

Supplemental Information Report

Management Indicator Species National Forests in Alabama

Draft – September 2001

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Management Indicator Species

National Forests in Alabama

In response to the National Forest Management Act (NFMA) of 1976 and as adopted in the planning regulations (USFS 1980) a Process Record (Hedrick 1985) was developed for the National Forests in Alabama, Land and Resource Management Plan. The Process Record was developed to demonstrate the rationale for selection of management indicator species and methods of inventory and monitoring of selected species. The process record includes review of potential species that were reliant on aquatic, terrestrial, and special habitats and results in the selection of species that would provide suitable and scientific indices for comparing or measuring land management actions.

Chapters in the process record include acknowledgements, a foreward, summary, introduction, relationship to present programs, methodology and criteria for selection, identification of major habitats, identification of native vertebrates, selection of management indicator species, literature cited, references and numerous appendices. The process record is on file and available to those desirous of review. This supplemental report was developed to update information on the management indicator species and for a comparison of treatments and vegetative activities.

In the process record, the rationale for selection of management indicator species is thoroughly described and substantiated. In this supplemental information report, the scale is reduced from the Forest level to the individual subunits. This is due to the need for unit specific information and demonstrations of change over time. The changes are displayed in terms of forest type, age class, and distribution by unit and over time.

The forest types are either pine, yellow pine, mixed or hardwood, while the age classes are 0-10, 11-30, 31-60 and over 60 years for the dominant or co-dominant species. The distributions by unit are described as either the Bankhead National Forest, Conecuh National Forest, Oakmulgee Division of the Talladega National Forest, Talladega Division of the Talladega National Forest or the Tuskegee National Forest. The information is based on two points in time, which are tied to Continuous Inventory of Stand Condition (CISC) data from 1983 and 1999. These two points in time were selected due principally to the presence of CISC data, which was retained during the 1985 Land and Resource Management Plan Process, the current 1999 CISC data and the need for at least two vegetative points in time to display change over time.

Temporal and Spatial Changes in the Forest

To evaluate changes in MIS populations, it is necessary to examine temporal changes in forest age and composition. The primary tool used by the Forest Service to evaluate the condition of the forests is CISC (continuous inventory of stand conditions) data; compiled from periodic field inventories throughout the forests.

CISC data for 1983 and 1999 were compared to evaluate changes in forest composition during the implementation of the current Forest Plan (1985 – present) for each National Forest in Alabama. CISC data from the years 1983 and 1999 do not include the same land classes and exhibit large acreage differences (524,484 acres for 1983 and 609,892 acres for 1999). These differences may be due to changes in direction, definition and classification by various observers, exclusion of certain land classes, such as wilderness, developed recreation sites, wild and scenic river corridors, and other non-commercial lands, or shifts in administrative patterns.

Forests are reported as one of four stand types: yellow pine, longleaf pine, mixed (pine and hardwood), and hardwood. It is important to recognize the natural and common occurrence of various species and structural conditions. For instance, a pine stand may be described as pine, yet up to 30 percent of the stand could be hardwood species.

Additionally, the stand structure could be typed a specific size class but contain a variety of tree sizes. Another point that the reader should be aware of is the return schedule for the CISC data collection. In general, the program is planned for entry and updating every ten years. Thus, information that is displayed on a selected year may be dated or historical in nature. This is due to the vast acreages to be reviewed and limitations visiting every site annually. Thus, the reader should be cognizant that the stand titles (pine, hardwood, mixed and yellow pine) represent an array of stand conditions, species, size classes and the information may be dated. Yellow pine includes all species of pine when stands display mixed occurrence of pine species. The most common species are loblolly (*Pinus taeda*), shortleaf (*P. echinata*), slash (*P. elliotii*), and Virginia (*P. virginiana*). When a stand is described as Longleaf pine, it is generally or primarily composed of longleaf pine (*P. palustris*). Mixed refers to stands that contain both pines (all species) and hardwoods (all species) and hardwood stands include all species of hardwood.

Bankhead National Forest

The most obvious changes in the forest on the Bankhead National Forest were the decrease in the 0-10 age class, the increase in the 60+ age class, and the reduction in mixed stands (Figure 1). These changes were primarily the result of reductions in the rate of reforestation and the implementation of the Land and Resource Management Plan. For instance, the direction of the forest plan was to shift pine/hardwood stands to pine and conversely shift hardwood/pine stands to hardwood. As a result, the amount of reforestation has decreased during the past 14 years. With the exception of longleaf pine, all forest types showed an overall decrease in age 0-10 (Figure 1). The significant reduction in regeneration (0-10 age class) reflects the reduction in even-aged management.

The 11-30 age class had a corresponding increase in acreage due to the large number of acres in regeneration in 1983 (Figure 1) which, via aging, has shifted into the 11-30 year

age class. The shift is predominantly in the pine forest types, which is the result of little or no hardwood regeneration.

Overall there was a large increase in the 60+ age class, primarily for hardwoods and yellow pine (Figure 1). Increases in hardwoods were due to changes in the mixed class and may be the results of stands being mistyped in 1983 or the removal of pine during thinning operations. For instance, additional or new forest types may have become available for use since 1983, but wasn't available for use during the forest typing in 1983. The increase for yellow pine, however, appears to be due to greater number of acres reported in 1999 data than in 1983.

The mixed acreage noticeably decreased for all age groups combined, particularly in the 60+ age class (Figure 1). The a large decrease in the mixed stands may be partially explained by regeneration cuts of hardwood and pine or intermediate cuts removing the pine from hardwood stands; however, it appears to be too great a change to be attributed solely to management activities; considering short time period. Thus, mistyping or use of new codes for forest types may be responsible.

Conecuh National Forest

The most prominent change on the Conecuh National Forest was the decrease in the 0-10 age class, the increase in the 60+ age class, and the replacement of yellow pine with longleaf pine (Figure 2). This was most likely due to reductions in regeneration, aging of the stands since 1983, and a focus on restoration of the longleaf pine ecosystem.

All forest types, except longleaf pine, showed decreases in the 0-10 class (Figure 2). Yellow Pine made up about 93% of the age 0-10 age class in 1983 but only about 7% in 1999 (Figure 2). Conversely, longleaf pine made up only about 2% of the age 0-10 age

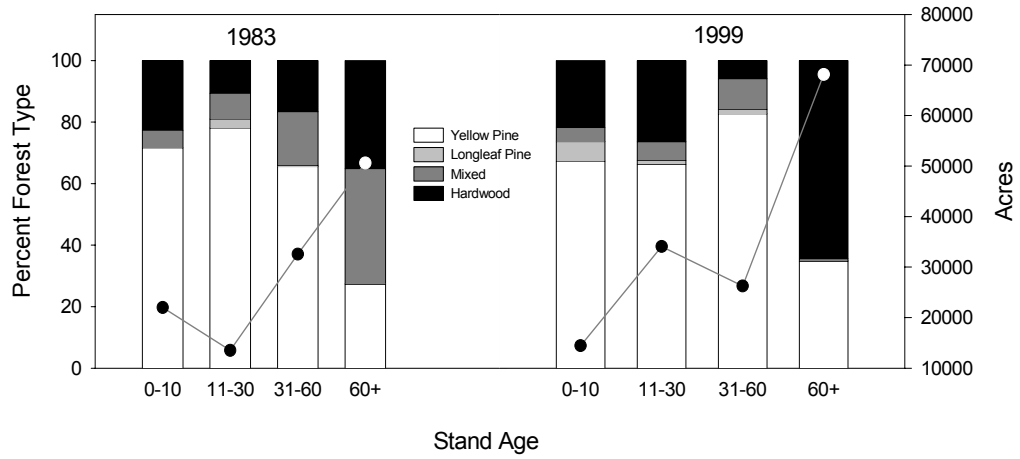


Figure 1. Changes in the age structures of forest stands on the Bankhead National Forest between 1983 and 1999 (USFS CISC Data). Bars represent the the percent composition of each forest type by age class and dots represent the total number of acres in each each age class.

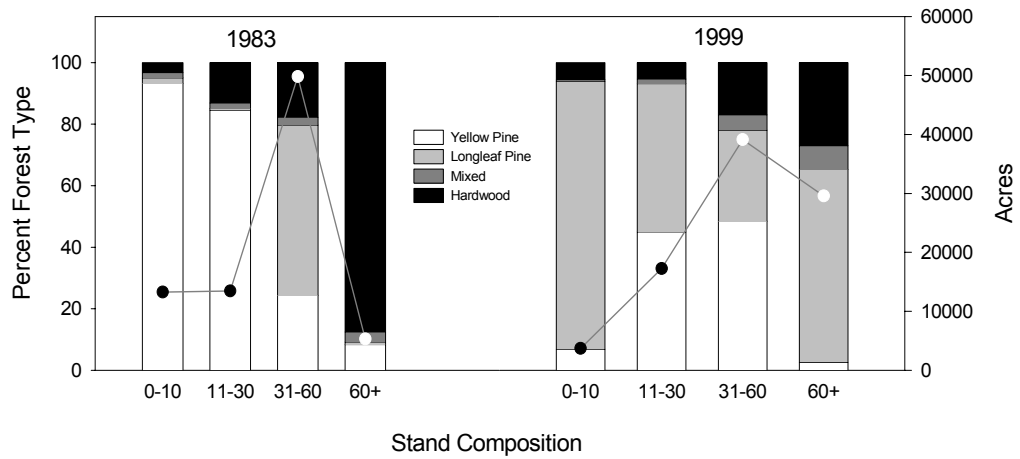


Figure 2. Changes in the age structures of forest stands on the Conecuh National Forest between 1983 and 1999 (USFS CISC Data). Bars represent the the percent composition of each forest type by age class and dots represent the total number of acres in each each age class.

class in 1983 and 83% in 1999 (Figure 2). This reflects the longleaf restoration efforts on the Conecuh National Forest.

There has been a substantial increase in the 60+ age class since 1983 (Figure 2). Most of change has been a shift from yellow pine to longleaf pine (Figure 2). The 60+ age class on the Conecuh national Forest was composed of about 8% yellow pine in 1983 and decreased to less than 3% by 1999. Longleaf pine, however, increased from 0.8% in that age class in 1983 to about 62% in 1999. Nevertheless, part of this increase was probably due to the difference between the total acreage reported in the 1983 and the 1999 data or increased awareness and accuracy of forest typing.

Talladega Division

General trends on the Talladega Division appear to be similar to those for the Conecuh National Forest: decreases in 0-10 age class and increases in the 60+ age class (Figure 3) which also reflects longleaf pine restoration and management (Figure 3). The 31-60 age class exhibits a corresponding drop which is primarily due to shifts into the older age class (Figure 3).

All forest types except longleaf showed decreases in the 0-10 age class (Figure 3). The most notable change in the composition of this age class was the shift from predominately yellow pine to longleaf (Figure 3). Overall, the amount of 0-10 age stands has dropped from 18% of the total area in 1983 to about 5% in 1999.

The 60+ age class composed about 27% of the unit in 1983, but today it makes up approximately 64% (Figure 3). Although all stand types have exhibited substantial increases, the greatest percentage of this age class is presently longleaf pine (Figure 3).

Comparison of changes in forest composition for the Talladega Division, however, should be viewed with caution due to large differences in acreage reported in the CISC

data (1999 data indicates more than 35% additional acreage than the 1983 data – approximately 58,000 acres).

Oakmulgee Division

Temporal changes in stand composition on the Oakmulgee Division were also similar to those on Conecuh National Forest. For example a decrease in 0-10, a notable increase in 60+, and a shift from yellow pine to longleaf pine (Figure 4). This may be due to the temporal shift due to aging, the increased focus on restoration of the longleaf pine ecosystem, and the removal of off-site pine species due to loblolly die-offs.

The 11-30 age class increased due to the large amount of 0-10 in 1983, and the 31-60 dropped sharply with much of that age class shifted to the 60+ in 1999 (Figure 4). The number acres in the 60+ age class has nearly quadrupled since 1983 which includes all forest types (Figure 4). Similar to other units, this was due to reduced regeneration, aging, and a focus on restoration activities.

Tuskegee National Forest

The one trend on the Tuskegee National Forest that was consistent with the other units was the large increase in the 60+ age class and the corresponding decrease in the 31-60 age class. Other trends seen on most of the forest were not observed on the Tuskegee National Forest. In fact, there was essentially no change in the 0-10 age class. It also appears that the forest composition has shifted toward yellow pines instead of longleaf pine (Figure 5). This was likely due to the shift in forest typing over the past 15 years. Stands formerly described as longleaf pine may have re-described in recent CISC updates as yellow pine due to the mixture of pine species. Thus, the shift in definitions over time make clear and comparative use of the CISC datasets somewhat problematic.

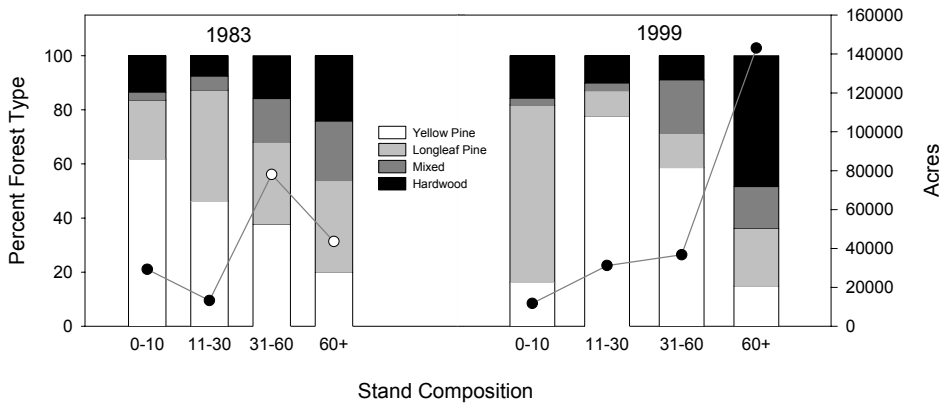


Figure 3. Changes in the age structures of forest stands on the Talladega Division between 1983 and 1999 (USFS CISC Data). Bars represent the the percent composition of each forest type by age class and dots represent the total number of acres in each each age class.

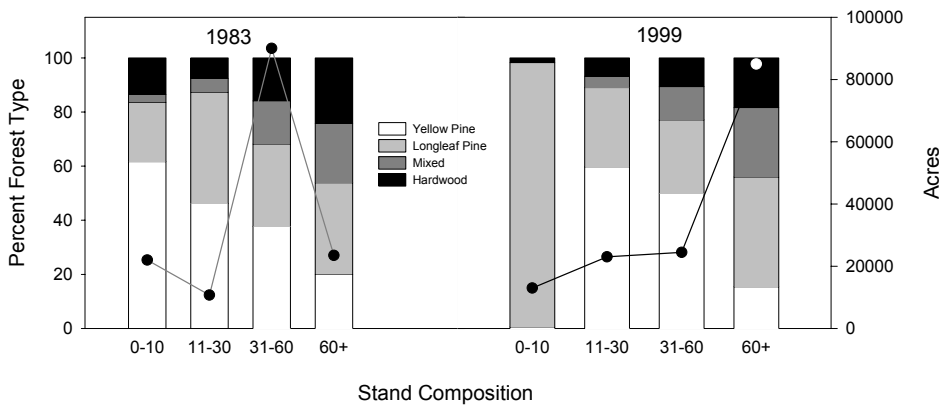


Figure 4. Changes in the age structures of forest stands on the Oakmulgee Division between 1983 and 1999 (USFS CISC Data). Bars represent the the percent composition of each forest type by age class and dots represent the total number of acres in each each age class.

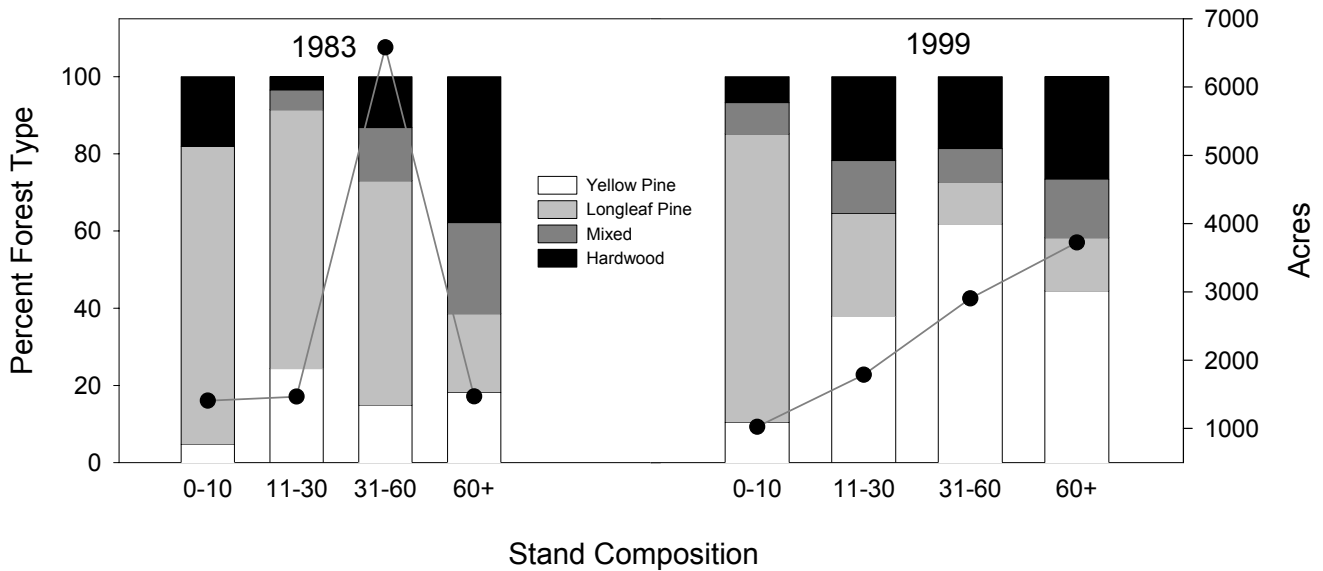


Figure 5. Changes in the age structures of forest stands on the Tuskegee National Forest between 1983 and 1999 (USFS CISC Data). Bars represent the the percent composition of each forest type by age class and dots represent the total number of acres in each each age class.

Forest-wide Trends

In general, the 0-10 age class decreased from 17% to 7%, with all forest types decreasing except for longleaf pine (which increased) on the National Forest in Alabama. The 60+ age class increased from 24% to 54% of the total acres. As expected, the longleaf pine increased notably while yellow pine decreased. As mentioned previously, the acreage discrepancy between the 1999 and 1983 data make some comparisons difficult.

Management Indicator Species

Data represented in this report was collected by a variety of external and internal sources including the National Forest in Alabama, USFS Southern Research Station, universities,

and private individuals. Much of the population data reported here often contains a considerable amount of temporal variation that makes interpretation difficult. Linear regression ($y = y_0 + ax$) was used to help identify long-term trends. In most cases, however, the relationship between population and time is weak and not statistically valid. Therefore regression lines are were use only as a guide (or reference) and should be interpreted with caution.

Birds

Twenty bird species were chosen as management indicator species on the National Forest in Alabama (Table 1). The primary methods of data collection include U.S. Geological Survey (USGS) breeding bird surveys (Sauer et. Al 1997), breeding bird plots (USDA Forest Service), harvest records (Alabama Department of Conservation and Natural Resources: Game and Fish Division), and individual species surveys (USDA Forest Service).

Road surveys, or breeding bird survey (BBS), have been conducted on the Tuskegee and Conecuh National Forests and the Oakmulgee Division of the Talladega National Forest since 1966. The Talladega Division (Shoal Creek District) and the Bankhead National Forest surveys began in 1980 and 1993, respectively.

Breeding bird survey data is collected on all birds seen or heard in a three (3) minute time interval every one half mile on the same road each year. The routes are generally 25

Table 1. Bird species, and their habitat associations, used as management indicator species on the National Forests In Alabama.

Common Name	Early Succession	Mature Forest	Mature Forest	Mature Forest	
	< 10 years old	Conifer	Upland Hardwoods	Bottomland Hardwoods	Cane Thickets
Mourning Dove	X				
Northern Flicker	X				
Eastern Bluebird	X				
Bobwhite Quail	X	X			
Yellow-breasted Chat	X				
Indigo Bunting	X				
Eastern Wild Turkey	X	X	X	X	
Brown-headed Nuthatch		X			
Screech Owl		X	X		
Pine Warbler		X			
Red-cockaded Woodpecker		X			
Pileated Woodpecker			X	X	
Broad-winged Hawk			X		
Wood Thrush			X		
Hooded Warbler			X	X	
American Redstart			X	X	
Barred Owl				X	
Wood duck				X	
Kentucky Warbler				X	
Swainson's Warbler					X

miles long (50 stops) and are conducted during breeding season to take advantage of increased vocalizations of many species of birds.

Although the BBS is a standardized survey method, it has some disadvantages. Passing vehicles and other noises can interfere with the detection of some individuals and the short time spent at each site may minimize the opportunity to notice small or relatively quiet species. It is also difficult to fit a given species to a specific habitat type using this type of survey. Nevertheless it does provide a relatively good list of the songbird species in a large area and can be used to estimate overall population trends.

There is at least one BBS route on each of the National Forest in Alabama. There are four routes on the Talladega National Forest, one on the Oakmulgee Division, and three on the Talladega Division. As a result, all BBS are reported as actual counts except for the Talladega Division, reported as an average of the three routes.

The Bankhead National Forest began monitoring breeding bird plots (BBP) in 1997. The BBP method consists of collecting the number of individuals and of each species in a given habitat within a 10 minute time interval. The 10 minute time interval is further divided into 0 - 3, 3 - 5, and 5 - 10 minute intervals which allows the data to be compared with other survey data. The BBP survey is an effective way to relate species to a given habitat type. Because the number of sample plots changed from 27 in 1997 to 121 in 1999, this data should be interpreted with caution. Annual data from all plots were averaged for this report.

Mourning Dove

The Mourning dove (*Zenaida macroura*) has been reported in BBP or BBS on each unit of National Forests in Alabama and in harvest data from the Talladega National Forest. Birding bird plots and BBS indicate an increase in the mean number of doves observed during the 1990s on the Bankhead National Forest (Figures 6 and 7, respectively).

Overall, dove populations appear to have increased on the National Forest (except on the Tuskegee) since the late 1960s but a decline in BBS observations are apparent between the early 1980s and the present (Figure 7). Game harvest data, however, indicates a slight increase in dove-hunter success since the mid 1980 (Figure 8).

Although the data is somewhat conflicting, population declines should be expected because of the increase in mature forest on Alabama's National Forest. Nevertheless, mourning doves continue to be considered at huntable population levels in Alabama by state and federal agencies.

