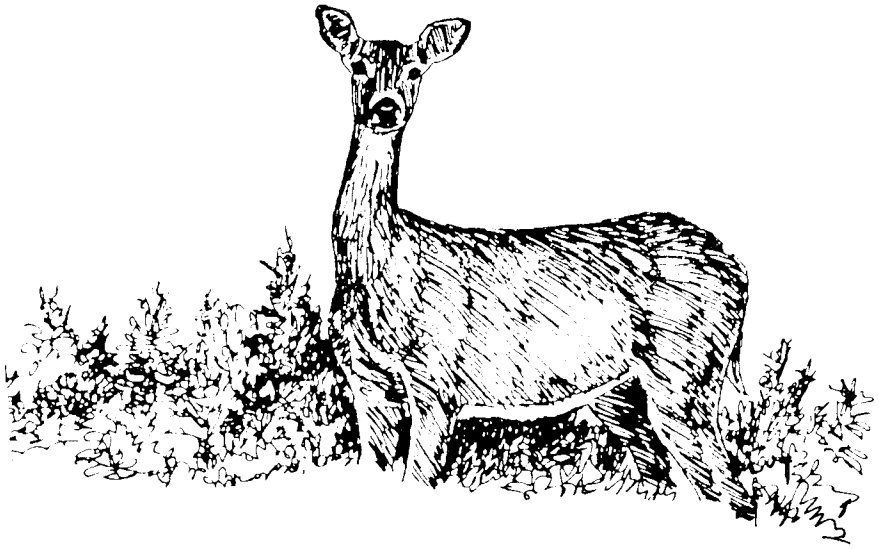
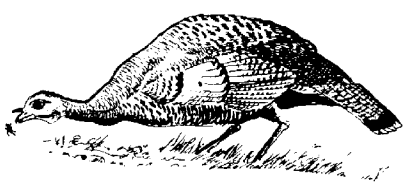
United States
Department of
Agriculture

Forest Service
Southern Region

Management Indicator Species Population and Habitat Trends

Chattahoochee-Oconee National Forests





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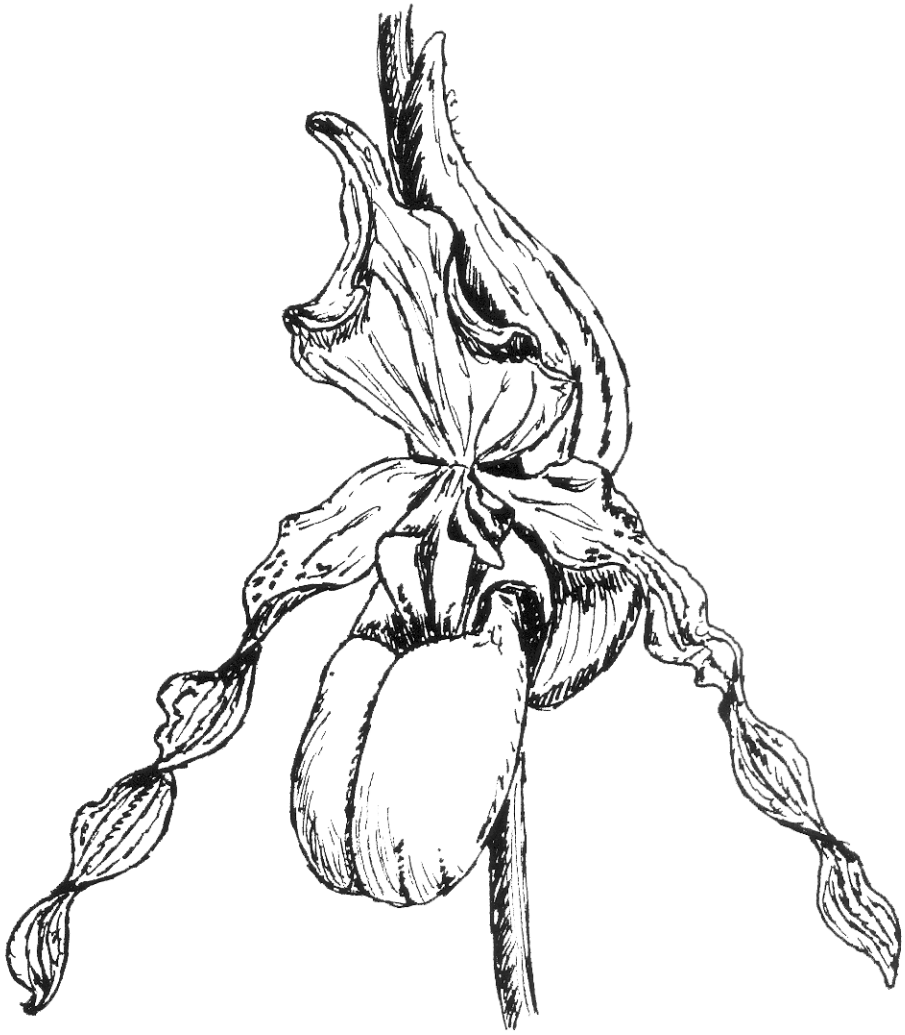


Yellow Lady's Slipper

Introduction

Wildlife and fish on the Chattahoochee-Oconee National Forests (NFs) are managed in cooperation with the Georgia Department of Natural Resources (GADNR). The State sets hunting and fishing regulations and law enforcement programs. The Forest Service and the State manage wildlife and fish habitat conditions.

Under the National Forest Management Act (NFMA), the forest is charged with preserving and enhancing the diversity of plants and animals consistent with overall multiple-use objectives stated in the Forest Plan (36 CFR 291.27—Planning, Management Requirements). To do this, Management Indicator Species (MIS) are selected "because their population changes are believed to indicate the effects of management activities" (36 CFR 291.19(a)(1), Planning—Fish and Wildlife Resource). The following describes the selection process for MIS for the 1985 *Chattahoochee-Oconee National Forests Land and Resource Management Plan* (Forest Plan).

Documentation of Management Indicator Species Selection

An initial draft MIS list was developed by E. V. Richards, Wildlife Staff Officer for the Chattahoochee-Oconee National Forests (NFs) on September 10, 1980. This original list was based on 13 research and informational references and professional opinion (USDA Forest Service, undated). Richards also compiled a document entitled "Procedure for Designation of Management Indicator Species" (USDA Forest Service, undated). On January 29, 1981, this document was sent to the Georgia Department of Natural Resources for review. A copy of this document is included below.

Procedure for Designation of Management Indicator Species

Background:

The September 17, 1979, Final Regulations regarding National Forest System Land and Resource Management Planning state:

219.12(g) Fish and Wildlife habitats will be managed . . . to maintain and improve habitat of management indicator species.

219.12(g) (2) Management indicator species, vertebrate and/or invertebrate, will be identified for planning, and the reasons for their selection will be given. The species considered will include at least: Endangered and threatened plant and animal species identified on State and Federal lists for the planning area; species with special habitat need that may be influenced significantly by planned management programs; species commonly hunted, fished, or trapped; and additional plant or animal species selected because their population changes are believed to indicate effects of management activities on other species of a major biological community or on water quality.

219.12(g) (6) Population trends of the management indicator species will be monitored and the relationships to habitat changes determined.

The Forest felt that two approaches existed that could be used in selecting Indicator Species.

Under the first approach the species presently being used to guide Forest management (such as featured species) would be related to the Forest Ecosystems.

With the second approach, the ecosystems existing on the Forest would be identified and then a list of species dependent upon these ecosystems determined. Finally, through a screening process, the management Indicator Species would be determined from this list.

Considerable confusion regarding the objectives and definitions relating to Management Indicator Species prevailed from the start. Within Region 8, a team of wildlife biologists assigned by the Regional Office to define approaches to the MIS mandate initially interpreted MIS to be ecological indicators of all management activities. The team postulated a matrix approach whereby the forest planning area would be divided into logical plant successional units, with an array of successional unit-dependent wildlife species identified. From this matrix would be selected one or more species representing each successional unit of forest. It was believed that by monitoring changes in population sizes of the various indicator species, the effects of management activities could be derived. This interpretation was not universally accepted by all Region 8 forest wildlife biologists.

A second approach was presented which viewed Management Indicator Species as comparable to Featured Species. This approach was later clarified and accepted by the Forest upon receiving Chapter 500 of the draft FSHB 1909.12, “National Forest Land and Resource Planning” Handbook, which was sent to all forests for review on November 5, 1980.

Since the Chattahoochee-Oconee National Forests had already developed a matrix of forest successional stages and determined the dependent wildlife species, this was modified to include deer, bear and ruffed grouse.

The preliminary selection of MIS based on the matrix was improved with the addition of these three species to better reflect the purposes and objectives actually stated in the regulations and clarified in FSHB 1909.12, Planning Handbook.

In its present form, MIS on this forest includes:

1. Game Species (deer, bear, turkey, grouse, quail, and squirrel).

2. Game Fishes (brook and rainbow trout).

3. Endangered, threatened or sensitive species (Red-cockaded Woodpecker, Yellow-lady's Slipper).

4. Animals and plants with very limited distribution (Bog Turtle, Mountain Pitcher Plant).

5. Animals whose numbers reflect major vegetative conditions (Indigo Bunting).

The final list of species reflects the Forest’s view that Management Indicator Species are those animals and plants having special management needs which must be met through coordination with other resource programs.

Step 1: The Forest is made up of the following Forest Ecosystems:

Loblolly - Shortleaf Pine
Oak - Pine
Oak - Hickory
White Pine - Hemlock

References:

Kuchler, A.W., 1964 - Potential Natural Vegetation of the conterminous United States, Amer. Geographical Soc., Spec. Publ. No. 36, New York, N.Y., pp 38.

Garrison George A., Ardell J. Bagstad, Don A. Duncan, et al [sic], 1974, Vegetation and Environmental Features of Forest and Range Ecosystems, U.S. Dept. Agric., Forest Service, Agric. Handbook 475, pp 62.

Step 2:

The Forest obtained a computer search of R.P.A. - Wildlife Assessment data listing 105 species which occur across all Forest Ecosystems and those that were coded as having an affinity for one age class grouping.

This list was scrutinized and the species screened as being reasonable entries for the Chattahoochee-Oconee National Forests.

Characteristics of good management indicator species are that they--

--will be significantly impacted by Forest management practices,

--are highly specialized or dependent on specific habitats,

--are not grossly effected [sic] by the vagaries of the weather,

--have a relatively high population turnover,

--are not cyclic due to disease or other factors,

--are capable of being monitored.

From this a listing of species associated with Forest ecosystems and age classes was made. This list represented tentative indicator species and were subject to further screenings.

Step 3:

In addition to RPA data the Forest used as reference for bird species occurring within Forest Ecosystems the following:

Le Grande Jr., Harry E., and Paul B. Hamel, 1980, Bird-Habitat Associations on Southeastern Forest Lands, Clemson University, Clemson, South Carolina, pp 276.

	Total No. of Different Bird Species Identified	Possible Breeding Pairs - Mature Stand
Loblolly-Short Leaf	101	240 pair/100 acres
Oak-Pine	127	225 pair/100 acres
Oak-Hickory	130	225 pair/100 acres
White Pine-Hemlock	61	153 pair/100 acres

Step 4:

The four Forest Ecosystems were then divided into Forest successional stages and were given approximate Forest succession age descriptions. They were also described by wildlife habitat communities, which was a broad grouping of habitats having similar age and stocking characteristics, as described below:

Forest Successional Stage	Forest Wildlife Habitat Group	Approximate Successional Age
Grass-Forbs	Forest openings, with grass-forbs-scattered shrubs	0–5
Shrub-Seedling	Shrubby-Forest Edge	6–20
Sapling-Pole Timber	Sapling-Pole, Pine or Pine Hardwood Forests	21–40
Sapling-Pole Timber	Sapling-Pole, Oak-Hickory Forests	21–40
Sapling-Pole Timber	Sapling-White Pine or White Pine Hardwood Forest	21–40
Immature Forest	Young Pine or Pine Hardwood Forest	41–60
Immature Forest	Young Oak-Hickory Forest	41–60
Immature Forest	Young White or White Pine/Hardwood Forest	41–60
Mature Forest	Mature - Pine or Pine/Hardwood Forest	61–100
Mature Forest	Mature - Oak-Hickory Forest	61–100
Mature Forest	Mature - White Pine or White Pine Hardwood Forest	61–100
Mature Forest	Old Growth - Pine or Pine Hardwood Forest	61–100
Old Growth Forest	Old Growth - Oak - Hickory Forest	100+
Old Growth Forest	*Old Growth - White Pine or White Pine Hardwood Forest	100+

In addition, the following special habitat groups were identified as existing on the Forest:

Special Habitat Groups	
Riparian - Margin	Bog, Swamp, Marsh, Ponds, Lakes
Riparian - Corridors	Riverbottom Forests, Streamside Zones, Floodplain Vegetation
Snag, Cavity Users	Snag, Cavity, Den Dependent Species
Cold Water	Trout Streams and Ponds
Warm Water	Warm Water Streams, Ponds, and Lakes

*Reference for providing Old Growth is vaguely inferred in the Federal Regulations, however it is referred to specifically in the following reference:

_____, 1979, Guidelines for Wildlife and Fish Management in Land Management Planning - A Working Paper, USDA Forest Service, pp. 21.

Step 5: A tentative list of "candidate" species was next subjected to a screening process of various criteria which included the following:

--Habitat preference
--Occurrence in 1, 2, 3, or 4 Forest ecosystems
--Forest successional age-class use (wide or narrow)
--Population response to management activities
--Status on Forest
--Maximum population density
--Whether background data existed
--Ease of monitoring, whether conspicuous or very audible or not
--Dependence on snags, cavities, dens
--Special habitat needs

Step 6: A rating sheet was devised which had a matrix of various screening criteria that could be displayed and given a numerical value or score for each of the categories. (See attached form.)

See the appendix for a complete explanation of the rationale behind each category on the scoring form.

Step 7: Species having the highest numerical value were chosen as Indicator species, or where ties occurred reason for the final choice was given.

Deer and Wild Turkey were also added as Management Indicator Species even though they were found using such a broad spectrum of Forest habitats.

These commonly hunted species were added because they represent species of "great public issue, management concern and opportunity," as cited in Wildlife and Fisheries Section 511.3, Management Indicator Species FSHB 1909.12.

Effects of alternatives will be measured relative to Management Indicator Species and the objectives for these species.

Step 8: Monitoring Plans for all Management Indicator Species will be made later in the planning process.

Chattahoochee-Oconee National Forests

Method and Rational [sic] Used In Scoring "Candidate" Species for Designation as Indicator Species.

<u>Habitat Preferrence</u> [sic]

Rationale Used - An ideal indicator species should by [sic] one having a narrow habitat requirement.

Scoring - A check was placed in column for each Forest Ecosystem where the "candidate" species was known to occur.

3 Forest Ecosystems checked = Value of 1
2 Forest Ecosystems checked = Value of 2
1 Forest Ecosystems checked = Value of 3

Forest Successional Age Class Usage

Rationale Used - An ideal indicator species would have a very narrow Forest succession age class usage. From available research data, etc., indicate by checks the different Forest ecosystems succession age classes where the "candidate" species was known to occur.

For example, a species found using only the Pine Forest Ecosystem - Shrub - Seedlings age class (6 to 15 years) would be preferred over a species found using the Pine Forest Ecosystem from Shrub-seedling to Mature Forest succession age classes, a spread of 6 to 80+ years.

Scoring - 31 or more years = Value of 1
16 to 30 years = Value of 2
15 years or less = Value of 3

Population Response (+ or -) to Forest Management Practice

Rationale - From documented research, indicate by checking under the various management practices if species shows a + or - response to a specific Forest Management practice. For example, does the species respond to prescribed buring [sic], does it respond to clearcutting?

Score: - Zero or one check = Value of 1
2 to 4 one [sic] check = Value of 2
5 checks or more = Value of 3

Nesting or Denning

Rationale - A species nesting or denning on the ground would be slightly more vulnerable to disruptive activities of more than one living in a tree den.

Scoring: - Tree nesting or denning = Value of 1
Ground nesting or denning = Value of 0

Status (on the Forest)

Rationale - Resident species are better Indicator species than migiants [sic].

Scoring: - Common Summer Resident = Value of 1
Uncommon or not a Summer Resident = Value of 0

Maximum Density

Rationale - Highest breeding pairs per/100 acres.

Scoring: - Less than 5 pair/100 ac. = Value of 1
Between 5 to 10 pair/100 ac. = Value of 2
Greater than 10 pair/100 ac. = Value of 3

Forest Habitat Used

Rationale - Narrow Forest succession age-class requirement is ideal for Indicator species.

Scoring: - Less than 20 year age class usage = Value of 1
More than 20 year age class usage = Value of 0

Breeds on Forest

Rationale - a species that raises young on Forest is desirable.

Scoring: - Yes = Value of 1
No = Value of 0

Baseline Data

Rationale - Baseline research, information or records must be available for monitoring purposes.

Scoring: - No data or little available = 1
Some available (out of State or Regional) = 2
Much available (On Forest or within States easily available) = 3

Ease of Mointoring [sic]

Rationale - Species must be conspicuous visually or very audible making identification or sighting easy.

Scoring: - Very Conspicuous or audible = Value of 1
Not Conspicuous or audible = Value of 0

Dependant Upon Snags

Rationale - Species dependant upon snags or dens or cavities for raising young or shelter.

Scoring: - Yes = Value of 1
No = Value of 0

After peer review and further consideration the list was refined. Table 1 shows Richards' final list.

Table 1 - Management Indicator Species Groupings

Early Forest Successional Management Indicator Species Association	Late Forest Successional Management Indicator Species Association
Quail	Gray Squirrel
Deer	Bear
Grouse	Turkey
Indigo Bunting	Pileated Woodpecker
Plants	
Yellow-Lady's Slipper	
Mountain Pitcher Plant	
Others	
Brook and Rainbow Trout	
Bog Turtle	
Northern Dusky Salamander	
Redeye Bass, Coosa Darter, and Turquoise Darter	
Yellowfin Shiner	

Source: USDA Forest Service, "Procedure for Designation of Management Indicator Species," undated, compiled by E. V. Richards, Wildlife Staff Officer, Chattahoochee-Oconee National Forests, Gainesville, GA.

It was later agreed that trout would be included as a resident trout group and brown trout would be added to the brook and rainbow trout, since they can occur either separately or together. The red-cockaded woodpecker (RCW) was also added to this list as a federally endangered species found on the Oconee NF, but it does not occur on the Chattahoochee NF.

Management Indicator Species Habitat Relationships

Each MIS has a relationship with a certain type of preferred habitat. A detailed write-up of the habitat requirements for each MIS was prepared in the early 1980s, which is included in the process record. This information was used to develop relationships displayed in Table 2.

Table 2 - Management Indicator Species by Successional Stages

Successional Stages	Approximate Successional Age	Forest Wildlife Habitat Communities	Deer	Turkey	Bear	Gray Squirrel	Ruffed Grouse	Quail	Indigo Bunting	Yellow Lady's Slipper
Grass-Forbs	0–5	Forest openings w/ scattered grass forbs, shrubs	X	X	X		X	X	X	
Shrub-Seedling	6–20	Shrubby, forest edge	X	X	X		X	X	X	
Sapling-Pole	21–-40	Sapling-Pole Pine or Sapling-Pole Hardwood	X X	X X	X X		 X	X X		
Immature Forest	41–60	Immature Pine Immature Hardwood	X X	X X	X X	X X		X		X X
Mature Forest	61–80 61–100	Mature Pine Mature Hardwood	X X	X X	X X	X X				X
Old Growth	80+ 100+	Old-Growth Pine Old-Growth Hardwood	X X	X X	X X	X X				X X

Special Habitat Communities	Examples of Habitat	Management Indicator Species
Riparian – Margins	Bogs, Swamp, and Ponds	Bog Turtle and Mountain Pitcher Plant
Riparian - Corridors	River Bottom Forests, Floodplains, and Streamside Zones	Northern Dusky Salamander
Cavity & Dens	Snags, Cavities, and Dens	Pileated Woodpecker
Cold Water	Trout Streams and Ponds	Brook, Brown, and Rainbow Trout
Warm Water	Creeks, Rivers, and Lakes	Redeye Bass, Coosa and Turquoise Darters, Yellowfin Shiner
Old Growth (Pine)	60 Year Old and Older Yellow Pine Stands	Red-cockaded Woodpecker

Source: USDA Forest Service, *Record of Decision, Final Environmental Impact Statement for the Chattahoochee-Oconee National Forests Land and Resource Management Plan*, Table 3-9, p. 3-22, Chattahoochee-Oconee National Forests, Supervisor's Office, Gainesville, GA, September 25, 1985.

Forestwide Management Indicator Species Habitat Monitoring and Evaluation

Management Indicator Species are monitored on the forest through the use of both population data and habitat data. An evaluation of the trends in population data for each MIS is presented later in this document. Habitat condition is one of the primary factors influencing population levels for these species; and therefore an assessment of trends in key habitat parameters also is important.

The primary tool for evaluating habitat conditions is the Continuous Inventory of Stand Conditions (CISC) data, which is compiled from periodic field inventories throughout the forest. Using this data, trends in forest habitat conditions can be displayed. Trends in forest wildlife habitat communities are shown in Table 3.

Table 3 - Percentage of Forested Acres by Forest Wildlife Habitat Communities on Chattahoochee-Oconee National Forests

Forest Wildlife Habitat Community	Age Class	1985	1990	1995	1999
Grass-Forbs	0–5	3.51	3.21	2.27	0.69
Shrub-Seedling	6–20	8.22	10.24	10.74	9.67
Sapling-Pole Pine	21–40	2.80	2.67	3.86	5.34
Sapling-Pole Hardwood	21–40	1.60	1.46	2.00	2.84
Immature Pine	41–60	11.45	7.60	4.65	3.26
Immature Hardwood	41–60	12.46	8.02	4.42	2.81
Mature Pine	61–80	10.48	11.57	11.51	11.58
Mature Hardwood	61–100	36.44	39.09	39.55	39.00
Late-Successional/Old-Growth Pine	81+	5.74	7.24	8.86	10.20
Late-Successional/Old-Growth Hardwood	100+	7.27	8.90	12.13	14.61

A diversity of habitat conditions exists on the Chattahoochee-Oconee NFs, which supports a wide range of plant and animal species. Successional diversity refers to the plant and animal communities that inhabit or utilize habitats of different successional stages. Early successional habitats—such as grass-forb and shrub seedlings habitats—contain dense cover, high fruit and browse production, and vertical structure necessary for many bird species. Late-successional stages produce abundant dens and hard mast along with a complex structure, which improves with age. All stages are necessary to maintain plant and animal diversity. The forest also provides a diversity of forest communities including white pine, Virginia pine, southern yellow pine, mixed pine-hardwood, upland hardwood, and cover hardwood forests. All of these forest wildlife habitat communities are well represented on the forest.

Many of the MIS are associated with one or more of these forest wildlife habitat communities (see Tables 2 and 3). Notable trends during the last 15 years include a decline in grass-forb habitat (Figure 1), a decline in both immature pine and hardwood habitat (Figure 2), and an increase in both late-successional old-growth pine and hardwood habitat (Figure 3). More detailed information on the CISC habitat trends can be found in Appendix A, Percentage of Forested Acres by Forest Type Working Group and Age Class for the Chattahoochee-Oconee National Forests, 1985–1999.

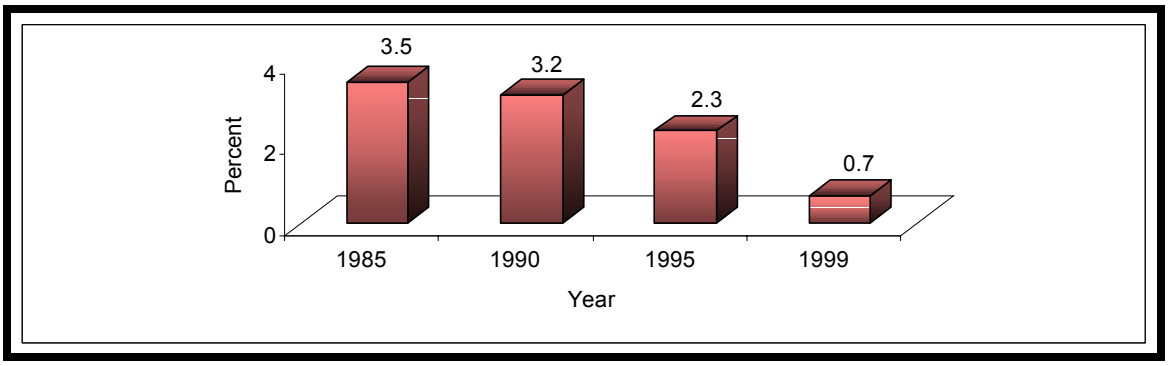


Figure 1 - Trends in Grass-Forb Habitat

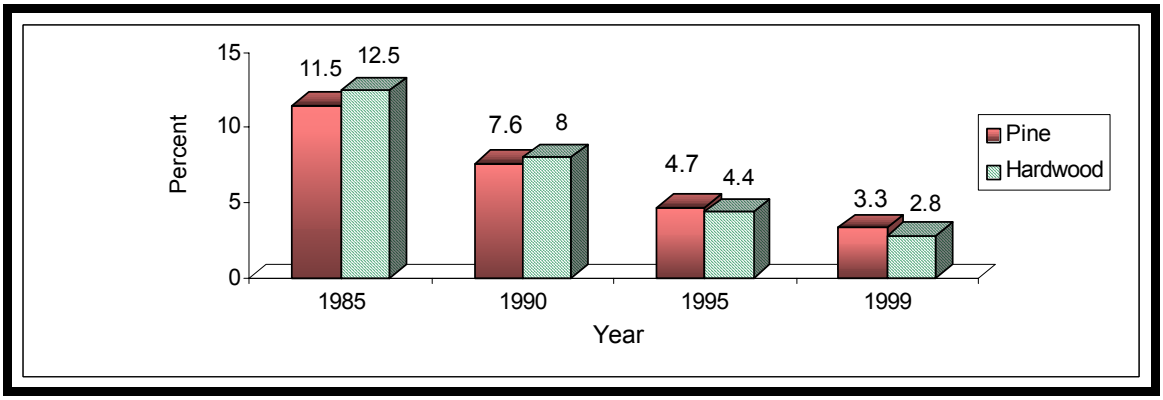


Figure 2 - Trends in Immature Forest Habitat

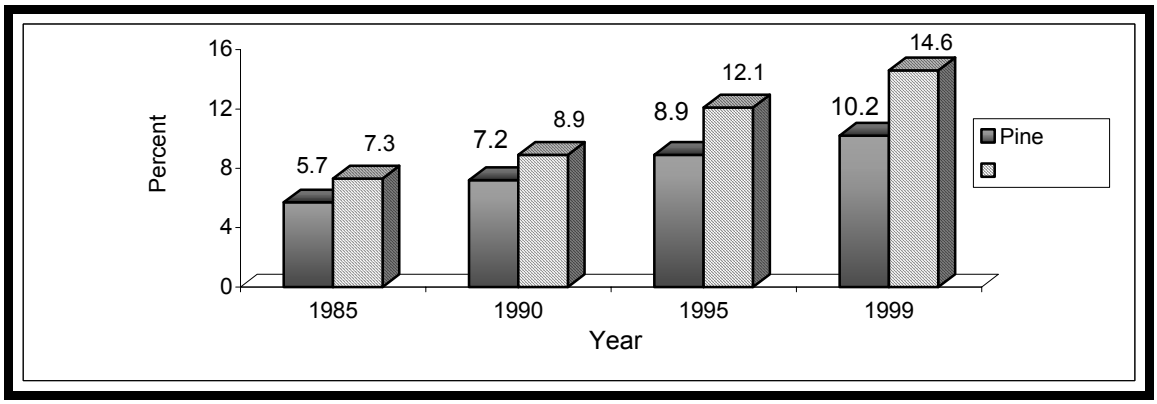


Figure 3 - Trends in Late-Successional/Old-Growth Forest Habitat

We can use a computer model called CompPATS (Computerized Project Analysis of Timber Sales) as a tool to estimate the potential effects of proposed activities on a variety of resources. CompPATS uses information gathered on the forest from a CISC database. This model can estimate habitat capability for several wildlife species, as well as key habitat parameters such as hard mast, browse, and dens (Wildlife Habitat Response Models from USDA Forest Service, *Implementation of the Land and Resource Management Plan*, July 1992). Figure 4 illustrates trends in hard mast capability potential from 1985 through 1999. Hard mast capability on the forest has increased slightly as a result of increased quantity of older hardwood forests.

