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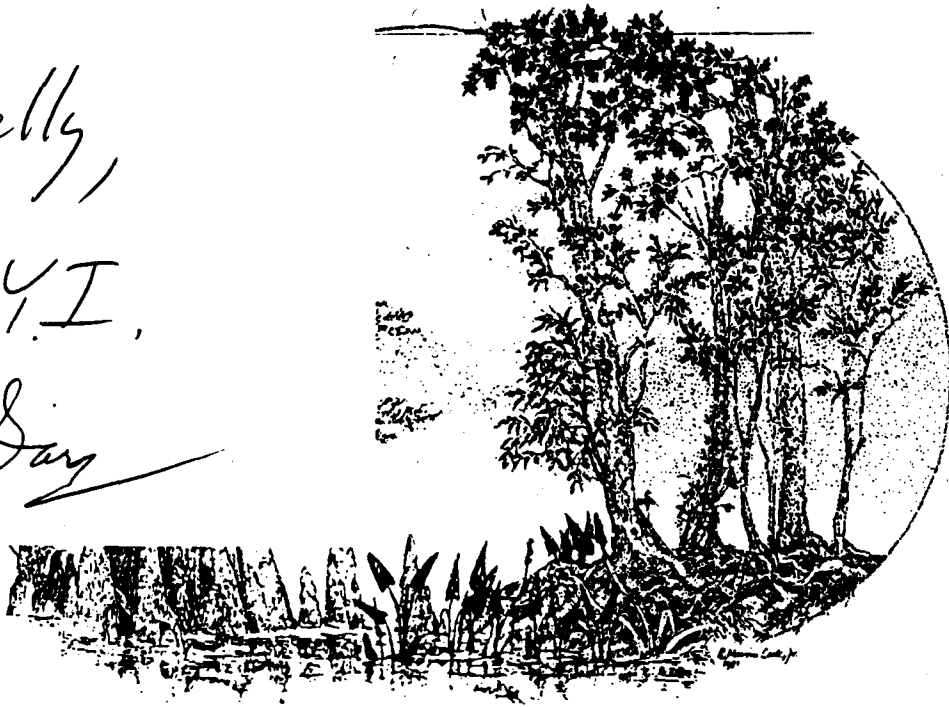
**NATIONAL PARK SERVICE
INVENTORY & MONITORING PROGRAM**

**NATCHEZ TRACE PARKWAY
AMPHIBIAN AND REPTILE
INVENTORY PROJECT
STUDY PLAN**

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Day



~~Progress~~
Report

1998

**National Park Service
Inventory & Monitoring Program**

**Natchez Trace Parkway
Amphibian and Reptile Inventory Project
Study Plan
1998**

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**STUDY PLAN
NATCHEZ TRACE PARKWAY
AMPHIBIAN AND REPTILE INVENTORY PROJECT**

Section I - Introduction

The National Park Service (NPS) is responsible for the preservation of native wildlife, including amphibian and reptile species, within the 51,410 acre Natchez Trace Parkway in accordance with the 1916 NPS Organic Act, as amended. This legislative direction is re-enforced through both NPS policy and guidelines affecting natural resource management.

NPS management policy stipulates that the bureau "has an obligation to 'manage the natural resources of the [N]ational [P]ark [S]ystem to maintain and perpetuate their inherent integrity'." This same policy goes on to state that the NPS "will assemble baseline inventory data describing the natural resources under its stewardship and will monitor those resources...to detect or predict changes. The resulting information will be analyzed to detect changes that may require intervention and to provide reference points for comparison with other, more altered environments." Both the NPS Natural Resources Inventory and Monitoring Guideline (NPS-75) and Natural Resource Management Guideline (NPS-77) provide guidance on the implementation of natural resource inventories and information needs in the parks. NPS-75 summarizes the importance of this information as follows: "Knowing the condition of natural resources within the National Park System is fundamental to the [NPS's] ability to protect and manage the parks."