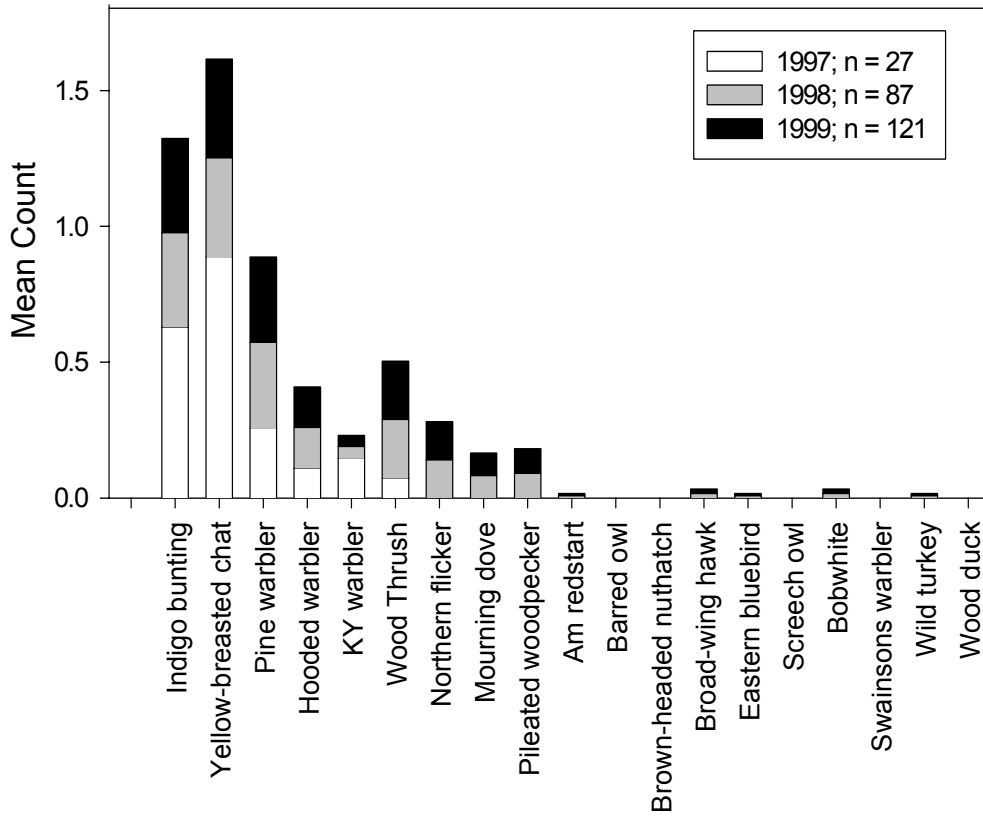


Figure 6. Mean number of birds counted in breeding bird survey plots on the Bankhead National Forest between 1997 and 1999

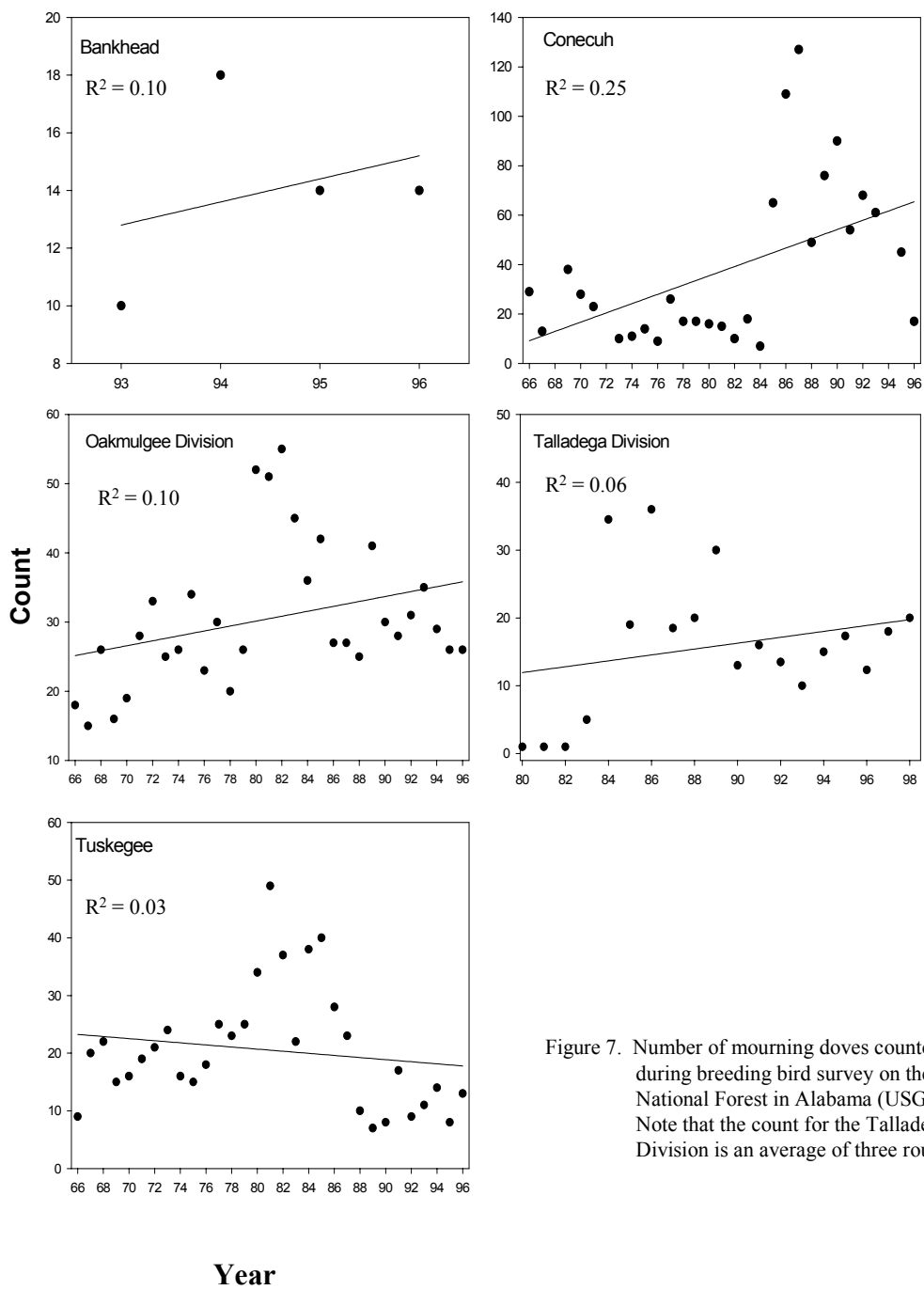


Figure 7. Number of mourning doves counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

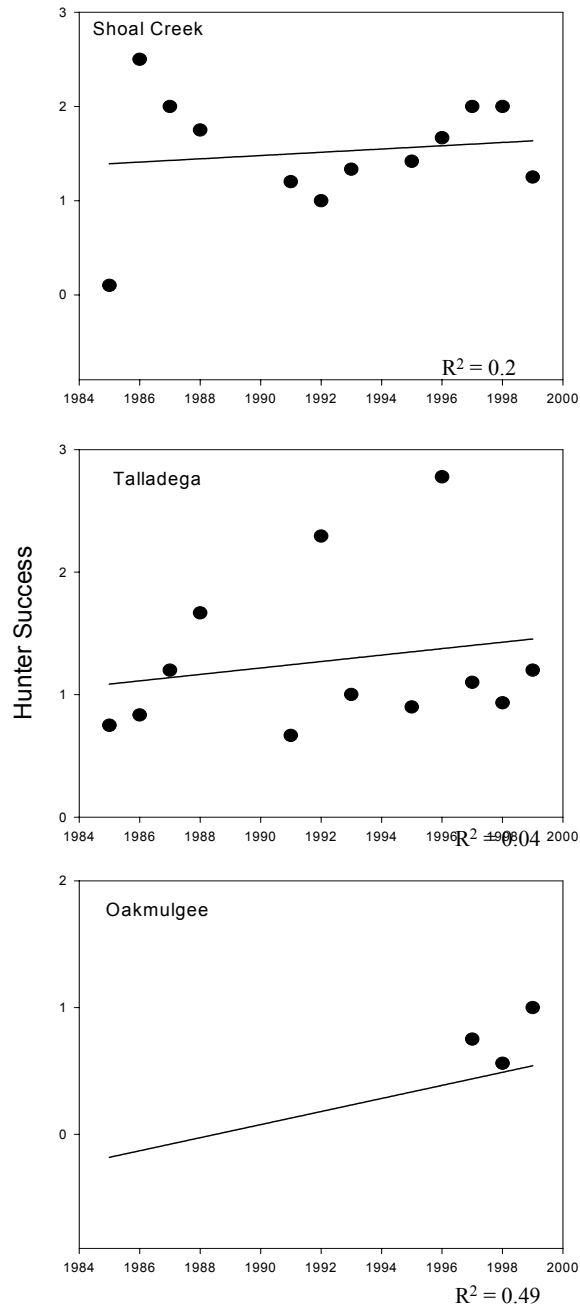


Figure 8. Dove harvest data of wildlife management areas located on Forest Service lands in Alabama. Hunter success is expressed as the number of doves harvested divided by the person-days hunted (Alabama Game and Fish Division).

Northern Flicker

Although northern flickers (*Colaptes auratus*) have not been observed BBS on the Bankhead National Forest, small numbers of the species have been observed in the BBPs (Figure 6). Data from the BBS from the other forests showed small numbers, varying from zero to four, every year since 1980 (Figure 9). Breeding bird survey data for northern flickers exhibit considerable annual variation. In general, northern flicker counts show a slight upward trend on the Conecuh National Forest and Talladega Division and a slight downward trend on the Oakmulgee Division and Tuskegee National Forest (Figure 9).

Eastern Bluebird

The Eastern bluebird (*Sialia sialis*) is cavity nester that inhabits early successional habitats. Both BBP and BBS data indicate that bluebird populations have increased on the Bankhead National Forest (Figures 6 and 10, respectively). Bluebird populations appear to have increased through the 1980's and then decreased to a lower yet stable low from 1990 through the present time on the Conecuh, Talladega (both Divisions), and Tuskegee National Forests (Figure 10).

Northern Bobwhite Quail

The northern bobwhite quail (*Colinus virginianus*) is an early successional species but also frequents open mature pine. The number of quail observed in BBP on the Bankhead National Forest increased from zero to an average of about 0.02 per plot (Figure 6). In contrast, BBS data showed an overall decrease (although highly variable) from ten in 1993 to one in 1996 (Figure 11).

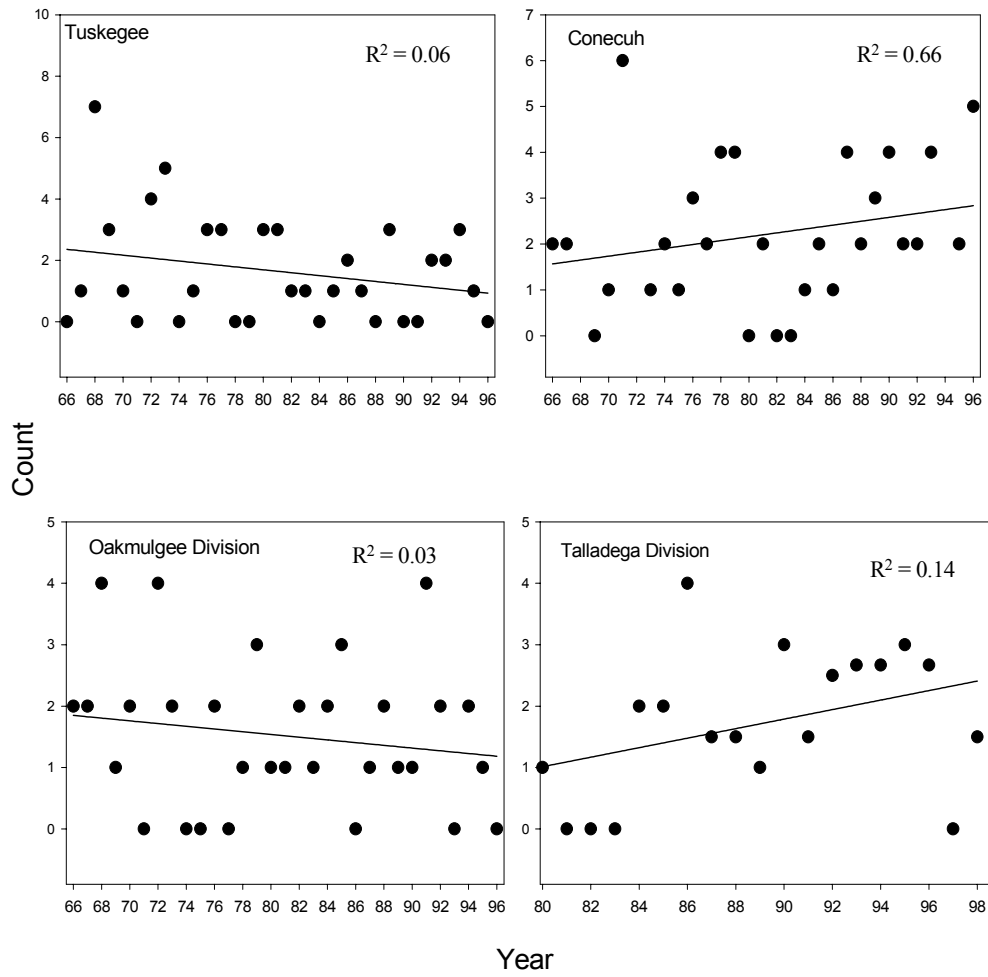


Figure 9. Number of northern flickers counted during breeding bird survey (BBS) on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

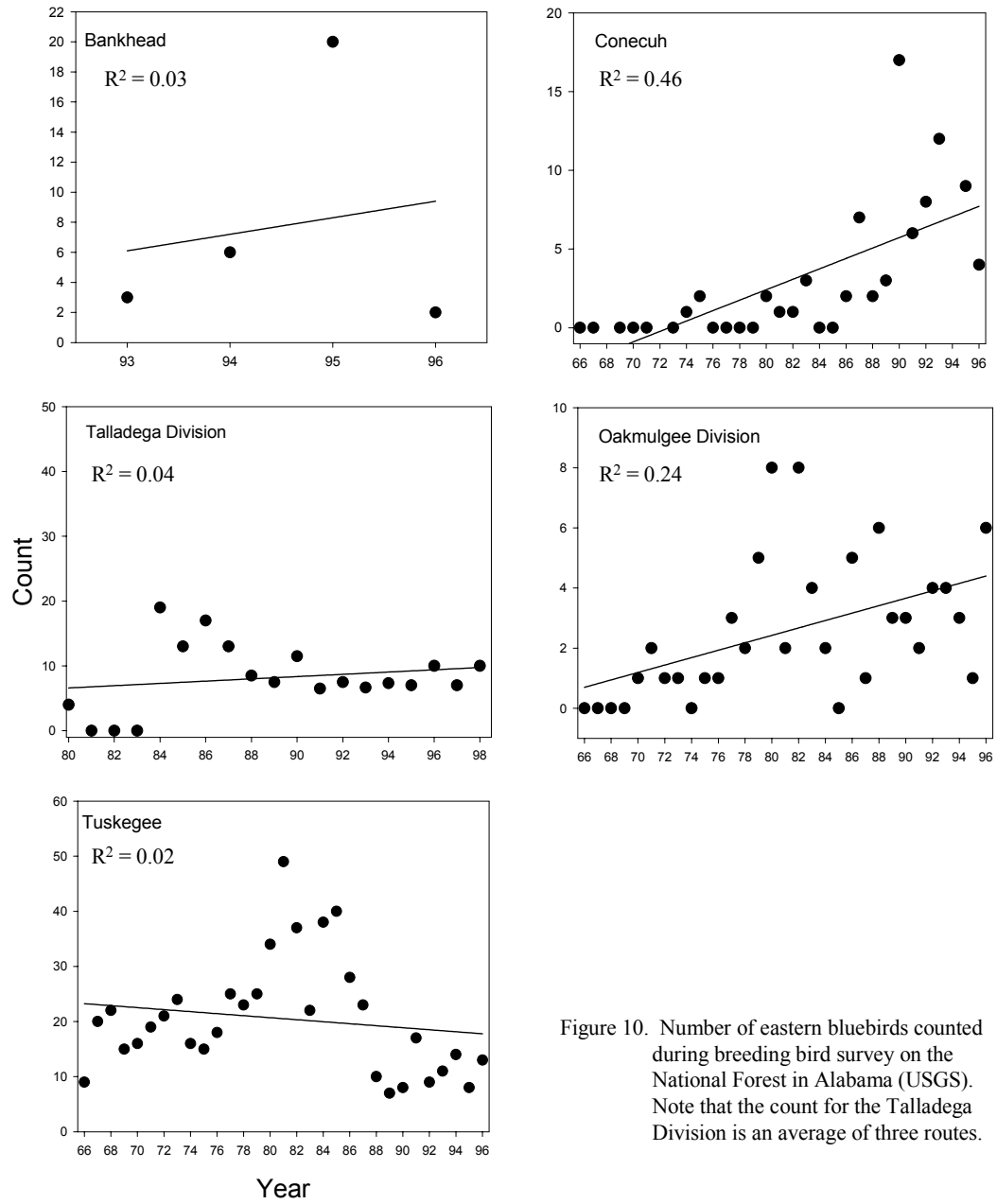


Figure 10. Number of eastern bluebirds counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

Breeding bird survey data for the Conecuh National Forest is also highly variable but suggests a slight increase (Figure 11). The remaining National Forest, both Division of the Talladega, and the Tuskegee, exhibit a strong downward trend in quail populations (Figure 11).

Harvest data offers both supporting and conflicting results. Both the BBS and harvest data indicate quail are declining on the Bankhead National Forest and Oakmulgee Division (Figures 12 and 11, respectively). Harvest data, however, showed a decrease in hunter success on the Conecuh National Forest whereas BBS showed a slight increase in observations (Figures 11 and 12, respectively). In contrast, BBS indicated a decline in quail numbers on the Talladega Division, whereas harvest data showed a sizable increase in hunter success (Figures 11 and 12, respectively).

The decline in quail numbers in some areas of the National Forest in the past 20 years should be expected due to the overall trend shift toward late-succession habitats. The prescribed burning program on the National Forest, however, is maintaining open mature pine stands that is suitable habitat for the species.

Yellow-breasted Chat

The yellow-breasted chat (*Icteria virens*) also early successional species, however, it is often found occupying small patches of suitable habitat. As a result, BBS probably over estimate the number of chats on National Forest lands because they often frequent the early successional habitat found along the side of the road.

Breeding bird plots on the Bankhead National Forest showed a decline in chats between 1997 and 1999 (Figure 6). The BBS, however, showed a substantial increase in chats in the 1990s (Figure 13).

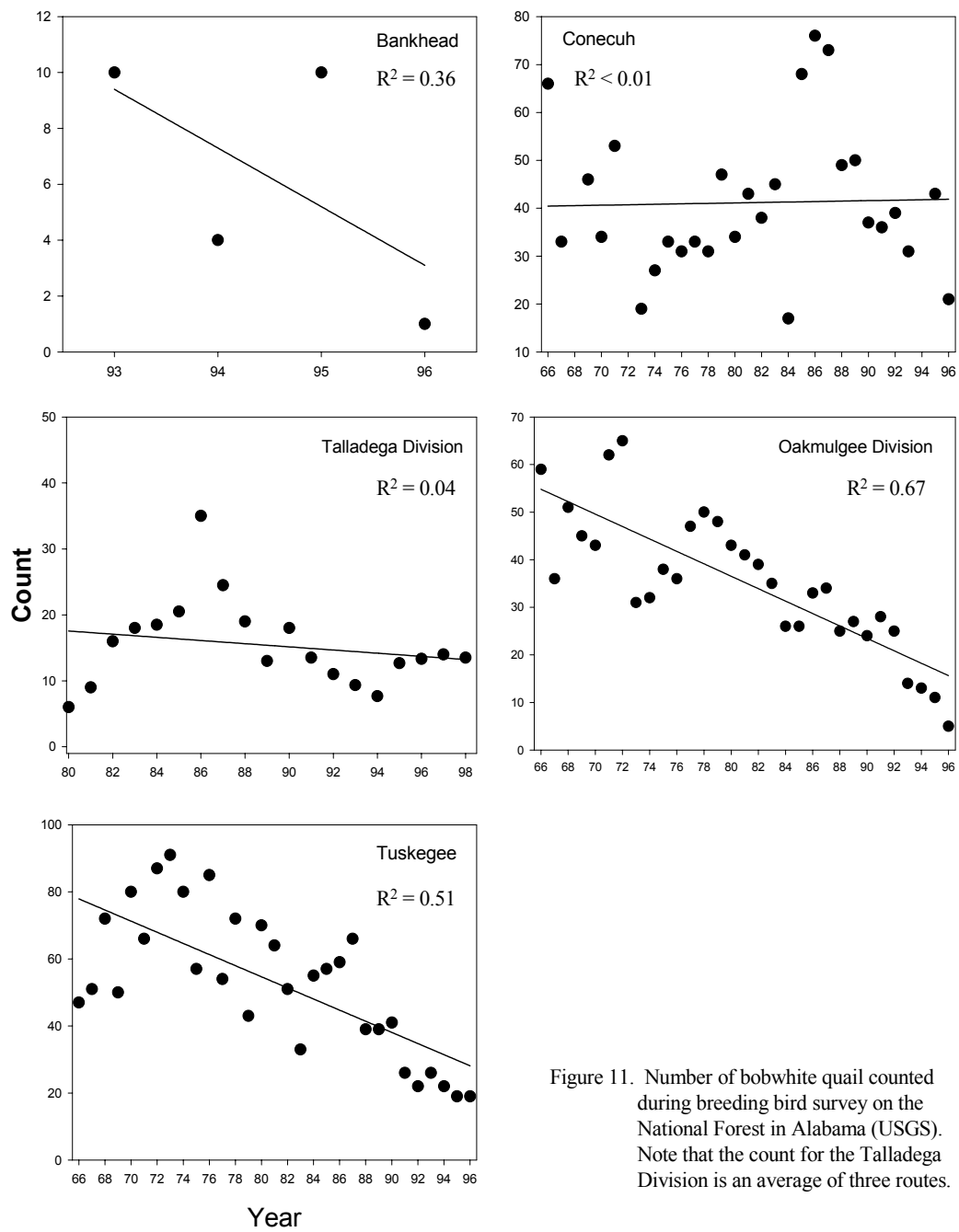


Figure 11. Number of bobwhite quail counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

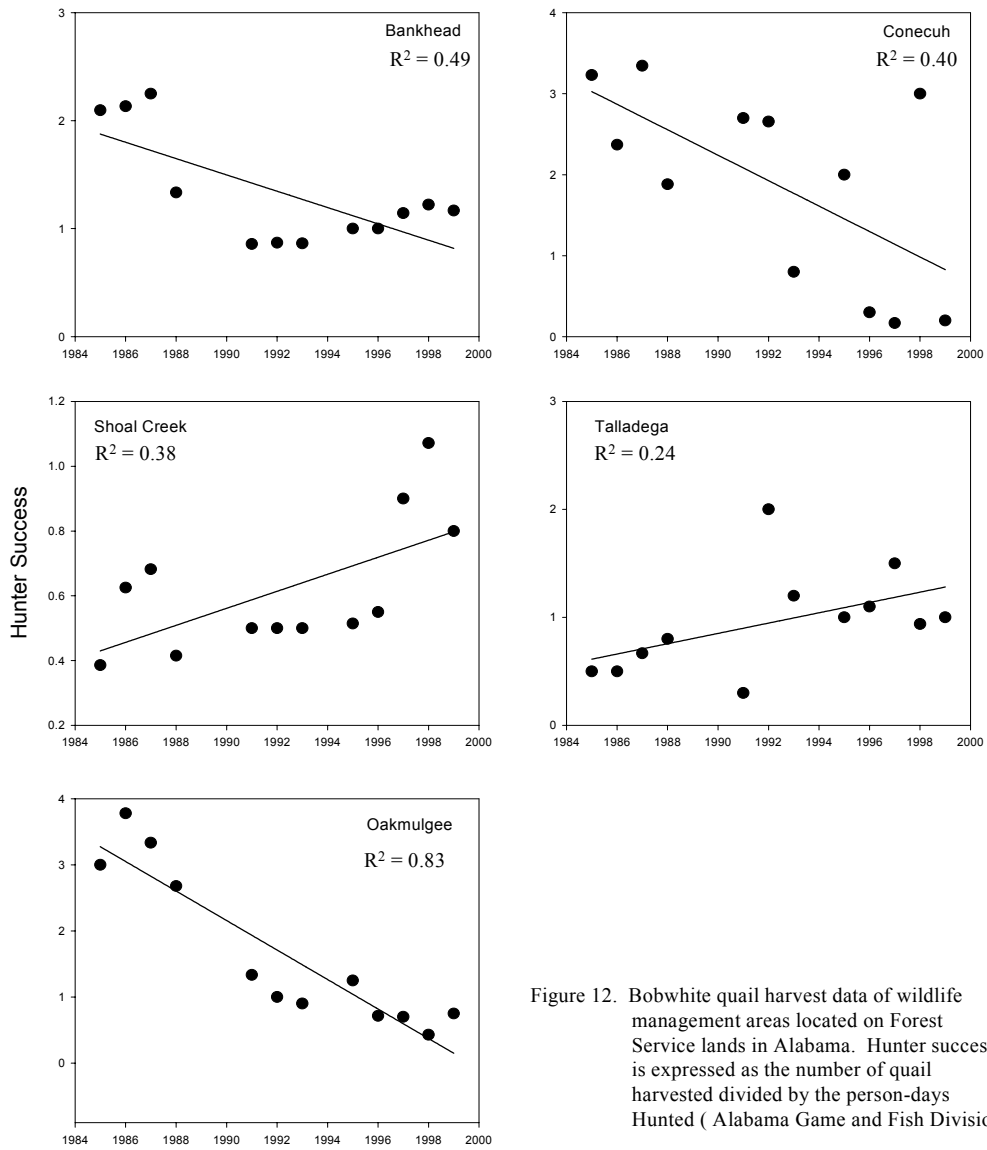


Figure 12. Bobwhite quail harvest data of wildlife management areas located on Forest Service lands in Alabama. Hunter success is expressed as the number of quail harvested divided by the person-days Hunted (Alabama Game and Fish Division).

Breeding bird surveys on the Conecuh National Forest and both divisions of the Talladega National Forest and suggest that chat populations are increasing (Figure 13). The only downward trend in the BBS was observed on the Tuskegee National Forest; however, the data is highly variable (Figure 13).

