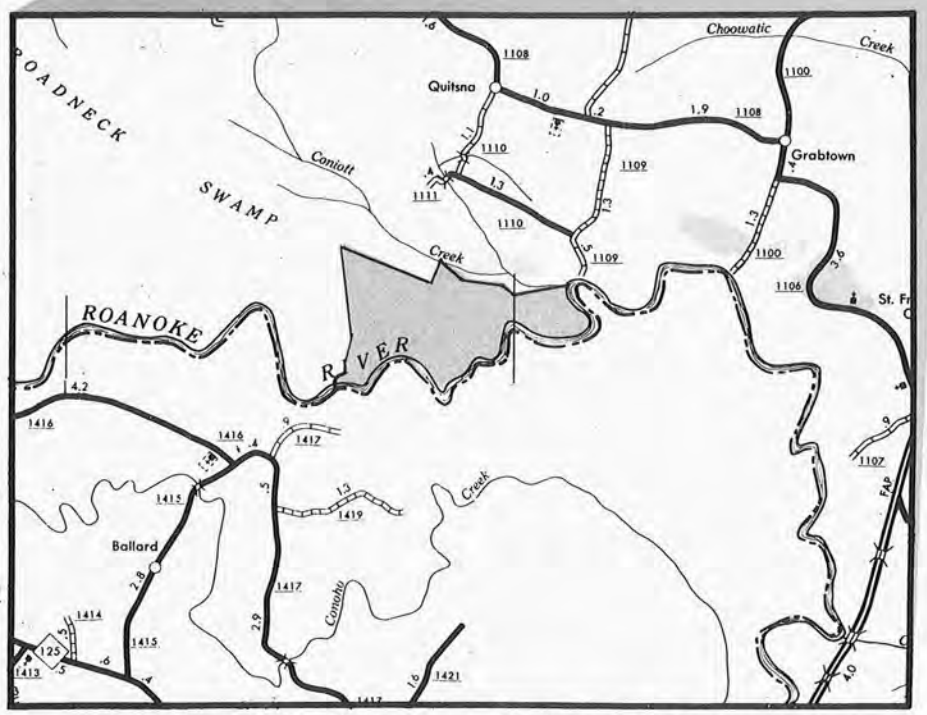
FINAL REPORT ON THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION COMPANY SWAMP MITIGATION BANK, BERTIE COUNTY, NORTH CAROLINA

Prepared by:
R. Wilson Laney, Dennis L. Stewart, Gerald R. McCrain,
Carol Mayes, and V. C. Bruton



U. S. Dept. of the Interior, Fish and Wildlife Service
N. C. Dept. of Transportation, Div. of Highways
NCNRCD, Wildlife Resources Commission
North Carolina Nature Conservancy

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United States Department of the Interior
FISH AND WILDLIFE SERVICE

Raleigh Field Office
Post Office Box 33726
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TAKE PRIDE IN AMERICA

February 10, 1989

Mr. James E. Harrington, Secretary
N.C. Department of Transportation
Division of Highways
P.O. Box 25201
Raleigh, North Carolina 27611

Dear Secretary Harrington:

Enclosed for your information and use is a copy of the Final Report on the North Carolina Department of Transportation Company Swamp Mitigation Bank, Bertie County, North Carolina. The report is the result of a joint effort by personnel of the U.S. Fish and Wildlife Service (Service), N.C. Department of Transportation's Division of Highways, N.C. Wildlife Resources Commission (Commission) and the N.C. Nature Conservancy (Conservancy). The bank was established through the cooperative efforts of your agency, the Service, the Commission and the Conservancy, and we appreciate the willingness of the participating agencies to enter into this experimental approach to mitigating wetland losses resulting from unavoidable highway construction impacts in bottomland hardwood wetlands in North Carolina.

The Service is pleased to provide this report to you, and we commend you and your staff for the excellent cooperation and coordination which occurred during the Habitat Evaluation Procedures Study conducted for the Company Swamp tract.

Sincerely yours,

L.K. Mike Gantt

L.K. Mike Gantt
Supervisor

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Raleigh, North Carolina

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ACKNOWLEDGEMENTS

The Company Swamp Terrestrial Habitat Evaluation Team consists of Charles Bruton and Gerald McCrain, representing the N.C. Department of Transportation (NCDOT), Division of Highways; Carol Mayes, representing the N.C. Nature Conservancy (NCNC); Dennis Stewart, representing the N.C. Wildlife Resources Commission (WRC) and Wilson Laney, representing the U.S. Fish and Wildlife Service (FWS). The aquatic team consists of the above-named individuals plus Ronald Sechler, representing the National Marine Fisheries Service (NMFS); and Pete Kornegay of the WRC. We would like to express our sincere appreciation to the following individuals who have assisted us to date in the study and evaluation of Company Swamp.

Cover mapping of the site was performed by Steve Leonard of the N.C. Department of Natural Resources, Division of Soil and Water Conservation, using aerial infrared photography provided by John Hefner of the Fish and Wildlife Services' National Wetland Inventory.

The Evaluation Team was assisted in groundtruthing and sample site establishment by Julie Hunkins and Rick Ward of NCDOT, Judi Durda of FWS, and Merrill Lynch of the Nature Conservancy.

Assistance in vegetative sampling, either through provision of equipment or active participation, was provided by the following: David Cobb, Department of Zoology, N.C. State University (NCSU); Jack Donnelly and Tom Henson, WRC Nongame and Endangered Wildlife Program; Kelly Hughes, Rod McClanahan, Tom Monschein, Susie Raudebaugh, David Rowe and Randy Wilson, WRC Division of Wildlife Management; and Ries Collier, Michael Fritz, Doug Lewis and Christopher Nash of FWS.

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We also express appreciation to Bruce Bell, FWS Region 4 Habitat Evaluation Procedures (HEP) Coordinator for his advice, assistance and counsel. Bruce has served as a sounding board both for various ideas concerning approaches to mitigation banking and for programming advice regarding our vegetation analysis software.

Word processing of the report was performed by Debra Miller of Data Group Management. Mike Gantt and Robert Noffsinger of FWS also reviewed and/or edited the report and provided valuable suggestions and comments.

This report is generally patterned after one by Soileau (1984) and liberally borrows segments of text from that report which deal with general aspects of the Clean Water Act, as amended, Section 404 process and mitigation banking.

EXECUTIVE SUMMARY

This report describes the establishment, results of habitat analyses and final operational procedures for the Company Swamp Mitigation Bank established by a September, 1985 Memorandum of Agreement between the N.C. Department of Transportation, N.C. Nature Conservancy, N.C. Wildlife Resources Commission and the U.S. Fish and Wildlife Service. Information presented within this report represents a major step within a process which began in 1981 when the FWS first encouraged the NCDOT to establish a mitigation bank for bottomland hardwoods. The NCDOT is commended for participating in this experimental approach to mitigating unavoidable wetland losses.

The provision of mitigation to offset adverse fish and wildlife resource impacts attributable to Federally funded or licensed projects is required under several Federal statutes. The FWS and WRC provide comments to construction and licensing agencies under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). Comments are provided to the NCDOT during review of environmental documents required by the National Environmental Policy Act (NEPA). Comments are provided also to the U.S. Army Corps of Engineers (USCE) on NCDOT permit applications considered under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Federal Water Pollution Control Act (Clean Water Act), as amended. Regulations to implement several of these statutes as well as the FWS Mitigation Policy stress the need to mitigate adverse impacts to fish and wildlife resources. Mitigation is generally defined as measures to avoid, minimize, rectify, reduce or compensate for adverse impacts.

Fish and wildlife impacts and habitat loss are continuing despite these Federal laws and their provisions regarding mitigation. Although the USCE may include mitigation measures as a condition of any necessary Federal permit to place fill material in wetlands, it has frequently proven difficult to condition NCDOT permits. This occurs because highway projects are generally perceived by the USCE as in the public interest, requiring little or no mitigation, and because of the difficulties in obtaining adequate onsite mitigation and enforcement of such conditions. As a consequence of the difficulty in obtaining adequate mitigation, the FWS and WRC were willing to participate in the establishment and operation of an experimental approach to mitigation in the form of the Company Swamp Mitigation Bank.

Mitigation banking is defined as habitat protection or improvement actions taken expressly for the purpose of compensating for unavoidable, necessary losses from specific future development actions. Measures to create, protect or improve fish and wildlife habitat are implemented in advance of anticipated project actions which adversely impact similar fish and wildlife habitat. The benefits of these measures are quantified using a habitat-based methodology which multiplies habitat extent by a factor assessing habitat quality for selected species, creating credits in the form of units of value called Habitat Units (HU). Withdrawals of credits, or HU, may be made from this "bank account" to mitigate for unavoidable fish and

wildlife impacts for one or more projects until the bank account is depleted.

The NCDOT Company Swamp Mitigation Bank was established in 1985 after many months of preliminary discussion between the involved agencies. Funding to acquire the bank site was ultimately provided through an appropriation by the State legislature. The provisions of the MOU which established the bank are similar to those used for the Tenneco Oil Company bank in Louisiana. The provisions: establish a 30-year bank life, with two 30-year renewals; provide for WRC management of the bank site; provide for use of FWS methodology to determine credits and debits for projects where impacts exceed five acres, and for acre-for-acre debiting below that level; establish an interagency review team to determine initial credits and future debits; require that only unavoidable impacts associated with NCDOT projects may be offset by the bank; mandate that the bank be used only for bottomland hardwoods habitat; prohibit use of the bank to mitigate habitat loss for any Federally-listed endangered species; require double debiting for any habitat loss resulting from projects within the bank site; establish FWS as the banker and establish time frames for review of debit transactions; require a preliminary assessment of the bank five years after establishment and a complete assessment after ten years; and provide for amending the MOU.

The bank is located on the 1436-acre Company Swamp tract which is adjacent to the Roanoke River in Bertie County, North Carolina. Although portions of the tract have been selectively timbered in the past, the majority of the tract is old-growth timber of high value to fish and wildlife resources. Harvesting of the timber would have been imminent had the State not acquired it.

Limited information was available on the natural resources and ecology of the tract at the time of its acquisition; however, field and research investigations associated with determining the credits within the bank have documented the habitat and fish and wildlife resources present. Soils present are frequently flooded and support vegetation which is typical of wetland ecosystems. No hydrological data are available for the tract. Extensive vegetation sampling reflects the presence of five cover types: gum-cypress forest, dominated by baldcypress and water tupelo gum; logged gum-cypress, occurring in slightly drier areas subject to selective cutting; bottomland hardwoods, located on the levee and dominated by a diverse assemblage of hardwood species; logged bottomland hardwoods which have been selectively cut; and transmission corridor habitat beneath a power line which is totally dominated by herbaceous vegetation. A diverse group of fish and wildlife species occurs within the tract or within adjacent upland areas. Approximately 105 species of plants are documented from the site. Fauna which are documented from the tract or are known from nearby areas include: 34 species of mammals; 90 of birds; 37 of reptiles; 40 of amphibians; and, 60 of fish.

The FWS Habitat Evaluation Procedures (HEP) were selected to document the quality and quantity of available terrestrial habitat in Company Swamp. The HEP involves three steps: defining the study limits, including delineating the evaluation area, delimiting cover types and selecting evaluation

species; describing the baseline conditions; and projecting the future habitat conditions. Habitat Units (HU), which are the product of the area of habitat times the Habitat Suitability Index (HSI), a measure of habitat quality, comprise the actual credits within the bank. The HSI for each species, within each cover type, is determined by measuring selected limiting habitat variables, such as tree diameter for gray squirrels, and calculating an index value from a model developed by species experts. Species selected for use within Company Swamp are the gray squirrel, mink, hairy woodpecker and wood duck.

Habitat acreages within the mitigation bank portion of Company Swamp and HSI values for the evaluation species were determined after field sampling was completed in September, 1986. Acreages within the bank were established as follows: 260 acres of bottomland hardwoods; 381 acres of logged bottomland hardwoods; 213 acres of gum-cypress; and 177 acres of logged gum-cypress for a total of 1,031 acres. The HSI values vary with the individual species and cover types. Overall, the value of the tract is highest for mink, slightly less for hairy woodpecker, and lowest for the gray squirrel and wood duck on a relative basis. Comparing the assumed future of the tract with and without the bank, and annualizing the results over the 90-year bank life, results in a net gain of 49,414 HU over the life of the bank. The gain of HUs with the bank is a result of preserving the high value of the old-growth timber which otherwise would have been lost as a consequence of logging. No credits are derived from placing the tract in public ownership.

A thorough analysis of the impact of highway development upon bottomland hardwoods habitat should include an assessment of the loss of aquatic functions as well as terrestrial ones; however, the Team is not able to conduct such an analysis for several reasons. Sufficient information is not presently available to determine how much aquatic habitat is present either permanently or seasonally on the tract. In addition, it is uncertain whether any aquatic credits would result from a comparison of the future with and without the bank. The same constraints apply to assessing individual highway projects. Because funding and personnel are presently unavailable to conduct studies necessary to develop information needed to perform an aquatic HEP for Company Swamp, and because the Evaluation Team believes that mitigating terrestrial components of the ecosystem will also protect aquatic components, no analysis of the aquatic habitat is planned at this time.

Final operational and implementation procedures for the bank are contained within this document. The FWS recommends that initial bank credits and credits from future proposed highway projects be kept within a single account to simplify bank accounting procedures. Debits for projects impacting less than five acres will be derived on an acre-for-acre basis by multiplying the average credits per acre value within the bank, 47.9 credits per acre, by the affected acreage for a given project. Debits for projects impacting more than five acres will be determined using the HEP. The FWS will maintain the official file and will be responsible for circulating proposed transactions to all MOU parties for comment and concurrence.

Although each of the involved parties may recommend use of the bank, concurrence of all is required prior to debiting the account. Monitoring activities will be conducted in accordance with the MOU, as special circumstances warrant, or as funding and personnel become available.

Letters of comment and/or concurrence with the contents of this final report are contained in Apendix 11.

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INTRODUCTION

This report describes the establishment, results of habitat analyses and final operational procedures for the Company Swamp mitigation bank. The NCDOT established the bank through provision of funding for partial acquisition of the 1,436-acre Company Swamp tract in Bertie County, North Carolina. This report, and the September, 1985, Memorandum of Understanding (MOU) (Appendix 1) among the NCDOT, the North Carolina Wildlife Resources Commission (WRC), the North Carolina Nature Conservancy (NCNC) and the U.S. Fish and Wildlife Service (FWS) direct the manner in which the Mitigation Bank will be administered jointly by the participating agencies.

Information presented within this report represents a major step within a process which began in 1981 when the FWS first encouraged the NCDOT to consider establishment of a mitigation bank for bottomland hardwoods. It should not be considered the culmination of the process, however. The assessment of terrestrial credits within the bank's account is subject to refinement when WRC's formal wildlife management plan for the bank is completed, and, as called for in the MOU, the effectiveness of this management program will be evaluated in the future.

The NCDOT is commended for participating in this experimental approach to mitigating unavoidable wetland losses. The linear nature of highway construction projects frequently makes onsite mitigation measures difficult to develop and costly to implement. Further, mitigation consisting of small, widely scattered and fragmented tracts of habitat is difficult to manage for wildlife. Hopefully, this joint effort by the NCDOT and WRC to acquire and manage the Company Swamp tract will result in a satisfactory solution for offsetting impacts for which onsite mitigation is unavailable or impractical.

Agency Roles and Involvement in the Section 404 Permitting Process

Under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the FWS and WRC provide comments to the U.S. Army Corps of Engineers (USCE) on applications for permits under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Federal Water Pollution Control Act (Clean Water Act), as amended. The FWS and WRC comments to the USCE on specific permit applications typically contain recommendations to mitigate adverse environmental impacts of proposed work on fish and wildlife resources. Mitigation, is defined in the Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act as:

(a) avoiding the impact altogether by not taking a certain action or parts of an action;
(b) minimizing impacts by limiting the degree or magnitude of the action and its implementation;
(c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
(d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and

(e) compensating for the impact by replacing or providing substitute resources or environments.

The FWS's Mitigation Policy, published in the Federal Register (Vol. 46, No. 15) on January 25, 1981, encompasses the above definition of mitigation.

The USCE may include measures to prevent, reduce, or minimize anticipated impacts to fish and wildlife as a condition of any necessary Federal permit to place fill material in wetlands. Traditionally, however, those measures, when required as permit conditions, are implemented at the actual work site. Unfortunately, significant losses of productive palustrine forested wetlands are occurring throughout North Carolina as a result of extensive highway development activities. Quantification of wetland losses associated with proposed or permitted NCDOT projects during 1984 indicated that approximately 194 acres of wetland habitat would be permanently lost or reduced in value (FWS, unpublished data). Since losses in other years have not been assessed, this value may or may not be representative of an average rate. The majority of this acreage was bottomland hardwoods. For many of these projects, onsite mitigation measures are often technically infeasible, economically prohibitive, and/or unacceptable to adjacent landowners. In those cases, offsite mitigation remains the only viable alternative available for compensating unavoidable losses of valuable fish and wildlife habitat.

Under present USCE regulations it has frequently proven difficult to have a permit conditioned to require offsite mitigation of unavoidable impacts for several reasons. The USCE presently perceives publicly-funded highway projects as generally in the public interest. As noted in recent correspondence from FWS Director Frank Dunkle to the U.S. Environmental Protection Agency (EPA), when it is determined by the USCE that a permit is otherwise found to be in the public interest, the USCE generally requires no additional mitigation. This results in unmitigated wetland losses, inconsistent mitigation decisions by USCE and inadequate mitigation for fish and wildlife resource losses.

The USCE also has taken the position that offsite mitigation is a matter to be resolved by agreements negotiated between the permit applicant and the commenting agency or agencies, such as the FWS and WRC. This, in essence, makes offsite mitigation a voluntary action by the applicant; it also places the FWS and WRC in the position of mitigation negotiators with no direct regulatory authority. When mitigation must be negotiated after the comments by FWS, WRC and other agencies are provided by the USCE to the permit applicant, delays in permit issuance are often attributed to FWS, WRC and other advisory agencies. Another consideration is that, because of inadequate staffing at the field level, FWS and WRC usually do not recommend offsite mitigation on permit applications involving works that individually do not cause major habitat losses but cumulatively lead to substantial reductions in fish and wildlife habitat.

Given the above-cited limitations on achieving offsite mitigation for adverse impacts to fish and wildlife resources for activities regulated by

the USCE, FWS and WRC managers must utilize innovative approaches to achieving full mitigation for unavoidable habitat losses caused by USCE-permitted actions in North Carolina. One such approach is mitigation banking.

There is cause for optimism that some issues surrounding the present USCE inconsistency regarding mitigation may soon be resolved. The FWS is supporting and presently assisting the USCE and the Environmental Protection Agency (EPA) during formulation of a joint mitigation policy. The FWS Director has recommended that all Section 404 permits be first screened under EPA Guidelines for Specification of Disposal Sites for Dredged or Fill Material (Federal Register 45(249): 85338-85357, December 24, 1980). Permits which still qualify for consideration after screening then should be subject to mitigation planning, as a sequential process, during the public interest review process. Mitigation planning should culminate in permit conditions mandating mitigation for unavoidable losses to wetlands and fish and wildlife resource values. Although implementation of such a policy would possibly diminish the need for a mitigation banking approach, there appear to be no practical alternatives to offsite mitigation at this time.

Mitigation Banking Concept

Within the FWS's January 15, 1981, Mitigation Policy and, again, in the FWS's June 23, 1983, Interim Guidance on Mitigation Banking (ES Instructional Memorandum No. 80), mitigation banking is defined as habitat protection or improvement actions taken expressly for the purpose of compensating for unavoidable, necessary losses from specific future development actions. In concept, mitigation banking is similar to maintaining a bank account (Brown 1983). Measures to create, protect or improve fish and wildlife habitat are implemented in advance of anticipated project actions which adversely impact similar fish and wildlife habitat. The benefits of these measures are quantified through a suitable habitat-based methodology (e.g., the FWS's Habitat Evaluation Procedures, or "HEP") and serve as "credits" from which future withdrawals may be made. Such a methodology quantifies habitat extent and multiplies it by a factor assessing habitat quality, creating credits in the form of units of value for a particular species. Withdrawals of credits from this "bank account" may be made to the degree necessary to mitigate for unavoidable fish and wildlife impacts for one or more projects until the bank account is depleted.

For credits to be applicable to a development proposal, in-kind habitat of the same or superior value within the same geographical area must be included in the mitigation bank area. Utilization of a mitigation bank only occurs after all attempts to avoid adverse impacts or to provide onsite mitigation have been exhausted. The credits being "banked" must have a period of effectiveness at least equal to the life of the proposed development, as well as that time required for project impacts to cease in the case of an abandoned project.

Development of the NCDOT Mitigation Bank

The FWS Division of Ecological Services, Raleigh Field Office, first recommended a mitigation bank for offsetting palustrine forested wetland losses caused by NCDOT highway construction in a letter to the NCDOT dated November 10, 1981. The FWS and the WRC continued to support and frequently reiterated this recommendation during ensuing years. Continued impetus for establishment of a forested wetland bank was provided whenever NCDOT applied for permits to place fill material in forested wetlands. Permit applications which neglected to specify mitigation measures resulted in recommendations for adequate mitigation by WRC and FWS and continual difficulty on NCDOT's part in implementing those recommendations. The NCDOT began to seriously consider establishing a bank to offset forested wetland losses in order to facilitate construction of a new bridge on US 13-17 across the Roanoke River at Williamston, North Carolina. The FWS and WRC were advised of NCDOT's willingness to seriously discuss establishment of a bank in March of 1985.

Selection of a site along the Roanoke River was suggested by Secretary James Harrington of the NCDOT. Mr. Harrington was aware that the NCNC had acquired either interest or options in a number of tracts of significant natural resource value along the river and also was aware that the WRC desired to ultimately obtain and manage those tracts. The suggestion was made that Federal funding be used to acquire a portion of one of those tracts for use as a mitigation bank site.

Discussions concerning the establishment, habitat evaluation, operation and maintenance of a potential forested wetland mitigation bank along the Roanoke River were initiated March 14, 1985 between personnel of the FWS and WRC. Ms. Mike Gantt and Dr. Wilson Laney of the Raleigh Field Office of FWS met with Dr. Jim Brown, FWS Regional Office, and Ms. Deborah Paul of WRC to discuss general issues concerning establishment of a bank and to begin preparation for presentation of the banking proposal to the Directors of the WRC and FWS and to NCDOT Officials. Discussions were held in early April with Mr. Ted Waters, Assistant Highway Administrator of the NCDOT, and Mr. Kenneth Bellamy, Division Administrator of the Federal Highway Administration (FHWA), to discuss general provisions which could provide the basis for a formal banking agreement and to discuss specific conditions which FWS and WRC believed should be incorporated into any permit issued for the US 13-17 bridge. All parties agreed that establishment and use of a mitigation bank along the Roanoke River should be a condition of that permit.

Participation in discussions regarding bank establishment requires approval of administrators above the field level for all agencies since State and National policies are involved. Approval for the Raleigh Field Office to participate in bank development was requested by the FWS Regional Director from the Director by memorandum dated April 5, 1985, and was approved on April 17, 1985. Mr. Bellamy (FHWA) requested approval of an NCDOT request that FHWA funding be provided to assist in establishing the bank by memorandum to his Regional Office on April 3, 1985. The FHWA's request to their Regional Administrator was denied on April 17, 1985, although they

were granted approval to reimburse the NCDOT for any subsequent bank debits on a case-by-case basis (Kenneth Bellamy, FHWA, personal communication). A proposal for establishing the bank was prepared by WRC staff with assistance from FWS and was presented to the WRC Commissioners on April 21 and 22, 1985. The proposal contained 12 general provisions which formed the basis for the subsequent discussions leading to development of the formal Memorandum of Understanding. The WRC agreed to the concept presented in the proposal and granted approval for continued negotiations.

Since the request for Federal funding was not approved, the NCDOT suggested that they apply for funding through an appropriation from the N.C. State Legislature. An insert was drafted for the 1985 Current Appropriations Budget Act which provided that the NCDOT be authorized to allocate funds for land acquisition in order to mitigate wetland losses attributable to highway projects planned and implemented by the State. The bill also provided that the NCDOT be authorized to improve, maintain and convey such lands pursuant to agreements with the NCNC and Federal and State agencies in order to maintain them as wildlife habitat. Funding for the bank in the form of a $500,000 appropriation was approved by the Joint Appropriations Committee in mid-May, 1985, and the bill was subsequently approved by the N.C. State Legislature.

As discussions continued, every attempt was made by the WRC and FWS to involve all agencies which review and comment on Section 404 Public Notices for highway projects in development of the formal agreement. Letters conveying copies of the draft Memorandum of Understanding for review and comment were sent to the N.C. Division of Coastal Management (DCM), N.C. Division of Environmental Management (DEM), N.C. Division of Marine Fisheries (DMF), N.C. Division of Water Resources (DWR), the EPA, and National Marine Fisheries Service (NMFS). Reviews were requested also from the U.S. Army Corps of Engineers, as the regulatory agency charged with implementing and enforcing the Section 404 program, and from the N.C. Nature Conservancy, which held the property proposed for acquisition by the State as the bank site. Comments received were considered in preparing a final version of the MOU for signatures of participating agencies and organization. The final draft was submitted to the FWS Regional Solicitor for legal review on June 28, 1985 and approved with minor changes on July 11, 1985. The final MOU was approved by the WRC on July 15, 1985 and then was circulated to all parties for signature. Signing was completed by the NCNC on September 11, 1985, formalizing the agreement and establishing the bank within 1436 acres of forested wetlands along the Roanoke River near Quitsna in Bertie County, North Carolina. A copy of the final document is found in Appendix 1.

The Company Swamp Mitigation Banking Agreement

The Company Swamp Mitigation Bank is one of only three fully operational mitigation banks within the southeastern United States (Brown, Soileau and Laney, in press). Other banks are the Tenneco Oil Company Mitigation Bank established by the Tenneco LaTerre Corporation on approximately 5,000 acres of coastal marsh in Louisiana (Soileau 1984; Brown, Soileau and Laney, in

press), and a small tidal marshland mitigation bank in Chesapeake, Virginia, established by the Virginia Department of Highways and Transportation (Russell 1983).

Provisions of the final MOU (Appendix 1) generally are based upon those contained within the Memorandum of Agreement (MOA) which established the Tenneco Oil Company Mitigation Bank (Soileau 1984), with a few notable exceptions. The Company Swamp MOU contains no assessment of credits available for use by the NCDOT, since at the time of its preparation, acreages, management plans and results of a Habitat Evaluation Procedure (HEP) were not available. That information is presented within this report. The life of the bank was established as 30 years, with two automatic 30-year renewal periods, upon recommendation of the FWS Regional Solicitor.

The bank site will be managed by the WRC in perpetuity as compared to the Tenneco MOA provision for a 25-year management period. The MOU stipulates that a management plan for Company Swamp will be developed by the WRC which identifies initial and long-range habitat improvement measures featuring nongame and old-growth timber values. The plan will be presented to all parties to the agreement for their concurrence, and when finalized, will become a part of the MOU.

The MOU also stipulates that initial management costs are to be paid by the NCDOT. Initial management costs were taken into consideration when the initial estimates of the acreage acquired with NCDOT funding were made. Those estimates presumed that $52,400 of the funding provided by the NCDOT was allocated for management during the initial five years of the bank's life. Due to the administrative manner in which funding for Company Swamp acquisition was handled by the State, however, no funds provided by the NCDOT could be set aside by WRC for management purposes. The WRC has committed to provide management on the tract, but it is not feasible to specify a precise level of funding. Estimates of acreage acquired by the NCDOT funding have been revised to reflect the provision of these additional funds for land acquisition rather than management. At present, the WRC has provided a general outline of management activities to be conducted during the next three years (Appendix 2). The Evaluation Team must defer analysis of credits resulting from management until a formal management plan, oriented to the evaluation species, is prepared and appended to the MOU since activities presently proposed for implementation will not affect the outcome of the habitat evaluation. Should the WRC elect to implement an essentially passive type of management with no habitat manipulations, it is unlikely that additional credits will be derived. Should more active measures be proposed, such as timber management, benefits to some species may occur and credits could increase.

The stipulation (Provision 3) that debits for projects impacting less than five acres will be done by subtracting credits on an acre-for-acre basis and that those impacting over five acres will employ the HEP methodology to determine debits represents a compromise on the part of parties to the MOU. The FWS and WRC preference is to always employ a habitat-based assessment methodology in an attempt to ensure provisions for adequate mitigation.

Since FHWA policy allows reimbursement only up to acre-for-acre, the NCDOT preferred debiting on that basis. Previous evaluations of forested wetland habitat within North Carolina, using HEP, usually have indicated that at least two to one replacement is necessary to maintain habitat quality, resulting in mitigation costs to NCDOT beyond those reimbursed by FHWA. All parties agreed, however, that performing HEP studies on all highway projects impacting forested wetlands would likely require an inordinate amount of staff time. Therefore, FWS and WRC agreed to the acre-for-acre stipulation with the understanding that when HEP evaluations prescribe debiting greater than acre-for-acre on larger projects, the NCDOT will not obtain complete reimbursement from the FHWA.

As in the Tenneco bank, evaluations will be performed by the Evaluation Team consisting of representatives from parties to the agreement. The MOU does not specify any particular version of the FWS HEP procedures in order to allow the team greater flexibility in performing future evaluations. The present evaluation was conducted using the 1980 version of the HEP. Credits for deposit within the bank are derived only from values retained by preventing logging of the site, an activity which is presently relatively unregulated, and from any management measures developed by WRC which will benefit the evaluation species. No credits are derived from placing the tract in public ownership.

The MOU presumes and clearly states that impacts may be offset by use of the bank only when they are unavoidable and when onsite means for mitigating are either unavailable or impractical. Substitution of mitigation banking for onsite wetlands creation or restoration results in a net loss of the habitat being mitigated and in decreased habitat and species diversity at the project site (Brown, Soileau and Laney, in press). There is also no assurance that individual species lost at a given project site will be replaced or regenerated at the bank site as a consequence of management activities.

The Company Swamp mitigation bank was established to mitigate only one, broadly-defined habitat type. That type is referred to within the MOU as bottomland hardwoods and is defined as palustrine, forested, broad-/needle-leaved deciduous/needle-leaved evergreen, semipermanently-, seasonally-, or temporarily-flooded wetlands. The definition is derived from the FWS National Wetland Classification System (Cowardin, Carter, Golet and LaRoe 1979) and covers all forested wetland ecosystems which receive periodic flooding from adjacent water courses. Palustrine forested wetland habitats covered by the bank would include those commonly referred to as swamp forest, bottomland hardwoods, gum-cypress swamps, swamp bottoms, river gallery forest and others which meet the above criteria. Forested wetland habitats which occur as pocosin or Carolina Bays (i.e., are isolated or are inundated largely through rainfall or upland runoff) are not eligible for mitigation using the bank. This provision also represents a compromise among the participants. The FWS and WRC ideally would prefer that any bank be limited in scope geographically to address habitat loss within a definable physiographic unit, such as a watershed, or within an ecologically definable unit, such as the coastal province. The NCDOT preference was to

establish a bank which would be applicable to impacts throughout the State. The compromise chosen was to define habitat such that losses mitigated will occur predominantly within the Piedmont and Coastal Plain. The area and extent of forested wetlands to be mitigated by the bank on individual projects will be determined by the Evaluation Team.

The remaining provisions of the MOU, 7 through 12, are self-explanatory and are based on provisions contained within the Tenneco agreement (Soileau 1984). The necessity to amend the agreement, in accordance with provision 12, has arisen already as a consequence of the absence of funding provided for initial management. The need for other amendments to clarify or refine operation and use of the bank will undoubtedly arise as time progresses, and, hopefully, will result in a more efficient mechanism which can serve as a model for any future banks.

HISTORY AND NATURAL RESOURCES OF THE COMPANY SWAMP TRACT

Historical Background

The 1436-acre Company Swamp tract extends approximately five miles along the Roanoke River in Bertie County, North Carolina (Figure 1). The entire tract has been timbered at various times in the past, most recently in 1980. During 1980, approximately 590 acres of the eastern end of the tract adjacent to the N.C. Power transmission corridor right-of-way (32 acres) was selectively cut for high grade timber. The western half of the tract, approximately 586 acres, remains intact and is characterized by a high quality, mature, second growth cypress backswamp community. Cutting has not occurred in this area in over 50 years. This tract is of prime ecological significance. The remaining acreage of the tract is open water and a narrow, natural levee community.

The harvest plans for Company Swamp by True Temper/Allegheny International or by any timber company as the highest bidder indicates that on the basis of the appraised value for the timber, harvesting would have been imminent. Timing and type of cut would depend entirely on: 1) hydrological conditions and release of waters by USCE from upstream impoundments in North Carolina and Virginia determining the extent and duration of flooding; and 2) on timber market conditions. As soon as these conditions allowed harvest, the forest would have been selectively cut for ash or for all high grade specimens of any species, or clear cut. The large timber companies harvesting in the Roanoke basin have practiced clear cutting under suitable conditions. Estimates of the stump value of the standing timber in the Company Swamp assumed the greatest value would be assured with harvest of all merchantable species and individuals. Furthermore, the topography and hydrology of Company Swamp make harvest a costly endeavor. A selective cut in this area would likely not be profitable, based on past market values. Therefore, harvest would most certainly have occurred under drought conditions and the extent of the cut would have been intensive.