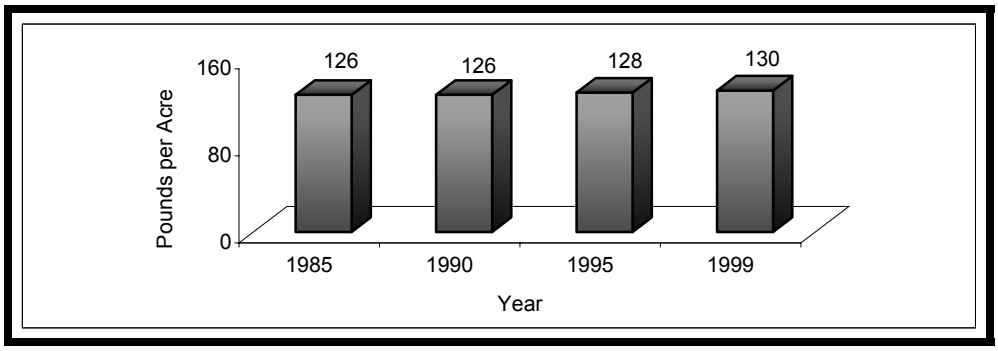


Figure 4 - Trends Hard Mast Capability

Hard mast is the fruit of oaks, hickory, and beech. This mast yield model was derived from information provided in Forest Service Handbook (FSH) 2609.23R, *Wildlife Habitat Management Handbook*, and from CISC data. It must be noted that the mast capability model relationship to actual mast production on an annual basis is merely a prediction of average hard mast capability. Actual annual hard mast production is measured using the mast survey index that is displayed in Figure 20.

CompPATS can estimate browse yields using forest stand data. As browse yields were developed for use in the planning process, the following assumptions were made:

- Production in cove hardwoods and white pine is similar.
- Production in upland hardwoods and yellow pine is similar.
- Coves are more productive than uplands due to more moisture and richer soils.
- The degree of response is inversely proportional to the age of the stand (Wildlife Management Process Records used in USDA Forest Service, *Chattahoochee-Oconee National Forests, Wildlife Management - Process Record Used in Land Management Planning*, January 1983).

Since the amount of timber harvesting has decreased during the planning period, we would expect a reduction also in the browse habitat capability. Figure 5 shows the trend in browse capability during the past 15 years.

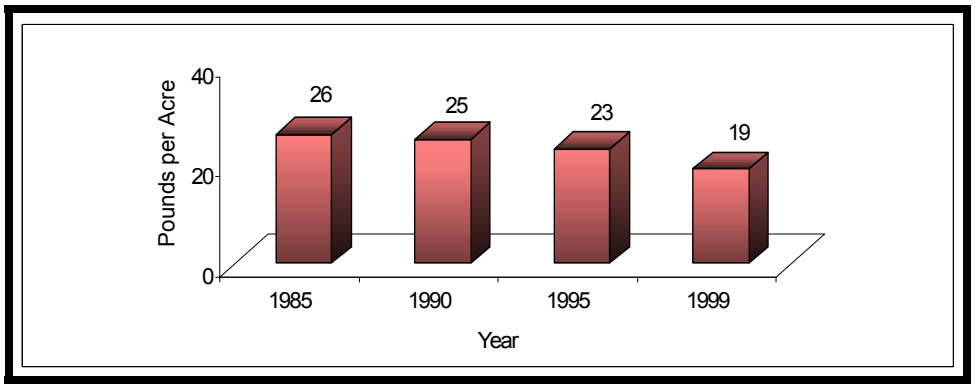


Figure 5 - Trends in Browse Capability

Dens in a forest environment can provide homes for many wildlife species, and a den yield table can also be displayed as a habitat capability model. In 1979 and 1980, random one-fifth acre plots were established on the forest to estimate the frequency of cavity and den trees. After analyzing this data, it showed some significant relationships regarding den richness among forest types and stand ages. Den richness was directly related to age and the amount of hardwood forest component (USDA Forest Service, January 1983). Primarily due to a gradual increase in forest age composition, we also see a slight increase in estimated den capabilities during the past 15-year period (Figure 6).

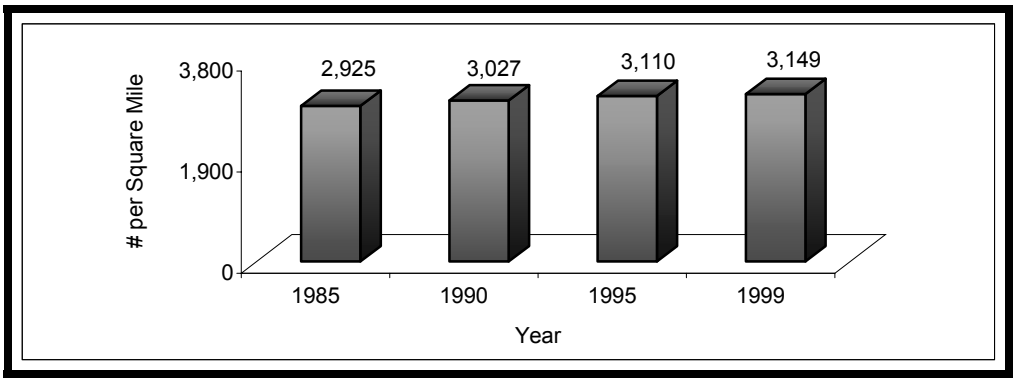


Figure 6 - Trends in Den Capability

Some MIS are associated with special habitat communities rather than specific forest habitats (see Table 2). Using Geographic Information System (GIS) technology, status of some of these special habitat communities can be examined. There are approximately 2,172 miles[1] of cold-water streams in the Blue Ridge portion of the forest and approximately 648 miles of warmwater creeks and rivers in the Ridge and Valley and Piedmont portions of the forest. Acres of riparian corridors can be estimated by using a 100-foot buffer either side of these streams. Based on this analysis, there are approximately 68,400 acres of riparian corridors on the Chattahoochee-Oconee NFs. The quantity of these habitats has remained constant during the planning period.

As discussed previously, habitat capability for dens, another special habitat community, shows a slight increase during the last 15 years (see Figure 6). Similarly, the quantity of 60-year-old and older yellow pine stands, which are important for the red-cockaded woodpecker, also has increased slightly. Trends for this special habitat community will be discussed in more detail in the section for the red-cockaded woodpecker later in the document (see Figure 33).

Forestwide Management Indicator Species Population Trend Monitoring and Evaluation

Chapter 5 of the Forest Plan describes the Monitoring Plan for the Chattahoochee-Oconee NFs. The Monitoring Plan (Table 5-1 of the Forest Plan) lists the monitoring techniques and data sources to be used for MIS. This includes the use of a combination of popula-

[1] Estimated miles using blue-line streams from U.S. Geological Survey Quad Maps (June 1999).

tion data, habitat data, and habitat capability models. The MIS portion of the monitoring plan is shown in .

Table 4 - Management Indicator Species Monitoring Plan

Description of Activities, Practices, or Effects to Be Monitored	Monitoring Techniques and Data Sources
Monitor Management Indicator Species and their habitat. Review status of Threatened and Endangered Species near Forests.	
A) Deer	A) Deer* - Population densities of deer in WMAs [wildlife management areas] will be determined by state (DNR) through analysis of kill data and herd modeling. Herd distribution outside WMAs will be determined through application of herd estimates by DNR for entire Forest. A distribution map of relative densities at a 4 sq. mi. grid will be maintained.
B) Bear	B) Bear* - 1) Determination of density index using scent station visitation rates on WMAs. 2) Density and relative population maps on a 25 sq. mi. grid basis.
C) Turkey	C) Turkey* 1) Spring gobble counts on selected routes. 2) Distribution maps showing relative density and area of occurrence.
D) Grouse	D) Grouse* - Spring drumming counts, brood counts.
E) Quail	E) Quail* - Spring whistle counts.
F) Squirrel	F) Squirrel* - Acres of upland and cove hardwoods 50 years and older will be monitored to determine changes in population capabilities.
G) Bog Turtle	G) Bog Turtle* - Survey, capture, mark, recapture.
H) Yellow Lady's Slipper	H) Yellow Lady's Slipper* - Survey, inventory, record, and map known sites.
I) Mountain Pitcher	I) Mountain Pitcher* Plant - Survey, inventory, record, and map known sites.
J) Brook, Brown & Rainbow Trout	J) Brook, Brown & Rainbow Trout*
K) Redeye Bass	K) Redeye Bass*
L) Turquoise Darter	L) Turquoise Darter*
M) Yellowfin Shiner	M) Yellowfin Shiner*
N) Coosa Darter	N) Coosa Darter* - Electrofishing surveys, biomass estimates, and water quality changes.
O) Pileated Woodpecker	O) Pileated Woodpecker* - songbird census routes.
P) Indigo Bunting	P) Indigo Bunting* - songbird census routes.
Q) Threatened, Endangered, and Sensitive Species	Q) Threatened and Endangered Species near Forest - Coordination with Forest Service Research and State DNR.

*Use habitat capability models, when available, to predict population levels.

Source: USDA Forest Service, *Chattahoochee-Oconee National Forests Land and Management Resource Plan*, Table 5-1, Southern Region, Chattahoochee-Oconee National Forests, Supervisor's Office, Gainesville, GA, 1985.

Once the monitoring data is collected, it must be evaluated. Evaluation of the monitoring data includes determination of trends, determination of the relationship of these trends to habitat changes, and determination of the need to change management direction. This report concentrates on the first two items for each of the 20 MIS. The third item, the need to change management direction is addressed in the annual Monitoring and Evaluation Reports.

Where appropriate, trends in selected populations parameters were evaluated using least squares linear regression analyses. Statistical significance was indicated at $p \leq 0.05$.

White-tailed Deer

The Monitoring Plan for the Chattahoochee-Oconee Forest Plan indicated that white-tailed deer (*Odocoileus virginianus*) herd estimates established by the GADNR through WMA harvest (Kammermeyer, 2002) would be used to examine population density trends on the forest (see Tables 5 and 6).

We used the following population data to monitor deer populations:

- Deer Habitat Capability Model (CompPATS)
- County-level Population Estimates - 1970 and 1995 (SAMAB, 1996)
- Wildlife Management Area Deer Harvest Data/Population Estimates - Annual (Kammermeyer, 2002)

We have, but did not display, the following monitoring information for the reasons cited below.

- Statewide Deer Herd Reconstruction and Population Monitoring—includes population estimates/trends by Physiographic Province and Deer Management Unit (DMU) - Annual (McDonald, 1997). This was not used because information was broad in nature.
- Statewide mail deer survey—includes number of hunters, harvest, and success rate (selected years). Statewide totals (Nicholson, 1999). This was not used because of gaps in the data over time and information was broad in nature.
- 1991 Population Estimates for Redlands WMA from Spotlight Counts (Nicholson, 1991). This was only a 1-year index, with no comparative years available.

The habitat capability model (based on CompPATS) shows a very slight decrease in potential deer habitat capability during the past 10 years (Figure 7). This is primarily due to a decline in browse availability, which is a result of a decrease in early successional habitat.

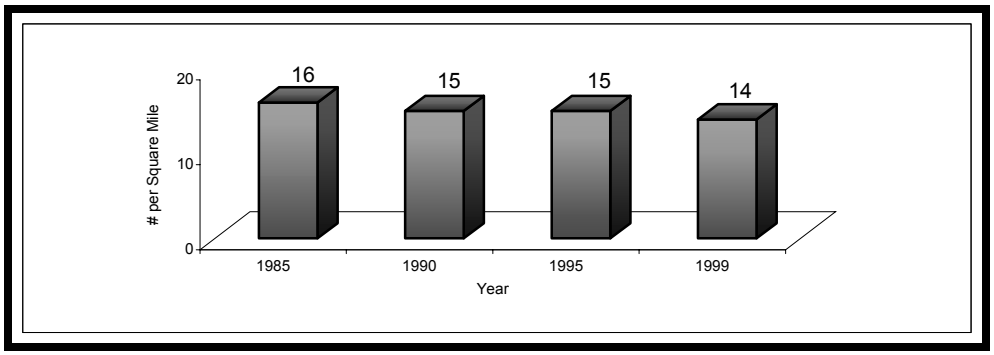


Figure 7 - Deer Habitat Capability Model

The WMA population estimates were used to display deer trends over time since specific WMAs are located on the forest. Earlier in the planning process we identified this data as the source to be used. The WMA population estimates are derived from mathematical population models using harvest data collected from each of the 14 WMAs on the forest (Kammermeyer, 2000).

Deer densities generally range from 15 to 31 deer per square mile in the mountains and from 20 to 73 deer per square mile in the Piedmont (Kammermeyer, 2002). The populations in the mountains are limited due to marginal habitats and poor soil fertility. Early succession habitats, high-quality, cool-season agricultural food plots, and areas of hard mast-producing trees all are important components of year-round deer habitat (Wentworth, Johnson, and Hale, 1990; Wentworth et al., 1990; Kammermeyer et al., 1993; Johnson et al., 1995).

There are ten WMAs in the mountain portion of the Chattahoochee NF. Deer population estimates, based on harvest data, are shown in Table 5Table 5.. Deer populations on five of the mountain WMAs have remained relatively stable (Chestatee, Cohutta, Burton, Swallow Creek, and Warwoman—$p > 0.05$, $r^2 = 0.01–0.28$), while the remaining WMAs show an increasing trend (Blue Ridge, Chattahoochee, Coopers Creek, Rich Mountain, and Coleman River—$p < 0.05$, $r^2 = 0.45–0.82$). All of the mountain WMAs exhibit some degree of annual fluctuations in density, primarily in response to acorn availability (Wentworth et al., 1992).

Deer population densities are higher in the Piedmont of Georgia than in the mountains. In the late 1980s and early 1990s, the Georgia Game Management Section liberalized doe harvest to reduce the deer densities since they were at or above carrying capacities in many parts of the Piedmont. The liberalization of the doe harvest has reduced deer densities on many Piedmont WMAs. However, deer densities have remained relatively high on two of the three WMAs on the Piedmont portion of the forest (Oconee NF). Deer densities have been stable on the Cedar Creek WMA ($p = 0.70$, $r^2 = 0.01$) and show an upward trend on the Lake Russell WMA ($p < 0.01$, $r^2 = 0.57$) (Kammermeyer, 2002).

Johns Mountain WMA is the only wildlife management area in the Ridge and Valley portion of the forest. Deer population densities on this area have increased since 1985 ($p<0.01$, $r^2 = 0.51$). However, as with the mountain WMAs, deer populations on Johns Mountain exhibit substantial annual fluctuations, largely in response to acorn availability. Deer population estimates for the WMAs in the Piedmont and Ridge and Valley portions of the Chattahoochee-Oconee are shown in Table 6.

According to the Southern Appalachian Assessment, deer densities in the Appalachian Region increased greatly between 1970 and 1995. This increase is attributed to both nonhabitat factors—such as protection—and harvest strategies, as well as increased acorn capability resulting from an increase in mid- to late-successional oak forests throughout the Southern Appalachian region. The outlook for deer trends in the region is for populations to level off, according to the report (SAMAB, 1996). Table 7 lists deer trends for the Chattahoochee NF (SAMAB, 1996). The numbers are the percent of the forest in each deer density class.

Density population objectives for deer as a management indicator species were reported in Table 2-2, page 2-8, of the 1985 Forest Plan. In 1985, the current population levels were listed as 1 deer per 43 acres or 14.9 deer per square. The plan objective was to provide desired range of 9.8 deer to 25.6 deer per square mile across the planning area. This range is very conservative and needs to be adjusted upward in future plans. Recreation generated by deer hunting produces $600 million annually in Georgia. From the harvest data displayed in Table 5, estimated deer densities for WMAs within the Chattahoochee NFs are within or above this desired range in the ten WMAs. Only one area, Rich Mountain WMA, has estimates below the 9.8 deer per square mile level for 1985 and 1987–89. Recent estimates for this area are well above the minimum level population objective for

deer. Population densities for the Piedmont area (Oconee NF) are much higher and are usually well above the maximum level objective (25.6/square mile) displayed in the Forest Plan.

Table 5 - Estimated Deer Densities per Square Mile for Mountain Wildlife Management Areas, Chattahoochee National Forest

WMA	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Blue Ridge	18	16	16	16	18	20	20	N/A	N/A	N/A	23	19	18	25	23	17	31
Chattahoochee	11	14	13	15	16	19	22	N/A	N/A	20	22	N/A	16	18	23	N/A	15
Chestatee	14	16	18	22	26	27	23	N/A	N/A	18	21	N/A	20	16	21	N/A	21
Cohutta	14	13	15	17	18	10	12	11	N/A	12	13	N/A	10	11	13	N/A	9
Coopers Creek	13	15	16	18	21	22	24	N/A	N/A	21	25	16	18	26	26	24	25
Burton	20	36	33	37	27	28	28	N/A	N/A	22	26	N/A	17	N/A	29	18	18
Rich Mountain	8	10	9	6	8	10	12	14	N/A	N/A	13	N/A	16	16	17	19	21
Swallow Creek	15	15	24	27	32	19	19	N/A	N/A	21	24	N/A	N/A	N/A	N/A	12	13
Warwoman	17	16	22	22	25	27	27	25	N/A	35	39	N/A	22	28	24	13	13
Coleman River	15	15	14	15	17	19	21	N/A	N/A	N/A	21	N/A	*	*	*	*	*

*The Coleman River area was dropped from the Wildlife Management Area System in 1997.

N/A - Not available because of low doe harvest; WMA - Wildlife Management Area

NOTE: Those wildlife management areas with higher acreages of maintained food plots have the highest density of deer per square mile (Kammermeyer and Moser, 1990; Kammermeyer, 1998).

Source: Kent Kammermeyer, 2000, "Deer population characteristics on wildlife management areas in Georgia from 1977 through 1999," P.R. Project W-55-R-3, Georgia Department of Natural Resources, 25pp., plus tables, figures, appendix, and updates provided by Kammermyer for 2000 and 2001.

Table 6 - Estimated Deer Densities for Piedmont and Ridge and Valley Wildlife Management Areas

Piedmont WMAs	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Cedar Creek	17	40	47	52	41	45	41	42	N/A	40	42	N/A	39	40	38	49	48
Lake Russell	45	43	46	43	46	55	58	54	48	49	55	54	59	58	54	58	73
Redlands	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	19	N/A	N/A	N/A	N/A
Ridge and Valley WMA																	
Johns Mountain	21	14	14	18	20	24	29	29	N/A	31	38	33	34	25	25	24	26

N/A - Not Available

Source: Kent Kammermeyer, 2000, "Deer population characteristics on wildlife management areas in Georgia from 1977 through 1999," P.R. Project W-55-R-3, Georgia Department of Natural Resources, 25pp., plus tables, figures, appendix, and updates provided by Kammermyer for 2000 and 2001.

Table 7 - Trends for Deer Populations, Chattahoochee National Forest, 1970 & 1995

Year	Deer Density Classes		
	Low	Medium	High
1970	71%	29%	0%
1995	38%	58%	4%

Low = < 15 deer per square mile

Medium = 15-30 deer per square mile

High = > 30 deer per square mile

Source: *Southern Appalachian Man and the Biosphere* (SAMAB), The Southern Appalachian Assessment Terrestrial Technical Report, Report 5 of 5, U.S. Department of Agriculture, Forest Service, Southern Region, Atlanta, GA, 1996.

Evaluation of White-tailed Deer Population Trends and the Relationship to Habitat Changes

The habitat capability model for the forest shows a slight decrease in deer browse availability during the past 10 years. This is due to a decline in the amount of forested early successional habitat. However, white-tailed deer are very adaptable. Game harvest regulations and habitat improvement techniques—such as forest thinnings, prescribed burning, and wildlife opening development—have helped create healthy deer populations throughout Georgia. Deer harvest data indicates that populations in the mountains and ridge and valley are stable to increasing with some fluctuations primarily due to differences in the annual mast crops. Piedmont harvest data shows higher overall deer densities, and State regulations have been liberalized to help reduce population numbers to within habitat capability levels. Overall, viability is well sustained for white-tailed deer on the Chattahoochee-Oconee NFs. The forest will continue to monitor deer densities, and deer populations are expected to remain relatively stable in the near future.

Black Bear

The Monitoring Plan for the Chattahoochee-Oconee Forest Plan indicates that the monitoring technique to be used for black bear (*Ursus americanus*) is a density index using scent station visitation rates (Gregory and Waters, 2002).

The forest uses several sources of population data to monitor black bears. These include:

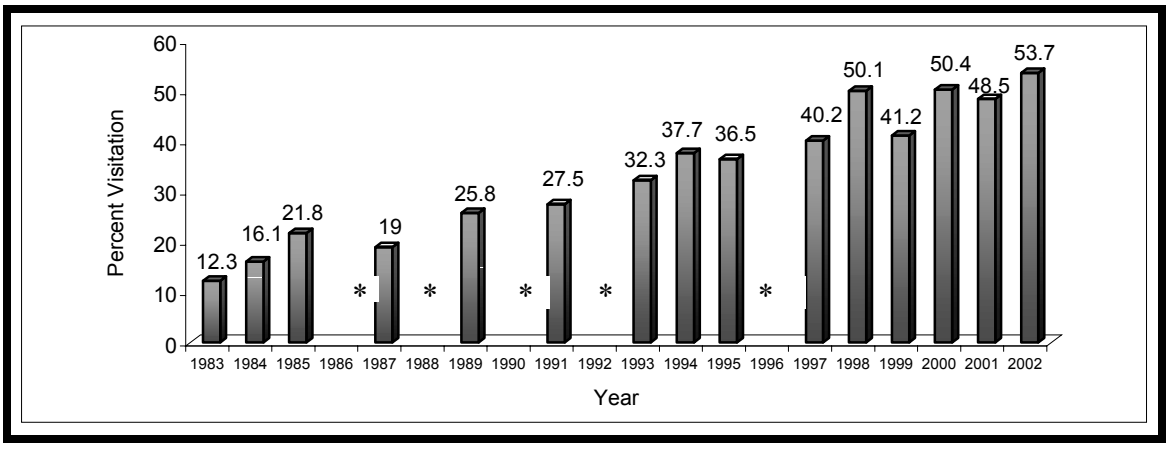
- Bait Station Survey - from GADNR (1983–2002) (Gregory and Waters, 2002)
- WMA, County Harvest Data from GADNR (1979–2002) (Gregory and Waters, 2002)
- County-level Population Estimates for 1970 and 1995 from the Southern Appalachian Assessment Terrestrial Report (SAMAB, 1996)

The Bait Station Survey, which is conducted annually by GADNR and Forest Service personnel, is the primary technique used to evaluate population trends. Forty-three bait station lines, consisting of 569 total bait stations, have been established in 11 counties across north Georgia. Each bait station consists of three partially opened sardine cans suspended from a tree in a manner that a bear has to climb the tree in order to reach the bait. Baits are spaced approximately one-half mile apart in natural travel ways. After five nights, the bait stations are checked for visitation by bears. The visitation rate (% of bait stations visited by bears) is used to determine the relative density and distribution of

bears in north Georgia. Visitation rates have been shown to be significantly correlated with black bear density trends (Carlock et al., 1983). This data is supplemented with bear harvest data collected by GADNR (Waters, unpubl. data) and the county-level population estimates for 1970 and 1995 from the SAA.

In 1985, the Forest Plan listed the current black bear population density as 1 bear per 2,460 acres or 304 bears for the entire forest (749,000 acres of Chattahoochee NF). The plan objective was set at 1 bear per 2,200 acres or 340 bears. The maximum level population object was set at 527 bears or 1 bear per 1,420 acres.

The visitation rate at black bear bait stations on the forest have increased significantly during the last 19 years ($p < 0.01$, $r^2 = 0.94$) (Figure 8). Total bear harvest also has increased significantly during this period ($p < 0.01$, $r^2 = 0.81$) (Figure 9). In 2000 the harvest of black bears in north Georgia climbed to 245, setting another state record (Table 8). The bait station and harvest results indicate that black bear numbers have increased steadily in north Georgia with an estimated current population of between 900–1,000 individuals (Carlock, 1999). Black bear population numbers are, therefore, estimated to be nearly double what planning biologists were expecting they would be 15 years ago.

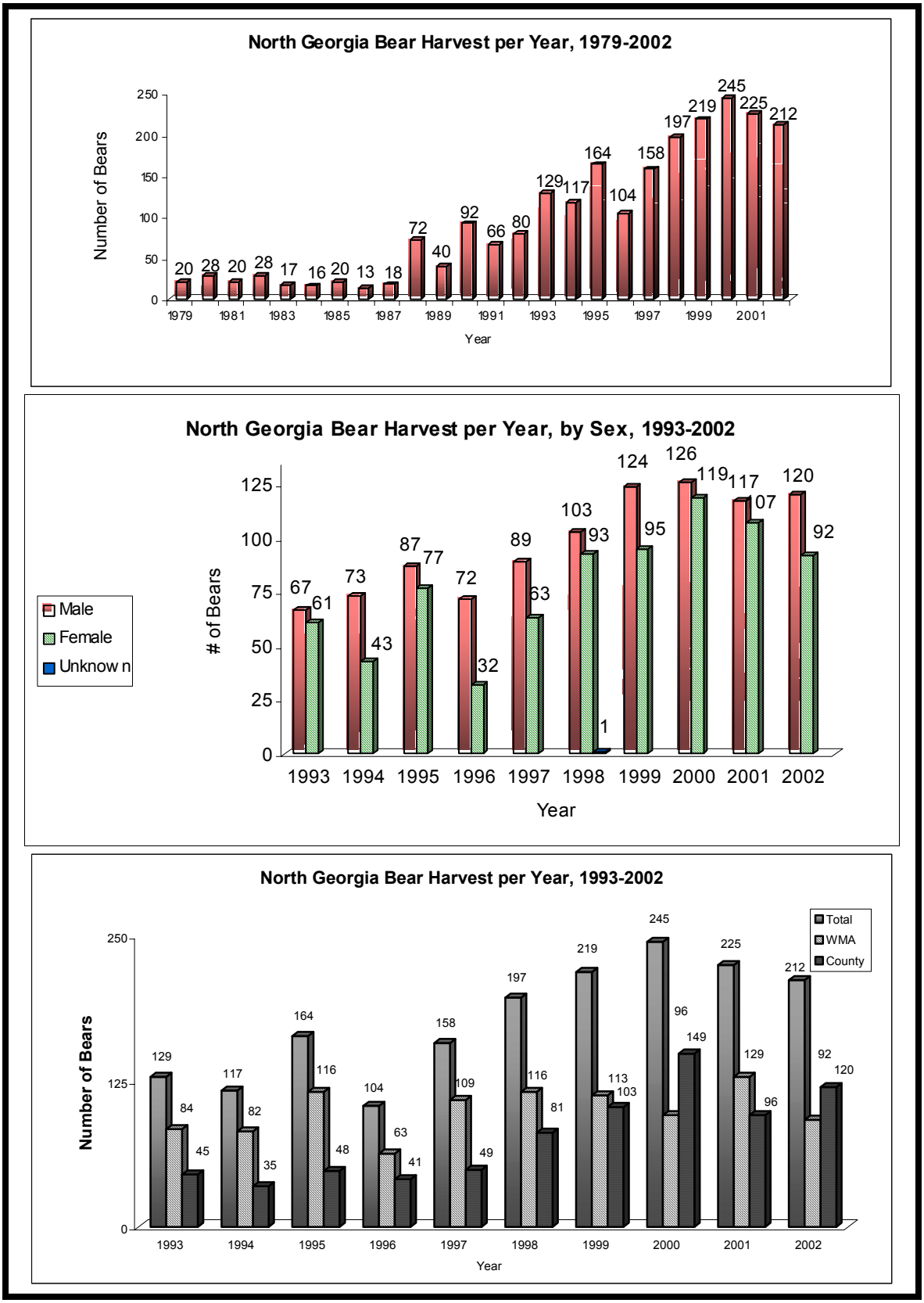


*Bear bait sites were not monitored in 1986, 1988, 1990, 1992, and 1996.