Currently, NPS managers at the Natchez Trace Parkway possess neither a comprehensive baseline inventory nor the information upon which to base monitoring of the Parkway's amphibian and reptile species breeding or otherwise utilizing park lands and waters. This project is designed to develop a park-wide inventory of amphibian and reptile species currently occurring at the Parkway.

The 445 mile long Natchez Trace Parkway traverses portions of four ecosystem provinces, the Lower Mississippi Riverine Forest, Outer Coastal Plain Mixed Forest, Southeastern Mixed Forest, and Eastern Broadleaf Forest [Continental] (after Bailey, *et al*, 1995, and Keys, *et al*, 1995), and twelve physiographic regions, including the Mississippi Alluvial Plain, Loess Hills, Long Leaf Pine Hills, Jackson Prairie, North Central (MS) Hills, Flatwoods, Pontotoc Hills, Black Prairie, Fall Line Hills, Great Valley of the Tennessee River, West Tennessee Plain, and Nashville Basin (after Lowe 1919; Adams, *et al*, 1926; Smith & Whitlatch 1940, and Keys, *et al*, 1995). The amphibian and reptile habitats encountered along its length include streams; lakes; swamps; riparian

woodlands; bottomland hardwood forests; upland hardwood, pine and mixed hardwood-pine forests; prairie; active agricultural row and forage croplands; and fallow fields naturally converting to woodlands. As a management unit the Natchez Trace Parkway constitutes an extended linear ecological transect spanning portions of three states with the potential to support a diverse assemblage of native amphibian and reptile species for a unit of the National Park System with the corresponding increased complexity in ensuring their perpetuation.

Anecdotal observation records collected between 1962 and 1990 report the occurrence of 67 amphibian and reptile species occurring within Parkway boundaries. The geographic distribution of a majority of the known amphibian and reptile species is consistent with published zoological literature. However, the latitudinal and physiographic range traversed by the Parkway creates situations where *in vivo* distribution of some species contrast with the range literature. In addition, the combined influences of surficial and shallow limestone geology on ecological processes and post-Pleistocene evolution of the landscape spanning more than 300 miles of the Parkway's length have both contributed to high rates of speciation.

In recent years, the emphasis in conservation biology has shifted away from an emphasis on protecting selected endangered or threatened species towards a broader appreciation for the need to preserve functional ecosystems. This approach, known popularly as biodiversity, has attracted considerable attention from both the academic and management communities (Grumbine 1994; Heyer, *et al*, 1994; Wilson 1985, 1988). Such increasing emphasis on biodiversity makes reliable inventory and monitoring programs of critical importance to Park management. Without detailed information on the distribution, habitat requirements, and relative abundance of native amphibian and reptile species, resource managers may only preserve that portion of the fauna which is highly visible or economically important (Bogan, *et al*, 1988).

Most recent data show that reptiles and amphibians are important, perhaps critical, components of terrestrial and aquatic ecosystems (Gibbons 1988; Vitt, *et al*, 1990). Because of their ectothermic physiology, amphibians and reptiles have extremely low energy requirements, and, consequently, may have a biomass that exceeds that of nearly all other vertebrates in aquatic and terrestrial ecosystems (Bennett and Gorman 1979; Burton and Likens, 1975; Bury, *et al*, 1980; Pough 1980; Bury 1988; Gibbons 1988; Vitt, *et al*, 1990). Both groups are excellent indicator species of environmental degradation, amphibians because of their complex life cycle and permeable skin, and reptiles because of their frequent position as top carnivores (Duellman and Trueb 1986; Gibbons 1988; Vitt, *et al*, 1990). These characteristics have led to increasing recognition of the

need for collecting better data on the biodiversity and ecology of amphibians and reptiles by National Park Service managers (Scott and Seigel 1992).