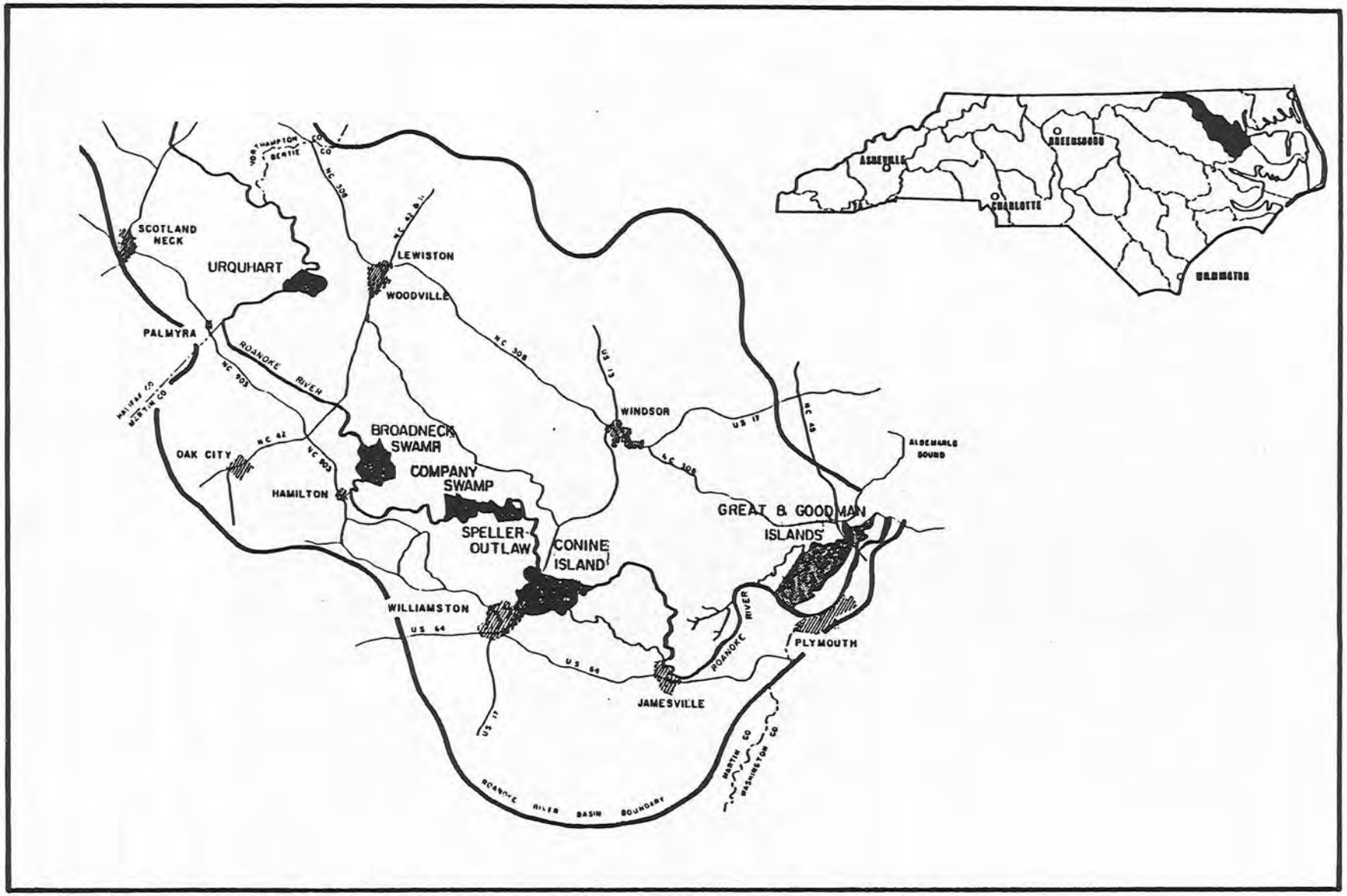


Figure 1. Location map of Company Swamp tract, Bertie County, North Carolina

Soils and Hydrology

Soils within Bertie County were originally described by the U.S. Department of Agriculture (USDA), Soil Conservation Service (SCS) in 1920 and are presently being reevaluated (USDA 1984). Only two soil types occur within the Company Swamp tract. The Wehadkee soil occurs throughout the gum-cypress cover types. All remaining portions of the tract are underlain by soils of the Chewacla series. Both soils are listed by SCS as frequently flooded. The Wehadkee series is listed as a hydric soil, i.e., a soil which is sufficiently wet under undrained conditions to support the growth and regeneration of hydrophytic (wetland) vegetation (USDA 1985). The Chewacla series has been submitted to the National Technical Committee for Hydric Soils as a candidate for inclusion on the list since it frequently exhibits hydric characteristics within North Carolina. Upland soils which occur adjacent to Company Swamp include Wickham fine sandy loam, Tarboro loamy sand, Conetoe loamy sand and Altavista fine sandy loam.

No specific hydrological data are available for the Company Swamp tract. We understand that the USCE has performed studies of flood extent and duration along the Roanoke River in order to evaluate the impact of floodwater releases from the John H. Kerr, Lake Gaston and Roanoke Rapids Lake impoundments. To date, we have been unable to obtain those data. Long-term river flow and stage data are available from the U.S. Department of the Interior, Geological Survey (GS), which maintains permanent gauging stations at several locations on the Roanoke River upstream of Company Swamp. The GS also presently maintains a gauge on the US 13-17 bridge at Williamston, downstream of the tract, from which data are transmitted to the USCE, Wilmington District. Precipitation data for the area are available from the U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, National Weather Service. Given time and an accurate survey of the Company Swamp tract, it is possible to use existing data to develop a hydrologic model which will estimate extent and duration of flooding on the tract under specified conditions of river flow and rainfall.

Vegetative Cover Types

Five distinct community patterns were identified in the 1436-acre Company Swamp tract (Figure 2). A description of each plant system is provided below, and a complete list of species in each community type is found in Appendix 3. Acronyms provided in Appendix 3 were derived from the National List of Scientific Plant Names developed by the Soil Conservation Service except as noted (USDA 1982a&b). Common and scientific names and wetland classifications for each species were derived from the U.S. Department of Interior's Wetland Plants of the State of North Carolina (Reed 1986).

Gum-Cypress Forest (GC):

The central core of the study area is comprised of approximately 586 acres of mature swamp forest. Because of regular flooding and associated physical constraints limiting accessibility, indications are that these sites have received relatively few disturbances over the last 50 to over 100 years. Forest cover is dominated by a water tupelo gum - bald cypress canopy averaging 80 to over 100 feet in height. Understory development is limited

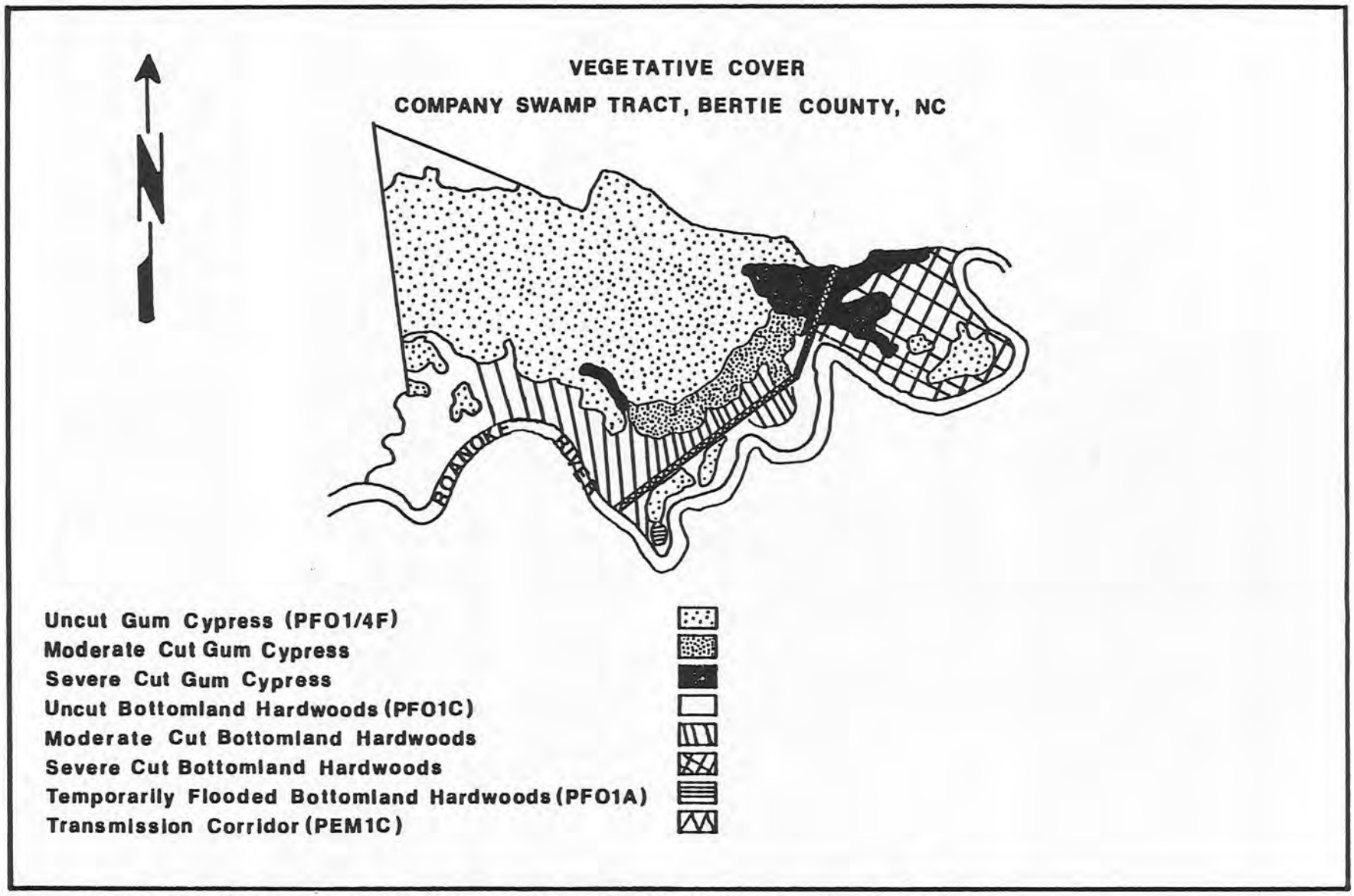


Figure 2. Cover map of Company Swamp tract, Bertie County, North Carolina

to scattered red maple, American elm, ash, and swamp cottonwood saplings along with regeneration of identified canopy species.

Although subjected to inundation during major portions of the year, these forest communities do dry out at periodic intervals. During such times, a diverse assemblage of herbaceous plants emerge as ground cover. Marsh purslane, lizard's tail, small beggarticks, marsh mermaid weed, false nettle, dogfennel, smartweeds, yerba de tajo, parrot's feather, grasses and sedges are common during appropriate growing seasons. Where standing water prevails, duckweed, watermeal, frog's-bit, creeping burhead and subcordate water plantain may be observed.

Gum-cypress habitat in Company Swamp is classified as palustrine, forested, broad/needle-leaved deciduous, semipermanently-flooded wetland (PFO1/4F).

Logged Gum-Cypress Forest (GCL):

Along fringes of the above described gum-cypress community where accessibility can be gained, approximately 177 acres of swamp forest have been logged. Affected communities currently are undergoing successional re-vegetation. Although scattered remnants of the water tupelo gum-bald cypress climax canopy still remain, timber removal has been responsible for the proliferation of gum and cypress saplings in the understory along with the emergence of associated hardwoods such as red maple, ash, and overcup oak.

Ground cover productivity has increased significantly as a result of clearing. In addition to those species previously identified in climax forest ground cover layers, marsh dayflower, marsh yellow cress, violets, purple mecardonia, trumpet creeper, Carolina false dandelion, peppervine and greenbrier contribute to the overall diversity.

Bottomland Hardwood Forest (BH):

Of the estimated 641 acres of bottomland hardwood forest adjacent to the Roanoke River, approximately 260 acres have been left undisturbed. Although these communities receive frequent flooding during various times of the year, elevational differences between high ground levee sites and nearby lowland swamp forests allow for sufficient drainage to enable these lands to support a mixture of facultative wetland, facultative, and upland species (Reed 1986).

A diverse hardwood canopy/subcanopy is present in undisturbed areas, consisting of American elm, ash, overcup oak, red and silver maple, box elder, sugarberry, American hornbeam (ironwood), sweetgum, winged elm, water oak, persimmon and sycamore. One area near Site GC-9 is dominated by overcup oaks ranging from 3.8 to almost 5 feet in diameter. Hardwood saplings of most of these species are prevalent throughout the understory along with growth of hawthorne, water hickory and winterberry. Rattan vine, grape and various species of greenbrier are often interwined in and among the branches.

Ground cover development is equally diverse including common pokeberry, false nettle, dicliptera, poison ivy, Virginia dayflower, asters, blackberry, cane, peppervine, violets, smartweeds, lizard's tail, trumpet creeper, Carolina false dandelion, grasses and sedges.

Bottomland hardwood habitat in Company Swamp is classified as palustrine, forested, broad-leaved deciduous, seasonally (PFO1C) or temporarily (PFO1A) flooded wetland.

Logged Bottomland Hardwood Forest (BHL):

Approximately 381 acres of bottomland hardwood forest were logged by local timber interests in 1980. Although such actions have resulted in removal of significant portions of the canopy/subcanopy in impacted areas, species composition and diversity remains similar to that found in undisturbed communities. However, as expected, opening of the canopy and subsequent clearing has allowed for the proliferation of small hardwood saplings and shrubs throughout the understory as well as increased production of herbaceous ground cover vegetation.

Transmission Corridor (TC):

A 185-foot-wide utility corridor comprising 32 acres is located within the eastern/southeastern boundary limits of the Company Swamp tract. The North Carolina Power Company maintains this right-of-way alignment by clearing vegetation on a 3-year rotational cutting cycle along with sporadic use of herbicides, including Garlon 4. A danger tree survey is conducted every 10 years in an effort to remove overhanging or emerging trees which may infringe on transmission lines.

This regular maintenance program has resulted in uniform plant coverage within the corridor, which is dominated by herbaceous, successional plant types. Ragweed, smartweeds, grasses and sedges are the most prevalent species present, complemented by growth of swamp mallow, lambsquarter, Virginia dayflower, lizard's tail, horsenettle, asters, peppervine, trumpet creeper, Carolina false dandelion, mustard, Virginia buttonweed and small beggarticks. Species composition is expected to experience little or no annual variation due to the artificial conditions imposed by regular mowing.

Transmission corridor habitat within Company Swamp is classified as palustrine, emergent, persistent, seasonally-flooded wetland (PEM1C).

Wildlife and Fisheries Resources

Values and functions of bottomland hardwood communities for wildlife and fisheries resources are well-documented in several publications and brochures (Brinson, Swift, Plantico and Barclay 1981; Clark and Benforado 1981; Greeson, Clark and Clark 1979; Harris, Sullivan, and Badger 1984; Wharton, Kitchens, Pendleton and Sipe 1982; Winger 1986). It is the intent of this section to identify species with known occurrence or those with a

high probability of occurrence within Company Swamp based upon distribution maps (Lee, Funderburg and Clark 1984; Lee, Gilbert, Hocutt, Jenkins, McAllister and Stouffer 1980 et seq.; Martof, Palmer, Bailey and Harrison, III 1980; Menhinick, Burton and Bailey 1974), personal observations, and professional opinion. The Evaluation Team also surveyed natural resource literature and unpublished records of the N.C. State Museum of Natural History. Representative species in each vertebrate taxon are discussed by common names in the text. Scientific names and species not mentioned in the text may be found in Appendices 4 and 5. Since there have been no comprehensive onsite faunal surveys, species lists in this report should not be considered as complete. Likewise, it is probable that some species may be included that do not occur in the Company Swamp tract but may occur in nearby habitat and could be occasional visitors. As the text and Appendices 4 and 5 imply, diverse plant communities provide habitat for a broad range of species. Since seasonal fluctuations in water level affects distribution for some species while others are highly mobile, it is not possible to discuss species distribution by cover-type.

Good interspersion of the five plant communities discussed in the vegetation section results in a highly diverse wildlife community. Mammalian species include the white-tailed deer, raccoon, opossum, gray squirrel, mink, and otter. Small rodents such as the hispid cotton rat and white-footed mouse constitute a prey base for predators such as the bobcat and gray fox. Beaver colonies are well established along Coniott Creek and tributaries and the Roanoke River. Muskrats may be found in the river, creek, and beaver pond. The black bear, although not a permanent resident, is an occasional visitor to Company Swamp. Additional mammalian species which may be present on or near the site are listed in Appendix 4.

Avifaunal diversity is high due largely to a variety of seres ranging from early succession (transmission corridor and heavily logged areas) to old-growth gum-cypress and bottomland hardwoods. Because of its size, the area provides valuable, relatively unfragmented habitat for many neotropical migrants. Common birds include the yellow-billed cuckoo, ruby-throated hummingbird, pileated woodpecker, eastern wood pewee, Carolina chickadee, tufted titmouse, Carolina wren, wood thrush, indigo bunting, and prothonotary warbler. Predatory birds such as the red-shouldered hawk and barred owl are relatively common. Colonial nesting birds such as the great blue heron and great egret are found on the property as well as in important rookeries just off the tract near the northeast and northwest corners (Osborn and Custer 1978). One anhinga was observed soaring near the northeast rookery during field work on June 26, 1986. Critical overwintering habitat for the wood duck, mallard, green-winged teal, hooded merganser, and black duck is found throughout Company Swamp. The wood duck also commonly nests in the area. The wild turkey, bobwhite, mourning dove, and woodcock are relatively common inhabitants of the area. Additional avian species which may be present on the site are listed in Appendix 4.

Perhaps least is known about the herpetofaunal diversity in Company Swamp. Because of the seasonally high water table, the large beaver pond, Coniott Creek, and Roanoke River, the area appears to provide habitat for a broad

range of reptiles and amphibians. Fallen, decaying trees, stumps, and logging slash provide numerous refuge sites as well as foraging and basking areas. Common turtles in areas with permanent water include the snapping turtle, cooters, mud turtle, musk turtle, and slider. The eastern box turtle may be found in the drier bottomland hardwoods as well as some of the seasonally dry gum-cypress. Based upon personal observations, skinks appear to be the most common group of lizards. Representative snakes include the rat snake, mud snake, eastern kingsnake, green snake, redbelly water snake, banded water snake, brown water snake, and eastern garter snake. Venomous snakes include the copperhead, cottonmouth, and timber rattlesnake. Among amphibians occurring in Company Swamp, sirens, the eastern newt, and salamanders such as the spotted, marbled, and tiger are probably more common. Representative toads and frogs would include the Eastern spadefoot toad, American toad, gray treefrog, green treefrog, spring peeper, bullfrog, and Southern leopard frog. Other reptiles and amphibians which may be found in Company Swamp are listed in Appendix 4.

Bordered on the south by the Roanoke River and Coniott Creek on or near the northern boundary, Company Swamp provides excellent habitat for a diverse assemblage of fish species. Fish (1968) classified the section of the Roanoke River between Williamston and the Roanoke Rapids dam as a carp-catfish stream, and Coniott Creek was classified ecologically as a redfin-warmouth tributary. Data presented by Fish (1968) for Coniott Creek and the Roanoke River represented summaries of creel censuses with relatively low numbers of contacts and did not provide a detailed list of species present. Sampling was conducted by Carnes (1965) in the Roanoke River upstream of Company Swamp.

Fish species in the Roanoke River having highest recreational values include sunfish such as the bluegill, redbreast, largemouth bass and black crappie. In addition, the white perch, yellow perch, carp, channel catfish, and white catfish have moderate recreational values. Anadromous fish utilizing the river include the blueback herring, alewife, hickory shad, American shad and striped bass. Other species include the longnose gar, bowfin, American eel, suckermouth redhorse, silver redhorse, and yellow and brown bullheads. Many species such as the golden shiner, ironcolor shiner, mosquitofish, and darters occupy important niches in the river.

Coniott Creek is a blackwater stream meandering through gum-cypress swamp and bottomland hardwoods for approximately 10 miles from mouth to headwaters. The creek channel has meandered over a large area through geologic time leaving numerous braids and oxbows. The lower and middle sections of the creek channel appear to become intermittent during summer low flow conditions. Relatively large beaver ponds on and adjacent to the Company Swamp tract retain water throughout the summer and appear to have existed for many years. These ponds probably function as important reservoirs for repopulating the creek channel. Because of interaction between the creek, beaver ponds, and river during normal and high-water events, species composition in Coniott Creek would have some overlap with the river.

Fish species in Coniott Creek having highest recreational values include the bluegill, redbreast, pumpkinseed, warmouth, flier, redfin and chain pickerel, yellow perch, and possibly largemouth bass. Yellow and brown bullheads and carp are caught incidentally while fishing for other species. The bowfin, longnose gar, American eel, tadpole madtom, margined madtom, and creek chubsucker are likely inhabitants of the creek and beaver pond. Many other species such as the swampfish, pirate perch, mosquitofish, cyprinids (e.g., golden shiner, ironcolor shiner, and creek chub), and percids, such as the swamp darter and tessellated darter, contribute to a high level of ichthyofaunal diversity. Fish species which occur in or adjacent to Company Swamp are listed in Appendix 5.

The gum-cypress swamp and Coniott Creek are of special significance to anadromous floodplain spawners such as the blueback herring and alewife. Also, the area is important to inland fish dependent upon spring flooding for floodplain spawning. In summary, the creek, including beaver ponds, river, and associated floodplains provide important nursery habitat for resident and anadromous fish species.

HABITAT ASSESSMENT METHODOLOGY

The Habitat Evaluation Procedures (U.S. Department of the Interior 1980) were selected to document the quality and quantity of available terrestrial habitat in the Company Swamp study area. The HEP provide information on the relative value of the same area at future points in time. A terrestrial HEP study provides a means whereby the relative habitat values of various species at a particular site may be compared under two scenarios, the future "without the project" (baseline condition) and the future "with the project" (future condition). By contrasting these comparisons, the impact of proposed or presumed land and water use changes on wildlife habitat may be quantified.

The HEP involve three steps which provide basic approaches for habitat assessments. These steps include:

1. defining study limits, which includes delineating the HEP evaluation area, determining cover types and selecting evaluation species;

2. describing the baseline condition; and,

3. projecting the future habitat condition.

A HEP analysis is structured around calculation of Habitat Units (HU's) for each evaluation species in the study area through time. A Habitat Unit is defined as the product of total area of available habitat, a measurement of quantity, and the Habitat Suitability Index (HSI), a measurement of habitat quality. Total area of available habitat for an evaluation species includes all areas that may be expected to provide some support to the evaluation species.

The HEP is based on the assumption that habitat quality for selected wildlife species can be described by an HSI, an index value ranging from 0.0 to 1.0, which represents the poorest and best habitats, respectively. The HSI is calculated through the use of HSI models, commonly referenced as species models.

The Company Swamp terrestrial analysis began by formation of a HEP Evaluation Team consisting of: Charles Bruton and Gerald McCrain, NCDOT; Dennis Stewart, WRC; Merrill Lynch, The Nature Conservancy; and Wilson Laney, FWS. Merrill Lynch was subsequently replaced by Carol Mayes of NCNC. The Team first met on August 26, 1985 on the project site to observe representative habitat types. The evaluation species selection process began at a subsequent meeting on September 6, 1985. A list of 24 candidate species was compiled. At subsequent meetings in 1986, the Team reduced the list using criteria listed below and designated the final evaluation species to include the gray squirrel, hairy woodpecker, mink and wood duck. The eastern box turtle was evaluated for possible use but was ultimately eliminated from the analysis because it does not use all habitats within the bank.

A primary consideration in species selection was to select species which would be of most utility in assessing impacts on bottomland hardwoods attributable to highway construction. Criteria considered for species selection included public visibility, economic importance, ecological importance, utilization of representative cover types, phylogenetic representation, home range size, and availability of adequate HSI Models. Selected evaluation species are listed in Table 1. The goal of the species selection process was to allow an assessment of positive and negative impacts of future highway projects on bottomland hardwood habitat types, as defined above, with a minimum of effort. Species selection was limited to four to reduce field time and data processing necessary for completing HEP studies.

Because funding did not permit development of HSI Models for the study, the Team selected evaluation species with published models which most closely represented habitat requirements of species in the study area. Modifications of the gray squirrel and mink models were determined to be necessary by the Team, primarily because the models were designed for broad geographical applicability and did not represent site specific habitat requirements or land use practices adequately. The gray squirrel model was modified to add hard mast value for gum cypress habitats. The mink model was modified to weight the value of tree canopy cover. Model modifications are fully enumerated in Appendix 8. Sampling limitations and unknown future conditions left gaps in the information base which were filled by assumed conditions. Assumptions employed in the analysis are documented in Appendix 8.

Field sampling within Company Swamp was scheduled initially to start in the fall, 1985, but was delayed due to onsite flooding. Ten randomly chosen sample sites were designated within each of the five cover types, and these were located and marked during the fall and winter of 1985-86. Compass

Table 1. Evaluation species, models employed, and habitat utilization for each species.

EVALUATION SPECIES	MODEL SOURCE	HABITAT UTILIZATION[1]			
		BH	BHL	GC	GCL
Mink	Allen 1986	X	X	X	X
Gray squirrel	Allen 1982	X	X	X	X
Hairy woodpecker	Sousa 1986	X	X	X	X
Wood duck	Sousa and Farmer 1983	X	X	X	X

[1] Habitat acronyms are: BH-bottomland hardwoods; BHL-logged bottomland hardwoods; GC-gum-cypress; GCL-logged gum-cypress

bearings and approximate distances to each site were recorded, and each site was marked with a six-foot length of steel reinforcing rod. Dates of establishment and locations for each site, including responsible personnel, are included in Appendix 6. Approximate site locations are depicted in Figure 3.

Sampling was initiated in June, 1986 and was completed in September, 1986. Station personnel and sample completion dates are included in Appendix 7. Details of sampling techniques and data editing and entry are provided within Appendix 8. Since the majority of the time and effort involved in collecting habitat data for Company Swamp was spent moving from one station to the next, the Team elected to expend minimal extra effort and measure every plant on the line transect established at each station, identifying each to species.

The collection of such detailed data establishes a unique database which provides a firm basis for future monitoring of habitat conditions within the bank. In addition, the database will provide a baseline against which the success of management measures may be assessed. It also will allow future refinements to species models to include variables based on the occurrence of individual plant species preferred by the evaluation species rather than employing summary variables such as percent total herbaceous cover. Studies have shown that using species specific data improves model predictability over that achieved using summary variables (Szaro and Belfit 1986).

Because of severe drought conditions prevalent during the summer of 1986, data collected probably represent optimum conditions for herbaceous growth. Areas which under more normal hydrologic conditions may have retained standing water and anoxic conditions were relatively dry and exhibited lush herbaceous growth. Since data were collected throughout a two-month time period, additional variability was introduced into the herbaceous component as a consequence of ongoing rapid plant growth.

When sampling was completed, data were compiled and entered onto diskettes for storage and further manipulation. Variables needed for individual species models were generated using software developed at the FWS Raleigh Field Office. Original data sheets will be retained by FWS. Copies of the clean dataset, as stored on diskettes, have been provided to all parties to the MOU.

Acreage estimates for each cover type were finalized in February, 1987. As a consequence of the difficulty in determining a precise boundary location and an accurate total acreage figure for the tract, the Team prepared a Memorandum of Record which detailed the assumptions made and the methodology employed to derive estimates for each cover type (Appendix 9). Acreages employed in the HEP analysis for each cover type are listed in Table 2. Bank acreages were finalized in May, 1987 (Appendix 9). However, it is important to note that a survey of the tract has not been conducted recently, and acreage estimats may be revised in future reports.

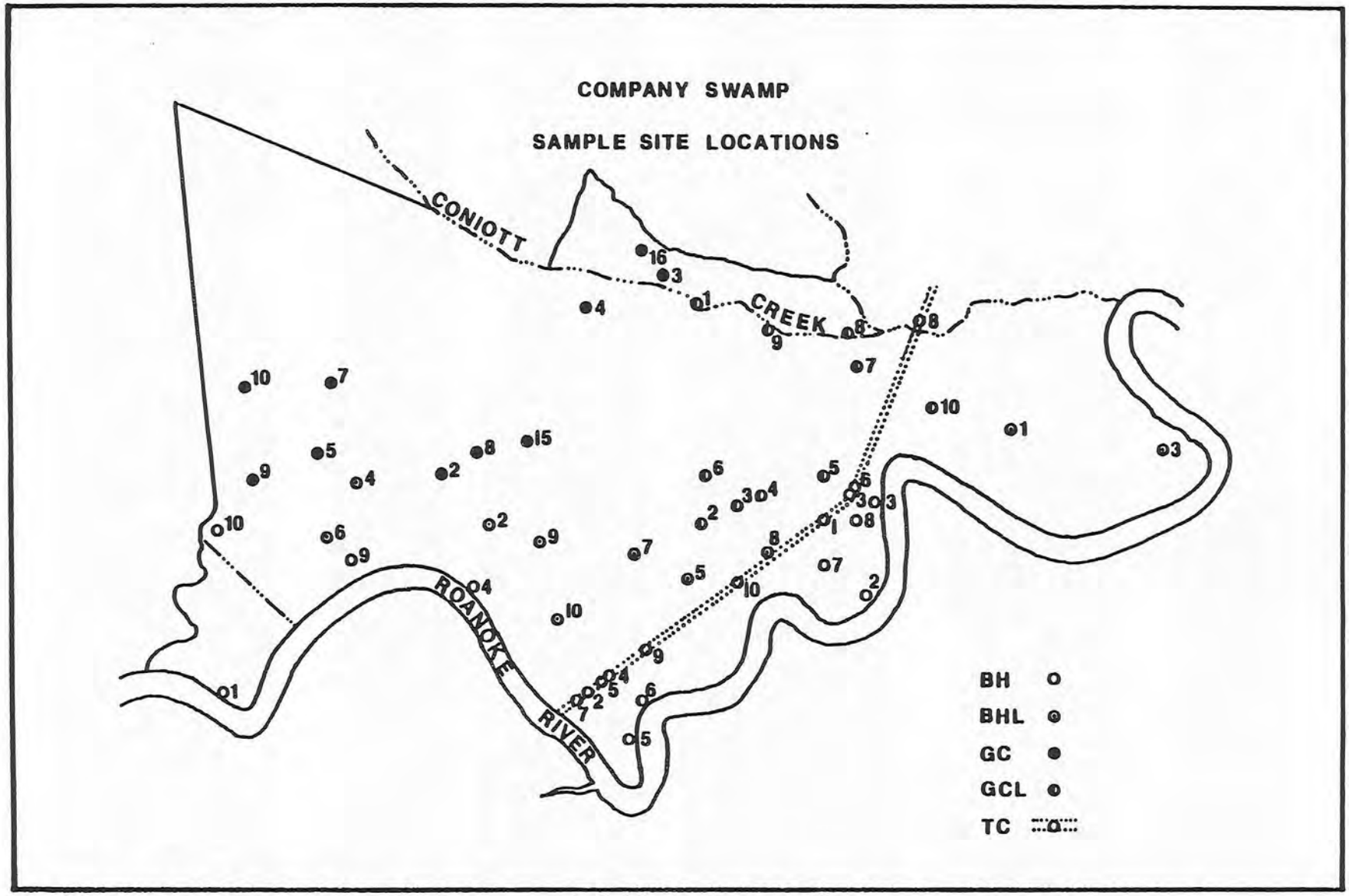


Figure 3. Company Swamp tract, Bertie County, North Carolina, showing approximate sample site locations (Station No. to the right of symbol).

Table 2. Cover type acreages within the Company Swamp Mitigation Bank as utilized in the HEP analysis.

COVER TYPE	ACREAGE
Bottomland hardwoods (BH)	260
Bottomland hardwoods-logged (BHL)	381
Gum-cypress (GC)	213
Gum-cypress-logged (GCL)	177
Total Acreage	1031

RESULTS OF THE HABITAT ASSESSMENT

The initial parameter developed by any HEP study is a baseline HSI value for each evaluation species. Baseline values for each species utilized for the Company Swamp study, by cover type, are presented in Table 3. Values for the mink are high within all cover types as a consequence of abundant water and cover. Gray squirrel values are lower than anticipated for forested habitats due to the low percent cover and diversity of hard mast-producing species. The potential exists to increase the values of these habitats through management which increases the abundance of mast-producing species. Value was high for the hairy woodpecker in unlogged, forested habitats and lower in logged areas as a consequence of reduced canopy cover. Wood duck values are low as a consequence of low cavity density, even though the Team was liberal in their assessment of available cavities and brood habitat area. In fact, cavity values employed in the HEP exceed measured values determined for other bottomland hardwood stands (Hill and Lowney 1986). Again, the potential exists for emplacement of artificial cavities to increase habitat values for this species.

Using the HEP process, the value of the tract preserved for fish and wildlife conservation purposes was compared to the future value without conservation. The values of the tract as conserved are based solely on natural growth and mortality processes and do not reflect increased values as a result of management activities. The future without conservation assumes that the entire tract would have been severely logged within a 6 year time period, allowed to regenerate naturally for 80 years, and cut once again over a 6-year time span. Detailed assumptions and supporting data are provided within Appendix 8.

The resultant Average Annualized Habitat Units (AAHU's) are presented within Table 4. All species benefit from conservation of the tract to some degree. The mink shows least change since the impact of tree removal upon it is compensated to a degree by the positive response to logging of shrubs and herbs. All other species benefit significantly as a result of maintaining old-growth timber values on the tract. Curves of AAHU's versus time, with and without the bank, are plotted for the gray squirrel, hairy woodpecker, wood duck and mink in Figures 4 through 7.

Credits for placement within the bank account are derived by multiplying the total net change in AAHU's for all species by the duration of the analysis. This results in an account with total available credits of 49,414 (Table 4). Credits are gained by retaining the habitats within the bank in a forested condition through conservation. No credits are derived from placement of the property in public ownership.

PROPOSED BANKING IMPLEMENTATION AND OPERATIONAL PROCEDURES

Period of Analysis

The FWS Mitigation Policy requires that mitigation provided to offset the habitat quality lost due to construction of a project should replace not

Table 3. Baseline Habitat Suitability Indices (HSI) for evaluation species.

EVALUATION SPECIES	HABITAT			
	BH	BHL	GC	GCL
Mink	.86	.85	.81	.72
Gray squirrel	.29	.34	.20	.25
Hairy woodpecker	.95	.68	.85	.53
Wood duck	.28	.10	.40	.32

Table 4. Credits derived for terrestrial evaluation species by establishing the bank, by cover type. Data are Average Annual Habitat Units (AAHU) for with-the-bank (W) and without-the-bank (WO) conditions.

COVER TYPE	CONDITION	EVALUATION SPECIES			
		Mink	Gray Squirrel	Hairy Woodpecker	Wood Duck
BH	W	204.82	100.72	222.15	72.28
	WO	193.12	74.65	141.66	36.45
	Net Change	+11.70	+26.07	+80.91	+35.83
BHL	W	308.04	159.54	319.70	79.73
	WO	281.23	116.84	212.17	46.05
	Net Change	+26.81	+42.71	+107.53	+33.68
GC	W	172.96	42.60	179.23	85.20
	WO	172.51	38.22	117.45	46.84
	Net Change	+0.44	+4.38	+61.78	+38.36
GCL	W	142.61	47.35	140.75	64.90
	WO	143.09	35.30	100.28	38.17
	Net Change	-0.47	+12.05	+40.47	+26.73
WHOLE BANK	W	828.43	350.21	862.25	302.11
	WO	789.88	265.01	571.56	167.51
	Net Change	+38.55	+85.20	+290.69	+134.60
GRAND TOTAL		549.04 x 90 years = 49,414 credits in the bank. For projects less than 5 acres, debit will equal 47.9 credits per acre.			

Figure 4. Average annualized habitat units (AAHU) versus time for gray squirrels on the Company Swamp tract, with and without bank establishment.