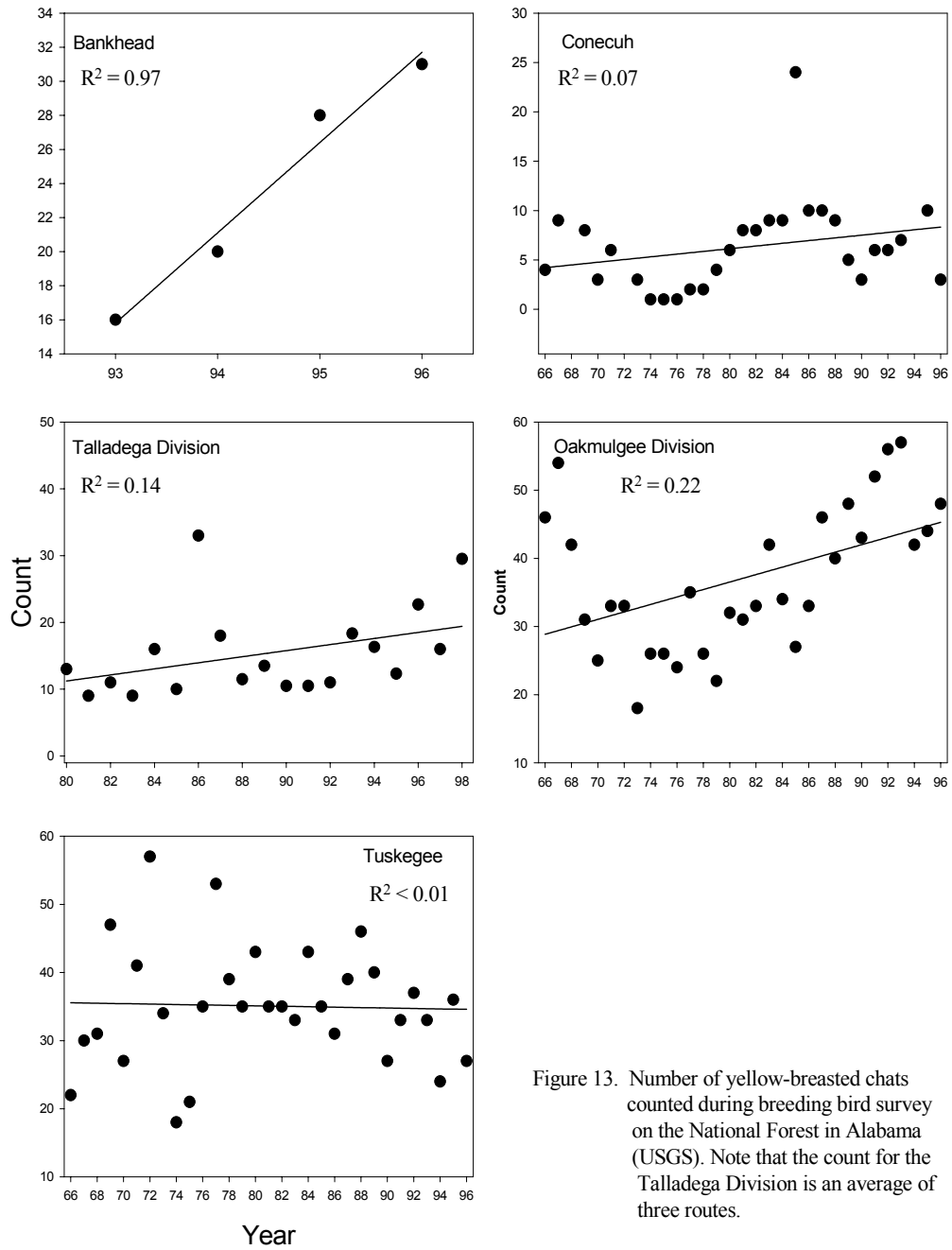


Figure 13. Number of yellow-breasted chats counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

Indigo Bunting

The habitat requirements of the indigo bunting (*Passerina cyanea*) are comparable to those of the yellow-breasted chat. Unlike the chat, however, there appears to be an overall decline in indigo buntings on the National Forest in Alabama; although the data is highly variable in all cases (Figure 14).

Data collected on the Bankhead National Forest by both BBP and BBS methods indicates that the indigo bunting population has declined in the 1990s (Figures 6 and 14, respectively). Similar declines have also been observed on Talladega Division, Oakmulgee Division, and the Tuskegee National Forest (Figure 14). Increases in the indigo bunting population were observed only on the Conecuh National Forest (Figure 14).

Eastern Wild Turkey

The Eastern wild turkey (*Meleagris gallopavo*) is a habitat generalist requiring numerous habitats types. Breeding bird plots and BBS are probably not effective for estimating turkey populations because these surveys are conducted after the breeding season (when most of the vocalization is heard). Nevertheless, turkeys were reported in the BBP on the Bankhead National Forest (Figure 6) and in the BBS on all the remaining forest (Figure 15).

Only one record of turkey was recorded on the Conecuh National Forest during the BBS (Figure 15). The BBS on the Talladega and Oakmulgee Divisions show an increase in turkey populations after 1989 and on the Tuskegee National Forest after 1981 (Figure 15).

Annual harvest data on wild turkeys indicated that hunter success has declined on the Bankhead and Conecuh National Forest since 1984 (Figure 16). Hunter success on both Divisions of the Talladega National, however, has increased (Figure 16).

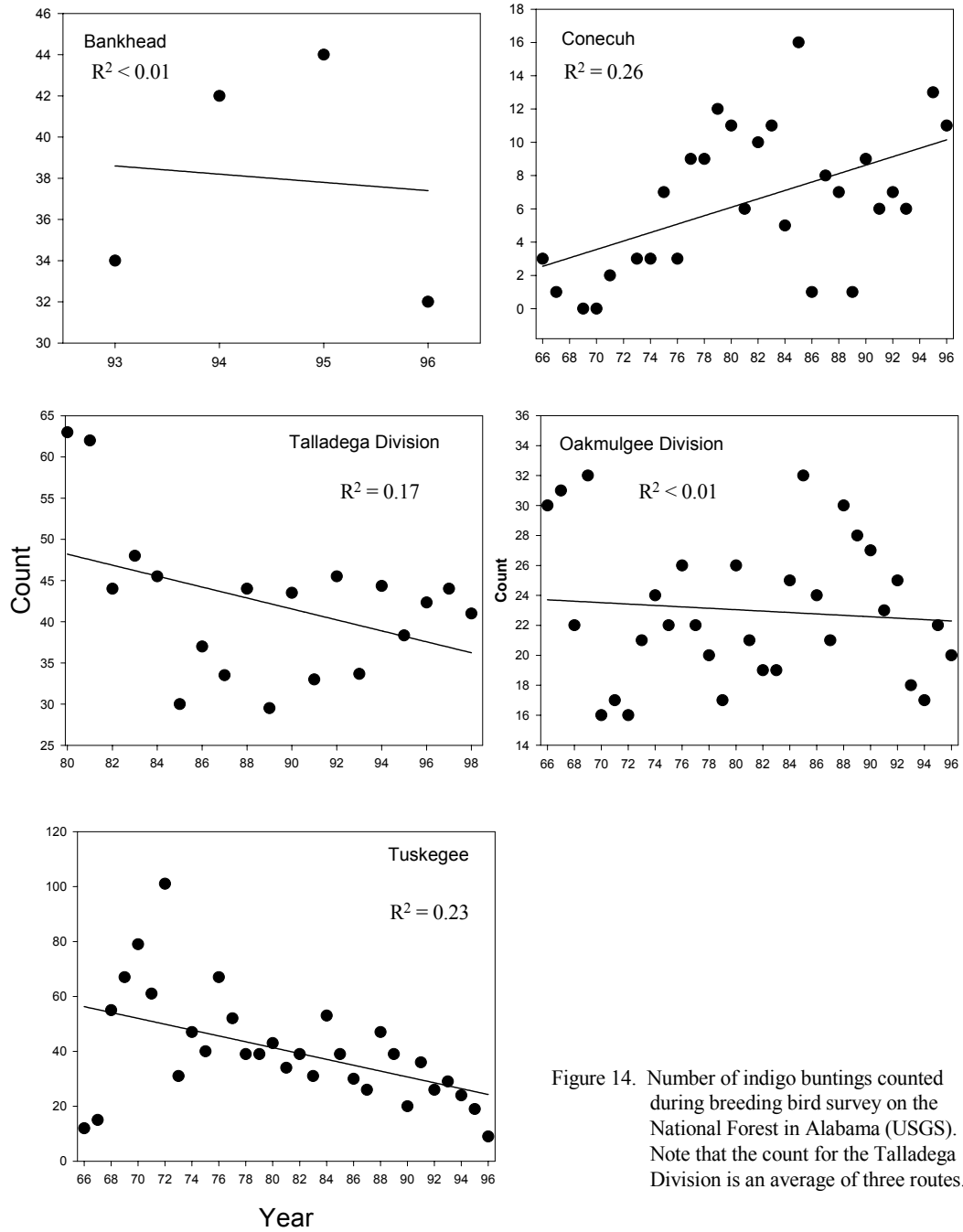


Figure 14. Number of indigo buntings counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

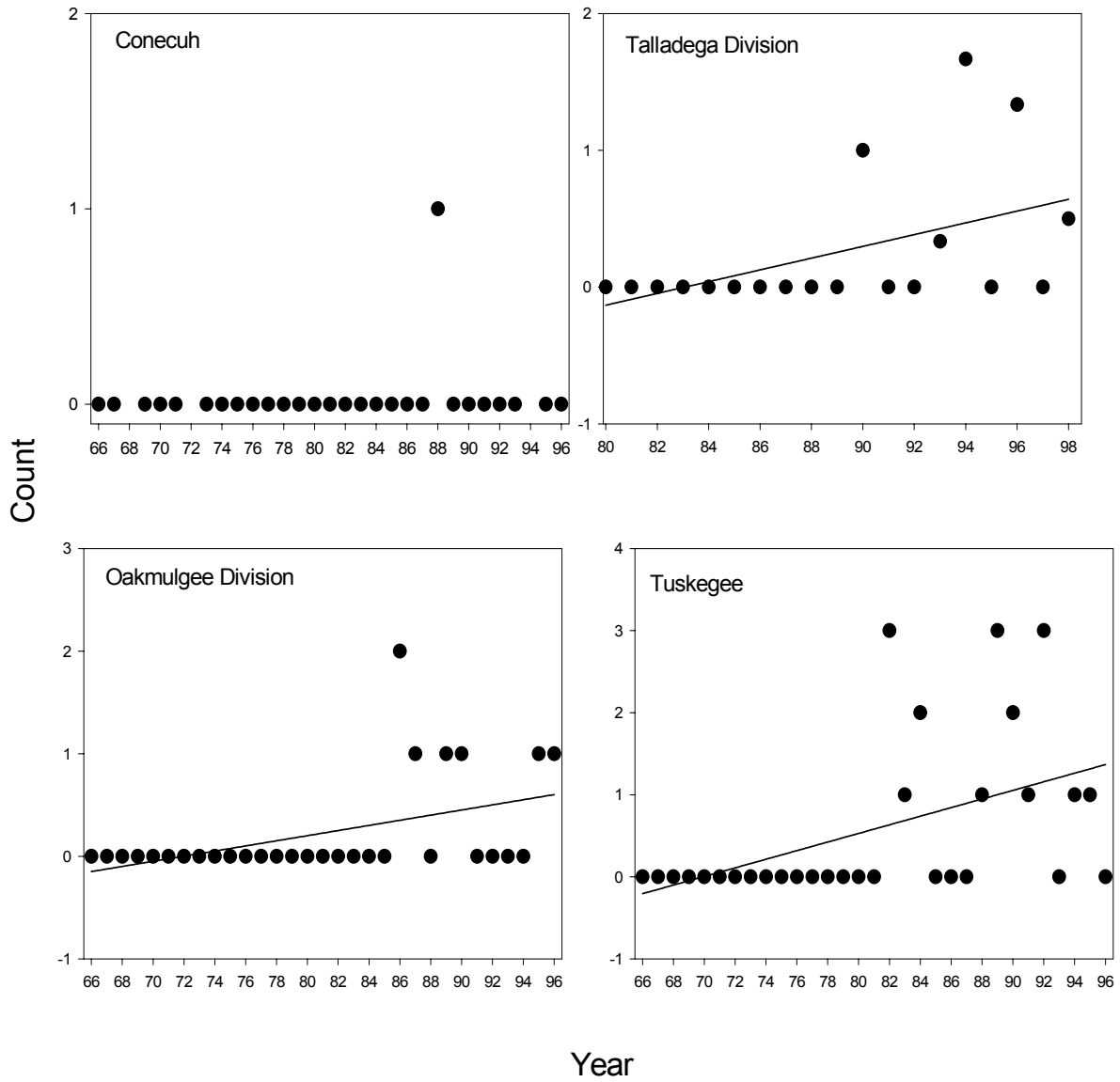


Figure 15. Number of wild turkeys counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

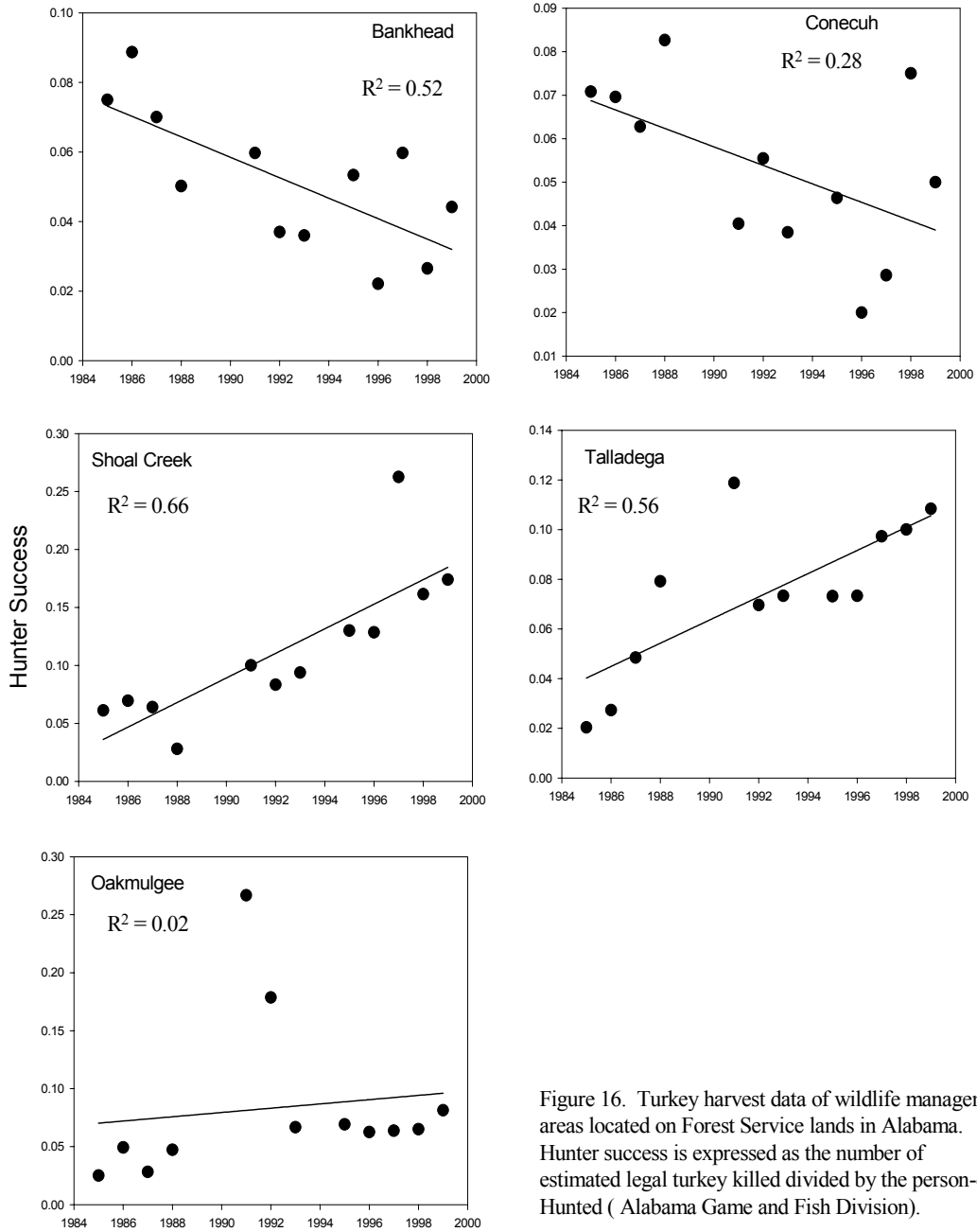


Figure 16. Turkey harvest data of wildlife management areas located on Forest Service lands in Alabama. Hunter success is expressed as the number of estimated legal turkey killed divided by the person-days Hunted (Alabama Game and Fish Division).

Brown-headed Nuthatch

In general BBS indicate a decline in brown-headed nuthatches on both the Bankhead National Forest and Oakmulgee Division (Figure 17). It appears that brown-headed nuthatch populations have increased on the Conecuh National Forest and Talladega Division (Figure 17). The BBS data collected on the Tuskegee National Forest is highly variable; however, it appears that the population was stable between 1982 and 1992 then began to decline (Figure 17).

The brown-headed nuthatch (*Sitta pusilla*) requires mature, relatively open, pine stands. This species' habitat requirements are similar to that of the endangered red-cockaded woodpecker (RCW). Brown-headed nuthatches are often seen in RCW colony sites but no formal data has been recorded RCW site visits. BBS three minute stops generally do not allow enough time to note this small shy species. Numbers of brown-headed nuthatches on BBS reports are often low. However, mature pine habitat on National Forests in Alabama has increased over the last 15 years. Red-cockaded woodpecker habitat improvements such as burning and midstory removal treatments should have increased brown-headed nuthatches habitat.

Pine Warbler

The Pine warbler (*Dendroica pinus*) requires mature pine habitat. CISC records indicate mature pine habitat has increased through out the National Forests in Alabama. As would be expected, bird monitoring data indicates an general increase in pine warblers.

Data from BBP on the Bankhead National Forest showed an increase in pine warblers since 1997; however, this may be the results of the differences in sample size between years (Figure 6). Breeding bird survey data shows an increase in the species in 1994 and 1995, but a sharp drop in 1996 (Figure 18). Although the data is highly variable, pine

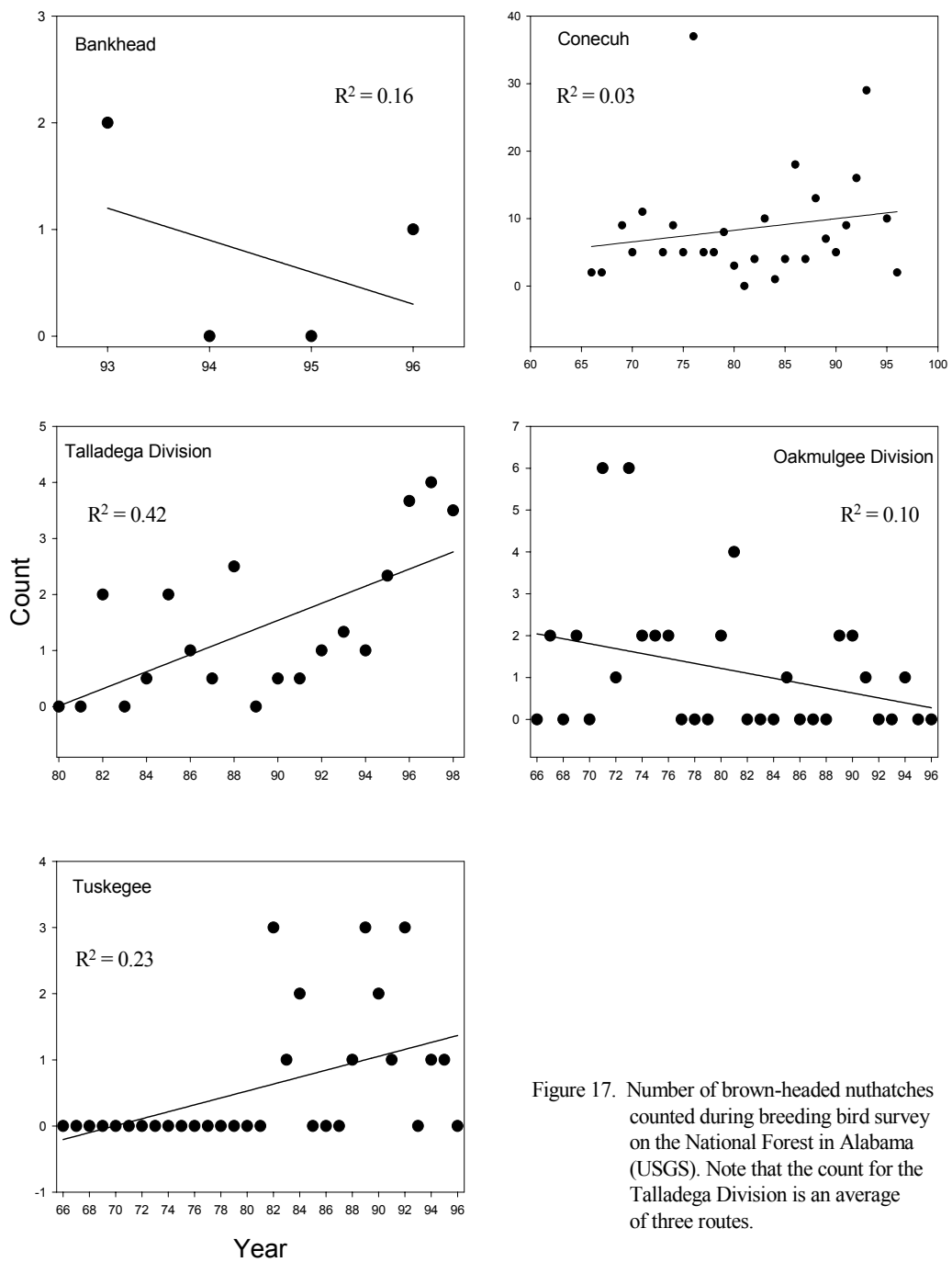


Figure 17. Number of brown-headed nuthatches counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

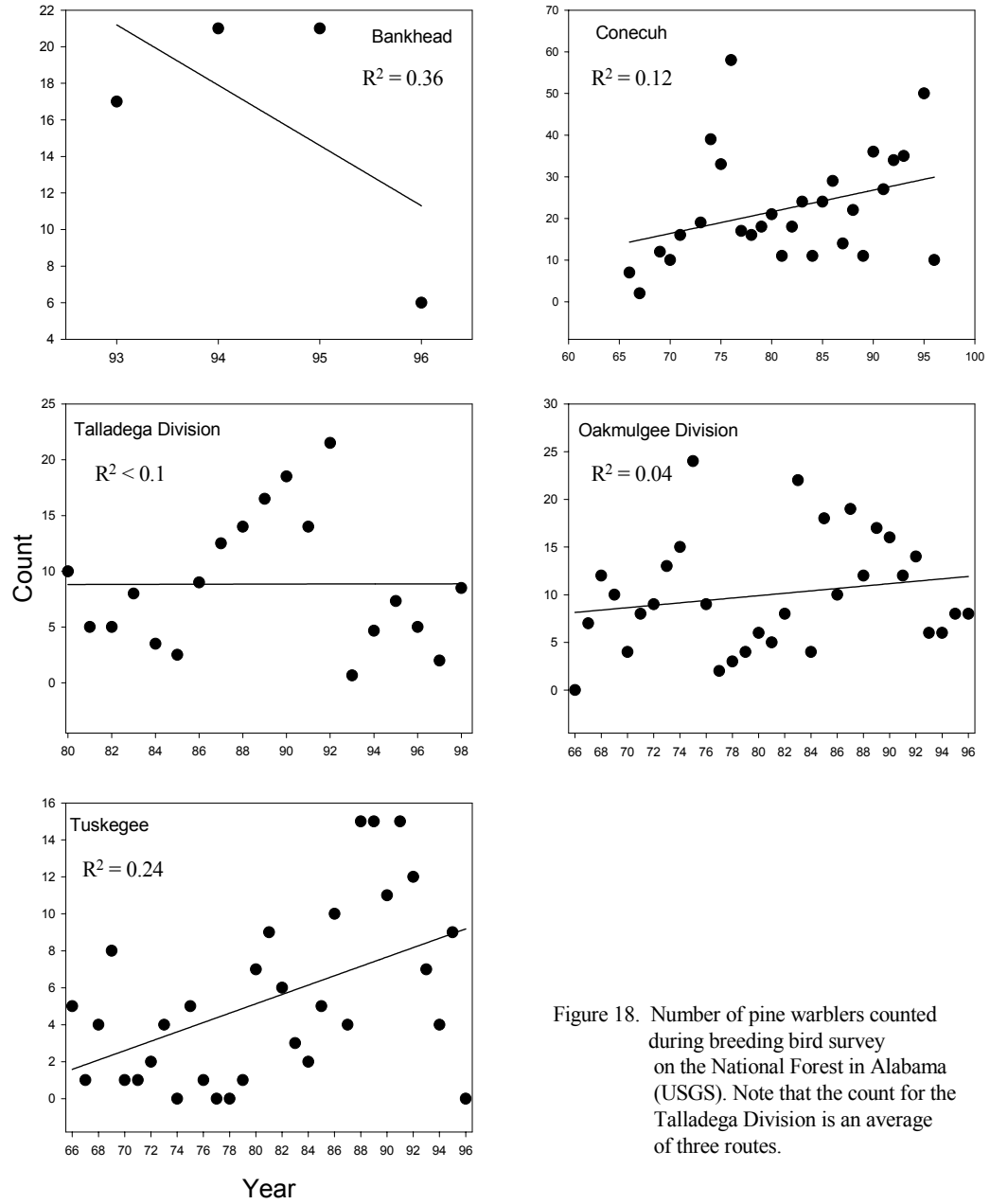


Figure 18. Number of pine warblers counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

warbler populations appear to be increasing on the Conecuh and Tuskegee National Forest and on the Oakmulgee Division (Figure 18). Although there was a prominent rise and fall in pine warbler counts between 1985 and 1993, the overall population on the Talladega Division appears to be stable (Figure 18).