The unique composition of the Natchez Trace Parkway makes it especially interesting for I&M studies of amphibians and reptiles. Since the Parkway passes through a wide variety of habitats and major river drainages, a high degree of diversity of amphibians and reptiles could be expected. In addition, the linear nature of the Parkway suggests it might function as an important wildlife "corridor", especially for amphibians and reptiles, which cannot easily transverse areas of unsuitable habitat. Conversely, the high degree of road traffic in close proximity to these habitats suggests the Parkway could function as a "sink" habitat (Pulliam 1988) for many amphibians and reptiles. These attributes make a quantified inventory of Parkway amphibian and reptile species of very high value to Park management.

The current lack of statistically sound information on the amphibian and reptile species occurring on Parkway lands is a critical deficiency in fulfilling park management's responsibility to identify and respond to potential issues necessary to achieve the NPS's resource stewardship mandate.

Section II - Project Description

Historical and Predicted Species Data

The Natchez Trace Parkway previously compiled a species list in conjunction with the 1993 Natural Resource Management Assessment Program component of the Service's Resource Management Assessment Program (R-MAP). This list was generated using the existing Parkway wildlife observation card database, together with information obtained through consultation with the Mississippi Department of Wildlife, Fisheries and Parks' Natural Heritage Program, Alabama Department of Game and Fish, Tennessee Department of Environment and Conservation's Natural Heritage Program, and Tennessee Wildlife Resources Agency. The Parkway also contacted the Mississippi, Alabama and Tennessee chapters of The Nature Conservancy for species data contained within that organizations Biological Conservation Database, and the U.S. Forest Service for data on file for the Trace Unit of the Tombigbee National Forest.

The original R-MAP amphibian and reptile species list was informally reviewed by biologists with the Mississippi Department of Wildlife, Fisheries and Parks' Natural Heritage Program and Tennessee Department of Environment and Conservation's Natural Heritage Program prior to submission. Although this original R-MAP data was reviewed again as part of the 1996 R-MAP update process in collaboration with the above outside entities, no new species occurrences were forthcoming.

Inventory Goals and Objectives

The Natchez Trace Parkway Amphibian and Reptile Inventory Project constitutes applied research designed to provide park management with the following.

Goal 1: Baseline inventory documenting the current composition and distribution of amphibian and reptile species at the Natchez Trace Parkway.

Objective 1A: Develop amphibian and reptile taxa-specific estimates of species richness and species-specific estimates of relative abundance for the Natchez Trace Parkway motor road corridor at the park-wide and physiographic regions levels.

Goal 2: Secure initial sample information on the habitat associations of Natchez Trace Parkway amphibian and reptile species to provide the basis for future monitoring to identify potential change from current resource conditions.

Objective 2A: Georeference sampling sites used to achieve Objectives 1A to permit their relocation and use in future repetition of Natchez Trace Parkway amphibian and reptile surveys for monitoring purposes.

Objective 2B: Develop distribution mapping of Natchez Trace Parkway amphibian and reptile species for use in interpreting the results of future repetition of the amphibian and reptile survey for monitoring purposes.

Habitat Delineation

The Natchez Trace Parkway currently possesses basic habitat cover mapping for 70% of its length in final form and 25% in provisional form scheduled for finalization within approximately 120 days. The remaining 5% is not currently mapped either because it is presently undergoing construction of the Parkway motor road or pending a decision by the NPS on the actual route that Parkway construction would follow.

This habitat cover mapping was developed using the 1":200' scale Parkway Land Use Maps (PLUMs) as a base map for the Parkway boundaries and centerline of the Parkway motor road. Vegetation and distinguishable physical features from ± 2 meters in size and larger were derived from 1:12,000 scale color aerial photography of the Parkway transposed onto this base map by zoom transfer

scope. The extensive attribute structure hierarchy employed in the preparation of this Parkway mapping, including habitat classification, is detailed in Appendix 1. A reduced scale version of one of the more than 900 individual PLUMs providing map coverage of the Parkway is provided in Appendix 2 as an example.