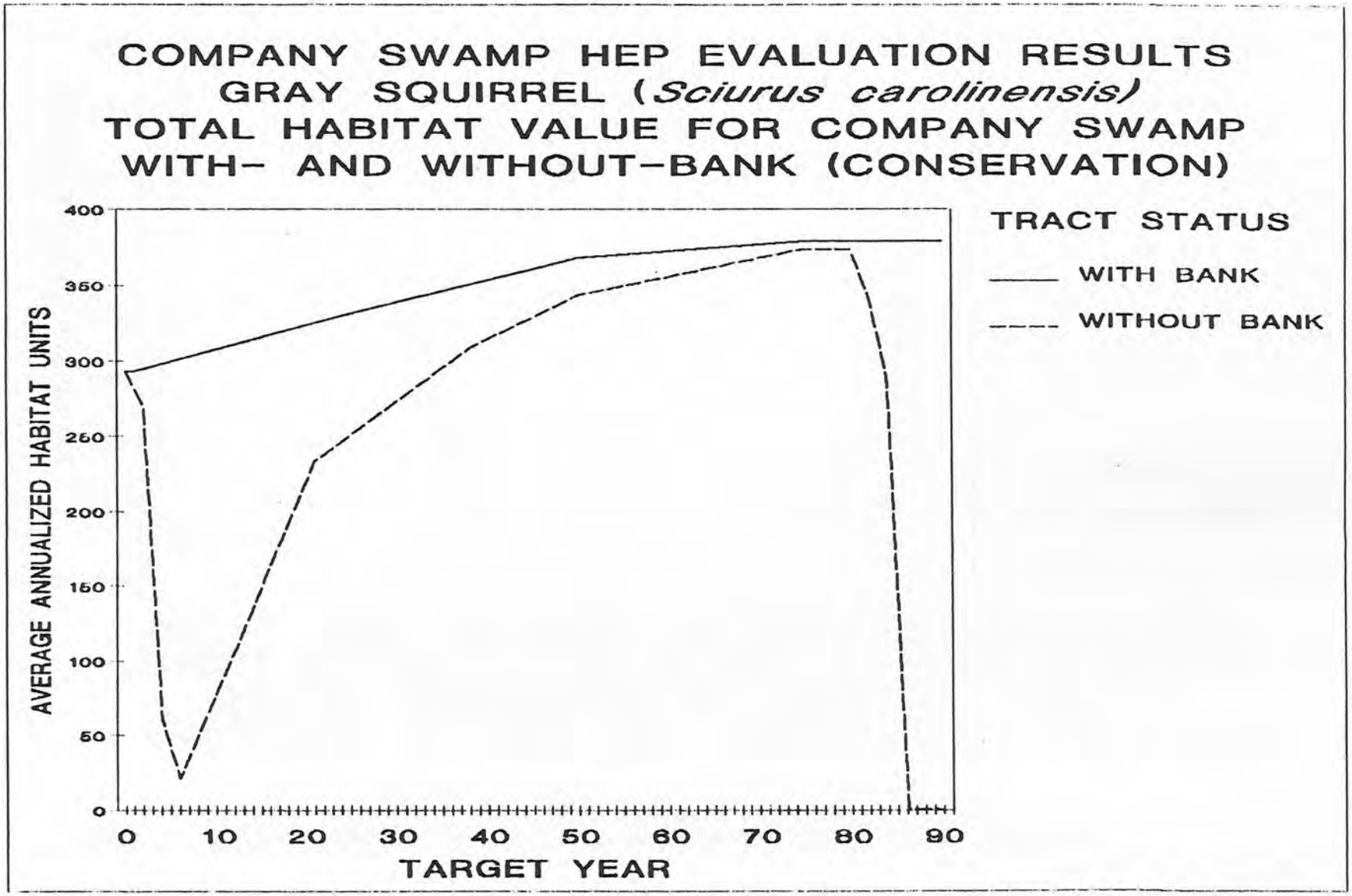


Figure 5. Average annualized habitat units (AAHU) versus time for hairy woodpeckers on the Company Swamp tract, with and without bank establishment.

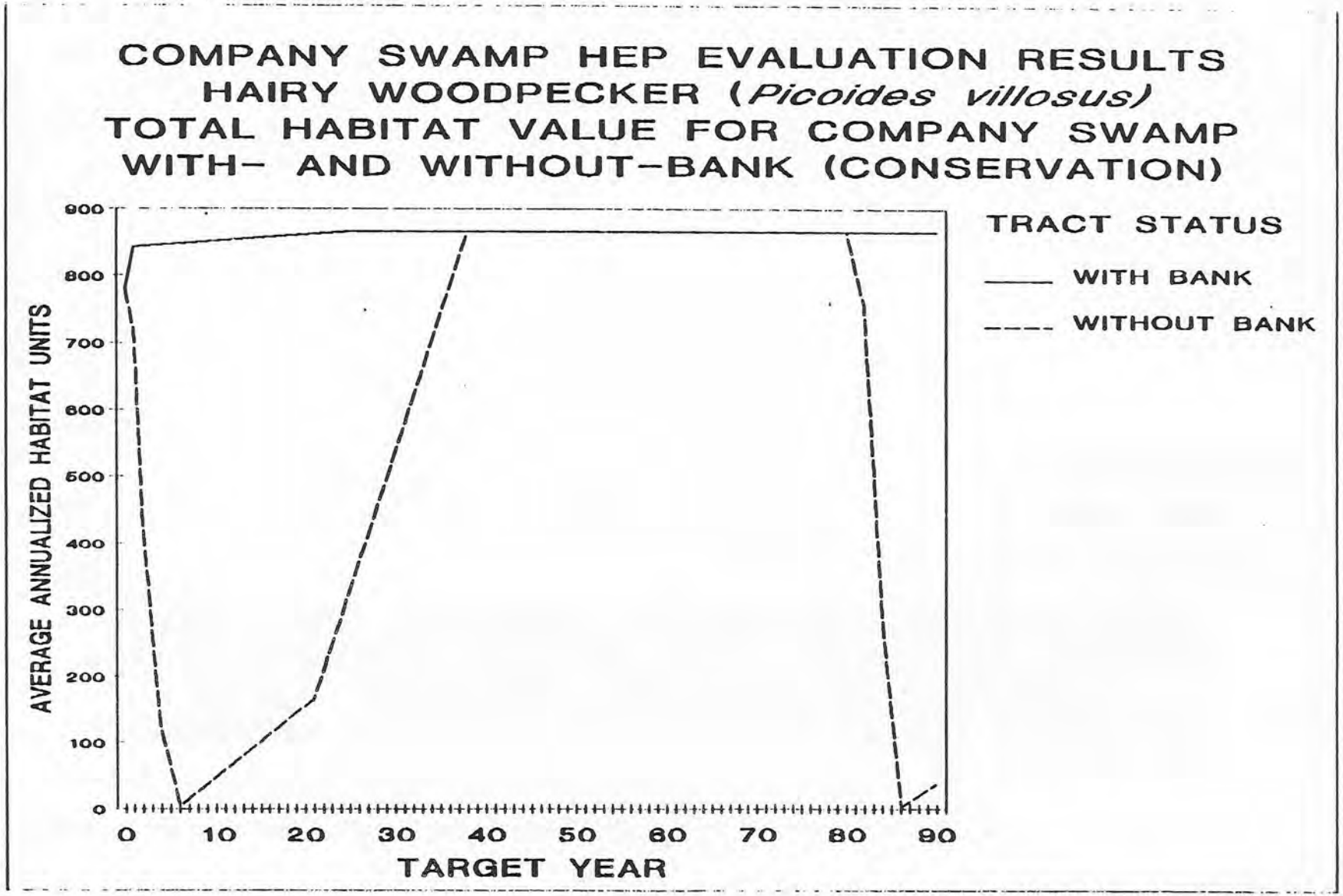


Figure 6. Average annualized habitat units (AAHU) versus time for wood ducks on the Company Swamp tract, with and without bank establishment.

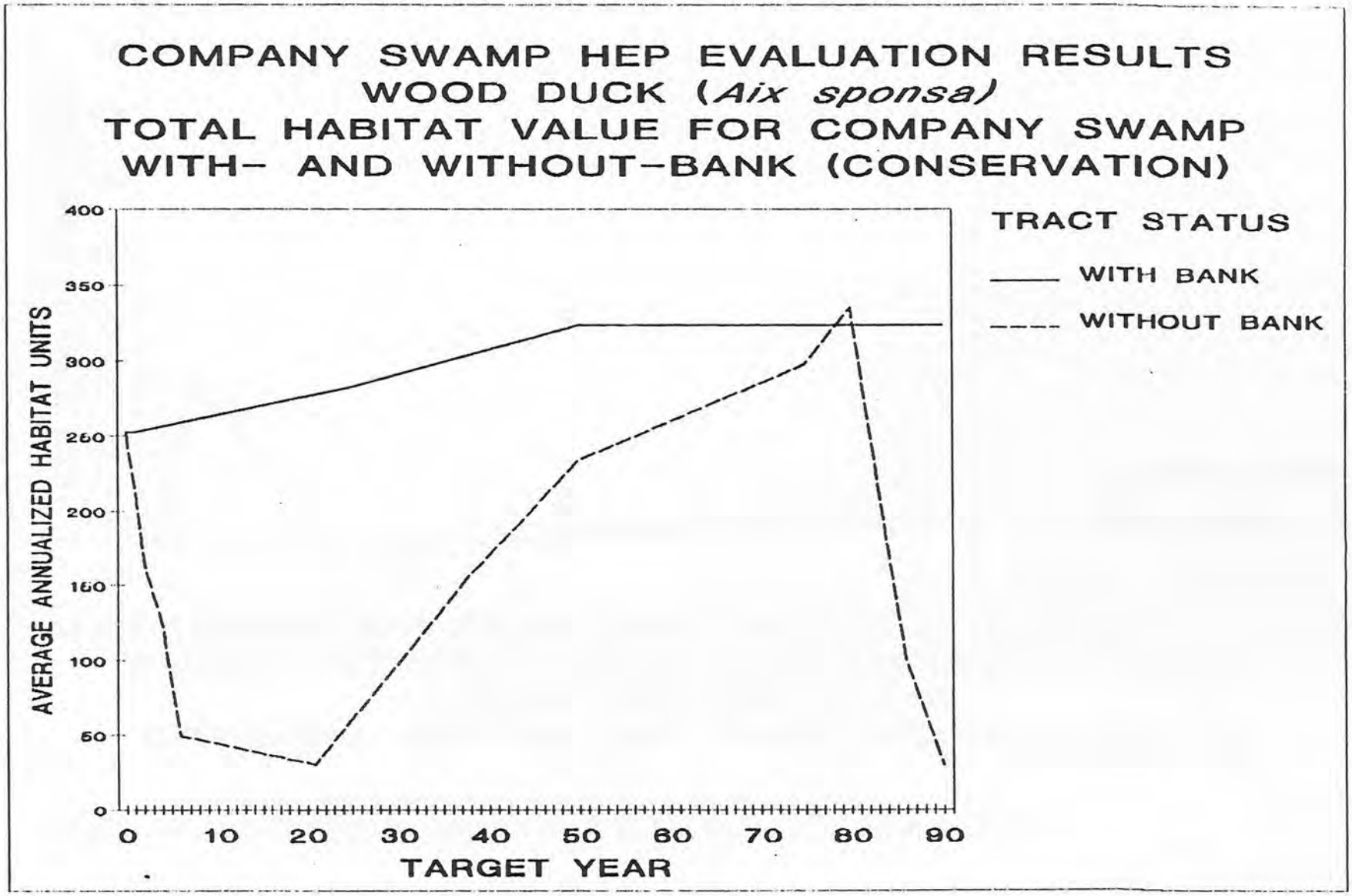
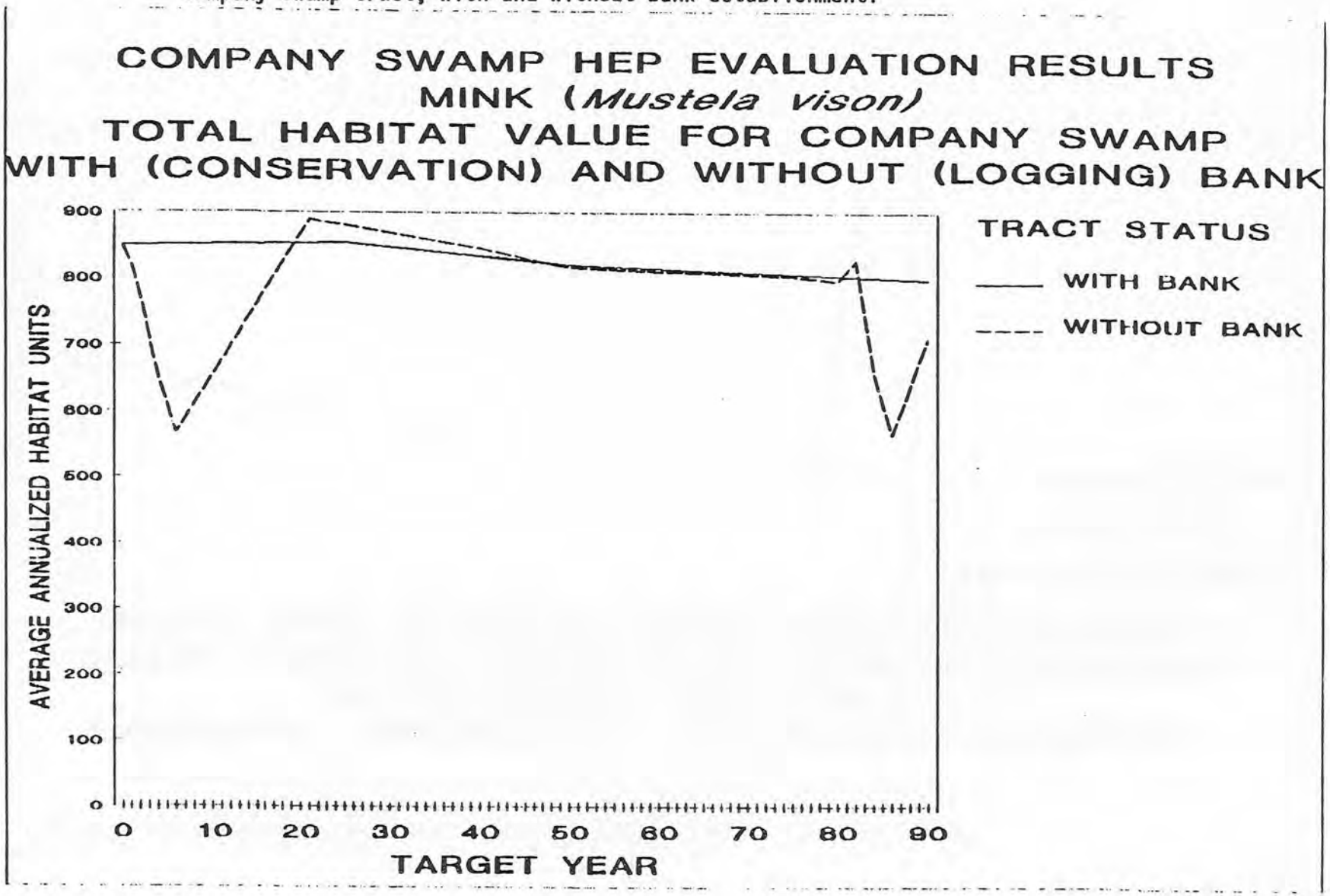


Figure 7. Average annualized habitat units (AAHU) versus time for mink on the Company Swamp tract, with and without bank establishment.



only the value lost during the project's life but also that necessary for habitat quality to become reestablished on the site if the project was abandoned. Such a requirement is especially appropriate where the habitat base impacted has a natural life expectancy of perpetuity, notwithstanding the possibility of future destruction by man-induced activities (Soileau 1984). In the case of highway construction, even though highways do deteriorate with time and require maintenance, abandonment is rare once an alignment has been established. Accordingly, the period of analysis selected for the Company Swamp Mitigation Bank and for all individual projects analyzed is 90 years. The selection of a 90-year time frame for the analysis is appropriate due to the fact that Company Swamp has been placed under perpetual State ownership and management and because the Mitigation Bank MOU specifies a total bank life of 90 years.

Mitigation bank credits will be used to offset the damages from projects causing impacts of a duration equal to or less than the duration of the mitigation bank. For new highway construction on new alignments, or for widening projects within or adjacent to existing rights-of-way, the 90-year time frame will be employed based on the assumption that habitat value loss will be essentially permanent. For projects which entail impacts of less than 90 year's duration, such as the construction of temporary detours at bridge replacement sites and haul roads, the duration employed will be adjusted to reflect only the period of time during which the habitat is physically absent plus the amount of time required to restore baseline habitat values. Such short-term impacts are normally the result of contractor activity and require separate mitigation negotiations with the individual contractor.

Determination of Credits

Initial credits within the terrestrial portion of the bank have been determined using the Habitat Evaluation Procedures (USDI 1980) developed by FWS and widely accepted as state-of-the-art methodology for determining habitat values. The difference between the projected future of the Company Swamp tract with and without its acquisition by the State determines the amount of credits actually in the bank's account. Credits, therefore, represent the difference in value of the tract for selected species of wildlife, between its actual future as a conservation area and its assumed future as a logged-over tract. Although credits are determined for individual species through separate analyses which account for differences in habitat value for each, the Evaluation Team elected to add all credits for each species to obtain a single total credit value.

Adding credits for all species into a single account will simplify bank accounting procedures. However, several assumptions deserve mention regarding this methodology. Addition of the credits appears to assume that all credits, regardless of the species, are equal in value. In actuality, credits will possess equal value only in two cases: 1) when projects impacting five or less acres are debited from the bank, since no HEP is performed, debits will be done on an acre-for-acre basis, disregarding variants of the bottomland hardwoods cover type, habitat quality differences

and species as stated in the MOU (Appendix 1); and 2) if species accounts were maintained separately, then at some future date, credits within a particular specie's account may be totally withdrawn, requiring debits for that species assessed at a given project site to be withdrawn from an account other than the particular species for which the account was totally depleted, resulting in a de facto assumption of equality. In the case of the HEP evaluation for the bank itself and for projects for which a HEP analysis is performed, credits are derived independently for each species and will reflect the differences in value for each habitat type at a given site. Again, the ideal solution is to perform a HEP or comparable analysis for each project to insure that credits are derived independently for each species, appropriately adjusted for habitat value.

Any analysis of credits within a bottomlands hardwood bank and any assessment of habitat losses within the same habitat type should consider both aquatic and terrestrial values. The intent of the Team was to conduct two separate analyses and to provide the results of both within this report. The aquatic evaluation, however, has not been conducted due to a number of difficulties which time has not permitted us to address. First and foremost is the inability to presently determine the extent and availability of aquatic habitat present within the tract. Although the area of riverine habitat present can be partially determined from aerial photography, channels which comprise Coniott Creek are largely hidden by the canopy and are not measurable from available photographs. An additional area of permanent aquatic habitat is provided through the impoundment of an undetermined portion of the gum-cypress cover type by beaver dams which were discovered during field work required for the terrestrial analysis. The extent of the impounded area and that of any seasonally-available aquatic habitat present as a consequence of overbank flooding are both undeterminable at present.

A second major problem in performing an aquatic HEP evaluation at this time concerns uncertainty regarding whether any aquatic credits would result from a comparison of futures with and without the bank. First, an assessment must be made to determine the value of the aquatic system under the conservation future as compared with the future under a logging scenario. Assuming that hydrological conditions remained unaltered, the major change to the system from an aquatic standpoint would be the loss of shading and an increase in emergent and herbaceous vegetation. Given that flood events are more likely to occur during the winter and spring months, increased temperatures within the shallowly-flooded system might prove beneficial to aquatic species and result in higher habitat value without the project. Conversely, increased temperature and vegetation density may prove detrimental to fish use of and/or access to these areas, resulting in a detrimental impact. A second difficulty is developing management measures which would increase habitat values for fishery and aquatic resources above those which presently exist. Aside from some type of hydrological modification to increase the extent of aquatic habitat on the tract, the Evaluation Team was unable to develop any management measures which would significantly improve the value of the tract for either resident or anadromous species. Lastly, the same problems which pertain to performing an aquatic analysis for the bank site apply to each site for which an individual HEP is required.

For these reasons, no aquatic HEP is planned at this time. The Evaluation Team believes that the mitigation of bottomland hardwoods will provide to some extent for the aquatic component of that ecosystem as well as the terrestrial elements. Further, the NCDOT routinely mitigates all permanent aquatic habitat impacts onsite through relocation and recreation of stream channels, thereby eliminating any need for use of the bank for that habitat. Should the necessary information be developed, and if funding and personnel become available, the team may elect to reconsider the desirability of conducting an aquatic HEP evaluation. If such a study is conducted at some future date, the Team recommends that anadromous species not be considered within any such analysis. Since habitat loss for those species should be mitigated within the specific stream system from which they are lost, as a consequence of the homing of these species to natal streams, use of the bank for such a purpose would be inappropriate.

Computing Debits for Unavoidable Impacts Less than Five Acres

In accordance with the MOU, projects which impact five or less acres of bottomland hardwoods habitat will be debited on an acre-for-acre basis. Habitat will be assessed at each site visually in order to make sure that it is eligible for mitigation using the bank.

Total credits (net AAHU's times the 90-year annualization period) for the bank, derived from the HEP analysis, will be divided by the total acreage within the bank to derive a credit per acre value for use in debiting projects impacting less than five acres. The credit per acre value will be multiplied by the acreage loss associated with each project within this category, and the bank account will be debited accordingly. This methodology may not result in adequate compensation for habitat quality losses attributable to such projects during the life of the bank relative to that which would be determined using HEP. In cases where habitat quality at an individual project site is much lower than that within the bank and would be likely to remain so throughout project life, more debits may occur than would be determined by a HEP. In the opposite case, where habitat quality for the evaluation species at a given project site exceeds the value within the bank, too few credits may be debited relative to those debited had a HEP been conducted. Depending upon the probability of habitat quality within the bank being exceeded or not achieved at a given project site, over-or under-debiting may balance out through the bank's life. The only method to determine the adequacy of this approach from a habitat quality standpoint is to conduct HEP studies concurrent with our proposed method in order to assess what differences in debiting would occur. The opportunity to conduct such a study exists for projects exceeding five acres of unavoidable impact. Debits derived by multiplying acreage times the bank's credit-per-acre value can be compared to values derived from the HEP studies conducted for these projects.

Computing Debits for Unavoidable Impacts Greater than Five Acres

Projects involving unavoidable impacts which affect over five acres will require a HEP study to determine the number of credits that will be debited

from the bank. Generally, it is presumed that such a study will take place after completion of the Final NEPA document but prior to application for any necessary Section 404 permits by the NCDOT. The HEP studies conducted for such projects will employ the same methodology and evaluation species as this study. Results for each species will be added together into a single value prior to debiting the mitigation bank account.

Accounting Responsibilities

Pursuant to the MOU, the responsibility for maintaining the official record of the bank rests with the FWS, Division of Ecological Services, Raleigh Field Office. The FWS will maintain complete files regarding development and maintenance of the bank as well as a master file which contains pertinent information regarding each transaction. All proposed transactions will be circulated to each party to the agreement in accordance with the MOU. Proposed standard forms for use in proposing debits for individual projects and for concurring with proposed debits are included in Appendix 10. Each transaction is subject to review and approval by other parties to the MOU. All MOU parties are equally responsible for endeavoring to ensure that necessary studies are conducted in a timely fashion and that credits and debits are accurately computed. All members of the terrestrial Evaluation Team, with the exception of the NCNC representative, have been certified in the FWS HEP methodology.

Monitoring the Mitigation Bank

Since the Company Swamp Mitigation Bank is an experimental, pilot program which is being implemented and administered under interim policy guidance like the Tenneco bank (Soileau 1984), it is imperative that it be subjected to close scrutiny and review on a periodic basis. Provision 10 of the MOU calls for a preliminary evaluation of the effectiveness of the management program five years after its implementation and for a complete evaluation, employing HEP or another mutually agreeable methodology, after ten years. It is reasonable to assume that if any significant management measures are implemented, the HEP evalution will need to be revised to reflect the bank's credit. This would be especially true for any measures affecting hydrology.

Additional knowledge regarding the resources, ecology and hydrology of the bank site would greatly facilitate any forthcoming reviews or reevaluations. The Evaluation Team has discussed the need for a detailed and accurate survey of the site, complete floral and faunal surveys, aging of trees, periodic resampling of permanent vegetation plots, and detailed hydrological studies. Such information would greatly facilitate future evaluations and would provide a sound data base for management decisions.

In addition to site-specific information, the FWS and WRC are especially interested in evaluating the predictive capabilities of HEP and other methodologies which may be developed and in evaluating the effectiveness of using a mitigation bank as a means of mitigation. Such issues can only be

addressed through some type of monitoring study designed to compare predicted HEP results with actual future conditions in the bank, and to compare acre-for-acre debiting with debiting as determined by HEP evaluations. At present, the FWS and WRC alone do not have sufficient funding or personnel to undertake such studies and evaluations.

Interagency Coordination

Coordination regarding projects proposed by NCDOT which will adversely impact bottomland hardwoods usually begins with the receipt of a request for early environmental coordination. Appropriate FWS and WRC personnel should provide information regarding significant fish and wildlife resources at that time and during the subsequent review of any environmental documents. Availability and practicality of onsite mitigation measures will be assessed during this review process. The rationale for justifying selected mitigation measures and an indication of whether the bank will be employed on a given project will be provided within the final environmental document.

Debit transaction forms will only be provided after project designs are finalized. It is preferable that NCDOT advise FWS and WRC of the completion of design work. When designs are final, alignments are staked on the ground, and acreages are finalized, the FWS will either provide a debit transaction sheet (for projects less than five acres) or will schedule a HEP study (for projects exceeding five acres). Upon completion of the HEP study, the results and a debit transaction form will be circulated to all parties to the MOU. Although such actions could occur subsequent to issuance of a Public Notice for an individual project, the time allocated for response to those notices by WRC and FWS is short. To avoid unnecessary delays, the NCDOT should provide appropriate information prior to applying for a permit. All debit transaction sheets must be signed to indicate concurrence and returned to FWS.

If all necessary information has been provided to FWS and WRC prior to receipt of the Public Notice, the Fish and Wildlife Coordination Act Reports which are provided to the USCE will contain a recommendation for use of the bank, if necessary, and other appropriate mitigation measures. Upon receipt of the reports, the NCDOT should complete the process by advising FWS, WRC, and NCNC of its concurrence to use the bank on the project in question. Suggested forms for use in this process are provided in Appendix 10. The FWS also plans to provide an annual summary of bank activity using an Annual Report form (Appendix 10).

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APPENDIX 1

MEMORANDUM OF UNDERSTANDING

MEMORANDUM OF UNDERSTANDING

BETWEEN

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION,
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION,
NORTH CAROLINA NATURE CONSERVANCY, AND
U.S. FISH AND WILDLIFE SERVICE

THIS AGREEMENT is made and entered into on the date hereinbelow last written, by and between the State of North Carolina, acting by and through the Wildlife Resources Commission (WRC) and the Department of Transportation (NCDOT); the United States of America, acting through the U.S. Department of the Interior, Fish and Wildlife Service (USFWS); and the North Carolina Nature Conservancy (NCNC).

WHEREAS, the USFWS is authorized to enter into agreements with the State of North Carolina in accordance with the provisions of the Fish and Wildlife Coordination Act, 16 U.S.C. Sections 661 et seq.; and

WHEREAS, under existing provisions of law the WRC and NCDOT are authorized to enter into agreements with the FWS; and

WHEREAS, the purpose of this Memorandum of Understanding is to establish a Mitigation Bank for mitigating unavoidable fish and wildlife habitat losses associated with future NCDOT projects in bottomland hardwood wetlands; and

WHEREAS, the Company Swamp Tract within the Roanoke River Basin has been identified by WRC and NCNC as one of the best bottomland hardwood sites remaining in North Carolina, in imminent danger of being clearcut and converted to forestry monoculture, and of top priority for protection from development;

NOW, THEREFORE, it is mutually agreed among the four parties that the following general provisions are adopted and will be implemented upon acquisition of the Company Swamp Tract.

General Provisions

1. The term of the agreement shall be for a period of thirty (30) years. The agreement shall be automatically renewed a maximum of two (2) times unless a party hereunto, upon six (6) months written notice, advises the other parties of its intent to terminate the agreement.

2. The WRC will manage the mitigation bank site in perpetuity. A management plan identifying initial and long-range habitat improvement measures featuring nongame and old-growth timber values will be developed by WRC and presented to all parties for concurrence, and implemented by WRC. When finalized,

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the management plan will be attached to this MOU as Appendix A. Acquisition and initial management costs will be paid by the project sponsor, NCDOT.

3. The parties to the MOU will use the U. S. Fish and Wildlife Service's Habitat Evaluation Procedures (HEP) to determine credits and debits to be applied to the mitigation bank for all projects greater than five (5) acres. For projects less than five (5) acres, mitigation will be on an acre-for-acre basis.

4. An interagency review team consisting of qualified biologists representing USFWS (serving as chairman), WRC, NCDOT and other agencies with interests in the mitigation bank will determine habitat units and the average annual habitat units (AAHU's) to be initially credited to the mitigation bank and shall determine future debits and credits to the mitigation bank.

5. Mitigation from the bank will be used only to offset unavoidable impacts on fish and wildlife when the applicant can demonstrate to the satisfaction of all parties to the MOU that there are no available or practical onsite mitigation alternatives.

6. The mitigation bank will be used for mitigating unavoidable impacts associated with future NCDOT projects occurring in North Carolina on bottomland hardwood wetland habitat types. For the purposes of this agreement, bottomland hardwood wetlands are defined as follows: Palustrine forested broad-leaved deciduous/needle-leaved deciduous/needle-leaved evergreen semipermanently or seasonally or temporarily flooded wetlands. Also, wildlife losses will be offset only by wildlife credits and fisheries losses will be offset only by fisheries credits.

7. The mitigation bank will not be used to offset any project impacts on Federally-listed endangered species.

8. If future projects requiring mitigation occur within the mitigation bank site and the bank is to be debited for such projects, then the debits will equal twice the AAHU's caused to be lost by the project.

9. The USFWS will provide data sheets for each credit or debit transaction to all parties to the MOU for signature concurrence. No credits or debits can be applied until all parties concur with the FWS data sheet analysis. Such concurrence, substantiations of reasons for noncurrence, or requests for additional review time must be forwarded to the Raleigh office of USFWS within 30 working days after receipt of the data sheet. If no response from a party is received within this time frame, it will be deemed to

indicate concurrence by that party. Copies of signed transaction data sheets will be held as a permanent record by USFWS and NCDOT. An annual summary of credits and debits will be prepared by the USFWS on a calendar year basis and provided to each party.

10. Ten (10) years after implementation of the management plan a complete evaluation of the management program will be made by the interagency review team using HEP, or a mutually agreeable and credible methodology. A preliminary analysis of the effectiveness of the management program will be conducted five (5) years after its implementation.

11. This MOU does not eliminate the applicant's or agency's responsibilities under all applicable Federal, State and local laws and/or regulations.

12. Amendment or modification of the MOU may be proposed at any time, but will not be adopted unless agreed to by all parties. If proposed revisions are not agreed to within one (1) year after submission, then the party proposing the revision may elect to terminate its participation in this agreement at the end of such one year period.

IN WITNESS THEREOF, the parties have caused this agreement to be executed on the date hereinbelow last written.

W Vernon Bennett
Executive Director
N. C. Wildlife Resources Commission

8/20/85
Date

Secretary
N. C. Department of Transportation

Aug 9, 1985
Date

Director
North Carolina Nature Conservancy

8/11/85
Date

Regional Director
U.S. Fish and Wildlife Service

SEP 3 1985
Date

APPENDIX 2

PRELIMINARY WRC MANAGEMENT PLANS FOR COMPANY SWAMP

file

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Division of Ecological Services
P.O. Box 25039
Raleigh, North Carolina 27611-5039

October 7, 1986

Mr. Hal Atkinson, Chief
Division of Wildlife Management
N.C. Wildlife Resources Commission
Archdale Building
512 North Salisbury Street
Raleigh, North Carolina 27611

Hal

Dear Mr. Atkinson:

The U.S. Fish and Wildlife Service, working with members of your staff, the N.C. Department of Transportation, Division of Highways and the N.C. Nature Conservancy, is currently preparing a Habitat Evaluation Procedures (HEP) analysis for the Roanoke River floodplain tract of bottomland hardwoods known as Company Swamp and located in Bertie County. This tract was acquired, in part, using funds provided by the N.C. Department of Transportation and has been designated as a Mitigation Bank, in accordance with the terms of the Memorandum of Agreement among the above-named agencies (copy attached), to offset future losses of bottomland hardwoods attributable to highway construction.

During the past year, personnel from our agencies: have ground-truthed cover-mapping for the site; have randomly selected 10 sample stations within each of 5 cover types; have located, permanently marked and flagged trails to all the sites; and recently completed sampling vegetation at all 50 stations using 50-meter line intercept and 500-square meter quadrat sampling procedures. Currently, FWS and WRC personnel are entering vegetation data into a computer database which will facilitate the calculation of variables for use in Habitat Suitability Index (HSI) models which will assess the value of the habitat for selected species. Baseline habitat value data then may be generated for the Company Swamp Tract, as well as data for anticipated future conditions if no Mitigation Bank had been established on the tract.

The final step necessary for completing the analysis is to assess future conditions which consider reservation of the tract and future WRC management plans. In that regard, please note that the 1985 Memorandum of Understanding signed by our agencies specifies that a management plan for the Company Swamp tract will be developed by the WRC, presented to all MOU signees for concurrence and incorporated into the MOU as Appendix A.

We will soon reach the point in conducting the HEP analysis where we will be unable to proceed further without a wildlife management plan for Company Swamp. The NCDOT has advised us that they wish to report

to the next session of the General Assembly, in February, 1987, regarding the degree to which the Mitigation Bank has been used and the amount of credit withdrawn and remaining. Since such a report requires completion of the HEP evaluation far enough in advance of that date to provide for review by all concerned agencies and the FWS Regional HEP Coordinator, we would like to obtain a proposed management plan for the Company Swamp tract from you, if possible, by November 15, 1986. We recognize that this is rather short notice, therefore in lieu of having a formal management plan by this date, we would find it acceptable if a list of management measures could be developed by your staff and the HEP team. This would allow us to proceed with the necessary computer modelling.

We have been involved with members of your staff in informal conversations regarding various management measures which could be employed at Company Swamp and anticipate reviewing and coordinating with you and your staff regarding any plan which is developed. As you may recall, the Company Swamp tract was selected as the Mitigation Bank due to the presence of approximately 700 acres of cut-over habitat which offers potential for improvement through management to a greater extent than uncut areas which are already of high value.

We anticipate hearing from you regarding this matter at your earliest convenience and would be pleased to work with you and your staff as you develop a specific plan for the Company Swamp Tract.

Sincerely yours,

Mike

L.K. (Mike) Gantt
Field Supervisor

cc: NCNC (Katherine Skinner)
NCDOT(Ted Waters, Barney O'Quinn)
FWS, Atlanta, GA (Jim Brown)

North Carolina Wildlife Resources Commission

512 N. Salisbury Street, Raleigh, North Carolina 27611, 919-733-3391
Charles R. Fullwood, Executive Director

1 December 86

L.K. (Mike) Gantt
U.S. Department of the Interior
Fish and Wildlife Service
Division of Ecological Services
P.O. Box 25039
Raleigh, North Carolina 27611-5039

Dear Ms. Gantt:

We have considered your request for a management plan covering the Company Swamp tract in Bertie County. At this time our staff is continuing to evaluate this property. Wildlife and forestry plans are incomplete, and at least another year will be required to finalize required field work.

Another important factor related to long range planning is the Roanoke River Committee's activities. Future access and public use of this area hinges on sensitive negotiations with local landowners and hunt clubs. At this time negotiations are continuing, and a meaningful access plan cannot be developed until these meetings are completed.

Since you must soon complete the Habitat Evaluation Procedures (HEP) analysis, we are prepared to offer a general outline of planned activities to be conducted during the next three years.

Habitat Management and Planning

During the period 1986-1989, we plan to develop ten acres of wildlife food plots annually.

Evaluation of possible water control techniques to improve waterfowl habitat will continue. Commission foresters will evaluate proposed boundaries separating "Primary Areas" and "Buffer Areas" as designated by The Nature Conservancy. This review will be completed by December 1, 1987, and final negotiations between The Nature Conservancy and The Wildlife Resources Commission will be concluded at that time.

Boundary Maintenance and Access

Boundaries will be painted and an appropriate sign will be placed at visible boundary points to designate state ownership. Approximately six miles of line will be maintained annually.

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The primary road along the power line will be maintained. Maintenance will involve two miles of grading and mowing per year. If funds are available, gravel will be purchased and spread to stabilize the road surface.

Public Hunting and Recreation

At the present time, the Roanoke River Advisory Committee is discussing hunt management options for the Company Swamp tract. During the interim period the Commission has continued the previously existing hunt lease with the Rainbow Hunt Club. Under consideration are youth hunts, special permit hunts to the general public, a continuation of the hunt club lease, or a combination of several options. The committee's recommendation should be made to the Commission early in 1987.