Source: Gregory and Waters, 2002, "Distribution and density of black bears in North Georgia," Annual Report P.R. Project 6-8-2-I/8-I #8, Georgia Department of Natural Resources.

Figure 8 - Visitations per Year to Bait Sites by Black Bears in North Georgia, 1983–2002

Recent bait station data suggests that the population is beginning to stabilize after 20 years of gradual increase (see Figure 8). David Carlock, senior wildlife biologist with the GADNR Game Management Section, reports slight increases during the last 4 years with bears moving into areas with higher human populations. He also reports that black bear are nearing carrying capacity on the Chattahoochee NF (Carlock, 1999).



WMA – Wildlife Management Area

Source: Gregory and Waters, 2002, "Distribution and density of black bears in North Georgia," Annual Report P.R. Project 6-8-2-I/8-I #8, Georgia Department of Natural Resources.

Figure 9 - North Georgia Bear Harvest

Table 8 - 1999 North Georgia Bear Harvest Summary

Wildlife Management Area	# of Male	# of Female	Unknown Sex	Totals
Blue Ridge	3	4	0	7
Chattahoochee	16	16	0	32
Chestatee	8	4	0	12
Cohutta	21	17	0	38
Coopers Creek	3	0	0	3
Coosawattee	0	0	0	0
Dawson Forest	2	3	0	5
Lake Burton	3	2	0	5
Rich Mountain	3	4	0	7
Swallow Creek	0	1	0	1
Warwoman	2	1	0	3
Subtotal	**61**	**52**	**0**	**113**
County	**# of Male**	**# of Female**	**Unknown Sex**	**Totals**
Dawson	1	5	0	6
Fannin	3	2	0	5
Gilmer	7	8	0	15
Habersham	4	2	0	6
Lumpkin	8	2	0	10
Murray	4	5	0	9
Pickens	1	0	0	1
Rabun	12	9	0	21
Stephens	0	0	0	0
Towns	5	5	0	10
Union	10	2	0	12
White	8	3	0	11
Subtotal	**63**	**43**	**0**	**106**
TOTAL	**124**	**95**	**1**	**219**

Source: C. Waters, Wildlife Biologist, GADNR Game Management Section, unpubl. data.

The population trends experienced on the forest are comparable to those seen throughout the Southern Appalachians. The SAA reported a moderate increase in regional bear population densities between 1970 and 1995 (SAMAB, 1996). The report concluded that this increase is likely related to both nonhabitat factors, such as protection changing attitudes, and conservative harvest, and the increased acorn capability resulting from the increase in mid- to late-successional oak forest. Table 9 displays the trends in bear population densities for the Chattahoochee NF as reported in the SAA. The number displayed is the percent of the forest in each bear density class.

Table 9 - Trends for Bear Population Densities, Chattahoochee National Forest, 1970 & 1995

Year	Bear Density Classes			
	Absent	Low	Medium	High
1970	8	92	0	0
1995	4	15	80	0

Low = < 1 bear/1,500 acres
Medium = 1 bear/1,000-1,500 acres
High = > 1 bear/1,000 acres

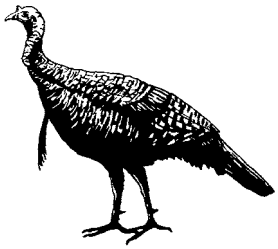
Source: *Southern Appalachian Man and the Biosphere* (SAMAB), The Southern Appalachian Assessment Terrestrial Technical Report, Report 5 of 5, U.S. Department of Agriculture, Forest Service, Southern Region, Atlanta, GA, 1996.

Many of these same factors are likely responsible for the increased bear populations on the Chattahoochee NF during the last 15 years. The relative abundance and distribution of oak mast, primarily white oak, have a significant impact on bears in terms of natality, mortality, and movements (Pelton, 1989). The birth and survival of young bears are directly associated with oak mast crops. Increased movements associated with poor acorn crops often result in significantly increased mortality. CompPATS model predictions suggest that hard mast capability on the forest has increased slightly during the last 15 years (see Figure 4). The acres of older hardwood stands on the forest have increased during this same period (see Figure 3) and have benefited bears through increased availability of den trees. In addition to older hardwood forests, bears also use a variety of other successional stages. Secondary foods (such as soft mast) can help buffer the effects of acorn shortages (Eiler, Wathen, and Pelton, 1989). Soft mast foods can be enhanced by forest management activities including prescribed burning and timber harvest (Wigley, 1993; Weaver, 2000). Important soft mast species—such as blackberries, blueberries, and huckleberries—often are more abundant in young forests.

Evaluation of Black Bear Population Trends and the Relationship to Habitat Changes

Black bear numbers have increased and are beginning to stabilize after 20 years of growth, according to bait station survey results. Based on harvest records and bear and human encounters, state biologists have concluded that bears are nearing carrying capacity on the Chattahoochee NF. Increased acres of older hardwood stands, sustained hard mast production, and enhanced soft mast production through forest management activities—such as prescribed burning and timber harvest—have contributed to improved black bear habitat on the forest. Information from harvest records and bait station visitation rates shows the black bear population to be very healthy and viable on the forest. However, reduction in forest management (early successional habitat) may result in reduced soft mast availability in the future. This could, in turn, reduce habitat quality for black bears, especially in years of low acorn abundance.

Eastern Wild Turkey



The Monitoring Plan for the Chattahoochee-Oconee Forest Plan indicates that the monitoring technique to be used for eastern wild turkey (*Meleagris gallopavo*) is spring gobble counts. The forest uses several sources of population data to monitor wild turkeys, including:

- Turkey Hunting Population Index Survey (Hours/Turkeys Seen, Hours/Gobblers Heard, Hours/Gobblers Killed) stratified by Physiographic Province (GADNR; VanBrackle, 2000)
- Turkey Production Index Survey (number of broods and Poults observed) stratified by Physiographic Province (GADNR; VanBrackle, 2000)
- Wildlife Mnagement Area Harvest Data (GADNR; Thackston, 1998)
- County-level Population Estimates – 1970 and 1995 (SAMAB, 1996)
- Wild Turkey Survey Cooperator Newsletter (Kennamer, 2002)
- Long Range Performance Report on Wild Turkey (Kennamer, 2002)

- Statewide mail survey – includes number of hunters, harvest, and success rate - Annual. Statewide totals (GADNR) – selected years (Nicholson, 1999)

The Hunting Population Index Survey conducted annually by GADNR is the primary technique used by the forest to monitor wild turkey populations (VanBrackle, 2000). This survey is conducted during the spring gobbler season by approximately 500 hunter cooperators. Specific information requested for each hunt includes the date, hours hunted, county or region of the state hunted, the number of turkeys seen, the number of gobblers heard, and the number of gobblers killed. From this data, population indices derived include hours per turkey seen, hours per gobblers heard, and hours per gobbler harvested. This data is stratified by physiographic province. The hours per gobbler heard is equivalent to the spring gobble counts described in the forest monitoring plan. The hours of hunting effort per turkey observed is used as the primary index of the hunting population by GADNR.

Reproduction is monitored through the Turkey Production Index Survey, which is conducted annually by GADNR personnel (VanBrackle, 2000). Field personnel record all sightings of turkey broods and hens with and without poults during the months of June–August. The number of poults per observer is used as an index of relative reproduction success. The relationship between the Population Index Survey and the Production Index Survey is used in evaluating annual production and resulting hunting season populations. This data is supplemented with WMA turkey harvest data and statewide mail survey data collected by GADNR (Thackston, 1998; Nicholson, 1999; and Kennamer, 2002) and the county-level population estimates for 1970 and 1995 from the SAA.

Table 10 shows hours of hunting effort for turkeys seen, gobblers heard, and gobblers harvested.

The number of hours per turkey seen has declined gradually since 1985, indicating an increase in turkey populations during this period (Ridge and Valley: $p = 0.02$, $r^2 = 0.40$; Blue Ridge: $p = 0.02$, $r^2=0.36$; Piedmont: $p<0.01$, $r^2 = 0.65$; Statewide: $p<0.01$, $r^2 = 0.65$). Turkey populations across the forest have remained moderate to high and relatively stable during the last 4 to 5 years (Carlock, 1999). With the exception of the Ridge and Valley which shows a slight upward trend, the Turkey Production Index (number of poults/observer) fluctuates from year to year with no significant trend upward or downward (Ridge and Valley: $p = 0.05$, $r^2 = 0.26$; Blue Ridge: $p = 0.48$, $r^2 = 0.04$; Piedmont: $p = 0.16$, $r^2 = 0.15$; Statewide: $p = 0.31$, $r^2 = 0.08$) (Table 11) (VanBrackle, 2000). The yearly fluctuations in poult production largely are a reflection of weather conditions during the nesting season, especially in the mountains (Healy, 1992).

In 1985, the Forest Plan listed the current turkey population density as 1/160 acres or 4 turkeys per square mile. The plan objective calls for 4.6 turkey per square mile with a minimum level population of 2.3 and a maximum population level of 10 per square mile. Current density estimates for the Chattahoochee NF are 6–15 turkey per square mile, with a total population for the forest estimated to be about 12,000 turkeys. Densities of about 10–16 turkeys per square mile were reported for the Oconee NF from the *Georgia Wild Turkey Status Report 1998* (Thackston, 1998). These estimates are within the desired planning population range. In some areas, especially on the Oconee NF, the estimated numbers of turkey exceed the maximum population objective reported in the Forest Plan. Obviously, these objectives were set at a very conservative level.

Table 10 - Summary of Turkey Hunt Data, 1985–2001

Population Index	Hunt Season	Physiographic Region			
		Ridge and Valley	Blue Ridge	Piedmont	Statewide
Hours/Turkeys Seen	1985	2.3	3.4	2.6	2.6
	1986	3.2	4.6	2.3	2.5
	1987	4.1	2.9	2.6	2.4
	1988	1.0	2.9	1.9	1.8
	1989	1.7	2.3	2.3	1.9
	1990	1.8	2.8	2.0	2.0
	1991	1.6	2.3	2.0	1.9
	1992	1.4	2.6	2.4	2.1
	1993	2.0	4.0	2.5	2.1
	1994	2.4	2.2	2.1	1.9
	1995	1.7	2.2	2.4	2.1
	1996	1.2	1.8	1.6	1.5
	1997	1.0	2.1	1.8	1.6
	1998	1.0	1.9	1.9	1.7
	1999	0.9	2.7	1.5	1.4
	2000	1.4	2.3	2.0	1.7
	2001	4.2	3.4	1.3	1.7
Hours/Gobblers Heard	1985	2.4	4.2	2.9	2.6
	1986	2.6	3.4	2.1	2.0
	1987	2.2	5.2	2.4	2.4
	1988	1.5	2.6	2.7	2.2
	1989	2.1	2.1	2.1	1.9
	1990	2.3	4.2	2.5	2.2
	1991	2.7	5.5	2.7	2.7
	1992	2.4	4.2	2.9	2.6
	1993	3.2	6.3	3.6	3.1
	1994	3.4	6.1	3.5	2.9
	1995	2.0	3.3	2.5	2.3
	1996	3.3	3.5	2.7	2.5
	1997	2.3	5.6	2.2	2.2
	1998	2.5	4.1	2.7	2.4
	1999	2.7	3.7	2.8	2.4
	2000	2.1	3.8	2.2	2.1
	2001	4.8	5.4	1.8	2.4
Hours/Gobblers Killed	1985	22.2	48.2	38.7	33.6
	1986	23.0	42.1	28.6	26.7
	1987	35.4	68.3	30.4	32.1
	1988	17.6	25.3	35.9	28.0
	1989	22.6	41.4	29.8	24.8
	1990	29.8	55.2	29.3	28.3
	1991	42.7	48.4	36.9	33.9
	1992	44.9	49.2	45.3	37.2
	1993	32.2	46.5	46.0	34.9
	1994	36.2	42.0	36.9	30.1
	1995	25.4	29.9	25.3	22.7
	1996	28.9	34.1	29.3	26.8
	1997	28.7	38.8	31.9	27.7
	1998	29.2	35.8	29.2	26.3
	1999	28.0	50.6	33.6	27.8
	2000	27.8	34.0	28.5	26.4
	2001	60.6	48.3	22.6	27.9

NOTE: Ridge and Valley = Armuchee RD
Blue Ridge = Brasstown, Cohutta, Tallulah, and Toccoa RDs and northern portion of Chattooga RD
Piedmont = Oconee and southern portion of Chattooga RD

Source: M. VanBrackle, 2000, *Wild Turkey Survey Cooperator Newsletter,* Georgia Department of Natural Resources, 6pp; and L. Kennamer, 2002. Wild Turkey Survey Cooperator Newsletter, GADNR Report.

Table 11 - Wild Turkey Production Index (Number of Poults/Observer), 1985–2000

Hunting Season	Physiographic Region			
	Ridge & Valley	Blue Ridge	Piedmont	Statewide
1985	7.2	7.9	15.9	13.1
1986	23.2	36.6	23.0	22.4
1987	27.9	19.8	23.1	17.3
1988	22.1	34.6	18.8	16.1
1989	30.7	21.8	21.7	17.5
1990	18.9	19.9	23.1	19.0
1991	21.2	7.1	20.7	12.0
1992	15.9	12.9	15.9	12.4
1993	26.8	17.3	22.0	16.4
1994	36.7	20.1	25.2	20.6
1995	66.3	22.1	49.0	31.8
1996	32.3	16.2	26.9	18.9
1997	20.8	13.7	26.6	16.2
1998	42.9	21.5	29.5	22.1
1999	30.3	19.9	18.2	17.7
2000	33.6	37.0	22.5	18.2

NOTE: Ridge & Valley = Armuchee RD
Blue Ridge = Brasstown, Cohutta, Tallulah, and Toccoa RDs and northern portion of Chattooga RD.
Piedmont = Oconee and southern portion of Chattooga RD.

Source: M. VanBrackle, 2000, *Wild Turkey Survey Cooperator Newsletter*, Georgia Department of Natural Resources, 6pp.

The population trends experienced on the forest are comparable to those seen throughout the Southern Appalachians. The SAA reported that turkey populations greatly expanded in range and density between 1970 and 1995 (SAMAB, 1996). The SAA concluded that this increase is likely related nonhabitat factors, such as extensive restoration efforts and protection and conservative harvest. Habitat-related factors contributing to the increase are increased numbers of high-quality wildlife openings for winter food and spring brood rearing and increased acorn capability resulting from the increase in mid- to late-successional oak forests. Table 12 displays the trends in wild turkey population densities for the Chattahoochee NF as reported in the SAA. The numbers are the percent of forest in each turkey density class.

Table 12 - Trends in Wild Turkey Densities, Chattahoochee National Forest, 1970 & 1995

Year	Wild Turkey Density Classes			
	Absent	Low	Medium	High
1970	8	92	0	0
1995	0	8	88	3

Low = < 6 turkeys/square mile
Medium = 6-15 turkeys/square mile
High = > 15 turkeys/square mile

Source: *Southern Appalachian Man and the Biosphere*, The Southern Appalachian Assessment Terrestrial Technical Report, Report 5 of 5, U.S. Department of Agriculture, Forest Service, Southern Region, Atlanta, GA, 1996.

Many of these same factors are likely responsible for the increased wild turkey populations on the Chattahoochee NF during the last 15 years. Wild turkeys use a wide range of habitats, with diversified habitats providing optimum conditions (Schroeder, 1985). This

includes mature mast-producing stands during fall and winter, shrub-dominated stands for nesting, and herb-dominated communities, including agricultural clearings for brood rearing. Habitat conditions can be enhanced by management activities such as prescribed burning and thinning (Hurst, 1978; Pack, Igo, and Taylor, 1988), and the development of herbaceous openings (Nenno and Lindzey, 1979; Healy and Nenno, 1983).

The habitat capability estimates for wild turkey—based on CompPATS models—have remained stable (Figure 10). However, these model predictions are based on forest type and age distribution only, and they do not take into account the beneficial effects of activities such as prescribed burning and wildlife opening development. On the forest, both habitat and nonhabitat factors—such as restoration efforts, protection, and conservative harvests—have been responsible for increased turkey populations. Wild turkey populations on the forest and throughout the state have increased and expanded into unoccupied habitat as a result of extensive restocking efforts by GADNR.

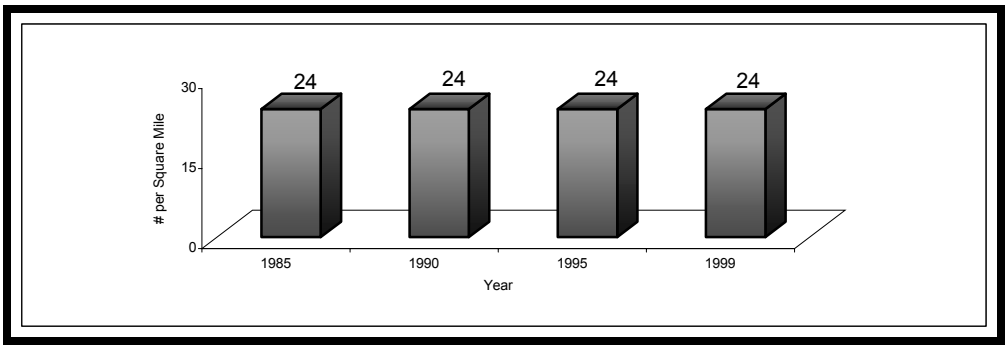


Figure 10 - Trends in Wild Turkey Habitat Capability, 1985, 1990, 1995, & 1999

Evaluation of Wild Turkey Population Trends and the Relationship to Habitat Changes

Data displayed above demonstrates that wild turkey populations have increased on the forest during the last 15 years. Both nonhabitat and habitat-related factors have contributed to this increase. Turkeys have benefited from management activities such as prescribed burning, which enhances brood habitat and soft mast production, and the development and maintenance of wildlife openings by GADNR and Forest Service personnel. These practices, along with anticipated increases in oak mast availability, will ensure continued viability of wild turkey populations on the Chattahoochee-Oconee NFs.

Ruffed Grouse

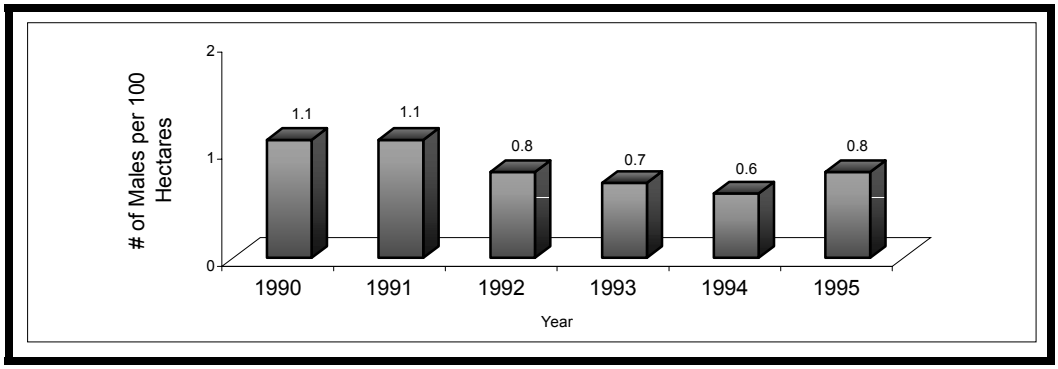
The Monitoring Plan for the Chattahoochee-Oconee Forest Plan indicates that the monitoring techniques to be used for ruffed grouse (*Bonasa umbellus*) are spring drumming counts and brood counts (see Figure 11 and Table 13).

The forest uses several sources of population data to monitor ruffed grouse. These include:

- Grouse Hunting Population Index Survey (Flush Rate and Harvest) – 1977–1980, 1989–1992, 1995–2002 (Bearden and Waters, 1999; and Bearden and Gregory, 2002
- Grouse Production Index Survey (number of brood observed and juvenile:adult ratio) – 1989–1999 (Bearden and Waters, 1999; and Bearden and Gregory, 2002)

- Grouse Drumming Survey – 1990–1995 (Bearden and Waters, 1999)
- County-level Population Estimates - 1970 and 1995 (SAMAB, 1996)

GADNR personnel conducted an early spring ruffed grouse drumming survey between 1990–95. Results of this survey are shown in Figure 11. Small sample sizes limit the value of this survey for monitoring population trend. For this reason, the drumming survey was discontinued in 1995 and was replaced with the Grouse Hunting Population Index Survey.

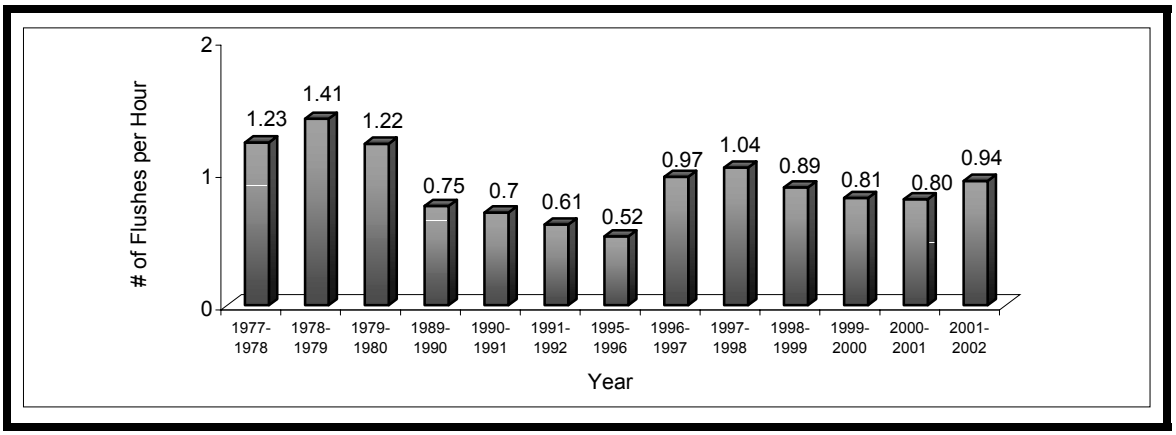


Source: J. Bearden and C. Waters, 1999, "Population parameters and harvest statistics of ruffed grouse in north Georgia, Fiscal Year 1999," Georgia Department of Natural Resources, Game Management Section, 5pp.

Figure 11 - Ruffed Grouse Drumming Counts, 1990–95

Because of the limitations in the spring drumming survey discussed above, the Grouse Hunting Population Index Survey, conducted annually by GADNR, is the primary technique used by the forest to monitor ruffed grouse populations (Bearden and Waters, 1999). This survey is conducted during the fall and winter hunting season by approximately 20–30 hunter cooperators. Specific information requested include hunt dates, county or WMA of hunt, number in party, hours hunted, grouse flushed, and grouse harvested. Flush rates (# flushed/hour) and harvest rates (# harvested/hour) are used as an index of the hunting population. This data is supplemented by the grouse production index survey conducted annually by GADNR personnel (Bearden and Waters, 1999) and the county-level population estimates for 1970 and 1995 from the SAA. GADNR field personnel conduct the Grouse Production Index Surveys annually. All sightings of adult grouse and chicks are recorded during the months of June–August. The juvenile:adult ratio is used as an index of relative reproduction success.

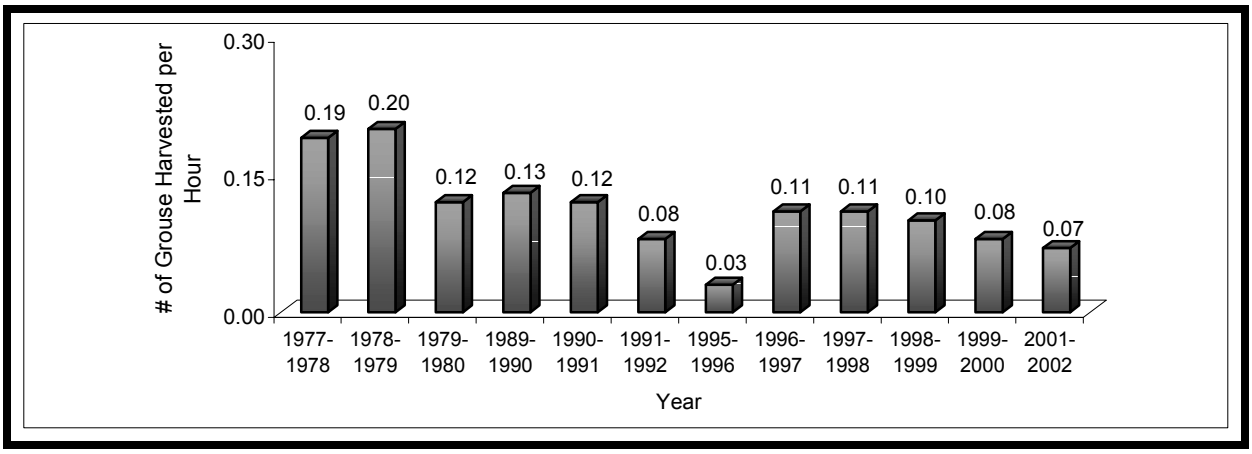
Years reported for grouse are displayed in 2-year intervals because the grouse-hunting season runs from October through February. Both flush rates ($p = 0.03$, $r^2 = 0.43$) and harvest rates ($p < 0.01$, $r^2 = 0.57$) have declined significantly since the 1977–78 season (Figure 12 and Figure 13) suggesting a gradual decrease in ruffed grouse populations. Populations appear to have recovered to some degree during the 1996–97 and 1997–98 seasons. However, observational surveys suggest a reduction in reproductive success for the spring of 1997, 1998, and 1999 compared to 1996 data (lower juvenile to adult ratio), which may result in reduced populations in future years (Table 13).



NOTE: No data was available for 1993–94.

Source: J. Bearden and C. Waters, 1999, "Population parameters and harvest statistics of ruffed grouse in north Georgia, Fiscal Year 1999," Georgia Department of Natural Resources, 5pp; and J. Bearden and D. Gregory, 2002.

Figure 12 - Ruffed Grouse Flushes per Hour, 1977–2002



NOTE: No data was available for 1993–94.