Red-cockaded Woodpecker

The Red-cockaded woodpecker (RCW, *Picoides borealis*) was declared an endangered species in the late 1970's. From the time of its listing to the present, data on the RCW and its colony sites on National Forests in Alabama has been collected. Standards and guidelines for monitoring and managing the RCW have been refined through the years by new scientific information and consultations with the U.S. Fish and Wildlife Service. Monitoring data from 1990 through 1998 has followed or exceeded guidelines set forth in the Regional RCW EIS.

The red-cockaded woodpecker population Tuskegee National Forest was lost in the late 1970's or early 80's. This National Forest was not considered in the Regional RCW environmental impact statement (EIS).

The last Red-cockaded woodpeckers observed on the Bankhead National Forest were in 1994. Searches since 1994 have failed to find RCWs on this forest.

Currently, there are four active colony sites on the Talladega Division and 14 active colony sites on the Conecuh National Forest. These two populations are considered in the most "Extreme Risk" of extirpation on the National Forest in Alabama. While numbers of red-cockaded woodpeckers on these two National Forests are very low, their numbers have remained relatively stable for the last nine years. Each colony site on these two units is monitored on an annual basis.

The Oakmulgee Division currently has 128 active RCW colonies. This population is considered stable and is used as a donor population in the RCW recovery program.

Standards require at least 25% of the known colony sites in a population of this size to be checked annually. Oakmulgee division personnel have been checking 40 - 50 % of the sites each year and a 100% survey should be completed by the 2000.

Pileated Woodpecker

Pileated woodpeckers (*Dryocopus pileatus*) are a cavity dependent species that inhabits mature upland hardwoods and, to a lesser extent, mature pine stands. CISC data indicates an increase in mature hardwood habitat but does not note cavity availability.

Pileated woodpeckers were not observed in any of the BBP on the Bankhead National Forest in 1997 but an average of 0.1 were observed per plot in 1998 and 1999 (Figure 6). All BBS data collected on pileated woodpeckers is highly variable and thus difficult to interpret. Linear regressions indicate a declining trend on the Bankhead and Tuskegee National Forest and on the Talladega Division and a slight upward trend on the Conecuh National Forest and the Oakmulgee Division (Figure 19).

Broad-winged Hawk

The Broad-winged hawk (*Buteo platypterus*) is a predatory species that frequents mature upland hardwood. Breeding Bird Surveys and BBP are probably not effective methods for estimating broad-winged hawk populations because this species are caring for their young, and thus less vocal, when these surveys conducted.

Broad-winged hawks were not observed in any of the BBP on the Bankhead National Forest in 1997 but an average of 0.02 were observed per plot in 1998 and 1999 (Figure 6). Breeding bird surveys report the presence of three broad-winged hawks each

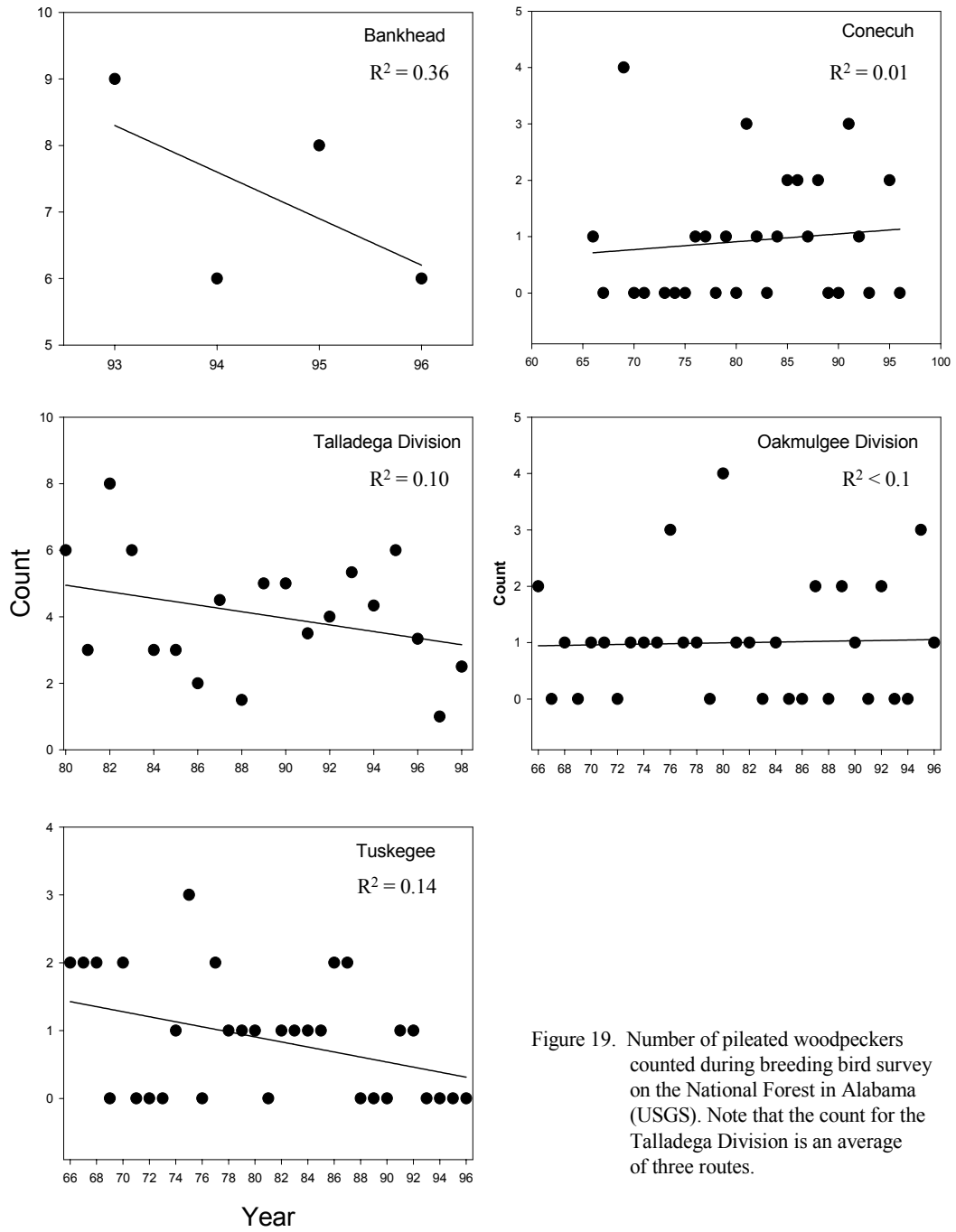


Figure 19. Number of pileated woodpeckers counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

year from 1993 to 1996 with the exception of 1995 when only one individual was observed (Figure 20).

Observations on the Talladega Division ranged from zero to six individuals (Figure 20). Although linear regression analysis indicated a downward trend, there were too few observations to be reliable. Similarly, BBS data collected on the Conecuh National Forest and the Oakmulgee Division include very few individuals; thus, population trends cannot be estimated (Figure 20).

Abundance rating from <http://www.ibird.com> gives Alabama the highest ranking for broad-winged hawk “Seen daily in good numbers in several habitats and seasons. Therefore it is reasonable to assert that even though our monitoring methods do not often account for this species, it is abundant in Alabama. As previously stated, current monitoring methods are not effective in estimating population numbers for this species primarily due to the timing of field surveys.

Wood Thrush

CISC data indicates an increase in mature hardwood habitat in the last 16 years. Because wood thrush (*Hylocichla mustelina*) require mature hardwoods, the increase in this habitat type should have resulted in an increase in wood thrush populations. The general trend on the National Forest in Alabama, however, is decreasing populations.

Wood thrush observations increased in the Bankhead National Forest BBPs in 1998 but remained unchanged in 1999 (Figure 6). Although the BBS data is highly variable between years, linear regressions indicate a downward trend for populations on the Bankhead, Talladega (both divisions), and the Tuskegee National Forests (Figure 21).

The only positive trend was observed on the Conecuh National Forest (Figure 21). The data, however, exhibit considerable annual variation.

Hooded Warbler

The hooded warbler (*Wilsonia citrina*) requires mature hardwoods. The reported increase in mature hardwood habitats appeared to have a mixed effect on hooded warblers. The mean number of hooded warblers observed in the BBPs on the Bankhead National forest increased from 0.11 to 0.15 between 1997 and 1999 (Figure 6). Hooded

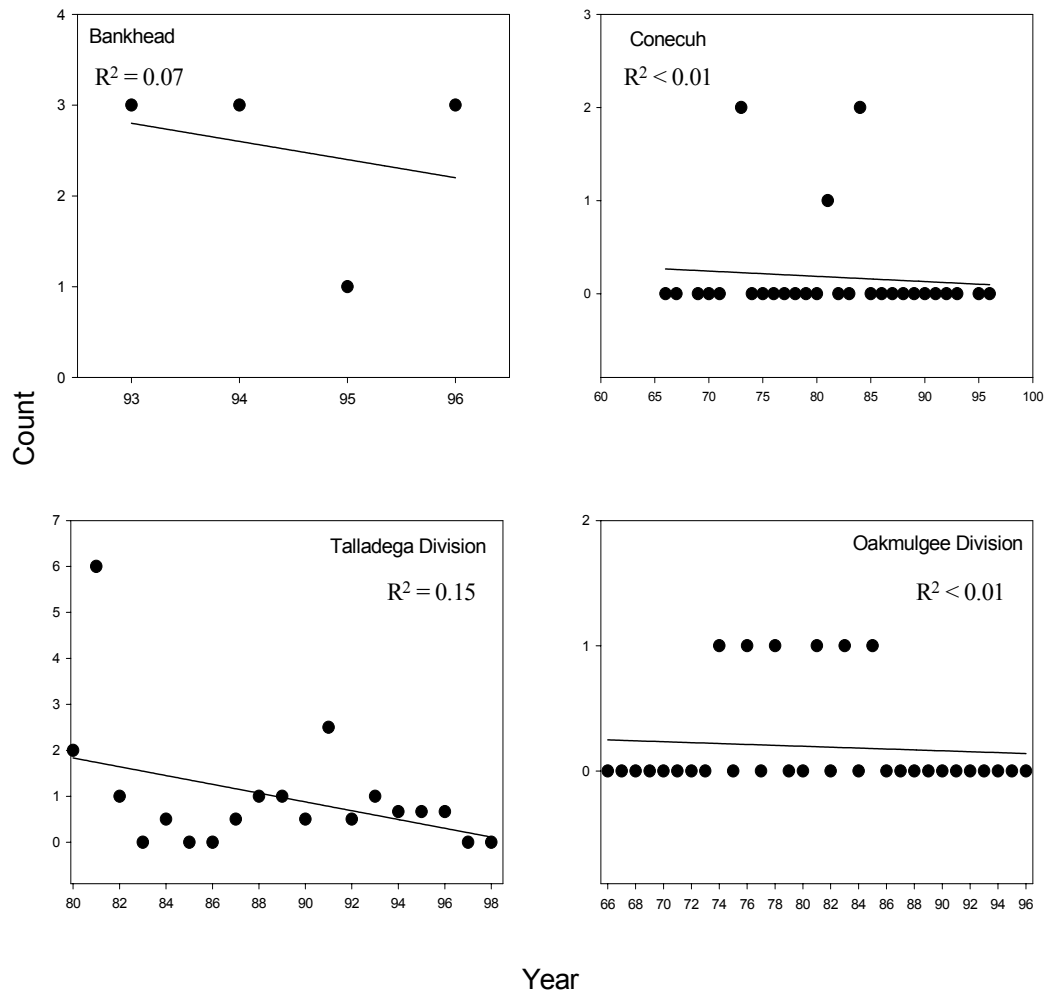


Figure 20. Number of broad-winged hawks counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

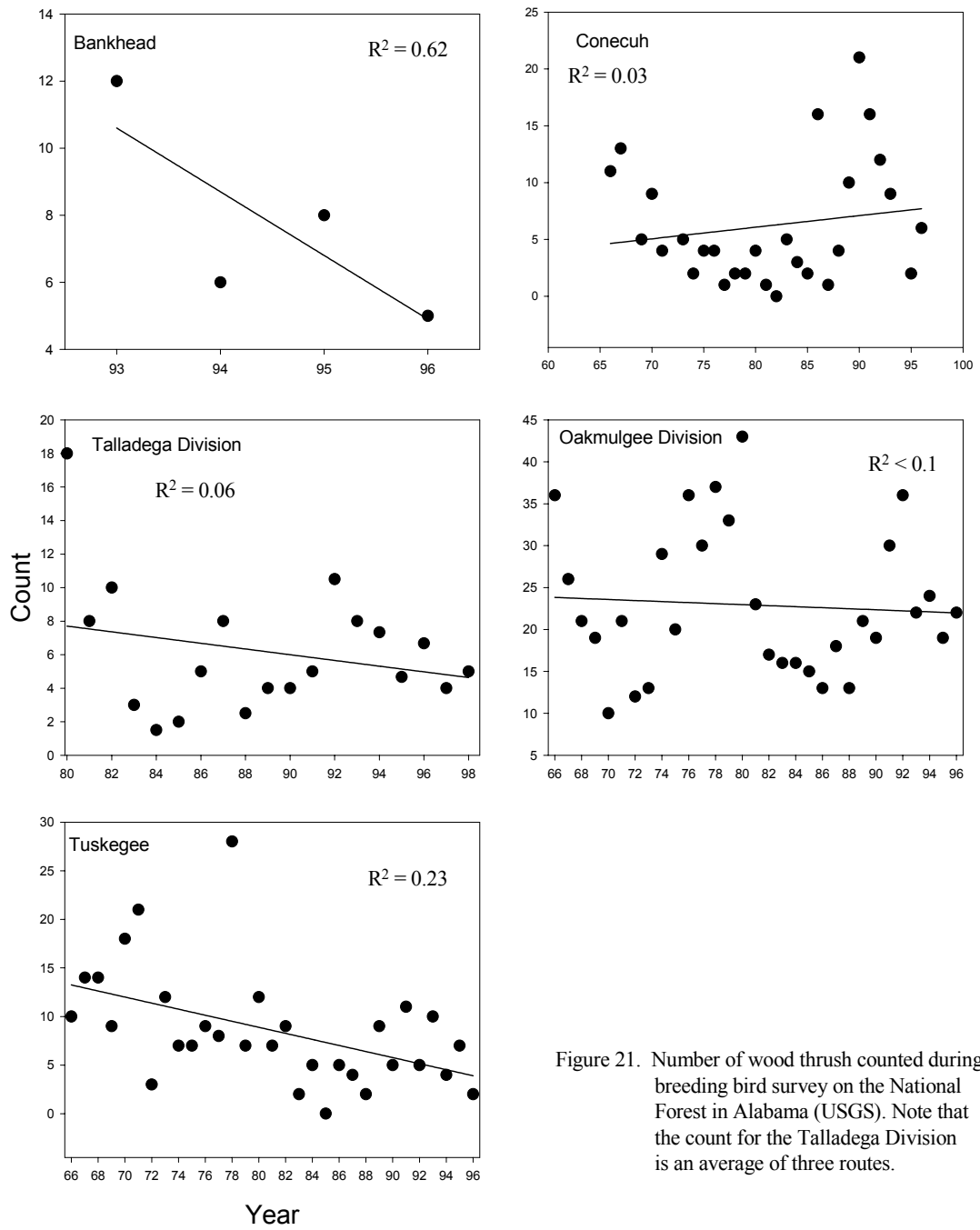


Figure 21. Number of wood thrush counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

warbler observations during BBS on the Bankhead National forest reached a high of five individuals in 1995 but dropped to a low of one in 1996 (Figure 22).

The data collected during BBS demonstrates high variation between years. Linear regressions indicate negative trends on the Conecuh and Tuskegee National Forest and positive trends on the Talladega and Oakmulgee Divisions (Figures 22).

American Redstart

Habitat requirements for the American redstart (*Setophaga ruticilla*) are similar to those of the Hooded warbler. Both of these species require mature hardwoods. Breeding bird surveys and breeding bird points were not effective in detecting this small fidgety bird even though it is considered one of the most abundant warblers in North America. It is difficult to identify from its vocalizations because it can sound like other species, such as the hooded warbler or the black and white warbler. The American redstart populations are considered stable in the boreal and Appalachian regions (<http://birdsource.cornell.edu>).

Barred Owl

The Barred owl (*Strix varia*) requires bottomland hardwood habitat and nest in tree cavities. Because barred owls are nocturnal, BBS and BBP, which are conducted during the daylight hours, are probably ineffective.

No barred owls were observed during the BBP or BBS on the Bankhead National Forest. One individual was observed on the Conecuh National Forest in 1995 (Figure 23). No barred owls were observed on the remaining National Forest during BBS in the majority of year the surveys were conducted. Maximum counts ranged from zero to 1.5 (mean) on the Talladega Division, zero to three on the Oakmulgee Division, and zero to two on the Tuskegee National Forest (Figure 23).

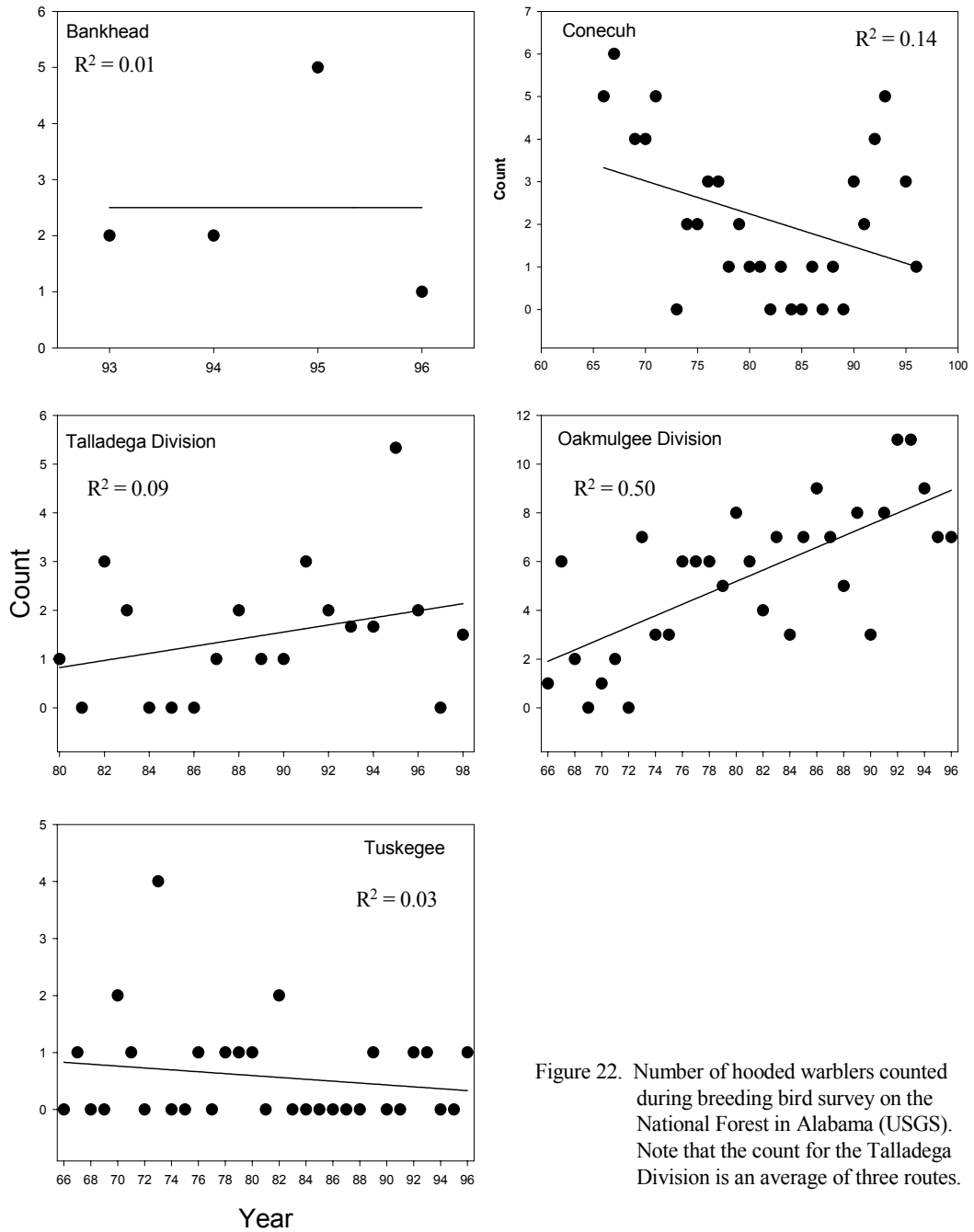


Figure 22. Number of hooded warblers counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

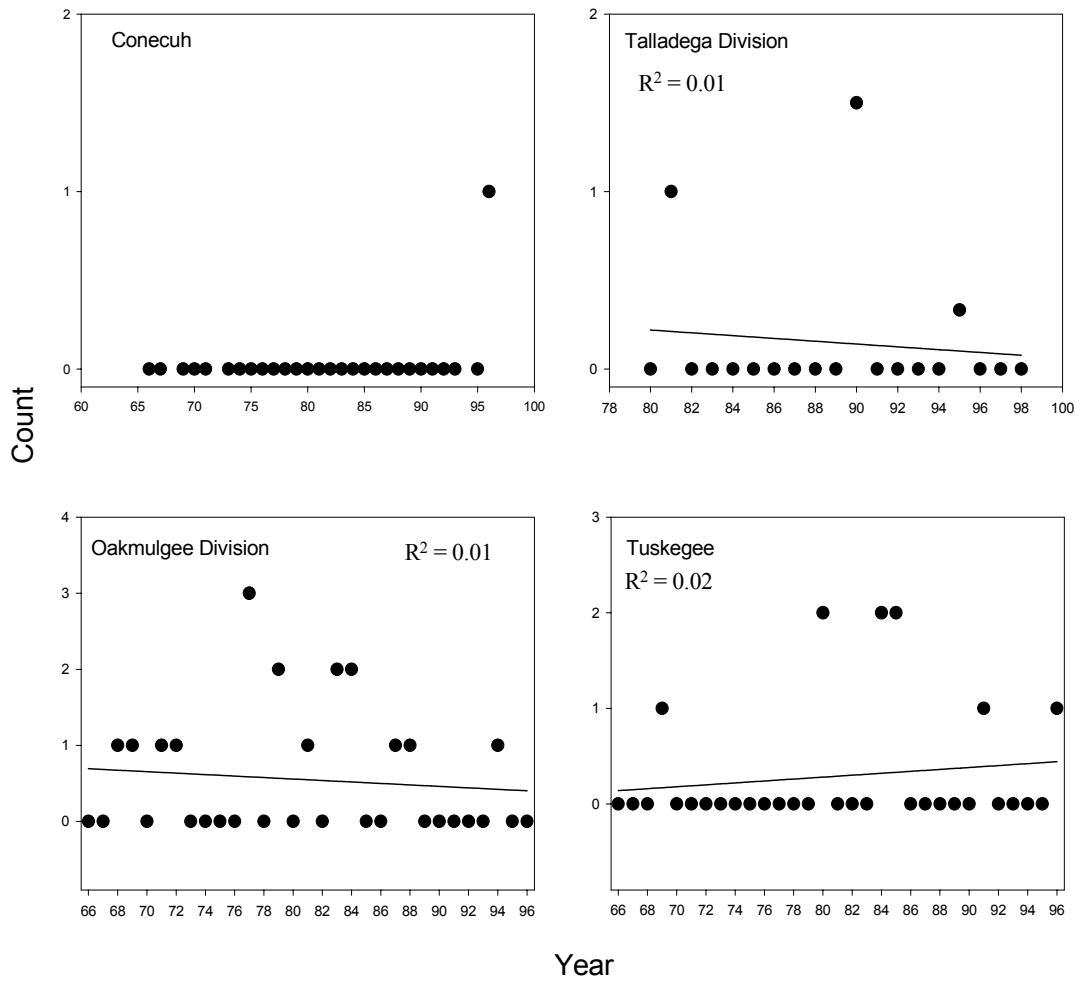


Figure 23. Number of barred owls counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

Kentucky Warbler

The Kentucky warbler (*Oporornis formosus*) is a bottomland hardwood species. This species was recorded on BBS for all five units of National Forest in Alabama. In general, monitoring data indicates that Kentucky warblers are declining on the National Forest in Alabama.