With reference to other recreational uses, the tract will be open to groups and individuals for birdwatching, viewing the unique swamp forests and other "primitive" recreational pursuits. No development to accommodate these users are anticipated. At this time public access, except along the river boundary, is not available.

Forest Management

No forest management activities, other than evaluation, are planned through 1989. Cutover areas will be left to regenerate naturally. After plans are completed, it is likely that timber stand improvement cuts will proceed on a scheduled basis.

I trust this outline will be helpful in completing your analysis of Company Swamp. Do not hesitate to call if we can be of further assistance.

Sincerely,

Hal S. Atkinson, Jr., Chief
Division of Wildlife Management

HSA/pm

cc: George Smith
Grady Barnes
Debbie Paul

North Carolina Wildlife Resources Commission

512 N. Salisbury Street, Raleigh, North Carolina 27611, 919-733-3391
Charles R. Fullwood, Executive Director

9 March 1987

Mr. George Wells
Highway Administrator
Department of Transportation
Division of Highways
Highway Building
Raleigh, North Carolina

Dear George:

The Wildlife Resources Commission (WRC) will begin marking property line boundaries on the Roanoke River bottomland tracts during the spring and summer of 1987. As you are aware, the Company Swamp tract has a special designation since it was purchased in part by the NC Department of Transportation (NCDOT) to be used as a mitigation bank. The purpose of this correspondence is to request NCDOT assistance in surveying and marking boundaries for the Company Swamp tract.

Since WRC has neither surveying equipment nor engineering expertise, our customary method of boundary line marking consists of locating old reference points and line trees or other marks and re-establishing the property line to the best of our abilities. Property line disputes with adjacent property owners are resolved on a case-by-case basis as they arise. To the best of our knowledge there are no recent surveys of the Company Swamp tract and a portion of the northern property line was contested and resolved in a court case in the 1960's. We do not know the potential for future property line disputes.

We believe that it is in the best interests of all involved in the mitigation bank to have an accurate, up-to-date survey of Company Swamp. WRC does not currently have funding for having the tract surveyed by a private contractor. Funds could have been allocated from money transferred by NCDOT for land acquisition if WRC had received the funds. However, the transfer of funds was made directly to the NC Department of Administration and WRC did not have an opportunity to allocate portions for

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management activities, including property line surveys. Without assistance, WRC will have little choice but to mark property lines in our customary way. The mitigation bank could remain the same, lose, or gain acreage, depending upon the occurrence of property line disputes. In addition, the mitigation bank HEP analysis could benefit from an accurate survey.

WRC sincerely hopes that you will give your attention to this matter. If you are unable to provide full survey crews, members of our staff would gladly assist with chopping and marking lines or providing any other assistance within our capabilities. Since we wish to proceed with boundary line marking soon, we would appreciate your advising us of any assistance that is available as soon as possible.

Sincerely,

Charles R. Fullwood

Charles R. Fullwood
Executive Director

CRF/cmh

cc: Mr. Ted Waters, NCDOT
Ms. Katherine Skinner, Nature Conservancy
Mrs. Linda K. Gantt, USFWS
Mr. Dennis Stewart, WRC

APPENDIX 3

PLANT SPECIES LIST FOR STATIONS SAMPLED
COMPANY SWAMP, BERTIE COUNTY, NORTH CAROLINA

COMMON NAME	SCIENTIFIC NAME[1]	ACRONYM[2]	LEAF[3]	CLASS[4]	HABITAT PRESENCE[5]				
					BH	BHL	GC	GCL	TC
American elm	Ulmus americana	ULAM	D	FACW	X	X	X	X	
American hornbeam	Carpinus caroliniana	CACA18	D	FAC	X	X	X	X	
Angle-pod	Matelea suberosa	MASU	D	FACW	X				
Arrow arum	Peltandra virginica	PEVI	H	OBL				X	
Ash	Fraxinus sp.	[FRAX]	D	(VARIES)	X	X	X	X	
Aster	Family Compositae	[ASTER]	H	(VARIES)	X	X			X
Baldcypress	Taxodium distichum	TADI2	D	OBL	X	X	X	X	
Barnyard grass	Enchinochloa crus-galli	ECCR	H	FACW-			X	X	
Basswood	Tilia sp. possibly floridana?	TIFL	D	NC	X				
Blackberry	Rubus sp.	[RUBUS]	D	(VARIES)	X				
Bladder sedge	Carex intumescens	CAIN12	H	FACW	X	X		X	
Bluntleaf bedstraw	Galium obtsum	GAOB	H	FACW-					X
Box elder	Acer negundo	ACNE2	D	FACW	X	X		X	
Bristlebract sedge	Carex tribuloides	CATR7	H	FACW+		X			
Broadleaf arrowhead	Sagittaria latifolia	SALA2	H	OBL			X	X	
Broomjute sida*	Sida rhombifolia	SIRH	H	NA(FACU)					X
Carolina falsedandelion	Pyrrhopappus carolinianus	PYCA2	H	NC	X	X		X	X
Catbrier	Smilax bona-nox	SMBO2	E	FAC	X	X			
Cattail sedge	Carex typhina	CATY	H	OBL	X	X		X	X
Climbing dogbane	Trachelospermum difforme	TRDI	D	FACW	X	X		X	X
Climbing hempweed	Mikania scandens	MISC	H	FACW+	X	X			
Cocklebur	Xanthium strumarium	XAST	H	FAC					X
Common greenbrier	Smilax rotundifolia	SMRO	E	FAC	X	X	X	X	X
Common pokeberry	Phytolacca americana	PHAM4	H	FACU+	X	X	X		
Common ragweed	Ambrosia artemisiifolia	AMAR2	H	FACU		X		X	X
Common trumpetcreeper	Campsis radicans	CARA2	D	FAC	X	X		X	X
Creeping burhead	Echinodorus cordifolius	ECCO3	H	OBL			X	X	
Creeping cucumber	Melothria pendula	MEPE3	H	FACW-	X				
Dicliptera	Dicliptera brachiata	DIBR2	H	FACW	X				
Dogfennel joepyeweed	Eupatorium capillifolium	EUCA5	H	FACU			X		X
Duckweeds	Lemna sp.	[LEMNA]	H	OBL			X		

COMMON NAME	SCIENTIFIC NAME[1]	ACRONYM[2]	LEAF[3]	CLASS[4]	HABITAT PRESENCE[5]				
					BH	BHL	GC	GCL	TC
False nettle	Boehmeria cylindrica	BOCY	H	FACW+	X	X	X	X	
Fowl mannagrass	Glyceria striata (flat grass)	GLST	H	OBL				X	
Frog's-bit	Limnobium spongia	LISP2	H	OBL			X	X	
Gaping panicum	Steinchisma hians	STHI3	H	OBL			X	X	
Giant cane	Arundinaria gigantea	ARGI	H	FACW	X	X			
Grape	Vitis sp.	[VITIS]	D	(VARIES)	X	X	X		
Grasses	Family Poaceae	[GRASS]	H	(VARIES)	X	X	X	X	X
Gray's sedge	Carex grayi	CAGR5	H	FACW		X			
Green ash	Fraxinus pennsylvanica	FRPE	D	FACW	X				
Green hawthorne	Crataegus prob. viridis	CRVI2	D	FACW	X	X			
Groundcherry	Physalis sp.	[PHYS]	H	(VARIES)	X				
Hawthorn	Crataegus sp.	[CRAT]	D	(VARIES)	X	X		X	X
Horse nettle	Solanum carolinense	SOCA3	H	NC		X	X		X
Indian heliotrope	Heliotropium indicum	HEIN	H	FAC+					X
Ironwood (See American hornbeam)									
Jump seed	Polygonum virginianum	POVI2	H	FAC		X			
Jungle rice	Echinocloa colona	ECCO2	H	FACW					X
Lambsquarters	Chenopodium album	CHAL7	H	FAC-					X
Laurel oak	Quercus laurifolia	QULA3	E	FACW	X				
Lizard's tail	Saururus cernuus	SACE	H	OBL	X	X	X	X	X
Marsh dayflower	Murdannia keisak	MUKE	H	OBL			X	X	
Marsh mermaid weed	Proserpinaca palustris	PRPA3	H	OBL			X	X	
Marsh purslane	Ludwigia palustris	LUPA	H	OBL			X	X	
Marsh yellow-cress	Rorippa palustris	ROPA2	H	OBL				X	
Minute duckweed	Lemna perpusilla	LEPE	H	OBL			X		
Mistletoe	Phoradendron flavescens	PHFL2	E	NC				X	
Mosses	Order Bryophyta	[MOSS]	H	NC			X		
Mustard	Family Brassicaceae	[MUSTS]	H	(VARIES)					X
Nutgrass	Cyperus rotundus	CYRO	H	FAC-	X				
Overcup oak	Quercus lyrata	QULY	D	OBL	X	X	X	X	
Parrot's feather	Myriophyllum brasiliense	MYBR	H	OBL			X	X	
Paw-paw	Asimina sp.	[ASIM]	D	(VARIES)	X			X	
Peppervine	Ampelopsis arborea	AMAR5	D	FAC+	X	X	X	X	X
Persimmon	Diospyros virginiana	DIVI5	D	FAC	X	X			
Pinkweed	Polygonum pensylvanicum	POPE2	H	FACW					X

COMMON NAME	SCIENTIFIC NAME[1]	ACRONYM[2]	LEAF[3]	CLASS[4]	HABITAT PRESENCE[5]				
					BH	BHL	GC	GCL	TC
Poison ivy	Toxicodendron radicans	TORA2	D	FAC	X	X	X		
Primrose willows*	Ludwigia decurrans	LUDE4	H	NA(OBL)	X				
Purple mecardonia	Mecardonia acuminata	MEAC	H	FACW			X	X	
Rattan-vine	Berchemia scandens	BESC	D	FACW	X	X	X		
Red maple	Acer rubrum	ACRU	D	FAC	X	X	X	X	X
Red mulberry	Morus rubra	MORU2	D	FAC	X				
River birch	Betula nigra	BENI	D	OBL		X			
Sedge	Cyperus sp. or Carex sp.	[CAREX]	H	(VARIES)	X	X	X	X	X
Sharp-winged monkey-flower*	Mimulus alatus	MIAL2	H	OBL	X				
Silver maple	Acer saccharinum	ACSA2	D	FACW	X	X		X	
Small beggarticks	Bidens discoidea	BIDI	H	FACW	X	X	X	X	X
Small-flowered thoroughwort	Eupatorium semiserratum	EUSE	H	FACW-	X	X			
Small white morning-glory	Ipomea lacunosa	IPLA	H	NA					X
Smartweed	Polygonum sp.	[POLY]	H	(VARIES)	X	X	X	X	X
Spotted touch-me-not	Impatiens capensis	IMCA	H	FACW			X	X	
Stinkweed	Pluchea camphorata	PLCA7	H	FACW			X	X	
St. Johnswort	Hypericum sp.	[HYPER]	H	(VARIES)			X		
Subcordate waterplantain	Alisma subcordatum	ALSU	H	OBL				X	
Sugarberry	Celtis laevigata	CELA	D	FACW	X	X			
Swamp cottonwood	Populus heterophylla	POHE4	D	OBL		X	X	X	X
Swamp rosemallow	Hibiscus moscheutos	HIMO	H	OBL					X
Sweet gum	Liquidambar styraciflua	LIST2	D	FAC+	X	X			
Swollen duckweed	Lemna gibba	LEGI	H	OBL			X		
Sycamore	Platanus occidentalis	PLOC	D	FACW-	X	X	X	X	
Three-seeded mercury	Acalypha rhomboidea	ACRH	H	NC	X	X	X	X	X
Violet	Viola sp.	[VIOLA]	H	(VARIES)	X	X	X		
Virginia bugleweed	Lycopos sp. probably virginicus	LYVI	H	OBL		X	X		
Virginia buttonweed	Diodia virginiana	DIVI3	H	FACW		X		X	X
Virginia creeper	Parthenocissus quinquefolia	PAQU2	D	FAC	X				
Virginia dayflower	Commelina virginia	COVI3	H	FACW	X	X		X	X

COMMON NAME	SCIENTIFIC NAME[1]	ACRONYM[2]	LEAF[3]	CLASS[4]	HABITAT PRESENCE[5]				
					BH	BHL	GC	GCL	TC
Water hickory	Carya aquatica	CAAQ2	D	OBL	X	X		X	X
Watermeal	Wolffia papulifera	WOPA	H	OBL			X		
Water oak	Quercus nigra	QUNI	D	FAC	X	X			
Water tupelo gum	Nyssa aquatica	NYAQ2	D	OBL	X	X	X	X	
Whorled pennywort	Hydrocotyle verticillata	HYVE2	H	OBL			X		
Willow	Salix sp. probably nigra or caroliniana	[SALIX]	D	OBL	X	X			
Willow oak	Quercus phellos	QUPH	D	FACW-	X	X			
Winged elm	Ulmus alata	ULAL	D	FACU+	X	X			
Winterberry	Ilex verticillata	ILVE	D	FACW	X	X		X	
Woolgrass	Scirpus cyperinus	SCCY	H	OBL				X	X
Yerba de tajo	Ecilpta alba	ECAL	H	FACW-			X	X	

[1] Scientific nomenclature follows Reed (1986)

[2] Acronyms are standard notations from USDA (1982a,b) unless they are in brackets. Designations in brackets were applied to taxa which were not readily identifiable to species in the field.

[3] Leaf designations are D = deciduous; H = herbaceous; E = evergreen.

[4] Class = wetland classification as determined in Reed (1986). NA means that no agreement was reached by the Regional Interagency Review Panel. The national status is usually given in () following an NA. NC indicates that a species was not considered because it is a recent addition to the list. A plus or minus sign following an indicator means that a species is more frequently (+) or less frequently (-) found in wetlands within a given classification. Definitions for the remaining classifications are as follows: OBL = obligate, found in wetlands with greater than 99 percent frequency; FACW = facultative wet, usually found in wetlands with a frequency of 67 to 99 percent; FAC = facultative, sometimes found in wetlands with a frequency of 34 to 66 percent; and, FACU = facultative upland, seldom found in wetlands with a frequency of 1 to 33 percent.

[5] Habitat designations: are BH - bottomland hardwoods; BHL = logged bottomland hardwoods; GC = gum-cypress; GCL = logged gum cypress; and TC = transmission corridor.

* Species followed by an asterisk were collected on the tract but not within a sample site.

APPENDIX 4

SCIENTIFIC AND COMMON NAMES FOR WILDLIFE WITH KNOWN OR PROBABLE OCCURRENCE WITHIN COMPANY SWAMP, BERTIE COUNTY, NORTH CAROLINA

CLASS	SCIENTIFIC NAME[1]	COMMON NAME
Mammalia	**Didelphis virginiana	Opossum
	Sorex longirostris	Southeastern shrew
	Blarina brevicauda	Short-tailed shrew
	Blarina carolinensis	Carolina short-tailed shrew
	Scalopus aquaticus	Eastern mole
	Lasionycteris noctivagans	Silver-haired bat
	Pipistrellus subflavus	Eastern pipistrelle
	Lasiurus borealis	Red bat
	Lasiurus cinereus	Hoary bat
	Nycticeius numeralis	Evening bat
	Oryzomys palustris	Rice rat
	Peromyscus leucopus	White-footed mouse
	Peromyscus gossypinus	Cotton mouse
	Ochrotomys nuttalli	Golden mouse
	Sigmodon hispidus	Hispid cotton rat
	Microtus pennsylvanicus	Meadow vole
	Rattus norvegicus	Norway rat
	Mus musculus	House mouse
	Marmota monax	Woodchuck
	**Sciurus carolinensis	Gray squirrel
	Glaucomys volans	Southern flying squirrel
	**Castor canadensis	Beaver
	**Ondatra zibethica	Muskrat
	Sylvilagus palustris	Marsh rabbit
	Sylvilagus floridanus	Eastern cottontail
	**Procyon lotor	Raccoon
	Ursus americana	Black Bear
	Mustela frenata	Long-tailed weasel
	**Mustela vison	Mink
	**Lutra canadensis	River otter
	**Urocyon cinereoargenteus	Gray fox
	**Lynx rufus	Bobcat
	**Odocoileus virginianus	White-tailed deer
Aves	**Anhinga anhinga	Anhinga (water turkey)
	**Ardea herodias	Great blue heron
	**Butorides striatus	Green heron
	**Casmerodius albus	Great egret
	**Nyctanassa violacea	Yellow-crowned night-heron
	**Aix sponsa	Wood duck
	**Anas platyrhynchos	Mallard
	**Anas rubripes	Black duck
	**Anas strepera	Gadwall
	**Anas acuta	Pintail
	**Anas crecca	Green-winged teal
	**Anas discors	Blue-winged teal
	**Aythya collaris	Ring-necked duck
	**Lophodytes cacullatus	Hooded merganser
	**Anas americana	American wigeon
	**Cathartes aura	Turkey vulture
	**Coragyps atratus	Black vulture
	**Accipter striatus	Sharp-shinned hawk

CLASS	SCIENTIFIC NAME[1]	COMMON NAME
	**Accipter cooperii	Cooper's hawk
	**Buteo jamaicensis	Red-tailed hawk
	**Buteo lineatus	Red-shouldered hawk
	**Pandion haliaetus	Osprey
	**Colinus virginianus	Bobwhite
	**Meleagris gallopavo	Wild turkey
	**Actitis macucaria	Spotted sandpiper
	**Scolopax minor	American woodcock
	**Larus delawarensis	Ring-billed gull
	**Zenaida macroura	Mourning dove
	**Coccyeus americanus	Yellow-billed cuckoo
	Otus asio	Screech owl
	**Bubo virginianus	Great horned owl
	**Strix varia	Barred owl
	Caprimulgus carolinensis	Chuck-will's-widow
	Caprimulgus vociferus	Whip-poor-will
	**Chaetura pelagica	Chimney swift
	**Archilochus colubris	Ruby-throated hummingbird
	**Megaceryle alcyon	Belted kingfisher
	**Colaptes auratus	Common flicker
	**Dryocopus pileatus	Pileated woodpecker
	**Melanerpes carolinus	Red-bellied woodpecker
	**Melanerpes erythrocephalus	Red-headed woodpecker
	**Sphyrapicus varius	Yellow-bellied sapsucker
	**Picoides villosus	Hairy woodpecker
	**Picoides pubescens	Downy woodpecker
	**Tyrannus tyrannus	Eastern kingbird
	**Myiarchus crinitus	Great crested flycatcher
	**Sayornis phoebe	Eastern phoebe
	**Empidonax virescens	Acadian flycatcher
	**Contopus virens	Eastern wood pewee
	**Hirundo rustica	Barn swallow
	**Cyanocitta cristata	Blue jay
	**Corvus brachyrhynchos	Common crow
	**Corvus ossifragus	Fish crow
	**Parus carolinensis	Carolina chickadee
	**Parus bicolor	Tufted titmouse
	**Sitta carolinensis	White-breasted nuthatch
	**Certhia familiaris	Brown creeper
	**Throglodytes troglodytes	Winter wren
	**Tryothorus ludovicianus	Carolina wren
	**Mimus polyglottos	Mockingbird
	**Dumetella carolinensis	Gray catbird
	**Toxostoma rufum	Brown thrasher
	**Turdus migratorius	American robin
	**Hylocichla mustelina	Wood thrush
	**Catharus guttatus	Hermit thrush
	**Sialia sialis	Eastern bluebird
	**Polioptila caerulea	Blue-gray gnatcatcher
	**Regulus satrapa	Golden-crowned kinglet
	**Regulus calendula	Ruby-crowned kinglet

CLASS	SCIENTIFIC NAME[1]	COMMON NAME
	**Anthus spinoletta	Water pipet
	**Sturnus vulgaris	Starling
	**Vireo griseus	White-eyed vireo
	**Vireo flavifrons	Yellow-throated vireo
	**Vireo olivaceus	Red-eyed vireo
	**Protonotaria citrea	Prothonotary warbler
	**Parula americana	Parula warbler
	**Dendroica coronata	Yellow-rumped warbler
	**Dendroica cerulea	Cerulean warbler
	**Dendroica dominica	Yellow-throated warbler
	**Seiurus motacilla	Louisiana waterthrush
	**Oporornis formosus	Kentucky warbler
	**Geothlypis triachas	Common yellowthroat
	**Wilsonia citrina	Hooded warbler
	**Setophaga ruticilla	American redstart
	**Agelaius phoeniceus	Red-winged blackbird
	**Icterus spurius	Orchard oriole
	**Quiscalus quiseula	Common grackle
	**Molothrus ater	Brown-headed cowbird
	**Piranga olivacea	Scarlet tanager
	**Piranga rubra	Summer tanager
	**Cardinalis cardinalis	Cardinal
	**Guiraca caerulea	Blue grosbeak
	**Passerina cyanea	Indigo bunting
	**Carpodacus purpureus	Purple finch
	**Carduelis pinus	Pine siskin
	**Carduelis tristis	American goldfinch
	**Pipilo erythrophthalmus	Rufous-sided towhee
	**Zonotrichia albicollis	White-throated sparrow
	**Melospiza georgiana	Swamp sparrow
	**Melospiza melodia	Song sparrow
	**Junco hyemalis	Dark-eyed junco
	**Spizella pusilla	Field sparrow
Reptilia	*Chelydra serpentina	Snapping turtle
	*Kinosternum subrubrum	Eastern mud turtle
	*Sternotherus oboratus	Eastern musk turtle
	Chrysemys concinna	River cooter
	Chrysemys floridana	Florida cooter
	Chrysemys picta	Painted turtle
	Chrysemys scripta	Yellowbelly slider
	Clemmys guttata	Spotted turtle
	**Terrapene carolina	Eastern box turtle
	Anolis carolinensis	Carolina anole
	*Sceloporus undulatus	Eastern fence lizard
	*Eumeces fasciatus	Five-lined skink
	*Eumeces inexpectatus	Southeastern five-lined skink
	**Eumeces laticeps	Broadhead skink
	*Scincella lateralis	Ground skink
	*Ophisaurus atlenuatus	Slender glass lizard
	Ophisaurus ventralis	Eastern glass lizard

CLASS	SCIENTIFIC NAME[1]	COMMON NAME
	Carphophis amoenus	Worm snake
	*Coluber constrictor	Black racer
	*Diadophis punctatus	Ringneck snake
	**Elaphe obsoleta	Rat snake
	*Heterodon platyrhinos	Eastern hognose snake
	Farancia abacura	Mud snake
	*Lampropeltis getulus	Eastern kingsnake
	**Nerodia erythrogaster	Redbelly water snake
	**Nerodia fasciata	Banded water snake
	Nerodia sipeodon	Northern water snake
	**Nerodia taxispilota	Brown water snake
	Opheodrys aestivus	Rough green snake
	*Storeria dekayi	Brown snake
	*Storeria occipitomaculata	Redbelly snake
	**Thamnophis sauritus	Eastern ribbon snake
	**Thamnophis sirtalis	Eastern garter snake
	*Virginia striatula	Rough earth snake
	*Agkistrodon contortrix	Copperhead
	*Agkistrodon piscivorus	Cottonmouth
	*Crotalus horridus	Timber(canebrake) rattlesnake
Amphibia	*Siren intermedia	Lesser siren
	*Siren lacertina	Greater siren
	Notophthalmus viridescens	Eastern newt
	*Necturus punctatus	Dwarf mudpuppy
	*Amphiuma means	Two-toed amphiuma
	Ambystoma mabeei	Mabee's salamander
	Ambystoma maculatum	Spotted salamander
	*Ambystoma opacum	Marbled salamander
	Ambystoma tigrinum	Tiger salamander
	*Desmognathus auriculatus	Southern dusky salamander
	*Eurycea bislineata	Two-lined salamander
	Eurycea guttolineata	Three-lined salamander
	Eurycea quadridigitata	Dwarf salamander
	*Plethodon cinereus	Redback salamander
	*Plethodon glutinosus	Slimy salamander
	Pseudotriton montanus	Mud salamander
	*Stereochilus marginatus	Many-lined salamander
	Scaphopus holbrooki	Eastern spadefoot toad
	Bufo americanus	American toad
	Bufo quercicus	Oak toad
	*Bufo terrestris	Southern toad
	Bufo woodhousii	Fowler's toad
	*Acris crepitans	Northern cricket frog
	*Acris gryllus	Southern cricket frog
	*Hyla chrysoscelis	Gray treefrog
	*Hyla versicolor	Gray treefrog
	Hyla cinerea	Green treefrog
	*Hyla crucifer	Spring peeper
	*Hyla femoralis	Pine woods treefrog
	Hyla gratiosa	Barking treefrog

CLASS	SCIENTIFIC NAME[1]	COMMON NAME
	*Hyla squirella	Squirrel treefrog
	*Limnaoedus ocularis	Little grass frog
	*Pseudacris brimleyi	Brimley's chorus frog
	*Pseudacris triseriata	Upland chorus frog
	*Rana catesbeiana	Bullfrog
	*Rana clamitans	Green frog
	Rana palustris	Pickerel frog
	**Rana sphenocephala	Southern leopard frog
	Rana virgatipes	Carpenter frog
	*Gastrophryne carolinensis	Eastern narrowmouth toad

[1] Nomenclature follows Martof et al. (1980), for reptiles and amphibians; Lee et al. (1982) for mammals; and Potter et al. (1980) for birds.

*Species preceded by an asterisk are documented from NCSM records.
**Species preceded by two asterisks are documented from Company Swamp.

Documentation for the presence of species occurring in Company Swamp is contained in the unpublished field notes of R. Wilson Laney and J. Merrill Lynch.

APPENDIX 5

SCIENTIFIC AND COMMON NAMES FOR FISH WITH KNOWN OR PROBABLE OCCURRENCE IN THE ROANOKE RIVER AND CONIOTT CREEK IN THE VICINITY OF COMPANY SWAMP, BERTIE COUNTY, NORTH CAROLINA

FAMILY	SCIENTIFIC NAME[1]	COMMON NAME
Acipenseridae	Acipenser brevirostrum	*Shortnose sturgeon
	Acipenser oxyrhynchus	*Atlantic sturgeon
Lepisosteidae	Lepiosteus osseus	*Longnose gar
Amiidae	Amia calva	**Bowfin
Anguillidae	Anguilla rostrata	*American eel
Clupeidae	Alosa aestivalis	*Blueback herring
	Alosa pseudoharengus	*Alewife
	Alosa mediocris	*Hickory shad
	Alosa sapidissima	*American shad
	Brevoortia tyrannus	*Atlantic menhaden
	Dorosoma cepedianum	*Gizzard shad
Umbridae	Umbra pygmaea	*Eastern mudminnow
Esocidae	Esox americanus	*Redfin pickerel
	Exos niger	Chain pickerel
Cyprinidae	Cyprinus carpio	*Carp
	Hybognathus regius	*Silvery minnow
	Nocomis leptocephalus	*Bluehead chub
	Notemigonus crysoleucas	*Golden shiner
	Notropis albeolus	White shiner
	Notropis analostanus	*Satinfin shiner
	Notropis chalybaeus	*Ironcolor shiner
	Notropis hudsonius	*Spottail shiner
	Notropis procne	Swallowtail shiner
	Semotilus atromaculatus	Creek chub
Catostomidae	Erimyzon oblongus	Creek chubsucker
	Moxostoma anisurum	*Silver redhorse
	Moxostoma macrolepidotum	*Shorthead redhorse
	Moxostoma papallosum	Suckermouth redhorse
Ictaluridae	Ictalurus catus	*White catfish
	Ictalurus punctatus	*Channel catfish
	Ictalurus natalis	*Yellow bullhead
	Ictalurus nebulosus	*Brown bullhead
	Noturus gyrinus	*Tadpole madtom
	Noturus insignis	*Margined madtom
Amblyopsidae	Chologaster cornuta	*Swampfish
Aphredoderidae	Aphredoderus sayanus	*Pirate perch
Cyprinodontidae	Fundulus lineolatus	*Lined topminnow
Poeciliidae	Gambusia affinis	**Mosquitofish

FAMILY	SCIENTIFIC NAME[1]	COMMON NAME
Percichthyidae	*Morone americana*	*White perch
	Morone saxatilis	*Striped bass
Centrarchidae	*Acantharchus pomotis*	*Mud sunfish
	Centrarchus macropterus	*Flier
	Enneacanthus chaetodon	*Blackbanded sunfish
	Enneacanthus gloriosus	*Bluespotted sunfish
	Enneacanthus obesus	*Banded sunfish
	Lepomis auritus	*Redbreast sunfish
	Lepomis cyanellus	*Green sunfish
	Lepomis macrochirus	*Bluegill
	Lepomis gibbosus	*Pumpkinseed
	Lepomis gulosus	*Warmouth
	Micropterus salmoides	*Largemouth bass
	Pomoxis annularis	*White crappie
	Pomoxis nigromaculatus	*Black crappie
Elassomatidae	*Elassoma zonatum*	*Banded pygmy sunfish
Percidae	*Perca flavescens*	*Yellow perch
	Etheostoma fusiforme	*Swamp darter
	Etheostoma nigrum	Johnny darter
	Etheostoma olmstedi	*Tessellated darter
	Etheostoma serriferum	*Sawcheek darter
	Etheostoma vitreum	*Glassy darter

[1] Scientific nomenclature follows Robbins et al. (1980).

*Species preceded by a single asterisk are documented by Carnes (1965), Lee et al. (1980) et seq.), from the Roanoke River in the vicinity of Company Swamp.

**Species preceded by two asterisks have been observed or collected from Coniott Creek or within Company Swamp.

APPENDIX 6

STATION LOCATIONS AND ESTABLISHMENT PERSONNEL FOR COMPANY SWAMP, BERTIE COUNTY, NORTH CAROLINA

COMPANY SWAMP

STATION ESTABLISHMENT PERSONNEL, DATE, APPROXIMATE LOCATION, TRANSECT BEARING AND FIELD NOTES

STATION	PERSONNEL[1]	DATE	LOCATION, TRANSECT BEARING[2] AND NOTES
BH-1	VCB, JH, DLS	October 10, 1985	Begin at stake on riverbank (see Figure 3). Travel 70 feet, bearing 60° magnetic. Transect runs east-west. End is 50 meters due east of station.
BH-2	VCB, JH, DLS	October 10, 1985	Begin at stake on riverbank (See Figure 3). Travel 50 feet, bearing 294°. Bearing for 50 meter transect direction was not recorded.
BH-3	VCB, JH, DLS	October 11, 1985	Begin at stake on riverbank (See Figure 3). Travel 50 feet, bearing 60°. Bearing for 50 meter transect is 350°.
BH-4	VCB, JH, DLS	October 10, 1985	Station is adjacent to road (See Figure 3) and staked at riverbank. Bearing for 50 meter transect is 172°.
BH-5	VCB, JH, DLS	October 10, 1985	Begin at stake on riverbank (See Figure 3). Travel 50 feet bearing 282°. Directional bearing for 50 meter transect was not recorded.
BH-6	VCB, JH, DLS	October 10, 1985	Begin at stake on riverbank (See Figure 3). Travel 300 feet from river bearing 62°. Bearing of 50 meter transect is 0° according to field sheet.
BH-7	VCB, DLS	June 24, 1986	Travel 650 feet SW of bend in powerline. From road, go 430 feet bearing 143° true. From rebar, measure 50 meters bearing 158° magnetic.
BH-8	RWL, GRM, DLS	June 23, 1986	Travel 125 feet SW of bend in powerline. Travel 200 feet from the west edge of the road bearing 149° true. Measure 50 meters from rebar bearing 184° magnetic.
BH-9	RWL, DHL, DLS	June 17, 1986	Begin at stake on road, 1350 feet E of bridge over big ditch, or 2175 feet W of bend in logging road. Station is

STATION	PERSONNEL[1]	DATE	LOCATION, TRANSECT BEARING[2] AND NOTES
			325 feet due N of river (bearing 7½° magnetic). Transect is 50 meters bearing 78° magnetic.
BH-10	RWL, GRM	June 24, 1986	Begin at stake on road, just east of bridge. Travel 1775 feet bearing 322.5° magnetic. Do not cross the big ditch. Transect is 50 meters bearing 108° true.
BHL-1	VCB, JH, DLS	October 11, 1985	From Station GC-2 travel 800 to 1000 feet, bearing 249° true. Measure 50 meters from station, bearing 187° true.
BHL-2	RWL, JML, GRM, RW	October 10, 1985	The site is located about 500 feet NNE of the logging road. Begin at a white-topped stake on the edge of the road at its junction with a skid trail. Follow the trail in almost to its end. Flagged trail cuts away to the east to the site.
BHL-3	VCB, JH, DLS	October 11, 1985	Begin at stake on riverbank (Figure 3) near Rainbow Hunting Club sign. Travel 450 feet, bearing 270° true. Blazes on trail do not necessarily flow 270°. Transect is 50 meters bearing 194° true.
BHL-4	JLD, RWL, GRM	October 23, 1985	Begin at BHL-6. Travel 1075 feet, bearing 36.5° magnetic. Transect is 50 meters bearing 230° magnetic. Transect was moved 235 feet back along the bearing from BHL-6 but rebar was left in place at original location.
BHL-5	RWL, JML, GRM, RW	October 10, 1985	The site is located about 200 feet down the short skid trail located off the power line road, north of the turnoff onto the natural levee. Follow flagging perpendicular to the skid trail in a NE direction about 225 feet to site. Transect is 50 meters bearing 178° magnetic.

STATION	PERSONNEL[1]	DATE	LOCATION, TRANSECT BEARING[2] AND NOTES
BHL-6	JLD, RWL, GRM	October 23, 1985	Begin at stake on northern side of road, 1000 feet upstream of the bridge. Travel 525 feet due north. Transect is 50 meters bearing 71° magnetic.
BHL-7	RWL, GRM, DLS	June 24, 1986	Begin at stake on road at first bend after turnoff from powerline. Travel 725 feet bearing 12° true. Transect is 50 meters bearing 162° magnetic.
BHL-8	RWL, DHL, DLS	June 17, 1986	Begin at stake on roadside, 1575 feet SW of bend in power line. Station is perpendicular to road, bearing 316°, approximately 85 feet off road. Transect is 50 meters bearing 278°.
BHL-9	RWL, GRM	June 24, 1986	Begin at BH-4 on riverbank, travel 775 feet bearing 45° true. Rebar was later moved approximately 300 feet back along bearing toward road into correct habitat. Transect is 50 meters bearing 230° magnetic.
BHL-10	RWL, DHL, DLS	June 17, 1986	Begin at stake on road, 650 feet west of first bend after road leaves power line, or 400 feet east of next bend. Station is 60 feet N of road. Transect is 50 meters bearing 38° magnetic.
GC-1	RWL, JML, GRM, RW	October 11, 1985	Begin at site GC-8. Travel 350 feet, bearing 252.5° magnetic. From GC-1 travel 900 feet, bearing 157.5° magnetic to return to BHL-2. Transect GC-1 is 50 meters bearing 100° magnetic.
*GC-2	VCB, JH, DLS	October 11, 1985	Begin at Station BHL-3. Travel 1000 feet bearing 293° magnetic. This station was not sampled but is enroute to BHL-1 which was done.
GC-3	RWL, JML, GRM, RW	October 10, 1985	Begin at site GCL-1. Travel 600 feet, bearing 301.5° magnetic. Site is normally flooded due to beaver impoundment. Transect is 50 meters bearing 252° magnetic.

