DOE Research Set-Aside Areas of the Savannah River Site

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ABSTRACT

Designated as the first of seven National Environmental Research Parks (NERPs) by the Atomic Energy Commission (now the Department of Energy), the Savannah River Site (SRS) is an important ecological component of the Southeastern Mixed Forest Ecoregion located along the Savannah River south of Aiken, South Carolina. Integral to the Savannah River Site NERP are the DOE Research Set-Aside Areas. Scattered across the SRS, these thirty tracts of land have been set aside for ecological research and are protected from public access and most routine Site maintenance and forest management activites. Ranging in size from 8.5 acres (3.44 ha) to 7,364 acres (2,980 ha), the thirty Set-Aside Areas total 14,005 acres (5,668 ha) and comprise approximately 7% of the Site's total area. This system of Set-Aside Areas originally was established to represent the major plant communities and habitat types indigenous to the SRS (old-fields, sandhills, upland hardwood, mixed pine/hardwood, bottomland forests, swamp forests, Carolina bays, and fresh water streams and impoundments), as well as to preserve habitats for endangered, threatened, or rare plant and animal populations. Many long-term ecological studies are conducted in the Set-Asides, which also serve as "control" areas in evaluations of the potential impacts of SRS operations on other regions of the Site.

The SRS Set-Aside Areas are administered under a formal DOE-SR Set-Aside Program. The University of Georgia's Savannah River Ecology Laboratory (SREL) is custodian of these areas and oversees their management and protection in collaboration with the SRS Set-Aside Task Group, which operates under the auspices of the Natural Resources Coordinating Committee. The SRS Set-Aside Areas fulfill a directive of the National Environmental Research Park Program by setting aside relatively unimpacted areas which can be used for assessment and monitoring purposes. These areas provide ideal sites for the collection of valuable baseline data which can be used for environmental restoration and risk assessment purposes and also ensure that representative plant communities and habitat types will be maintained on the SRS.

The purpose of this document is to give an historical account of the SRS Set-Aside Program and to provide a descriptive profile of each of the Set-Aside Areas. These descriptions include a narrative for each Area, information on the plant communities and soil types found there, lists of sensitive plants and animals documented from each Area, an account of the ecological research conducted in each Area, locator and resource composition maps, and a list of Site-Use permits and publications associated with each Set-Aside. This publication of the SRS National Environmental Research Park Program is intended to be a working document which can aid in the preparation of environmental reports and assist field researchers in selecting study sites on the Savannah River Site.

ACKNOWLEDGMENTS

The Savannah River Site Set-Aside Program owes its success to the efforts of a number of people over the years. Early research conducted by Dr. Eugene P. Odum of the University of Georgia was critical to the acknowledgement by the then Atomic Energy Commission that areas of the plant site should be set aside for long-term ecological research. Dr. William S. Osburn (DOE/OHER) worked to gain Department of Energy support for the designation of Set-Aside Areas on DOE lands. More recent efforts by William McCort, formerly of the Savannah River Ecology Laboratory, and Gary Wein (SREL) were instrumental in achieving the addition of 20 new Set-Aside Areas to the Program in the late 1980's. Other site personnel who were instrumental in the development of this program include John Irwin (SRFS),Thomas O. Smith (SRFS), Roger Pitts (SRFS), Steve Wright (DOE-SR), Ronald Jernigan (DOE-SR), Ben Gould (DOE-SR), and Elizabeth Goodson (DOE-SR).

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Finally, we thank the current non-SREL members of the SRS Set-Aside Task Group, who help administer the SRS Set-Aside Program: Diana Hannah (DOE-Office of Science, Technology, and Business Development), Thomas O. Smith (Savannah River Forest Station), Winona Specht (WSRC-Savannah River Technology Center), Michael Caudell (South Carolina Department of Natural Resources), and D. Vernon Osteen (WSRC-Environmental Protection Division).

INTRODUCTION

OVERVIEW

For over four decades, the Savannah River Site (SRS) has offered itself as an outdoor laboratory for environmental study. Much of the research conducted on the SRS has been undertaken with the goal of gaining a fundamental understanding of the terrestrial and aquatic ecology of the area. Studying the biotic and abiotic components which comprise the natural communities on the SRS has led to a greater understanding of the value and function of these systems. Collectively, the knowledge gained from these studies has increased our understanding of the role that natural processes play in the SRS landscape. The results from these ecological studies aid Site resource and facilities managers in making wise programatic and natural resource management decisions.

It has been the practice on the SRS to set aside specific habitats and research sites which are protected from most routine Site maintenance and forest management activities; currently there are 30 DOE Research Set-Aside Areas on the Savannah River Site. These areas vary in size from 8.5 acres (3.44 ha) to 7,362 acres (2,980 ha); all thirty Set-Asides total 14,005 acres (5,668 ha) and comprise approximately 7% of the Site's total area. This precedent of setting aside tracts of land was founded on the principles of conservation and the need for the SRS to have nonimpacted areas as reference sites where baseline data can be obtained. Preserving and protecting examples of representative and unique habitats, as well as allocating lands for ecological study, provides opportunities to test and apply ecological principles in natural resource management.

The purpose of this document is to give an historical account of the SRS Set-Aside Program and to provide a profile of each of the 30 Set-Aside Areas. These descriptions include a narrative for each Area, information on the plant communities and soil types found there, lists of sensitive plants and animals documented from each Area, accounts of the ecological research conducted in each Area, locator and resource composition maps, and a list of Site-Use permits and publications associated with each Set-Aside. This publication of the SRS National Environmental Research Park Program is intended to be a working document which can aid in the preparation of environmental reports as well as assist field researchers in selecting study sites on the SRS.

SAVANNAH RIVER SITE DESCRIPTION

The Savannah River Site is a former nuclear production facility located along the Savannah River, south of Aiken, South Carolina (Fig. 1). The 310-square mile (80,267 hectare) facility occupies portions of Aiken, Allendale, and Barnwell Counties in South Carolina. The industrial complex is comprised of five shut down nuclear reactors as well as facilities for nuclear materials processing, tritium extraction and purification, waste management, solid waste disposal, and power plants for steam generation and production of electric power (Noah, 1995). When land area for the SRS was acquired in 1950, approximately 67% was forested, 33% was crop or pasture land, and most accessible forest stands had been logged (Workman and McLeod, 1990). Today, much of the suitable forested area of the SRS is managed for multiple uses, primarily commercial timber production, by the Savannah River Forest Station (SRFS), a unit of the U.S. Department of Agriculture-Forest Service. Game management on the SRS includes annual deer and hog hunts conducted by the Westinghouse Savannah River Company (WSRC) on the general Site, as well as hunts for deer, hogs, turkey, waterfowl, and small game, which are conducted by the South Carolina Department of Natural Resources (SCDNR) on

a portion of the Site designated as the Crackerneck Wildlife Management Area. Habitat enhancement for wild turkey and bobwhite quail also is conducted on the Site by SCDNR and SRFS.

Over 20% of the SRS currently is covered by wetlands, including bottomland hardwoods, cypress-tupelo swamp forests, two large cooling water reservoirs (Par Pond and L Lake), creeks and streams, and over 300 isolated upland Carolina bays and wetland depressions (Lide, 1994; Wike *et al.*, 1994). There are five main drainage basins located on the SRS. The five streams that originate on or pass through the SRS before flowing into the Savannah River are Upper Three Runs Creek, Beaver Dam Creek, Fourmile Branch, Steel Creek, and Lower Three Runs Creek. A sixth stream, Pen Branch, does not flow directly into the Savannah River but joins Steel Creek in the Savannah River floodplain swamp (Wike *et al.,* 1994). Of these streams, three (Four Mile, Pen Branch, and Steel Creek) have been impacted thermally as a result of past reactor operations and Beaver Dam Creek has been contaminated with heavy metals. The thermally impacted streams now are recovering. The upper reaches of Lower Three Runs were impounded in 1958 to form Par Pond; L Lake was formed in 1985 by damming Steel Creek above the Meyers Branch confluence (Wike *et al.,* 1994).

SRS NERP Program

In 1972 the entire Savannah River Site was designated by the Atomic Energy Commission as the nation's first National Environmental Research Park (NERP). The purpose of the NERP program is to provide tracts of land where the effects of human impacts upon the environment can be studied. Since 1972, six additional NERPs have been designated by the Department of Energy at DOE facilities across the United States. On the SRS, the Savannah River Operations (SRO) Office recognized the need to preserve unimpacted "control" areas representing the major plant communities of this geographic region; such control areas are vital to provide a context for comparisons with other communities on the Site which may be impacted by human activites. In accordance with DOE orders and policies (DOE Order 4300.1B, 1 July 1987; DOE policy P 430.1), several areas on the SRS have been "...set aside for the exclusive use of nonmanipulative research for definite or indefinite periods of time." These areas have been designated DOE Research Set-Aside Areas and are taken into consideration during land-use planning on the SRS.