Sampling Strategy and Rationale

The Natchez Trace Parkway amphibian and reptile inventory will employ seven sampling approaches; general herpetological collecting, minnow traps, turtle trapping, coverboards (artificial shelters), frog breeding surveys, road surveys, and drift fences. Information on each of these strategies, basis for their use, sampling schemes and data analyses are summarized below. Due to the diversity of the Parkway's amphibian and reptile fauna and range of habitats multiple methods are necessary to obtain an adequate inventory of these species.

There has been a recent emphasis in herpetology towards developing more standardized and quantified methods for conducting inventories of reptiles and amphibians (Bury and Corn 1988; Campbell and Christman 1982; Dodd and Scott 1992; Fitch 1992; Gibbons and Semlitsch 1981; Grant, *et al*, 1992; Heyer, *et al*, 1994; Peterson and Dorcas 1992; Seigel and Doody 1996; Vogt and Hine 1982). Although the success of specific methods necessarily varies among habitats, some combination of the sampling methods listed below has proven successful in conducting amphibian and reptile inventories at other NPS units, e.g. Gulf Islands National Seashore (GUIS) and the Canaveral National Seashore (CANA) (Seigel and Doody 1996; Seigel and Demuth 1998). Table 1 provides an overview of these methods, their relative effectiveness, and the amount of training and manpower required. Applications of these methods are designed to be as flexible as possible in response to habitat conditions. As a consequence, assumptions on how much reliance may be placed on a particular method would be speculative prior to project implementation.

These amphibian and reptile surveys, as a form of point count sampling, have been the subject of extensive evaluation through various statistical analyses and professional literature reviews for more than three decades. These inventory approaches provide for the sampling of amphibian and reptile species occurrence data in a systematic manner which lends itself to mapping and modeling of species distributions.

Data collected through these amphibian and reptile survey approaches would be analyzed with respect to population estimates (indices including species richness and relative abundance) in both geographic and general habitat distribution

contexts. Such analyses would utilize descriptive and inferential multivariate statistical methods potentially including hypothesis testing, multivariate distributions, transformations, ordination, classification, inference for means, inference for dispersion parameters, discriminate function analysis, and correlation and association. The analyses would also seek to assess bias and precision of the survey data. The measures to provide quality assurance and quality control (QA/QC) to this project include the following: (1) use of standardized survey, sampling protocols and data recording methodologies, (2) consistent training of observers for each survey approach and their replicates to reduce observer bias, and (3) recording all sample points and transect beginning and ending points on PLUMs.

The deliverables prescribed in conjunction with this survey would include: (1) original copies of all data recording sheets; (2) copies of printed and digital raw survey data; (3) analyses of amphibian and reptile species richness and relative abundance at the (a) park-wide, (b) ecosystem province, (c) physiographic region and (d) habitat levels; (4) printed results of independent and comparative analyses survey approach efficiencies, (5) copies of a printed and bound report documenting the methodology, implementation, analytical procedure and results, (6) maps illustrating the survey based probable geographic distribution of each amphibian and reptile species recorded through the project at the park-wide level (or physiographic region map level if species record is isolated or geographically restricted to only a few sites), (7) maps (PLUMs) illustrating the geographic locations of each approaches sample points and the beginning and ending points of all survey routes, and (8) a separate recommended monitoring design based on the results of the inventory project which addresses both long-term park-wide monitoring for species richness and relative abundance, and provides data for the portions of the Parkway most susceptible to external threats, e.g. habitat fragmentation or loss of wildlife movement corridors.

Sampling Approach 1: General Herpetological Collecting

Also known as hand-collecting, this method provides the largest number of individuals and the largest numbers of species based on comparable inventory projects at GUIS (Seigel and Doody 1996). Specific methods include carefully turning and replacing ground cover, time-constrained hand-collecting, seining of small ponds, and spotlight surveys of aquatic habitats in small boats or canoes. The sample stratification would proportion the number of sampling points within each physiographic region to the relative length of the Parkway traversing it, but there would always be at least two replicate sites in each major physiographic region.