STATION	PERSONNEL[1]	DATE	LOCATION, TRANSECT BEARING[2] AND NOTES
GC-4	RWL, JML, GRM, RW	October 11, 1985	Begin at site GC-15. Travel 2400 feet, bearing 15.5° magnetic. Transect is 50 meters bearing 226° magnetic.
GC-5	JLD, RWL, GRM	October 23, 1985	Begin at site BHL-4. Travel 850 feet, bearing 314.5° magnetic. Transect is 50 meters bearing 155° magnetic.
*GC-6	RWL, JML, GRM, RW	October 11, 1985	Begin at site GC-4. Travel 1125 feet, bearing 224° magnetic. Transect was not put in since this station was not sampled.
GC-7	JLD, RWL, GRM	October 23, 1985	Begin at site GC-5. Travel 1100 feet bearing 37.5° magnetic. Transect is 50 meters bearing 198° magnetic.
GC-8	RWL, JML, GRM, RW	October 11, 1985	Begin at site GC-6. Travel 1650 feet, bearing 195.5° magnetic. Transect is 50 meters bearing 222° magnetic.
GC-9	JLD, RWL, GRM	October 23, 1985	Begin at site GC-10. Travel 1500 feet, bearing 172.5° magnetic. Travel 1800 feet, bearing 129.5° magnetic, to return to BHL-6. Transect GC-9 is 50 meters bearing 245° magnetic.
GC-10	JLD, RWL, GRM	October 23, 1985	Begin at GC-7. Travel 1775 feet, bearing 277.5 magnetic. Transect is 50 meters bearing 108° magnetic.
GC-15	RWL, JML, GRM, RW	October 11, 1985	Begin at Site BHL-2. Go about 1250 feet, bearing 28.5° magnetic. Flagged trail originally crossed 1000 feet of GCL with nothing to tie flagging to. Subsequently flagged new route to NW of original one. Transect is 50 meters bearing 104° magnetic.
GC-16	RWL, JML, GRM, RW	October 10, 1985	Begin at Site GC-3. Go about 600 feet NNW, bearing 328.5° magnetic. Site is near edge of swamp/high ground interface and is usually flooded. Transect is 50 meters bearing 222° magnetic.

STATION	PERSONNEL[1]	DATE	LOCATION, TRANSECT BEARING[2] AND NOTES
GCL-1	RWL, JML, GRM, RW	October 10, 1985	Begin at the junction of Coniott Creek channel and the road, on the south bank. Site is 1600 feet, bearing 282.5° magnetic. Route requires crossing a beaver dam across channel to the north side of the stream. Starting point is marked with a tall stake. Flagging is red. There is a short stake approx. 400 feet in just below beaver dam. A second beaver dam is passed about 800 feet in. At about 1300 feet in, cross the stream on a large fallen tree. Station stakes are in a large cypress stump. Transect is 50 meters bearing 187° true.
GCL-2	VCB, DLS	June 24, 1986	Begin at Station GCL-6. Travel 410 feet bearing 207° true. Transect is 50 meters bearing 73° magnetic.
GCL-3	VCB, DLS	June 24, 1986	Begin at Station GCL-4. Travel 150 feet bearing 277° true. Transect is 50 meters bearing 165° magnetic.
GCL-4	VCB, DLS	June 24, 1986	Begin at Station BHL-8. Travel 610 feet bearing 1° magnetic. Transect is 50 meters bearing 124° magnetic.
GCL-5	RWL, DHL, DLS	June 17, 1986	Begin at stake in edge of road 75 feet north of powerline bend. Station is approximately 243 feet bearing 302° true. Transect is 50 meters bearing 286° magnetic.
GCL-6	VCB, DLS	June 24, 1986	Begin at Station GCL-3. Travel 320 feet bearing 325° true. Transect is 50 meters bearing 135° magnetic.
GCL-7	RWL, DHL, DLS	June 17, 1986	Begin on west side of road 280 feet south of last channel crossing powerline cut. Station is 275 feet off road bearing 290° true. Transect is 50 meters bearing 65° true.

STATION	PERSONNEL[1]	DATE	LOCATION, TRANSECT BEARING[2] AND NOTES
GCL-8	RWL, GRM, DLS	June 23, 1986	Begin at stake 300 feet north of bend where road begins to parallel power line. Travel 250 feet west into swamp. Transect is 50 meters bearing 12° true.
GCL-9	RWL, GRM, DLS	June 23, 1986	Begin at site GCL-8. Travel 630 feet bearing 260° true. Transect is 50 meters bearing 265° true.
GCL-10	RWL, GRM, DLS	June 23, 1986	Begin at SE corner of intersection of last stream crossing powerline with E edge of cut. Travel 825 feet bearing 107° true. Transect is 50 meters bearing 73° magnetic, but begins along that bearing 78 feet from station.
TC-1	RWL, JML, GRM, RW	October 10, 1985	Site is 125 feet into corridor from the west edge of the road, about 400 feet south of the dogleg in the power line. Transect is 50 meters bearing 56° magnetic.
TC-2	JLD, RWL, GRM	October 24, 1985	The site is 36 feet from the western side of the corridor, about 550 feet south of the turnoff into the natural levee. Transect is 50 meters bearing 105° true.
TC-3	JLD, RWL, GRM	October 24, 1985	The site is 89 feet from the western side of the corridor, about 650 feet south of the southernmost creek channel which crosses the corridor. Transect is 50 meters bearing 207° magnetic.
TC-4	JLD, RWL, GRM	October 24, 1985	The site is 61 feet from the western side of the road, about 100 feet north of the northern edge of the turnoff onto the natural levee. Transect is 50 meters bearing 243° magnetic.
TC-5	JLD, RWL, GRM	October 24, 1985	The site is 109 feet from the western side of the road, opposite the turnoff onto the natural levee. Transect is 50 meters bearing 66° magnetic.

STATION	PERSONNEL[1]	DATE	LOCATION, TRANSECT BEARING[2] AND NOTES
TC-6	JLD, RWL, GRM	October 24, 1985	The site is 134 feet from the western edge of the road; about 625 feet south of the southernmost channel within the corridor. Transect is 50 meters bearing 360° magnetic.
TC-7	JLD, RWL, GRM	October 24, 1985	The site is 32 feet from the western edge of the corridor, about 725 feet south of the southern edge of the turnoff onto the natural levee. Transect is 50 meters bearing 124° true.
TC-8	JLD, RWL, GRM	October 24, 1985	The site is 126 feet from the western edge of the road, about 50 feet north of the channel at the junction of the road and the powerline corridor. Transect is 50 meters bearing 23° magnetic.
TC-9	JLD, RWL, GRM	October 24, 1985	The site is 125 feet from the western edge of the road, about 400 feet south of the skid trail to the north of the turnoff onto the natural levee. Transect is 50 meters bearing 39° magnetic.
TC-10	JLD, RWL, GRM	October 24, 1985	The site is 51 feet from the western edge of the road, about 1800 feet south of the dogleg in the power line corridor. Transect is 50 meters bearing 88° magnetic.

[1] Agency personnel involved in sample site establishment and initials are:
North Carolina Department of Transportation, Division of Highways
V. Charles Bruton (VCB),
Julie Hunkins (JH), Co-op Civil Engineering Student
Gerald M. McCrain (GRM)
Rick Ward (RW), Civil Engineering Trainee
North Carolina Wildlife Resources Commission
Dennis L. Stewart (DLS), Habitat Conservation Biologist II
The Nature Conservancy
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[1] Agency personnel involved in sample site establishment and initials are: (continued)

U.S. Fish and Wildlife Service
Judi L. Durda (JLD), Wildlife Biologist
R. Wilson Laney (RWL), Fish and Wildlife Biologist
Doug H. Lewis (DHL), Young Adult Conservation Corps (YACC)

[2] An attempt was made to report all compass bearings as magnetic readings in order to avoid confusion on the ground. When in doubt, look for flagging on the trees and blazes, where indicated. At the site itself, most, but not all sites, have both ends flagged and marked. All origins are marked with rebar. Most are marked also with white- or red-topped surveying stakes. Compass bearings in this table need to be re-confirmed on the ground and are subject to variability due to differences in personnel.

* Sites preceded by an asterisk were located and marked but not sampled.

APPENDIX 7

STATION PERSONNEL AND SAMPLE COMPLETION DATES
COMPANY SWAMP, BERTIE COUNTY, NORTH CAROLINA

COMPANY SWAMP
STATION PERSONNEL AND SAMPLE COMPLETION DATES[1]

STATION	LINE PERSONNEL	QUAD PERSONNEL	DATE SAMPLED
BH-1	GRM (READ)[2], RWL	VCB, DLS	JUNE 26, 1986
BH-2	RM (READ), TM	RW, DLS	AUGUST 22, 1986
BH-3	K H (READ), RWL	TH, JD	AUGUST 22, 1986
BH-4	RWL (READ), GRM	CBN, DLS	JULY 17, 1986
BH-5	RWL (READ), KH	TH, JD	AUGUST 22, 1986
BH-6	RM (READ), TM	RW, DLS	AUGUST 22, 1986
BH-7	RWL (READ), KH	TH, JD	AUGUST 18-20, 1986
BH-8	RWL (READ), GRM	DLS, DHL	JULY 22, 1986
BH-9	GRM (READ), RWL	DLS, CBN	JULY 15, 1986
BH-10	RM (READ), TM	DLS, Rw	AUGUST 21, 1986
BHL-1	RWL (READ), MAF	DLS	SEPTEMBER 4, 1986
BHL-2	GRM (READ), RWL	DLS, DHL	JULY 23, 1986
BHL-3	RWL (READ), MAF	DLS	SEPTEMBER 5, 1986
BHL-4	GRM (READ), RWL	DLS, CBN	JULY 16, 1986
BHL-5	RWL (READ), KH	TH, JD	AUGUST 20, 1986
BHL-6	GRM (READ), RWL	DLS, CBN	JULY 15, 1986
BHL-7	RWL (READ), KH	TH	AUGUST 21, 1986
BHL-8	RWL (READ), KH	TH, JD	AUGUST 20, 1986
BHL-9	RM (READ), TM	DLS, RW	AUGUST 21, 1986
BHL-10	RW (READ), TM	DLS	AUGUST 20, 1986
GC-1	KH (READ), RWL	TH, JD	AUGUST 21, 1986
GC-3	GRM (READ), RWL	DLS, CBN	JULY 18, 1986
GC-4	RWL (READ), GRM	DSL, DHL	JULY 23, 1986
GC-5	GRM (READ), RWL	DLS, CBN	JULY 16, 1986
GC-7	RWL (READ), GRM	DLS, CBN	JULY 16, 1986
GC-8	RWL (READ), KH	TH, JD	AUGUST 21, 1986
GC-9	GRM (READ), RWL	DLS, CBN	JULY 17, 1986
GC-10	GRM (READ), RWL	DLS, CBN	JULY 17, 1986
GC-15	GRM (READ), RWL	DLS, DHL	JULY 23, 1986
GC-16	GRM (READ), DLS	TH	JULY 1, 1986
GCL-1	GRM (READ), RWL	DLS, CBN	JULY 18, 1986
GCL-2	VCB (READ), DHL	RSC	JULY 24, 1986
GCL-3	VCB (READ), RWL	DLS, RSC, DHL	JULY 25, 1986
GCL-4	RM (READ), TM	DLS, RW	AUGUST 20, 1986
GCL-5	GRM (READ), DLS	TH	JULY 1, 1986
GCL-6	RWL (READ), VCB	DLS, RSC, DHL	JULY 25, 1986
GCL-7	GRM (READ), RWL	DLS, VCB	JUNE 24-25, 1986
GCL-8	VCB (READ) RWL	DLS, GRM	JUNE 26, 1986
GCL-9	GRM (READ), DLS	DLS, GRM	JUNE 30, 1986
GCL-10	GRM (READ), RWL	DLS, DHL	JULY 22, 1986
TC-1	VCB (READ), RSC	---[3]	JULY 24, 1986
TC-2	DLS (READ), RWL	---	JULY 14, 1986
TC-3	RWL (READ), DLS	---	AUGUST 5, 1986
TC-4	RWL (READ), DLS	---	AUGUST 5, 1986
TC-5	DLS (READ), RWL	---	AUGUST 5, 1986
TC-6	DLS (READ), RWL	---	AUGUST 5, 1986
TC-7	DLS (READ), RWL, CBN	---	JULY 14, 1986
TC-8	VCB (READ), RSC, DHL	---	JULY 24, 1986

STATION	LINE PERSONNEL	QUAD PERSONNEL	DATE SAMPLED
TC-9	DLS (READ), RWL	---	AUGUST 5, 1986
TC-10	VCB (READ), RSC, DHL	---	JULY 24, 1986

[1]Agency personnel involved in sampling and initials are:

North Carolina Department of Transporation, Division of Highways
V. Charles Bruton (VCB), Wildlife Biologist III
Gerald R. McCrain (GRM), Wildlife Biologist III

North Carolina Wildlife Resources Commission
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Tom Henson (TH), Coastal Project Leader, Nongame and Endangered Wildlife Section
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Randall Wilson (RW), Furbearer Project Leader
Dennis L. Stewart (DLS), Habitat Conservation Project Leader

U.S. Fish and Wildlife Service
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Christopher B. Nash (CNB), Group Leader, Young Adult Conservation Corps

[2]The designation "READ" in () for line personnel indicates which observer called out the data.

[3]No trees are present in the transmission corridor; therefore no quadrat data were collected.

APPENDIX 8

TECHNICAL PROVISIONS OF THE HEP ANALYSIS

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TECHNICAL PROVISIONS OF THE HEP ANALYSIS

Cover Mapping

A vegetative cover map of the Company Swamp tract was prepared by Steve Leonard of the N.C. Department of Natural Resources and Community Development, Division of Soil and Water Conservation. Aerial infrared photography for use in stereoscopic mapping was provided by the FWS National Wetland Inventory program. The photography originated from the National High Altitude Photography Program and consisted of 9 by 9-inch transparencies at a scale of 1:58000. Four primary wetland cover types and four additional disturbed variants of those were mapped within the tract. These were:

1) Palustrine, forested, broad-leaved deciduous, seasonally-flooded, (PFO1C) or Bottomland Hardwoods (BH)

   a. PFO1C-Moderately Logged

   b. PFO1C-Severely Logged

2) Palustrine, forested, broad-leaved deciduous, temporarily-flooded, (PFO1A), also Bottomland Hardwoods

3) Palustrine, forested, broad/needle-leaved deciduous, semipermanently-flooded (PFO1/4f) or Gum-Cypress (GC)

   a. PFO1/4F-Moderately Logged

   b. PFO1/4F-Severely Logged

4) Palustrine, emergent, persistent, seasonally-flooded (PEM1C) or Transmission Corridor (TC)

Cover map ground truthing was conducted by Team members on September 4 and 5, 1985. The map was determined to be accurate. Habitat mapped as PFO1A was an old spoil disposal area resulting from past dredging activity within the Roanoke River which had revegetated to bottomland hardwoods. Although the area is elevated slightly relative to the surrounding habitat, no readily apparent difference in the vegetation was discernible.

As a result of ground truthing, the Team elected to combine several cover types to reduce the amount of necessary sampling. The PFO1A and PFO1C categories were combined in the designated BH cover type. Moderately- and severely-logged PFO1C categories were also combined within a new Bottomland Hardwoods-Logged (BHL) designation. The moderately- and severely-logged PFO1/4F categories were combined also, resulting in the Gum-Cypress-Logged (GCL) category. All other categories, namely the GC and TC cover types, were retained as mapped.

The final cover map derived is provided as Figure 2 within the text of this report.

Sample Site Selection and Establishment

Sample sites within each cover type were selected randomly. Black-and-white aerial photography at a scale of 1:4800 was provided by the NCDOT for use in sample site selection. A transparent overlay with a grid, consisting of seconds of latitude and longitude, was placed on the photograph. Pairs of numbers, corresponding to seconds of latitude and longitude, were generated using a random numbers table until ten or more sites fell within each of the four forested cover types. Only two sites fell within the TC at the completion of this process. The small number of sites is attributable to the decreased probability of hitting this cover type as a consequence of its small extent and linearity. Remaining sites within TC were selected by designating an end (north) by coin toss and generating additional random number pairs, consisting of distance down the corridor and distance from the east or west boundary, respectively. The starting boundary for each site was selected by coin toss.

Distance from the nearest evident landmark and compass bearing to each site was determined by plotting the location of each on the aerial photography. For most sites, distance and direction were measured from either a distinctive bend on the Roanoke River, the junction of Coniott Creek and the logging road, or distinctive bends in the logging road or transmission corridor. Teams, consisting of at least one Evaluation Team member plus other agency personnel, located and marked each site. Trails into each site were marked through use of plastic flagging, blazing tree trunks, or a combination of the two. All sites were located and marked during the period October, 1985 through June, 1986.

Each site was permanently marked for future reference. The Team placed a six-foot length of steel reinforcing rod at each station, in addition to a labeled, white-topped wooden stake. Sites which fell within ecotones between two distinct cover types were shifted from the premeasured distance, along the appropriate compass bearing until they were within the appropriate cover type.

Ten sites were located and marked within each of the five cover types. The Team arbitrarily chose to employ ten sites per cover type in order to minimize sampling time and costs and not for statistical reasons. Ideally, the appropriate procedure would be to sample at least three sites within each cover type, using the results to estimate the number of sample sites required to obtain a preferred degree of accuracy when estimating variable means. Although data were collected for it, the TC cover type was subsequently eliminated from the HEP analysis because its value for all species remains unchanged with or without the project.

Evaluation Species Selection

The Team developed an initial list of 24 terrestrial vertebrates and 7 fish for consideration as potential evaluation species on September 6, 1985.

Criteria for inclusion and initial ranking included: dependence of the species on bottomland hardwoods habitat; special protection status, e.g. State or Federal threatened or endangered or game status; HSI model availability; and public interest value. Each of the factors was rated for each species by the Team by assigning an index value of from 1 (low) to 5 (high). A total value for each species was derived by summing all values.

The initial list of terrestrial species was reduced to 16 at the October 4, 1985 Team meeting by eliminating those species for which final or draft HSI Models were not available. The remaining species were listed in priority based on the ranking index assigned each by the Team. All fish species were retained since published HSI Models were available.

After further consideration and discussions with the FWS Raleigh Field Office Supervisor and Region 4 HEP Coordinator, the Team recognized the need to: reduce the number of terrestrial evaluation species to a level which would minimize the time necessary for performing individual HEP analyses; select species with broad applicability within North Carolina bottomland habitats; and chose species with small territories which would best reflect the impact of highway construction. Species which were obligate multi-cover type species, or which require large territories, were eliminated from further consideration to simplify the HEP analyses and minimize the time required to conduct them. Elimination of these species for use as evaluation species in no way diminishes the impact of highway construction upon them, especially in cases where fragmentation of presently contiguous habitat occurs.

Terrestrial species selection was finalized by the Team on December 9, 1986. The four species designated for the initial bank study were the eastern box turtle, gray squirrel, hairy woodpecker, and wood duck. The eastern box turtle was subsequently replaced by the mink in April, 1987. The Team believes that the species selected represent a group with high utility for this particular application. They all are found within bottomland hardwood systems (Wharton, Lambou, Newsom, Winger, Gaddy and Manke 1981; Wharton et al. 1982). They are all protected under State and/or Federal laws. They represent both game and nongame species. They are functionally diverse and occupy different structural components of the bottomland hardwoods system.

Finally, the selected species all possess relatively small territories. Sousa (1986) cited documented values ranging from 1.5 to 37.5 acres for hairy woodpecker territory size, although 10 acres was estimated to be necessary for breeding, and the species was not found in tracts of less than 5 acres. Average home range size for mink varies as a function of the amount of vegetative cover available (Allen 1986). Mink home ranges in areas where cover was not limiting were estimated at about 20 acres. Allen (1982) cited documented gray squirrel home ranges of from 1.2 to 40 acres, again suggesting that territories would be somewhat larger. Sousa and Farmer (1983) documented the fact that wood ducks do not maintain stable home ranges. Documented home range size for hens with broods varied from 1.9 to 73.1 acres in South Carolina, and in North Carolina a 40-acre brood-rearing area supported from 17 to 27 broods in different years.

Territories required for nesting pairs and for overwintering are usually larger.

Fish species selected for use with an aquatic HEP study are the largemouth bass, warmouth, channel catfish, and redbreast sunfish. Final HSI models have been published for all of these species. As stated in the report, no aquatic study is planned at this time.

Methodologies and Sampling

Vegetation and other habitat parameters necessary for using the HSI models were sampled at each site. Vegetation sampling was conducted utilizing line intercept and quadrat methods. The Team used a 50-meter steel tape to establish the base of an imaginary, unbroken, plane and recorded the extent, height, and identity of each plant which broke the plane. The direction of each line intercept was randomly chosen, except when the proximity of another cover type necessitated otherwise. In either case, Team members present gave randomly-selected compass bearings which were averaged to determine the bearing for the line. The tape was then stretched and the distal end prominently marked to facilitate reestablishing the line. Line origins always coincided with previously-established site markers (i.e., the tape was always hooked on the rebar). Herb, forb and grass heights were recorded to the nearest centimeter. Shrub heights were recorded to the nearest centimeter, and understory and canopy heights were estimated to the nearest meter. All distances along the line were recorded to the nearest centimeter.

In addition to living plants, height and extent of cover components such as fallen logs, slash piles, and stumps were recorded. Two, 5- by 50-meter quadrats were established on either side of the line intercept line. The diameter-at-breast-height (dbh), height, and species of all trees exceeding six inches (15.24 cm) in diameter were recorded within each quadrat. Total cavities, snag numbers and dbh, and potential den trees were recorded also.

Field sampling was initiated on June 26 and completed September 5, 1986. Sampling was originally proposed to begin in August, 1985, but was deferred due to flooding in Company Swamp. By the time floodwaters had subsided, vegetation die-back was well underway. The Team elected to defer sampling until vegetation was well established in the following spring and all sites had been located and marked. Conditions during sampling were marked by a record drought. As a result of the unusually dry conditions, herbaceous data recorded for GC and GCL cover types may represent maximum coverage due to the additional areas available for production which normally may be saturated and probably anoxic.

Data Processing and Analysis

Line intercept data were recorded on field sheets (Figures 8-1, 8-2) during sampling and were entered onto eight-inch floppy diskettes for storage and manipulation using TRS-80 Model II and Model 12 micro-computers. Data were entered using the VEGANAL software developed by FWS for a previous HEP study. Data printouts were obtained and proofed and necessary corrections were made.

Figure 8-1. LINE-INTERCEPT VEGETATION DATA SHEET

Location _____ Station # _____ Date _____

Habitat Type _____ Observers _____

Compass Bearing _____ Starting Point _____

Comments _____

Species	Distance (m) (DBH) (Ht) - Trees Shrubs				
	0.00-10.00	10.01-20.00	20.01-30.00	30.01-40.00	40.01-50.00

Information Needs:
Trees by species, dbh of Hard mast trees $\geq$ 10" dbh
Shrubs by species Shrub height

Figure 8-2. Quadrat Data Sheet.

LOCATION _____ DATE _____

OBSERVERS _____ COMMENTS _____

Station	Species	DBH	Distance	Height	Understory species

Sheet ___ of ___

Vegetation variables necessary for entry into the HSI Models were calculated by the software package and printed out by sample site. Observations with missing values were eliminated from the dataset.

Quadrat data were also recorded on data sheets in the field (Figure 8-2). Quadrat data were processed by programmable calculator. Data from the two quadrats at each site were combined into one dataset for purposes of analysis. Observations with missing values were eliminated from the dataset.

HSI Models and Modifications

All four models employed in the HEP analysis were developed or funded by FWS. Models used were the mink (Allen 1986), gray squirrel (Allen 1982), hairy woodpecker (Sousa 1986), and wood duck (Sousa and Farmer 1983). Variables required for employing the models are listed in Table 8-1. All baseline variables were either sampled directly in the field or computer generated from the vegetative database.

The hairy woodpecker model was used as written by Sousa (1986) without modification. The mink model was modified to weight the presence of tree canopy cover more heavily than other cover variables. This modification appears justified to the Team based on the fact that mink harvest is higher in palustrine forested than in palustrine emergent habitats (Allen 1986). The gray squirrel model was modified to provide some minimum habitat value when the "percent cover of hard mast" and "hard mast species diversity" variables had a value of 0 since the Team believes that gum-cypress habitats do provide some value for that species despite the lack of hard mast species. The wood duck model was employed as a single-cover-type model to evaluate only the reproductive and brood-rearing potential of the bank.

Baseline variables employed in running the models are provided in Table 8-2. Values given represent means and ranges for the indicated habitats. Mean values within Table 8-2 were used for Target Year (TY) 0 values within each species model.

Some of the variables were adjusted to reflect site conditions more accurately. Percent of overstory composed of hard mast was estimated from the intercept data by obtaining percent cover of hard mast trees exceeding 5 meters (16 feet) in height. This method was found to underestimate the actual percentage of hard mast coverage within adjacent quadrats, since trees which were to one side of the line often intercepted the vertical plane at lower heights. The Team compensated to a degree by re-estimating coverage to include hard mast at or above three meters in height. Even with the adjustment, hard mast coverage may be underestimated and should be reevaluated during scheduled future HEP evaluations.

Since cavities were visually observed from the ground and were not measured to screen for minimum size useable by wood ducks, counts were reduced by 50 percent to reduce the likelihood of overestimating the actual numbers available. In actuality, further reductions may be warranted in view of the

Table 8-1. Variables necessary for HSI determinations for Company Swamp terrestrial evaluation species.

VARIABLE	MINK	GRAY SQUIRREL	HAIRY WOODPECKER	WOOD DUCK
NO. OF SNAGS $\geq$ 25 CM DBH PER HECTARE (HA)			X	
MEAN DBH OF OVERSTORY TREES (CM)		x	x	
PERCENT TREE CANOPY CLOSURE	X	X	X	
PERCENT OVERSTORY IN SPRUCE			X	
PERCENT OVERSTORY IN PINE			X	
PERCENT OVERSTORY IN HARD MAST[1]		X		
DIVERSITY OF HARD MAST SPECIES PER SITE		X		
PERCENT SHRUB CROWN COVER (LESS THAN 500 CM)	X	X		
PERCENT HERBACEOUS COVER	X			
PERCENT WATER SURFACE WITH BROOD COVER[2]				X
PERCENT OF YEAR SURFACE WATER PRESENT	X			
NO. OF SUITABLE CAVITIES PER ACRE				X
NO. OF NEXT BOXES PER ACRE				X
DENSITY OF NEST SITES PER ACRE				X

[1]Trees greater than 25 cm dbh which produce hard-shelled fruit.
[2]Brood cover consists of shrub cover, overhanging tree crowns, woody downfall, and herbaceous cover within one meter of the water surface.

Table 8.2 Cover type variables measured for the Company Swamp site which were employed within the HEP analysis.

VARIABLE	BH			BHL			GC			GCL		
	n	$\bar{x}$	range	n	$\bar{x}$	range	n	$\bar{x}$	range	n	$\bar{x}$	range
NO. SNAGS/HA	10	6	0-20	10	16	0-40	10	16		10	16	0-40
MEAN OVER-STORY DBH	10	29.91	23.9-40.9	10	29.43	23.1-36.0	10	41.44	26.7-54.2	10	34.23	26.5-44.8
% CANOPY CLOSURE	10	92.4	63.6-99.98	10	62.6	0-83.86	10	97.54	89.8 100.0	10	52.31	11.62-88.78
% OVERSTORY SPRUCE	10	0	---	10	0	---	10	0	---	10	0	---
% OVERSTORY PINE	10	0	---	10	0	---	10	0	---	10	0	---
% OVERSTORY HARD MAST	10	11.6	0-52.9	10	18.8	0-42.9	10	0	---	10	5.23	0-27.4
HARD MAST DIVERSITY	10	1	0-2	10	1	0-3	10	0	--- 0	10	0	0-2
% SHRUB COVER < 500 CM	10	42.76	14.2-78.4	10	49.5	15.7 81.1	10	20.5	0-56.4	10	28.2	.038-81.26
% HERBACEOUS COVER	10	42.02	12.3-84.22	10	49.49	23.7-74.5	10	45.18	14.2-79.7	10	75.45	41.5-93.3
% BROOD COVER	10	30.48	9.5-85.4	10	59.48	30.4-97.1	10	23.08	3.7-74.3	10	72.63	26.5-94.3
PRESENCE OF WATER[1]	-	100	--- -	-	100	---	-	100	--- -	-	100	---

Table 8.2. Continued.

VARIABLE	BH			BHL			GC			GCL		
	n	$\bar{x}$	range	n	$\bar{x}$	range	n	$\bar{x}$	range	n	$\bar{x}$	range
CAVITIES/ ACRE[2]	10	7.7	0-48.8	10	2.9	0-20.4	10	11.0	0-29.4	10	9.0	0-32.6
NEST BOXES/ ACRE	10	0	---	10	0	---	10	0	---	10	0	---
NEST SITES/ ACRE[3]	1	1.4	--- -	1	0.5	--- -	1	2.0	--- -	1	1.6	---

[1]Presence of water was arbitrarily set at the optimum percentage within the tract since it is not a limiting factor.
[2]Cavity counts were reduced to half observed values in order to eliminate those too small for wood duck use.
[3]This variable is calculated by the HSI software for each value of cavities/acre and nest boxes/acre entered. Values given are for baseline conditions within each cover type.

availability of suitable wood duck nest cavities as measured in other bottomland hardwood stands (Hill and Lowney 1986).

Future, With-the-Bank, Assumptions

Major changes which are presumed to occur within Company Swamp for the next 90 years, assuming no hydrological alterations, are those associated with maturation of the cover types to old-growth stands. The only exception is the transmission corridor, which is assumed to remain unchanged as a consequence of continued management by Virginia Power. Within all other cover types, assumptions the Team made regarding each variable are as follows. (Assumptions are graphically depicted for each cover type in Figures 8-3 through 8-6):

1) Since the estimated age of unlogged forested cover types vary from 50 - 100 years, the Team assumed that mortality rates would remain relatively constant and that snag densities would remain initially stable within the BH and GC cover types. Snag densities were decreased at TY 25 within the BHL, GC, and GCL habitats to reflect loss of existing snags and declining tree mortality rates as the tract ages.

2) Mean tree diameter was presumed to increase throughout time in all forested cover types. Based on literature values for a number of bottomland hardwood species (Fowells 1965), average growth was assumed to be 0.3 inches per year (.762 cm per yr) for all species within all habitats. This also assumes that no logging would take place and that no reduction in mean diameter would thereby occur as a consequence.

3) The percent overstory in spruce remains constant at zero.

4) The percent tree canopy closure will increase from existing values to 98 percent by TY 25 and remain constant thereafter for all forested cover types.

5) The percent overstory in pine remains constant at zero.

6) The percent overstory in hard mast remains constant in GC. In BH and BHL, it increases as saplings mature from its present value of 18.8 percent to 50 percent at TY 90. In GCL, it increases from the present 5.2 percent value to 10 percent at TY 50 and remains constant thereafter. These percentages are based on discussion with Russ Lee and Team members regarding vegetational succession in bottomland hardwoods ecosystems.

7) The diversity of hard mast trees was held constant. Given that the Team has to date only detected six hard-mast-producing species on the tract, one of which was not at a sample site, the likelihood of any increase in mean diversity appears minimal. There is the possibility that further evaluation of the data would determine that additional sampling should be performed to narrow the confidence limits associated with the database. If such sampling is performed and indicates that higher hard mast diversity values are warranted, then future HEP reevaluations should reflect such a change.