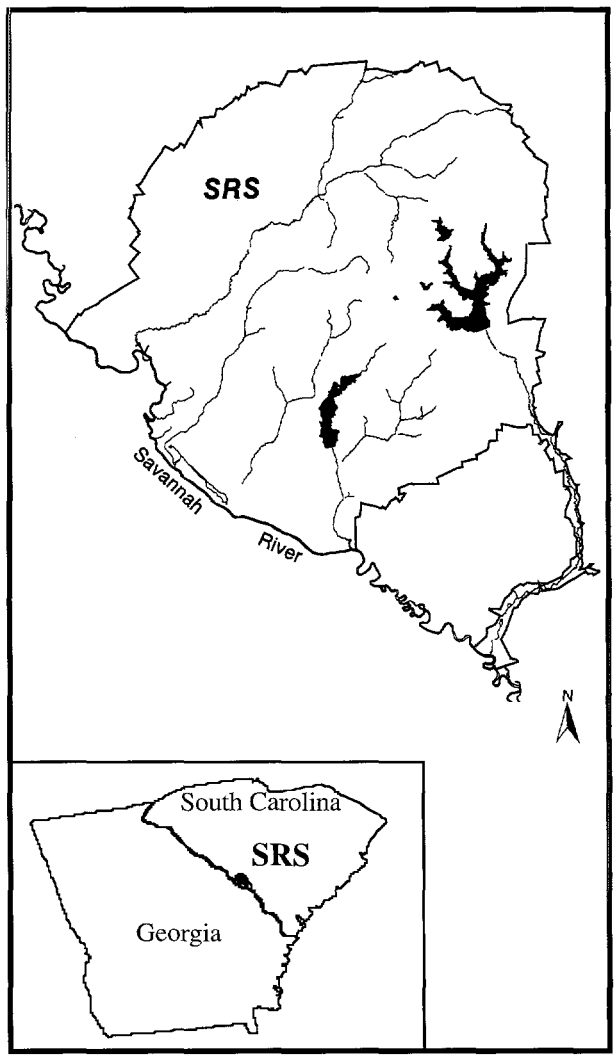

Figure 1. *The Savannah River Site.*
The SRS is about 25 miles southeast of Augusta, GA and 12 miles south of Aiken, SC. The Site, approximately 310 square miles in area, covers about 1 percent of the state of South Carolina.

Savannah River Site Set-Aside Program

Program History

The origin of the Set-Aside Program on the Savannah River Site can be traced to 1951, when the Atomic Energy Commission-Savannah River Operations Office (AEC-SROO) invited the Universities of Georgia (UGA) and South Carolina to conduct land-use surveys and ecological inventories at the newly acquired Savannah River Plant (SRP). These surveys and inventories gathered baseline ecological data from different habitats on the SRP to monitor ecological impacts from plant construction and operation. As part of the land-use survey, UGA scientists selected representative examples of the five ecological land types (habitats) known to exist on the SRP, so that research projects could be conducted in them. These projects were geared toward population studies of the flora and fauna of undisturbed habitats as well as those undergoing successional change. Two studies were of particular importance in initiating the concept of setting aside lands on the SRP for the purpose of research: UGA's studies in abandoned farm fields (the Georgia Fields/Field 3-412), and studies of the wetland habitats associated with Carolina bays (Ellenton Bay and Craig's Pond). The Carolina bays especially were recognized as being unique and worthy of future study and protection and it was suggested by UGA that these bays be "preserved undisturbed." Six months following the initiation of these research projects, the manager of the AEC-SROO recommended that 12,000 acres of land—representing ecologically different land types on the SRS—be set aside from reforestation and used for ecological research projects (letter from C. A. Nelson, Manager AEC-SROO, to G. H. Giboney, 2 February 1952). Early recognition by the AEC of the value of these ecological habitats as "controls" in comparisons with industrial and forest management impacts on the remainder of the Site set the stage for the SRS Set-Aside Program. In addition to the concept of setting aside habitats for ecological research, the formal establishment of natural areas on the SRS began in 1957 when university scientists and U.S. Forest Service (USFS) personnel recognized the importance of the old-growth forest in the Lower Three Runs Creek drainage. Through the efforts of the USFS and The Nature Conservancy, the 9-acre Boiling Springs area was preserved as a Natural Area.

Department of Energy National Environmental Research Parks

♦ Fermilab	Batavia, IL	6,795 acres	2,750 ha
♦ Hanford	Richland, WA	365,708 acres	148,000 ha
♦ Idaho	Idaho Falls, ID	568,330 acres	230,000 ha
♦ Los Alamos	Los Alamos, NM	28,417 acres	11,500 ha
♦ Nevada	Las Vegas, NV	864,850 acres	350,000 ha
♦ Oak Ridge	Oak Ridge, TN	12,375 acres	5,008 ha
♦ Savannah River	Aiken, SC	198,340 acres	80,000 ha

For the next decade, the University of Georgia continued to use specific field research sites to conduct ecological inventories and habitat studies that provided the SRP with a means to evaluate impacts resulting from plant operations. In 1963, these study areas acquired the name "reserve areas" and a memorandum was drafted among the AEC, the United States Forest Service (USFS), and UGA to designate that certain areas be set aside for ecological studies. These study areas were to be posted with signs and timber management activites within these areas were to be coordinated between researchers and the USFS. This coordination was necessary to restrict reforestation and ensure protection of research studies.

By 1966, UGA scientists had been conducting ecological research in the Georgia Fields/ Field 3-412 for 15 years. That same year the AEC allocated additional research areas to UGA, including the old-field areas adjacent to the buildings then occupied by the Savannah River Ecology Laboratory (SREL) and the abandoned Risher Farm Pond. In 1967, SREL selected seven areas (the original habitat study sites) on the SRP and recommended that the AEC set these aside as examples of the various ecosystems on the SRP for continued and future study by environmental scientists. In 1968, these areas, combined with the three habitats previously allocated to UGA, were granted set-aside status and officially were called SREL Reserve Areas. These ten areas, totaling 892 acres (0.5% of the SRP), permanently were set aside by the manager of the AEC-SROO to represent and protect examples of the major plant communities and habitat types within SRP boundaries. These areas, protected from public access, forest management, and most routine Site activities, offered locations for long-term ecological research as well as "control" sites for collecting data to compare with other areas of the SRP that could be impacted in some way by Site operations. That same year, the Society of American Foresters (SAF) registered two Natural Areas on the SRS—the Boiling Springs Natural Area and the Scrub Oak Natural Area. These two areas, added to the ten SREL Reserve Areas, gave the Site 12 areas recognized as part of the SRP Habitat Reserve System.

During the 1970's, the set-aside areas continued their status as controls, used for evaluating ecological impacts from plant operations. Because these operations continued to have stressful impacts on some of the Savannah River Plant (SRP) environs, particularly the aquatic ecosystems, the AEC continued to need these "unstressed" areas as benchmarks. In 1972, the SRS was designated as the nation's first National Environmental Research Park (NERP). The NERP program is dedicated to the study of the interaction of man-managed environments with natural systems, and NERP sites provided opportunities for ecological research. NERP-funded projects were initiated in the Set-Aside Areas and in 1976 SREL began the preparation of a report that characterized the Set-Aside Areas and the studies that were being conducted in them. The following year, SREL produced a report summarizing the baseline studies of habitat characterization and natural resource inventories that had been conducted on the SRS (Brisbin *et al.*, 1977).

In addition to research within the Set-Aside Areas, long-term studies also were being conducted in areas on the SRS other than Set-Asides. To prevent land-use conflicts and to track the experimental research being conducted in these areas, the AEC initiated the Site-Use coordination and approval system, which authorized land use by issuing permits. Also during the 1970's, university surveys of Upper Three Runs Creek (UTRC) showed that high water quality and an incredibly rich fauna were associated with this stream system, resulting in the U.S. Geological Survey (USGS) designating this stream as a National Hydrological Benchmark Stream. The USGS removed this status from UTRC in 1992 as a result of current and proposed development in the watershed north of the Savannah River Site.

In 1982 the first NERP report was published describing the SRP Habitat Reserve Areas as Set-Aside Areas (Hillestad and Bennett 1982). This report was written as a basis for re-evaluation of the SRP Habitat Reserve System as well as for developing future land-use plans for the SRP. By the mid-1980's, the Set-Aside Areas and other study sites, particularly bay wetlands, were increasingly confronted with encroachments from industrial development and natural resource management activities administered by the SRFS. Areas on the SRS which traditionally had seen low intensity management were increasingly being prescribed for silvicultural treatments, leaving some long-term research areas without buffering. In addition, proposed industrial development of Upper Three Runs Creek threatened the integrity of this stream as an ecological control to the Site's thermally altered creeks. As a result, in keeping with the philosophy of the NERP program and in response to the expanding needs of the Department of Energy (DOE) for studies assessing the potential ecological impacts of various SRS operations, a Set-Aside Review Committee was formed in 1986 to evaluate the Set-Aside Program and determine whether expansion of the program was warranted. In 1988, a document (MacFarlane, 1988) was prepared for SREL describing the role that Set-Aside Areas play in natural resource management on the SRS and a proposal was submitted to DOE by SREL to expand the program by adding long-term study sites, additional representative habitat areas, and SAF Natural Areas (McCort and Wein, 1988). In 1989, as a result of this proposal, the DOE approved the addition of twenty areas to the program, resulting in thirty Set-Aside Areas totaling 14,005 acres (5,668 ha), or 7% of the land on the SRS. These thirty areas are designated as DOE Research Set-Aside Areas (Fig. 2).

