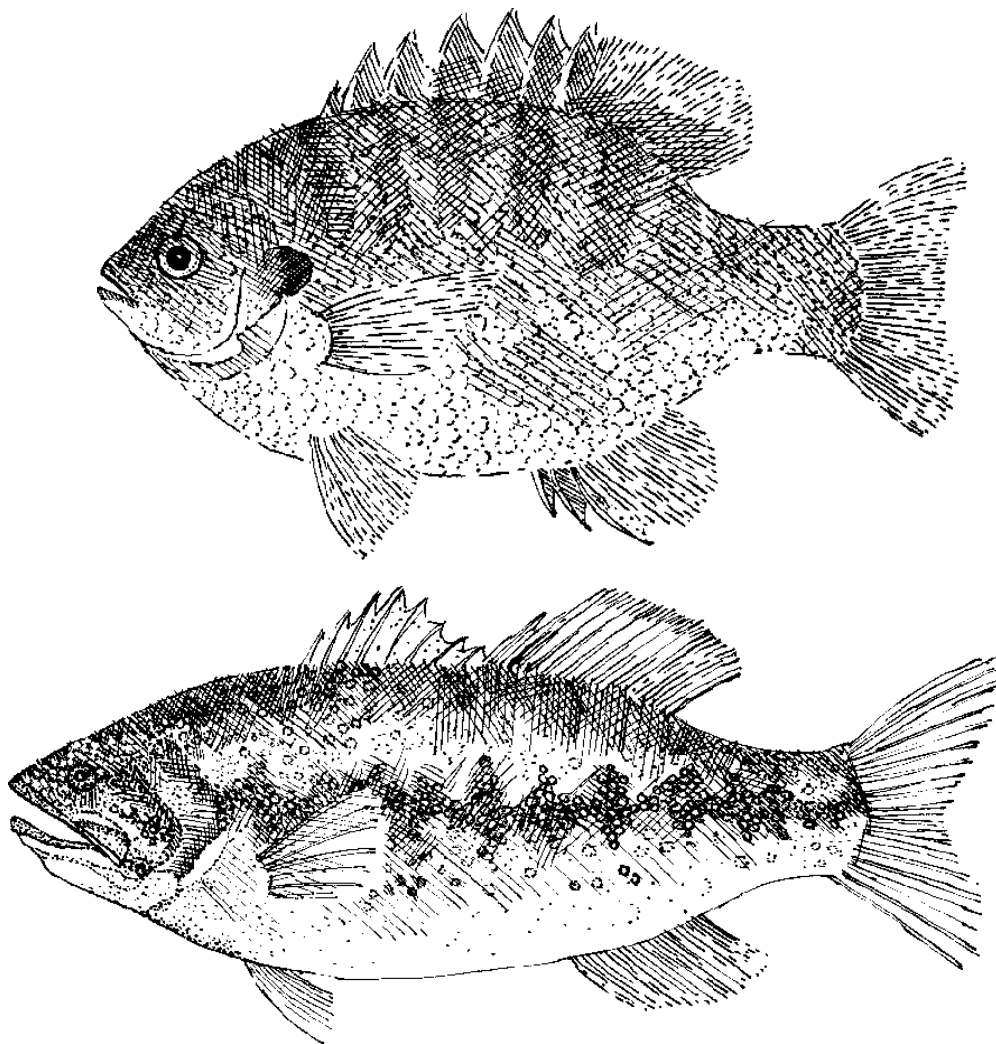
<b>Table 28. Recreational fisheries managed lakes on the Francis Marion and Sumter NFs</b>		
<b>Impoundment Location</b>	<b>Impoundment Name</b>	<b>Acreage</b>
<b>Sumter National Forest</b>		
<b>Andrew Pickens Ranger District</b>	Presbyterian Lake	4
<b>Enoree Ranger District</b>	Molly's Rock Lake	1
	Pittman Lake	4
	John's Creek Lake	4
	Sedalia Lake	13
	Wildcat Lake	7
	Macedonia Lake	11
<b>Long Cane Ranger District</b>	Lick Fork Lake	7
	Parson's Mountain Lake	28
<b>Francis Marion National Forest</b>		
	Bellfield Pond	2
	Rhem's Church Pond	1
	Cane Swamp Pond	1
	Twin Ponds	10
	Willow Hall Pond	4
	Tibwin Pond	13
	Old Georgetown Road Pond	2
	New Hope Pond	4
	Bluebird Pond	3
	Windom Corner Pond	4
	Upper Nebo Pond	1.5
	Middle Nebo Pond	4
	Lower Nebo Pond	1.5
	Asphalt Pond	2
	Jackie Pond	2
	Gator Pond	2
	Co-op Pond	2

Plan for the Sumter (1985) and the Revised Land and Resource Plan for the Francis Marion (1996) provide protection to Forest waters from erosion and herbicide use. More recent policy (letter from Regional Forester dated May 15, 2000) expands the definition of riparian influence specifying minimum widths “to ensure that riparian ecosystems will be managed to maintain and restore their many functions and values.”

Warm water impoundment habitats are periodically enhanced with brush and tree structure. The placement and frequency of impoundment enhancement needs to be addressed with District Lake management plans. Stream habitat enhancement has been implemented on the Long Cane. Additional opportunities need to be addressed through habitat surveys on all districts.

### **Need For Change**

Largemouth bass and bluegill are monitored specifically for recreational fisheries in impoundments on the Francis Marion and Sumter. These waters are managed for these two species and reflect trends specific to each impoundment. Habitat enhancement, population monitoring for proper species composition and balance, aquatic vegetation problems, water quality and fertilization need increased emphasis with District Lake management plans to efficiently manage these habitats and populations.



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