Source: J. Bearden and C. Waters, 1999, "Population parameters and harvest statistics of ruffed grouse in north Georgia, Fiscal Year 1999," Georgia Department of Natural Resources, 5pp; and J. Bearden and D. Gregory, 2002.

Figure 13 - Number of Ruffed Grouse Harvested per Hour of Hunting, 1977–2002

Table 13 - Ruffed Grouse Observational Surveys, 1989–99

Juvenile:Adult Ratio										
1989	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
1.7:1	2.2:1	4.3:1	0.6:1	4.5:1	2.1:1	2.5:1	2.7:1	1.3:1	1.9:1	1.1:1

The population trends experienced on the forest are comparable to those seen throughout the Southern Appalachians. The SAA reported that ruffed grouse population densities have declined in the region since 1970 (SAMAB, 1996). The SAA concluded that the declining trend is largely a result of the regional reduction of forest cover in the sapling-pole class (11–40 years of age), which is important to this species. Table 13 displays the trends in ruffed grouse densities for the Chattahoochee NF as reported in the SAA. The numbers represent the percent of the forest in each ruffed grouse density class.

Table 14 - Trends in Ruffed Grouse Densities, Chattahoochee National Forest, 1970 & 1995

Year	Ruffed Grouse Density Classes			
	Absent	Low	Medium	High
1970	2	17	40	40
1995	< 1	20	80	0

Low = < 5 grouse/square mile
Medium = 5-10 grouse/square mile
High = > 10 grouse/square mile

Source: *Southern Appalachian Man and the Biosphere*, The Southern Appalachian Assessment Terrestrial Technical Report, Report 5 of 5, U.S. Department of Agriculture, Forest Service, Southern Region, Atlanta, GA, 1996.

Forest Plan population objectives for ruffed grouse were 16.4 grouse per square mile with a minimum desirable level of 7.1 grouse per square mile and a maximum desirable level of 32 grouse per square mile. The data discussed previously indicates that a decline in grouse numbers has occurred during the past 15 years. The SAA reported that in 1995, 80 percent of the Chattahoochee NF had an estimated density of 5–10 grouse per square mile and the remainder of the forest had a grouse density of <5 per square mile (SAMAB, 1996). Therefore, current estimates are below the plan objective levels. However, estimated densities still are above the 7.1 per square mile minimum level identified in the Forest Plan.

Although ruffed grouse use a variety of forest habitats and successional stages, population responses are most strongly tied to the availability of early successional habitat, particularly hardwood shrub-seedling habitat (Dimmick et al., 1996; Wiggers, Lauban, and Hamilton, 1992). The reductions in preferred habitat, mainly as a result of a reduction in even-aged management and clearcutting, are largely responsible for the declines observed in the population indices on the Chattahoochee NF. The 1996–97 and 1997–98 hunting seasons for grouse were similar and more productive than normal, probably due to some recent forest disturbances such as pine beetle outbreaks, hurricanes, ice storms, and tornado-damaged stands of timber, which result in additional habitat diversity and therefore improved grouse habitat (Bearden and Waters, 1998).

Trends in hardwood shrub-seedling habitat (6–20 years old) for the Chattahoochee NF are shown in Figure 14. Acres of this preferred habitat increased slightly in the late 1980s but have declined since 1990. A similar pattern is evident for grouse habitat capability based on CompPATS models (Figure 15).

Evaluation of Ruffed Grouse Population Trends and the Relationship to Habitat Changes

Ruffed grouse populations on the forest generally have declined during the last two decades, as they have throughout the Southern Appalachians. Much of this decline is attributable to reduced availability of hardwood shrub-seedling habitat due to reductions in timber harvest levels. Although this trend is expected to continue, habitat conditions created from timber management and natural disturbance are expected to be adequate to ensure continued viability of ruffed grouse on the forest.

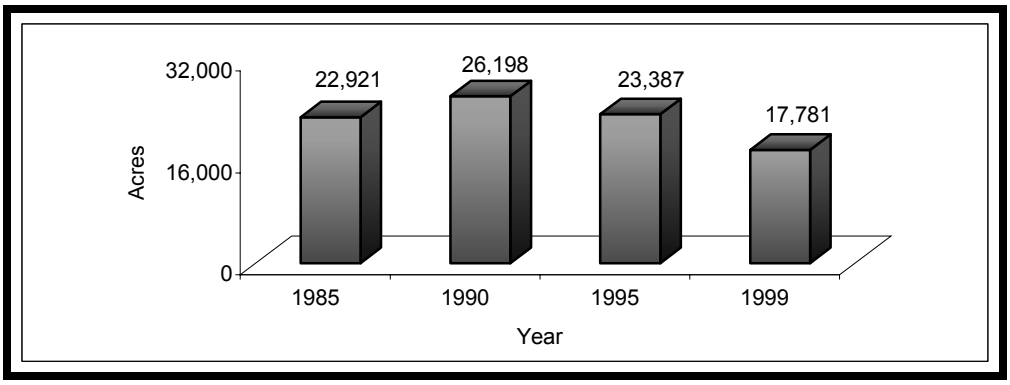


Figure 14 - Trends in Acres of Hardwood Shrub-Seedling Habitat on the Chattahoochee National Forest, 1985, 1990, 1995 & 1999

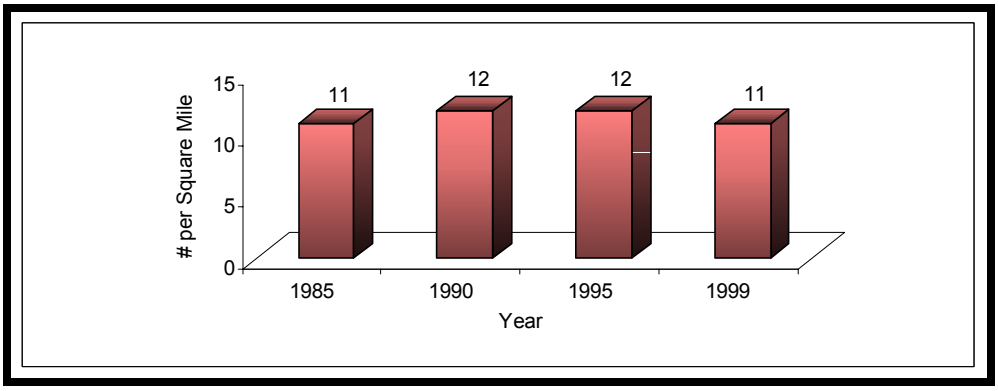


Figure 15 - Trends in Ruffed Grouse Habitat Capability, 1985, 1990, 1995 & 1999

Bobwhite Quail

The Monitoring Plan for the Chattahoochee-Oconee Forest Plan indicates that whistle (call) counts will be used as a means of tracking bobwhite quail (*Colinus virginianus*) population trends over time (see Table 4).

The types of data available for bobwhite quail include:

- Chattahoochee-Oconee songbird road survey summary for 1989–1990 (Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA)
- Chattahoochee-Oconee point counts from 1992 through 2002 (Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA)
- Breeding Bird Survey results from U.S. Fish and Wildlife Service (Sauer et al., 2002)
- County-level Population Estimates - 1970 and 1995 (SAMAB, 1996)

We have, but did not display, the following monitoring information for the reasons cited below.

- Quail Hunting Population Index Survey (coveys/hour, kill/hour, etc.) - through 1989 only. Stratified by Physiographic Province (Simpson, 1990). This was not used since the index was discontinued in 1989.
- Quail Production Index Survey (number of broods observed) - through 1989 only. Stratified by Physiographic Province (Simpson, 1990). This survey was not continued after 1989; therefore, it was not used.
- Statewide mail survey—includes number of hunters, harvest, and success rate (selected years). Statewide totals (Nicholson, 1999). Selected years of information did not display good trend information; and it was collected statewide, not just on the forest.

Breeding bird surveys (road routes or point counts) have been conducted on the forest since 1989. The forest has used these breeding bird surveys as the primary method of monitoring bobwhite quail, instead of the specific quail whistle counts as was indicated in the monitoring plan. The two surveys are similar, although the breeding bird surveys are conducted over a wide range of habitats in order to collect information on many bird species while the quail whistle counts concentrate on habitats specifically favored by quail.

In 1989 and 1990, road route surveys were conducted on the forest. Tables 15 and 16 display the average number of quail heard during the road route survey stops. A total of 368 stops were conducted in the spring of 1989 and then again in 1990.

Table 15 - Bobwhite Quail Heard, Chattahoochee National Forest, 1989–90

Year	Average # of Quail per Plot
1989	0.03
1990	0.04

Source: Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA.

Table 16 - Bobwhite Quail Heard, Oconee National Forest, 1989–90

Year	Average # of Quail per Plot
1989	0.35
1990	0.88

Source: Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA.

Road route surveys for the Oconee NF for the spring of 1989 and 1990 have a much higher frequency rate than those on the Chattahoochee. Overall potential for quail is much greater in the Piedmont than in the Mountain Physiographic Region (Hamel, 1992). More intense prescribed fire and active red-cockaded woodpecker management activities resulting in more habitat diversity also contribute to the higher density of quail on the Oconee (Brennan, 1991). However, numbers of quail for the forest as a whole are still low.

Beginning in 1992, the survey method was changed to songbird point counts in order to better represent conditions throughout the forest. An average of 468 points were surveyed between 1992 and 1995. Since 1996, an average of 175 points have been surveyed annually.

Figure 16 shows the number of bobwhite quail heard or observed per point from the annual bird point counts. The number of quail observed has remained low over this period with no significant trend upward or downward ($p = 0.82$, $r^2 < 0.01$). The low number of quail on the forest are likely a result of the limited availability of early successional habitat, especially on the Chattahoochee NF (Brennan, 1991).

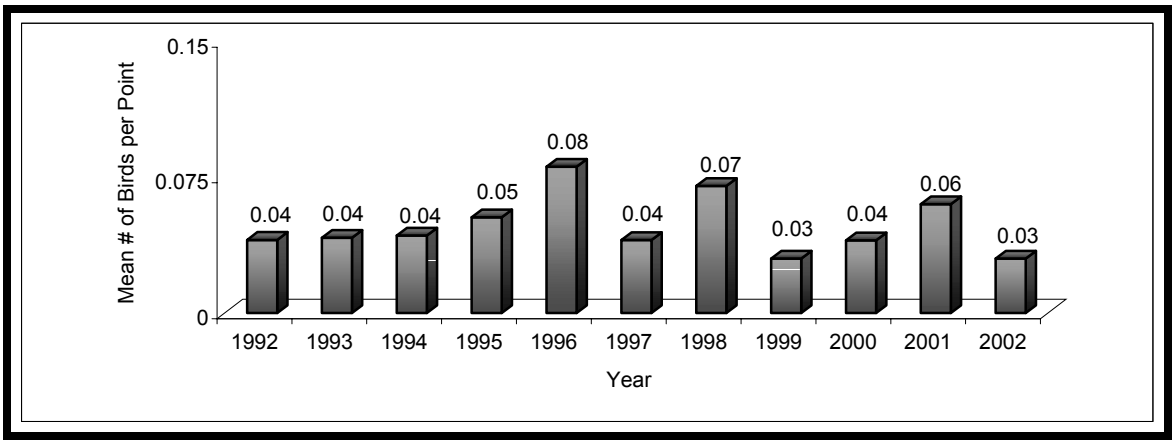
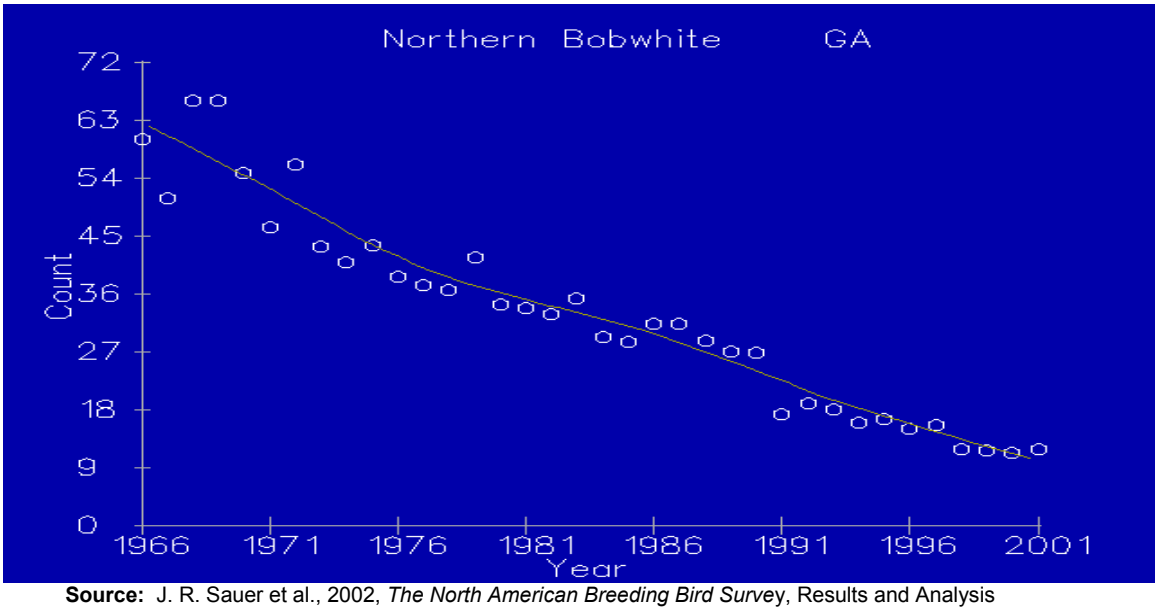


Figure 16 - Point Count Survey Results for Bobwhite Quail, 1992–2002

Based on breeding bird survey results from the U.S. Fish and Wildlife Service (USFWS), statewide populations declined significantly from 1966 through 1999 ($p<0.01$) (Sauer et al., 2002) (Figure 17).



Source: J. R. Sauer et al., 2002, *The North American Breeding Bird Survey*, Results and Analysis 1966–2001, Version 2002.1, USGS Patuxent Wildlife Research Center, Laurel, MD.

Figure 17- Breeding Bird Survey Results for Bobwhite Quail in Georgia, 1966–2001

Bobwhite quail populations have been declining throughout the Southeastern United States for the past 25 years. Quail hunting has experienced a dramatic decline, down from 115,000 hunters in 1970 to 41,900 in 1998 in Georgia, a 64% decline (GON, 2002) According to the SAA, 50 percent of the region had a low bobwhite density in 1970 (SAMAB, 1996). By 1995, more than 70 percent of this same region had a low density, and high densities were not found anywhere in the area. These regionwide declines primarily are attributed to loss of agricultural land and changes in agricultural practices. As shown in Table 17, estimated quail population densities have remained low on the majority of the Chattahoochee NF throughout this 25-year period. The numbers represent the percent of the forest in each quail density class.

Table 17 - Trends in Bobwhite Quail Densities, Chattahoochee National Forest, 1970 & 1995

Year	Bobwhite Quail Density Classes		
	Low	Medium	High
1970	80	20	0
1995	85	15	0

Low = < 1 quail/100 acres
Medium = 1 quail/100 acres - 1 quail/10 acres
High = > 1 quail/10 acres

Source: *Southern Appalachian Man and the Biosphere* (SAMAB), The Southern Appalachian Assessment Terrestrial Technical Report, Report 5 of 5, U.S. Department of Agriculture, Forest Service, Southern Region, Atlanta, GA, 1996.

For the Chattahoochee NF, population estimates are well below plan objective levels (1 quail per 34 acres). According to the SAA, 85 percent of the Chattahoochee NF has population levels less than 1 quail per 100 acres. This is below the minimum desirable level established in the Forest Plan (1/100 acres). Quail populations on the Oconee NF are higher and estimated to fall within the Forest Plan minimum and maximum levels (1 per 25 acres to 1 per 100 acre range).

Evaluation of Bobwhite Quail Population Trends and the Relationship to Habitat Changes

Using several different approaches and sources of information, we can conclude there is evidence of declining populations of bobwhite quail on the forest. Breeding bird survey results for Georgia show a significant decline statewide during the past 30 years. While bird road surveys and point counts for the past 10 years show no drastic changes, numbers of quail reported remain very low throughout the forest. A reduction in early successional habitat on the forest is at least partly responsible for low numbers of this species. However, active management, including prescribed burning and thinning, for RCWs on the Oconee NF also will benefit quail. Bobwhite quail are still considered a game species in Georgia, meaning state biologists are not concerned about the viability of the species.

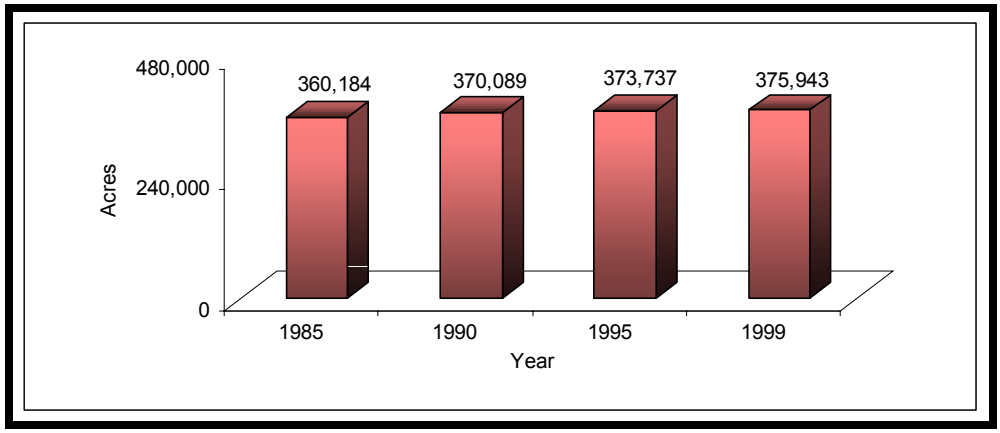
Gray Squirrel

The Monitoring Plan for the Chattahoochee-Oconee Forest Plan (Table 4) indicated that acres of upland and cove hardwoods 50 year and older would be monitored to determine change in population capabilities for the gray squirrel (*Sciurus carolinensis*).

The types of data available for gray squirrel include:

- Continuous (Forest) Inventory of Stand Condition database - 1985–Present (used to show habitat capability trends)
- Annual Oak Mast Index Survey - 1985–Present
- Statewide mail survey—includes number of hunters, harvest, and success rate Statewide totals - 1984–1987, 1989–1990, 1992–1993, 1995–1996, 1998–1999 (Nicholson, 1999)
- County-level population estimates for 1970 and 1995 (SAMAB, 1996)

All of these sources are used in this discussion on gray squirrel population trends. Since squirrels are primarily dependent on mast produced by older hardwoods, monitoring of changes in the acres of upland and cove hardwoods 50 years and older was thought to be a good way to track changes in the overall population. Based on changes in upland and cove hardwood acreage that are greater than 50 years old, habitat for squirrel increased during each 5-year period and suitable habitat remains abundant (Figure 18).



Source: Continuous Inventory of Stand Conditions data for Chattahoochee-Oconee National Forests.

Figure 18 - Trends in Acres of Squirrel Habitat, 1985, 1990, 1995, & 1999

Similarly, data from CompPATS shows a slight increase in squirrel habitat capability in from 1985 to the present (Figure 19).

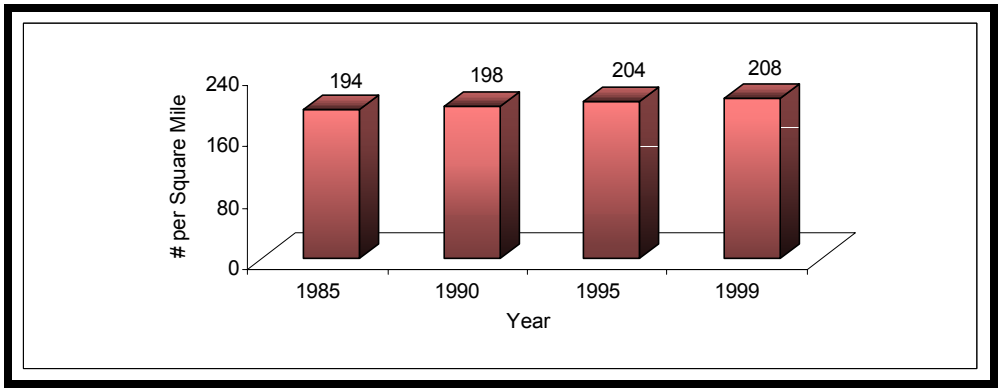
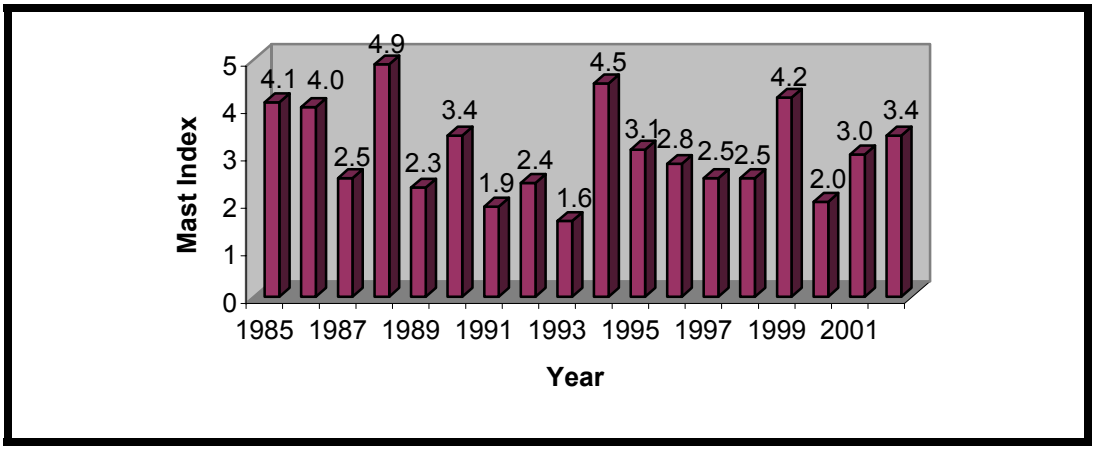


Figure 19 - Trends in Squirrel Habitat Capability, 1985, 1990, 1995, & 1999

Squirrel population levels are largely determined by the quantity of available acorns, which is highly variable from year to year (Nixon, McClain, and Donohoe, 1975). Squir-

rel populations generally are highest the year following a good acorn crop, and they often decline following poor acorn years. GADNR conducts mast index surveys each fall to estimate the size of the acorn crop (Waters and Ezell, 2002). Acorn crops were good in 1994, 1995, 1999, and 2002; fair in 1996, 1998, and 2001; and poor in 1997 and 2000 (Figure 20). A rating of 0–2 is poor, 2–3 is fair, and more than 3 is good (Wentworth et al., 1992).



*An index from 0 to 10 represents amount of available acorns present for wildlife consumption.

Source: C. Waters and J. Ezell, 2002, "Relative abundance of mast in north Georgia," Grant number 8-1, Georgia Department of Natural Resources, Social Circle, Georgia.

Figure 20 - North Georgia Oak Mast Survey, 1985–2002

The results of the squirrel hunter harvest indices are shown inTable 18. Gray squirrel are displayed in 2-year intervals because the season starts in the fall of one year and then runs through February of the following year. Number of hunters, number of squirrels harvested, and number of squirrels per hunter fluctuate from year to year with no significant trend upward or downward ($p > 0.05$, $r^2 < 0.01$). These changes likely reflect changes in squirrel densities resulting from differences in hard mast availability.

Table 18 - Hunting Pressure and Harvest Levels for Squirrels in Georgia by Licensed, Resident Hunters, 1984–99

Year	# of Hunters	Total Kill	Squirrels per Hunter
1984–85	101,344	1,094,593	10.8
1985–86	87,500	867,514	9.9
1986–87	85,426	965,438	11.3
1989–90	87,906	940,398	10.7
1992–93	71,959	677,550	9.4
1995–96	104,529	1,204,906	11.5
1998–99	89,773	942,616	10.5

Source: Hunter surveys from W. S. Nicholson, "Harvest of wildlife in Georgia," Georgia Department of Natural Resources, Game Management Section, Social Circle, Georgia, 1999.

According to the SAA, gray squirrel population densities have remained very stable throughout the region during the last 25 years. Squirrel populations have likely benefited from increased acorn (mast) production as a result of maturation of the forest. The rela-

tive density classes for gray squirrel are displayed in Table 19. The numbers represent the percent of forest in each squirrel density class.

Table 19 - Trends for Gray Squirrel, Chattahoochee National Forest, 1970 & 1995

Year	Gray Squirrel Densities		
	Low	Medium	High
1970	9	70	21
1995	2	77	21

Low = < 1 squirrel/10 acres
Medium = 1 squirrel/10 acres - 1 squirrel/3 acres
High = > 1 squirrel/3 acres

Source: *Southern Appalachian Man and the Biosphere*, The Southern Appalachian Assessment Terrestrial Technical Report, Report 5 of 5, U.S. Department of Agriculture, Forest Service, Southern Region, Atlanta, GA, 1996.

Forest Plan population density objective for squirrel was set at 1 squirrel per 4 acres. Minimum and maximum density objectives were 1 squirrel per 8.5 acres and 1 squirrel per 3.6 acres, respectively. Estimates from the SAA indicate that the majority of the Chattahoochee NF has squirrel densities between from 1 squirrel per 3 acres to 1 per 10 acres (SAMAB, 1996). Based on this data, it appears that squirrel populations are in line with plan objectives.

Evaluation of Gray Squirrel Population Trends and the Relationship to Habitat Changes

Results from squirrel harvest indices (Nicholson, 1999) and regional assessments (SAMAB, 1996) indicate that gray squirrel densities have remained very stable throughout the region during the last 15 years. However, squirrel population levels vary greatly from year to year and largely reflect the quantity of available hard mast. Gray squirrel habitat is abundant on the forest (upland and cove hardwoods that are 50 years and older) and has increased in availability during the last 15 years (CISC data). By using this information, it can be concluded that gray squirrel viability is being maintained throughout the Chattahoochee-Oconee NFs. No significant changes are expected in the future, although an increase in habitat capability is likely due to continued maturation of the forest.

Bog Turtle

The Monitoring Plan for the Chattahoochee-Oconee Forest Plan indicates that the monitoring techniques to be used for bog turtle (*Clemmys muhlenbergii*) are surveys, capture, mark, and recapture (see Table 4). Density population objectives for the bog turtle were not identified since it was only know to occur at one location, according to the Forest Plan. The bog turtle was first reported from the forest in 1979. Currently, the following population data is used for the species:

- Ken Fahey, "Habitat Survey and Census of Bog Turtle Populations in Georgia, Final Report for 1994–1996," unpublished report for GADNR

- Ken Fahey, "Habitat Survey and Census of Bog Turtle Populations in Georgia, Final Report for 1992–1993," unpublished report for GADNR
- Ken Fahey, "Habitat Survey and Census of Bog Turtle Populations in Georgia, Final Report for 1991–1992," unpublished report for GADNR
- Wolf Creek Bog Surveys - 1979, 1981, 1983, 1984, 1985, 1991, 1992, 1997, 1998, 2001

The only current records of a bog turtle population on national forest land are for the Wolf Creek Zoological Area on the Brasstown RD. The techniques used to monitor the population are trapping (capture), marking, and identification of all individuals. Between 1979 and 2001, seven different individuals have been captured and marked at this location (Table 20).