Administrative Protection and Management

SREL serves as custodian for the 30 DOE Research Set-Asides and provides day-to-day administration of the SRS Set-Aside Program, including boundary maintenance and coordination of the activities of SREL and other contractors within and around the Set-Aside Areas. The Set-Aside Program receives guidance and technical advice from the Set-Aside Task Group, which was established in 1992 under the auspices of the Natural Resources Coordinating Committee (NRCC) to assist DOE in the management of the natural resources of the SRS (Appendix 1). The Set-Aside Task Group ensures that the Set-Aside Program meets the objectives of the "Set-Aside Protection and Management" Plan (Appendix 2), which stipulates that:

- Set-Aside Areas are for research, not for intensive management objectives,
- Set-Aside Areas should receive as little management as possible,
- Set-Aside Areas should be protected to remain as natural as possible with little or no human influence, and
- Set-Aside Areas are primarily for non-manipulative research, with no research being conducted in a Set-Aside Area that would alter the long term value of the Set-Aside.

To date, boundary lines for the 30 Set-Asides have been established and marked (with the exception of Cypress Grove, Area No. 9) and a computer-based Geographic Information System (GIS) data layer documenting these boundary lines has been distributed for site-wide use. During the past three years the SREL Set-Aside Program actively has encouraged student/ technician-initiated research projects within Set-Aside Areas by offering small research grants for projects deemed to enhance our basic knowledge of the floral, faunal, and geochemical features of these Areas.

Purpose of the DOE Research Set-Aside Areas

The 30 Set-Aside Areas serve a number of functions on the Savannah River Site, including the following:

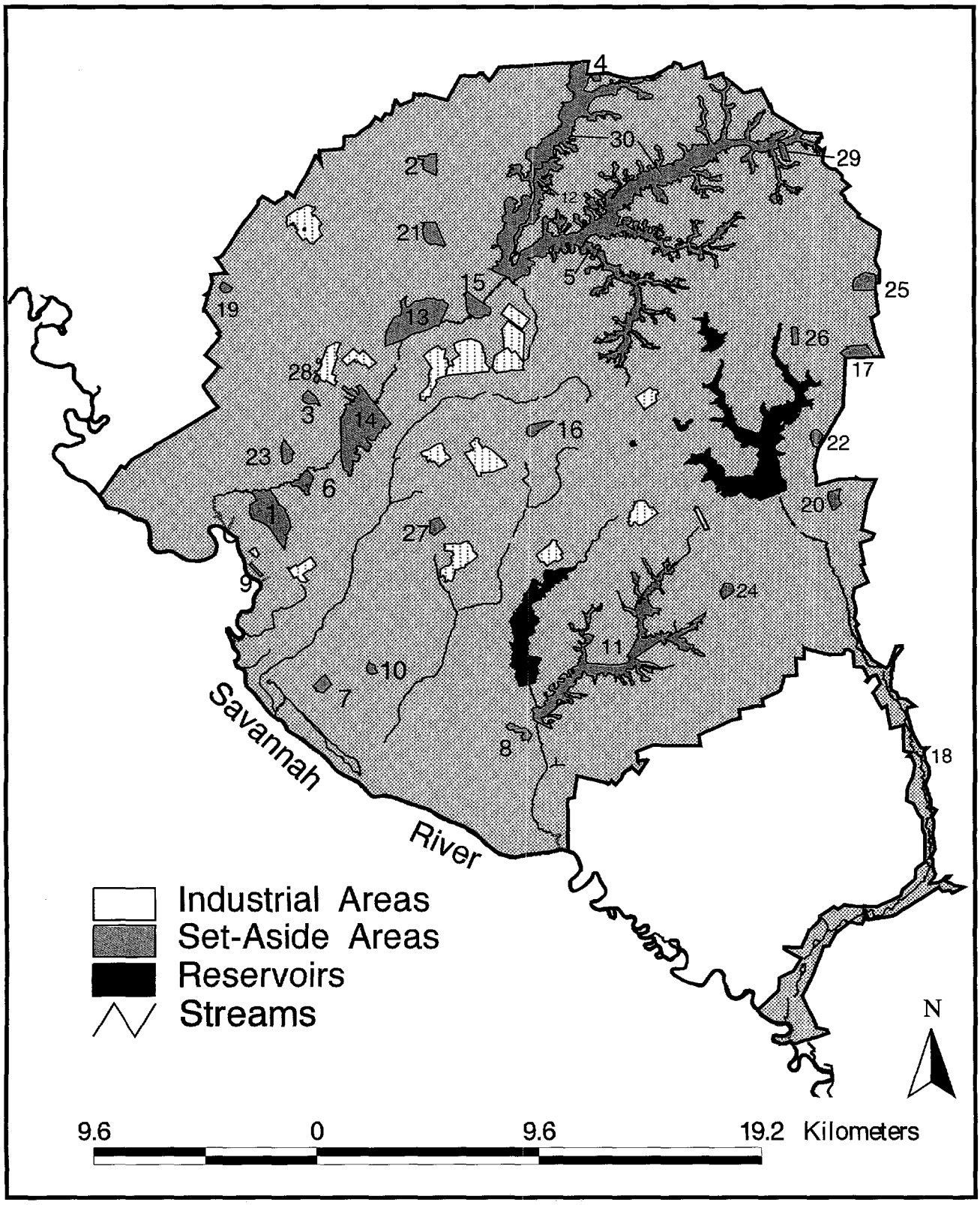

Figure 2. *The 30 DOE Research Set-Aside Areas on the Savannah River Site.*

- Set-Aside Areas serve as sources of "control" data for compliance-mandated monitoring activities, given that the Set-Asides are exempt from many of the normal Site operations and forest management activities.

- Set-Asides serve as reference "clean" areas which can be assessed for appropriate reference or "end-point" species to be used in ecological risk assessments of potentially contaminated areas.

- Set-Asides provide baseline information on how SRS natural communities are structured and how they function in a setting relatively unimpacted by human activities, thus providing targets for how restoration/ remediation activities should proceed to restore disturbed and contaminated areas to functioning biological systems.

- Set-Asides provide areas in which to conduct long-term ecological research, to enhance our understanding of how communities on the SRS function and how these communities may be impacted by anthropogenic activities related to Site or other industrial activities.

- Set-Asides provide "reserve" areas which are not managed for timber or other forest products, thus preserving both typical and unique habitat types of the southeastern United States in an area that can be protected from urban/industrial development.

- Set-Aside Areas provide critical habitat for rare, threatened, or endangered plant and animal species.

- Some of the Set-Asides have been documented to contain significant archaeological sites and the "Set-Aside" status of these Areas serves to preserve and protect these cultural resources.

- A recent proposal for "Wetland Mitigation Banking" on the SRS included the Set-Aside Areas as a significant portion of the "banked" wetlands on the site, validating the importance of Set-Asides to the SRS in meeting obligations mandated by federal and state regulations and agencies.

- Set-Aside Areas provide natural areas for educational and public outreach activities—both SREL and the SRFS are using portions of certain Set-Aside Areas to introduce ecological and natural resource management principles to students and SRS visitors.

Boundary Line Establishment and Maintenance

SREL is responsible for the establishment, marking, and maintenance of the Set-Aside boundaries. Boundary lines were established to identify Set-Aside Areas and to prevent impacts to the Set-Asides from adjacent forest management and other land-use activities. The assumptions and criteria employed during delineation and marking of Set-Aside boundary lines are detailed in Appendix 4. The 30 Set-Aside Areas are covered by two SRS Site-Use permits, SU-79-74-R (Set-Asides 1-10) and SU-89-58-R (Set-Asides 11-30), which detail the boundaries of the Areas.

Boundary lines delineating the ten original SREL Reserve Areas were marked originally in 1969 with a painted, 4-inch wide, white band on boundary line trees, approximately every 50 feet. In addition, white metal signs with blue letters identifying "SREL Reserve Area" were posted on boundary trees approximately every 300 feet. Boundary lines for the original ten Areas were not refurbished until 1989, when boundary lines also were established for the additional 20 Set-Aside Areas. Areas now are marked by painted white blazes or by white metal signs with black letters identifying "DOE Set-Aside Research Area" posted on boundary trees approximately every 75 feet. Modifications to boundary lines for Set-Aside Area Nos. 1 and 10 were made as a result of amendments to Site-Use permit SU-89-58-R. Set-Aside No. 9 (Cypress Grove) had no historical markings to delineate a boundary,

and therefore received no boundary line treatment in 1990. Set-Aside No. 9 (Cypress Grove) has been documented to be contaminated from past site operations and an amendment to SU-79-74-R has been approved to delete Cypress Grove from the Set-Aside Program and replace it with two other areas representative of the swamp forest community type.

The Set-Aside Protection and Management Plan dictates that boundary lines will be refurbished every seven years. In compliance with this objective, SREL has developed a procedure for periodic inspections of Set-Aside boundary postings. This process is detailed in Appendix 4.