Sampling Approach 2: Minnow Traps

Minnow traps are an effective means of capturing aquatic amphibians and

reptiles, especially tadpoles, salamanders and salamander larvae, and aquatic snakes. This approach has been highly successful method based on comparable inventory projects at GUIS and CANA (Seigel and Doody 1996; Seigel and Demuth 1998). Minnow traps can be set in most aquatic situations, but appear to be most effective in ponds or swamps that have shallow waters. Traps are set near the shoreline, in water deep enough to at least cover the funnel openings. Traps are set 5-10 meters apart, and a small wooden dowel (1/4 inch diameter) is usually installed immediately behind the trap to insure it does not roll into deeper water. Unless temperatures are very hot, it is usually sufficient to check traps once per day. The sample stratification would proportion the number of sampling points within each physiographic region to the relative length of the Parkway traversing it, but there would always be at least two replicate sites in each major physiographic region.

Sampling Approach 3: Turtle Trapping

Many species of turtles cannot be effectively sampled by hand collecting. Consequently, it will be necessary to establish an active live trapping program in several aquatic habitats on Parkway lands and waters to adequately sample these reptiles. The procedure uses a standard baited hoop trap (Plummer 1979), operated mainly during the period late March - early July as the primary method of catching turtles.

Sampling Approach 4: Coverboards (Artificial Shelters)

One of the major disadvantages of approaches 1 and 2 above is that they are "active" in nature, i.e., traps must be set and monitored on a continual basis. An alternative method of inventorying herpetological communities involves the use of artificial shelters established in systematic arrays in different habitats. The method was originally developed by Fitch (1975) and has been used extensively to sample reptile and amphibian populations at the Channel Islands National Park (CHIS), the Savannah River Plant in South Carolina, and at both GUIS and CANA (Grant, *et al*, 1992; Seigel and Doody 1996; Seigel and Demuth 1998).

Utilizing the design developed at Savannah River, a series of coverboard arrays would be established in each of the physiographic regions traversed by the Parkway, with at least two replicate plots/habitat. Each plot will have 24 boards (91 x 91 x 5 cm). Such shelters would be expected to be very effective in sampling salamanders, lizards, snakes, and some frogs. The major advantages of these shelters are (1) they require no maintenance, and (2) they can be checked whenever time permits.

Sampling Approach 5: Frog Breeding Surveys

The fact that anuran amphibians congregate for breeding allows for highly effective inventories of these species. Frog breeding surveys involve the

systematic survey of each major aquatic habitat during winter (December - January), early spring (March - April), and early summer (June - July) for breeding sites for frogs. These sites will then be intensively surveyed at night for identification of species present. Minnow traps would also be used in these habitats to capture and identify tadpoles of species which might have been missed during nighttime surveys.

In addition, This approach would use the recently-developed automated data collecting techniques to sample anuran populations. Developed by Peterson (Peterson and Dorcas 1992) these techniques allow collection of data on frog breeding populations without the investigator being present. By using a programmable timer and an inexpensive tape recorder, all frog calls at a local site can be recorded, and the data archived for future processing. Extensive use of this technique would be employed to sample frog breeding populations during periods when investigators are not present on the study sites.

Sampling Approach 6: Road Surveys

Many amphibians and reptiles routinely cross roads during their daily activities, and previous investigators (Seigel and Demuth 1998) have found this approach to be the most effective method of sampling many terrestrial and semi-aquatic snakes. By recording the start and end time and total distance traveled, data from road surveys can be easily quantified and compared between sampling periods. This approach has been used to successfully census and monitor amphibians and reptiles at CANA (Seigel and Demuth 1998) and provides a transferable approach for use at the Parkway.

Sampling Approach 7: Drift Fences

Drift fences are frequently the most productive method of inventorying herpetological communities. Equipped with either pitfall traps, funnel traps, or both, the productivity of drift fences is significantly higher than hand-captures (Gibbons and Semlitsch 1981). The major disadvantage to drift fences are the high initial costs (both in labor and funds), and the necessity of daily checks when operational.