The number of Kentucky warblers observed in BBP on the Bankhead National Forest declined in the years following the 1997 surveys (Figure 6). Three individuals were observed during the BBS of 1993, 1994, and 1996: one was observed in 1995 (Figure 24).

The Shoal Creek BBS data indicates a slight decline in numbers of Kentucky warbler from 1980 to 1998 (Figure 24). The data from the Oakmulgee Division shows high variability in the number of Kentucky warblers observed each year; however, this population appears to be at a stable (Figure 24).

Data from the Tuskegee National Forest shows no Kentucky warblers observed on a BBS since 1986 (Figure 24). This indicates a more comprehensive survey for this species is needed on the Tuskegee National Forest. Only one Kentucky warbler has been observed on the Conecuh since 1965 (Figure 24).

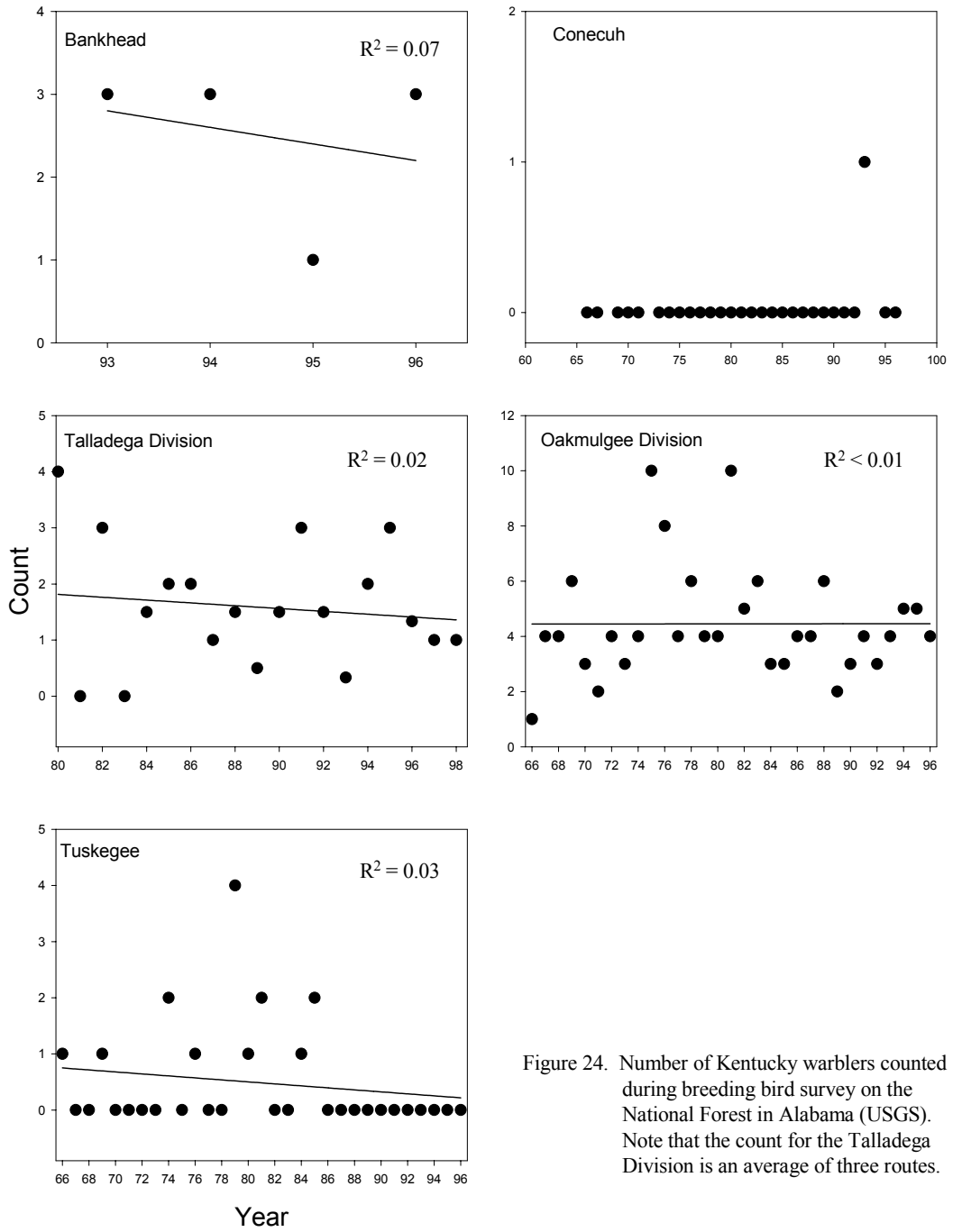


Figure 24. Number of Kentucky warblers counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

Swainson's Warbler

The Swainson's warbler (*Limnothlypis swainsonii*) requires cane thicket habitat. This habitat type is not abundant on any National Forests in Alabama. Further, BBS are road routes and do not generally go through cane thickets as road construction would alter this habitat type. As a result, this species has been reported only from the Talladega National Forest.

Swainson's warbler appears to be the most common on the Oakmulgee Division and the population there appears to be increasing (Figure 25). Only one individual was observed on the Talladega Division since 1980 (Figure 25).

Eastern Screech Owl

Eastern screech owls *Otus asio* are nocturnal. Therefore BBS and BBP, which are conducted during the daylight hours, are probably ineffective. Screech owls are also cavity nesters and are often found nesting in wood duck house. Data collected during wood duck box surveys and maintenance on the Talladega Division indicates the percentage of wood duck boxes used by screech owls has increased in the 1990s (Figure 26).

Wood Duck

The wood duck (*Aix sponsa*) is a cavity nester and associated with bottomland hardwoods. The wood duck life cycle is directly tied to various aquatic habitats (i.e. lakes, rivers, swamps, etc.) and probably rarely encountered in surveys of BBP or during BBS. Wood ducks were observed in low numbers during BBS and only on the Talladega and Oakmulgee Divisions.

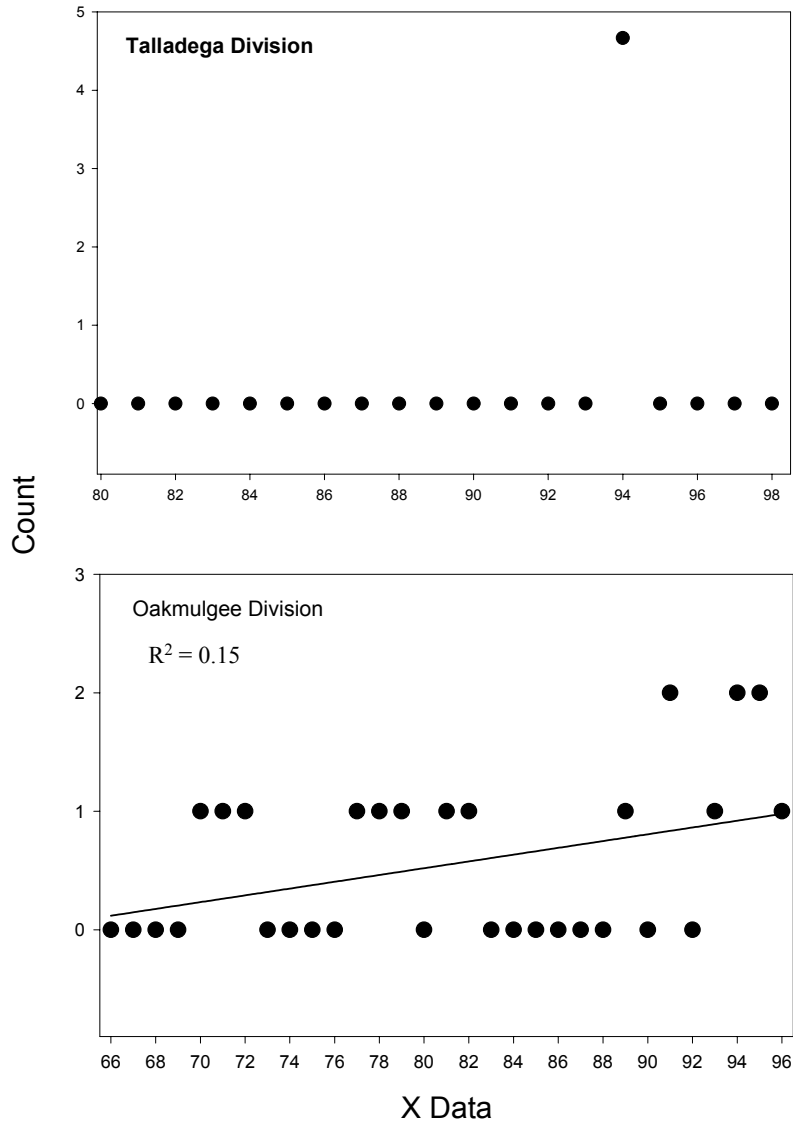


Figure 25. Number of Swainson's warblers counted during breeding bird survey on the National Forest in Alabama (USGS). Note that the count for the Talladega Division is an average of three routes.

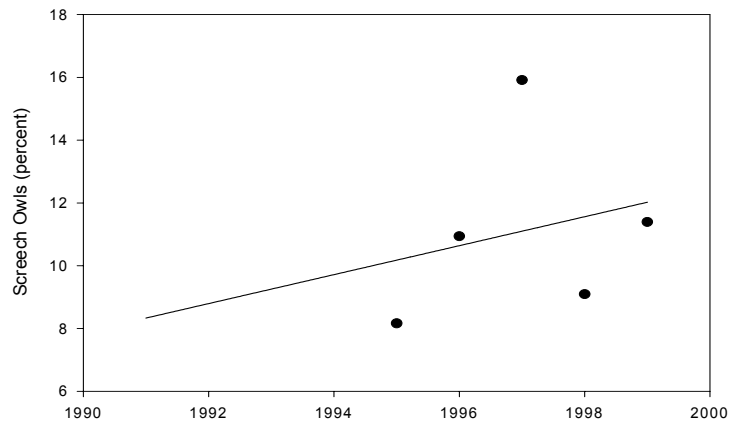


Figure 26. The percentage of screech owls occupying wood duck boxes on the Talladega Division.

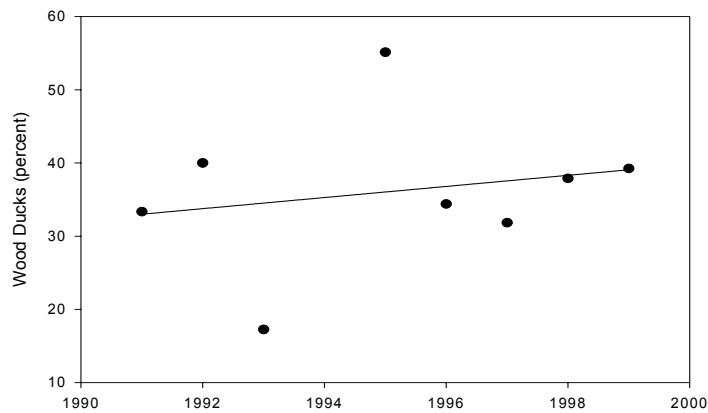


Figure 27. The percentage of wood duck boxes used as nest sites for wood ducks on the Talladega Division.

Surveys of wood duck boxes on the Talladega Division indicate that the percentage of these boxes used by wood ducks has not substantially changed during the last nine years (Figure 27). The only exceptions were in 1993 when the use of wood duck boxes dropped below 20 percent and 1995 when use increase to greater than 50 percent (Figure 27).

Mammals

Four mammals were chosen as MIS on the National Forest in Alabama (Table 2). The primary methods of data collection were harvest records for white-tailed deer and squirrel (Alabama Department of Conservation and Natural Resources: Game and Fish Division) and spotlight surveys for deer (USDA Forest Service).

Table 2. Mammal species, and their habitat associations, used as management indicator species on the National Forests In Alabama.

Common Name	Early Succession	Mature Forest	Mature Forest	Mature Forest	Cane Thickets
	< 10 years old	Conifer	Upland Hardwoods	Bottomland Hardwoods	
White-tailed Deer	X	X	X	X	
Eastern Fox Squirrel		X			
Eastern Gray Squirrel			X	X	
White-footed Mouse	X				
Oldfield Mouse	X				

White-tailed Deer

White-tailed deer (*Odocoileus virginianus*) occupy numerous habitat types (Table 2) but are primarily an ‘edge’ species. As a result, deer populations tend to increase as early successional habitat increases. CISC indicates that the amount of this habitat type has decreased on the National Forest in Alabama in the last 16 years. Nevertheless, there appears to be an overall increase in the number of deer on the forests. This may be due to several factors: 1) prescribed burning that maintains open mature pine stands and creates browse and cover, 2) the influence of surrounding private lands, and 3) the increase in the size of the state’s deer herd.

Changes in deer populations on the National Forest in Alabama were assessed using two types of data: hunter success and spotlight surveys on wildlife management areas (WMA) on the forest. Hunter success data exhibits a large amount of annual variation. Linear regression shows an upward trend in the deer populations on the Bankhead National Forest and the Talladega Division and a downward trend on the Conecuh National Forest and Oakmulgee Division (Figure 28).

Deer spotlight surveys indicate that populations are increasing on the National Forest (Figure 29). The number observed during deer spotlight surveys, however, also varies from year to year.

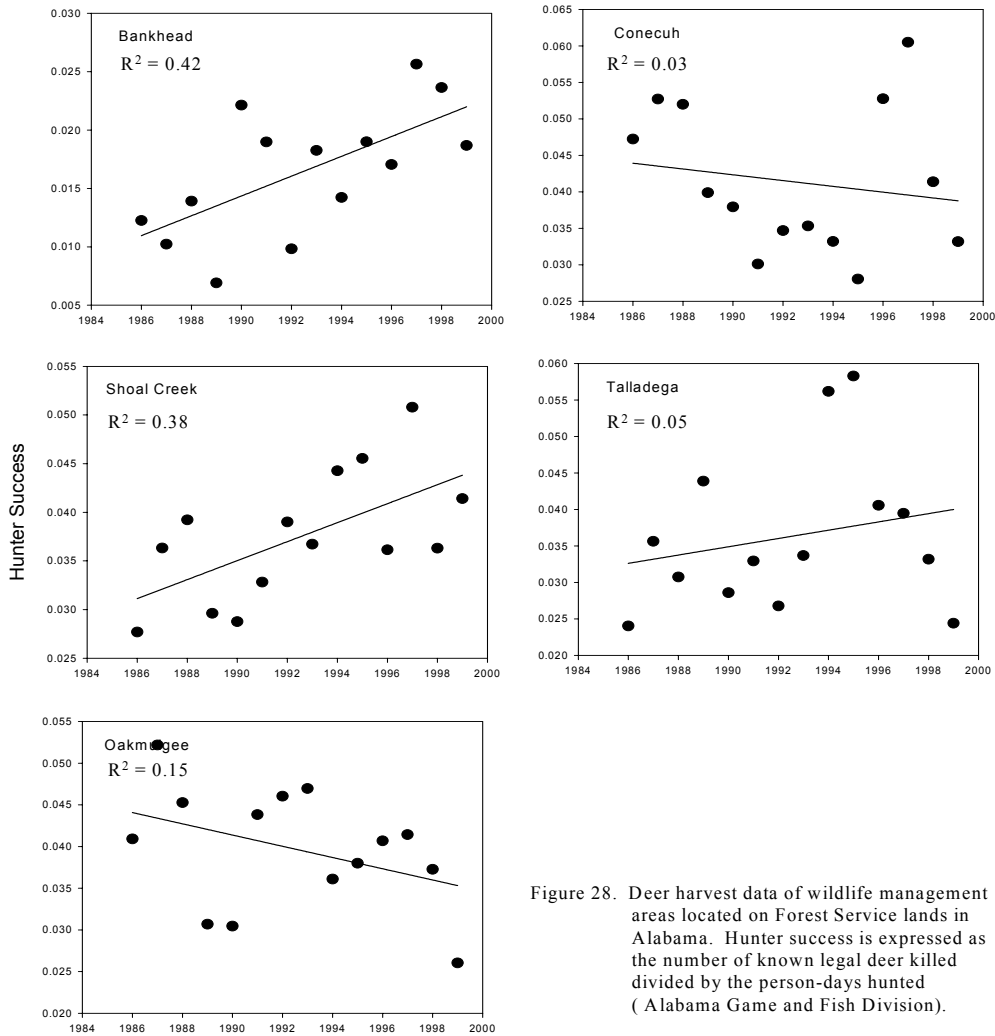


Figure 28. Deer harvest data of wildlife management areas located on Forest Service lands in Alabama. Hunter success is expressed as the number of known legal deer killed divided by the person-days hunted (Alabama Game and Fish Division).

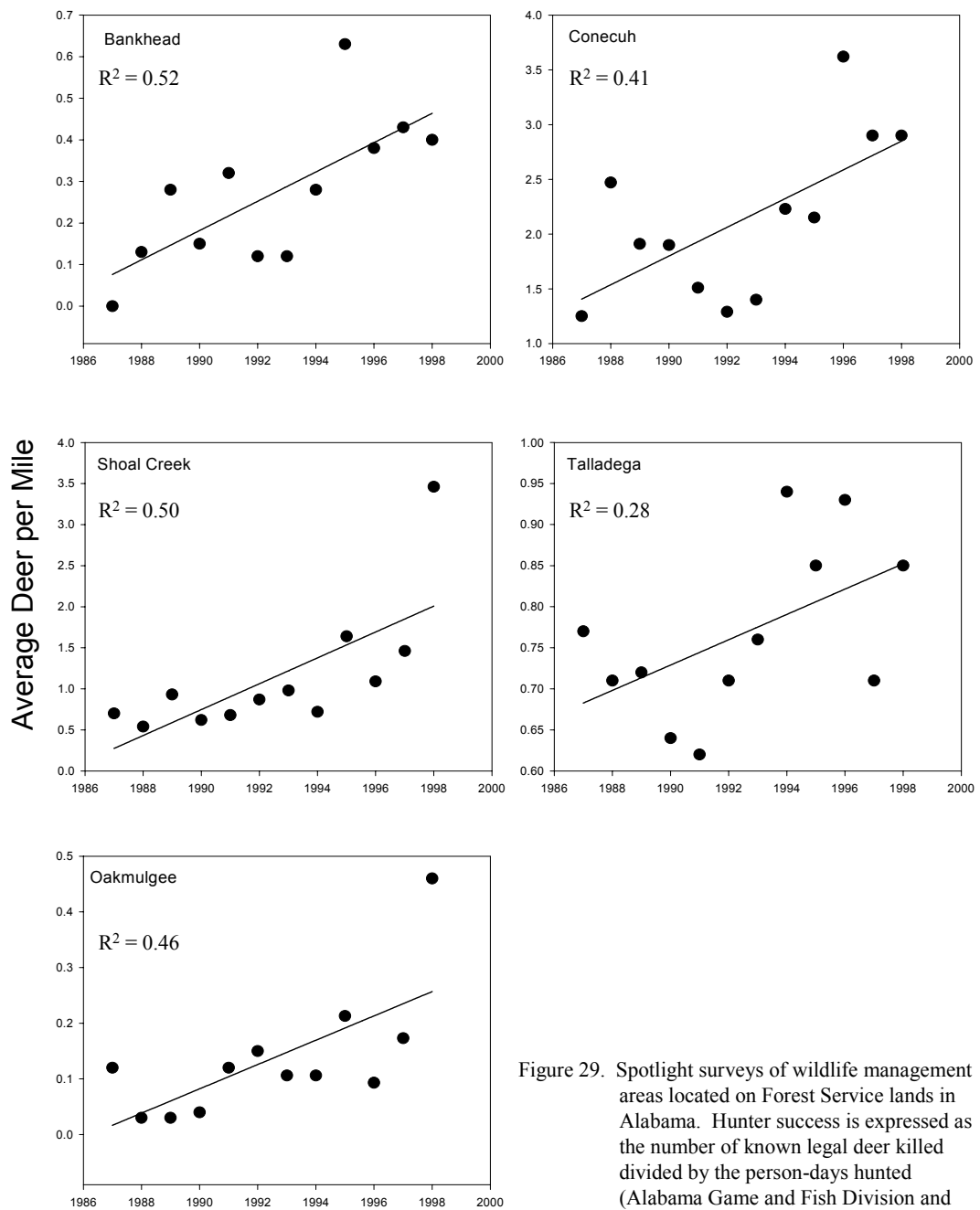


Figure 29. Spotlight surveys of wildlife management areas located on Forest Service lands in Alabama. Hunter success is expressed as the number of known legal deer killed divided by the person-days hunted (Alabama Game and Fish Division and USFS).

Gray and Fox Squirrel

Although gray (*Sciurus caroliniensis*) and fox squirrels (*Sciurus niger*) can be found in numerous habitats (from backyards to golf courses) they are primarily associated with mature forest. Changes in squirrel populations were assessed using harvest data collected on National Forest WMAs. Unfortunately, no distinction was made between the two species. Therefore, the data includes both gray and fox squirrels.

Squirrels appear to be declining on all of the forest except the Talladega, which appears to be stable (Figure 30). As typical of hunter data, success varies between years. The reason for the downward trend in squirrel populations of the National Forest is unclear, especially when CISC data indicates an increase in suitable habitat. One reasonable explanation is inadequate data collection methods. This method assumes that the information provided by the hunter is accurate.

White-footed Mouse

White-footed mouse (*Peromyscus leucopus*) is a medium sized mouse with large ears that is commonly found in upland mature forests with downed woody debris, rocks and/or brush piles. It is also found in marshes, canebrakes and brushy fencerows. The white-footed mouse is a nocturnal species found in the mountains and piedmont regions of northern Alabama and the eastern United States. This species is not found in the coastal plains area.

Monitoring data on the National Forests in Alabama is not available for this species because monitoring efforts have only occurred during daylight hours, and this species is seldom active during the daytime. This species is rated as very abundant, with no special status (Natureserve 2001).

Oldfield Mouse

Oldfield mouse (*Peromyscus polionotus*) is a small burrowing mouse that lives in old fields and beaches throughout coastal Alabama, Georgia, South Carolina and northern and eastern Florida. The oldfield mouse is common and abundant throughout most of its range . Like the white-footed mouse, this species is primarily nocturnal, therefore no monitoring data is currently available for this species.

If these mice are to be kept as MIS, monitoring protocols will need to be revised to survey for these species at night.