Set-Aside GIS Coverages

SREL developed a computer-based Geographical Information System (GIS) data layer describing the Set-Aside boundaries (Davis *et al.*, 1996). This GIS coverage was created primarily to generate maps and area statistics and to give positional coordinate values to the Set-Aside boundary lines. The inclusion of these line coordinates into the site-wide automated Site-Use system (SUSA) for Site-Use permit coordination was necessary to reduce encroachment conflicts on the Set-Aside Areas. In addition, the inclusion of this GIS coverage into the SRS sitewide GIS database ensures that the Set-Aside Areas will be incorporated into SRS current and future use planning. Based upon the latest version of this GIS coverage (Version 3, 1996), the 30 Set-Aside Areas total 14,005 acres (5,668 ha), with a posted boundary length of 267.7 miles (430.8 km).

The GIS dataset of Set-Aside boundary lines was derived from interpretations of USFS aerial photography (dated 1/31/92; scale 1:15,840) and rectified satellite imagery (merged SPOT 20m multispectral data from 4/17/88 and 10m panchromatic data from 10/22/87). Onscreen digitizing was done using ARC-INFO Version 7. Where Set-Aside boundaries were coincident with USGS 7.5 minute DLG data (such as roads or stream courses), the DLG line was adopted if the DLG line was determined to be accurate. The Set-Aside coverage is in UTM zone 17, NAD 27 coordinates, as are all site GIS layers. Extensive field work was conducted to define and establish the Set-Aside boundaries and to annotate this information onto the aerial photography used to generate the GIS coverage. The completed dataset was compared to other existing SRS-wide datasets, both imagery and vector-based, to verify accuracy. Spatial accuracy is approximately 10 meters, since the Set-Aside boundaries are based in part upon satellite data of 10 meter resolution. Additionally, Set-Aside boundaries often represent a transitional zone, being influenced by several factors (see Appendix 4: criteria for Set-Aside No. 30). Therefore, the Set-aside boundaries are best utilized in GIS analyses as buffer zones of 60 meters (200 feet). A feasibility study was undertaken by the SRFS and SREL to determine accuracy of the boundary line coverage and for acerage verification. This effort was initiated by the SRFS in July, 1995, as a project to GPS part of the Set-Aside No. 30 boundary in timber compartment 53. The results, although accepted for inclusion in the GIS boundary data set, demonstrated the limitations of GPS technology used in dense forest canopy with high soil moisture. Line features determined by GPS fell within the accuracy statement of lines derived from interpretations of satellite imagery.

Characterization of vegetation communities was accomplished by creating a second GIS coverage to illustrate the current plant communities and habitat types comprising each Area. The following vegetation categories were identified, including: old fields--represented by forb/grassland, scrub/shrub, or mixed pine fields; loblolly pine; longleaf pine; slash pine; sand pine; mixed pine/hardwood; upland hardwood; sandhills scrub oak/pine; sandhills pine/scrub oak (a higher percentage pine component); bottomland hardwood; bottomland hardwood/pine; mixed swamp forest; Carolina bays; water; and other-disturbed area (e.g. roads). The

description of each Set-Aside Area in subsequent sections of this document includes information on plant community composition as well as vegetation/resource maps derived from this vegetation GIS coverage. Interpretations of habitat types were based upon satellite imagery signatures (see GIS section), aerial photography, and field observations. Pre-SRS land-use in and around the Set-Aside Areas was determined using 1951 black and white aerial photographs (1:24000 series, USDA, Salt Lake City, Utah) and 1951 digital orthophotography (Summerall *et al.*, 1995). Farming activity, drainage ditches, vegetation patterns, and disturbances were noted. Recent land-use was determined from 1989 and 1996 natural color and 1992 false color infrared aerial photographs (1:15840 series; EG&G, Las Vegas, Nevada) and field observations.

Vegetation communities or "stands" were delineated to identify the communities comprising each Area and to generate area statistics. These area statistics, based upon interpretations of the dominant canopy vegetation, were approximated for the various community types and should not be regarded as having a high degree of accuracy. Additional descriptions of the various vegetation communities characteristic of the SRS can be found in Jones *et al.* (1981), Whipple *et al.* (1981), Knox and Sharitz (1990), and Workman and McLeod (1990). Some of the Set-Aside vegetation/resource maps show similar adjacent communities (stands) separated by boundaries—these boundaries indicate that there are age differences within a community type. Stand ages were obtained from the SRFS's 1993 Continuous Inventory of Stand Condition (CISC) stand database. Where applicable, the SRFS's GIS Stands coverage was evaluated for comparative purposes and/or to support stand delineations; several other Site GIS coverages also were employed for resource information and possible map integration (see Appendix 5 for a listing of GIS coverages used). The resulting vegetation/resource maps should provide researchers and other Site personnel with information about each Set-Aside Area which can aid in the selection of appropriate research or sampling sites and in performing spatial analyses in support of ecological risk assessments. These maps also should aid SRS land managers in making natural resource management decisions for lands adjacent to Set-Asides.

Community Types Found in Set-Aside Areas

The 30 Set-Aside Areas encompass the eight vegetation communities characteristic of the SRS: old-fields, sandhills, upland hardwoods, pine forests, bottomland forests, swamp forests, Carolina bays, and fresh water streams and impoundments (Workman and McLeod, 1990; botanical nomenclature follows Radford *et al.*, 1968). The specific vegetation communities associated with each Set-Aside Area are listed below and in the following table (Table 1). Table 2 summarizes the vegetation communities associated with each Set-Aside Area.

<u>Old Fields and Utility Rights-of-Way</u>

Old Fields

Field 3-412/Ellenton Bay (Area No. 1)
UGA Old Lab Site (Area No. 2)
Field 3-409 (Area No. 28)

Rights-of-Way (herbaceous/scrub-shrub)

Field 3-412 and Ellenton Bay (Area No. 1)
Risher Pond (Area No. 10)
Ruth Patrick-Meyers Branch (Area No. 11)
E.P. Odum Wetland (Upper Three Runs/Tinker Creek; Area No. 30)

<u>Carolina Bays (isolated wetland depressions)</u>

Herbaceous—depression meadow

Field 3-412/Ellenton Bay (Area No. 1)
Steel Creek Bay (not a true bay; Area No. 8)
Rainbow Bay Amphibian Reserve Area (not a true bay; Area No. 16)
Craig's Pond and Sarracenia Bay (Area No. 17)
Thunder Bay (Area No. 20)
Flamingo Bay (Area No. 21)
Dry Bay (Area No. 23)
Mona Bay and Woodward Bay (Area No. 25)
Road 6 Bay (not a true bay; Area No. 27)

Shrub

Woods Bay (in Field 3-412; Area No. 1)
Ginger's Bay (not a true bay; Area No. 19)
Little Cypress Bay (Area No. 22)

Forested

Woods Bay (in Field 3-412; Area No. 1)
Steel Creek Bay (not a true bay; Area No. 8)
Rainbow Bay Amphibian Reserve Area (not a true bay; Area No. 16)
Ginger's Bay (not a true bay; Area No. 19)
Flamingo Bay (Area No. 21)
Little Cypress Bay (Area No. 22)
Cypress Bay (Area No. 24)
Road 6 Bay (not a true bay; Area No. 27)

Streams and Impoundments

Streams

Beech Hardwood Forest--Upper Three Runs Creek (Area No. 6)
Organic Soils--Upper Three Runs Creek (Area No. 13)
Mature Hardwood Forest--Upper Three Runs Creek (Area No. 14)
Whipple/OHER Study Site--Upper Three Runs Creek (Area No. 15)
Rainbow Bay Amphibian Reserve Area (not a true bay; Area No. 16)

Impoundments

Oak Hickory Forest #1 (abandoned, beaver activity, successional recovery; Area No. 5)
Risher Pond (active pond, beaver activity; Area No. 10)
Ruth Patrick-Meyers Branch (abandoned; Area No. 11)
Beaver Pond Site--E.P. Odum Wetland (Upper Three Runs/Tinker Creek; abandoned, beaver activity; Area No. 30)
Boggy Gut--E.P. Odum Wetland (Upper Three Runs/Tinker Creek; abandoned, successional recovery; Area No. 30)
Kennedy's Pond--Scrub Oak Natural Area and E.P. Odum Wetland (Upper Three Runs/ Tinker Creek; abandoned, beaver activity, successional recovery; Areas No. 29 and 30)
Mill Creek--E.P. Odum Wetland (Upper Three Runs/Tinker Creek; abandoned, beaver activity; Area No. 30)
Reedy Branch--E.P. Odum Wetland (Upper Three Runs/Tinker Creek; abandoned, successional recovery; Area No. 30)

Pine Forest

Field 3-412 and Ellenton Bay (natural and planted; Area No. 1)
UGA Old Lab Site (natural and planted; Area No. 2)
Sandhills (Area No. 3)
Loblolly Pine Stand (natural; Area No. 4)
Steel Creek Bay (planted; Area No. 8)
Risher Pond (planted; Area No. 10)
Ruth Patrick-Meyers Branch (natural and planted; Area No. 11)
Mature Hardwood Forest (natural and planted; Area No. 14)
Rainbow Bay Amphibian Reserve Area (planted; Area No. 16)
Craig's Pond and Sarracenia Bay (planted; Area No. 17)
Ginger's Bay (planted; Area No. 19)
Thunder Bay (planted; Area No. 20)
Flamingo Bay (planted; Area No. 21)
Little Cypress Bay (planted; Area No. 22)
Dry Bay (planted; Area No. 23)
Cypress Bay (planted; Area No. 24)
Mona Bay and Woodward Bay (planted; Area No. 25)
Road 6 Bay (planted; Area No. 27)
Field 3-409 (natural and planted; Area No. 28)
E.P. Odum Wetland (Upper Three Runs/Tinker Creek; natural; Area No. 30)