Table – Summary of Bog Turtle Captures at Wolf Creek Zoological Area, 1979-98

Date	Sex	Mark	Collection Method	Collectors
05/08/79	-	-	Grouse Trap	Hale and Harris
05/10/79	-	-	Grouse Trap	Hale and Harris (2 individuals)
05/22/79	-	-	Grouse Trap	Hale and Harris
07/16/79	-	-	Grouse Trap	Hale and Harris
07/29/81	F	32	Visual	Sanders
05/07/83	F	32*	Visual	Fahey
05/06/84	M	2	Visual	Fahey
04/28/85	M	3	Visual	Fahey
05/04/85	M	4	Visual	Fahey
06/30/91-7/14/91	M	5	Turtle Trap 3 Captures	Wentworth, Harkins, Fahey
04/22/92-6/26/92	M	3*	Turtle Trap, Visual 6 Captures	Wentworth, Harkins, Fahey
06/03/98-6/11/98	M	6	Turtle Trap 3 Captures	Fahey, Wentworth
06/05/98	M	5*	Turtle Trap	Fahey, Wentworth
5/30/01-6/19/01	M	6*	Turtle Trap 6 Captures	Fahey, Wentworth
5/30/01-7/11/01	F	7	Turtle Trap, Visual 6 Captures	Fahey, Wentworth
6/2/01-7/6/01	M	5*	Turtle Trap 4 Captures	Fahey, Wentworth

*Recapture of marked turtle

NOTE: A bog turtle nest containing three eggs was found at Wolf Creek on 07/21/97.

In spring 1997, bog turtle eggs were found at Wolf Creek, the first evidence of reproduction taking place in Wolf Creek bog. In spring 1998 and 2001, this site was intensively trapped with the cooperation of Dr. Fahey and GADNR. In 1998, a sixth individual, an unmarked male turtle never before captured, was trapped, marked, and then released. In 2001, an unmarked female turtle was captured at Wolf Creek. This is only the second female turtle trapped at this site and the first since 1983.

Habitat improvement work to restore bog conditions at the Wolf Creek site was initiated in 1992 and continues to date. Extensive girdling of trees to restore bog conditions has been conducted and this site was prescribed burned in March 2003.

As additional sites are found on the forest that appear to provide bog turtle habitat, they are trapped to determine if the turtles are present. For example, in 1995, on national forest land within a few miles of the Brasstown site and near known sites on private land, Dr. Fahey intensively trapped (2,280 trap nights) a potential bog turtle site. Despite 4 months of trapping, no turtles were found. Dr. Fahey concluded there are no turtles in the bog, or, if there are any, the number is so low it does not represent a viable population. However, the site provides excellent bog turtle habitat. Therefore, in 1998 and 2000, in preparation for possible future bog turtle introduction of local genetic stock, Georgia Herp Atlas volunteers, GADNR biologists, and Chattahoochee NF biologists conducted habitat improvement work at this location. This site also was prescribed burned in March 2003.

Another potential site was noted on the Tallulah RD in 1993 by the forest ecologist. This site was located not far from a historical record of occurrence for this species. Therefore, in 1996, 1998, and 2001, Dr. Fahey placed live traps in the area. However, no bog turtles were trapped at the site. Due to the fact the site does provide excellent bog turtle habitat and is located near a historical record, trees were girdled on the site in 1998 to improve habitat (allow more sunlight into the forest floor) for the species. Forest biologists and Dr. Fahey surveyed a boggy area on the Chattooga RD that appeared to provide habitat for the bog turtle in late summer 1997 and early spring 1998. There are no historical records of bog turtle occurrence in the area, and the species was not found during the trapping.

The Forest continues to work with other agencies and organizations to further conservation of the bog turtle in Georgia. Several bog turtle conservation meetings have been held in north Georgia in the last 5 years. Participants have included biologists from the USDA Forest Service, The Nature Conservancy, GA DNR, Georgia Power Company, Georgia Department of Transportation, the Tennessee Aquarium, and the Chattahoochee Nature Center. Recent discussions have included monitoring and management of habitat management needs and the potential of bog turtle reintroduction to several sites on the Forest.

Evaluation of Bog Turtle Population Trends and the Relationship to Habitat Changes

Extremely limited in distribution and range, there is only one bog turtle population on the forest and sampling and monitoring efforts have resulted in the marking of seven individuals from that population between 1979 and 2001. This site and sites with potential to provide bog turtle habitat are managed to improve habitat for the species. Potential new sites are trapped to determine if bog turtle populations are present, and the known site is trapped periodically to obtain population and trend data. Habitat manipulation seems to be improving conditions for the one bog turtle population on the forest. Although it is doubtful this is a viable population, evidence of reproduction taking place is encouraging. We hope that future habitat improvement will encourage continued reproduction and the eventual establishment of a viable bog turtle population.

Yellow Lady's Slipper

The Chattahoochee-Oconee Monitoring Plan for the Forest Plan (Table 4) states that we will inventory, record, and map known sites of the yellow lady's slipper (*Cypripedium calceolus*). Since 1991, the forest has been conducting extensive plant inventories across the forest. Several populations of this orchid have been found during these inventories. The populations have been recorded and mapped, and the numbers of individuals documented for each population. The forest uses the following sources of population data for the yellow lady's slipper:

- *Atlas of the Vascular Flora of Georgia* (maps of county locations of plant populations), compiled by Marie Mellinger for the Georgia Botanical Society (Milledgeville, GA: Studio Designs Printing), 1984
- "The Distribution of the Vascular Flora of Georgia," compiled by Samuel B. Jones and Nancy Craft Coile, 1988, unpublished report, Department of Botany, University of Georgia, Athens, GA
- 1972 Biological Survey of the Chattahoochee NF (a list of yellow lady's slipper populations)
- Inventory data and maps across the forest documenting populations of yellow lady's slipper (116 populations found between 1991 and 1998)
- Georgia Department of Natural Resources, Georgia Natural Heritage Program - documentation of yellow lady's slipper occurrences in Georgia

Mellinger (1984) shows occurrence of yellow lady's slipper populations in 32 counties in Georgia. Jones and Coile (1988) document specimens from populations in 13 Georgia counties. The 1972 report titled "Biological Survey of the Chattahoochee-Oconee National Forest" listed 11 populations of yellow lady's slipper known to occur on the forest. Prior to 1991, the Georgia Natural Heritage Program had documented six known occurrences of the species in Georgia. As a result of botanical inventories conducted by the Chattahoochee-Oconee, approximately 116 new populations of this orchid have been found on the forest between 1991 and 1998, with numbers of individuals within the populations ranging from 1 to 200. Although populations of yellow lady's slipper have been found on every district in the Chattahoochee NF, the majority of the populations occur on the Brasstown and Toccoa RDs. Between 1991 and 1998, plant inventories conducted by the forest yielded 34 populations of the orchid on the Brasstown RD and 57 populations on the Toccoa RD. During the period 1999-2002, there have been few project-level plant inventories due to reduced project activity. No additional populations of yell lady's slipper have been found during the 1999-2002 inventories that have been conducted.

In Table 2-2 of the 1985 Forest Plan, the current density for yellow lady's slipper at the time of the plan was written was estimated to be 1 per 17 acres, with a population objective ranging from 1 per 7 acres to 1 per 21 acres. Although not stated, it is assumed that these density objectives apply to acres of suitable habitat, not total forest acres. On 2,875 acres surveyed where the orchid was found on the Chattahoochee, 1,695 plants were counted for a density of 1 per 1.75 acres. Yellow lady's slipper was found in 15 percent of the suitable habitat (upland hardwood, cove hardwood, and yellow poplar forest types) surveyed on the Toccoa and Brasstown RDs. Extrapolating from these figures, the den-

sity of yellow lady's slipper is estimated to be 1 per 12 acres of suitable habitat, well within the desired range listed in Table 2-2 of the 1985 Forest Plan.

The yellow lady's slipper occurs in a variety of forest types and age classes on the forest. However, based on plant inventories, the orchid appears to occur on the Chattahoochee primarily in cove hardwood forest types 60 years and older. The Chattahoochee currently has approximately 87,174 acres of this habitat. The trend in acreage amounts for this habitat from 1985 to 1999 has been steadily increasing, as shown in Figure 21.

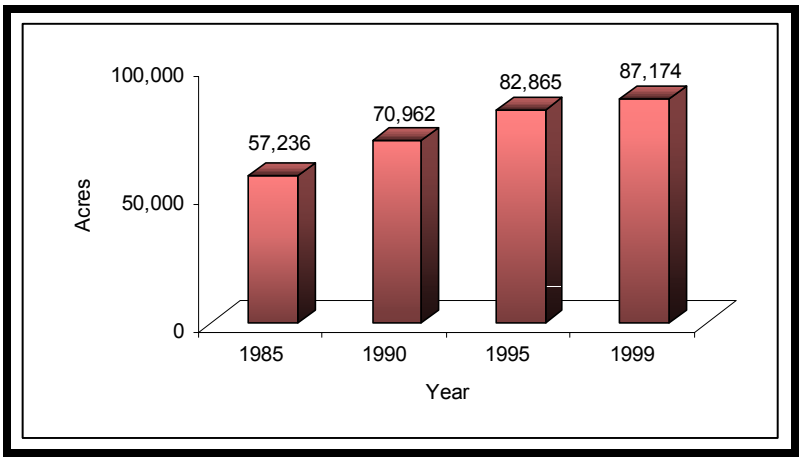


Figure 21 - Acreage of Potential Habitat for Yellow Lady's Slipper

Evaluation of Yellow Lady's Slipper Population Trends and the Relationship to Habitat Changes

As a result of project-level botanical surveys, the number of known yellow lady's slipper populations on the forest has increased since 1991. The forest will continue to conduct plant inventories on sites proposed for ground-disturbing activities. New populations of yellow lady's slipper have been and will continue to be documented and mapped as stated in the forest monitoring plan. Management of this species consists of protection of all populations of 10 or more individuals from all direct or indirect impacts. These measures, along with the increased availability of suitable habitat (see Figure 21), will ensure the continued viability of yellow lady's slipper on the forest.

Mountain Pitcher Plant

The Monitoring Plan for the Chattahoochee-Oconee Forest Plan (Table 4) states that we will inventory, record, and map known sites of the mountain pitcher plant (*Sarracenia purpurea*). Density population objectives were not listed in the Forest Plan for this species since it occurs at only one location on the forest. Plant inventories have been conducted across the forest since 1991. Although the forest continues to inventory for the mountain pitcher plant, to date, only one population has been found on the forest. This bog site was designated as a botanical area in the 1985 Forest Plan and is thus protected from any activities other than those that would improve habitat for, and growth of, the mountain pitcher plant. The following sources of mountain pitcher plant population and habitat information are available from the one site on the Chattahoochee NF.

- Population data - 1980–1983, 1985, 1989, 1993–1994, 1997–1999 2000-2002 (Data and records for Chattahoochee National Forest, files)

- Establishment of photo-monitoring plots in 1997 and 1999 to monitor habitat changes over time and photos taken in 1997, 1998, and 1999

Table 21 - Population Trends for Mountain Pitcher Plants, 1980–99
(Selected Years Inventory)

Year	Number of Mountain Pitcher Plants
1980	157
1981	144
1982	130
1983	87
1985	167
1989	42
1993	44
1994	86
1997	134
1998	144
1999	182
2000	187
2001	216
2002	165*

*Note: The 2002 count is an incomplete count. In one of the microsites, only the flowering individuals were counted. Also, extensive plant damage due to bear activity (as determined by bear scat and tree-marking) was evident in some of the sites.

Ben Sanders, Forest Service biologist (now retired), first counted the mountain pitcher plant in 1980, counting 157 plants. Between 1980 and 1985, the population varied from a low of 87 plants in 1983, to a high of 167 plants in 1985 (see Table 21). When Sanders and GADNR biologists visited the site in 1989, the site had dwindled to approximately 42 plants. The reduction was believed to be a result of poaching and of succession of the bog to woody species. A site visit was made in 1990 by Forest Service and GADNR biologists and representatives from Atlanta Botanical Gardens and Chattahoochee Nature Center to excise rhizomes for propagation by Atlanta Botanical Gardens and subsequent transplanting back to the site. Counts in 1993 yielded 44 plants, and at that time habitat restoration was conducted by removal of woody vegetation encroaching in the bog. During the period 1993–94, Atlanta Botanical Gardens, GADNR, and USFS augmented the bog with plants grown by the Atlanta Botanical Gardens from genetic stock taken from the site. In 1994 the count was up to 86 plants.

In 1995, the Georgia Plant Conservation Alliance (GPCA) was established and undertook mountain bog restoration, including this bog, as one of its priority projects (GPCA is an organization composed of biologists from the Georgia State Botanical Gardens, Atlanta Botanical Gardens, The Nature Conservancy, Callaway Gardens, University of Georgia, Georgia Southern University, GADNR Natural Heritage Program, and USDA Forest Service). This mountain pitcher plant population and the surrounding habitat are currently being restored and monitored by GPCA. GPCA has improved the habitat at the site by removal of encroaching woody vegetation and expansion of the sphagnum moss mats to improve plant vigor and to encourage expansion of the plants into adjacent areas. As microsites are restored, the sites are augmented with mountain pitcher plants propagated from pitchers present in the bog. Visits to the site are made at least once annually for

continued monitoring. Plants are periodically counted and mapped. As shown in Table 21, the population has increased from 1997-2001 (see note concerning 2002 counts), with counts consisting of 134, 144, 182, 187, and 216 plants, respectively. In October 1999, a site visit showed the plants in the natural site had flowered and produced fruit for the first time in 12 years. In 2002, 84 pitcher plants were flowering.

In 1997, a fence was installed by GPCA to protect the plants from deer browsing occurring on the site. Monitoring in 1998 indicated the fence appeared to be successful in preventing herbivory. In April 1997, permanent photo-points were established at the site to monitor habitat changes. In 2002, it was noted that black bear activity in the area had disrupted many of the pitchers recently planted in one of the restored bog microsites.

In 1997, plans were begun by GPCA to establish two safeguarding sites on the forest for rare bog plants, including the mountain pitcher plant, using local genetic stock propagated by the Atlanta Botanical Gardens. GPCA made several field trips in 1997 and 1998 to the potential sites to assess the habitat and feasibility of establishing such areas. Mountain pitcher plants were planted in the safeguarding sites in December 1998 and April 1999, and in winter and spring of 1999 the plants appeared to be doing well. Site visits in 2001 and 2002 showed the plants were continuing to thrive, and several were producing seed capsules.

Evaluation of Mountain Pitcher Population Trends and the Relationship to Habitat Changes

The forest continues to inventory for the mountain pitcher plant; but, to date, only one location has been found. In this location, as well as the two established sites, these plants are being actively monitored and their habitat monitored and restored by the agencies and organizations in GPCA, including the USDA Forest Service. Monitoring counts show that the number of plants has increased during the last 13 years through recruitment and augmentation of the populations. The production of flowers and fruits is an indication of improved habitat conditions resulting from active management of the site by GPCA. GPCA is working to further increase the number of plants and expand the suitable habitat, with a goal of eventually establishing a viable population of the mountain pitcher plant on the Chattahoochee NF.

Dusky Salamander

The Monitoring Plan for the Chattahoochee-Oconee Forest Plan does not address the dusky salamander (*Desmognathus fuscus*). The following data is available for this species.

- Savannah Ecology Lab records of populations in Georgia (records of museum specimens, some located on the Chattahoochee-Oconee)
- University of Georgia - Athens Museum of Natural History records of populations in Georgia (records of museum specimens, most of which overlap the data in the Savannah Ecology Lab records above. However, there are some 1993 records of specimens from the Tallulah RD that are not found in the Savannah Lab records)

Conversations with local professional herpetologists indicate that the dusky salamander is abundant in the state. In Georgia, this salamander is found primarily in the Piedmont and

the Ridge and Valley, where it is commonly encountered in streamside habitats (Camp, 1999; Jensen, 1999). It occurs less frequently in the mountain region where it tends to be replaced by other *Desmognathus* species. Populations are known from national forest lands in 22 counties, encompassing all ranger districts (Table 22); and species viability is not a concern on the forest. Note that although the majority of the museum specimens are from the mountains, this merely reflects the fact that sampling efforts have concentrated on that physiographic region.

Table 22 - Number of Known Populations of Dusky Salamander On or Near National Forest Lands

County	Number of Populations
Chattooga	5
Dawson	3
Fannin	10
Floyd	4
Gilmer	5
Gordon	3
Greene	2
Habersham	2
Jasper	1
Jones	1
Lumpkin	2
Morgan	1
Murray	8
Oconee	1
Oglethorpe	4
Rabun	9
Stephens	3
Towns	3
Union	11
Walker	8
White	5
Whitfield	4
TOTAL	**95**

In the 1985 Forest Plan, the dusky salamander was chosen as an MIS to represent riparian corridor habitat. As discussed previously, the forest has approximately 68,400 acres of riparian habitat, which is protected by Forest Plan standards and guidelines. These streamside standards and guidelines are addressed in Amendment 5 of the Forest Plan. In addition, areas in the Piedmont physiographic province on the Oconee NF that would provide excellent habitat for this species are currently protected in the 1985 Forest Plan. These areas are comprised of 1,185 acres in the Murder Creek Research Natural Area and the Monticello Bottomland Hardwoods Botanical Area.

Evaluation of Dusky Salamander Population Trends and the Relationship to Habitat Changes

The acres of riparian habitat would be expected to remain constant over time. The use of streamside standards and guidelines on all projects, as well as designation of special protected areas, will maintain the quality and integrity of the riparian corridors. These measures will ensure continued viability of the dusky salamander on the forest.

Upon further review of the dusky salamander, the forest has identified several limitations in its usefulness as a management indicator species. These include:

1. The genus *Desmognathus* is the most complex amphibian group in the Southeast, and most herpetologists have great difficulty in identifying certain specimens to species level. The difficulty in the identification and monitoring of *Desmognathus fuscus* make it unsuitable as a MIS.

2. This species is not well distributed across the forest. It is most abundant in the Piedmont and is largely replaced by other *Desmognathus* species in the mountains.

For these reasons, the forest decided to replace the northern dusky salamander with the Acadian flycatcher (*Empidonax virescens*). (This change was made through an amendment [Amendment 19, June 2, 2000] to the current Chattahoochee-Oconee Forest Plan.) The Acadian flycatcher is associated with deciduous forests near streams (Hamel, 1992) and, therefore, is a good representative of riparian corridor habitat. It also is well distributed across the forest and is easily monitored through the system of breeding bird survey points established throughout the forest.

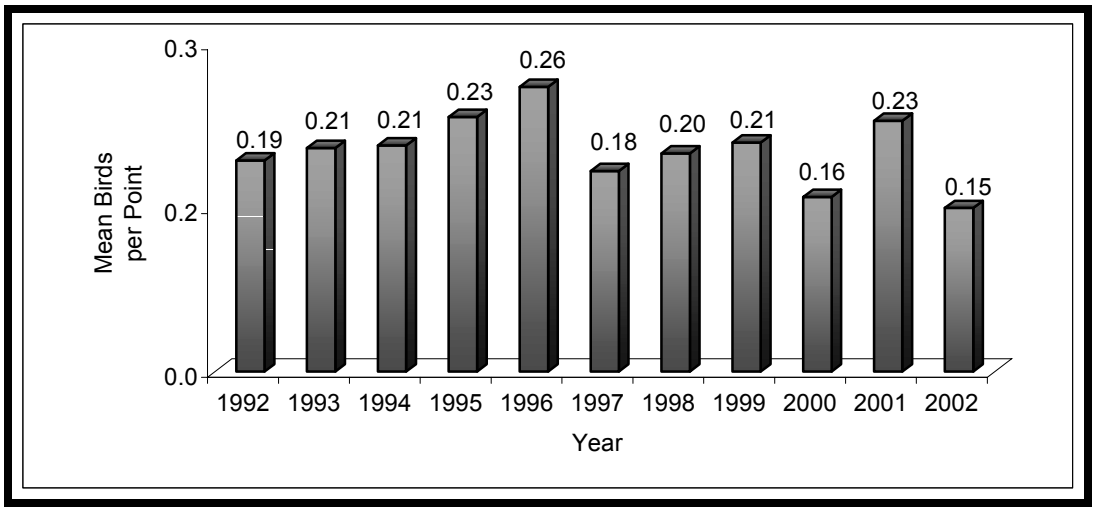
Acadian Flycatcher

The forest uses several data sources to monitor Acadian flycatcher (*Empidonax virescens*) populations.

- Point Count Survey - 1992–2002 (Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA)

- Breeding Bird Survey results from U.S. Fish and Wildlife Service - 1966–2001 (Sauer et al., 2002)

Since 1992, the forest has conducted songbird surveys using the Point Count Survey technique. An average of 468 points were surveyed between 1992 and 1995. Since 1996, an average of 175 points have been surveyed annually. This data is supplemented with statewide data from the U.S. Fish and Wildlife Service Breeding Bird Surveys (Sauer et al., 2002). The point count data for Acadian flycatcher is displayed in Figure 22. Acadian flycatcher populations have remained stable during the last 9 years ($p = 0.46$, $r^2 = 0.08$).



Source: Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA.

Figure 22 - Point Count Survey Results for Acadian Flycatcher, 1992–2002

Riparian habitat quality is maintained on the forest on all projects through the implementation of streamside standards and guidelines. These specific guidelines meet or exceed State Best Management Practices (BMPs). These include the establishment of a logging equipment limitation zone, which prohibits the use of logging equipment within a minimum of 40 feet of any defined stream channel; the establishment of an erosion protection strip, which prohibits major ground-disturbing practices such as roads and log landings within a minimum of 80 feet of defined stream channels; and the establishment of a shade protection strip on all perennial streams. Additionally, there are requirements in the Forest Plan and timber sale contracts for road construction activities—such as the quantity of gravel required, type, and frequency of road drainage structure—and requirements for the revegetation and stabilization of exposed soils. All timber sales are monitored by a District Timber Sale Administrator to ensure that forestwide standards and guidelines and timber sale contract guidelines are followed.

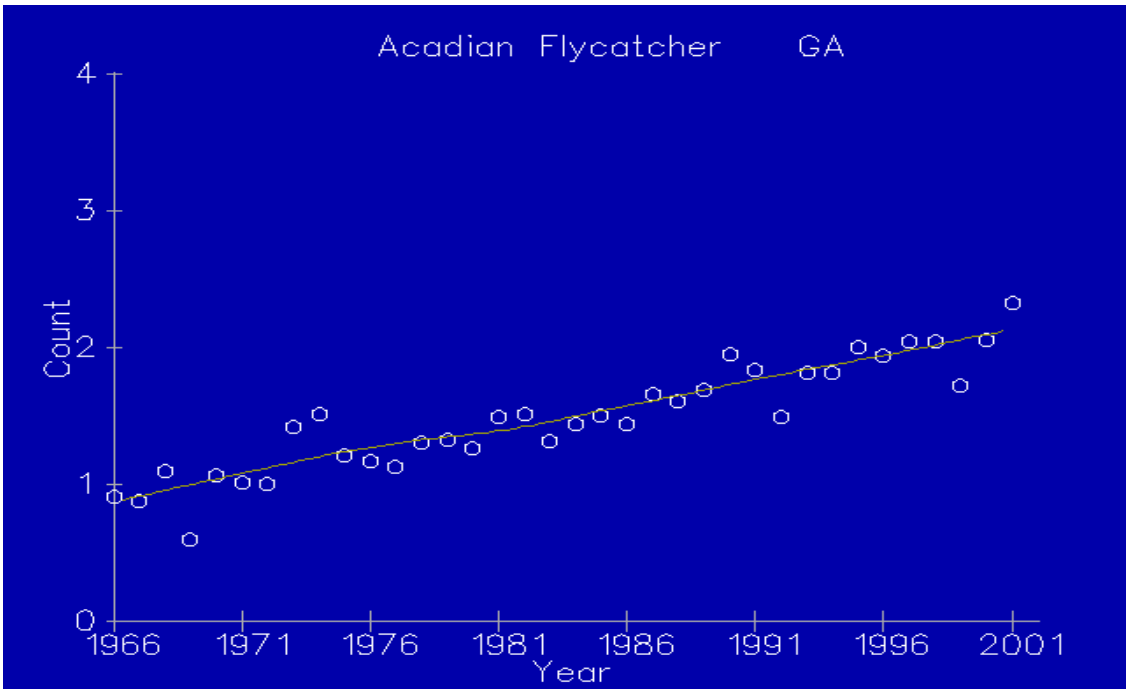
Results of breeding bird surveys compiled by the U.S. Fish and Wildlife Service indicates the Acadian flycatcher population is doing well in Georgia (Figure 23). From 1966–2001, there was a significant increasing trend in abundance for this species ($p = 0.122$) (Sauer et al., 2002).

Amendment 19 of the Forest Plan estimated that the current population density for Acadian flycatcher is one pair per 90 acres. The plan population objective was set as one pair per 75 acres. A comparable population density cannot be calculated from the types of data collected through the Point Count Surveys. However, these surveys permit the evaluation of population trends, based on mean number of birds per plot.

Evaluation of Acadian Flycatcher Population Trends and the Relationship to Habitat Changes

Bird survey data discussed previously demonstrates that Acadian flycatcher populations have been relatively stable on the forest and are increasing statewide. The acres of riparian habitat are expected to remain constant over time. The use of streamside standards and guidelines on all projects, as well as designation of special protected areas, will main-

tain the quality and integrity of existing riparian corridors. These measures will ensure continued viability of the Acadian flycatcher on the forest.



Source: J. R. Sauer et al., 2002, *The North American Breeding Bird Survey, Results and Analysis 1966–2001*, Version 2001.2, USGS Patuxent Wildlife Research Center, Laurel, MD.

Figure 23 - Breeding Bird Survey Results for Acadian Flycatcher in Georgia, 1966–2001

Fish

The Monitoring Plan for the 1985 Forest Plan stated that fish MIS monitoring techniques and data sources could include electrofishing surveys, biomass estimates, and water quality changes (see Table 4).

MIS species selected included all three species of trout (brook, rainbow, and brown), redeye bass, yellowfin shiner, turquoise darter, and Coosa darter. The trout were selected to represent cold-water streams on the Chattahoochee NF, since at least one of the three species is found in most streams. While brook trout are only known to be native to the Tennessee drainage, all three trout are considered exotics. Their distributions are primarily a function of where they were stocked. These trout are also occurring at the southern edge of their range and are limited by elevation and stream temperature. The redeye bass, yellowfin shiner, and turquoise darter were selected to represent the lower reaches of the Savannah drainage and the Oconee NF, where water temperature is too warm to support trout. The redeye bass and Coosa darter were also selected to represent the Armuchee RD and lower reaches of the Conasauga River, where temperatures are also too warm for trout.

MIS population trends and changes are for resident fish rather than hatchery reared fish. Although hatchery brown and rainbow trout are stocked in some streams, the majority of surveys in this report occurred in nonstocked sections. Stocked trout can be visually distinguished from resident trout, and this separation is usually noted in surveys.

Fish monitoring was accomplished with the use of electrofishing surveys, including biomass and number estimates, as well as water quality changes. The Georgia Department of Natural Resources and USDA Forest Service conducted the majority of these surveys.

General Population Sampling. During the period 1954–98, GADNR and the Forest Service collected approximately 868 fish population samples on 373 Chattahoochee NF streams, representing all watersheds on the forest. The primary purpose of these sampling efforts was to determine fish distribution and to monitor management activities. Prior to the 1970s, primary emphasis was directed toward game fish, with less data collected on nongame species (sometimes identified only to family or genus). By the late 1970s, emphasis had changed to the point that identification of nongame fish was usually carried to the species level. The majority of these samples were collected making single-pass electrofishing runs. In addition, many streams were surveyed using the multiple-pass depletion sampling method, which can provide quantitative estimates of fish biomass and numbers. The bulk of this data is on file in three GADNR offices (Gainesville, Lake Burton, and Calhoun), with additional data in Forest Service Supervisor's Office in Gainesville.