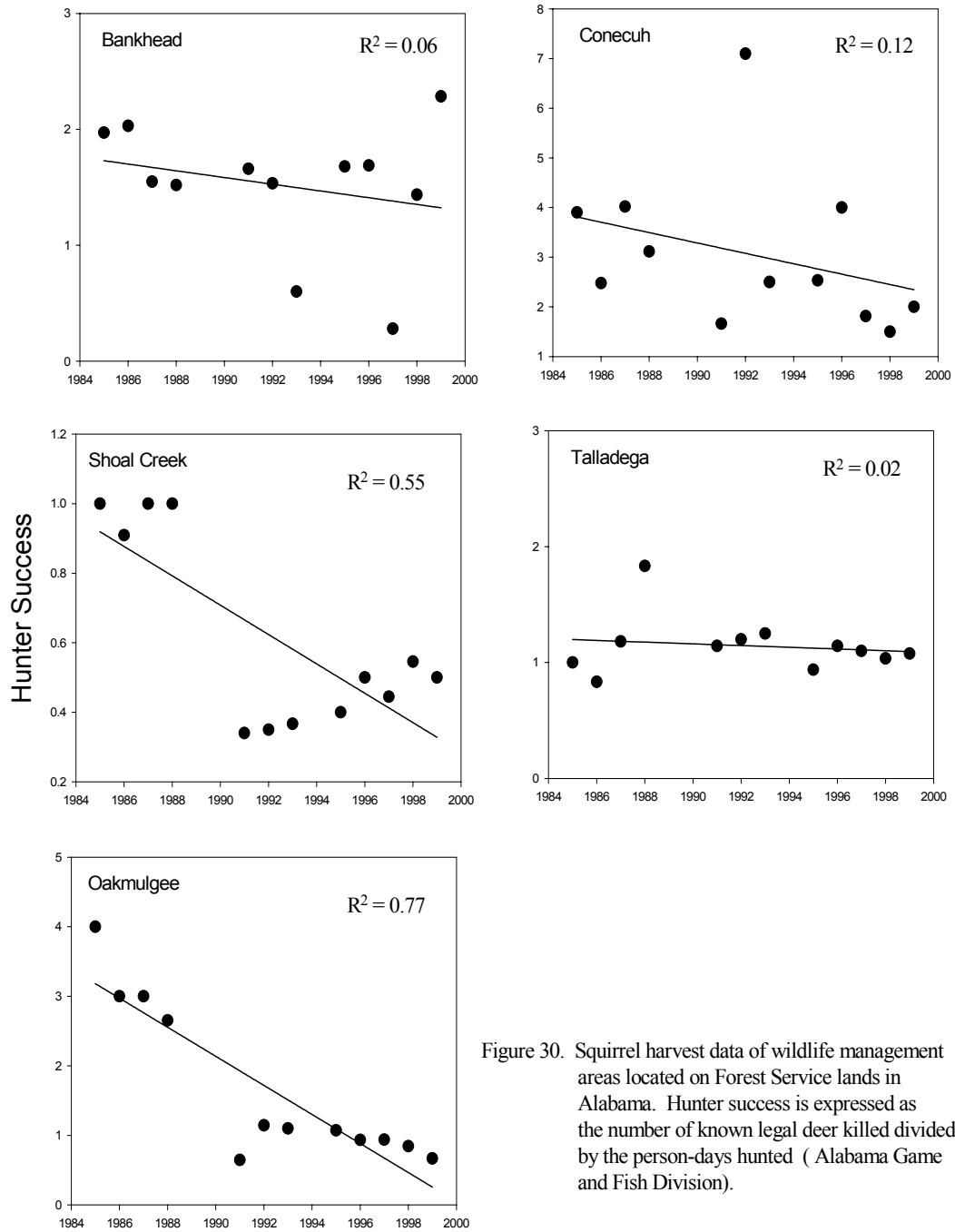


Figure 30. Squirrel harvest data of wildlife management areas located on Forest Service lands in Alabama. Hunter success is expressed as the number of known legal deer killed divided by the person-days hunted (Alabama Game and Fish Division).

Reptiles and Amphibians

Two reptiles and three amphibians were chosen as indicators of habitat on the National Forest in Alabama: flattened musk turtle (*Sternotherus depressus*), gopher tortoise (*Gopher polyphemus*), flatwoods salamander (*Ambystoma cingulatum*), seepage salamander (*Desmognathus aeneus*), and dusky gopher frog (*Rana capito sevosa*). Seepage salamander was chosen as an indicator of mature upland hardwood habitat (Talladega and Oakmulgee Divisions) and flatwoods salamander as an indicator of mature conifer forest (Concuh National Forest). Gopher tortoise and dusky gopher frog were selected as indices of the sandhills community on the Concuh National Forest. The flattened musk turtle was added to the MIS list in Plan amendment #7 and is occurs only in the Warrior River Basin in northern Alabama (Bankhead National Forest).

Seepage Salamander

Seepage salamander (*Desmognathus aeneus*) is a tiny (1.75 - 2.25 inches [44-57mm] in length) salamander that is reddish bronze in color with a median series of dark irregular spots. The belly is heavily mottled with dark pigment. These salamanders are found in shaded seepage areas in moist deciduous or semideciduous ravines. They live beneath the leaf litter and are not found out in the open. They are clearly a terrestrial species and never voluntarily take to the water (Donovan and Folkerts 1972).

Seepage salamanders are very difficult to detect due to their limited distribution, size and reclusive nature. Although the National Forests in Alabama has not collected monitoring data on this species, we are working with partners and cooperators on a special project to inventory for this species.

Flatwoods Salamander

Three flatwoods salamander larvae were reported from one locality on the Conecuh National Forest in 1980 (Mount 1980). A 1992 survey of potential breeding ponds for flatwoods salamanders found no evidence of the species (Bailey and Jensen 1993). Flatwoods salamander have not been found during subsequent surveys for dusky gopher frogs (1993-95), even though all amphibians observed were reported. The rarity, or absence of the flatwoods salamander on the Conecuh National Forest is not understood. Nevertheless, Bailey and Jensen (1993) reported the Conecuh National Forest to be the northern most periphery of the flatwoods salamander range and that minimum winter temperatures may limit their distribution. Palis (Bailey and Jensen 1993) also suggested that the cypress ponds on the Conecuh are too deep and lack sufficient vegetative cover to provide optimal habitat for this species.

Dusky Gopher Frog

Prior to 1980 the dusky gopher frog was known only from one specimen at one locality on the Conecuh. In 1980, Mount (1980) recorded a chorus of five gopher frogs at Salt Pond. Attempts locate other breeding populations were unsuccessful. In 1988 a monitoring program was developed in cooperation with Auburn University, University of Montevallo, and interested individuals to investigate breeding activities on the Conecuh Ranger district. Breeding site were monitored at Salt Pond from 1988 to the present and Nellie Pond from 1993 to the present. Both site have experienced and increase in gopher frog egg masses overtime except for a sharp decline in salt Pond in 1997. The number of egg masses reported dropped from 183 in 1995 to 48 in 1997 but increased to 163 in 1998 (Figure 31).

Gopher Tortoise

An early assessment of gopher tortoise populations on the Conecuh Ranger District found them to be 'extremely low' relative to the carrying capacity (Mount 1980). Monitoring data, collected between 1986 and 1990, showed that active burrows increased from 91 in 1988 to 137 in 1989. By 1990 the number of active burrows decreased to 114 (Figure 32). An increase in the number of small burrows in 1990 suggests that reproduction was more successful than in 1988. A cooperative study with Auburn University was established in 1991 to investigate the relationship between forest thinning and prescribed fire and burrow abandonment. The study concluded that stand thinning to a basal of 30m²/ha and prescribed growing season burns should improve habitat quality for this species (Aresco and Guyer 1999); thus, the longleaf pine restoration efforts in place on the Conecuh Ranger District should have a positive effect on the distribution and abundance of the gopher tortoise.

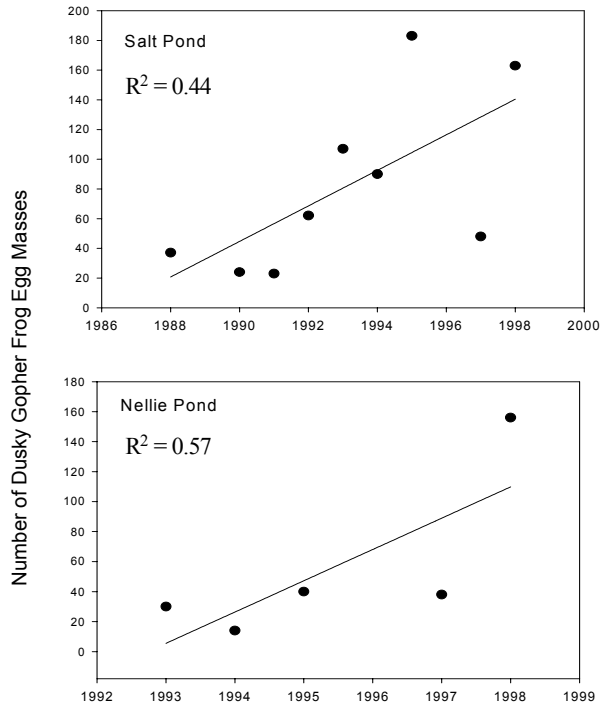


Figure 31. Number of dusky gopher frog egg masses counted each year on the Conecuh National Forest.

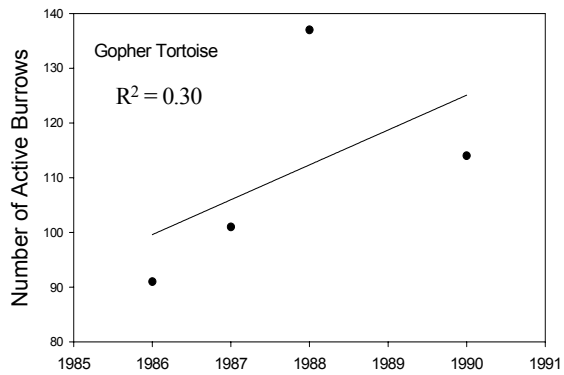


Figure 32. Number of active gopher tortoise burrows surveyed on the Conecuh National Forest.

Flattened Musk Turtle

The flattened musk turtle was listed as threatened by the U.S. Fish and Wildlife Service in 1987. Numerous studies (i.e. life history, disease, and habitat and habitat degradation) as well as status surveys have been conducted on the flattened musk turtle in the last 20 years. In a recent study, Schnuelle and Guyer (1996) reported a decline in trapping success in two of three streams on the Bankhead National Forest, relative to three earlier studies conducted in 1981, 1983, and 1986. A similar pattern was observed for three streams outside National Forest lands. Although the authors suggest a possible decline in the population, they also point out that precipitation, temperature, and turtle movement affects trapping success. Because of the variability of trapping success, a reliable population trend is difficult to establish and presents problems in monitoring flattened musk turtle populations.

Fish

Nineteen species of fish were initially chosen as indicators of habitat alterations potentially caused by Forest Service management activities (USFS 1985). Two species, Largemouth bass (*Micropterus salmoides*) and bluegill (*Lepomis macrochirus*) were chosen as indicators of lake and pond habitat quality as well as indicators of attainment of public demand for recreational fishing activities. The 17 remaining species (Table 3) were chosen as indicators of habitat quality in streams.

Table 3. Management Indicator Species for streams and rivers (lotic), and lakes and ponds (lentic) of the National Forest in Alabama (USFS 1985).

SUBREGION/HABITAT ¹ Common Name	Scientific Name	Ranger District ²	Drainage or Basin ³
WIDE SPREAD LENTIC:			
Largemouth bass	<i>Micropterus salmoides</i>	Bank, Oak, Tal, SC, Tus, Con	Almost all
Bluegill	<i>Lepomis macrochirus</i>	Bank, Oak, Tal, SC, Tus, Con	Almost all
WIDE-SPREAD STREAMS:			
Least Brook Lamprey	<i>Lampetra aepyptera</i>	Bank, Oak, Tal, SC, Tus	TN, BW, CR, BC, CS, TR, UC
Speckled Darter	<i>Etheostoma stigmaeum</i>	Bank, Oak, Tal, SC, Tus	BW, CR, AR, CS, TR, UC
Speckled Madtom	<i>Noturus leptacanthus</i>	Bank, Oak, Con, Tus	BW, CR, AR, CH, YR, BC, UC

TENNESSEE VALLEY:			
Rock Bass	<i>Ambloplites rupestris</i>	Bank	TN
Rosyside Dace	<i>Clinostomus funduloides</i>	Bank	TN
Black Darter	<i>Etheostoma duryii</i>	Bank	TN
Flame Chub	<i>Hemitremia flammea</i>	Bank	TN, BW
UPPER MOBILE HIGHLANDS:			
Silverstripe Shiner	<i>Notropis stilbius</i>	Bank, Tal, SC	BW, CS, TR
Redeye Bass	<i>Micropterus coosae</i>	Bank, Tal, SC	BW, CS
Banded Sculpin	<i>Cottus carolinae</i>	Bank, Oak, Tal, SC	TN, CR, AR, CS, TR
Black Madtom	<i>Noturus funebris</i>	Oak, Tal, SC	BW, TR
Rough Shiner	<i>Notropis baileyi</i>	Oak, Tus	BW, CR, AR, UC
COASTAL PLAIN:			
Sailfin Shiner	<i>Pteronotropsis hypselopterus</i>	Con	CH, YR, BC
Gulf Darter	<i>Etheostoma swaini</i>	Con	CH
Redeyed Chub	<i>Notropis harperi</i>	Con	YR
Southern Brook Lamprey	<i>Ichthyomyzon gagei</i>	Con	CH, YR
Brown Darter	<i>Etheostoma edwini</i>	Con	YR, BC

¹ Stratification of species assemblages is based upon a modification and synthesis of physiographic provinces (Fenneman 1937; Hunt 1967), river basins, and major aquatic ecoregions as evident within Alabama (Metee, O'Neil, and Pierson 1996; Boschung 1992).

² Districts: Bank = Bankhead; Oak = Oakmulgee; Tal = Talladega; SC = Shoal Creek; Tus = Tuskegee.

³ River drainages: TN = Tennessee River; BW = Black Warrior River; CR = Cahaba River; AR = Alabama River; CH = Conecuh River; YR = Yellow River; BC = Blackwater Creek; CS = Coosa River; TR = Tallapoosa River; UC = Uphapee and Choctafaula Creeks.

Ponds and Lakes

Within the last 20 years (1982-2001), seventeen ponds and lakes on the National Forests in Alabama were surveyed by USFS personnel using electrofishing equipment. Data for all of the electrofished lakes and ponds were combined by Ranger District in order to examine potential population trends at the district and physiographic province levels. In order to provide a basis for comparisons, catch per unit effort was calculated as the number of fish captured divided by the time spent actively sampling.

Table 4. Lakes and Ponds sampled for largemouth bass and bluegill by Ranger District.

Ranger District	Lake/Pond
<u>Bankhead</u>	Brushy
<u>Conecuh</u>	Buck
	Otter
	Ditch
	Blue
<u>Oakmulgee</u>	Payne
<u>Shoal Creek</u>	Sweetwater
	Coleman
	Liberty Hill

	Choccolocco
	High Rock
	Morgan
<u>Talladega</u>	Virginia
	Little Wills
	Mump Creek
	Howard
<u>Tuskegee</u>	Big

Largemouth Bass

Largemouth bass (*Micropterus salmoides*) were originally included as a MIS due to their desirable gamefish status, moderate sensitivity to water quality, and well established monitoring methodology (USFS 1985). However, largemouth bass are generally a heavily exploited species and reside within intensively managed habitat. Population variation can be extreme from year to year and between various bodies of water. If largemouth bass are to be used to track the effects of land management activities, monitoring protocols need to be established in order to avoid interference of unrelated variation and in order to meet statistical requirements. Sampling should be stratified and fixed for each body of water across sequential years.

Largemouth bass populations often exhibited considerable variation between years. Nevertheless, most Ranger Districts showed an increase in numbers over the past 15 years (Figure 33). One exception in this trend was the lakes and ponds on the Conecuh National Forest, which showed an overall decrease in largemouth bass numbers (Figure 33).

Bluegill

Bluegill (*Lepomis macrochirus*) were originally included as a MIS due to their desirable gamefish status, moderate sensitivity to water quality, and well established monitoring methodology (USFS 1985). However, bluegill are generally a heavily exploited species and reside within intensively managed habitat. Population variation can be extreme from year to year and between different but nearby bodies of water. If bluegill are to be used to track the effects of land management activities, monitoring protocols need to be

established in order to avoid interference of unrelated variation and in order to meet statistical requirements. Sampling should be stratified and fixed for each body of water across sequential years.

Bluegill population trends also exhibited considerable variation between years. The Bankhead National Forest and Talladega Division exhibited relatively stable to slightly upward trends in bluegill populations, while the Conecuh National Forest, Oakmulgee Division, and Tuskegee National Forest showed downward trends (Figure 34). Only the Shoal Creek Ranger District showed a distinct increase in bluegill numbers over the sampling period (Figure 34).

Streams

Data for all streams sampled were combined by National Forest or Ranger District to examine population trends at the forest/district level. Recent data was not available for some species so population trends may not be current. Catch per unit effort was calculated as the number of fish captured divided by the sampling time. The University of Alabama, using seines, collected most of the data used in this report. Some data collected on the Bankhead National Forest between 1992 and 1995 was collected by USDA Forest Service, Southern Research Station (SRS), Oxford Mississippi using electrofishing gear.

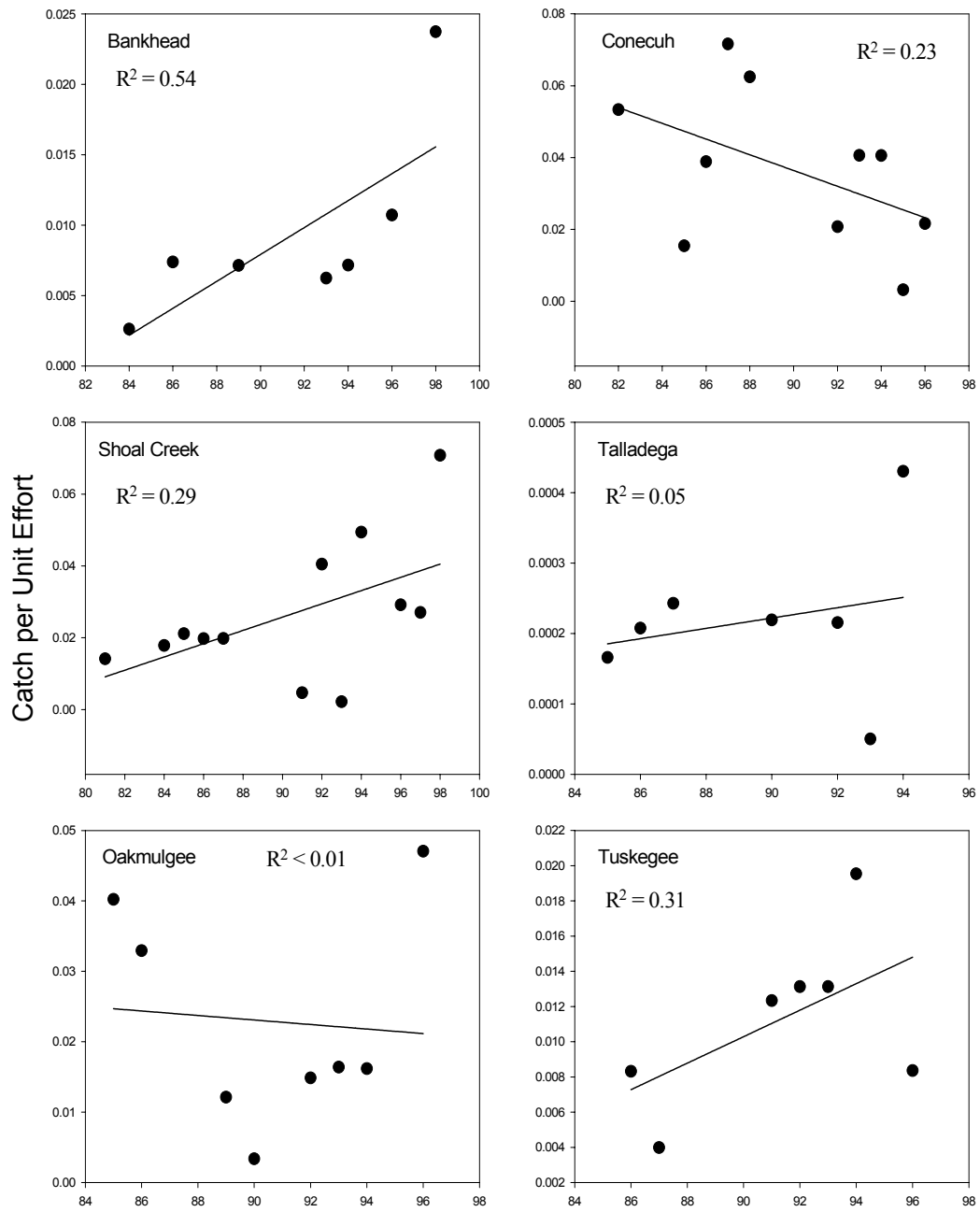


Figure 33. Mean number of largemouth bass captured per minute (catch per unit effort) in ponds on Forest Service lands in Alabama.

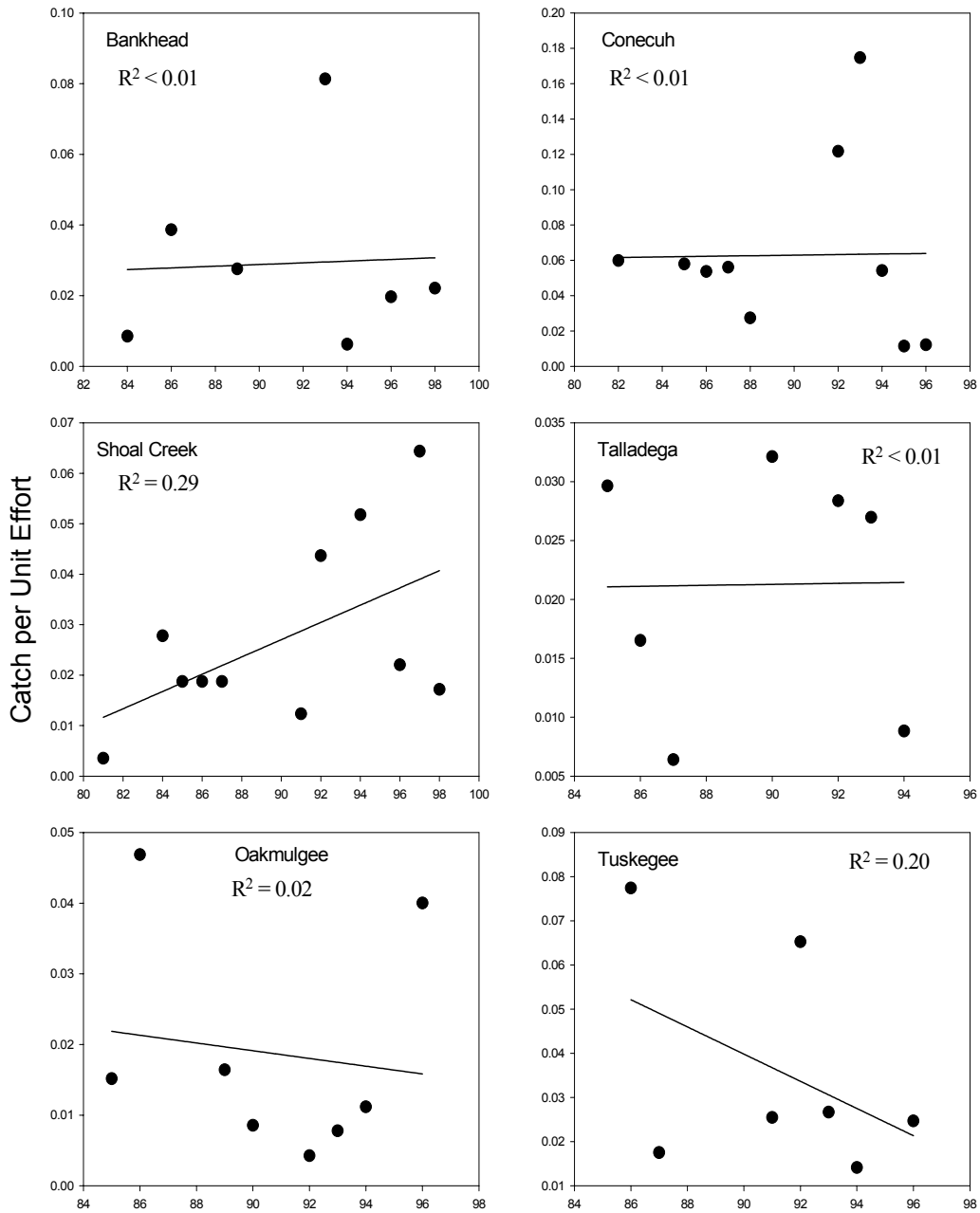


Figure 34. Mean number of bluegill captured per minute (catch per unit effort) in ponds on Forest Service Lands in Alabama.

Wide-spread species: Least Brook Lamprey

Least brook lampreys (*Lampetra aepyptera*) are found in all physiographic and major hydrological regions of Alabama. However, they appear to be in greater abundance within the Cahaba and Coosa River basins and specific to medium sized sandy streams within the Upper Mobile River hydrological region (Mettee et al. 1996). The species would therefore be expected to be in greatest occurrence on the Oakmulgee Division and Talladega National Forest.

Although least brook lamprey were reported to occur on all districts/divisions, the only samples collected by the University of Alabama were on the Oakmulgee Ranger District and occurred in only two years (1974 and 1985). The Southern Research Station, however, collected least brook lamprey ammocoetes in their 1993-95 surveys. Although the data is limited, the trend indicates a decrease in numbers (Figure 35).

Several species of non-parasitic lamprey were initially chosen as MIS due to their vulnerability to siltation of spawning gravels (USFS 1985). This species may not be an ideal MIS, however, given its seasonal variation in abundance and secretive habits that contribute to difficulty in capture or detection.

Wide-spread: Southern Brook Lamprey

The southern brook lamprey (*Ichthyomyzon gagei*) is found within various locations within the upper and lower Mobile River Basin and coastal plain drainages. This species prefers moderate sized streams with sand and gravel substrates.

On the Conecuh Ranger District, the Southern Brook Lamprey population appears to be steady and possibly increasing (Figure 42). Although only one lamprey was captured during each sample, the catch per unit effort indicates an upward trend. Nevertheless, this data should be interpreted with caution because trends cannot be established from data

collected in only three points in time and with such low levels of occurrence per unit of effort.