Sandhills (Xeric forest)

Sandhills (Area No. 3)
Craig's Pond and Sarracenia Bay (Area No. 17)
Sandhills Fire Site (Area No. 26)
Scrub Oak Natural Area (Area No. 29)

Swamp Forest (Riverine floodplain forest)

Field 3-412 and Ellenton Bay (Area No. 1)
Mixed Swamp Forest (Area No. 7)
Cypress Grove (Area No. 9)
Ruth Patrick-Meyers Branch (Area No. 11)

Upland Hardwood (Mesic forest)

Field 3-412 and Ellenton Bay (Area No. 1)

UGA Old Lab Site (Area No. 2)
Oak-Hickory Forest #1 (Area No. 5)
Beech Hardwood Forest (Area No. 6)
Steel Creek Bay (Area No. 8)
Ruth Patrick-Meyers Branch (Area No. 11)
Oak-Hickory Forest #2 (Area No. 12)
Organic Soils (Area No. 13)
Mature Hardwood Forest (Area No. 14)
Whipple/OHER Study Site (Area No. 15)
Flamingo Bay (Area No. 21)
Boiling Springs Natural Area (Area No. 18)
Ginger's Bay (Area No. 19)
Little Cypress Bay (Area No. 22)
Dry Bay (Area No. 23)
Road Six Bay (Area No. 27)
Scrub Oak Natural Area (Area No. 29)
E.P. Odum Wetland (Upper Three Runs/Tinker Creek; Area No. 30)

Bottomland Hardwood Forest (Hydric-floodplain forest)

Field 3-412 and Ellenton Bay (Area No. 1)
Oak Hickory Forest #1 (Area No. 5)
Beech Hardwood Forest (Area No. 6)
Mixed Swamp Forest (Area No. 7)
Steel Creek Bay (Area No. 8)
Risher Pond (Area No. 10)
Ruth Patrick-Meyers Branch (Area No. 11)
Oak Hickory Forest #2 (Area No. 12)
Organic Soils (Area No. 13)
Mature Hardwood Forest (Area No. 14)
Whipple/OHER Study Site (Area No. 15)
Rainbow Bay Amphibian Reserve Area (Area No. 16)
Boiling Springs Natural Area (Area No. 18)
Flamingo Bay (Area No. 21)
Dry Bay (Area No. 23)
Cypress Bay (Area No. 24)
Road Six Bay (Area No. 27)
Scrub Oak Natural Area (Area No. 29)
E.P. Odum Wetland (Upper Three Runs/Tinker Creek; Area No. 30)

Table 1. Summary of vegetation types in all Set-Aside Areas.

Vegetation Type	Total Acres	Total Hectares	%
Mixed Pine Field	16.78	6.79	0.12%
Loblolly Pine	1,069.9	432.98	7.64%
Longleaf Pine	258.95	104.80	1.85%
Slash Pine	307.13	124.29	2.19%
Sand Pine	0.36	0.15	0.00%
Mixed Pine/Hardwood	1,982.71	802.39	14.16%
Upland Hardwood	1,506.47	609.66	10.76%
Bottomland Hardwood	5,854.83	2,369.42	41.80%
Mixed Swamp Forest	146.92	59.46	1.05%
Carolina Bay Wetland	113.44	45.91	0.81%
Water	355.96	144.06	2.54%
Bottomland Hardwood/Pine	1,864.48	754.54	13.31%
Sandhill Scrub Oak/Pine	120.97	48.96	0.86%
Forb/Grassland	201.68	81.62	1.44%
Other—Disturbed Area	80.39	32.53	0.57%
Sandhill Pine/Scrub Oak	16.83	6.81	0.12%
Scrub/Shrub	107.45	43.48	0.77%
Totals:	14,005.25	5,667.85	100.00%

Table 2: Vegetation communities associated with Set-Aside Areas (after Workman and McLeod, 1990)

	Set-Aside Area	Total Acres	Total Hectares	Bottom-land Hardwoods	Depressional Wetlands	Streams & Ponds	Old Fields (OF) & Utility ROWs (UR)	Pine Forest	Sandhills	Swamp Forest	Upland Hardwoods
1	Field 3-412 & Ellenton Bay	579.78	234.64	X	X		OF;UR	X		X	X
2	UGA Old Lab Site	113.06	45.76				OF	X			X
3	Sandhills	66.17	26.78					X	X		
4	Loblolly Pine Stand	21.95	8.88					X			
5	Oak-Hickory Forest #1	84.50	34.20	X		X					X
6	Beech-Hardwood Forest	119.03	48.17	X		X					X
7	Mixed Swamp Forest	80.51	32.58	X						X	
8	Steel Creek Bay	81.61	33.03	X	X			X			X
9	Cypress Grove	22.52	9.11							X	
10	Risher Pond	36.33	14.70	X		X	UR	X			
11	Ruth Patrick-Meyers Branch	1,868.90	756.37	X		X	UR	X		X	X
12	Oak-Hickory Forest #2	459.96	186.15	X							X
13	Organic Soils	767.32	310.54	X		X					X
14	Mature Hardwood Forest	1,055.54	427.20	X		X		X			X
15	Whipple/OHER Study Site	183.64	74.32	X		X					X
16	Rainbow Bay Amphibian Reserve Area	87.47	35.40	X	X	X		X			
17	Craig's Pond & Sarracenia Bay	142.91	57.84		X			X	X		
18	Boiling Springs Natural Area	8.49	3.43	X							X
19	Ginger's Bay	38.53	15.59		X			X			X
20	Thunder Bay	82.21	33.26		X			X			
21	Flamingo Bay	165.81	67.10	X	X			X			X
22	Little Cypress Bay	68.39	27.68		X			X			X
23	Dry Bay	91.40	36.99	X	X			X			X
24	Cypress Bay	63.76	25.80	X	X			X			
25	Mona's Bay & Woodward Bay	156.71	63.42		X			X			
26	Sandhills Fire Site	45.41	18.38						X		
27	Road Six Bay	83.72	33.88	X	X			X			X
28	Field 3-409	14.22	5.75				OF	X			
29	Scrub Oak Natural Area	53.53	21.66	X		X			X		X
30	E.P. Odum Wetland (UTR/Tinker Creek)	7,361.87	2,979.39	X		X	UR	X			X
	TOTALS:	14,005.25	5,668.00	19	12	10	6	20	4	4	18

Table 3. Sensitive plant occurrences in Set-Aside Areas.

Common Name	Scientific Name	Federal Status	SC Heritage Trust Rankings and State Status	Set-Aside Number																													
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Milk pea (vetch)	*Astragalus villosus*	UN	UN;G4																														X
Sandhills milk vetch	*Astragalus michauxii*	UN	UN;R											X																			
Carolina bogmint	*Macbridea caroliniana*	C2	UN;G2						X					X																			
Chapman's sedge	*Carex chapmanii*	C2	UN;SP					X																									X
Nutmeg hickory	*Carya myristicaeformis*	UN	UN;G4;RC;S1																		X												
Pink tickseed	*Coreopsis rosea*	UN	UN;G3;RC;S2																					X									
Wild indigo	*Baptisia lanceolata*	UN	UN;G2;G3			X								X																			
Elliott's croton	*Croton elliottii*	3C	UN;G2;G3																	X					X			X					
Spathulate seedbox	*Lugwigia spathulata*	UN	UN;G2;G3																X	X													X
Bog-spice bush	*Lindera subcoriacea*	C2	UN;RC;G2											X	X																		X
Little bur-head	*Echinodorus tenellus*	C2	UN;G3;SL;S2																														
Swamp lobelia	*Lobelia boykinii*	C2	UN;G2																	X													
Collin's sedge	*Carex collinsii*	UN	UN;SP																	X													
Nestronia	*Nestronia umbellula*	UN	UN;G3;G4;S2					X						X			X																X
Epiphytic sedge	*Carex decomposita*	3C	UN;G3;G4																														
Sandhill seedbox	*Nolina georgiana*	UN	UN;G3;G5					X						X			X			X													X
Wolly bumelia	*Bumelia lanuginosa*	UN	UN																														
Green-fringed orchid	*Platanthera lacera*	UN	UN;G5;SL;S1					X											X														X
Awned meadow beauty	*Rhexia aristosa*	C2	UN;G3;S2																	X													
Oconee azalea	*Rhododendron flammeum*	UN	UN;G3;SL;S2												X		X																X
Drowned hornedrush	*Rhynchospora inumdata*	UN	UN;G3;G4																				X										
Beak-rush	*Rhynchospora tracyi*	UN	UN;R																	X			X					X					
Stalkless yellowcress	*Rorippa sessiliflora*	UN	UN;G5						X																								
Slender arrow-head	*Sagittaria isoetiformis*	UN	UN;G3;G5;SL;S2																	X			X					X					
Trepocarpus	*Trepocarpus aethusea*	UN	UN;R						X																								
Florida bladderwort	*Utricularia floridana*	UN	UN;G3;G5;SL;S1																				X					X					
Dwarf bladderwort	*Utricularia olivacea*	UN	UN;G4;SL;S1																	X													

UN = Unlisted; **RC** = Regional concern; **SL** = State concern; **R** = Rare; **SP** = Status pending; **C2** = Category 2 - Taxa where there is some evidence of vulnerability, but for which there are not enough data to support listing proposals; **3C** = Taxa that have proven to be more abundant or widespread than previously believed; **G2** = Imperiled globally due to worldwide rarity; **G3** = Either very rare throughout its range or found locally in a restricted range or having factors making it vulnerable; **G4** = Apparently secure globally, though it may be rare in parts of its range; **G5** = Demonstrably secure globally, though it may be rare in parts of its range; **S1** = Critically imperiled state-wide because of extreme rarity or because of some factors making it especially vulnerable to extirpation, or fewer than 6 occurrences in the state; **S2** = Imperiled state-wide because of rarity or factors making it vulnerable, or 7-20 occurrences in the state.