B) Processing of individuals

All reptiles and amphibians captured will be identified, sexed, measured (length and mass), checked for reproductive condition, and released at point of capture. If deemed necessary, a small series of voucher specimens will be collected and preserved according to NPS guidelines. No voucher specimens of Federal or State listed sensitive, rare, threatened, or endangered species would be taken. All personnel collecting reptiles will be trained in handling venomous snakes, and no venomous snakes will be handled except by specialized tools.

Sampling Scheme and Data Analysis

Much of this information has been incorporated into the introduction in the above section in order to provide concise, comprehensive descriptions of the seven survey approaches to be used in this inventory. The preceding information has addressed the sampling frame, study design to address specialized habitats, data analyses, and quality assurance/quality control methods associated with these survey approaches.

All amphibian and reptile data that would be collected in conjunction with this project meets or exceeds the data elements and protocols utilized for previous surveys at other NPS units (GUIS, CANA). Consequently, the data accrued through this project would be transferable to other long-term amphibian and reptile research activities and may magnify the scope and sensitivity of broader ecological studies attempting to identify changes in amphibian and reptile species diversity and distribution.

Field Survey

To be implemented pursuant to retention of cooperating agency or contractor services beginning in FY1999.

Species Richness

Pending collection of initial sample data and its analysis. The standardization of methodology and observer training previously noted are efforts to reduce variability.

Relative Abundance

Pending collection of initial sample data and its analysis.

Species Distribution

Pending collection of initial sample data and its analysis.

Monitoring Scheme

Pending collection of initial sample data and its analysis; recommended monitoring plan is included above as a deliverable in conjunction with this inventory project.

Section III - Coordination and Logistical Support

The principle investigator(s) performing the tasks comprising this inventory project will contact the Parkway in advance of initiating field sampling to schedule coordination meetings and meet with the NPS Point-of-Contact (Parkway Natural Resource Specialist) prior to initiating fieldwork. The purpose of these pre-fieldwork meetings are to (1) review the sampling protocols, (2) identify and resolve project concerns, (3) provide a schedule of the upcoming fieldwork, and (4) review scope of work tasks and QA/QC methods.

The principle investigator(s) shall provide quarterly reports to the NPS Point-of-Contact commencing 120 days following the date of the initial coordination meeting. These reports will document (1) the status of the project and (2) the status of individual component tasks of the project acted upon during the preceding 120 day period.

The NPS will not provide logistical support in the form of housing or transportation, or in any other form, to the principle investigator(s), except as may otherwise be specified herein.

The principle investigator(s) will be responsible for the training and safety of all individuals under their auspices. All vehicles used by the principle investigator(s) or their staff will display a flashing or rotating amber warning light consistent with Parkway standards whenever any portion of such vehicles are parked adjacent to and within five (5) feet of the Parkway motor road or any other public road on Parkway lands. Similarly, all vehicles used by the principle investigator(s) or their staff being operated on the Parkway motor road ten (10) miles per hour or more below the posted speed limit will display an amber warning light as above and a slow moving vehicle triangle affixed to the rear of the vehicle visible to approaching traffic.

Section IV - Budget

The total cost of the project is \$85,000. A detailed, itemized budget for the entire project is presented in Appendix 3.

Section V - Resumes

Resumes of the principle investigator(s) would be acquired as part of the procurement action to implement the project.

Section VI - Project Completion Schedule

CY1999

1. January 1999 Determine sampling site and survey transect locations.
2. Spring- Conduct Year 1 amphibian and reptile surveys and
-Fall 1999 database assembly

CY2000

3. Spring- Conduct Year 2 amphibian and reptile surveys and
-Fall 2000 database assembly
4. Fall 2000 Analyze amphibian and reptile survey data

CY2001

5. March 2001 Draft Final Report
6. June 2001 Final Report

Section VII - Voucher Specimens

Voucher specimens would be collected as part of this inventory project. All specimens will be prepared in accordance with standard herpetological techniques and would be assessioned as part of the Parkway museum collection. At the conclusion of the project all specimens would be provided to the Parkway unless a loan and curation agreement had previously bee implemented between the NPS and an academic institution consistent with NPS-28.