Several species of non-parasitic lamprey were initially chosen as MIS due to their vulnerability to siltation of spawning gravels (USFS 1985). This species may not be an ideal MIS, however, given its seasonal variation in abundance and secretive habits that contribute to difficulty in capture or detection.

Wide-spread streams: Speckled Darter

Speckled darter (*Etheostoma stigmaeum*) is widespread and abundant throughout the Mobile Basin and less abundant in the Tennessee River system and coastal drainages (Mettee et al. 1996). This species occurs primarily in pools and shallow riffles and shoals of small to large streams of small to moderate flow.

Although speckled Darters are common in Alabama, the only data available was collected on the Bankhead National Forest and Talladega Division. However, the last record reported by the University of Alabama for the Talladega Division was in 1984. Populations on the Bankhead National Forest were highly variable between years. A slight upward trend, however, was observed in the data collected by the University of Alabama (Figure 40).

Wide-spread streams: Speckled Madtom

The speckled madtom (*Noturus leptacanthus*) is well distributed and abundant throughout the less alkaline small to large sized streams of slow to moderate currents within the coastal plain and lower portion of the Upper Mobile Basin highlands. This species seems to specifically favor submerged vegetation, leaf packs, and stream margins (Mettee et al. 1996).

Speckled madtom were initially selected as a MIS for their apparent sensitivity to siltation and turbidity. In retrospect, madtoms may not be a good MIS, however, since they are known to bury themselves in bottom substrates and elude capture.

In general, the number of speckled madtoms collected by the University of Alabama appears to have increase on the Bankhead and Conecuh National Forests since the early 1970s (Figure 39). In contrast, the SRS only collected speckled madtoms on the Bankhead National Forest in 1994 and 1995. Catch per unit effort dropped from about 0.17 in 1994 to 0.7 in 1995 (Figure 39).

The University of Alabama last collected this species on the Talladega Division in 1982. A recent survey by Auburn University and the USFS, however, shows that speckled madtoms are still present in the upper Terrapin Creek drainage (Phillips and Johnston 1999).

Tennessee Valley: Rock Bass

In Alabama, rock bass (*Ambloplites rupestris*) are only found in the Tennessee River Drainage (Mettee et al. 1996) and are not known to occur on any of the National Forests in Alabama. Rock bass is therefore, an inappropriate species for monitoring Forest Service management activities in this area.

Tennessee Valley: Rosyside Dace

The Rosyside Dace (*Clinostomus funduloides*) is restricted to the Tennessee River drainage and favors rocky substrate runs, chutes, and plunge pools of medium-sized streams (Mettee et al. 1996). This species appeared in the sampling records in only two years (over 20 years apart) on the Bankhead Ranger District. Only one fish was captured during sampling each year; however, it took more effort to collect the one individual in 1970 than in 1995 (Figure 36).

This species is a less than ideal MIS since it is sparsely distributed and rare within the National Forests in Alabama.

Tennessee Valley: Black Darter

The Black Darter (*Etheostoma duryii*) is abundant but restricted only in the Tennessee River Drainage. This species prefers medium-sized clear streams with rocky substrates. Favored habitats include pools and riffles (Mettee et al. 1996). A MIS specifically aimed on the Bankhead National Forest, black darter survey data is limited with only two years of data (over 20 years apart). Catch per unit effort was considerably higher in 1995 than in 1971 (Figure 46).

Tennessee Valley: Flame Chub

The Flame Chub (*Hemitremia flammea*) is found within the Cumberland plateau and Tallapoosa River drainages. This species prefers springs, seeps, and spring-fed springs. It may be locally abundant in some areas (Mettee et al. 1996). The Flame Chub, which occurs on the Bankhead National Forest and the Talladega Division, were only reported for one year (1971) so trends cannot be determined. In 1971, only two fish were found during sampling on National Forest land.

This species was initially selected as a MIS since it inhabits springs and spring-fed headwaters and may be sensitive to altered temperature regimes (USFS 1985). However, in practice, it's apparent rarity and patchy distribution in remote locations may hamper it's utility as a MIS.

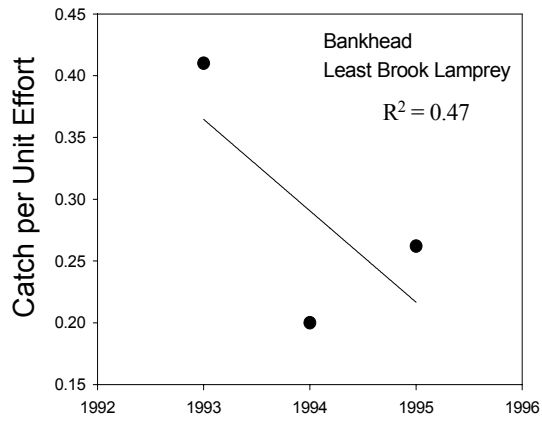


Figure 35. Mean number of least brook lamprey captured per minute (electrofishing) on the Bankhead National Forest.

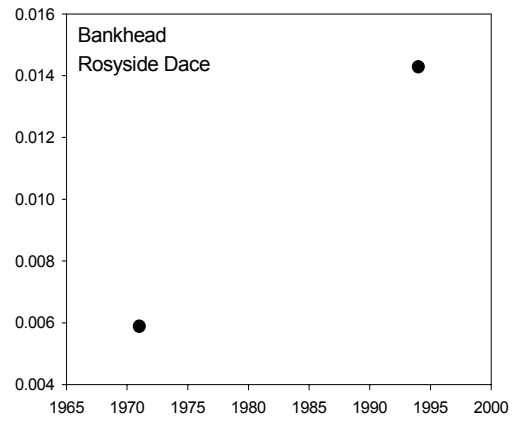


Figure 36. Mean number of rosyside dace captured per minute on the Bankhead National Forest.

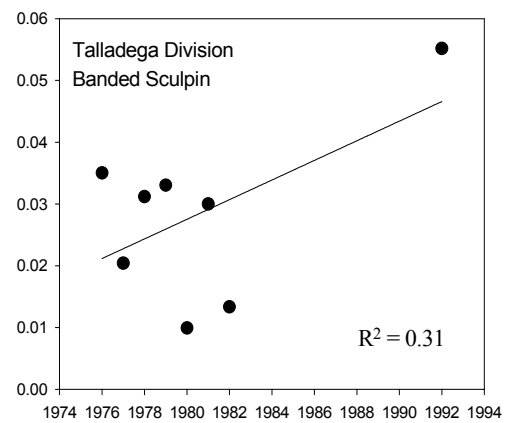
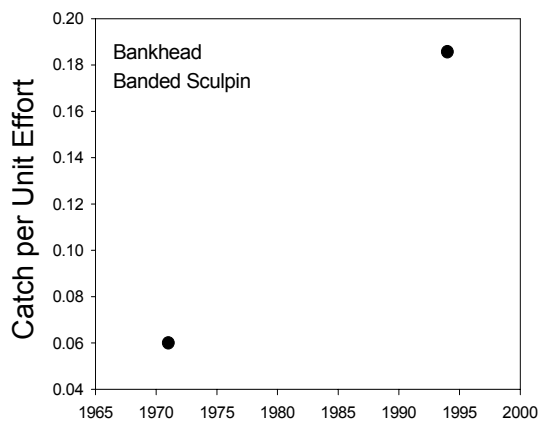


Figure 37. Mean number of banded sculpin captured per minute on the National Forest in Alabama.

Upper Mobile Basin Highlands: Silverstripe Shiner

Silverstripe shiner (*Notropis stilbius*) is endemic to the Mobile basin where it is most common within the upper basin above the fall line. This species prefers moderate flowing medium sized streams with deep runs and eddies over rocky unconsolidated rocky substrate (Mettee et al. 1996). Silverstripe Shiner data collected by University of Alabama on the Bankhead National Forest and Talladega Division does not show a clear trend, even though linear regression indicates an upward trend (Figure 38). Data collected by the SRS on the Bankhead National Forest indicates an increase in the population between 1993 and 1996 (Figure 38). A recent survey by Auburn University and the USFS indicates that silverstripe shiners are still relatively common in the upper Choccolocco Creek drainage (Phillips and Johnston 1999).

Upper Mobile Basin Highlands: Redeye Bass

Redeye bass (*Micropterus coosae*) was initially identified as a MIS due to its desirable gamefish status. Redeye bass is endemic to the upper Mobile Basin. It prefers medium-sized upland streams with willow and other aquatic vegetation, undercut banks, and large woody debris or boulder substrates (Mettee et al. 1996). Data collected by the University of Alabama on Bankhead National Forest population showed an upward trend from 1952 to 1978, but there was no data again until 1994 when a dramatic drop in numbers was observed (Figure 41). This drop in 1994 may be due to the very small sampling time for that year when compared to other years. Data collected by the Southern Research Station shows a decline in the population between 1993 and 1995 (Figure 41). A recent survey by Auburn University and the USFS indicates that redeye bass are still common in the upper Terrapin and Choccolocco creek drainages (Phillips and Johnston 1999).

Upper Mobile Basin Highlands: Banded Sculpin

Banded sculpins (*Cottus carolinae*) are found primarily within the upper Mobile Basins of the Coosa and Talapoosa River drainages. This species is most abundant in clear cool upland streams. Coastal plain populations are restricted to hardened bottom cool water streams (Mettee et al. 1996).

Banded sculpin appeared in the sampling records in only two years (over 20 years apart) on the Bankhead Ranger District. The Talladega Division is the only unit with catches in multiple years; however, a trend is not easily identifiable. From 1976 to 1982, the population appeared to be steady to slightly down, but from 1982 to 1992 appeared to increase considerably (Figure 37). A recent survey by Auburn University and the USFS indicates that banded sculpins are still relatively common in the upper Terrapin and Choccolocco creek drainages (Phillips and Johnston 1999). The Oakmulgee Division had captures in only one year.

Several species of sculpin were initially selected as MIS due to their requirement of clear, high quality stream habitat (USFS 1985). Most sculpins are benthic species, however, and they elude proper representation in standard fisheries sampling methods (electrofishing, seining, etc.). This species therefore may not be an ideal MIS.

Upper Mobile Highlands: Black Madtom

Black madtom (*Noturus funebris*) are found throughout the Upper Mobile Basin and Coastal drainages. This species prefers slow current small to medium-sized streams with aquatic vegetation, leaf litter, and undercut banks (Mettee et al. 1996). There was only one forest, the Oakmulgee Division, with survey data for black madtom. Unfortunately this species was reported only in one year.

Upper Mobile Highlands: Rough Shiner

The rough shiner (*Notropis baileyi*) is found throughout much of the Mobile Basin with highest abundance below the fall line. Prefers small to large sized streams with sandy and gravel substrates (Mettee et al. 1996). This species is relatively tolerant of silt and stagnant Rough Shiner was observed on only the Bankhead and Oakmulgee National Forests. Only one year of data (1971) was available for the Bankhead National Forest and the most recent data collected on the Oakmulgee Division data was in 1985.

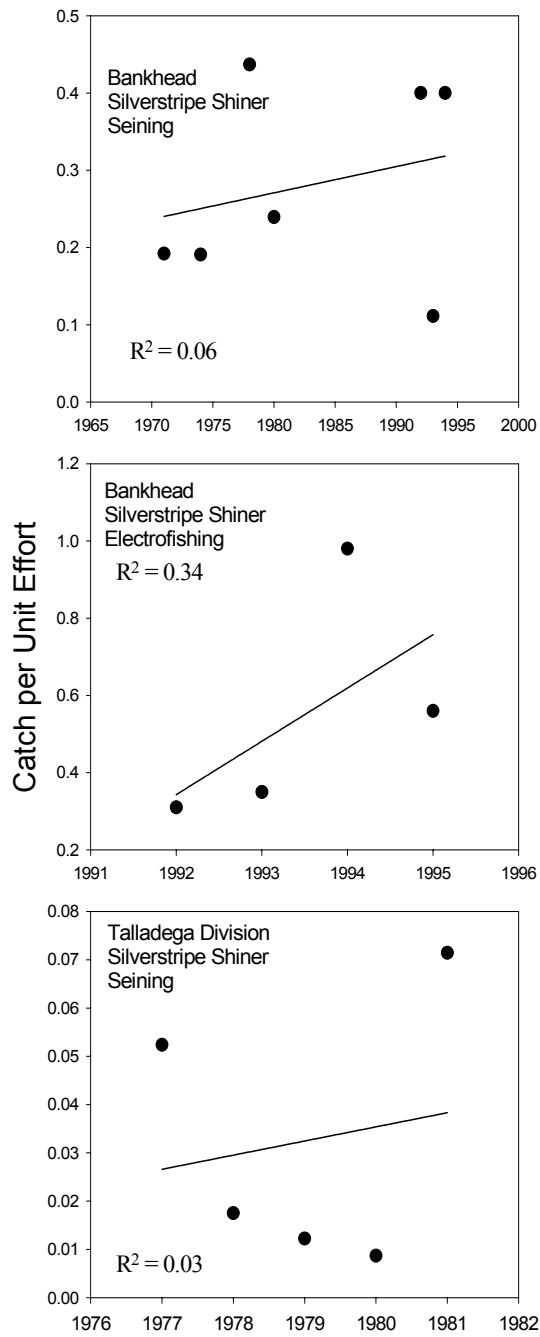


Figure 38. Mean number of silverstripe shiner captured per minute (catch per unit effort) in streams on Forest Service lands in Alabama.

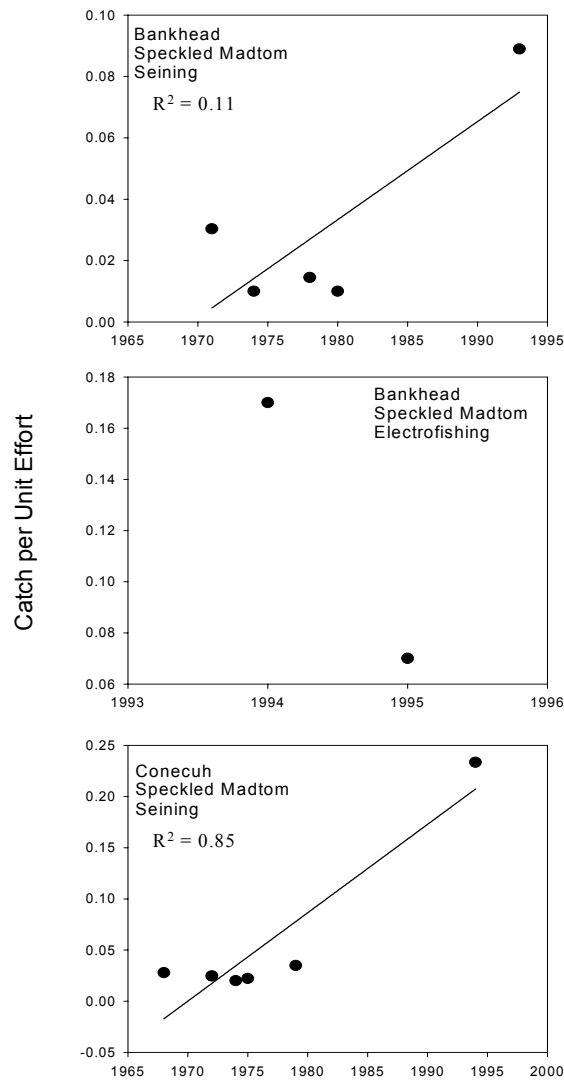


Figure 39. Mean number of speckled madtoms captured per minute (catch per unit effort) in streams on Forest Service lands in Alabama.

Coastal Plain: Sailfin Shiner

Sailfin shiner (*Pteronotopsis hypselopterus*) is only found within the immediate Mobile Bay area and coastal streams. It prefers riffle-runs of small clear streams with sand and clay substrates and largewoody debris (Mettee et al. 1996). Sailfin Shiner occurs only on the Conecuh National Forest, and there was a 20-year absence of data from 1974 to 1994.

The general population trend appears to be down but there was very limited sampling time in 1994 (Figure 43). The 1969 sample indicates that a large number of Sailfin Shiner were caught in a very short period of time, but it is possible that this is an error in the data.

Coastal Plain: Gulf Darter

The Gulf darter (*Etheostoma swaini*) is found predominantly in the lower Mobile Basin and coastal plain. It prefers swift flowing clear streams with riffles and over gravel and clay substrates associated with the cover of woody debris, rubble, or man-made structures (Mettee et al. 1996). On the Conecuh National Forest, data is only available for three years (1972, 1974, and 1995). Based on this limited information, the population may be declining (Figure 44); however, these results should be viewed with caution. There is also data for only two years (1974, 1985) on the Oakmulgee National Forest.

Coastal Plain: Redeye Chub

The redeye chub (*Notropis harperi*) is only found within coastal plain drainages. It is almost exclusively found within constant temperature springs and spring-fed stream runs (Mettee et al. 1996). Redeye Chub numbers appear to be decreasing on the Conecuh National Forest based upon USFS personnel observations. However, there was an apparent increase in numbers from the previous survey data of 1979 to the most recent survey data of 1994 (Figure 45).

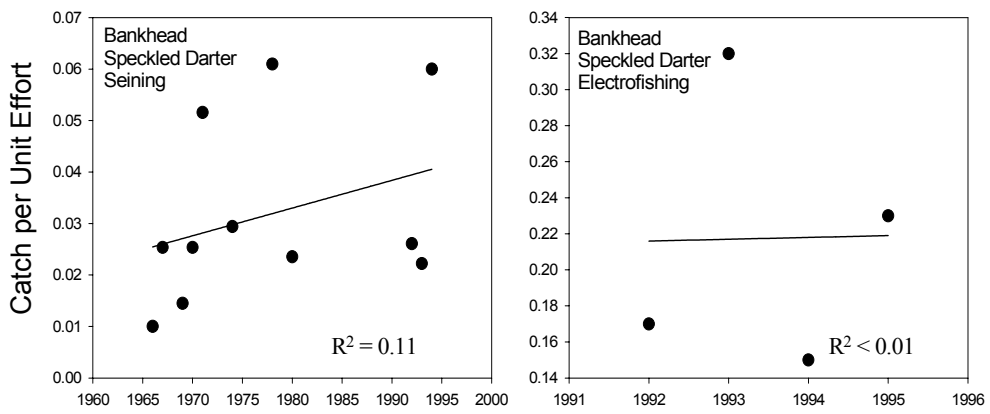


Figure 40. Mean number of speckled darters captured per minute (catch per unit effort) in streams on Forest Service lands in Alabama.

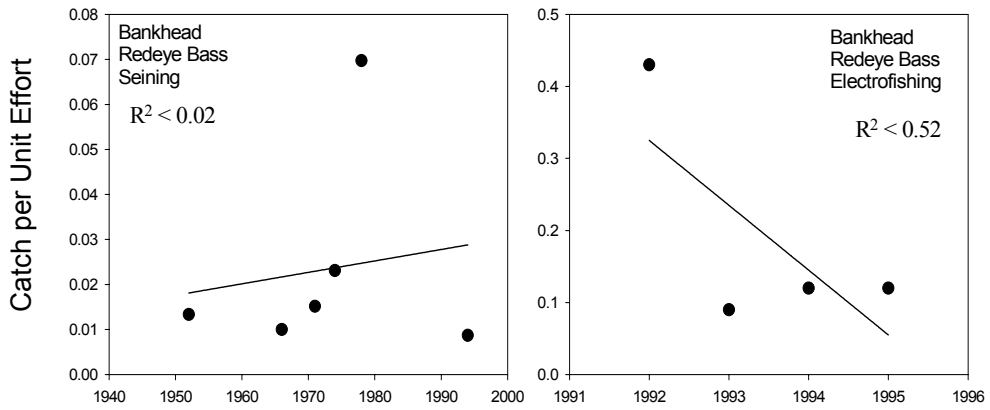


Figure 41. Mean number of redeyed bass captured per minute (catch per unit effort) in streams on Forest Service lands in Alabama.

Coastal Plain: Brown Darter

Brown darter (*Etheostoma edwini*) are found almost exclusively within coastal plain streams. This species prefers detritus, aquatic vegetation, woody debris in small to moderate shallow flowing streams (Mettee et al. 1996). The most recent data available for the brown darter on the Conecuh Ranger District is from over 20 years ago.

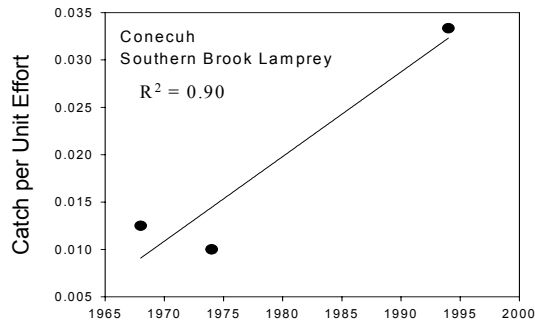


Figure 42. Mean number of southern brook lamprey captured per minute (electrofishing) on the Conecuh National Forest.

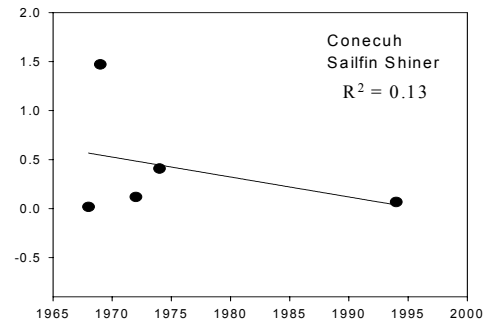


Figure 43. Mean number of sailfin shiner captured per minute on the Conecuh National Forest.

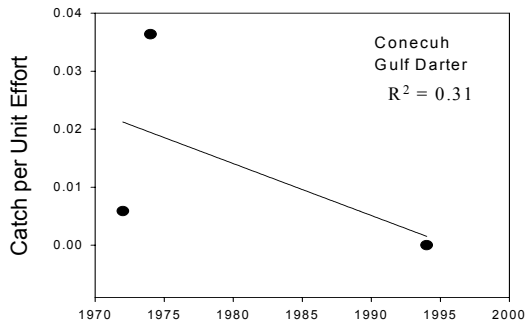


Figure 44. Mean number of least Gulf darter captured per minute (electrofishing) on the Conecuh National Forest.

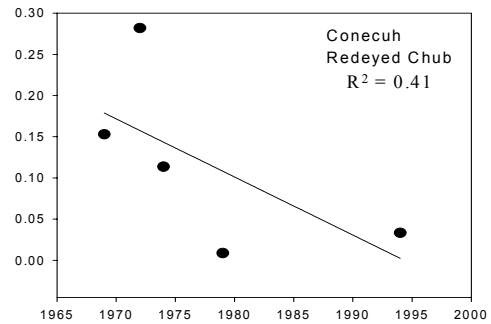


Figure 45. Mean number of redeyed chub captured per minute on the Conecuh National Forest.

Plants

Grasspink Orchid (*Calopogon* spp) and Pitcher Plant (*Sarracenia* spp) were chosen as MIS for the bog habitats that occur on the National Forest in Alabama. Three species of *Calopogon* (*C. multiflorus*, *C. pallidus*, and *C. barbatus*) and six species of *Sarracenia* (*S. flava*, *S. leucophylla*, *S. psittacina*, *S. purpurea*, *S. rubra* sp *S. wherryi*) are found on forest lands in Alabama. Because no distinction was made between species in Process Record for the Selection of Management Indicator Species all species within their respective genus were combined for this report.

Grasspink orchid and pitcher plant surveys have been conducted since the early 1980s by the USDA Forest Service, U.S. Fish and Wildlife Service, Alabama A & M, Huntington College, Auburn University, Alabama Natural Heritage Program, and The Nature Conservancy. Grasspink orchid and pitcher plant data is categorical (ordinal) according to The Nature Conservancy's ranking system. Data collected in all bogs on the Conecuh National Forest were combined by year and assigned a mean rank.

Ocular estimates of abundance indicate that both species are increasing (Figures 47 and 48). It is unclear, however, if this is the function of an increase in suitable habitat or in the number of bogs searched each year. Further, several bogs have been recently discovered.

Proactive measures, such as prescribed burning and bog restoration project, appear to be successful in increasing pitcher plant habitat and abundance. Similarly, grasspink orchids have only been observed in restored and managed bogs on the National Forest.

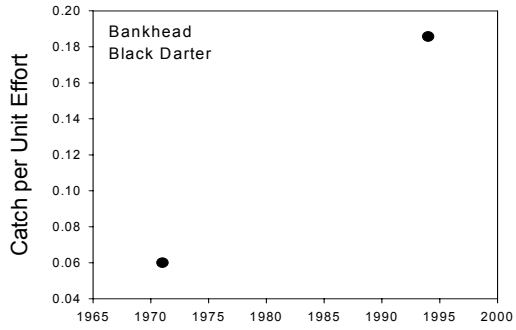


Figure 46. Mean number of black darters captured per minute (electrofishing) on the Bankhead National Forest.