Figure 8-3. Graphical depiction of future vegetative cover assumptions, bottomland hardwoods, with the bank

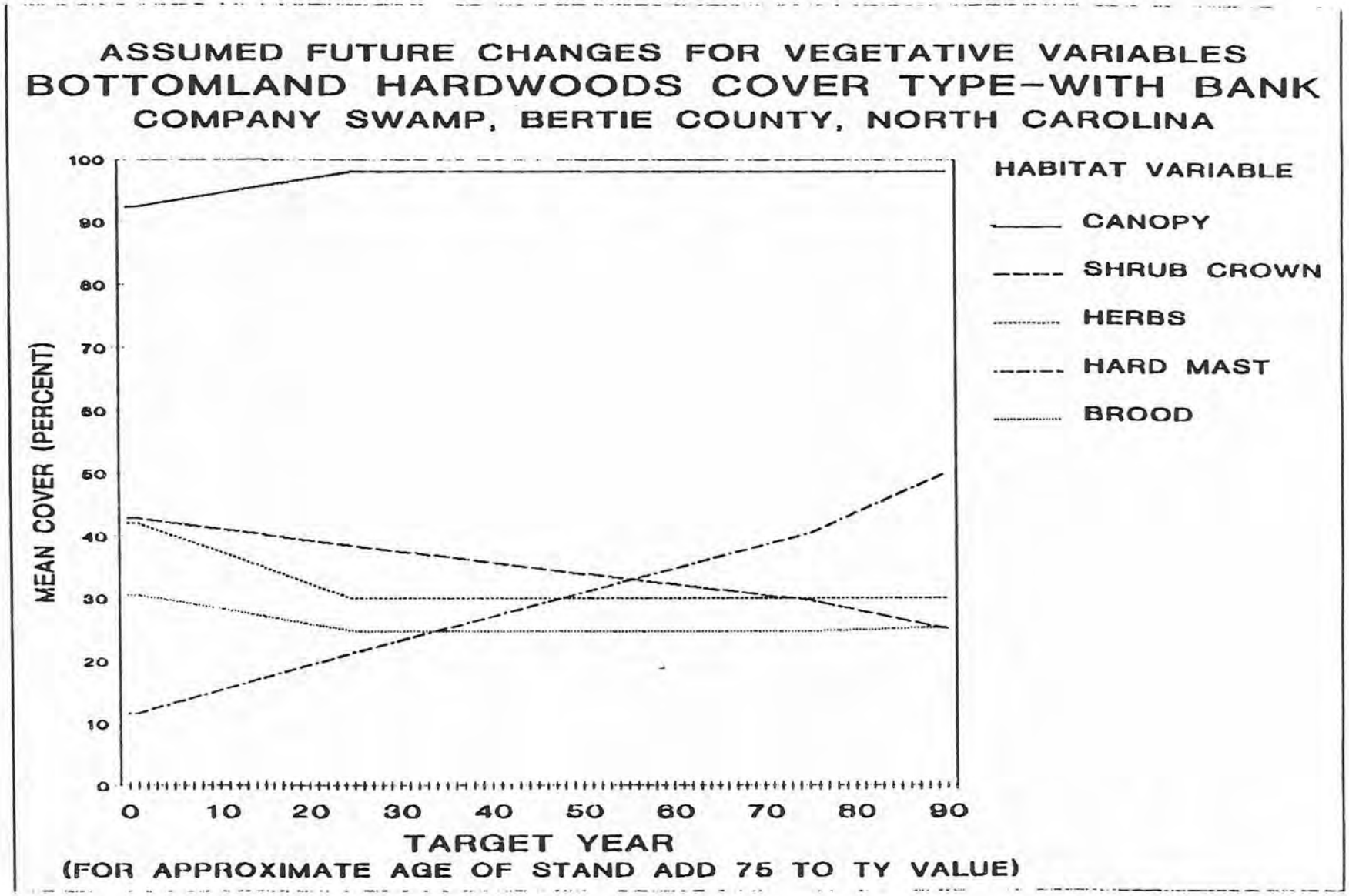


Figure 8-3. Graphical depiction of future vegetative cover assumptions, bottomland hardwoods, with the bank

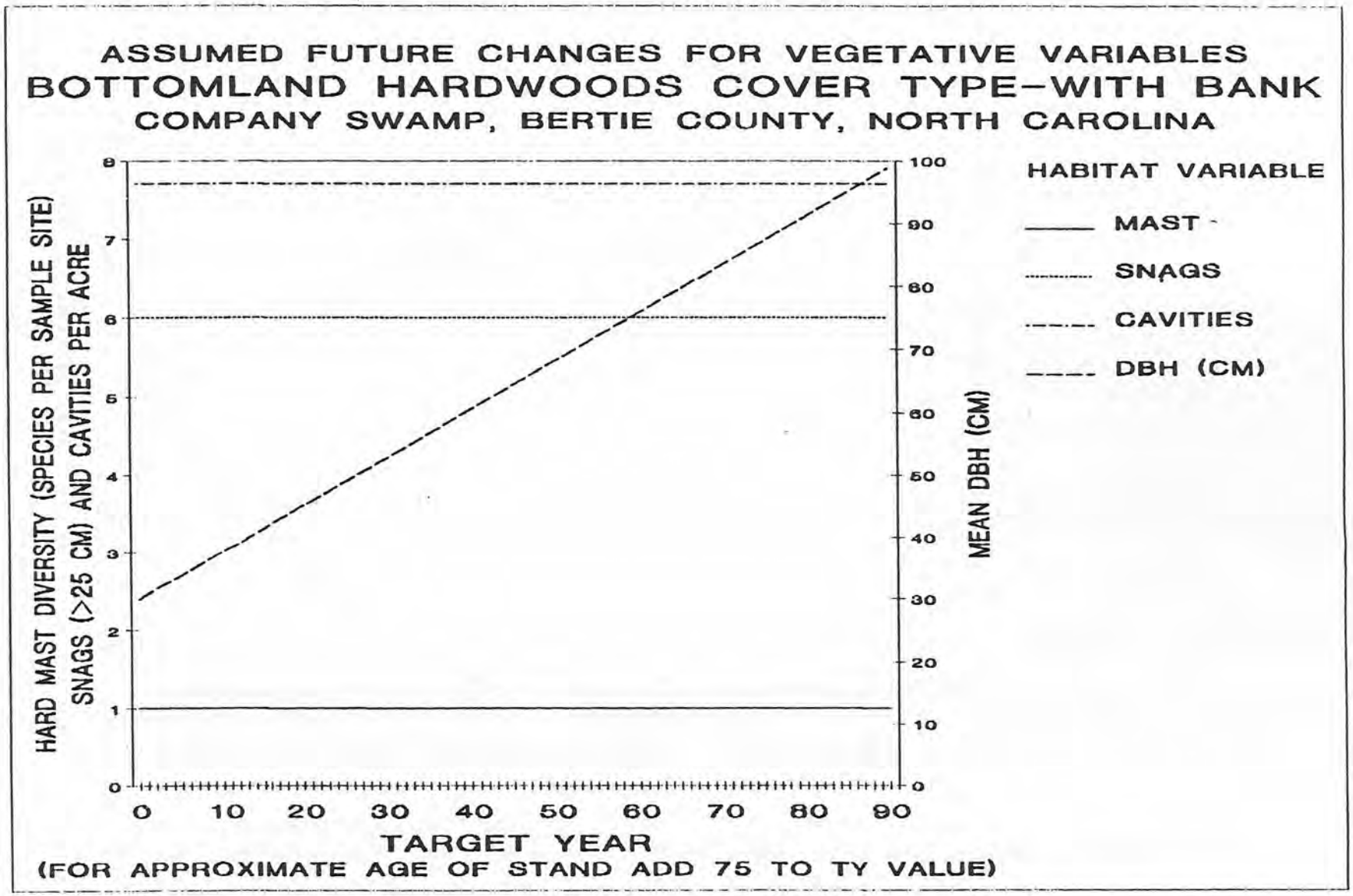


Figure 8-4. Graphical depiction of future vegetative cover assumptions, logged bottomland hardwoods, with the bank

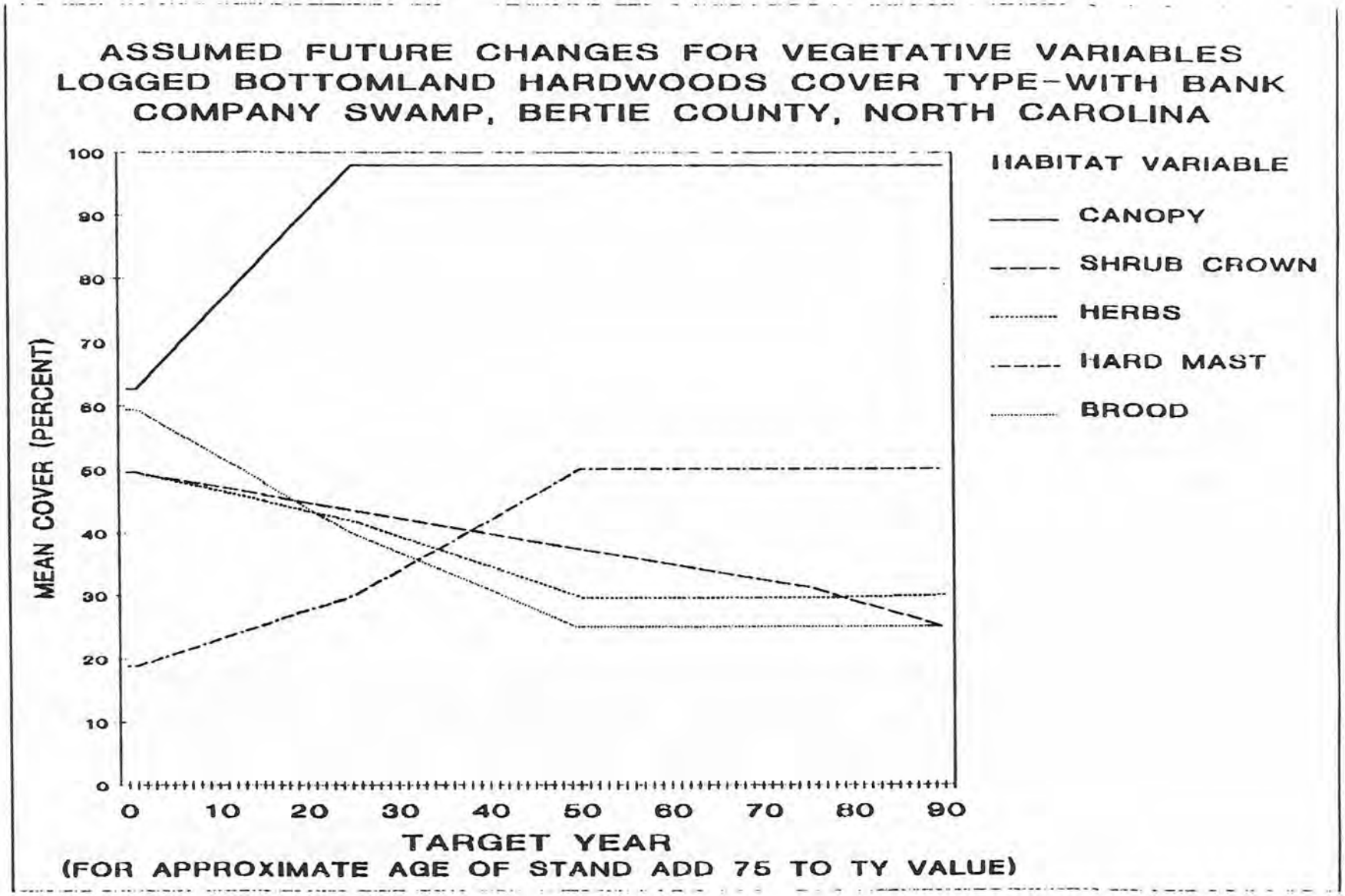


Figure 8-4. Graphical depiction of future vegetative cover assumptions, logged bottomland hardwoods, with the bank

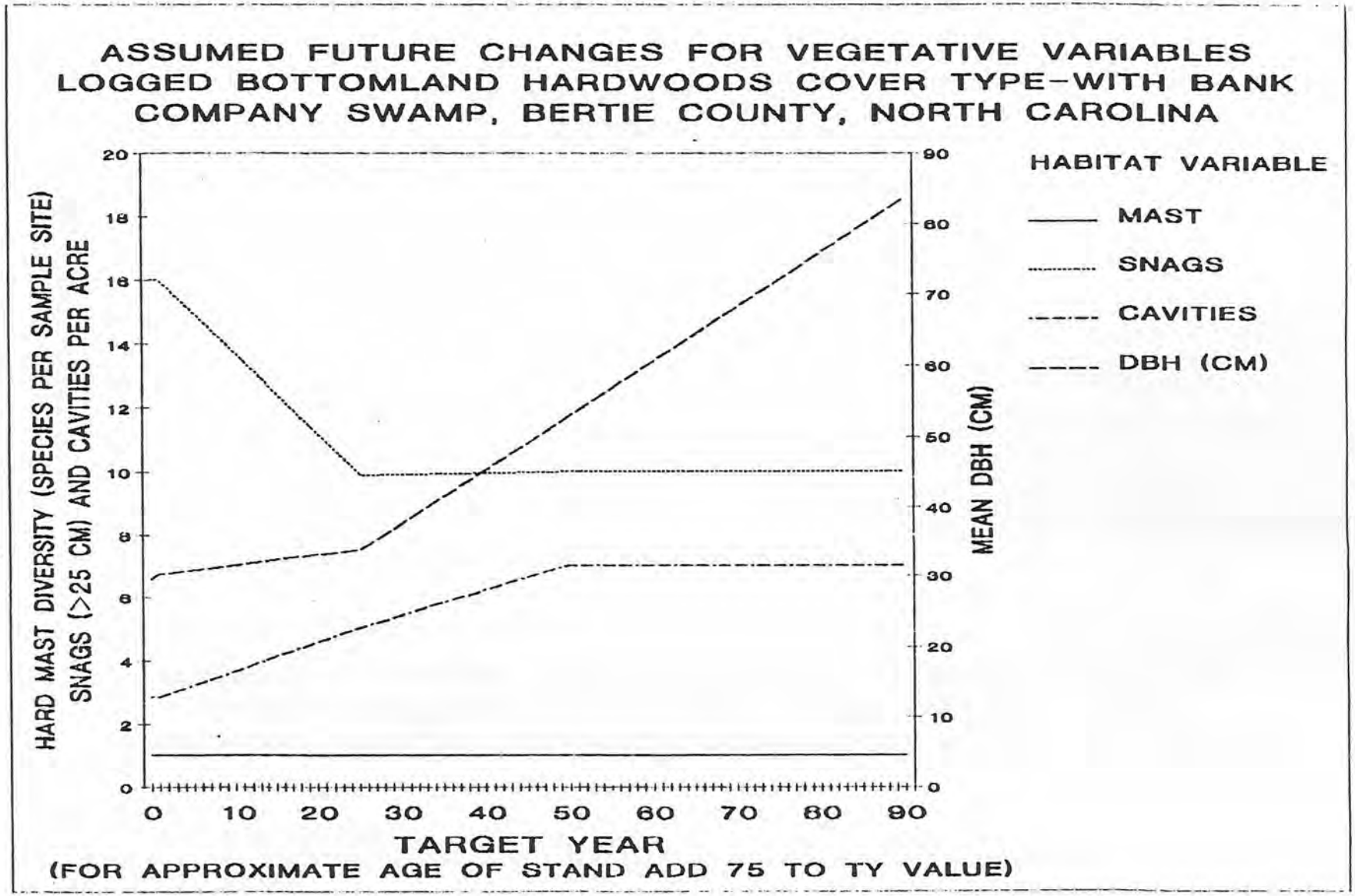
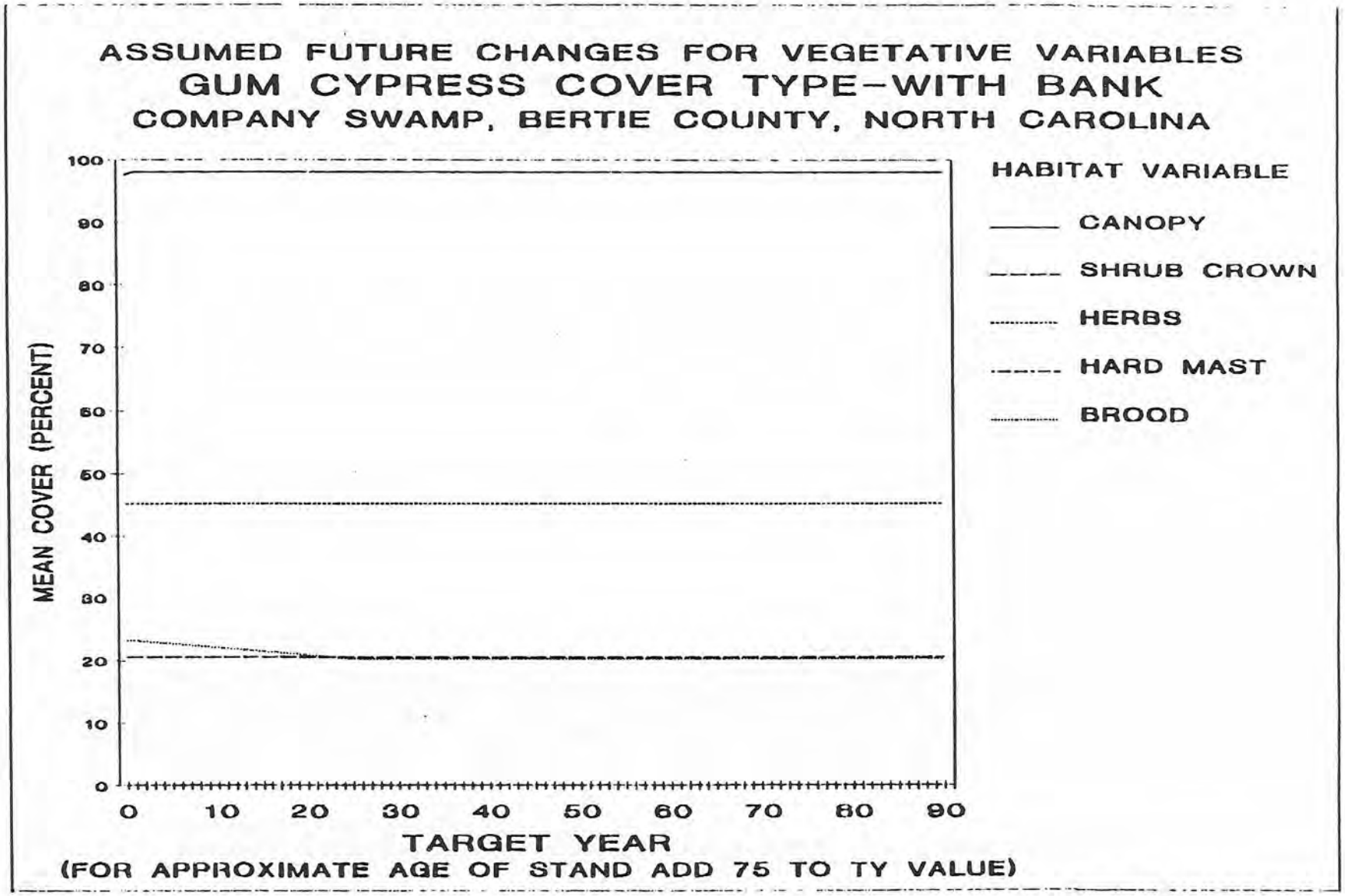


Figure 8-5. Graphical depiction of future vegetative cover assumptions, gum cypress, with the bank



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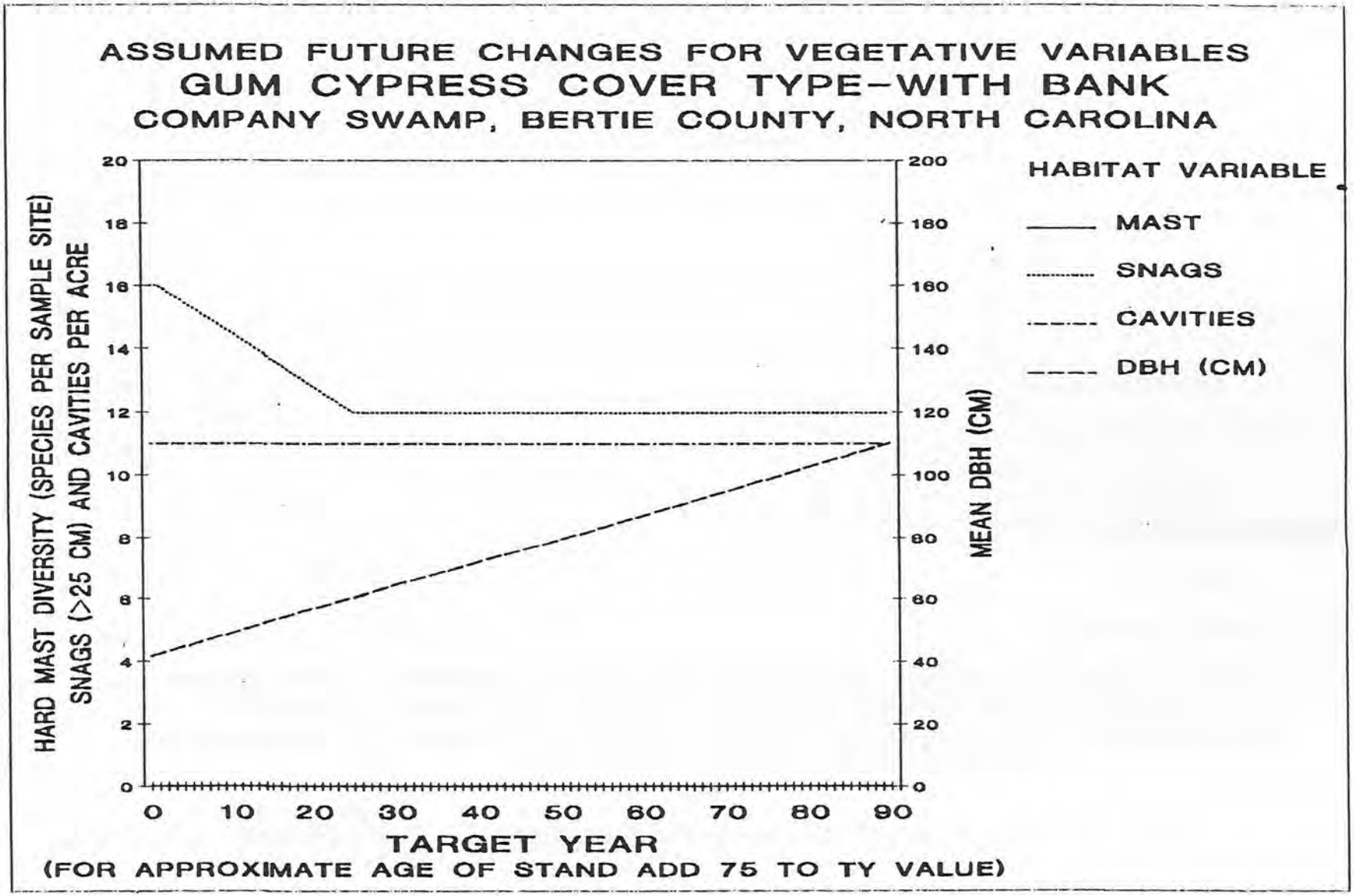


Figure 8-6. Graphical depiction of future vegetative cover assumptions, logged gum cypress, with the bank

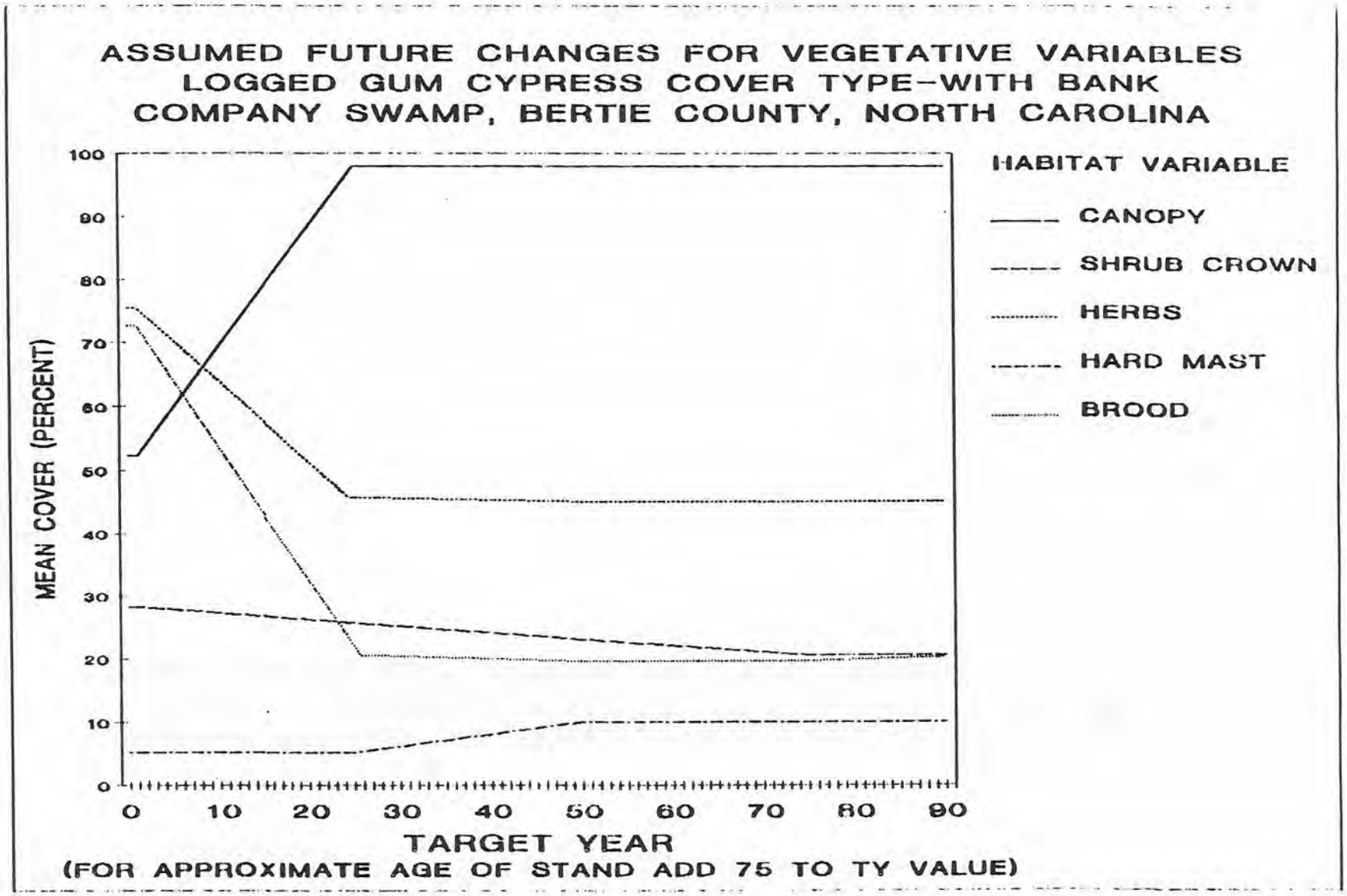


Figure 8-6. Graphical depiction of future vegetative cover assumptions, logged gum cypress, with the bank

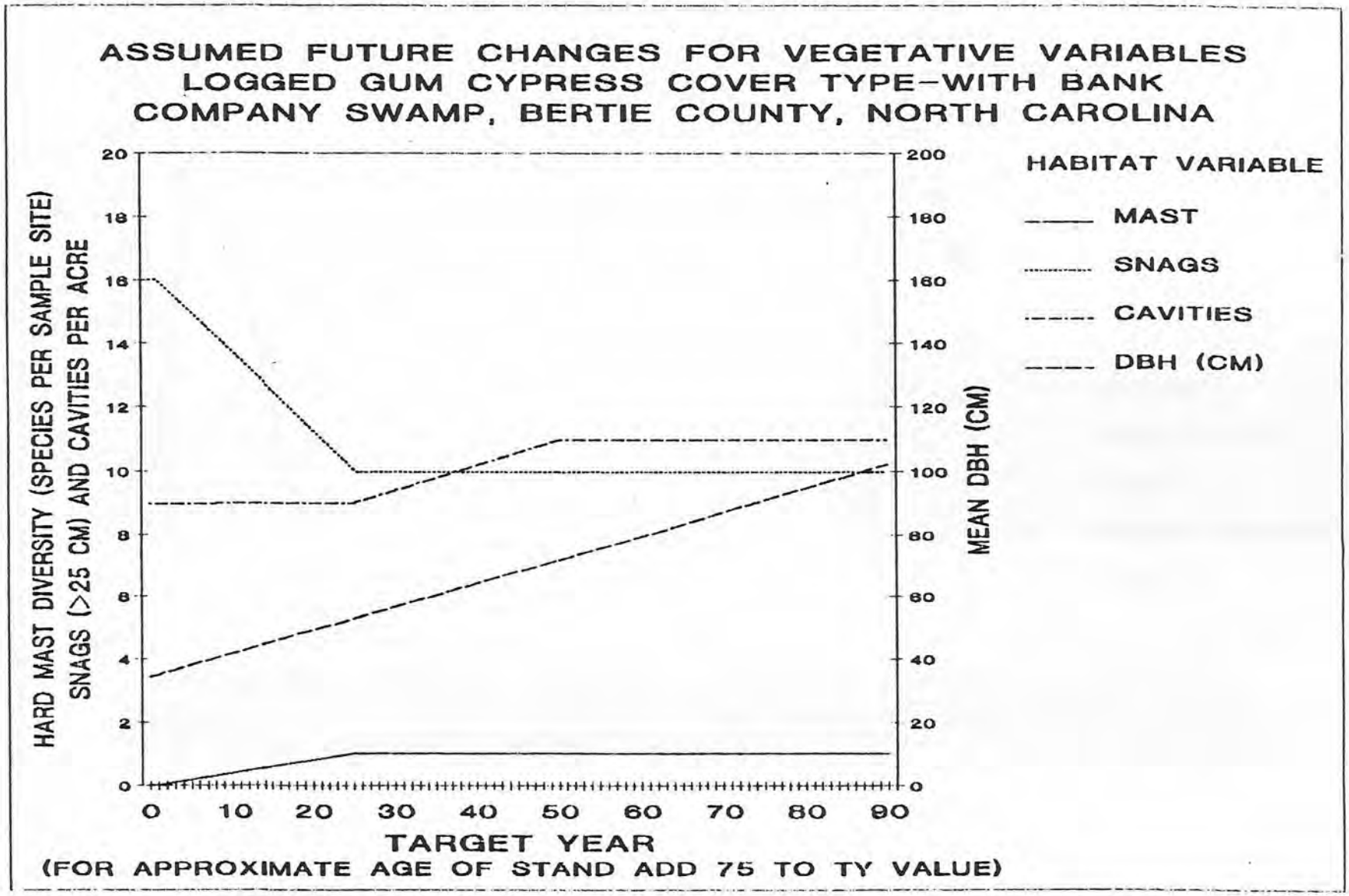


Figure 8-7. Graphical depiction of future vegetative cover assumptions, bottomland hardwoods, without the bank

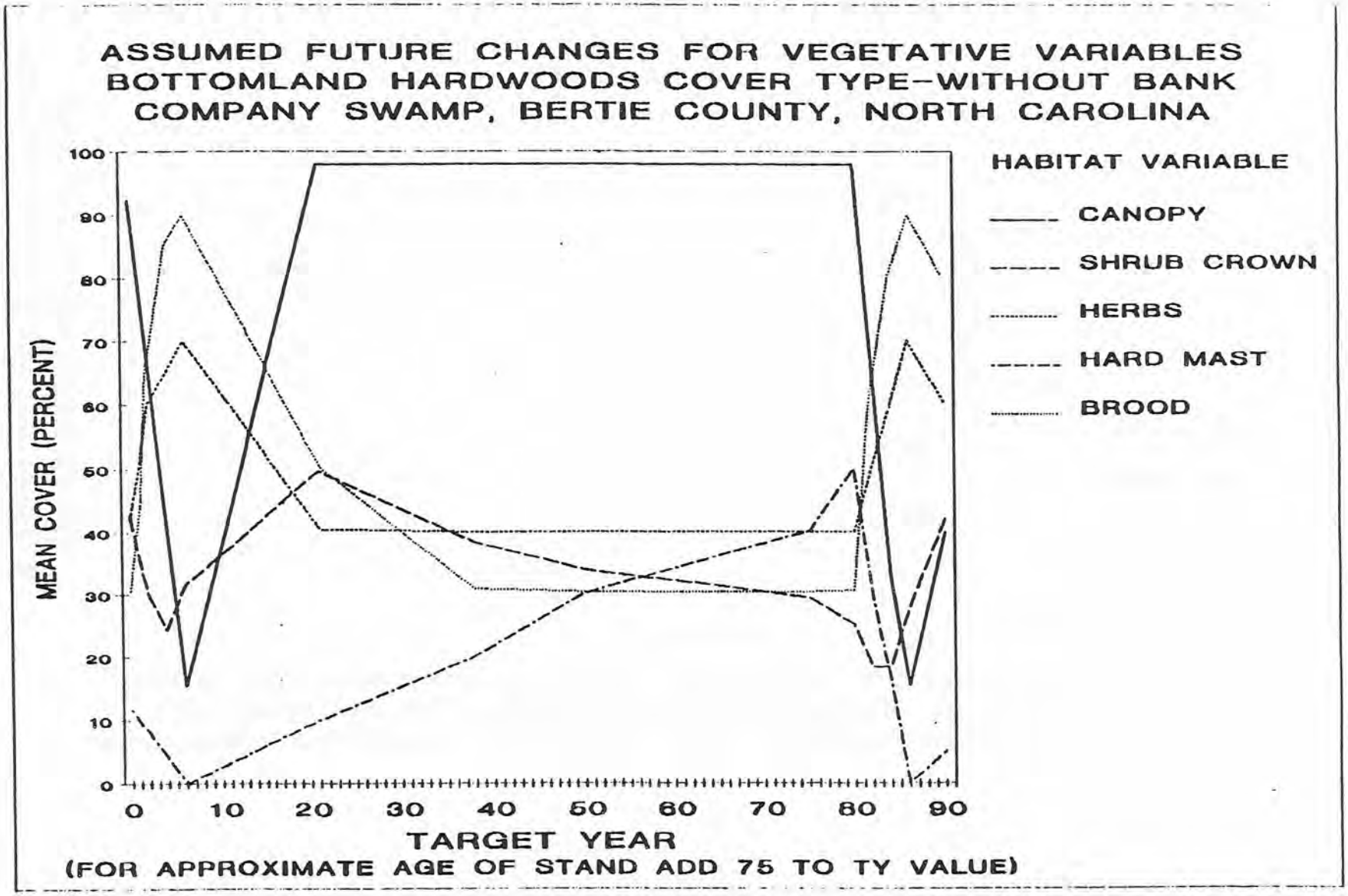


Figure 8-7. Graphical depiction of future vegetative cover assumptions, bottomland hardwoods, without the bank

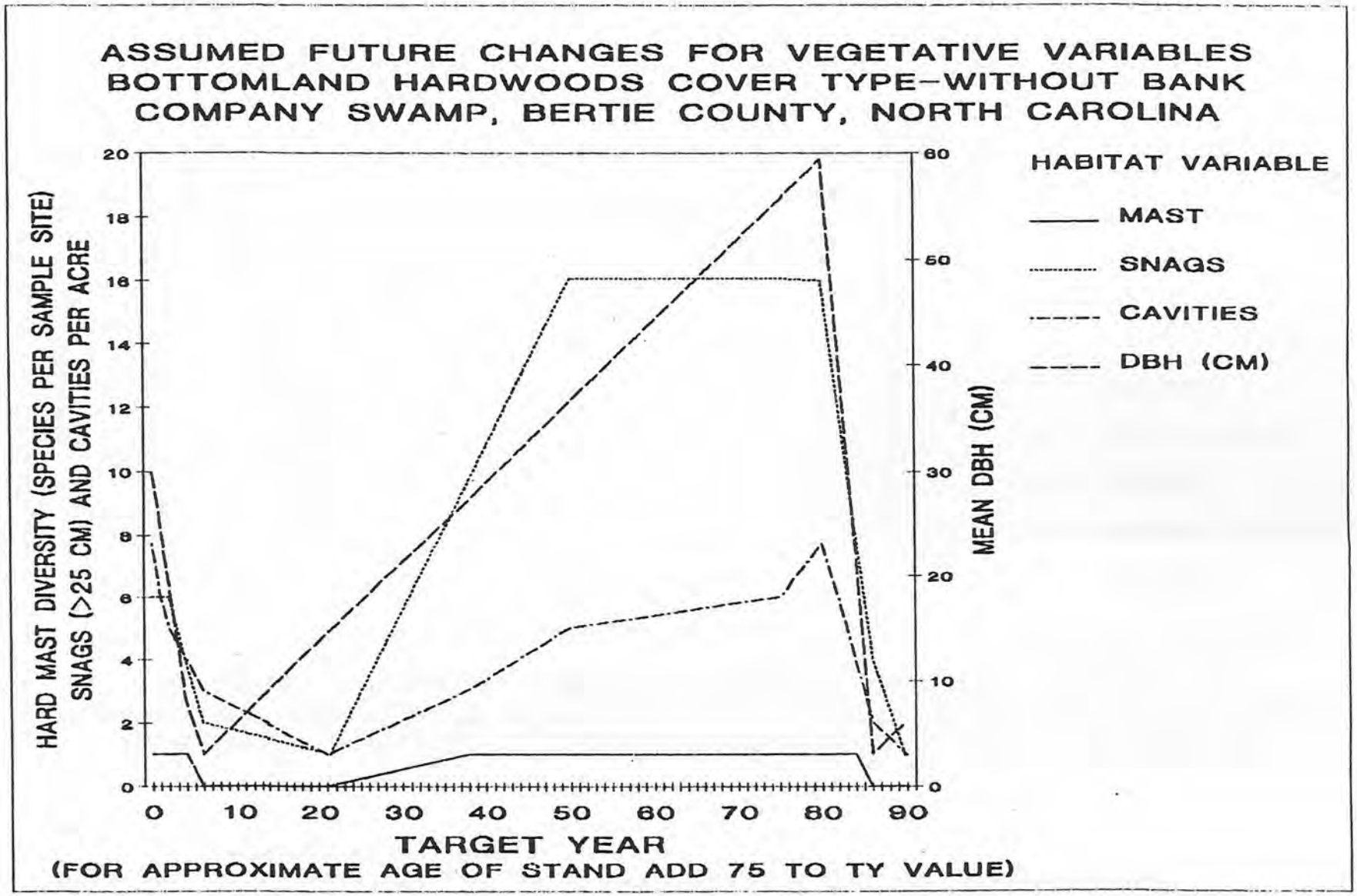


Figure 8-8. Graphical depiction of future vegetative cover assumptions, logged bottomland hardwoods, without the bank