Cooperative Baseline Monitoring. The Forest Service cooperated with GADNR in selecting and sampling 27 reaches in 19 trout streams across north Georgia to establish baseline data and develop a long-term fish population monitoring program (Durniak, Keefer, and Ruddell, 1997). All but two streams (Dover and Upper Totterypole) were located on the Chattahoochee NF. From 1991–95 these steams were sampled annually using depletion electrofishing techniques. Three, approximately 100m, sampling stations were established at each location. Habitat, substrate, and temperature variables also were estimated for each stream reach.

Streams were grouped by the predominant trout species present. Comparisons were made among years on the same stream and among streams for fish population differences within a group during the 5-year study period. Relationships between habitat and substrate variables and fish abundance also were evaluated.

Results of these surveys are shown in Tables 23 through 26. Most of the observed variations occurred among streams and not among years of individual streams or stream groupings. For young-of-year trout, mean annual density varied among years only for rainbow trout streams. There were no significant differences among years for young-of-year brook trout, brown trout, or sympatric streams. For adults, mean annual densities varied among years only for brook trout.

Negative relationships were obscured between combined sand and sediment and rainbow trout density, and positive relationships were obscured between large woody debris (LWD) and the density of brook and brown trout.

These streams will be sampled periodically to monitor population trends. A subset of these streams was resampled in the summer of 2000, and additional streams were sampled in 2001 and 2002.

Table 23- Average Density of Young-of-Year and Adult Trout, Georgia Rainbow Trout Streams, 1991-2002

Stream	Age Group	Average Density (Fish/Hectare) By Year								Average of All Years
		1991	1992	1993	1994	1995	2000	2001	2002	
Charlies, Lower	YOY	673	1149	719	338	779	-	441	-	3732
	Adult	**577**	**646**	**878**	**475**	**558**	**-**	**1044**	**-**	**3308**
Charlies, Upper	YOY	365	588	385	332	843	-	187	-	2544
	Adult	**245**	**267**	**743**	**333**	**407**	**-**	**785**	**-**	**2126**
Dicks, Lower	YOY	187	591	502	248	1044	419	-	116	3008
	Adult	**98**	**81**	**344**	**267**	**253**	**100**	**-**	**176**	**1168**
Dicks, Upper	YOY	80	221	87	322	388	419	-	238	1551
	Adult	**71**	**54**	**169**	**99**	**212**	**91**	**-**	**423**	**756**
Dukes,Lower	YOY	278	670	998	82	542	-	225	-	2608
	Adult	**225**	**340**	**867**	**746**	**615**	**-**	**551**	**-**	**2885**
Dukes,Upper	YOY	546	650	1226	46	1079	-	579	-	3644
	Adult	**195**	**366**	**877**	**935**	**663**	**-**	**920**	**-**	**3189**
Moccasin, Main Stream	YOY	82	55	132	44	152	-	50	-	473
	Adult	**149**	**58**	**159**	**144**	**186**	**-**	**128**	**-**	**717**
Stonewall, Lower	YOY	0	69	43	0	146	-	4	-	259
	Adult	**20**	**4**	**19**	**25**	**111**	**-**	**50**	**-**	**187**
Stonewall, Upper	YOY	0	16	242	0	0	-	28	-	263
	Adult	**0**	**6**	**37**	**44**	**53**	**-**	**110**	**-**	**158**

NOTE: The Kruskal-Wallis test was used to detect differences (within age groups only) in annual values within each stream, 5-year averages among all streams, and annual averages from combined streams. Within each of these three groups, values with the same superscript letter are not significantly different (a = 0.05). Standard errors are in parentheses. Where no standard error is shown, insufficient data was collected to calculate it.

Source: J. P. Durniak, L. C. Keefer, and W. R. Ruddell, 1997, "Standardized Sampling of Wild Trout Streams," Final Report, *Dingell-Johnson Project F-25-24*, Georgia Department of Natural Resources, 100pp.

Table 24 - Average Density of Young-of-Year and Adult Trout, Georgia Brown Trout Streams, 1991-2002

Stream	Age Group	Average Density (Fish/Hectare) By Year								Average of All Years
		1991	1992	1993	1994	1995	2000	2001	2002	
Hedden	YOY	19	302	73	34	447	233	-	141	914
	Adult	**19**	**19**	**225**	**80**	**76**	**137**	**-**	**271**	442
Jones, Lower	YOY	128	223	220	64	155	-	74	158	802
	Adult	**86**	**135**	**227**	**159**	**157**	**-**	**111**	**-**	783
Jones, Upper	YOY	424	742	1258	556	1179	-	358	-	4219
	Adult	**424**	**291**	**649**	**662**	**728**	**-**	**848**	**-**	2895
Moccasin, South Fork	YOY	0	29	130	76	27	14	-	58	309
	Adult	**161**	**97**	**99**	**86**	**364**	**178**	**-**	**274**	1176
Ridley	YOY	85	697	248	61	600	242	-	145	1481
	Adult	**164**	**79**	**388**	**218**	**139**	**158**	**-**	**376**	1454

NOTE: The Kruskal-Wallis test was used to detect differences (within age groups only) in annual values within each stream, 5-year averages among all streams, and annual averages from combined streams. Within each of these three groups, values with the superscript letter are not significantly different (a = 0.05). Standard errors are in parentheses. Where no standard error is shown, insufficient data was collected to calculate it.

Source: J. P. Durniak, L. C. Keefer, and W. R. Ruddell, 1997, "Standardized Sampling of Wild Trout Streams," Final Report, *Dingell-Johnson Project F-25-24*, Georgia Department of Natural Resources, 100pp.

Table 25 - Average Density of Young-of-Year and Adult Trout, Georgia Brook Trout Streams, 1991-2002

Stream	Age Group	Average Density (Fish/Hectare) By Year								Average of All Years
		1991	1992	1993	1994	1995	2000	2001	2002	
Board Camp	YOY	217	588	362	274	308	851	-	419	2833
	Adult	**185**	**177**	**591**	**488**	**514**	**788**	**-**	**901**	3485
Chattahoochee River,	YOY	254	88	285	258	390	391	-	431	1879
Lower	**Adult**	**113**	**140**	**63**	**79**	**345**	**557**	**-**	**630**	1830
Chattahoochee River,	YOY	659	354	243	522	533	611	-	623	2980
Upper	**Adult**	**135**	**235**	**142**	**193**	**692**	**314**	**-**	**483**	2078
Moccasin, North Fork	YOY	149	163	166	273	223	412	-	609	1867
	Adult	**109**	**161**	**25**	**103**	**443**	**293**	**-**	**493**	1534
Totterypole, Lower	YOY	62	41	86	ND	202	603	-	337	1279
	Adult	**100**	**93**	**79**	**ND**	**152**	**92**	**-**	**188**	621
Totterypole, Upper	YOY	297	242	256	232	512	665	-	391	2340
	Adult	**287**	**313**	**431**	**333**	**520**	**381**	**-**	**462**	2481

NOTE: The Kruskal-Wallis test was used to detect differences (within age groups only) in annual values within each stream, 5-year averages among all streams, and annual averages from combined streams. Within each of these three groups, values with the same superscript letter are not significantly different (a = 0.05). Standard errors are in parentheses. Where no standard error is shown, insufficient data was collected to calculate it.

Source: J. P. Durniak, L. C. Keefer, and W. R. Ruddell, 1997, "Standardized Sampling of Wild Trout Streams," Final Report, *Dingell-Johnson Project F-25-24*, Georgia Department of Natural Resources, 100pp.

Table 26 - Average Density of Young-of-Year and Adult Trout, Georgia Sympatric Trout Streams, 1991-2002

Stream	Age Group	Average Density (Fish/Hectare) By Year								
		1991	1992	1993	1994	1995	2000	2001	2002	Average of All Years
Coopers	YOY	137	153	247	60	143	-	61	-	687
	Adult	**140**	**200**	**221**	**10**	**89**	**-**	**188**	**-**	731
Dover	YOY	244	992	2007	1037	998	-	2419	-	7494
	Adult	**220**	**283**	**607**	**589**	**464**	**-**	**488**	**-**	2468
Hoods, Lower	YOY	60	211	253	12	91	108	-	6	690
	Adult	**151**	**66**	**144**	**53**	**155**	**77**	**-**	**56**	573
Hoods, Upper	YOY	0	0	6	0	0	0	-	0	6
	Adult	**25**	**19**	**12**	**19**	**12**	**0**	**-**	**61**	127
Noontootla, Lower	YOY	112	44	345	48	62	206	-	90	811
	Adult	**192**	**196**	**242**	**168**	**179**	**201**	**-**	**253**	1266
Noontootla, Upper	YOY	318	484	728	276	525	295	-	475	2828
	Adult	**491**	**593**	**575**	**461**	**530**	**561**	**-**	**465**	3255

NOTE: The Kruskal-Wallis test was used to detect differences (within age groups only) in annual values within each stream, 5-year averages among all streams, and annual averages from combined streams. Within each of these three groups, values with the same superscript letter are not significantly different (a = 0.05). Standard errors are in parentheses. Where no standard error is shown, insufficient data was collected to calculate it.

Source: J. P. Durniak, L. C. Keefer, and W. R. Ruddell, 1997, "Standardized Sampling of Wild Trout Streams," Final Report, *Dingell-Johnson Project F-25-24*, Georgia Department of Natural Resources, 100pp.

Rainbow Trout

Most of the trout streams on the Chattahoochee NF contain rainbow trout. This trout depends on gravel substrated streams to spawn.

During 1978, the Forest Service initiated a long-term study with the objective of determining the effectiveness of adding stream improvement structures and to document annual fish populations (Figure 24 and Figure 25) (USDA Forest Service, 1995). Cane Creek is a wild rainbow trout stream, and only six brown trout were collected during this study. No management activities occurred during the time period of the study. A continuous stretch of stream was divided into five sections: two sections with structures, two control areas, and a buffer section between the structures and the control. Each of the two control sections and two structure sections were 152 meters in length. The buffer section was 58 meters in length. Average stream width was 2.5 meters. The structure section of stream was sampled in 1978 prior to structure installation in 1979 and 1980. These five sections of stream were electrofished twice annually for 15 years, using depletion (quantitative) techniques. Additional structures were added to one of the control sections in 1989.

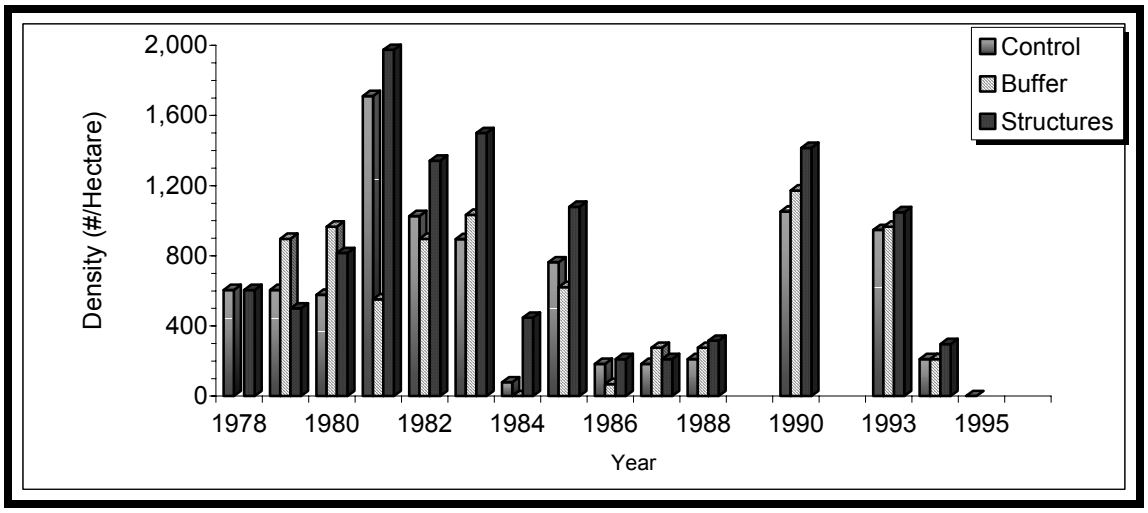


Figure 24 – Spring Density of Rainbow Trout from Cane Creek, 1978–94

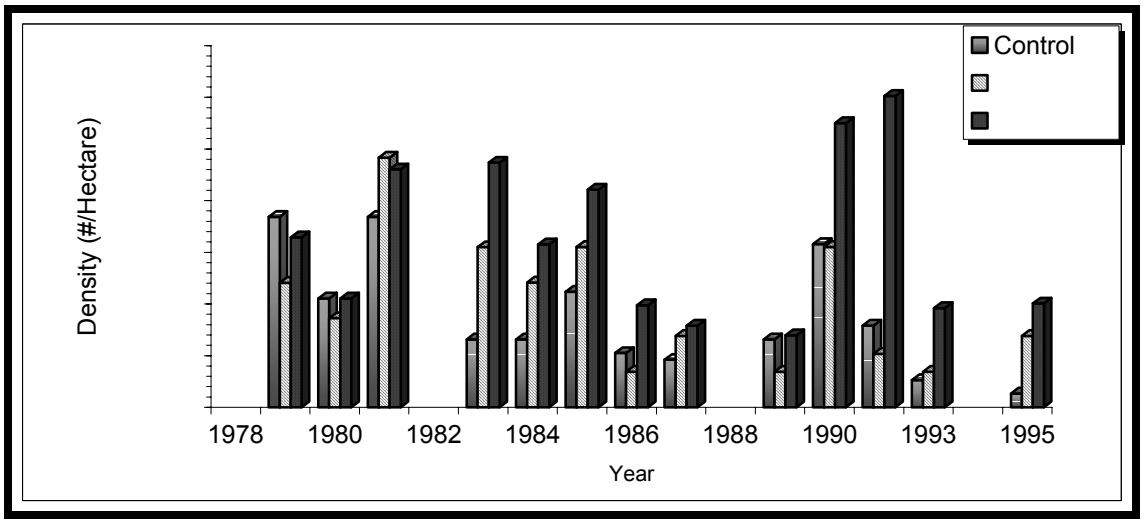


Figure 25 – Fall Density of Rainbow Trout from Cane Creek, 1979–95

The trout population fluctuated greatly in the absence of management activity in all sections over time. Fluctuations were most likely due to natural occurrences, as the numbers decreased in years of high floods or severe droughts. However, numbers of trout within the structured areas were higher than in the control for most years during the 15-year period. For the spring samples, rainbow trout density averaged 646, 611, and 840 trout/hectare for the control, buffer, and structure sections, respectively. For the fall samples, rainbow trout density averaged 356, 409, and 654 trout/hectare for the control, buffer, and structure section, respectively.

Populations of rainbow trout as shown in Table 23, Figure 24, and Figure 25 fluctuated greatly over time. However, this is not uncommon and has been shown to occur in other Southern Appalachian streams. These findings do not suggest negative impacts to those streams where numbers declined, but rather that rainbow trout numbers are highly variable due to natural occurrences (drought, floods, high temperatures, etc.). In streams of the Coosa basin, Jacks and Conasauga Rivers (see Table 30), and Mountaintown Creek (see Table 31), numbers of rainbow trout were relatively stable. These studies indicate that rainbow trout populations are healthy and fluctuating numbers are not cause for concern.

The Forest Plan does not list population objectives for individual trout species. Instead, it gives population objectives for resident trout as a group, which includes rainbow, brown, and brook trout. The population objective for resident trout is 11 fish per acre (27.2/hectare), with a maximum and minimum population objective of 13 fish per acre (32.1/hectare) and 7 fish per acre (17.3/hectare), respectively. All rainbow trout streams reported in Durniak, Keefer, and Ruddell (1997) have average adult rainbow trout densities that exceed the plan population objective of 27.2 fish per hectare (see Table 23). All but one stream had average adult densities that exceed the maximum population objective for resident trout.

Evaluation of Rainbow Trout Population Trends and the Relationship to Habitat Changes

From samples of rainbow trout taken on several streams on the Chattahoochee NF, population levels remain healthy with fluctuations normally occurring from time to time. This resident trout is a game fish that is harvested throughout north Georgia; and, therefore, viability is not a concern. Most rainbow trout populations are in excellent condition, which infers the habitat and water quality needs are present for this trout.

Brown Trout

Across the Chattahoochee NF, brown trout are commonly found in low abundance, usually coexisting with rainbows in many streams, especially at lower elevations. However, as shown in Table 27, in the Chattooga River, brown trout are the dominant trout. The reason for this success is the brown trout's ability to seek out and find suitable spawning sites within the overall sand-dominated substrate of the Chattooga River; whereas, rainbow trout do not spawn in this river.

The Chattooga Coalition was formed in 1986 to monitor and improve fishing and the overall health of the aquatic community in the Chattooga River. Its activities have included sampling for both fish and invertebrates, as well as habitat assessment in the Chattooga River watershed. The coalition was formed from North Carolina, South Carolina,

and Georgia cooperators of State game and fish agencies, the USDA Forest Service, and Trout Unlimited Councils.

Table 27 – Density (#/Hectare)of Brown Trout Collected from Chattooga River, 1986–98

Year	Bullpen (Upper)	Bullpen (Lower)	Ellicott Rock	East Fork	Burrells Ford	Big Bend (Upper)	Big Bend (Lower)
1986			141	185	221		
1987						70	44
1988		461					44
1990			212		53	45	
1991						56	
1992	501	537					
1993	445	520	303				
1994		226					
1995		363					
1996		474					
1997			176				
1998					478		

NOTE: Bullpen upper is at Grimshaw bridge. Big Bend upper is above the falls and Big Bend lower is below the falls. Each area is an established sampling station that is surveyed over the same reach for each listed year. This data includes fin-clipped subadult and wild trout.

Two electrofishing samples have occurred for the main stream each year from 1986 through the present. However, no sample of the Chattooga River was conducted in 1999 due to severe weather conditions. In 2000, a 200-meter depletion sample of the Chattooga River immediately downstream of East Fork was conducted, and 105 brown trout were collected. No rainbow trout were collected. In 2001, 305 meters were sampled with the depletion method of 3 passes. The sampling yielded 70 brown trout and 1 rainbow trout. In 2002, a 110-meter depletion sample was conducted on the Chattooga River above Big Bend Falls. A total of 100 brown trout and 9 rainbow trout were collected.

There is a transition of cool-water fish species to warmwater species in the stretch of river around Big Bend Falls. Downstream of Big Bend, redeye bass replaces trout as the dominant sport fish. Four of the forest MIS (brown trout, yellowfin shiner, turquoise darter, and redeye bass) are found in the Chattooga River and its tributaries.

As evidenced in Table 27, brown trout had the highest density at the most upstream site at Bullpen bridge. Density of brown trout decreased from upstream to downstream sites. The main variables creating this decline in numbers of brown trout are the increase in temperature in downstream waters and the increase in numbers and types of fish that compete with the brown trout, primarily the redeye bass, bluehead chub, and striped jumprock. All of the surveys were within the wild and scenic section of the Chattooga River, where no management activity is allowed within 0.25 miles from the river. In the absence of management activity, the populations of brown trout fluctuated indicating that natural events create these fluctuations. The brown trout are, however, stable and populations are in good health on the Chattooga River.

A voluntary creel survey was conducted annually from 1991–98 on the Chattooga River by the Chattooga Coalition to determine fishing trends and success rates of anglers. The rate has remained relatively constant with approximately one trout being caught per hour of fishing.

Other fish (non-game) collected in these sections of the Chattooga River were: yellowfin shiner, warpaint shiner, turquoise darter, mirror shiner, mottled sculpin, redbreast sunfish, rosyside dace, striped jumprock, white sucker, central stoneroller and longnose dace.

The single most important water quality parameter in determining the presence or absence of trout is temperature. Recording thermographs were installed in 6–8 locations on the Chattooga River and its tributaries every summer from 1989–2002. This information has allowed USDA Forest Service and GADNR to determine the extent of suitable trout habitat in the Chattooga. Water temperatures remain below the thermal threshold for trout from Bullpen to U.S. Highway 76. Below Highway 76, temperatures are too high to support significant numbers of trout. This database of temperature on the Chattooga River is available at Forest Service office in Gainesville.

In "An Assessment of Water Quality in the Chattooga River and Tributaries Through Analysis of the Benthic Macroinvertebrate Community Structure," English (1990) gives an assessment of the system's water quality, the trout fishery, and their food resources (macroinvertebrates). Twenty-four stations were sampled annually from 1986–89. Analysis of the macroinvertebrate data from the collections indicates the water quality in the Chattooga River watershed is good. The average density over the entire Chattooga River watershed suggests that this river is neither over nor under productive compared to streams in the Great Smoky Mountains.

In "Water Quality Assessment using a Macroinvertebrate Biotic Index," a Chattooga River Drainage Project (Weber and Isely, 1995), 27 sites were sampled in 1994 within the Chattooga River watershed using macroinvertebrates as biological indicators of water quality. It was concluded that water quality in this basin is good to excellent.

As mentioned previously, the Forest Plan does not list population objectives for individual trout species. Instead, it gives population objectives for resident trout as a group, which includes rainbow, brown, and brook trout. The population objective for resident trout is 11 fish per acre (27.2/hectare), with a maximum and minimum population objective of 13 fish per acre (32.1/hectare) and 7 fish per acre (17.3/hectare), respectively. All brown trout streams reported in Durniak, Keefer, and Ruddell (1997) have average adult brown trout densities that exceed the maximum plan population objective of 32.1 fish per hectare (see Table 24). Similarly, density of brown trout from the Chattooga River exceeded the maximum plan population objective at all stations, including the most downstream site (see Table 27). However, since the Chattooga River samples include both wild and stocked fish, these results should be interpreted with caution.

Evaluation of Brown Trout Population Trends and the Relationship to Habitat Changes

Each brown trout stream that was surveyed yielded population numbers that were at or above Forest Plan population objective numbers. This resident fish is harvested throughout north Georgia and remains a game fish, further indicating the population is healthy, and viability is not a concern on the Chattahoochee NF.

Brook Trout

Brook trout (*Salvelinus fontinalis*) have the most restricted range within the forest compared to the other two trout. They have a difficult task of competing with the other trout and are usually restricted to the very headwaters, above waterfalls or other barriers that

prevent encroachment of the rainbow and brown. However, brook trout occur in every major watershed across the forest (see Table 28, below). It is thought by some fisheries biologists that only the Tennessee drainage is the historical range of this trout in the Southeast.

Table 28 - Brook Trout Streams on Chattahoochee National Forest

Toccoa River Basin

Watershed	Stream	Tributary	Sub Tributary	Genetic Type	Sympatric With	Comments
Cooper Creek	**Logan Creek**			S1		
Cooper Creek	Logan Creek	Board Camp Creek		S1		
Cooper Creek	Logan Creek	Tigue Branch		S1		
Cooper Creek	**Burnett Creek**			U		
Cooper Creek	**Bryant Creek**			S1		
Cooper Creek	Bryant Creek	Petty Branch		U		
Cooper Creek	Bryant Creek	Petty Branch	Unnamed	S1		
Rock Creek	**Little Rock Creek**			SH3, H6		
Rock Creek	Little Rock Creek	Unnamed		SH3, H6		
Noontootla Creek	**Lovingood Creek**			SH3		
Noontootla Creek	Lovingood Creek	Unnamed		SH3		
Noontootla Creek	**Long Creek**			SH3		
Noontootla Creek	**Chester Creek**			U	RB	
Noontootla Creek	Chester Creek	Frick Creek		U		
Noontootla Creek	Chester Creek	Underwood Creek		U	RB	
Noontootla Creek	Chester Creek	Davis Creek		U		
Noontootla Creek	Chester Creek	Davis Creek	Unnamed	U		

Chattahoochee River Basin

Watershed	Stream	Tributary	Sub Tributary	Genetic Type	Sympatric With	Comments
Chattahoochee River	**Chattahoochee River**			H4		
Chattahoochee River	**Unnamed**			H4		
Chattahoochee River	**Unnamed**			H4		
Chattahoochee River	**Martin Branch**			U		
Chattahoochee River	England Camp Branch	Unnamed		U		
Chattahoochee River	**Smith Creek**			H6		
Chattahoochee River	Smith Creek	York Creek		H6		
Chattahoochee River	Smith Creek	Unnamed		H6		
Dukes Creek	**Davis Creek**			NH8		
Dukes Creek	**Dover(lower)**			NH7	RB,BN	BN in lower end
Dukes Creek	**Dover**			NH7		
Dukes Creek	Dover	Winkley		NH7		
Dukes Creek	Dover	Winkley	Winn	NH7		

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Soque River Basin

Watershed	Stream	Tributary	Sub Tributary	Genetic Type	Sympatric With	Comments
Left Fk, Soque River	**South Prong**			U		Not Sampled
Left Fk, Soque River	**Middle Prong**			U		No fish found in '99
Left Fk, Soque River	**North Prong**			S1		
Right Fk, Soque River	**Baker Branch**			U	RB	RB in lower end
Right Fk, Soque River	**Goshen Branch**			H5		

Tallulah River Basin

Watershed	Stream	Tributary	Sub Tributary	Genetic Type	Sympatric With	Comments
Wildcat Creek	**Hellhole Creek**			N10		Larger fish than avg.
Wildcat Creek	**Jessie Branch**			NH8		
Moccasin Creek	**North Moccasin Creek**			H5		
Moccasin Creek	**Jake Branch**			H5		No Barrier
Moccasin Creek	**Chastain Creek**			H5		No Barrier
Moccasin Creek	Chastain Creek	Double Spring Branch		H5		No Barrier
Moccasin Creek	**Dicks Creek**			U	RB	Low fluctuating num.
Moccasin Creek	Dicks Creek	Lindsey Branch		U		
Moccasin Creek	Dicks Creek	Shook Branch		U	RB	
Moccasin Creek	Dicks Creek	Firescald Branch		H6		
Moccasin Creek	**Popcorn Creek**			SH3		
Moccasin Creek	Popcorn Creek	Nicholson Branch		No BKT		Few BKT
Moccasin Creek	Popcorn Creek	York Branch		SH3		
Moccasin Creek	Popcorn Creek	Hanna Branch		U		
Moccasin Creek	**Fall Branch**			U		
Moccasin Creek	**Mill Creek**			U		
Moccasin Creek	**Coleman River**			U	RB(Lower End)	Good in upper creek
Moccasin Creek	Coleman River	Unnamed		U		Not Sampled,no barrier
Moccasin Creek	Coleman River	Ridgepole Creek		U		Not Sampled,no barrier
Moccasin Creek	Coleman River	Ridgepole Creek	Unnamed	U		Not Sampled,no barrier
Bridge Creek				U		
Tiger Creek	Worley Creek	Stamp Creek		U		1 BKT in 59, none in 81

Little Tennessee River Basin

Watershed	Stream	Tributary	Sub Tributary	Genetic Type	Sympatric With	Comments
Keener Creek				S1		
Darnell Creek	**Thomas Creek**			SH3		
Darnell Creek	**Ramey Creek**			U		

Hiwassee River Basin

Watershed	Stream	Tributary	Sub Tributary	Genetic Type	Sympatric With	Comments
High Shoals Creek				S1		
Corbin Creek				U		RB
Corbin Creek	**Mossy Cove Branch**			U		RB
Corbin Creek	Mossy Cove Branch	Unnamed		U		
Corbin Creek	Big Net Branch			U		RB
Corbin Creek	Gizzard Branch			S1		

Conasauga River Basin

Watershed	Stream	Tributary	Sub Tributary	Genetic Type	Sympatric With	Comments
	Rough Creek			S1		

Chattooga River Basin

Watershed	Stream	Tributary	Sub Tributary	Genetic Type	Sympatric With	Comments
Warwoman Creek	**Finney Creek**	Martin Branch		H6		
Warwoman Creek	**Tuckaluge Creek**			U	RB, BN low	
Warwoman Creek	Tuckaluge Creek	Unnamed		U		Not Sampled
Warwoman Creek	**Walnut Fork**			U	RB, BN low	
Westfork Chat.	**Totterypole Creek**			U	RB	
Westfork Chat.	Totterypole Creek	Metcalf Creek		U	Rb	
Westfork Chat.	Totterypole Creek	Smith Creek		U		
Westfork Chat.	**Holcomb Creek**			H5	RB, BN	
Westfork Chat.	Holcomb Creek	Billingsley		U		
Westfork Chat.	Holcomb Creek	Unnamed		U		Not Sampled
Westfork Chat.	Holcomb Creek	Bailey Branch		U		
Westfork Chat.	Holcomb Creek	Bailey Branch	Addie Branch	U	RB	BK, RB in 62,66. None in 92
Westfork Chat.	Holcomb Creek	Ammons Branch		U		Not Sampled
Westfork Chat.	Holcomb Creek	Ammons Branch	Unnamed	U		Not Sampled
Westfork Chat.	Holcomb Creek	Emory Branch		S1		
Westfork Chat.	**Goldmine Branch**			N10		
Reed Creek	**Hicks Creek**			U		
Reed Creek	**Hedden Creek**			H6	BN?	BKT in Headwaters
Reed Creek	Hedden Creek	Ridley Branch		U	BN	
Harden Creek				U	BN	

MIS POPULATION AND HABITAT TRENDS

"A Watershed Approach To Assessing Brook Trout (*Salvelinus fontinalis*) Distribution and Ecological Health in the Hiwassee River Watershed" (TVA, 1996) includes an assessment of 42 streams on the Chattahoochee NF in 1995 (Table 29). The survey documented 9 previously undescribed brook trout populations on the Chattahoochee NF. The ecological health of these streams was evaluated by using bioassessment techniques using fish and benthic community parameters. All brook trout streams were rated as good to excellent condition based on their Biological Assessment scores (see Table 29). This study reports all the macroinvertebrates collected and water chemical test results for use in assessing water quality. This study also identified streams where only brook trout species were present, as well as streams where other trout were present with the brook trout.