Sources: J.N. Knox and R.R. Sharitz, 1990; Hyatt, P.E., 1994; Federal Register, Feb., 1994; GIS coverage of endangered, threatened, and sensitive plants of the SRS--Savannah River Forest Station, 1996.

Table 4. Rare animal occurrences in Set-Aside Areas.

Common Name	Scientific Name	Federal Status	SC Heritage Trust Rankings and State Status	Set-Aside Number																													
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MOLLUSKS																																	
Mill Creek Elliptio	*Elliptio hepatica*	UN	UN;R					X																									X
Red mucket mussel	*Lampsilis radiata splendida*	UN	SC																														X
AMPHIBIANS																																	
Eastern tiger salamander	*Ambystoma t. tigrinum*	UN	UN;SC	X									X						X			X		X		X		X					
Bird-voiced treefrog	*Hyla avivoca*	UN	UN;SC							X	X		X																				
Carolina gopher frog	*Rana capito*	C2	UN	X									X						X			X		X		X							
Pig frog	*Rana grylio*	UN	UN;SC								X									X						X							
Pickerel frog	*Rana palustris*	UN	UN;SC	X									X																				
REPTILES																																	
American alligator	*Alligator mississippiensis*	FT(SA)	ST(SA)	X							X		X			X	X	X		X			X	X		X							X
Spotted turtle	*Clemmys guttata*	UN	UN;SC	X							X											X				X							
Southern hognose snake	*Heterodon simus*	C2	UN	X	X	X							X						X					X		X							
Eastern coral snake	*Micrurus f. fulvius*	UN	UN;SC		X																												
Florida green water snake	*Nerodia floridana*	UN	UN;SC	X																X						X		X					
Eastern slender glass lizard	*Ophisaurus attenuatus longicaudus*	UN	UN;SC										X						X														
Pine snake	*Pituophis m. melanoleucus*	C2	UN;SC	X	X	X					X		X																X				
Carolina swamp snake	*Seminatrix pygaea*	UN	UN;SC	X							X		X																				
Smooth earth snake	*Virginia valeriae*	UN	UN;SC																X							X							
Pine woods snake	*Rhadinaea flavilata*	UN	UN;R																							X							
Queen snake	*Regina septemvittata*	UN	UN																														X
BIRDS																																	
Red-cockaded woodpecker	*Picoides borealis*	FE	SE																														
Wood stork	*Mycteria americana*	FE	ST								X									X			X										
MAMMALS																																	
Star-nosed mole	*Condylura cristata*	UN	UN;SC	X									X						X			X											
Bobcat	*Lynx rufus*	UN	UN;SC	X				X	X	X			X						X			X											X
River otter	*Lutra canadensis*	UN	UN;SC						X	X																X							X
Southeastern big-eared bat	*Plecotus refinesquii*	C2	UN;G4																							X							

UN = Not listed; **FE** = Federally endangered; **FT** = Federally threatened; **SE** = State endangered; **ST** = State threatened; **SA** = Similarity of appearance; **SC** = State concern; **R** = Rare; **C2** = Category 2--Taxa where there is some evidence of vulnerability, but for which there are not enough data to support listing proposals; **G4** = Apparently secure globally, though it may be rare in parts of its range.

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AREA NO. 1
FIELD 3-412/ELLENTON BAY

SET-ASIDE LOCATION ON THE SRS:

The Field 3-412/Ellenton Bay Set-Aside Area is located in the western portion of the SRS within the Sunderland Pleistocene Terrace (Langley and Marter, 1973). Found in timber compartment 6, west of the former town of Ellenton, this Area is bordered by Upper Three Runs Creek (UTRC) on the north, by SRS Road A-4 on the east, and by Road 3-2 and a river water line right-of-way (ROW) on the west. Site Road 3 passes through this Area, as do five ROWs, including two South Carolina Electric and Gas (SCE&G) powerlines and three Site underground river water distribution lines (Fig. 1-2). This Area is the southernmost of the seven Set-Asides located on UTRC (Fig. 2).

SET-ASIDE DESCRIPTION:

Field 3-412 was one of the original ten SREL habitat reserve areas that were established on the SRS in the 1960's. Known as Reserve #8, this Area originally was 350 acres (141.7 ha) in size and was selected by early researchers as a site for studies of the flora and fauna of old-field communities where experimental manipulations were possible. Included in this reserve area was Ellenton Bay (Bay No. 176—see Schalles *et al.*, 1989 for numbering), a Carolina bay at which considerable research has been conducted on the wildlife that use these wetland communities. When the Set-Aside Program was expanded in 1989, this Set-Aside was enlarged to include additional Carolina bays and a bottomland hardwood connection to UTRC. This additional area enhanced this Set-Aside by providing multiple habitat types which include a continuum from floodplain forests to upland old-fields to Carolina bays. As a result of the expansion, this Set-Aside Area now includes 580 acres (234.6 ha).

The old-field habitat of this Area was under cultivation in 1951 when the SRS was established; corn, cotton, and peanuts were the last row crops planted in this field. In the early 1950's, Field 3-412 was selected for studies of old-field habitat undergoing successional change (Odum, 1960; and others). Located within the northeastern portion of this Area are four 1.09-acre (0.44 ha) enclosures. Constructed in 1965, these enclosures have been used for studies of the survivorship of and predation on irradiated cotton rats (Pelton, 1966; Weeks, 1969). This Area also contains three other enclosures (one 0.4-ha and two 0.8-ha) in which numerous studies have been conducted (Hillestad and Bennett, 1982). Some of these enclosures remain today but owl pens and circular enclosures were removed as part of an "ecolitter" cleanup conducted by SREL in 1993.

A range of vegetation communities exists within this Set-Aside, including swamp and bottomland hardwood forests, forb/grassland and scrub/shrub, and Carolina bay wetlands (Fig. 1-2). Although described by Hillestad and Bennett (1982) as being dominated by grasses and forbs, the Field 3-412/Ellenton Bay Set-Aside Area today is comprised of about 43% forb/grassland-scrub/shrub, with the remainder of the vegetation consisting of pines, mixed pine/hardwoods, floodplain forests, and Carolina bay wetlands. Workman and McLeod (1990) give general descriptions of these communities. During the 46 years of research that has been conducted within Field 3-412, some of the old-field areas periodically have been cultivated for experimental purposes. Loblolly pines (*Pinus taeda*) have had limited success invading the original old-fields and exist only in scattered clumps (Golley *et al.*, 1994). However, black cherries (*Prunus serotina*), hickories (*Carya* spp.), and oaks (*Quercus* spp.) have been more successful invaders (Pinder *et al.*, 1995).

Predominant in the landscape of this Area are numerous utility rights-of-way (ROW) associated with electric lines and the Site river water distribution system. These ROWs cross the Set-Aside at several locations and this Area thus is impacted by activities required to maintain the ROWs.

Ellenton Bay is a semi-permanent, open-water, herbaceous Carolina bay located within the southeastern portion of this Set-Aside (Figs. 1-1, 1-2). Carolina bays are shallow elliptical depressions found throughout the coastal plain of North Carolina, South Carolina, and Georgia. The origin of these geologic features continues to be the subject of much debate, although they have been studied for many years (Sharitz and Gibbons ,1982). Schalles *et al.* (1989) cataloged 194 Carolina bays on the SRS and a more recent study by Kirkman *et al.*(1996) recorded 299 depressional wetlands on the Site. All of these SRS bays share three features which are common to all Carolina bays: they generally are ovoid or elliptical, with smooth, unbroken margins; their long axes are oriented NW to SE and display remarkable parallelism; and they frequently are ringed by sand ridges that are particularly prominent along the southeast quadrant. The vegetation in SRS Carolina bays can be quite diverse, ranging from grassland and sedge to dense associations of hardwoods and shrubs to completely aquatic vegetation. The plant community of a particular Caroliona bay usually is dependent upon the amount of water present and the length of time water remains in the bay. The surrounding forest types and historical land-use, such as pasture or agriculture, have affected many of these bays.