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Appendix 1

LAND-USE AND LAND-COVER CLASSIFICATION SYSTEM FOR NATCHEZ TRACE PARKWAY

CATEGORY		ATTRIBUTE CODE
1	Urban or built-up land	1000
11	Residential	1100
12	111 Surroundings and associated structures	1110
13	Commercial and services	1200
14	Industrial	1300
	Transportation	1400
	141 Interstate highways	1410
	142 U. S. highways	1420
	143 State highways	1430
	144 County roads	1440
	145 Railroads	1450
	146 Local roads	1460
	147 Mowed rights of way	1470
15	Communications (specify company name)	1500
	151 Right of way	1510
	152 Public road corridor	1520
	153 Deed reserved right	1530
16	Utilities	1600
	161 Petroleum pipeline (specify company name)	1610
	1611 Right of way	1611
	1612 Public road corridor	1612
	1613 Deed reserved right	1613
	162 Electrical (specify company name)	1620
	1621 Right of way	1621
	1622 Public road corridor	1622
	1623 Deed reserved right	1623
163	Other above ground (specify company name)	1630
	1631 Right of way	1631
	1632 Public road corridor	1632
	1633 Deed reserved right	1633
17	Historic structures	1700
18	Cemeteries	1800
2	Agricultural land	2000
21	Cropland and pasture (specify tract number if on NPS land)	2100
	211 Cropland	2110
	212 Hay	2120
	213 Fallow (inactive)	2130
	214 Previous (succession toward natural vegetation)	2140
	215 Pasture fences	2150
	216 Pastures	2160
22	Orchards, groves, vineyards, nurseries, and ornamental horticultural areas	2200
23	Confined feeding operations	2300
24	Farmsteads	2400
	241 Isolated farm buildings	2410

Appendix 1 (Continuation)

LAND-USE AND LAND-COVER CLASSIFICATION SYSTEM FOR NATCHES TRACE PARKWAY -- PAGE 2

CATEGORY		ATTRIBUTE CODE
3	Natural vegetation	
	301 Cutover land	3000
31	Deciduous forest land (some will also be wetland -- 51)	3010
	311 Bald cypress	3100
32	Evergreen forest land	3110
33	Mixed forest land	3200
34	Blackbelt prairie	3300
	341 Primarily grassland/herbaceous	3400
	342 Mixed post oak/blackjack -- grassland/herbaceous	3410
	343 Mixed cedar -- grassland/herbaceous	3420
	344 Cedar-dominated prairie	3430
4	Water	3440
	41 Streams and canals	4000
	411 Streams	4100
	412 Canals	4110
43	Lakes (natural)	4120
44	Reservoirs (built)	4200
5	Wetland	4300
	51 Forested wetland	5000
52	Nonforested wetland	5100
6	Barren land	5200
	61 Beaches	6000
	62 Sandy areas other than beaches	6100
	63 Bare, exposed rock	6200
64	Strip mines, quarries, and gravel pits	6300
7	Parkway features	6400
	71 Roads	7000
	711 Parkway motor road	7100
	712 Visitor facility roads	7110
	7121 Day use areas	7120
	7122 Campgrounds	7121
	7123 Other	7122
	713 Administrative roads	7123
	714 Private/deed reserved/access roads	7130
72	Visitor facilities	7140
	721 Restrooms	7200
	722 Viewpoints/overlooks	7210
	723 Visitor centers	7220
	724 Contact stations	7230
	725 Nature trails	7240
	7251 Foot	7250
	7252 Motor vehicle	7251
	726 Campgrounds	7252
		7260

Appendix 1 (Continuation)

LAND-USE AND LAND-COVER CLASSIFICATION SYSTEM FOR NATCHES TRACE PARKWAY -- PAGE 3

CATEGORY		ATTRIBUTE CODE
73	Administrative facilities	7300
	731 Offices	7310
	732 Maintenance buildings	7320
74	Landscaped areas	7400
	741 Mowed areas	7410
	742 Other landscaped areas	7420
8	Cultural resources	8000
	81 Old Natches Trace stands	8100
	82 Native American mounds	8200
	83 Historic structures	8300
	84 Cemeteries	8400