Table 29 – Number of Trout Collected and Biological Assessment Scores for Headwater Streams of the Hiwassee River Watershed, Chattahoochee National Forest, 1995

Stream Surveyed	Trout Species Present	Number of Individuals Collected	Biological Assessment Score*
Bald Creek	Rainbow	29	48
Big Net Branch	Rainbow and Brook	1, 59	56
Board Camp Creek	Brook	46	60
Brier Creek	Rainbow	69	52
Bryant Creek	Brook	35	56
Burnett Branch	Rainbow	23	48
Burnett Creek (1682-1)	Brook	56	60
Burnett Creek (1685-1)	Rainbow and Brown	6, 32	44
Chester Creek	Rainbow and Brook	34, 5	56
Clements Branch	Rainbow	34	52
Corbin Creek	Rainbow and Brook	52, 1	56
Davis Creek	Brook	12	48
Edmondson Branch	Rainbow	57	44
Fightingtown Creek	Rainbow	12	44
Fodder Creek	Rainbow	50	44
Frick Creek	Brook	39	60
Frozen Branch	Rainbow	23	44
Gizzard Branch	Rainbow and Brook	8, 77	56
Gurley Creek	Brook	26	60
Henson Creek	Brook	24	56
High Shoals Creek	Brook	42	60
Indian Camp Creek	Rainbow	7	52
Ivy Thicket Branch	Rainbow	52	52
Jarrard Creek	Rainbow	12	40
Joel Creek	Brook	32	60
Little Rock Creek	Brook	25	56
Logan Creek	Brook	50	60
Long Creek	Brook	22	56
Lovingood Creek	Brook	52	60
Mossy Cove Branch	Rainbow and Brook	61, 50	56
Mulky Creek	Rainbow	7	48
Pretty Branch	Brook	19	60
Right Fork Fodder Creek	Rainbow	60	48
Slaughter Creek	Rainbow and Brook	37, 13	52
Soapstone Creek	Rainbow and Brown	47, 7	48
Spaniard Branch	Rainbow	42	48
Spruce Pine Creek	Rainbow	2	44
Stover Creek	Rainbow and Brook	43, 9	56
Underwood Creek	Rainbow and Brook	1, 8	—
Unnamed tributary 90039-1	Brook	15	—
Watkins Branch	Rainbow and Brook	9, 1	52
West Seabolt	Rainbow	27	48

*Poor 28–34, Fair 36–44, Good 46–52, Excellent 56–60

GADNR estimated that there are at least 65 brook trout streams for a total of 86 miles on the Chattahoochee NF (USDA Forest Service, 1978). In regard to the brook trout, there is strong evidence that the population has been quite stable for at least the past 20 years. In 1997, GADNR estimated a total

of 62 streams, totaling 85 miles. One or two of the small streams listed separately in the 1978 estimate were combined in the 1997 estimate, making them virtually identical. Fourteen additional brook trout streams have been identified since the two estimates, making a total of 76 on the forest. There are undoubtedly several other small headwater streams containing brook trout that still have not been sampled. Baseline monitoring stations generally are established further downstream, with extreme headwaters normally sampled only when management activity is planned for those areas.

In "Brook Trout in the Chattooga Watershed," McLarney (1996) reported to the Chattooga Coalition that nine previously unknown brook trout populations occurred in the Chattooga River watershed, four of which were on the forest. Overall, brook trout populations are stable, and the conditions on the forest of good water quality are providing excellent habitat for this species of trout. Abundance of brook trout across the Chattahoochee NF has not declined over time, but rather new populations are being recorded as shown in Table 29. There are now 24 brook trout populations known from the Hiwassee drainage. It appears that the brook trout are in good health within this watershed.

As noted previously, the Forest Plan does not list population objectives for individual trout species. Instead, it gives population objectives for resident trout as a group, which includes rainbow, brown, and brook trout. The population objective for resident trout is 11 fish per acre (27.2/hectare), with a maximum and minimum population objective of 13 fish per acre (32.1/hectare) and 7 fish per acre (17.3/hectare), respectively. All brook trout streams reported in Durniak, Keefer, and Ruddell (1997) have average adult brook trout densities that exceed the maximum plan population objective of 32.1 fish per hectare (see Table 25).

Evaluation of Brook Trout Population Trends and the Relationship to Habitat Changes

Each brook trout stream that was surveyed yielded population numbers that were at or above Forest Plan population objective numbers. Rangewide, there is some concern about acid rain and global warming effects on brook trout. However, there is no current evidence that these factors are presenting a problem in Georgia streams at this time. This native fish remains a game fish in Georgia, further indicating the population is healthy, and viability is not a concern on the Chattahoochee NF.

Redeye Bass

Redeye bass (*Micropterus coosae*) are common throughout the forest, primarily occupying the transition zone between cold trout waters and the larger cool-water streams occupied by spotted bass (*Micropterus punctulatus*) and shoal bass (*Micropterus sp.*), another form of the redeye bass that attains a much greater size than the upland strain discussed here.

Redeye bass thrive even in large- and intermediate-size rocky streams, in the absence of the other two stream black basses. The lower Chattooga River, below wild trout water, is a prime example, providing an excellent fishery from Big Bend Falls downstream. Redeye bass are a serious competitor with wild trout in marginal lower reaches of trout streams across the forest but are rare in the colder upstream reaches.

High populations of redeye bass are found in the smaller cool-water streams in the Coosa River watershed, upstream from serious competition with its major competitor, the spotted bass. As indicated in the following discussions and in Tables 30 and 31, it occurs in the lower reaches of trout wa-

ter in the Jacks, Conasauga, and Mountaintown drainages, but in much lower numbers than are found further downstream. Samples indicate upstream extension of their range occurring when stream temperature increases due to extended drought periods. Large waterfalls tend to hinder distribution in smaller streams due to their tendency to migrate downstream to deeper water during cold winter months.

Table 30 - Number of Rainbow Trout, Brown Trout, and Redeye Bass Collected on Jacks and Conasauga Rivers*, 1995 - 2002

Jacks River			
Year	**Rainbow Trout**	**Brown Trout**	**Redeye Bass**
1995	279	43	8
1996	282	30	20
1997	213	29	13
1998	272	21	0
1999	43	30	0
2000	119	32	3
2001	168	55	0
Conasauga River			
Year	**Rainbow Trout**	**Brown Trout**	**Redeye Bass**
1995	92	36	63
1996	192	64	34
1997	182	72	83
1998	135	62	101
1999	0	0	0
2000	87	50	60
2001	95	36	14
2002	47	27	2

*Combined data from 3–200 meter sections of stream.

Table 31 – Number of Redeye Bass, Brown Trout, and Rainbow Trout Collected on Mountaintown Creek, 1988–98

Species	1988	1989	1990	1991	1996	1997	1998
Redeye	2	5 (5)	5 (5)	2 (5)	5 (0)	12 (7)	* (0)
Brown	6	4 (15)	6 (13)	2 (11)	12 (17)	3 (21)	* (17)
Rainbow	4	3 (10)	2 (10)	4 (6)	9 (29)	20 (38)	* (29)

( ) Numbers collected within the area of installed structures.
*No sample was taken in the area without any structures.

Very little quantitative sampling has been attempted in waters where redeye dominate. The only quantitative samples included in Table 31 are the 1991 and 1992 East Armuchee samples. The others are one run electrofishing samples and not necessarily indicative of actual populations. East Armuchee Creek, Ponder Creek, and West Armuchee Creek are cool-water streams containing excellent habitat, including rocky gravelly substrate, and correspondingly excellent redeye populations. Swamp, Pocket, and Furnace Creeks are cold spring runs with a sandy substrate providing lower quality habitat and, logically, lower standing crops of redeye bass.

The main channels of the Jacks and Conasauga Rivers were surveyed from 1995–2001 (Biesser, GA DNR). The 4 years of data are on populations of the three trout and redeye bass (see Table 30). Coosa darters were collected in these surveys and were noted to be common in abundance.

Two-hundred meter sections were sampled in the main channel of the Conasauga River at the following locations: Chestnut Lead Trail, Brayfields, and Rough Creek. In the Jacks River, sample sites were located at Bear Branch, Sugar Cove Trail, and Penitentiary Branch. The Upper Conasauga watershed was last stocked with trout in 1972; the year the Cohutta Wilderness Area was designated. The existing trout resource of the Cohutta Wilderness Area consists of naturally-reproducing populations of all three trout and redeye bass. All fish were collected using electrofishing techniques. Rainbow trout outnumbered brown trout 7:1 on the Jacks River and 4:1 on the Conasauga River. Rainbow trout recruitment in both rivers appears to be adequate based on the numerical percentage of 1-year-old trout to other ages of trout. The number of redeye bass was low at all sites during the course of this study. This is expected, since these sample stations are located in trout water with temperatures lower than optimum for redeye bass.

Table 32 – Number of Redeye Bass Collected in Oostanaula Drainage, 1969–92

Stream	1969	1975	1976	1988	1991	1992
East Armuchee	3	5	*	*	34	49
Swamp	5	*	*	*	*	*
Ponder	10	*	61	*	*	*
Pocket	0**	*	1	*	*	*
West Armuchee	4	*	*	*	*	*
Furnace	*	*	0	6	*	*

*Not sampled.
**Sampled twice that year.

In a Forest Service survey of Mountaintown Creek, two stations were established to monitor trout and redeye populations to determine if the addition of structures resulted in an increased carrying capacity. Structures were installed in Mountaintown Creek during 1988–90 period. Two 100-meter sections were electrofished from 1988–98; seven samples were collected during this time period (see Table 31). The 1988 sample was conducted prior to structure installation. Rainbow trout, brown trout, and redeye bass collected were counted and measured for length and weight. The numbers of fish remained relatively constant over time with higher numbers occurring in the section with structures.

Armuchee RD sampling of the Coosa drainage was conducted on the far western edge of Georgia. Streams within this drainage were sampled to estimate the redeye bass populations. One-hundred meters on six streams were sampled six times from 1969–92 (Table 32). Redeye bass inhabited streams dominated by gravel substrate. Those streams lacking gravel were not as suitable (such as Pocket Creek).

Density population objectives of redeye bass are stated in the Forest Plan. The maximum population level objective for redeye bass is 0.50 fish per acre (1.26/hectare). The redeye bass minimum population level objective is 0.15 fish per acre (0.37/hectare). In the Jacks and Conasauga Rivers, fish were collected in three 200-meter sections with average stream witdths of 8 meters. This amount of area is approximately 0.5 hectare in surface area. Even in trout waters, redeye bass numbers were only below the maximum level one year on the Jacks River. In all other years, redeye bass populations far exceeded the maximum objective with a range of 17/hectare to the high of 210/hectare (7–85/acre). In other samples of Mountaintown Creek (see Table 31) and in the Oostanaula drainage (see Table 32), where the sample site was approximately 0.5 hectare in surface area (100 meters in length by 5 meters in width), the majority of stream sites had a higher density than the maximum objective. For both rivers, redeye bass were collected in 18 of the 22

samples. The range in numbers of redeye bass collected in these 0.5 hectare sections was from 1 to 38, or extrapolated to range from 20–760 redeye bass per hectare (8–308/acres).

Evaluation of Redeye Bass Population Trends and the Relationship to Habitat Changes

Although numbers of redeye bass are low in some streams, most streams where this species occurs yielded numbers that met or exceeded maximum population objectives established in the Forest Plan. The redeye bass is a game fish in the State of Georgia, which means it continues to produce harvestable numbers in the streams where it occurs. Based on its game status, along with the survey information presented, viability for the redeye bass is not a concern on the forest.

Yellowfin Shiner and Turquoise Darter

The yellowfin shiner (*Notropis lutipinnis*) and turquoise darter (*Etheostoma inscriptum*) occur in the Savannah drainage and are most abundant in clean, cool small to medium-size streams below or downstream from trout water. Because they are both common fish in these upper Savannah drainage streams, they are reported together in this document.

The objective of "West Fork Chattooga River Watershed Study - Habitat and Fish Summary for Spring 1993" (USDA Forest Service, 1996) was to develop habitat relationships based on specific habitat parameters and concurrent fish populations in this drainage. From 1989–92, all habitat units were inventoried with every fifth pool and glide, and every tenth riffle and cascade surveyed for fish by snorkeling. Ten percent of the snorkeled areas was then electrofished to validate snorkeling efforts. All MIS fish species, except the Coosa darter (outside of its range), were collected in this drainage. In the 10 streams sampled during this study, the yellowfin shiner and turquoise darter were collected in only one stream (Table 33), the main channel of the West Fork Chattooga River, below where the colder trout water occurs. The collection station on the West Fork Chattooga River provided the warmer temperature and habitat conditions for sustaining populations of these two MIS fish. The habitat within this watershed is in good condition.

Table 33 – Number of Turquoise Darters and Yellowfin Shiners Collected on West Fork Chattooga*, 1989–92

Species	1989	1990	1991		1992	
		Fall	Spring	Fall	Spring	Fall
Turquoise Darter	75	55	17	31	45	12
Yellowfin Shiner	**	**	1	42	12	10

*Electrofishing site on main stem using three-pass depletion of contiguous pool/riffle sequence.
**Minnows were not separated into species.

Source: USDA Forest Service, Coldwater Fisheries Research Unit, Blacksburg, Va., unpublished data.

In 1984, 39 yellowfin shiners were collected in Nancytown Creek and 36 in the Middle Broad River within 100-meter sampling reaches (Durniak and Ruddell, 1990). In both streams, yellowfin shiners were the only shiner present.

Fish surveys and water quality testing were conducted in 1994 from five sites on Stekoa Creek, Rabun County, Georgia, each approximately 100 meters in length (Hopey, 1994). All sites were on the main stem of Stekoa Creek, which were all upstream of Forest Service property. The only shiner collected was the yellowfin shiner, and it was the most abundant fish present of the 768 total individuals collected (Table 34).

Table 34 – Number of Yellowfin Shiner Collected in Stekoa Creek, 1994

Species	Site	Site 2	Site 3	Site 4	Site 5	Total
Yellowfin Shiner	53	58	59	47	40	257

Source: Georgia Department of Natural Resources, "A Preliminary Assessment of Water Resource Quality in Stekoa Creek, Rabun County, Georgia using a Fish-Based Index of Biotic Integrity," compiled by M. Hopey, 1994.

The purpose of "A Fisheries Survey of the Upper Chattooga River" (Durniak and England, 1989) was to characterize the trout fishery and the overall fish community within a 10-kilometer section of the Chattooga River from Bullpen (the most upstream) to immediately below Big Bend (the most downstream site). From 1986–88, the river was sampled at 7 sites on the main channel of the Chattooga River (Table 35). A total of 17 species of fish were collected in this 10-kilometer stretch. The diversity increased with distance downstream: 8 species were collected at Bullpen and 15 below Big Bend. MIS collected were yellowfin shiner, redeye bass, turquoise darter, and the 3 trout species. Redeye bass were only collected at 1 site, below Big Bend. Turquoise darter was collected at 6 of the 7 sites, and yellowfin shiner from all sites. The turquoise darter was the only type darter collected in these surveys. There were 3 other species of shiner taken other than the yellowfin shiner.

Table 35 – Number Yellowfin Shiner and Turquoise Darter Collected in the Chattooga Drainage, 1986–88

Year	Stream	Turquoise Darter	Yellowfin Shiner
1986	Burrells Ford	3	25
	Bad Creek	0	80
	East Fork	3	35
1987	Below Big Bend	19	33
	Above Big Bend	10	1
1988	Below Big Bend	45	92
	Bullpen	30	39

No sample of the Chattooga River was conducted in 1999 due to severe weather conditions.

In 2000, a 200-meter depletion sample of the Chattooga River immediately downstream of East Fork was conducted, 10 yellowfin shiners and 3 turquoise darters were collected.

In 2001, 305 meters were sampled with the depletion method of 3 passes, 128 yellowfin shiners and no turquoise darters were collected.

In 2002, a 110-meter depletion sample was conducted on the Chattooga River above Big Bend Falls, 8 yellowfin shiners and 20 turquoise darters were collected.

The Georgia Department of Natural Resources sampled a 100-meter section of Middle Fork Broad in 1986-1988. Both yellowfin shiners and turquoise darters inhabit moderate-size streams such as the three stretches of stream in which they were collected. These were the dominant species of their respective families (*Cyprinidae* and *Percidae*), and they were present as indicated in Table 36.

GA DNR sampled 100 meters in the streams listed in Table 37, collecting yellowfin shiner and turquoise darter.

Table 36 – Number of Yellowfin Shiner and Turquoise Darter Collected in Middle Broad Stream, 1986–88

Year	Species	Middle Broad			
1986	Turquoise Darter	Fall	—	Spring	44
	Yellowfin Shiner	Fall	100	Spring	600
1987	Turquoise Darter	Fall	19	Spring	49
	Yellowfin Shiner	Fall	78	Spring	638
1988	Turquoise Darter		27		
	Yellowfin Shiner		143		

Table 37– Number of Yellowfin Shiner and Turquoise Darter Collected in Hoods and Moccasin Streams, 1991–93

Year	Species	Hoods	Moccasin
1991	Turquoise Darter	1	4
	Yellowfin Shiner	0	0
1992	Turquoise Darter	–	7
	Yellowfin Shiner	–	0
1993	Turquoise Darter	3	7
	Yellowfin Shiner	0	0

In a 180-meter depletion sample of the Middle Fork Broad River on July 7, 2001, 1033 yellowfin shiners, 152 turquoise darters and 3 brown trout were collected. On the same day, two other sites were sampled. Upstream, within the Middle Fork Broad River at the pumping station, 75 meters were sampled with the depletion method, and 401 yellowfin shiners and 41 turquoise darters were collected. The second station was on the North Fork Broad River where 100 meters were sampled with depletion, and 27 yellowfin shiners were collected.

The Forest Plan indicated that at that time, both yellowfin shiner and turquoise dater were considered scarce. Numerous stream surveys since then indicate that these species are relatively common in the specific drainages where they occur. Turquoise darter is known to be present on the forest in streams in the Savannah and Altamaha drainages (Freeman, 1997). Yellowfin shiner is known to occur in forest streams in the Savannah, Chattahoochee, Coosa, Little Tennessee, and Altamaha drainages. In the survey of the West Fork Chattooga River (see Table 33), the sample sites were approximately 0.1 hectare in surface area. The number of turquoise darters collected ranged from 12 to 152 individuals. The number of yellowfin shiner ranged from 1 to 1033 individuals. Comparable densities were found in the other surveys that were discussed previously.

Evaluation of Yellowfin Shiner and Turquoise Darter Population Trends and the Relationship to Habitat Changes

Although restricted to specific drainages on the forest, and based on available data, populations of yellowfin shiner and turquoise darter are in good condition within the small riverine streams where they occur. Water quality is being maintained in the watersheds of the forest; and, therefore, viability of these two fish is not a concern.

Coosa Darter

The Coosa darter (*Etheostoma coosae*) is limited to the Alabama drainage. As noted earlier from the Jacks River and Conasauga River study, the Coosa darter is common within its range.

"The Distribution, Status, and Ecology of the Fishes of the Conasauga River System" (Walters, 1997) is a comprehensive distributional database of fishes in the Conasauga River watershed. Past data was compiled, and new surveys for fish were conducted in 1996. The Coosa darter is known from 98 sites mostly in the Upper Conasauga River watershed.

Approximately 3 river miles of the Conasauga River and 1.2 miles of the Jacks River on the Chattahoochee NF were surveyed for all fish by snorkeling (USDA Forest Service, 1997). The Coosa darter was found throughout both river sections and was common. The other common darters ob-

served included the holiday darter (*Etheostoma brevirostrum*), greenbreast darter (*E. jordani*), and bronze darter (*E. palmaris*). The fish communities that the Coosa darter was observed within were highly diverse and healthy.

The Coosa darter is typically a very common species in suitable habitats. The surveys mentioned above document the wide occurrence of this darter indicating the status of its populations are good. From more extensive MIS data information from fish that are sympatric with this darter, those MIS (brown and rainbow trout and redeye bass) are in good health, and it can be inferred that the Coosa darter inhabits good water conditions.

Evaluation of Coosa Darter Population Trends and the Relationship to Habitat Changes

The 1985 Forest Plan indicated that at that time, the Coosa darter was considered scarce. The Coosa darter is restricted to the Coosa River drainage (Freeman, 1997). However, numerous stream surveys since then indicate that this species is relatively common in the specific streams where it occurs. The Coosa darter has been found to be one of the most common darters in suitable habitat, and viability is not a concern for this species.

Indigo Bunting

The Chattahoochee-Oconee Monitoring Plan for the Forest Plan indicates that the monitoring techniques and data sources to be used for indigo bunting (*Passerina cyanea*) are songbird census routes (see Table 4).

The forest uses several sources of population data to monitor indigo buntings. These include:

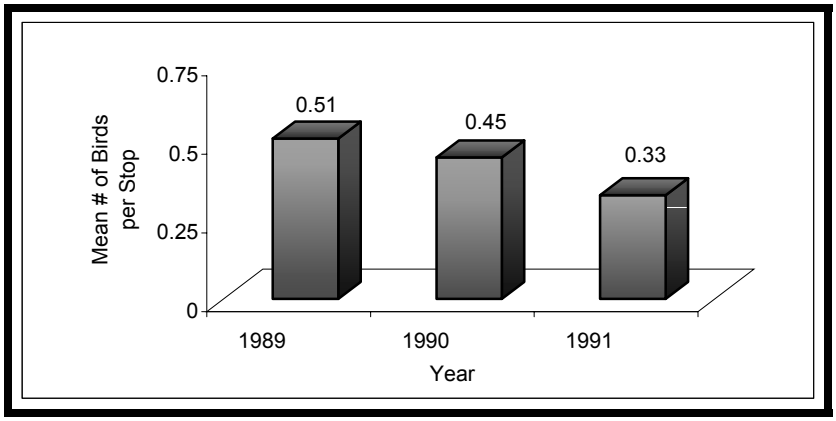
- Chattahoochee-Oconee songbird road survey summary for 1989–1991 (Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA)
- Chattahoochee-Oconee point counts from 1992–2002 (Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA)
- Breeding Bird Survey results from U.S. Fish and Wildlife Service - 1966–2001 (Sauer et al., 2002)

Road route surveys were used to monitor indigo bunting and other breeding birds on the forest between 1989 and 1991. Approximately 380 points along 190 miles of roads were surveyed annually during this period. In order to better represent conditions throughout the forest, the forest changed the survey method to songbird point count in 1992. An average of 468 points were surveyed annually between 1992 and 1995. Since 1996, an average of 175 points have been surveyed annually. This data is supplemented with regional data from the Breeding Bird Surveys (Sauer et al., 2002).

The Forest Plan density population objective for indigo bunting was one pair per 4 acres within suitable habitat. The types of data collected through the Road Route Survey and Point Count Survey are not appropriate to calculate a comparable population density. However, these surveys permit the evaluation of population trends, based on number of birds per plot.

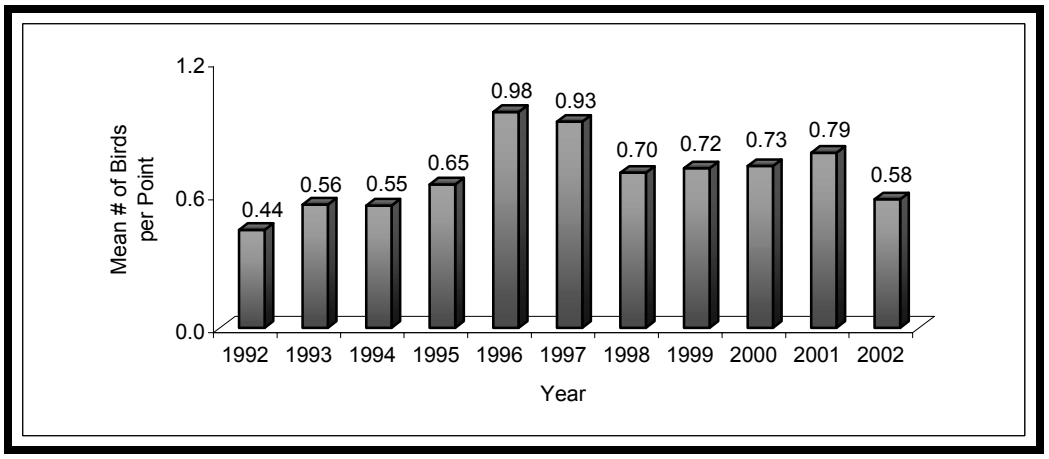
Road Route Survey and Point Count Survey results for indigo bunting are shown in Figures 26 and Figure 27. Because of differences in the survey techniques and locations the results of these two surveys are not directly comparable.

Results of the point count surveys suggest that indigo bunting populations on the forest have remained relatively stable ($p = 0.10$, $r^2 = 0.34$). A slight increasing trend is evident since 1996. This upward trend is probably due to some recent forest disturbances—such as pine beetle outbreaks, hurricanes, ice storms, and tornado-damaged stands of timber—which produced numerous small shrubby openings favored by this species.