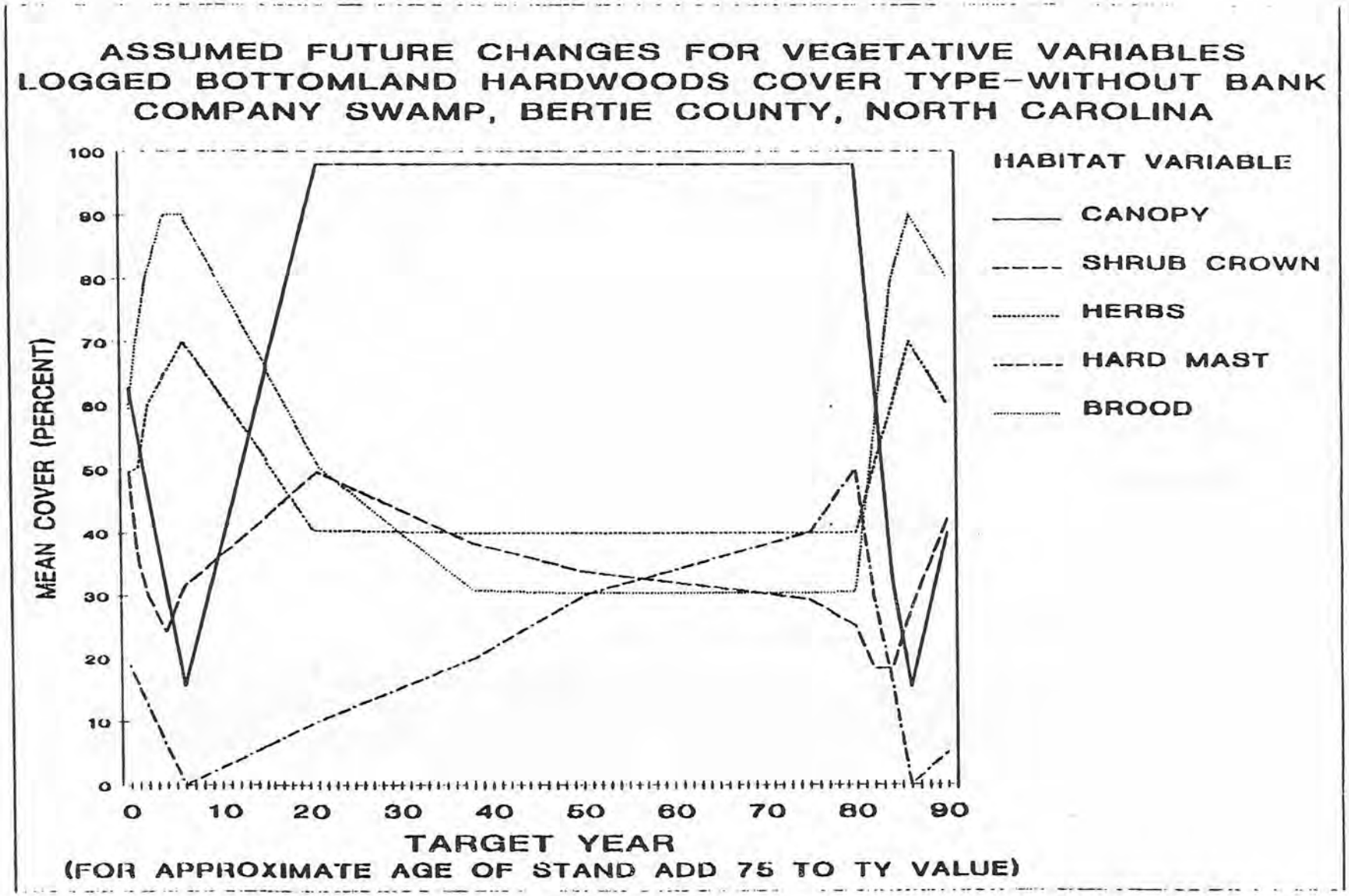


Figure 8-8. Graphical depiction of future vegetative cover assumptions, logged bottomland hardwoods, without the bank

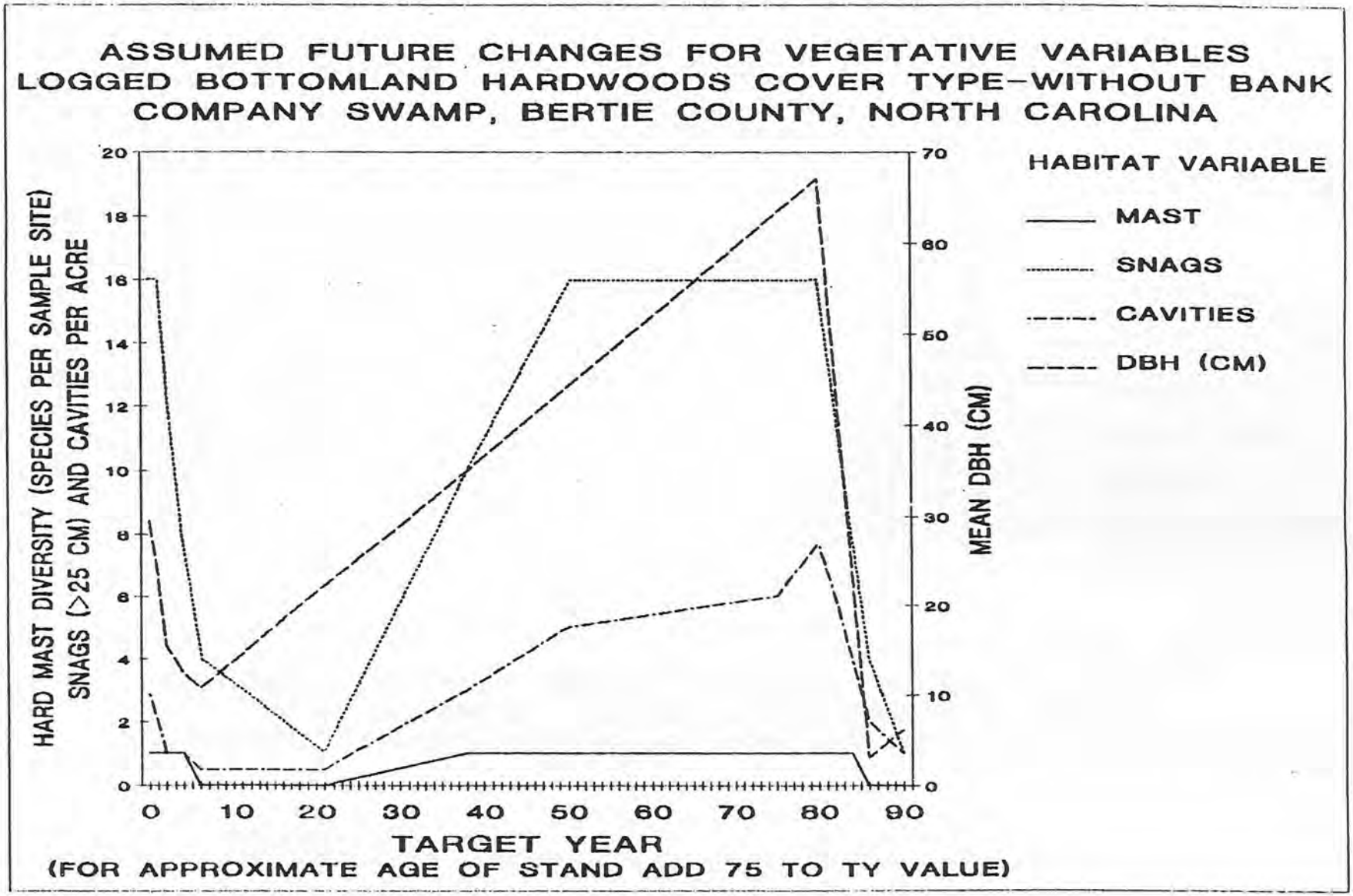


Figure 8-9. Graphical depiction of future vegetative cover assumptions, gum cypress, without the bank

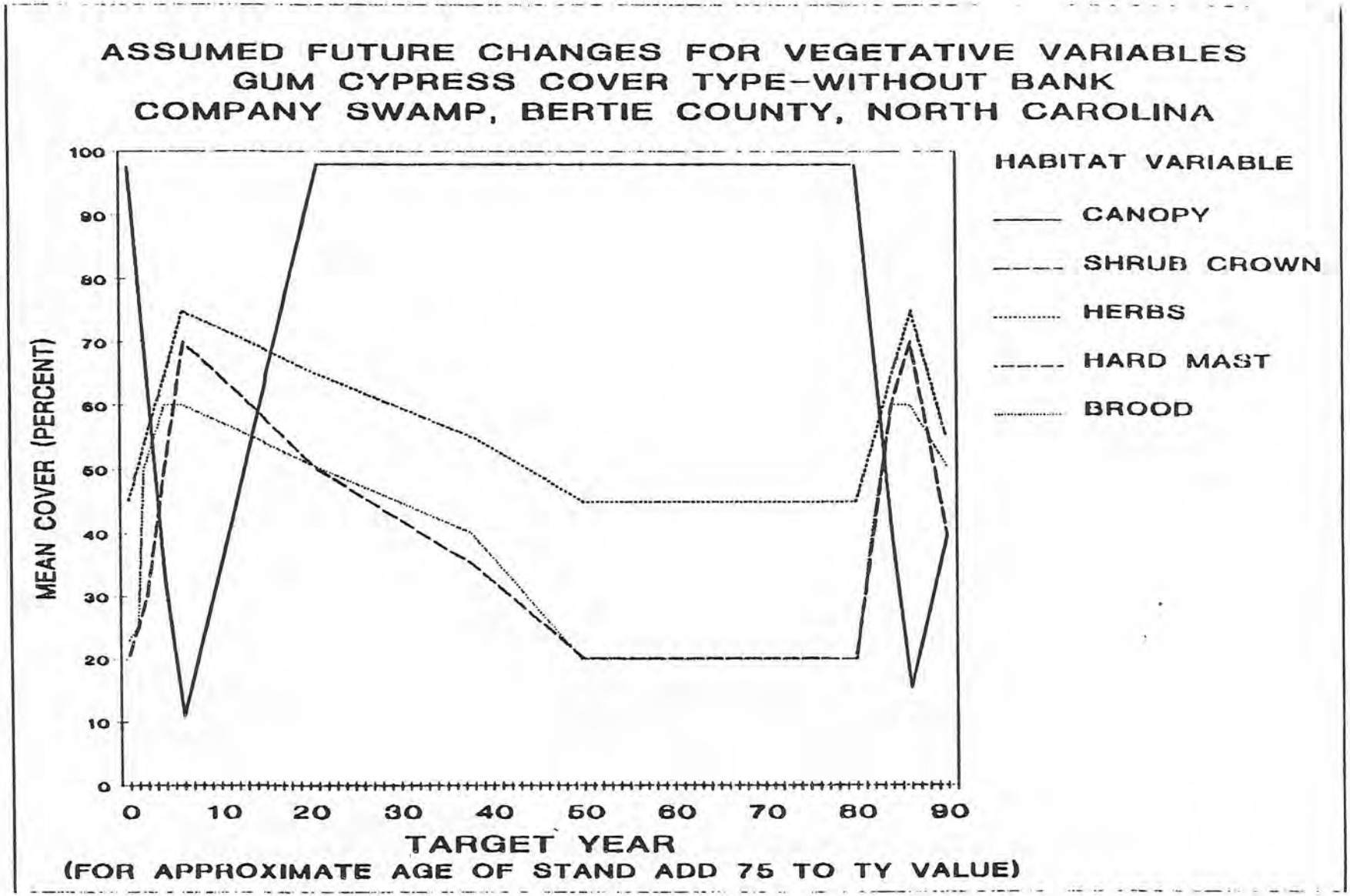


Figure 8-9. Graphical depiction of future vegetative cover assumptions, gum cypress, without the bank

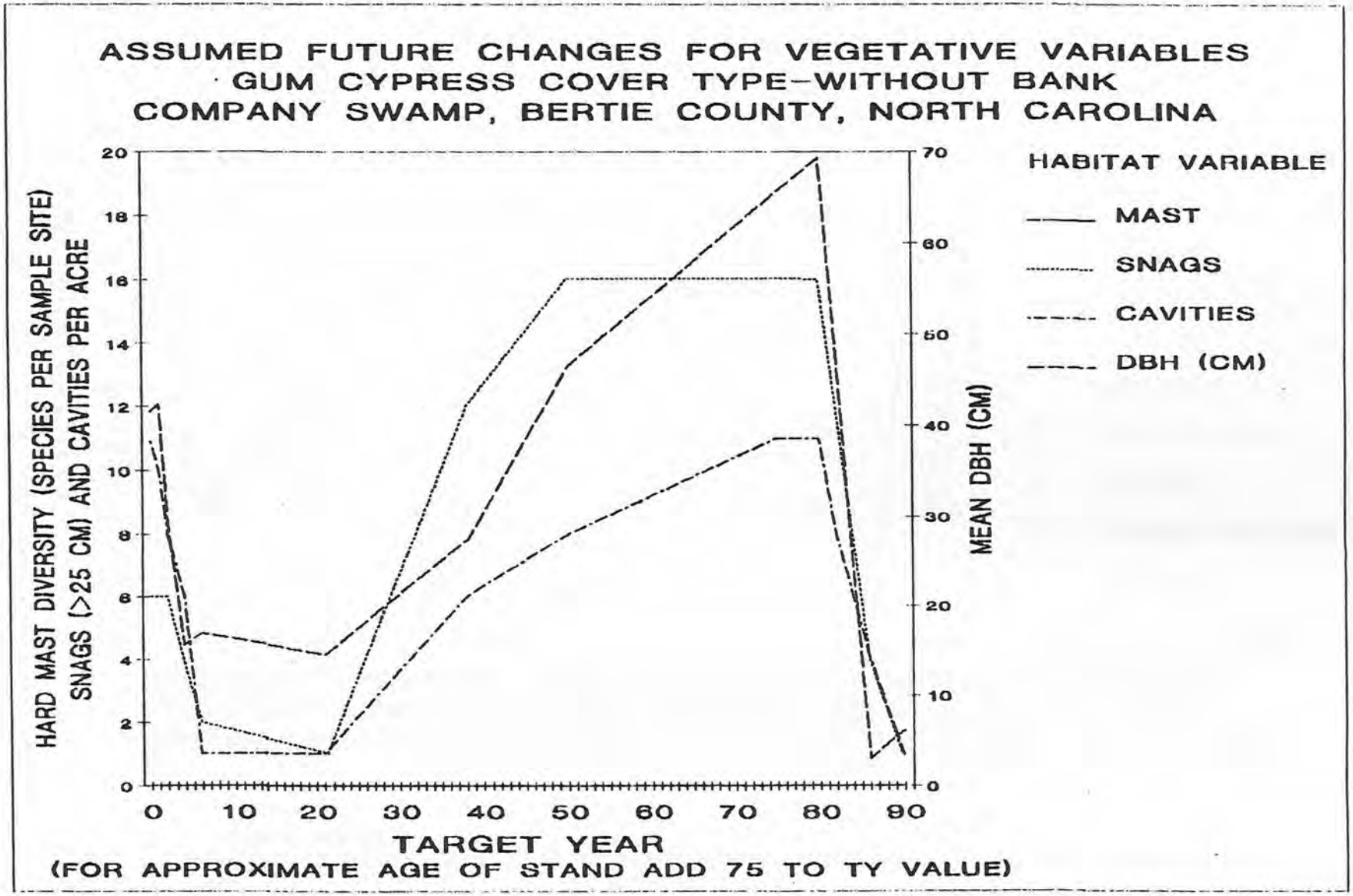


Figure 8-10. Graphical depiction of future vegetative cover assumptions, logged gum cypress, without the bank

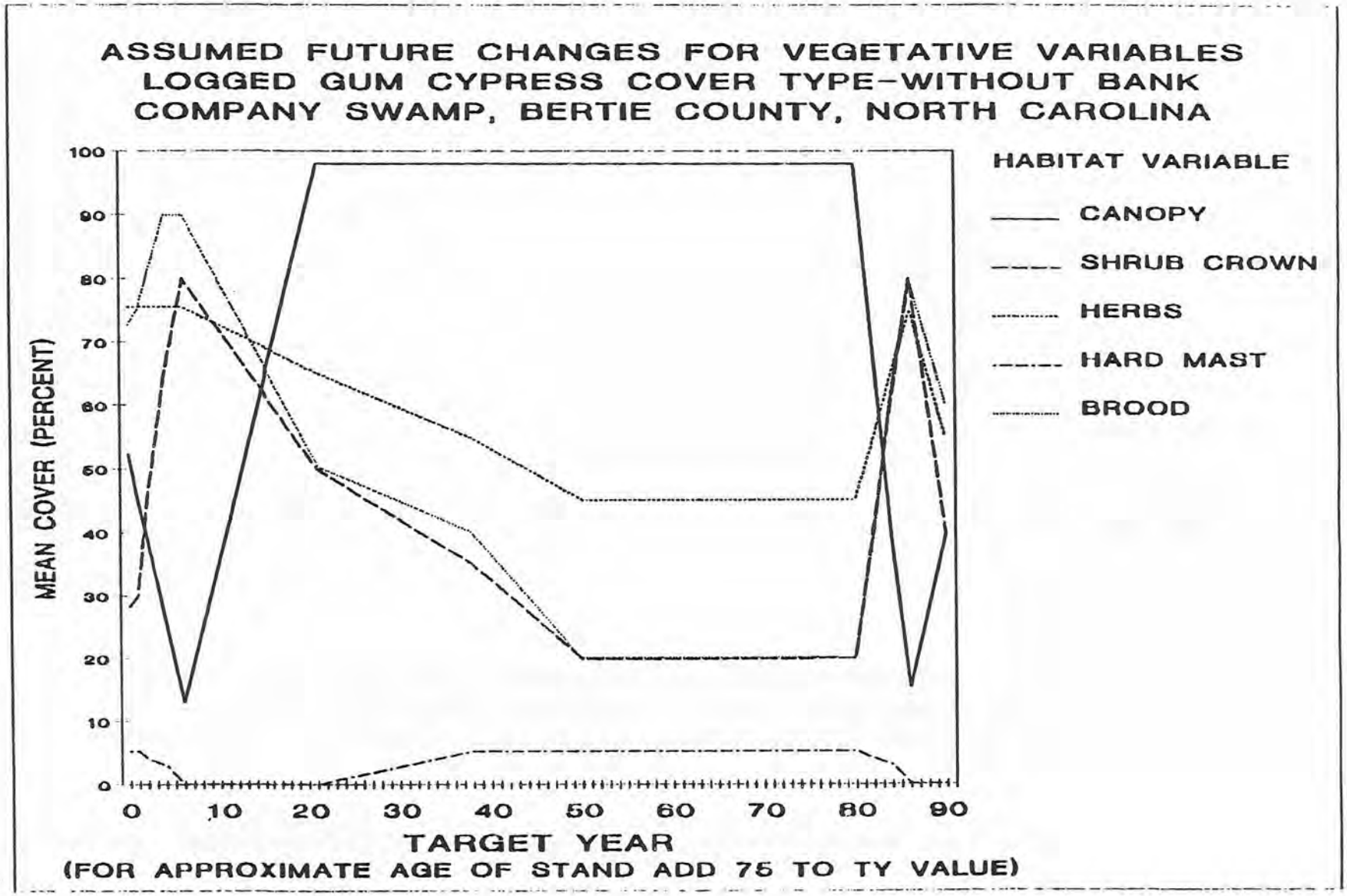
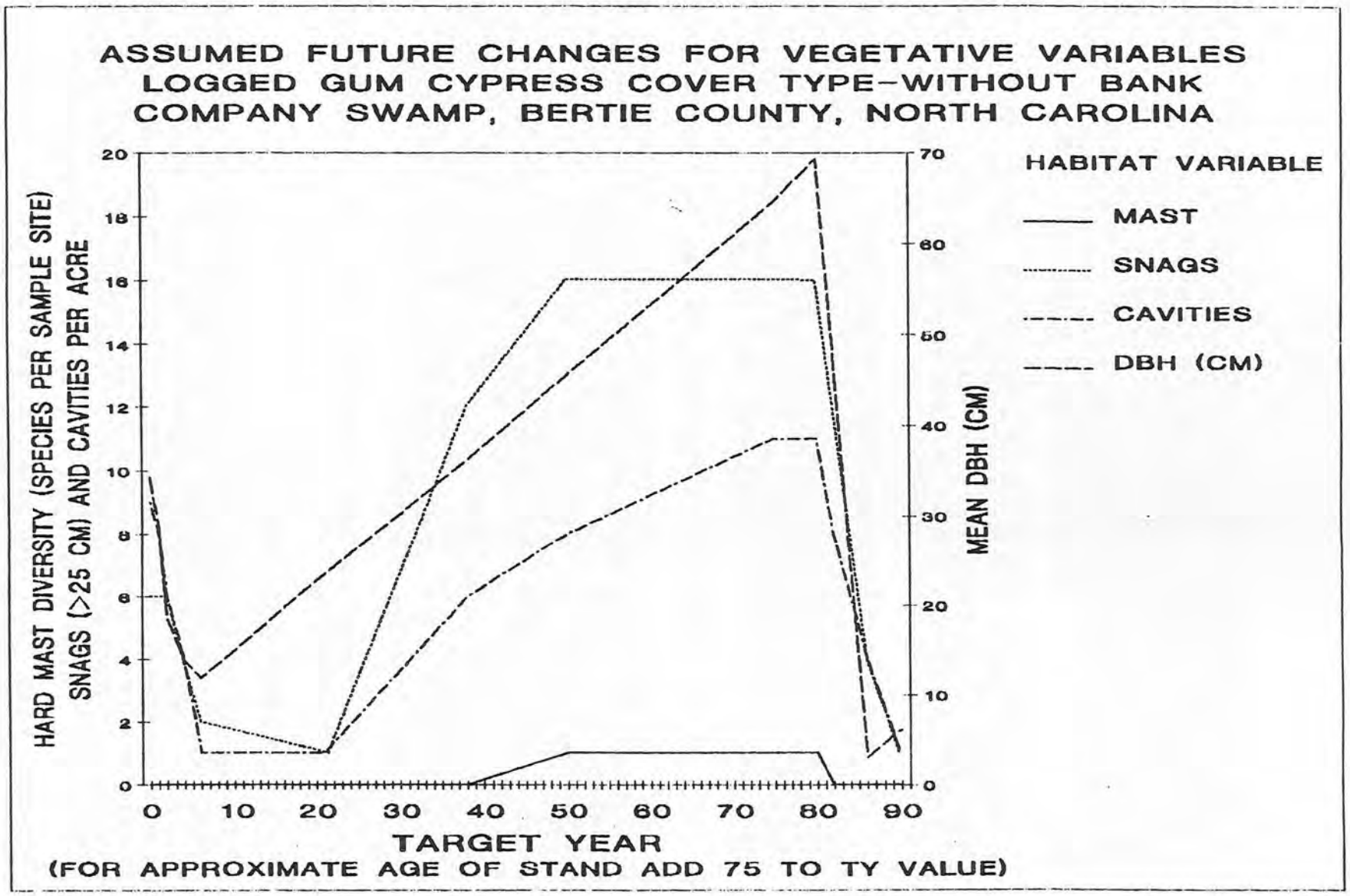


Figure 8-10. Graphical depiction of future vegetative cover assumptions, logged gum cypress, without the bank



8) The percent shrub crown cover (less than 500 cm) and percent herbaceous cover were presumed to decrease in all cover types with increasing canopy cover. Values were determined by plotting the percent of each of these variables versus tree canopy cover for each site and setting future values to correspond with the average of values for sites which presently have a high percent canopy cover. This was done independently for each cover type to take into consideration the differences in hydrology within each which also exerts an influence on these variables.

9) Assuming no change in the hydrological regime, presence of water was presumed constant through time at 100 percent availability. Due to the abundance of permanent water within the river and stream and of temporary water within stumpholes, depressions, and within food sources, the Team does not consider this to be a limiting factor for mink within Company Swamp.

10) Cavity densities were held constant within BH and GC cover types. Densities were increased within BHL and GCL to equal existing baseline levels in the corresponding unlogged habitats by TY 50 and held constant thereafter. This appears valid in view of the fact that our measured cavity values far exceed those measured in old-growth bottomland hardwood sites (Hill and Lowney 1986) and are probably lower in actuality.

11) It was assumed that no nest boxes would be added to the tract.

12) Brood cover in the future was assumed to decline in BHL and GCL habitats to levels presently observed within BH and GC sites with the highest percent canopy cover. The predicted percent of the water surface which would be covered by brood cover was derived by plotting the values obtained from the vegetation database versus canopy cover for each site, assuming that the entire tract was flooded during the brood-rearing season to a depth of 25 cm (10 in). This probably overestimates the value of the tract for wood duck reproduction since the system is probably not flooded for this length of time on an annual basis. Brood cover was calculated as the percent cover of all vegetation between 26 and 126 cm in height (i.e., 1 meter or less above the water surface).

13) Beaver activity was presumed to remain at its present level and not to affect assumptions 1-12.

Future, Without-the-Bank, Assumptions

In the absence of the bank, the Team assumed that the tract would have been severely cut within the immediate future. This assumption is based: upon the three timber appraisals available, all of which assumed severe cutting in order to obtain maximum value from the tract; and, upon the fact that adjacent tracts up- and downstream of Company Swamp were logged during field sampling. Selective cutting continued throughout the summer months on an adjacent upstream tract, and a tract further downstream was clearcut.

The team assumed that cutting of the entire tract would occur during a six-year time period from TY 1 through TY 6. Regrowth of the tract would

occur through TY 80, at which time the 6-year cycle would repeat. Based on information from Dr. Russ Lea (N.C. State University, School of Forestry), the Team assumed that canopy closure would occur at TY 21, or 15 years after the logging ceased, and that maximum mortality (i.e., snag production) would occur at TY 38, or 32 years after logging ceased. Mean diameter of trees also would reach 25 cm (10 in) in TY 38, based on the growth rate used. Earlier peaks in mortality which occur within bottomland hardwood systems were ignored since the snags produced are below the minimum size necessary for use by hairy woodpeckers as defined by the HSI model. Detailed assumptions for each variable within the cover types are as follows (assumptions are graphically depicted for each cover type in Figures 8-7 through 8-10):

1) Densities of suitable snags within each cover type decreased as logging progressed and reached a value of 1 per acre (ac) upon its completion. Values remain at 1/ac until TY 38 when the mean dbh reaches 25 cm, at which time densities were set to equal the baseline values measured for BH and GC cover types. Values remain constant until TY 80 when the cutting cycle is repeated, during which the values again decline to 1/ac.

2) The Team assumed the same growth rate for trees within all forested cover types as that used in the with-bank condition. Mean dbh values were calculated by averaging the dbh of uncut trees within each cover type with that of growing saplings in cutover areas. Average dbh at completion of a cutting cycle was then taken as the average within a particular cover type and increased in subsequent target years as a function of the growth rate.

3) Percent overstory of spruce remains constant at zero.

4) Percent tree canopy closure declines until logging is completed, at which time it increases to 98 percent at TY 21 and remains constant through TY 80. The cycle begins to repeat from TY 80 through TY 90.

5) Percent overstory of pine remains constant at zero.

6) The percent overstory of hard mast declines throughout the logging cycle. Values are minimal thereafter until TY 38, when trees reach 25 cm mean dbh and begin mast production. Levels assigned within BH and BHL for TY 38 and following years through TY 80 are the average of the baseline values observed within those cover types. Value within the GC cover type remains at zero throughout the entire period. Value within GCL achieves baseline levels and declines throughout the logging cycle as in the BH and BHL cover types.

7) Diversities of hard mast trees decline with logging. Upon regrowth, values reach baseline levels at TY 38 and following and remain constant until the logging cycle is repeated.

8) Percent shrub crown cover and herbaceous cover levels were determined by averaging baseline values from sites with different canopy coverage. Levels increase throughout logging to the mean levels observed at the most severely logged sample sites. As canopy coverage increases to 98

percent, values decline to levels observed at sample sites with the highest percent cover.

9) Presence of water remains constant throughout time and was set to the maximum value since the Team did not consider it limiting.

10) Cavity densities were decreased through the logging cycle, then allowed to reach baseline levels by TY 50, remaining constant thereafter until the logging cycle repeats beginning in TY 80.

11) Nest box values were again presumed equal to zero.

12) Percent of the water surface covered by brood cover was derived in the same manner as shrub and herbaceous cover values. Values for logged areas were derived from baseline values from sites with little or no canopy cover. As canopy closure occurs, values decline to baseline values observed within sites with high percent canopy cover. All values were obtained from within the same cover type in order to account for the influence of varying hydrological regimes upon the vegetation.

13) Beaver activity was assumed not to affect regeneration or growth beyond its present extent.

Results of the HEP Analysis-Baseline Value

The HSI values for all species within each cover type were calculated using the software developed for that purpose by FWS (Hayes 1986). The programs were run on an IBM PC/AT microcomputer. Baseline values for each species within each cover type are provided in Table 3 within the text of this report.

Baseline HSI values indicate that present habitat quality within Company Swamp is greatest for the mink within the BH, BHL and GC cover types. The high calculated value for that species is a function of the presence of abundant water and herbaceous, shrub and tree cover within optimum ranges of percent cover. Value for GCL was lower as a result of the reduced canopy cover within that habitat type.

Habitat quality is also high for the hairy woodpecker. Highest values are obtained within the BH and GC cover types where average dbh, density of snags greater than ten inches in diameter, and percent canopy cover are near optimum. Values within BHL and GCL are lower as a consequence of decreased canopy cover and snag loss as a result of logging activity.

Habitat quality is lower than anticipated for the gray squirrel within forested cover types. This is largely attributable to the low value obtained for winter food within the forested cover types. The cover/reproduction component of the model indicates that values for that life requisite are high within all forested habitats in Company Swamp and in many cases approach optimum levels. The low values obtained for hard mast cover and diversity, in part, may be attributable to the sampling methodology employed to estimate percent coverage of hard mast, or they may truly

reflect the impact of past timbering practices which selectively removed those species.

Habitat quality is also lower than anticipated for the wood duck. Again, the low values obtained for the forested cover types are primarily attributable to the low density of cavities. The brood-rearing component value is never less than 0.4 within the forested habitats and equals 1.0 under some conditions. Given that observed cavity values for Company Swamp are higher than those measured in other sites with presumably high wood duck value, consideration should be given to modifying the model to provide higher suitability indices for lower cavity densities.

Results of the HEP Analysis-Futures

Habitat values for the Company Swamp tract during the next 90 years, both with and without the bank, were analyzed using the HEP software developed by FWS (Hayes 1985) for use with microcomputers. The program accepts data in the form of habitat acreages and HSI values for evaluation species at selected target years and provides Average Annualized Habitat Values (AAHU) of habitat through the time period analyzed.

Future value with the bank in the form of AAHU's is plotted versus target year for the mink, gray squirrel, hairy woodpecker, and wood duck in Figures 4-7 within the text of this report. Bank value increases with time for the gray squirrel, hairy woodpecker and wood duck as a consequence of improving life requisite values concurrent with continued growth of the forested cover types. Increases observed are primarily attributable to the increase in value within the BHL and GCL cover types as reforestation occurs. Value within the BH and GC habitats generally remains constant or, in the case of the hairy woodpecker, declines marginally as canopy closure increases. Although value for the mink increases overall with the bank, value within logged cover types remains constant or decreases as understory vegetation is shaded out. The values of AAHU for each species, cover type and target year for the with-bank analysis are provided in Table 8-3.

Value without the bank is plotted versus target year for the evaluation species in Figures 4-7 in the text. Value of Company Swamp without the bank is less for all four species as a consequence of the logging cycle. Values decline during logging, recover to near or slightly above baseline levels during the 80-year regrowth period, and decline once more when logging is repeated. The values of AAHU for each species, cover type and target year for the without-bank analysis are provided in Table 8-4. The net change for each species when the two futures are compared is provided in Table 8-5.