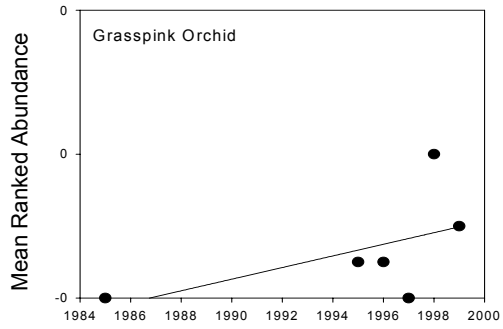


Figure 47. Mean ranked abundance of grasspink orchid in bogs on the Conecuh National Forest

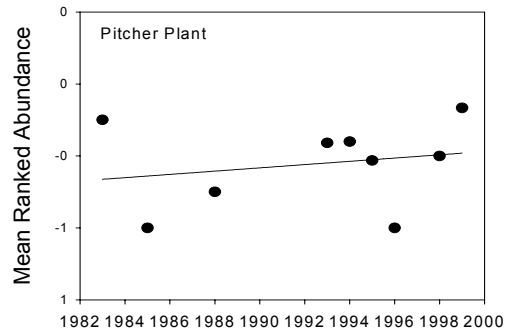


Figure 48. Mean ranked abundance of pitcher plants in bogs on the Conecuh National Forest

Discussion

In accordance with NFMA (1976) and USFS planning regulations (1980) the National Forest in Alabama adopted the use of MIS to assess the relationship between land use practices and trends in species populations (Hedrick 1985). Although the use of MIS is controversial (see Landres et al. 1988; Niemi et al. 1997) it is based on the assumption that suitable habitat for the indicator is also suitable for other associated species (Niemi et al. 1997). Thus, monitoring indicator species was implemented to assess the degree to which fish and wildlife goals outlined in the current forest plan were being met and to determine if adjustments in the forest plan were needed (Hedrick 1985).

The use of MIS and associated sampling methodologies on the National Forest in Alabama over the past 15 years has resulted in varying degrees of success and usefulness. The Land and Resource Management for National Forest in Alabama (appendix C, 1985) outlined specific monitoring protocols and schedules for MIS on the forests. Unfortunately, declining budgets and personnel and shifts in priorities (i.e. the unanticipated concern for freshwater mussel populations in the late 1980's) resulted in a deviation from some of these protocols and the reliance on external sources for much of the data.

Standardized methods, addressing appropriate objectives, were used to monitor largemouth bass and bluegills in National Forest ponds. This data produced data adequate for managing fishing ponds. The assessment of largemouth and bluegill populations at the forest level, however, was less useful because there is usually more variability in the species populations between ponds than within individual ponds. Nevertheless, fishing ponds are managed for recreation; therefore, monitoring fish populations in ponds is probably more pertinent at the local level than at the forest level.

Likewise, population assessments of game species were primarily made through harvest data collected by the Alabama Department of Conservation. Hunter success data

exhibited a large amount of variation. Although this variation may be due to variation in species populations, it also could be the result of weather, hunter experience, the number of hunters, etc. Further, this method relies on the 'honor system' for reporting harvest that may or may not be accurate. Harvest data was collected in wildlife management areas; thus, the data only reflects conditions in the management areas and not forest-wide conditions.

Standardized methods, addressing appropriate objectives, were also used in the breeding-bird-plots. These surveys were initiated in 1997, although the four National Forests are in different stages of implementation. Bird-plots appear promising for relating species to a given habitat. Analysis of the relative abundance of bird species in these plots (not included in this report), however, suggests that the composition of bird species (community) will be a better indicator of habitat than individual MIS.

Monitoring protocols, tied to specific objectives and designed to answer specific questions, were used to evaluate long-leaf pine ecosystem restoration efforts on the Conecuh NF. Many of the plants and animals found on the Conecuh National Forest evolved in this fire-dominated ecosystem and thus can be used to measure the success of ecosystem restoration efforts. Recent studies indicate that both dusky gopher frog and the gopher tortoise populations are responding positively to current management activities. Songbird studies, published by Hill (1998), also found that frequent burning and the preservation (or restoration) of wetlands are needed to maintain the highest number and greatest diversity of birds. Although the Conecuh National Forest currently monitors numerous MIS at varying levels of precision, the integration of these three studies appears to be a good measure of the ecosystem restoration efforts. This is likely due to several factors: 1) the study species are highly dependent on a naturally functioning longleaf pine ecosystem, 2) the studies were scientifically designed to answer specific questions, and 3) the integration of the studies reflects a community response rather than a species-specific response.

Data collected for purposes other than monitoring species responses to forest management activities were problematic. Data collected during breeding bird points may be biased toward species that inhabit early successional habitats because of canopy openings associated with roadways. Another example would be the data collected on aquatic MIS. Most of this data was gleaned from universities, primarily collected to determine distributions. Standardizing this data (catch-per-unit-effort) is difficult because it is unlikely that the different researchers used the same protocols. Further, much of this data was collected at different sites and in different streams with few replications. Thus, the natural variation in populations between streams was not measured. As a result, the data exhibited what appeared to be high temporal variation that could not be accurately assessed for its relevance to depicting true changes over time.

Some species chosen as MIS are too rare or broadly distributed (i.e. locally rare, top predators, etc.) to be monitored effectively. These include broad-winged hawk, flatwoods salamander, flame chub, and rosieside dace. Hawks are top predators and often occur in relatively low densities or are observed in flight and cannot be associated with a particular habitat. Flatwoods salamanders have not been found on the Conecuh NF since 1980, despite numerous attempts and extensive effort. Finally, National Forest lands encompasses only the periphery of the range of flatwoods salamander, flame chubs and rosieside dace (Boschung and Mettee 1974; Mettee et al. 1996). Species on the periphery of their range may be much more susceptible to climatic variation and trends that are beyond the influence and scope of forest management practices. While it may be important to closely monitor such “fringe” species for the sake of species conservation, it may not be the most effective approach for monitoring either trends in habitat quality or the effects of Forest management activities,

The behavior and/or life history of some species can also make them difficult to sample effectively and may require species-specific monitoring techniques. These include the seepage salamander, flatwoods salamander, screech owl, barred owl, least brook lamprey, southern brook lamprey, speckled madtom, black madtom, and banded sculpin.

Seepage salamanders inhabit woodlands and are usually encountered in the leaf litter near seeps, springs, and small streams. This species requires both species- and site- specific monitoring techniques. This usually involves sifting through the leaf litter while following transects or night surveys.

Flatwoods salamanders are members of the family Ambystomidae (mole salamanders). Members of this family spent most of their lives underground, thus making sampling difficult (Corant 1958). The most effective strategy for surveying these animals is during a short time in the spring when they congregate in temporary pools and ponds to breed. Finding these species before or after the breeding season is generally a matter of chance (Corant 1958). The behavior of this species, coupled with its rarity in Alabama, makes surveying this species particularly difficult.

Both barred and screech owls are relatively common in suitable habitats across Alabama. These species, however, are rarely seen or heard between dawn and dusk. Observation of these animals requires species-specific surveys conducted between dusk and dawn.

In general, freshwater lampreys are secretive animals (Jenkins and Burkhead 1993). As a result, adequate population information is difficult to obtain. Similarly, both sculpins and madtoms are primarily nocturnal and 'hide' beneath large stones, woody debris, and other forms of cover during the day. Sampling these species is most effective at night, thus requiring special surveys for adequate population estimates. Conventional sampling techniques (seining, electrofishing, etc. in daylight hours) are usually sufficient for determining presence; however, population trends developed from this type data should be interpreted with caution.

For some MIS, data was not collected. These include the oldfield mouse, white-footed mouse, and seepage salamander (discussed earlier). The two mice species were chosen to represent species that exploit ground vegetation in conifer-grass/forbs habitat. Monitoring mice populations requires setting trap-lines, primarily at night. Collecting an

adequate sample size for population analysis requires considerable effort and thus cost. It is questionable whether the significant use of limited resources on these species can be justified.

Another question related to MIS is viability. An overall goal of management is to “maintain viable populations of existing native and desired non-native vertebrate species in the planning area” (36 CFR 219.19). A viable population is defined as one that has the estimated numbers and distribution of reproductive individuals to insure the continued existence of the species, well distributed in the planning area. The assumption is that all species needs can be adequately met on NF lands alone. While this may be true for some species, it is not a valid assumption for wide ranging species such as bald eagle and migratory birds. Viability was determined not to be a concern for most of the MIS species; only 5 of the 50 MIS species for the National Forests in Alabama have a low likelihood of persistence over time. This finding is based on the information that was gathered on or near the forest and based on the Natural Heritage Program’s global and state rankings. Agency biologists and specialists reviewed the information and made the associated viability determinations. The viability findings and the Natural Heritage global and state rankings are summarized for each MIS in the following table. A key to the rankings is also provided in a second table.

Table 5 - Viability findings for each MIS are:

Primary Habitat Association	Species	Global Ranking	State Ranking	Viability Finding ¹
Upland hardwood Forest	Brown-headed nuthatch	G5	S5	High
Upland hardwood Forest	Broad-winged hawk	G5	S5B	High
Conifer forest	Wood thrush	G5	S5B	High
Bottomland hardwoods	Hooded warbler	G5	S5B	High
Bottomland hardwoods	American redstart	G5	S4B	High
Cane thicket	Swainson’s warbler	G4	S3	Med
Grass/forb	Mourning dove	G5	S5	High
Grass/forb	Northern Flicker	G5	S4B/S5N	High
Grass/forb	Eastern bluebird	G5	S5	High
Grass/forb	Bobwhite	G5	S5	High
Shrub/sapling	Yellow-breasted chat	G5	S5B/S2N	High
Shrub/sapling	Indigo bunting	G5	S5B/S2N	High
Habitat generalist	Eastern wild turkey	G5	S5	High

Primary Habitat Association	Species	Global Ranking	State Ranking	Viability Finding ¹
Upland hardwoods	Screech owl	G5	S5	High
Conifer forest	Pine warbler	G5	S5	High
Upland hardwoods	Pileated woodpecker	G5	S5	High
Hardwood forst	Barred owl	G5	S5	High
Bottomland hardwoods	Wood duck	G5	S5B	High
Bottomland hardwoods	Kentucky warbler	G5	S5	High
Conifer forest	Red-cockaded woodpecker	G3	S2	Low
Habitat generalist	White-tailed deer	G5	S5	High
Forest habitat generalist	Eastern fox squirrel	G5	S5	High
Bottomland hardwoods	Eastern gray squirrel	G5	S3/S4	High
Grass/forb	White-footed mouse	G5	S4	High
Grass/forb	Oldfield mouse	G5	S5	High
Wide-spread streams	Least brook lamprey	G5	S5	High
Wide-spread streams	Southern brook lamprey	G5	S5	High
Wide-spread streams	Speckled darter	G5	S5	High
Wide-spread streams	Speckled madtom	G5	S5	High
Tennessee V. streams	Rock Bass	G5	S3	Med
Tennessee V. streams	Rosyside dace	G5	S3	Med
Tennessee V. streams	Black darter	G4	S4	High
Tennessee Valley springs	Flame chub	G4	S3	Med
	Silverstripe shiner	G4	S4	High
Mobile Highland streams	Redeye bass	G5	S5	High
	Banded sculpin	G5	S5	High
Mobile Highland streams	Black madtom	G5	S5	High
	Rough shiner	G5	S5	High
Mobile Highland streams	Sailfin shiner	G5	S3	Med
Mobile Highland streams	Gulf darter	G5	S5	High
	Redeyed chub	G4	S3	Med
Mobile Highland streams	Brown darter	G5	S3	Med
	Largemouth bass	G5	S5	High
Coastal Plain streams	Bluegill	G5	S5	High
Coastal Plain streams				
Coastal Plain streams				
Coastal Plain streams				
Wide-spread lentic				
Wide-spread lentic				
Sandhills	Gopher tortoise	G3	S2	Low
Sandhills	Dusky gopher frog	G3/G4	S2	Low
Conifer forest	Flatwoods salamander	G2	S1	Low

Primary Habitat Association	Species	Global Ranking	State Ranking	Viability Finding ¹
Upland hardwoods forest	Seepage salamander	G3/G4	S2	Med
Herbaceous/Shrub Bog	Grasspink orchids	G4	S1/S2	Low
Herbaceous/Shrub Bog	Pitcher plants	G2/G3	S2/S3	Med

¹ Viability = likelihood of persistence over time (High, Medium, or Low)

Table 6 – The Nature Conservancy (TNC) Ratings

RANKING	DEFINITION
G2	Imperiled locally
G3	Either very rare and local throughout its range or found locally in a restricted range
G4	Apparently secure globally
G5	Demonstrably secure globally
S1	Critically imperiled in Alabama,
S2	Imperiled in Alabama
S3	Rare or uncommon in Alabama
S4	Apparently secure in Alabama
S5	Demonstrably secure in Alabama
B	Qualifier – ranking refers to species presence in state during breeding season
N	Qualifier – ranking refers to species that are usually migratory, and typically non-breeding in the state. They may pass through the state twice a year or may remain in winter.

Conclusions

Most MIS showed high annual variation in their populations over time. This indicates that they have low potential as management indicators (Niemi et al. 1997). Monitoring protocols, tied to specific objectives and designed to answer specific questions, and standardized sampling procedures, however, may improve the precision of the data.

The best examples of habitat indicators appear to be associated to community parameters or the integration of several studies and species. This includes the ecosystem approach used on the Conecuh NF and community approaches, such as the breeding-bird-plots.

The assessment of aquatic communities, rather than individual fish species, also may be a better indicator of changes in stream habitat because the relationships between many fish populations and their habitat are complex and still remain poorly understood. Top predators, such as largemouth bass, present particular challenges as MIS, since their populations may fluctuate in a delayed and cyclic response to fluctuations in the prey base. Further, the natural variability between individual bodies of water makes inferences at a forest-wide scale difficult without both extensive and intensive sampling effort (and the possibility of substantial adverse impacts due to direct and indirect mortality associated with the needed levels of sampling).

Game species should be monitored to evaluate conditions on specific management areas or individual fishing ponds, and probably should not be used as MIS for forest-wide changes. These areas are generally intensively managed specifically for those species and do not reflect the overall condition or effects of management activities on the aquatic ecosystems of the National Forests in Alabama. Game species populations may also fluctuate according to rates of harvest rather than habitat conditions.

Several species chosen as MIS are rare and/or difficult to detect and therefore close to impossible to monitor, such as the seepage salamander, white-footed mouse, oldfield mouse, American redstart, and flame chub. A number of the current MIS (least brook lamprey, speckled madtom, rosieside dace, banded madtom, and southern brook lamprey) are also difficult to detect or capture. (Niemi et al. 1997) found that species that exhibit these characteristics show inconsistent patterns that cast doubt on their usefulness as indicators. Although it is critical that rare species be monitored for their own sake and to meet legal requirements and management objectives, these species may not be appropriate indicators of other species or their habitats, and therefore limit their effectiveness as management indicator species.

Finally, at a time of decreasing budgets and personnel, it is critical that the National Forest implement efficient and effective monitoring protocols. Although species-specific surveys place a high demand on Forest Services resources, they provide little in

the way of immediate information about the changes in habitat at the forest level. Surveys should document all species encountered (i.e. bird community) and protocols standardized so the data can be analyzed across multiple scales (i.e. project, forest, region). The predominant community should reflect the habitat type. Species-specific population surveys, and the resources used to conduct them, should be directed toward targeted special interest species, federally listed species, species exhibiting low natural variability, and populations of special management concern.

In conclusion, monitoring protocols need to be tied to specific objectives that are designed to answer specific **management** questions. Management indicator species selection needs to be clearly tied to addressing these specific questions or resource issues. Study methods also should be standardized so the data can be analyzed across multiple scales. Finally, integration of the data across species and species groups should more accurately display the effect of land use practices on habitats and habitat conditions.

Recommendations

The National Forests in Alabama is currently in the process of revising the Land and Resource Management plan. In the interim, all of the forests will be operating under the focus of forest health and ecosystem restoration. Current forest health issues in Alabama are primarily loblolly pine die-off (related to trees that were historically planted on sites where other species are better suited), stands in need of thinning to reduce stress, and southern pine beetle infestations. Timber harvest will focus on off-site loblolly pine stands that are slated for improvement thinnings or restoration. Pine stands may be periodically burned to mimic natural processes under controlled conditions.

Based on the information reviewed for this report, input from agency biologists, and biologists with Alabama Game & Fish Division of the State Department of Conservation and Natural Resources, it is recommended that the National Forests in Alabama revise the list of MIS and update monitoring protocols for some of the MIS. The following

tables display, by habitat group, a summary of the recommendations for MIS. More detailed information on these recommendations is included in the discussion section.

TABLE 7 – RECOMMENDED CHANGES TO MIS LIST FOR THE NFS IN ALABAMA

Grass/Forb

MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol for MIS	Rationale for Deleting MIS
Bobwhite quail	Field sparrow	Mourning dove		Mourning dove is a better indicator of activities in agricultural areas than forest areas.
		Northern Flicker		This species is not well sampled, other MIS are better indicators of grass/forb conditions
		Eastern bluebird		This species is too widely distributed across landscapes to be effective indicator of grass/forb conditions.
		White-footed mouse		Difficult to monitor and this species tends to population fluctuations seasonally that may negate use as a MIS.
		Oldfield mouse		Difficult to monitor and this species tends to population fluctuations seasonally that may negate use as a MIS.

Shrub/Sapling

MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol	Rationale for Deleting MIS
Indigo bunting		Yellow-breasted Chat		Yellow-breasted chat are common, & may be over-represented due to affinity for thickets associated with roadside. Trends inferred from BBS would indicate temporary roadside habitat changes

Conifer Forests

MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol	Rationale for Deleting MIS
Red-cockaded Woodpecker	Liatris spp.	Screech owl	Eastern fox squirrel	Screech owls are a nocturnal species, therefore not picked up by BBS or BBP.
Pine warbler		Flatwoods salamander		Flatwoods salamander is presumed no longer extant in AL.

Upland Hardwood Forests

MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol	Rationale for Deleting MIS
Brown-headed nuthatch		Screech owl		Screech owl is a nocturnal species, therefore not picked up by BBS or BBP.
Pileated woodpecker		Broad-winged hawk		Too much of a habitat generalist

Bottomland Hardwood Forests/Riparian Areas

MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol	Rationale for Deleting MIS
Pileated woodpecker		American redstart Barred owl		Common, but hard to distinguish. Nocturnal
		Wood duck		
		Eastern gray squirrel		

Aquatic Habitat – Wide-spread Lentic (Pond & Lakes)

MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol	Rationale for Deleting MIS
Large mouth bass			Focus on specific lakes stratified by Districts and representative of both the more natural and the intensively managed fisheries communities.	
Bluegill			Focus on specific lakes stratified by Districts and representative of both the more natural and the intensively managed fisheries communities	

Aquatic Habitat – Lotic (streams)

HABITAT MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol	Rationale for Deleting MIS
ALL HABITATS	Mussel diversity Benthic invertebrates Water chemistry Habitat components		Monitor aquatic communities rather than single species. A smaller # of community focused MIS species would be monitored along with biological and physio- chemical parameters indicative of overall aquatic habitat quality and ecosystem health.	
WIDE-SPREAD Speckled darter				
	Shadow bass?			
		Least brook lamprey		This species is secretive, seasonally absent & difficult to capture or detect.
		Speckled madtom		This species is secretive, nocturnal, & difficult to capture or detect.

TN VALLEY				
Black darter				
		Rosyside dace		This species is rare & difficult to locate.
	Rock bass	Rock bass		Not on NF in AL
		Flame chub		This species is rare on the NF in AL and sampling could be destructive.
MOBILE HI				
Flatn musk turtle				
Silverstripe shin				
Redeye bass				
Black madtom				
Rough shiner				
		Banded sculpin		This species is nocturnal & difficult to capture or detect.
COASTAL PL				
Brown darter				
Sailfin shiner				
Gulf darter				
Redeye chub				
		Southern brook lamprey		This species is secretive, seasonally absent & difficult to capture or detect

Cane Thicket

MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol	Rationale for Deleting MIS
Swainson's warbler				

Sandhills

MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol	Rationale for Deleting MIS
Gopher tortoise				
Dusky gopher frog				

Cavity Nesters

MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol	Rationale for Deleting MIS
Brown-headed nuthatch		Eastern bluebird		This species is too widely distributed across landscapes to be effective indicator of cavity availability.
		Screech owl		Nocturnal species, therefore not picked up by BBS or BBP.

Herbaceous/Shrub Bogs

MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol	Rationale for Deleting MIS
Pitcher plants (Sarracenia spp.)		Grasspink orchids (Calapogon spp.)		Difficulty in distinguishing from other similar species

Habitat Generalists

MIS retained	MIS Added	MIS Deleted	Change Monitoring Protocol	Rationale for Deleting MIS
White-tailed deer				
Eastern wild turkey				

The above proposal will leave us with a total of 28 of the previously identified MIS including 19 individual MIS, plus 9 stream fish species that will be monitored in conjunction with indices of overall aquatic ecosystem condition. The shadow bass (*Ambloplites ariommus*) deserves consideration of inclusion on a revised MIS list. Shadow bass are found throughout all hydro-physiographic areas of Alabama except for the Tennessee River basin. This species prefers medium to large slow-moving streams and rivers with aquatic macrophytes, undercut banks, and brush piles. Shadow bass are a good MIS since they are intolerant of siltation and degraded water quality (Mettee et al. 1996).

To better manage limited funding while the plan is being revised, it is recommended that analysis of individual projects focus on species that reflect current management activities: forest health, restoration and prescribed burning; and habitat types being affected.

It is also recommended that for the five species with viability concerns: Red-cockaded woodpecker, Gopher tortoise, Dusky gopher frog, Flatwoods salamander, and Grasspink orchids, additional tracking and evaluation of their status be included as part of the annual monitoring and evaluation report. Red-cockaded woodpecker is a federally listed, endangered species with specific recovery actions tied to the RCW FEIS. Status of populations is reported annually to USF&WL. Gopher tortoise and Dusky gopher frog are on the revised Regional Forests Sensitive Species List. We will continue to work with partners and cooperators to inventory and monitor for these species. The work with the Dusky gopher frog “head start” program should also be continued as a method to increase populations on the Conecuh Ranger District. Flatwoods salamander and grasspink orchids are not on the sensitive species list, but are locally rare and every opportunity to work with cooperators and partnerships should be capitalized on in order to get better information on actual population numbers and trends for these species.

Literature Cited

- Aresco, M.J. and C. Guyer. 1999. Burrow abandonment by gopher tortoises in slash pine plantations on the Conecuh National Forest. *Journal of Wildlife Management* 63(1):199.
- Bailey, M.A. and J. Jensen. 1993. Survey for the dusky gopher frog and flatwoods salamander: Conecuh National Forest. Report to the USDA Forest Service, Contract Cone.93-1.
- Gough, G.A., Sauer, J.R., Iff, M. 1998. Patuxent Bird Identification Infocenter. Version 97.1. Patuxent Wildlife Research Center, Laurel, MD. <http://www.mbr-pwrc.usgs.gov/Infocenter/infocenter.html>.
- Hedrick, L.D. 1985. Process record for selection of management indicator species: National Forest in Alabama.
- Landres, P.B., J. Verner, and J.W. Thomas 1988. Ecological uses of vertebrate indicator species: a critique. *Conservation Biology* 2:316-328.
- Natureserve: An online encyclopedia of life [web application]. 2001. Version 1.4. Arlington, Virginia, USA: Association for Biodiversity Information. Available: <http://www.natureserve.org/>.
- Mount, R.H. 1980. Survey for the presence of threatened or endangered reptiles and amphibians, Conecuh National Forest. Report to the USDA Forest Service, Contract 53-4322P-9-00443.
- Niemi, G.J., J.M. Hanowski, A.R. Lima, T. Nicholls, and n. Wieland. 1997. A critical analysis on the use of indicator species in management. *Journal of Wildlife Management* 61(4):1240-1251.
- Phillips, B.W. and C.E. Johnston. 1999. Survey of selected streams in the Talladega National Forest (Coosa River drainage). . Report to the USDA Forest Service, Contract 08-CCS-99-011.
- Schnuelle, K.A. and C. Guyer. 1996. Flattened musk turtle demography, diet, and prey availability. Report to the USDI Fish and Wildlife Service (Contract 14-16-0009-15-5045) and USDA Forest Service (Contract 10-94-01)
- Sauer, J. R., J. E. Hines, G. Gough, I. Thomas, and B. G. Peterjohn. 1997. The North American Breeding Bird Survey Results and Analysis. Version 96.4. Patuxent Wildlife Research Center, Laurel, MD.
- USDA Forest Service. 1985. Process Record for Selection of Management Indicator Species; National Forests in Alabama.

USDA Forest Service. 1980. Fish and wildlife management, 1922.33 in Forest Service Manual 1920 – land and resource planning. Interim Directive No. 6, March 10.