Source: Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA.

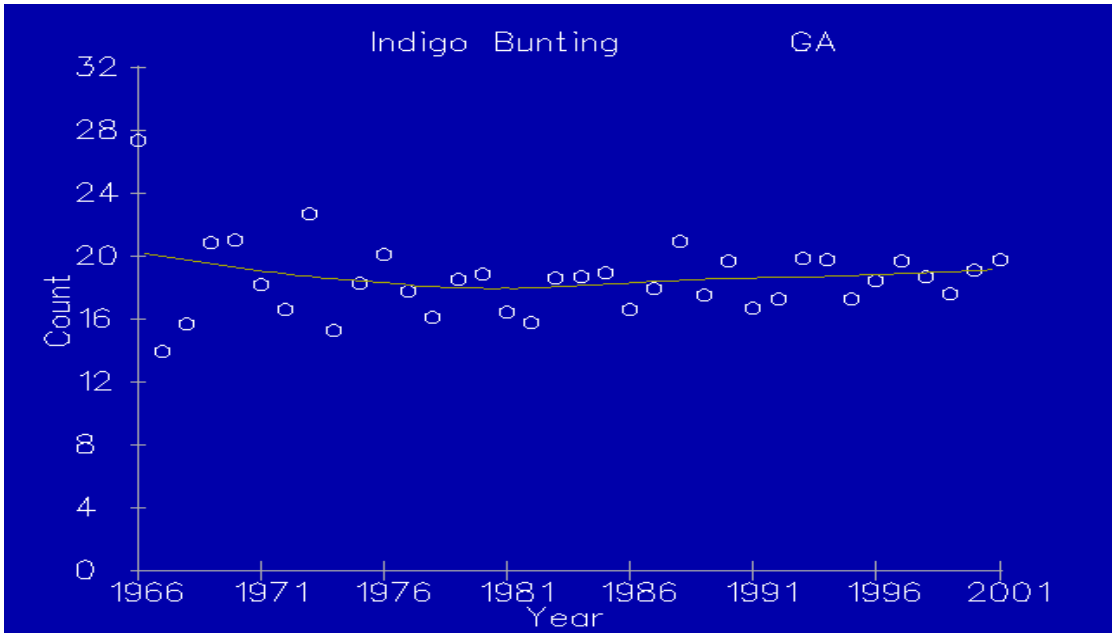
Figure 26 - Road Route Survey Results for Indigo Bunting, 1989–91



Source: Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA.

Figure 27 - Point Count Survey Results for Indigo Bunting, 1992–2002

Results of Breeding Bird Surveys compiled by U.S. Fish and Wildlife Service (Sauer et al., 2002) also indicate that indigo bunting population is stable in the state (Figure 28) ($p = 0.70$).



Source: J. R. Sauer et al., 2002, *The North American Breeding Bird Survey, Results and Analysis 1966–2001*, Version 2001.2, USGS Patuxent Wildlife Research Center, Laurel, MD.

Figure 28 - Breeding Bird Survey Results for Indigo Bunting in Georgia, 1966–2001

Indigo buntings are primarily associated with deciduous saplings or trees in open or partially open situations, particularly along woodland edges (Hamel, 1992). They are most often found in young forests, especially shrub-seedling successional habitats. The quantity of shrub-seedling habitats has remained stable on the forest during the last 15 years (see Table 3), indicating habitat diversity is being maintained.

Evaluation of Indigo Bunting Population Trends and the Relationship to Habitat Changes

Bird survey data discussed above demonstrates that indigo bunting populations have been relatively stable on the forest during the last decade, as have the shrub-seedling successional habitats favored by this species. Declining timber harvest levels likely will result in a reduction in the future availability of these habitats, which could impact population levels of indigo buntings. However, expected timber harvest levels coupled with openings created by natural disturbance should be adequate to ensure continued viability of indigo buntings on the forest.

Pileated Woodpecker

The Chattahoochee-Oconee Monitoring Plan for the Forest Plan indicates that the monitoring techniques and data sources to be used for pileated woodpecker (*Dryocopus pileatus*) are songbird census routes (see Table 4).

The forest uses several sources of population data to monitor pileated woodpeckers. These include:

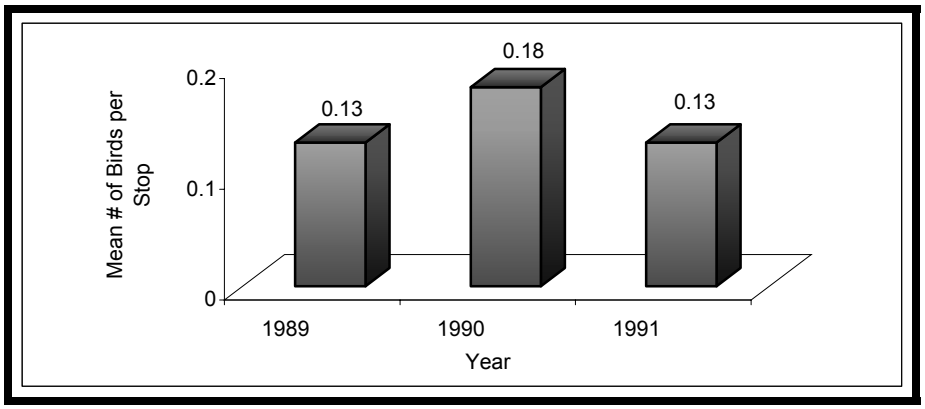
- Road Route Surveys - 1989–1991 (Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA)

- Point Count Surveys - 1992–2002 (Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA)
- Breeding Bird Survey results from U.S. Fish and Wildlife Service - 1966–1999 (Sauer et al., 2002)

Road route surveys were used to monitor pileated woodpecker and other breeding birds on the forest between 1989 and 1991. Approximately 380 points along 190 miles of roads were surveyed annually during this period. In order to better represent conditions throughout the forest, the forest changed the survey method to songbird point count in 1992. An average of 468 points were surveyed between 1992 and 1995. Since 1996, an average of 175 points have been surveyed annually. This data is supplemented with regional data from the Breeding Bird Surveys (Sauer et al., 2002).

The Forest Plan density population objective for pileated woodpecker was one pair per 125 acres of suitable habitat. Since monitoring for birds is done by Point Count Surveys, it is not possible to extrapolate the number of birds per acre on the forest based on this data. The monitoring information gathered does show meaningful changes in trends of the average number of pileated woodpeckers observed per plot throughout the forest.

Road Route Survey and Point Count Survey results for pileated woodpecker are shown in Figure 29 and Figure 30. Because of differences in the survey techniques and locations the results of these two surveys are not directly comparable.

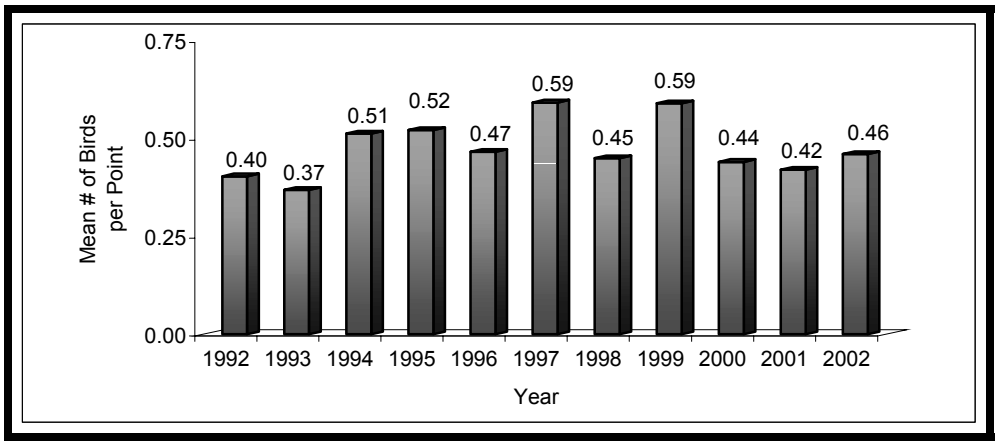


Source: USDA Forest Service, Supervisor's Office, Chattahoochee-Oconee NFs, Management Indicator Species Process Records (Blue Notebook), Management Indicator Species used in Land Management Planning, Gainesville, GA.

Figure 29 - Road Route Survey Results for Pileated Woodpecker, 1989–91

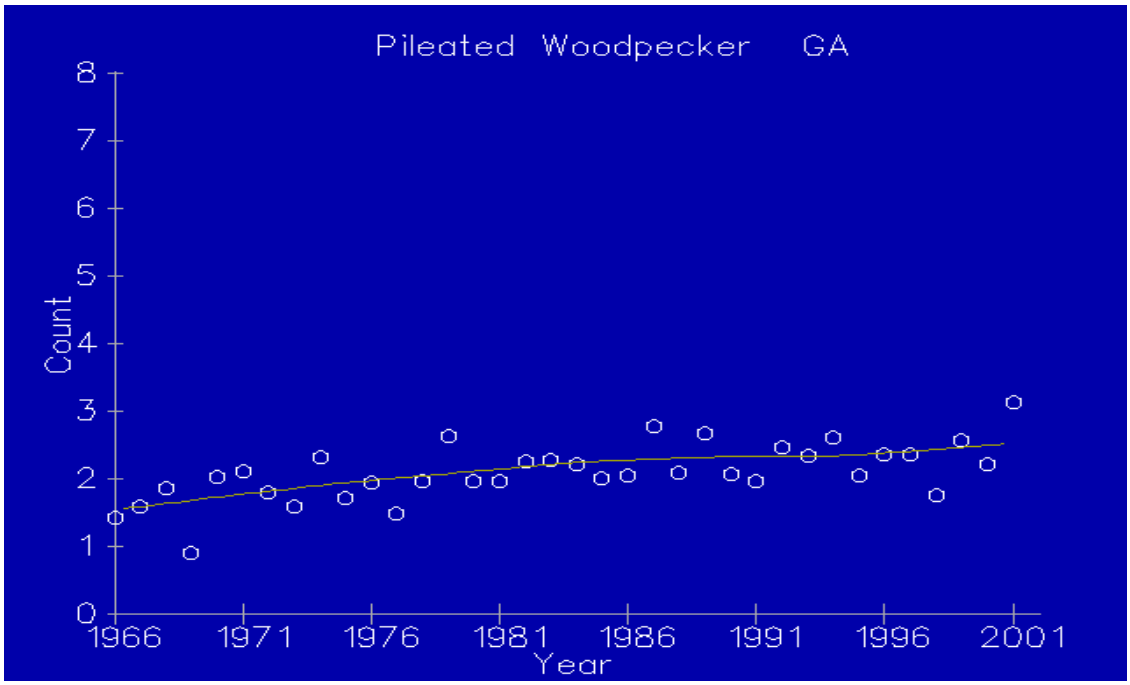
Results of these surveys suggest that pileated woodpecker populations on the forest have remained relatively stable ($p = 0.23$, $r^2 = 0.20$). Results of Breeding Bird Surveys compiled by the U.S. Fish and Wildlife Service (Sauer et al., 2000) also indicate that pileated woodpecker populations are stable in the state (Figure 31) ($p = 0.26$).

Pileated woodpeckers are associated with mature and extensive forests with dead trees for nesting (Hamel, 1992). Deciduous forests are preferred over coniferous forests. During the past 15 years, the acres of older hardwood forests have increased on the forest (Table 3), which helps to maintain habitat diversity for this and other mature forest associated species. CompPATS models suggest that habitat capability for cavity nesters such as pileated woodpecker has been relatively stable during the last 15 years (Figure 32).



Source: Bird Data Files, USDA Forest Service, Chattahoochee-Oconee NFs, Supervisor's Office, Gainesville, GA.

Figure 30 - Point Count Survey Results for Pileated Woodpecker, 1992–2002



Source: J. R. Sauer et al., 2002, *The North American Breeding Bird Survey, Results and Analysis 1966–2001*, Version 2001.2, USGS Patuxent Wildlife Research Center, Laurel, MD.

Figure 31 - Breeding Bird Survey Results for Pileated Woodpecker in Georgia, 1966–2001

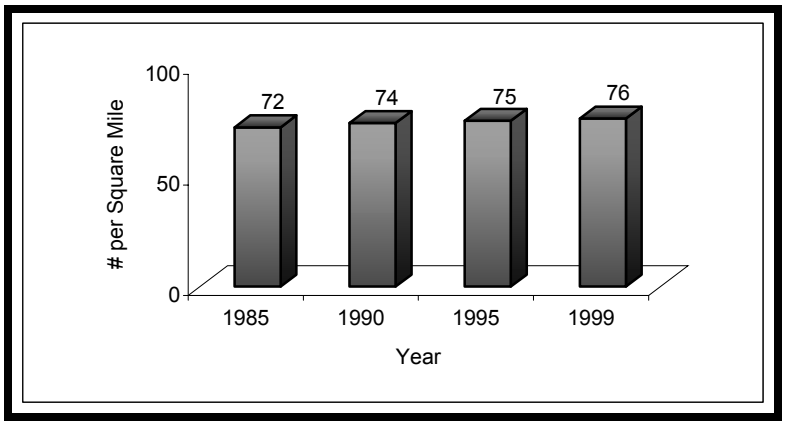


Figure 32 - Trends in Habitat for Cavity Nester, 1985, 1990, 1995, & 1999

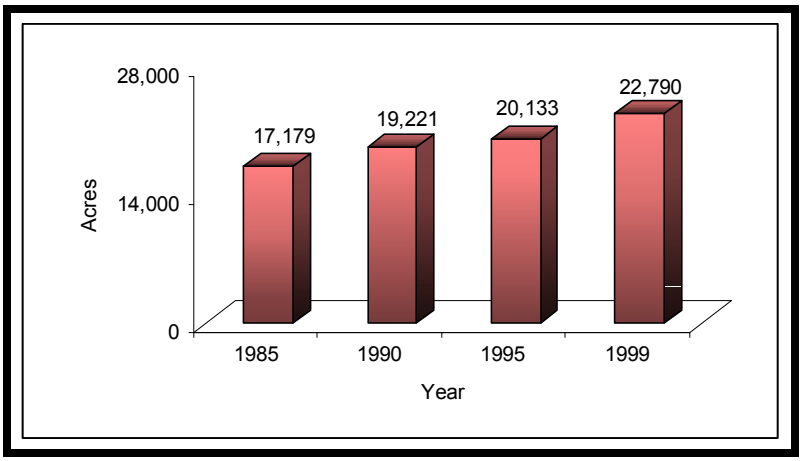
Evaluation of Pileated Woodpecker Population Trends and the Relationship to Habitat Changes

Bird survey data discussed previously demonstrates that pileated woodpecker populations have been relatively stable on the forest during the last decade. The availability of older hardwood forest habitats favored by this species has increased, and this trend is expected to continue as the forest ages. As a result, stable to increasing populations of pileated woodpeckers and continued viability on the forest are expected.

Red-cockaded Woodpecker

The red-cockaded woodpecker (*Picoides borealis*) is listed as a federally endangered species throughout its range. It does not occur on the Chattahoochee NF but is present on the Oconee NF. The 1985 Forest Plan did not specifically state how the RCW would be monitored. The density population objective was not stated in the 1985 Forest Plan. A minimum population was listed as 50 colonies. Since that time, the *Final Environmental Impact Statement for the Management of the Red-cockaded Woodpecker and its Habitat on National Forests in the Southern Region (*RCW FEIS) has been approved and a density of 176 active clusters is the computed, desirable recovery population for Piedmont RCWs in loblolly pine habitat.

We can track habitat trends by displaying the acres of pine and pine-hardwood that are more than 60 years old that occur within the RCW habitat management area (HMA) on the Oconee NF (Figure 33). This type of maturing, 60 years and older, pine habitat (especially loblolly pine, which is the dominant pine species on the Oconee NF) is reported to be best for RCW foraging and cavity excavation activities (USDA Forest Service, 1995). More mature pines provide more insect (food source) varieties and numbers. In addition, larger, older trees are more prone to heart rot, which the RCW prefers for cavity excavation.



Source: Continuous Inventory of Stand Conditions data from Oconee National Forest.

Figure 33 - Red-cockaded Woodpecker Pine Habitat – Acres of Pine/Pine-Hardwood 60+ Years of Age within Oconee Red-cockaded Woodpecker Habitat Management Area, 1985, 1990, 1995, & 1999

RCW monitoring has been conducted on the Oconee NF (which included the Hitchiti Experimental Forest) for the past 15 years. Evening roost checks of the clusters, along with cavity nest checks, occur throughout the forest. A cluster is an aggregate of cavity trees, plus a 200-foot buffer around this group of trees. In 2002, one new active cluster was identified. Currently, there are 26 total clusters, with 16 known to be active. One juvenile pair from the Piedmont Wildlife Refuge was translocated into suitable habitat in 1998. As stated earlier, recovery populations with 52,966 acres of HMA (1 group/300 acres) would need 176 active clusters to meet current density goals. Although far short of this density objective, increases from 11 clusters to 16 have occurred during the past 15 years ($p<0.01$, $r^2 = 0.82$) (Figure 34 and Table 38). The number of adult birds also has increased over this period ($p<0.01$, $r^2 = 0.53$).

Approximately 12,450 acres of foraging habitat was prescribed burned during 2002. Of these acres, about 8,000 acres were around or close to RCW clusters. Besides utilizing controlled burning to improve habitat, there were 18 clusters that received direct midstory removal efforts by mechanical methods in 1998. Six inserts were installed in 1999, eight were installed in 2000, and four inserts were put in stands with suitable RCW habitat in 2002. The Oconee RCW population seems to be responding to habitat improvements. Figure 34 and Table 38 show RCW population numbers in both adult numbers and active roost/nesting clusters.

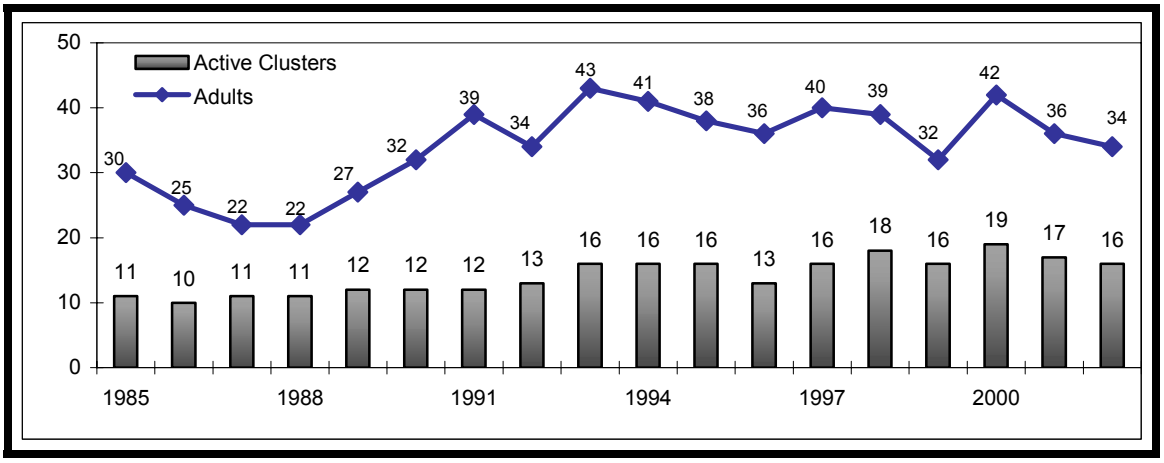


Figure 34 – Oconee/Hitchiti Experimental Forest Red-cockaded Woodpecker Population Data, 1985–2002

Table 38 - Red-cockaded Woodpecker Population Numbers, 1985–2002

Oconee/Hitchiti Experimental Forest RCW Population Data		
Year	**# of RCW**	**# of Active RCW Clusters**
1985	30	11
1986	25	10
1987	22	11
1988	22	11
1989	27	12
1990	32	12
1991	39	12
1992	34	13
1993	43	16
1994	41	16
1995	38	16
1996	36	13
1997	40	16
1998	39	18
1999	32	16
2000	42	19
2001	36	17
2002	34	16

RCW - Red-cockaded Woodpecker

Factors other than habitat sometime affect RCW population numbers, especially when population numbers are low. Competition for cavity sites and predation often present problems with regard to increasing numbers of individuals within these small populations (Baker, 1983). Overall, trends for habitat capability and the RCW population on the Oconee have increased slightly during the past 15 years. Annual monitoring of population numbers will continue and continued habitat maintenance and improvement will be priorities on the Oconee NF. All activities proposed within the HMA are analyzed for effects on the RCW. Management is guided by the RCW FEIS, and coordination and communication with the U.S. Fish and Wildlife Service is an ongoing commitment.

Evaluation of Red-cockaded Woodpecker Population Trends and the Relationship to Habitat Changes

Total acres of 60 year old pine and pine-hardwood habitat continues to increase on the Oconee, which should provide good foraging and roosting habitat for the RCW. Actual number of adult birds has increased from 30 individuals in 1985 to 34 in 2002. In addition, active RCW clusters have risen from 11 in 1985 to 16 in 2002. The forest continues to improve and maintain favorable habitat conditions for this endangered species, and population viability is being maintained on the Oconee NF.

Summary/Conclusion

This document discusses 21 different Management Indicator Species and evaluates their population trends and the relationship to habitat changes on the forest. Most of the MIS have population trends that are stable or increasing slightly. Ruffed grouse populations are declining on the forest, as well as regionally. Bobwhite quail populations have experienced significant declines regionally and have remained low on the forest. The declines for these two species are likely associated with the reduced availability of early successional habitat. Early successional habitat is on the forest and thus these species are expected to continue declining. Creating early successional habitat in appropriate areas would be an option to stabilize or increase their populations.

Current populations of two rare MIS, bog turtle and mountain purple pitcher plant are probably not considered viable on the Chattahoochee-Oconee NFs. The bog turtle is limited in distribution and range, consisting of only six known individuals on the forests. Similarly, the mountain purple pitcher plant has been found to occur in only one natural site, despite numerous inventories of the species. Through protection of the species, augmentation, and management to improve habitat, the Chattahoochee-Oconee is attempting to establish viable populations of these species on the forest. Monitoring has show these attempts are having positive results on these species.

Due to the difficulty identifying the dusky salamander and the fact it is not well distributed across the forest, this species was replaced with the Acadian flycatcher as the MIS representing riparian or streamside habitat zones.

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APPENDIX A

Percentage of Forested Acres by Forest Type Working Group and Age Class for the Chattahoochee-Oconee National Forests, 1985–99

	Age Class																
Y ear	**0-5**	**6-10**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	**81-90**	**91-100**	**101-110**	**111-120**	**121-130**	**131-140**	**141+**	**Totals**
									Yellow Pine*								
1985	1.93	1.92	1.60	0.64	0.77	1.91	2.75	2.36	1.66	1.55	0.45	0.20	0.01	0.01	0.05	0.01	**17.82**
1990	1.69	1.93	2.93	0.61	0.75	0.83	2.33	2.58	1.54	1.60	0.80	0.30	0.05	0.01	0.00	0.06	**18.01**
1995	1.18	1.69	3.83	1.55	0.54	0.63	1.50	2.04	1.74	1.38	1.29	0.39	0.16	0.00	0.01	0.06	**17.99**
1999	0.36	1.43	3.91	2.56	0.55	0.63	0.79	1.93	2.24	1.35	1.40	0.61	0.24	0.02	0.01	0.08	**18.11**
									White Pine								
1985	0.64	0.45	0.56	0.39	0.16	0.42	1.65	1.20	0.34	0.16	0.05	0.04	0.00	0.00	0.00	0.04	**6.10**
1990	0.56	0.64	0.73	0.50	0.18	0.26	0.83	1.70	0.51	0.24	0.07	0.04	0.00	0.00	0.00	0.04	**6.30**
1995	0.18	0.56	1.04	0.56	0.36	0.16	0.39	1.47	1.07	0.28	0.16	0.04	0.03	0.00	0.00	0.04	**6.34**
1999	0.02	0.24	1.16	0.72	0.46	0.17	0.26	0.85	1.58	0.48	0.19	0.07	0.04	0.00	0.00	0.04	**6.28**
									Virginia Pine								
1985	0.02	0.07	0.18	0.15	0.31	0.76	1.62	0.54	0.28	0.12	0.08	0.03	0.01	0.00	0.00	0.00	**4.17**
1990	0.01	0.02	0.24	0.09	0.19	0.58	1.12	1.06	0.44	0.12	0.09	0.04	0.02	0.00	0.00	0.00	**4.02**
1995	0.03	0.01	0.14	0.18	0.15	0.30	0.69	1.50	0.49	0.24	0.10	0.07	0.03	0.01	0.00	0.00	**3.94**
1999	0.00	0.03	0.06	0.24	0.10	0.21	0.55	1.32	0.79	0.40	0.10	0.10	0.02	0.01	0.00	0.00	**3.93**
									Mixed Hardwood/Pine								
1985	0.22	0.45	0.73	0.21	0.53	1.45	3.33	4.45	4.45	3.86	1.47	0.92	0.30	0.04	0.04	0.14	**22.59**
1990	0.30	0.22	0.94	0.35	0.31	0.90	2.41	4.32	4.34	4.19	2.16	1.09	0.42	0.09	0.05	0.15	**22.24**
1995	0.47	0.30	0.73	0.73	0.20	0.53	1.43	3.22	4.22	4.19	3.47	1.33	0.88	0.29	0.04	0.18	**22.21**
1999	0.18	0.48	0.48	0.93	0.31	0.33	0.96	2.46	4.31	4.08	3.94	1.86	1.00	0.43	0.06	0.18	**21.99**
									Cove Hardwood								
1985	0.20	0.39	0.66	0.15	0.60	1.24	3.97	2.79	2.08	1.20	0.51	0.41	0.20	0.15	0.01	0.03	**14.59**
1990	0.19	0.20	0.94	0.21	0.39	0.71	2.66	3.84	2.39	1.50	0.71	0.50	0.27	0.16	0.01	0.03	**14.71**
1995	0.16	0.19	0.67	0.66	0.15	0.60	1.24	3.95	2.75	2.00	1.14	0.48	0.37	0.19	0.15	0.04	**14.74**
1999	0.05	0.18	0.43	0.90	0.18	0.41	0.79	2.89	3.61	2.48	1.36	0.68	0.39	0.25	0.17	0.04	**14.81**
									Upland Hardwood								
1985	0.50	0.58	0.61	0.17	0.33	1.29	3.53	5.17	6.89	6.28	3.87	2.90	1.68	0.60	0.10	0.18	**34.68**
1990	0.46	0.50	0.97	0.34	0.21	0.61	2.37	4.29	6.39	7.40	4.46	3.64	1.79	0.73	0.36	0.21	**34.73**
1995	0.25	0.46	1.13	0.61	0.17	0.33	1.28	3.47	5.07	6.78	6.16	3.72	2.83	1.66	0.59	0.28	**34.79**
1999	0.07	0.24	1.04	0.28	0.28	0.23	0.75	2.47	4.61	6.66	6.73	4.43	3.49	1.77	0.69	0.49	**34.23**

*Working Group Definitions:
Yellow Pine - CISC Forest Types: 22, 31, 32, 38, 39
White Pine - CISC Forest Types: 3, 4, 5, 6, 7
Virginia Pine - CISC Forest Types: 33
Mixed Hardwood/Pine - CISC Forest Types: 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49
Cove Hardwood - CISC Forest Types: 50, 55, 56, 58, 61, 62, 63, 64, 65, 68, 69, 71, 72, 73, 75, 76, 81
Upland Hardwood - CISC Forest Types: 8, 51, 52, 53, 54, 57, 59, 60