Table 8-3. AAHU values by species, cover type and target year for the with-bank condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 1 (with project) BH COVER TYPE
Period of Analysis: 90
Evaluation Species: 4 WOOD DUCK AAHU's: 72.28

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	260.00	0.28	72.28
1	260.00	0.28	72.28
25	260.00	0.28	72.28
50	260.00	0.28	72.28
75	260.00	0.28	72.28
90	260.00	0.28	72.28

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 1 (with project) BH COVER TYPE
Period of Analysis: 90
Evaluation Species: 5 MINK AAHU's: 204.82

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	260.00	0.86	224.38
1	260.00	0.86	224.38
25	260.00	0.79	205.40
50	260.00	0.78	202.80
75	260.00	0.76	197.60
90	260.00	0.75	195.00

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 1 (with project) BH COVER TYPE
Period of Analysis: 90
Evaluation Species: 1 GRAY SQUIRREL AAHU's: 100.72

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	260.00	0.29	76.44
1	260.00	0.29	76.44
25	260.00	0.35	91.78
50	260.00	0.40	105.04
75	260.00	0.45	116.22
90	260.00	0.45	116.22

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 1 (with project) BH COVER TYPE
Period of Analysis: 90
Evaluation Species: 2 HAIRY WOODPECKER AAHU's: 222.57

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	260.00	0.95	247.26
1	260.00	0.95	247.26
25	260.00	0.84	218.40
50	260.00	0.84	218.40
75	260.00	0.84	218.40
90	260.00	0.84	218.40

Table 8-3. AAHU values by species, cover type and target year for the with-bank condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 3 (with project) BHL-WITH BANK
Period of Analysis: 90
Evaluation Species: 1 GRAY SQUIRREL AAHU's: 159.54

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	381.00	0.34	129.54
1	381.00	0.34	129.54
25	381.00	0.40	152.40
50	381.00	0.45	170.31
75	381.00	0.45	170.31
90	381.00	0.45	170.31

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 3 (with project) BHL-WITH BANK
Period of Analysis: 90
Evaluation Species: 2 HAIRY WOODPECKER AAHU's: 319.70

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	381.00	0.68	259.08
1	381.00	0.84	320.04
25	381.00	0.84	320.04
50	381.00	0.84	320.04
75	381.00	0.84	320.04
90	381.00	0.84	320.04

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 3 (with project) BHL-WITH BANK
Period of Analysis: 90
Evaluation Species: 4 WOOD DUCK AAHU's: 79.73

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	381.00	0.10	38.10
1	381.00	0.10	38.10
25	381.00	0.18	68.58
50	381.00	0.25	95.25
75	381.00	0.25	95.25
90	381.00	0.25	95.25

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 3 (with project) BHL-WITH BANK
Period of Analysis: 90
Evaluation Species: 5 MINK AAHU's: 308.04

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	381.00	0.85	322.71
1	381.00	0.85	322.71
25	381.00	0.86	328.04
50	381.00	0.79	299.85
75	381.00	0.77	292.61
90	381.00	0.75	285.75

Table 8-3. AAHU values by species, cover type and target year for the with-bank condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 5 (with project) GC-WITH BANK
Period of Analysis: 90
Evaluation Species: 1 GRAY SQUIRREL AAHU's: 42.60

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	213.00	0.20	42.60
1	213.00	0.20	42.60
25	213.00	0.20	42.60
50	213.00	0.20	42.60
75	213.00	0.20	42.60
90	213.00	0.20	42.60

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 5 (with project) GC-WITH BANK
Period of Analysis: 90
Evaluation Species: 2 HAIRY WOODPECKER AAHU's: 179.23

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	213.00	0.85	181.05
1	213.00	0.85	181.05
25	213.00	0.84	178.92
50	213.00	0.84	178.92
75	213.00	0.84	178.92
90	213.00	0.84	178.92

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 5 (with project) GC-WITH BANK
Period of Analysis: 90
Evaluation Species: 4 WOOD DUCK AAHU's: 85.20

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	213.00	0.40	85.20
1	213.00	0.40	85.20
25	213.00	0.40	85.20
50	213.00	0.40	85.20
75	213.00	0.40	85.20
90	213.00	0.40	85.20

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 5 (with project) GC-WITH BANK
Period of Analysis: 90
Evaluation Species: 5 MINK AAHU's: 172.96

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	213.00	0.81	172.96
1	213.00	0.81	172.96
25	213.00	0.81	172.96
50	213.00	0.81	172.96
75	213.00	0.81	172.96
90	213.00	0.81	172.96

Table 8-3. AAHU values by species, cover type and target year for the with-bank condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 7 (with project) GCL-WITH BANK
Period of Analysis: 90
Evaluation Species: 1 GRAY SQUIRREL AAHU's: 47.35

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	177.00	0.25	44.25
1	177.00	0.25	44.25
25	177.00	0.25	44.25
50	177.00	0.28	49.56
75	177.00	0.28	49.56
90	177.00	0.28	49.56

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 7 (with project) GCL-WITH BANK
Period of Analysis: 90
Evaluation Species: 2 HAIRY WOODPECKER AAHU's: 140.75

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	177.00	0.53	93.81
1	177.00	0.53	93.81
25	177.00	0.84	148.68
50	177.00	0.84	148.68
75	177.00	0.84	148.68
90	177.00	0.84	148.68

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 7 (with project) GCL-WITH BANK
Period of Analysis: 90
Evaluation Species: 4 WOOD DUCK AAHU's: 64.90

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	177.00	0.32	56.64
1	177.00	0.32	56.64
25	177.00	0.32	56.64
50	177.00	0.40	70.80
75	177.00	0.40	70.80
90	177.00	0.40	70.80

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 7 (with project) GCL-WITH BANK
Period of Analysis: 90
Evaluation Species: 5 MINK AAHU's: 142.61

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	177.00	0.72	127.97
1	177.00	0.72	127.97
25	177.00	0.83	146.56
50	177.00	0.82	145.14
75	177.00	0.81	143.72
90	177.00	0.81	143.72

Table 8-4. AAHU values by species, cover type and target year for the without-bank (logging) condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 11 (without project) BH-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 1 GRAY SQUIRREL AAHU's: 74.65

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	260.00	0.29	76.44
1	260.00	0.28	72.80
2	260.00	0.27	69.68
4	260.00	0.00	0.00
6	260.00	0.00	0.00
21	260.00	0.18	46.80
38	260.00	0.35	89.96
50	260.00	0.40	104.00
75	260.00	0.45	116.22
80	260.00	0.45	116.22
82	260.00	0.40	104.00
84	260.00	0.32	83.72
86	260.00	0.00	0.00
90	260.00	0.00	0.00

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 11 (without project) BH-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 2 HAIRY WOODPECKER AAHU's: 141.66

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	260.00	0.95	247.26
1	260.00	0.91	236.34
2	260.00	0.53	137.80
4	260.00	0.15	38.74
6	260.00	0.00	0.26
21	260.00	0.08	21.84
38	260.00	0.84	218.40
50	260.00	0.84	218.40
75	260.00	0.84	218.40
80	260.00	0.84	218.40
82	260.00	0.71	185.64
84	260.00	0.22	56.94
86	260.00	0.00	0.78
90	260.00	0.04	9.36

Table 8-4. AAHU values by species, cover type and target year for the without-bank (logging) condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 11 (without project) BH-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 4 WOOD DUCK AAHU's: 36.45

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	260.00	0.28	72.28
1	260.00	0.22	57.20
2	260.00	0.18	46.80
4	260.00	0.14	36.40
6	260.00	0.11	28.08
21	260.00	0.04	9.36
38	260.00	0.11	28.60
50	260.00	0.18	46.80
75	260.00	0.22	57.20
80	260.00	0.28	72.80
82	260.00	0.22	57.20
84	260.00	0.14	36.40
86	260.00	0.07	18.72
90	260.00	0.04	9.36

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 11 (without project) BH-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 5 MINK AAHU's: 193.12

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	260.00	0.86	224.38
1	260.00	0.88	229.32
2	260.00	0.82	212.16
4	260.00	0.64	167.44
6	260.00	0.51	133.12
21	260.00	0.82	214.24
38	260.00	0.79	205.40
50	260.00	0.78	202.80
75	260.00	0.76	197.60
80	260.00	0.75	195.00
82	260.00	0.77	200.20
84	260.00	0.58	149.76
86	260.00	0.50	130.26
90	260.00	0.66	173.86

Table 8-4. AAHU values by species, cover type and target year for the without-bank (logging) condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 12 (without project) BHL-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 1 GRAY SQUIRREL AAHU's: 116.84

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	381.00	0.34	129.54
1	381.00	0.32	122.30
2	381.00	0.30	114.30
4	381.00	0.00	0.00
6	381.00	0.00	0.00
21	381.00	0.28	107.82
38	381.00	0.35	131.83
50	381.00	0.40	152.40
75	381.00	0.45	170.31
80	381.00	0.45	170.31
82	381.00	0.40	152.40
84	381.00	0.32	122.53
86	381.00	0.00	0.00
90	381.00	0.00	0.00

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 12 (without project) BHL-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 2 HAIRY WOODPECKER AAHU's: 212.17

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	381.00	0.68	259.08
1	381.00	0.53	201.93
2	381.00	0.24	91.44
4	381.00	0.12	45.72
6	381.00	0.01	3.81
21	381.00	0.21	78.49
38	381.00	0.84	320.04
50	381.00	0.84	320.04
75	381.00	0.84	320.04
80	381.00	0.84	320.04
82	381.00	0.71	272.03
84	381.00	0.25	95.25
86	381.00	0.00	1.14
90	381.00	0.04	13.72

Table 8-4. AAHU values by species, cover type and target year for the without-bank (logging) condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 12 (without project) BHL-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 4 WOOD DUCK AAHU's: 46.05

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	381.00	0.10	38.10
1	381.00	0.07	26.67
2	381.00	0.04	15.24
4	381.00	0.04	15.24
6	381.00	0.02	6.86
21	381.00	0.02	6.86
38	381.00	0.11	41.91
50	381.00	0.18	68.58
75	381.00	0.22	83.82
80	381.00	0.28	106.68
82	381.00	0.22	83.82
84	381.00	0.14	53.34
86	381.00	0.07	27.43
90	381.00	0.02	6.86

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 12 (without project) BHL-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 5 MINK AAHU's: 281.23

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	381.00	0.85	322.71
1	381.00	0.76	290.32
2	381.00	0.70	265.56
4	381.00	0.58	222.88
6	381.00	0.51	195.45
21	381.00	0.82	313.94
38	381.00	0.79	300.99
50	381.00	0.78	297.18
75	381.00	0.76	289.56
80	381.00	0.75	285.75
82	381.00	0.77	293.37
84	381.00	0.58	219.46
86	381.00	0.50	190.88
90	381.00	0.69	263.27

Table 8-4. AAHU values by species, cover type and target year for the without-bank (logging) condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 13 (without project) GC-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 1 GRAY SQUIRREL AAHU's: 38.22

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	213.00	0.20	42.60
1	213.00	0.20	42.60
2	213.00	0.20	42.60
4	213.00	0.20	42.60
6	213.00	0.10	21.30
21	213.00	0.20	42.60
38	213.00	0.20	42.60
50	213.00	0.20	42.60
75	213.00	0.20	42.60
80	213.00	0.20	42.60
82	213.00	0.20	42.60
84	213.00	0.20	42.60
86	213.00	0.00	0.00
90	213.00	0.00	0.00

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 13 (without project) GC-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 2 HAIRY WOODPECKER AAHU's: 117.45

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	213.00	0.85	181.05
1	213.00	0.95	202.35
2	213.00	0.72	153.36
4	213.00	0.13	27.69
6	213.00	0.00	0.00
21	213.00	0.08	17.89
38	213.00	0.84	178.92
50	213.00	0.84	178.92
75	213.00	0.84	178.92
80	213.00	0.84	178.92
82	213.00	0.77	163.16
84	213.00	0.35	73.91
86	213.00	0.00	0.64
90	213.00	0.04	7.67

Table 8-4. AAHU values by species, cover type and target year for the without-bank (logging) condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 13 (without project) GC-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 4 WOOD DUCK AAHU's: 46.84

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	213.00	0.40	85.20
1	213.00	0.36	76.68
2	213.00	0.29	61.77
4	213.00	0.22	46.86
6	213.00	0.04	7.67
21	213.00	0.04	7.67
38	213.00	0.22	46.86
50	213.00	0.29	61.77
75	213.00	0.40	85.20
80	213.00	0.40	85.20
82	213.00	0.29	61.34
84	213.00	0.22	46.86
86	213.00	0.14	30.67
90	213.00	0.04	7.67

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 13 (without project) GC-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 5 MINK AAHU's: 172.51

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	213.00	0.81	172.96
1	213.00	0.85	181.05
2	213.00	0.81	171.47
4	213.00	0.67	142.71
6	213.00	0.60	128.01
21	213.00	0.93	197.03
38	213.00	0.88	187.44
50	213.00	0.81	172.53
75	213.00	0.81	172.53
80	213.00	0.81	172.53
82	213.00	0.86	182.54
84	213.00	0.74	157.83
86	213.00	0.63	133.76
90	213.00	0.69	145.91

Table 8-4. AAHU values by species, cover type and target year for the without-bank (logging) condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 14 (without project) GCL-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 1 GRAY SQUIRREL AAHU's: 35.30

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	177.00	0.25	44.25
1	177.00	0.25	44.25
2	177.00	0.24	42.48
4	177.00	0.10	17.70
6	177.00	0.00	0.00
21	177.00	0.20	35.40
38	177.00	0.25	44.25
50	177.00	0.25	44.25
75	177.00	0.25	44.25
80	177.00	0.25	44.25
82	177.00	0.24	42.48
84	177.00	0.23	40.71
86	177.00	0.00	0.00
90	177.00	0.00	0.00

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 14 (without project) GCL-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 2 HAIRY WOODPECKER AAHU's: 100.28

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	177.00	0.53	93.81
1	177.00	0.43	76.11
2	177.00	0.24	42.48
4	177.00	0.08	14.16
6	177.00	0.00	0.00
21	177.00	0.26	46.55
38	177.00	0.84	148.68
50	177.00	0.84	148.68
75	177.00	0.84	148.68
80	177.00	0.84	148.68
82	177.00	0.77	135.58
84	177.00	0.35	61.42
86	177.00	0.00	0.53
90	177.00	0.04	6.37

Table 8-4. AAHU values by species, cover type and target year for the without-bank (logging) condition (Form C's).

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 14 (without project) GCL-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 4 WOOD DUCK AAHU's: 38.17

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	177.00	0.32	56.64
1	177.00	0.29	51.33
2	177.00	0.22	38.94
4	177.00	0.14	24.78
6	177.00	0.04	6.37
21	177.00	0.04	6.37
38	177.00	0.22	38.94
50	177.00	0.29	51.33
75	177.00	0.40	70.80
80	177.00	0.40	70.80
82	177.00	0.29	51.33
84	177.00	0.22	38.94
86	177.00	0.14	24.78
90	177.00	0.04	6.37

Form C: Average Annual Habitat Units Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 14 (without project) GCL-ACRES CONSTANT
Period of Analysis: 90
Evaluation Species: 5 MINK AAHU's: 143.09

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	177.00	0.72	127.97
1	177.00	0.68	121.07
2	177.00	0.69	122.84
4	177.00	0.68	119.65
6	177.00	0.63	111.16
21	177.00	0.93	163.73
38	177.00	0.88	155.76
50	177.00	0.81	143.37
75	177.00	0.81	143.37
80	177.00	0.81	143.37
82	177.00	0.86	151.69
84	177.00	0.74	131.16
86	177.00	0.63	111.16
90	177.00	0.69	121.25

Table 8-5. Net change of AAHU's by species and cover type between the without- and with-bank futures (Form D's).

Form D: Net Change in AAHU's Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 1 (with project) BH COVER TYPE
Compared To: PA 11 (without project) BH-ACRES CONSTANT
Period of analysis: 90

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	GRAY SQUIRREL	100.72	74.65	26.07
2	HAIRY WOODPECKER	222.57	141.66	80.91
4	WOOD DUCK	72.28	36.45	35.83
5	MINK	204.82	193.12	11.70

Form D: Net Change in AAHU's Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 3 (with project) BHL-WITH BANK
Compared To: PA 12 (without project) BHL-ACRES CONSTANT
Period of analysis: 90

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	GRAY SQUIRREL	159.54	116.84	42.71
2	HAIRY WOODPECKER	319.70	212.17	107.53
4	WOOD DUCK	79.73	46.05	33.68
5	MINK	308.04	281.23	26.81

Table 8-5. Net change of AAHU's by species and cover type between the without- and with-bank futures (Form D's).

Form D: Net Change in AAHU's Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 5 (with project) GC-WITH BANK
Compared To: PA 13 (without project) GC-ACRES CONSTANT
Period of analysis: 90

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	GRAY SQUIRREL	42.60	38.22	4.38
2	HAIRY WOODPECKER	179.23	117.45	61.78
4	WOOD DUCK	85.20	46.84	38.36
5	MINK	172.96	172.51	0.44

Form D: Net Change in AAHU's Date: 09/30/1988

Study Name: NCDOT MITIGATION BANK STUDY
Action: PA 7 (with project) GCL-WITH BANK
Compared To: PA 14 (without project) GCL-ACRES CONSTANT
Period of analysis: 90

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	GRAY SQUIRREL	47.35	35.30	12.05
2	HAIRY WOODPECKER	140.75	100.28	40.47
4	WOOD DUCK	64.90	38.17	26.73
5	MINK	142.61	143.09	-0.47

APPENDIX 9

MEMORANDUM OF RECORD AND BACKGROUND INFORMATION REGARDING ACREAGE CALCULATIONS

United States Department of the Interior

FISH AND WILDLIFE SERVICE

MEMORANDUM OF RECORD
March 30, 1987

The undersigned agency representatives have read the attached background information and concur with the use of the cover type acreages presented in Attachment 1 for the Company Swamp Mitigation Bank terrestrial HEP analysis. It is also understood that upon completion of an accurate land survey of the tract, the cover type acreage estimates may be refined, thereby making desirable some revision within the original HEP analysis. If an accurate survey is completed prior to the completion of a formal N.C. Wildlife Resources Commission management plan for Company Swamp, then revisions to the original acreage analysis will be performed concurrent with the analysis of the effect of the management plan upon the bank's account. If such information is not available at that time, then no revisions regarding acreage changes will be performed until the first reevaluation mandated by the Memorandum of Understanding.

Mike Gantt 3/27/87

L.K. "Mike" Gantt, Field Supervisor, U.S. Fish and Wildlife Service

Hal Atkinson 30 Mar 87

Hal Atkinson, Division Chief, N.C. Wildlife Resources Commission

TW Waters 3/30/87

Ted Waters, Assistant Highway Administrator, N.C. Department of Transportation

Katherine D. Skinner 3/30/87

Katherine Skinner, Director, N.C. Nature Conservancy

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Divison of Ecological Services
P.O. Box 25039
Raleigh, North Carolina 27611-5039

May 15, 1987

Mr. Ted Waters
Assistant Highway Administrator
N.C. Division of Highways
N.C. Department of Transportation
P.O. Box 25201
Raleigh, North Carolina 27611

Dear ~~Mr. Waters~~ Ted:

The preliminary draft of the Company Swamp Mitigation Bank Report was circulated to the members of the HEP Evaluation Team for review and comment on April 8, 1987. The Team met on April 24, 1987 to discuss review comments and to consider any final changes necessary before releasing a draft report for general review.

The NCDOT requested at the April 24th meeting that the Transmission Corridor (TC) cover type be dropped from the analysis. The request was made because: (1) the TC cover type is subjected to relatively constant management by Virginia Power with or without the establishment of a bank; (2) and the Habitat Evaluation Procedures (HEP) analysis indicated that essentially no credits are derived from it for any evaluation species with the bank in place. Such a modification would not be permissible when performing a HEP analysis for an individual project since cover types within the area of impact are fixed. However, in this case the NCDOT does have a degree of flexibility in designating habitat they wish to include within the bank, subject to the concurrance of other Team members. The team has agreed to the NCDOT request.

The deletion of the TC cover type from the bank necessitated the recalculation of the acreage within the bank. Attached are revised Background Information and Attachments 1 and 4 of the Memorandum of Record which was circulated for your signature. Please remove and destroy the original Background Information and Attachments 1 and 4 from your copy of the MOR and replace them with the attached copies dated May 15, 1987.

It was anticipated that removing the TC would result in an undetermined increase in the Gum-Cypress (GC) cover type. While this is the case, there is no apparent change in the GC acreage due to the fact that a mathematical error occurred during the original calculations resulting in an overestimate of the original GC acreage. In actuality, costs originally charged for the 32-acre TC parcel are now applied to the GC cover type resulting in a 2-acre gain in that

category. The disparity in acreage removed versus that added is a result of the cost differential between bare land at $70.07 per acre and uncut old growth at $974.23 per acre.

If you have any questions regarding these changes, we would be pleased to discuss them with you further. Wilson Laney has contacted each Team member on your staff and provided a detailed explanation of the revised calculations.

Other changes recommended by the Team members are presently being implemented by the FWS and WRC. We anticipate that the draft report will be transmitted for review and comment within the next two weeks. Assuming a two-week review period, the final report should be released during June. We anticipate further coordination with you and your staff as the study is finalized and credits within the bank are applied to individual projects.

Sincerely yours,

Mike

L.K. "Mike" Gantt
Field Supervisor

BACKGROUND INFORMATION

The HEP analysis on the NCDOT Company Swamp Mitigation Bank requires acreage values for each vegetative cover type within the bank. Since no two existing sources of information agree regarding the actual acreage within the tract (see Attachment 2), FWS and WRC have delineated the cover types on a 1:12000 scale aerial photograph and estimated acreages for the cutover gum-cypress, cutover bottomland hardwoods, and uncut bottomland hardwoods using a dot grid. Estimates for the HEP study were derived as follows: the transmission corridor acreage was set equal to 32, based on information from Virginia Power and on measurements from the 1:4800 scale aerials of the site, and dot counts were converted to acreages, accordingly. Since the exact location of the western and northern property boundaries remain uncertain, the HEP Team derived the estimate for uncut gum-cypress acreage by subtraction from 1436 acres, assuming that 1436 is a correct acreage total for the tract. This total apparently comes from an early property survey and may not have been corrected for property disputes resolved in the early 1960's. However, since we are recommending that NCDOT designate the uncut bottomland hardwoods as being entirely within the bank, utilizing gum-cypress only for the remainder, any error in our acreage estimates should be minimal.

During the course of seeking accurate acreage estimates for the entire tract and for the portion purchased using funding provided by the NCDOT, several discrepancies also were discovered in the original N.C. Nature Conservancy calculations of the latter acreages. The attached copy (Attachment 3) of the N.C. Nature Conservancy's handwritten calculations used a 700-acre figure for cutover acreage, when the actual figure, based on timber surveys of the tract and on our own estimates derived from 1983 aerial infrared photography, is approximately 590 acres (including 32 acres of transmission corridor). It also employed a $200 per acre bare land value, which was apparently derived from an appraisal other than that obtained by the State.

We have recalculated the acreage purchased using NCDOT funding utilizing a 558-acre figure as the value for cutover forest. The value for uncut acreage reflects the deletion of the transmission corridor acreage from the bank. Further, since the NCDOT funding was transferred in such a manner so as to preclude the WRC from setting aside funds for management purposes, the figures have been revised to reflect the fact that the NCDOT interest in the uncut portion of the tract is higher than that shown in the original calculations. Personnel of the WRC were advised of this proposed recalculation and concurred with it during a meeting on February 3, 1987. The new calculations are enclosed as Attachment 4 and reflect the fact that the NCDOT Company Swamp Mitigation Bank contains 558 acres of cutover forest and 473 acres of uncut forest.

We have recommended to the NCDOT that they stipulate, for the purposes of the HEP analysis, that their interest in the uncut portion of the

tract consist of the entire remaining acreage of uncut bottomland hardwoods, estimated at 260 acres, plus an additional 213 acres of old-growth gum-cypress forest. They concurred with our recommendation on January 23, 1987. The cutover portion, which they provided total funding for, is estimated to consist of 381 acres of cutover bottomland hardwoods and 177 acres of cutover gum-cypress habitat. The total acreage is assumed to be 1436 acres, of which 1031 acres comprise the Mitigation Bank.

ATTACHMENT 1

Table 2. Cover type acreages within the Company Swamp Mitigation Bank as utilized within the HEP analysis.

COVER TYPE	ACREAGE
Bottomland hardwoods (BH)	260
Bottomland hardwoods-logged (BHL)	381
Gum-cypress (GC)	213
Gum-cypress-logged (GCL)	177
Total Acres	1031

Attachment 2. Acreage estimates for the Company Swamp tract, Bertie County, North Carolina.

COVER TYPE OR CONDITION	SOURCE OF ESTIMATE				
	Bertie Co. Tax Records	True-Temper(1980)[2]	Timberlands Unlimited(1984)	Harvey Realty (1985)	Present Study
Cutover acreage[1]	-----	600	----	647	590
Uncut acreage	-----	800	----	789	846
Total	1566.25	1436	1436	1436	1436[3]
Bottomland hardwoods[4]	-----	574	561	744[5]	673
Gum-cypress	-----	862	875	692	763
Total	1566.25	1436	1436	1436	1436
Bottomland hardwoods-uncut	-----	100	----	97	260
Bottomland hardwoods-cutover	-----	---	----	----	381
Gum-cypress-uncut	-----	700	----	692	586
Gum-cypress-cutover	-----	---	----	----	177
Transmission corridor	-----	---	----	31.68	32
Total	1566.25	1436	1436	1436	1436

[1] Cutover acreage includes the approximately 32 acres within the transmission corridor as well as logged bottomland hardwood and gum-cypress habitats.

[2] True Temper estimates for cutover and uncut acreage apparently do not include the transmission corridor. Estimates for bottomland hardwoods and gum-cypress forest were derived from percentages contained in the sale prospectus.

[3] In the interest of expediency, FWS and WRC assumed the 1436-acre total to be correct and derived some other acreages by subtraction. We are uncertain whether the 1436-acre value has been adjusted for property disputes resolved in the early 1960's and are unable to verify that value as an estimate for the entire tract since we have been unable to accura locate the western and northern property boundaries on our aerial photographs.

[4] The bottomland hardwoods cover type includes the transmission corridor acreage, and any adjacent open water.

[5] FWS added the 32-acre transmission corridor acreage to the original Harvey Realty estimate of 712.32 acres for "...flats and ridges adjacent to the river".

Cost to State for Company Swamp = $863,300

Appraised Value = $1,053,000

Bargain Sale = 1053000) 863,300 = 82 %

Bare Land Value = $200/ac (? Check Appraisal)

Bare Land Value to State = 82% × $200/ac = $164/

4. 700 ac × $164/ac = $114,800

Cutover Area — Bare Land Value to State — Cost to State (DOT) for Cutover Area

5. $1,053,000 − $140,000 = $913,000

Total Appraised Value — Value of Cutover (700 ac × $200/ac) — Old Growth Value

$913,000 × 82% = $748,660

Old Growth Value — Value to State — Cost to State for Old Growth

6. DOT Costs = $114,800 + $52,400 + $332,800 = $500,

100% of Cost to State for Cutover Area — Initial 5 Yrs Management per Proposed Mgt Plan — 44.4% Interest in Old Growth

May 15, 1987

ATTACHMENT 4*

1. Cost to State for Company Swamp = $863,300.00.
   Appraised value = $1,053,000.00.

2. Bargain Sale (percentage of appraised value as determined for the State by Harvey Realty) = $863,300 divided by $1,053,000 X 100 = 81.9848 %.

3. Bare Land Value = $120,000 divided by 1404 = $85.47 per acre, exclusive of the transmission corridor.
   Bare Land Value to State = 0.819848 X $85.45 per acre = $70.07.

4. Cost to State (NCDOT) for Cutover Area = 558 Acres X $70.07 per acre = $39,101.00.

5. Total Appraised Value ($1,053,000) - Value of Bare Land ($120,000) = Old Growth Timber Value ($933,000).

6. Old Growth Timber Value ($933,000) X Value to State (0.819848) = Cost to State for Old Growth Timber ($764,918).

7. NCDOT Interest in Old Growth Acreage is therefore equal to:

   Amount Contributed by NCDOT ($500,000) - Total Cost to State of Cutover Acreage ($39,101) = $460,899 i.e. the amount to be applied toward Old Growth, which constitutes 56% of the cost to State for the Old Growth portion of the tract.**

* The calculations in Attachment 4 are based on cutover acreage of 558 (590 minus the 32-acre transmission corridor) as determined by FWS and WRC, and appraisals as determined by Harvey Realty in a report for the State Property Office dated April 5, 1985.

** For clarification, the total cost breakdown is as follows:

Cost for 558 acres of cutover land	= $ 39,101
Cost for 846 acres of uncut land	= $ 59,281
Cost of timber on uncut acres	= $764,918
Total cost to State	= $863,300

Therefore:

Total cost of uncut timber	= $824,199

NCDOT contributed $460,899 or 56 % of that cost.

APPENDIX 10

PROPOSED STANDARD DEBIT FORMS AND CORRESPONDENCE

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Division of Ecological Services
P.O. Box 25039
Raleigh, North Carolina 27611-5039

June 12, 1986

Mr. Ted Waters
Deputy Administrator
N.C. Department of Transportation
Raleigh, North Carolina 27611

RE: Mitigation Bank MOU

Dear Mr. Waters:

In accordance with our telephone conversation of May 23, 1986, attached is a proposed form letter for use by NCDOT when all parties to the MOU agree that there are no available or practical onsite mitigation alternatives. This proposed letter will serve as the written agreement to use the Bank for mitigation purposes. As the MOU states, the Bank will only be used to offset unavoidable impacts on fish and wildlife when the applicant can demonstrate to the satisfaction of all parties that there are no other alternatives, and it may only be used to mitigate losses in bottomland hardwood wetlands.

In the cases where use of the Bank is appropriate, we envision that the process would proceed as follows in an efficient way:

- FWS and WRC review Corps of Engineers' Public Notice on proposed highway improvement (on-site visits, meetings with NCDOT, if necessary)

- FWS and WRC submit Fish and Wildlife Coordination Act Reports on Public Notice proposed work to Corps including, where appropriate, a recommendation to mitigate project-related impacts on fish and wildlife resources via debiting habitat credits from the Mitigation Bank. A copy of this report would be sent at the same time to NCDOT.

- Upon NCDOT's review of the FWCA Reports and concurrence, the proposed form letter would be sent directly to FWS with a copy to WRC. NCDOT's written agreement to utilize the Bank would thus negate the need for any condition regarding Bank use on the Corps' permit.

Thus far, we have proposed utilizing the Mitigation Bank on the following projects:

PROJECT	LOCATION	P.N.#	ACRES	TYPE	FWCAR
NC 210 (Moore's Creek)	Pender Co.	SAWC085-N-071-0038	0.65	PFO1C	10-18-85 1-10-86
US 13-17 (Roanoke Ri.)	Martin-Bertie Co.	SAWC086-N-008-0049	TBA	PFO1/4F	12-26-85
US 421 (East-West Buies Ck)	Harnett Co.	SAWC086-N-043-0233	2.0	PFO1C	4-28-86
NC 561 (Ahoskie Ck.)	Hertford Co.	SAWC086-N-046-0201	0.2	PFO1C	5-13-86

We hereby request your concurrence in writing on the above projects.

Finally, we envision that the field work for the baseline Habitat Evaluation Procedures (HEP) study will begin within several weeks, and we look forward to working closely with NCDOT representatives as the study progresses.

Sincerely yours,

L.K. (Mike) Gantt

L.K. (Mike) Gantt
Field Supervisor

Attachment

Ms. L. K. (Mike) Gantt
Field Supervisor
U.S. Fish and Wildlife Service
P. O. Box 25039
Raleigh, North Carolina 27611

Dear Ms. Gantt:

We are in receipt of the U.S. Fish and Wildlife Service's letter of _____ (date) _____ concerning _____, (name of project, location, county, state) _____. Our comments on the recommendations by the FWS and NCWRC are as follows:

1. We agree to mitigate the unavoidable impacts by debiting credits from the Company Swamp Mitigation Bank established by Memorandum of Understanding among the N.C. Wildlife Resources Commission, the N.C. Department of Transportation, the N.C. Nature Conservancy and the U.S. Fish and Wildlife Service.

If you need additional information or clarification, please advise.

Sincerely,

cc: Mr. Dick Hamilton, NCWRC
Director, N.C. Nature Conservancy
Mr. Charles Hollis, COE, Wilmington District

PROPOSED DEBIT TRANSACTION FORM

TRANSACTION NUMBER _____

DATE OF TRANSMITTAL _____

PROJECT NAME _____ TIP # _____

COUNTY (IES) _____

EA/DEIS DATE _____ FONSI/FEIS DATE _____

CORPS/CAMA PERMIT NUMBER AND DATE _____

DESCRIPTION OF AFFECTED HABITAT _____

_____

_____

_____

_____

TOTAL ACREAGE _____

PROPOSED DEBIT METHODOLOGY _____

_____

_____

_____

_____

PROPOSED DEBITS _____

[FOR FWS USE ONLY]

DATES OF CONCURRENCE: WRC _____

NCNC _____

NCDOT _____

PROPOSED ANNUAL DEBIT BALANCE SHEET

DATE OF TRANSMITTAL _____

BEGINNING BALANCE FROM LAST QUARTER _____

PROJECTS DEBITED THIS QUARTER

NAME	AMOUNT DEBITED
TOTAL DEBITS	

ENDING BALANCE _____

APPENDIX 11

LETTERS OF COMMENT/CONCURRENCE ON THE DRAFT REPORT

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH 27611

JAMES G. MARTIN
GOVERNOR

JAMES E. HARRINGTON
SECRETARY

August 7, 1987

Ms. L. K. "Mike" Gantt
Field Supervisor
U. S. Fish & Wildlife Service
Division of Ecological Services
P. O. Box 25039
Raleigh, North Carolina 27611

Dear Ms. Gantt:

Our staff has reviewed the Draft Report on the North Carolina Department of Transportation Company Swamp Mitigation Bank. Our comments are included in the attached memorandum.

The Memorandum of Understanding stipulates a HEP study will be conducted for all projects involving a taking greater than five acres. Given the significant time required to conduct such a study and the manpower limitations of our qualified staff, debiting the bank on an acre-for-acre basis appears more reasonable. We would hope you would give serious consideration to this suggestion.

We appreciate the opportunity to comment and look forward to receiving the final report.

Yours truly,

Bill Coby for
James E. Harrington

JEH/cl

Attachment

cc: Mr. George E. Wells, PE
Mr. William G. Marley, PE
Mr. James M. Greenhill, PE

AUG 1 1 1987

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201
RALEIGH 27611-5201

JAMES G. MARTIN
GOVERNOR

JAMES E. HARRINGTON
SECRETARY

DIVISION OF HIGHWAYS

GEORGE E. WELLS, P.E.
STATE HIGHWAY ADMINISTRATOR

RECEIVED
JUL 23 1987
OFFICE OF
ASST. HIGHWAY ADMINISTRATOR

July 20, 1987

MEMORANDUM TO: Bill Marley, Assistant Highway Administrator

FROM: Charles Adkins, Planning and Research

SUBJECT: Comments on NCDOT mitigation bank draft EIS

Our staff has reviewed the above referenced document and we submit the following comments:

-(p.4) NCDOT does not support the contention that USCE wetland decisions have been inconsistent. On the contrary, we generally perceive Corps wetland calls to be fair and reasonable. Since the U. S. Army Corps of Engineers is the only agency with regulatory authority involving permits for wetland encroachment, NCDOT will continue to utilize Corps guidelines for defining wetlands and for mitigation.

-(p.13) All bank debits requiring greater than acre for acre reimbursement will be reviewed and approved on a case by case basis only.

-(p.45) NCDOT does not intend to utilize the bank for temporary loss of habitat (temporary haul roads, detour routes, etc). Minimization, use of best management practices, re-establishment of plant communities after construction or avoidance are preferred and accepted practices that have been, and will continue to be, employed.

-(p.37,45,50) While NCDOT can appreciate the effort made to truly reflect habitat value through HEP studies in the Company Swamp tract, past and present analyses reflect the problems associated with using such a methodology to establish a "credit" system. In an earlier draft report the bank generated 60,383 habitat units (HUs). Later changes included: 1) replacement of one indicator species (box turtle) with another (mink) that supposedly better represented usage of the habitat; 2) increased values for hard mast, snags and cavities; and 3) reduction in the annualization period from 100 to 90 years to reflect the true life of the bank as mandated in the MOU. The result has been a loss of 13,128 bank credits (60,383 to 47,255) or a 12% decrease. By manipulating the data base, overall credit values can apparently vary widely - in this case, resulting is a reduced number of HUs available to our agency for later withdrawal.

-Provision 2 of the Memorandum of Understanding (MOU) indicates that the N. C. Wildlife Resources Commission (WRC) will produce a management plan for the Company Swamp tract as well as participate in active oversight of these lands. However, a detailed plan outlining future management options has yet to be prepared. If active management is initiated, enhanced habitat desirability for target species could be realized and an increase in HUs may result. Such actions would increase the "value" of the bank from a NCDOT standpoint, resulting in additional credits against which to debit future projects. Therefore, NCDOT encourages NCWRC to prepare a plan of action for future management of this area.

The MOU stipulates that a HEP study will be conducted on all projects exceeding five acres in taking. Our staff biologists agree that this procedure should be implemented on several projects to determine if debiting HUs utilizing the HEP method is similar to the units debited on an acre-for-acre basis (45.8 credit/acre). If debits are similar for both methods, we propose that an amendment of the MOU may be in order allowing acre-for-acre withdrawals in all cases. Even if HU differences are significant, debiting on an acre-for-acre basis may be more sensible considering the amount of time required to perform HEP evaluations, the current manpower requirements needed to conduct these studies, and the absence of a viable management plan.

JM/sdt

cc: Dr. Charles Bruton
Jim Greenhill
Barney O'Quinn

North Carolina
Nature Conservancy

Post Office Box 805 / Chapel Hill, North Carolina 27514 / (919) 967-7007

November 6, 1987

Ms. Mike Gantt
Division of Ecological Services
P. O. Box 25039
Raleigh, NC 27611-5039

Dear Mike:

The North Carolina Nature Conservancy has reviewed the document entitled Draft Report On The North Carolina Department of Transportation Company Swamp Mitigation Bank, Bertie County, North Carolina.

We fully concur with the methodology, assumptions, and results so stated in the aforementioned document.

It has been a pleasure to work with the Fish and Wildlife Service on the mitigation bank and commend you on a job well done.

With warm personal regards, I am

Sincerely,

Katherine D. Skinner

Katherine D. Skinner
Executive Director

NOV 0 9 1987

North Carolina Wildlife Resources Commission

512 N. Salisbury Street, Raleigh, North Carolina 27611, 919-733-3391
Charles R. Fullwood, Executive Director

October 28, 1987

Mrs. L. K. Gantt, Supervisor
US Fish and Wildlife Service
Division of Ecological Services
PO Box 25039
Raleigh, North Carolina 27611-5039

Dear Mike:

This correspondence is to advise your office that the Wildlife Resources Commission has completed a review of the Draft Company Swamp Mitigation Bank HEP Report. As we have no significant points of disagreement with the report, we fully concur with methodologies, assumptions and results. Editorial comments and other minor recommendations for revision were made in margins and text of the draft copy and mailed to you under separate cover.

We have enjoyed working with you and your staff on this project and look forward to continued close coordination between our respective agencies. Please advise us of any further assistance that we may be able to provide with regards to the mitigation bank.

Sincerely,

Richard B. Hamilton

Richard B. Hamilton
Assistant Director

RBH/tw

cc: Mr. Don Baker
Mr. Dennis Stewart