0	Land Resources	0000
	01 Federal Land	0100
	011 Fee Simple Federal Ownership	0110
	012 Less-than-free Federal Interest	0120
	0121 Scenic Easement	0121
	0122 Parkway Use Easement	0122
	02 State Land	0200
	021 Fee Simple State Ownership	0210
	0211 State of Tennessee (TDOT)	0211
	0212 State of Alabama (ADOT)	0212
	0213 State of Mississippi (MDOT)	0213
	022 Less-than-free State Interest	0220
	0221 State of Tennessee	0221
	0222 State of Alabama	0222
	0223 State of Mississippi	0223
	03 Other Government Land	0300
	031 Fee Simple State Ownership	0310
	032 Less-than-free State Interest	0320
	0321 Pearl River Valley Water Management District	0321
	04 Private Land	0400
	041 Fee Simple Private Ownership	0410
	042 Less-than-free Private Interest	0420
	0421 Private Driveway	0421
	0422 Agricultural Underpass	0422
	0423 Subsurface Mineral Estate -- Oil & Gas	0423
		0424

Appendix 2
Natchez Trace Parkway
Avifauna Inventory Project

Example Parkway Land Use Map (PLUM)
Illustrating Vegetation-Habitat Information



Historic Napier Mine
(Bare Ground)

Paved Roads
(NPS Maintained)

Paved Roads
(County Maintained)

Grass-Brush Roadside
(County Maintained)

Mowed Turfgrass
Parkway Roadside

Deciduous Oak
Woodland

Natchez Trace Parkway
Parkway Land Use Map
Base: PLUM Sheet 1F10
Scale 1"=400' (approx.)

Prepared by NATR GIS/CAD Lab 05/21/98

Appendix 3

Natchez Trace Parkway Amphibian and Reptile Inventory Project Budget¹ Years 1 and 2

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<u>CATEGORY</u>	<u>SUBCATEGORY</u>	<u>YEAR 1</u>	<u>YEAR 2</u>	<u>SUBTOTAL</u>
Salaries	Prin. Investigator	\$4,000	\$4,000	\$ 8,000
	Res. Assistant 1	\$6,000	\$6,000	\$12,000
	Res. Assistant 2	\$6,000	\$6,000	\$12,000
	Res. Assistant 3	\$2,500	\$2,500	\$ 5,000
	Res. Assistant 4	\$2,500	\$2,500	\$ 5,000
Per Diem	----	\$7,800	\$7,800	\$15,600
Transportation	----	\$5,000	\$5,000	\$10,000
Supplies/Materials/ Equipment	----	\$8,672	\$1,000	\$ 9,672
SUBTOTAL				\$77,272
University Overhead (10%)	----			\$ 7,728
TOTAL				\$85,000

¹ Cost estimate based on academic institution comparable estimating.

Table 1

**Natchez Trace Parkway
Amphibian and Reptile Inventory Project
Overview of Survey Approaches and Efficiencies**

Potential methods for assessing the biodiversity of amphibians and reptiles at the Parkway are identified below .

Sampling Approach	Efficiency¹	Manpower required²	Training and Experience required	Groups sampled
Hand captures	Low	Low	High	Snakes, lizards, frogs, salamanders
Coverboards	High	Low	Moderate	Lizards, snakes, salamanders
Minnow traps	High	Low	Low	aquatic snakes, tadpoles, salamanders, frogs
Road Surveys	Moderate	Low	Moderate	Snakes, frogs, salamanders, turtles
Automated frog recorders	High	Low	Moderate	Calling frogs
Drift fences	High	Moderate	Moderate	All amphibians; turtles; snakes

¹ Efficiency refers to the amount of data per unit of effort.

² High manpower requires a minimum of 3 hours per day of sampling.