Ellenton Bay is an acidic, softwater system dominated by aquatic and marsh vegetation. This 27.9-acre (11.3 ha) bay has an extended hydroperiod and remains inundated throughout most of the year, drying to small pools only during exceptionally dry summers (Gibbons and Coker, 1977). The predominant plants include water lilies and water shield in the open water, with switch cane, sedges, willow, and extensive areas of grass (*Panicum* spp.) along the edges (Hillestad and Bennett, 1982). The bay is ringed by dense blackberry thickets and some pine trees.

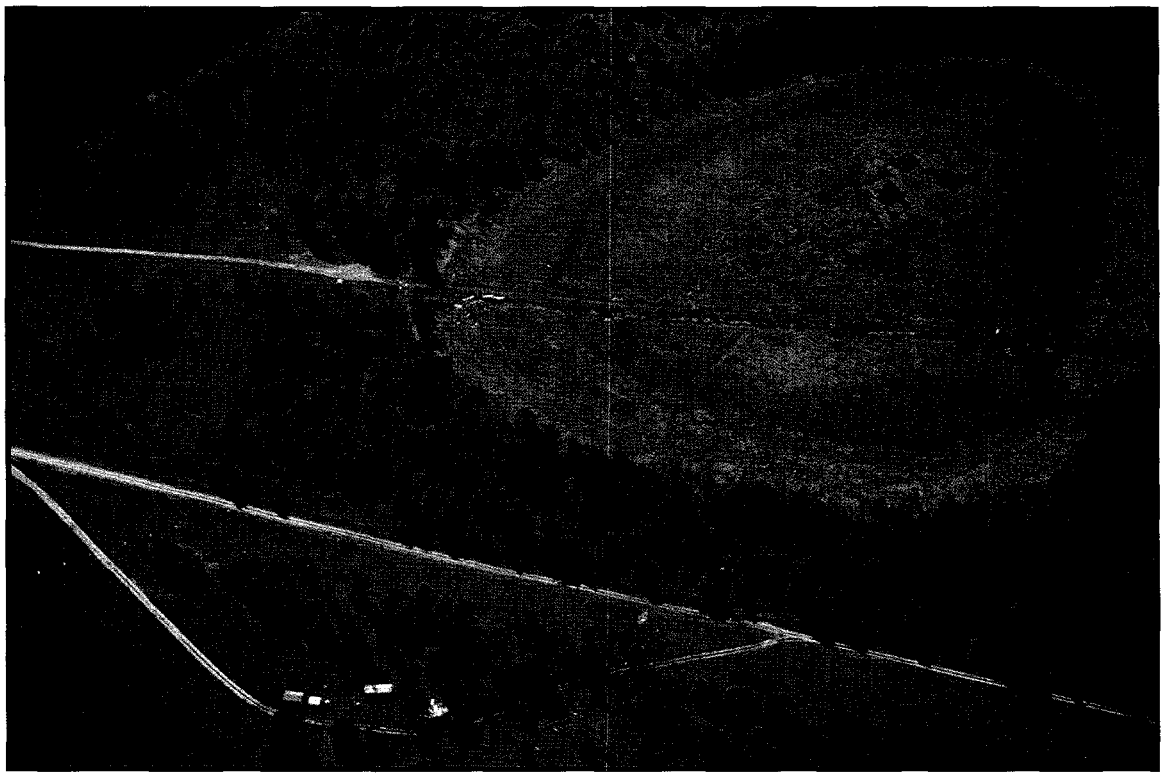

Figure 1-1. *Aerial view of the Field 3-412/Ellenton Bay Set-Aside Area.*

Table 1-1. Vegetation communties of the Field 3-412/Ellenton Bay Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	76.61	31.00	13.21%
Slash Pine	31.33	12.68	5.40%
Mixed Pine/Hardwood	57.59	23.31	9.93%
Upland Hardwood	40.12	16.24	6.92%
Bottomland Hardwood	67.07	27.14	11.57%
Mixed Swamp Forest	8.08	3.27	1.39%
Carolina Bay Wetland	19.18	7.76	3.31%
Water	15.09	6.11	2.60%
Bottomland Hardwood/Pine	12.06	4.88	2.08%
Forb/Grassland	145.34	58.82	25.07%
Other—Disturbed Area	1.44	0.58	0.25%
Scrub/Shrub	105.87	42.85	18.26%
Totals:	579.78	234.64	100.00%

A powerline ROW and associated road cross the northern quadrant of the bay and are gated on both ends to limit access. Ellenton Bay has a central internal ditch that runs parallel to the long axis of the bay. A remnant ditch on the northwestern rim of the bay still is evident and appears to have drained into Ellenton Bay in the past. A smaller internal ditch lies perpendicular to the central ditch at its southern end; old fence lines still are evident in this southern portion of the bay. These ditches predate the SRS whereas the road/ROW crossing through Ellenton Bay was constructed after establishment of the SRS, presumably in the early 1950's. A road embankment 5-6 m wide divides the bay, creating two completely separate aquatic areas. The water depth of Ellenton Bay varies considerably, with maximum depth at full pool being more than 2 m. Ellenton Bay dried almost completey in the drought years of 1955-56 and the summers of 1968, 1981, 1985, 1986, and 1987. In 1986 Ellenton Bay contained no standing water.

Ellenton Bay is the site of on-going research into the life histories of various reptile and amphibian species. A drift fence approximately 1300 m in length with 246 paired buckets located approximately 15 m apart completely encircles the bay (Gibbons, 1969, 1970; Gibbons and Bennett, 1974; Burke and Gibbons, 1995; and others). The buckets, used as pitfall traps, are sunk into the ground on the inside and the outside of this fence. The first partial drift fence at Ellenton Bay was constructed in 1968. The current drift fence has been moved three times to accomodate the variable water levels of Ellenton Bay. Other Set-Aside bays with drift fences are Risher Pond (Area No.10), Rainbow Bay (Area No. 16), Ginger's Bay (Area No. 19), Flamingo Bay (Area No. 21), and Dry Bay (Area No. 23). A laboratory facility known as the " E-Bay field lab" is located next to Ellenton Bay and is equipped with electricity. Research equipment is stored in a shed next to the powerline road that crosses the bay.

Three other Carolina bays also are present in the southernmost corner of this Set-Aside (Fig. 1-2). Woods Bay (Bay No. 175) is a small (1.5 ha), temporary, shrub-dominated Carolina bay located approximately 200 m south of Ellenton Bay. Woods Bay is surrounded by hardwoods and slash pines and dries completely every year. Animal populations are known to move between Woods Bay and Ellenton Bay. A ditch drains from Woods Bay into two adjacent Carolina bays (Bay Nos. 5020 and 5021). Pechmann (1995) studied amphibian ecology in field enclosures on the north side of Woods Bay and Poiani and Dixon (1995) conducted vegetation studies there.

The Field 3-412/Ellenton Bay Set-Aside Area has a 4.6-mile (7.4 km) boundary line that is marked with metal DOE Research Set-Aside Area signs. Only a few remnant, white-banded boundary trees remain from SREL's 1969 posting of this Area. Both Ellenton Bay and Woods Bay have been recommended for inclusion in the EPA's ADID project for Carolina bays (Lide and Davis, 1993; EPA,1994).

What This Set-Aside Represents:

The Field 3-412/Ellenton Bay Set-Aside Area was one of the areas on the SRS selected for ecological studies in the early 1950's by scientists from the University of Georgia. This Area became well-known as a result of E. P. Odum's research on old-field succession and other studies of energy flow through ecosystems. Odum (1960) observed the general pattern of plant succession on 600 reference fields. Productivity and soil measurements were made on 30 selected fields representing the eight major agriculture soil series and intensive studies were carried out on two of the study fields which represented the two physiographic subregions of the SRS and two of the major soil types. Field 3-412 and Field 9-111 (Loblolly Pine Stand, Area No. 4) were the two primary old-fields selected. Located on the lowland portions of the floodplain terrace, Field 3-412 has more fertile soils than Field 9-111, which is located on the Aiken Plateau, but succession was more advanced in Field 9-111 (Odum *et al.*, 1984; Friebaum, 1987). Field 3-409 (Area No. 28) historically was used as a comparison to Fields 3-412 and 9-111. Workman and McLeod (1990) estimated that 260 ha of old-field communities remain on the SRS; approximately 50% of these old-fields are found in the Field 3-412/Ellenton Bay Set-Aside Area.

This Area is one of the few Set-Asides in which manipulative studies are allowed. In the past, researchers have plowed areas of the old-field, planted various agricultural crops, and constructed numerous enclosures for studies of owl predation, small mammal population dynamics, and the movement of radioactive tracers through ecosystems. This Area is one of four Set-Asides which contain old-field communities, the others being the UGA Old Lab Site, the Loblolly Pine Stand, and Field 3-409 (Areas No. 2, 4, and 28, respectively). Area No. 2 also contains enclosures similar to those found in this Set-Aside.

Ellenton Bay was the site of early ecological research and this wetland remains the focus of current research by SREL scientists. Ellenton Bay is a relatively large bay and represents one of only 15 Carolina bays on the SRS that is larger than 10 acres in size. It represents an isolated, natural, relatively undisturbed freshwater habitat in which mosquito fish (*Gambusia affinis*) are known to be seasonally abundant (Bennett and McFarlane, 1983; Liu *et al.*, 1985). Ellenton Bay is one of five Set-Aside bays in which an amphibian-call recording device has been installed.

The Field 3-412/Ellenton Bay Set-Aside is a relatively disturbed area due in part to its history of manipulative research, the construction of various experimental enclosures, and because multiple utility ROWs and roads cross both the old-fields and Ellenton Bay. Despite these disturbances, this Area contains relatively large undisturbed areas of old-fields which have been experiencing vegetative succession for the last 46 years.

Table 1-2. Soils of the Field 3-412/Ellenton Bay Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Albany loamy sand, 0-6% slopes	AnB	19.78	8.01	3.41%
Blanton sand, 0-6% slopes	BaB	251.79	101.90	43.43%
Blanton sand, 6-10% slopes	BaC	12.10	4.90	2.09%
Chastain clay, frequently flooded	Ch	31.31	12.67	5.40%
Fluvaquents, frequently flooded	Fa	35.87	14.52	6.19%
Lakeland sand, 0-6% slopes	LaB	19.70	7.97	3.40%
Lucy sand, 0-2% slopes	LuA	36.76	14.88	6.34%
Ogeechee sandy loam, ponded	Og	16.66	6.74	2.87%
Orangeburg loamy sand, 0-2% slopes	OrA	88.74	35.91	15.31%
Troup sand, 0-6% slopes	TrB	28.53	11.54	4.92%
Troup sand, 6-10% slopes	TrC	12.84	5.19	2.21%
Udorthents, friable substratum	Uo	8.50	3.44	1.47%
Williman sand	Wm	17.22	6.97	2.97%
Totals:		579.77	234.64	100.00%

History:

When the SRS was established in 1951, Field 3-412 was in agricultural production and the drier portions of Ellenton Bay presumably were in pasture or were under cultivation. A peach orchard and two home sites were located on the periphery of the old-fields. An historical account of the former town of Ellenton contains information about the farming and land-use practices in and around this Set-Aside (Browder and Brooks, 1996). The origins of the SRS Set-Aside Program can be traced to this Set-Aside, where representative examples of old-field and Carolina bay habitats were the sites of initial land-use surveys and ecological inventories on the SRS. Portions of the original old-fields were re-established for experimental reasons in the 1960's and were cultivated, fertilized, and planted to row crops such as corn. In 1973, the South Carolina Wildlife and Marine Resource's Heritage Trust Program (now the SCDNR) inventoried this Set-Aside Area as part of a Smithsonian Coastal Plain Theme Study. When the Set-Aside Program was expanded in 1989, approximately 230 acres (93 ha) were added to this Set-Aside Area (SU-89-58-R Amendment 1) and approximately 8 acres (3.2 ha) were deleted from the original Reserve Area because the stands were planted in pines. In 1993, the wetland boundary of Ellenton Bay was delineated according to current federal wetland regulations and a GIS coverage was generated for this Set-Aside.

An interesting historical note is the discovery of a Clovis point in this Set-Aside in 1990 (Brooks, 1991). One of only three Clovis points found on the SRS, this Paleoindian Period (ca. 11,500-11,000 B.P.) artifact was found adjacent to the UTRC floodplain, downslope from the old-fields.

Set-Aside Plant Community Composition:

The Field 3-412/Ellenton Bay Set-Aside is a mosaic of different successional stages that currently is comprised of approximately 50% pine/hardwood and about 43% forb/grassland-scrub/shrub (Fig. 1-2; Table 1-1). The portion of this Area adjacent to UTRC consists of bottomland hardwood and mixed pine/hardwood, with some loblolly pine immediately bordering the creek. Forb/grassland and scrub/shrub communities predominate in the middle portion of this Area where utility ROWs cross the Set-Aside. The southern portion of this Area is comprised of the wetland communities associated with Ellenton Bay; the southernmost corner contains slash pine, mixed pine/hardwood, and bottomland hardwood/pine surrounding Woods Bay and Bay Nos. 5020 and 5021. The age of the UTRC floodplain vegetation dates to 1922, the pine and mixed/hardwood communities in around the old-fields and Ellenton Bay date to 1941, and the slash pine plantation in the Woods Bay portion was planted in 1957 (SRFS CISC stand database).

The old-field portion of this Area contains some perennial grasses, including panic grass and fall witch grass. Broom sedge also is present and dog fennel and horseweed are widely scattered throughout. Hawthorne, blackberry, and wild plum form dense thickets at some locations. Portions of the field are being reinvaded by pine (loblolly and longleaf). Reinvasion by tree species appears to be a function of the surrounding forest type, with pines invading along the edges of the bordering pine stands and hardwoods invading along the bordering hardwood stands. Black cherry is a common hardwood invader throughout all portions of the field. Prickly pear cactus is abundant in the field, reflecting the xeric conditions of this habitat (Hillestad and Bennett, 1982).

The vegetation of Ellenton Bay has been well described by Hodges (1985), Keough *et al.* (1990), and Kirkman (1992). There are five herbaceous community types or zones found in Ellenton Bay (Hodges, 1985). Ellenton Bay differs from Craig's Pond (Area No. 17) primarily in that portions of Ellenton Bay and the surrounding area were cultivated intensively and used as pasture prior to establishment of the SRS. Hodges (1985) suggested that this disturbance explains the almost perfectly concentric pattern of low diversity community types found in Ellenton bay. Contrary to this, a survey of Set-Aside Bays by Keough *et al.* (1990) found that Ellenton Bay had the highest species richness of the 12 Set-Aside bays and that Ellenton Bay had a pronounced hydrologic gradient. These zones of vegetation also were studied by Kormondy (1968).

Sensitive Flora and Fauna:

To date, no sensitive flora have been documented from this Set-Aside Area (Table 3). Several sensitive animal species are known to occur in this Set-Aside, including the eastern tiger salamander (*Ambystoma t. tigrinum*), the Carolina gopher frog (*Rana capito*), the pickerel frog (*R. palustris*), the American alligator (*Alligator mississippiensis*), the spotted turtle (*Clemmys guttata*), the southern hognose snake (*Heterodon simus*), the Florida green water snake (*Nerodia floridana*), the pine snake (*Pituophis m. melanoleucus*), the Carolina swamp snake (*Seminatrix pygaea*), the star-nosed mole (*Condylura cristata*), and the bobcat (*Lynx rufus*; Table 4).

Set-Aside Soils:

Thirteen soil series and phases comprise this Set-Aside, the majority (78%) of which are the upland, historically farmed soils of this Area's old-fields. These include the somewhat excessively drained sands of the Blanton (BaB) series (43.4%), the more loamy Lucy sands (6.3%), the fine-loamed Orangeburg series (15.3%), the well-drained sandy loams of the Troup (18.7%), and the droughty, excessively drained Lakeland sands found on Ellenton Bay's rim (6.2%; Table 1-2). The somewhat poorly

drained Albany loamy sands and the Blanton (BaC) series account for 5.5% of this Area's soils; these soils are associated with the UTRC floodplain and with the transitional low ridge and side slopes adjacent to the floodplain. Hydric soils account for 17% of this Area and are associated either with the UTRC floodplain or Carolina bays. Floodplain soils of UTRC are the poorly drained Chastain series and the frequently flooded Fluvaquent series. Ellenton Bay's peripherial soils are Fluvaquents while its interior basin is the ponded Ogeechee series (2.9%). Two Carolina bays in the tail section of this Set-Aside have the poorly drained Williman sands associated with the bay depressions (3%). A third bay has soils that have been disturbed; these are the Udorthents and they account for 1.5% of the soils of this Set-Aside. See Fig. 1-2 for a soils mapping of this Area and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

The Field 3-412/Ellenton Bay Set-Aside Area has been the site of many research studies, originating with E. P. Odum's investigations of old-field succession in the early 1950's. Many of these early studies used radioactive tracers to study organisms found in the old-field habitats and to evaluate energy flow within this community type (Odum and Golley, 1963). Other early research in this Area included ant and bird surveys (Van Pelt and Gentry, 1985; Norris, 1963). Over the course of more than four decades, the emphasis of the research conducted in this Set-Aside has been primarily on vegetation colonization, the fauna associated with plant succession, and studies of herpetofauna and waterfowl in Carolina bays. Experimental enclosures from early studies remain in this Area and some are still in use today. Ellenton Bay has been the site of numerous studies of the life histories of various species of amphibians and reptiles; recent research at this bay has focused on the use of terrestrial buffer areas by species of freshwater turtles (Burke and Gibbons, 1995). Nest boxes were erected 20 years ago at both Ellenton Bay and Woods Bay for studies of the reproductive biology of wood ducks (*Aix sponsa*; Fendley 1978) and still are in use (Hepp *et al.*, 1991; Kennamer *et al.*, 1990; and others). Some of the many studies conducted in this Set-Aside include investigations of:

- old-field succession;
- food webs and food chains in arthropod communities of old-fields;
- the use of radioactive tracers in studies of energy flow and food webs;
- life histories, population dynamics, and reproductive characteristics of freshwater turtles;
- population dynamics, food habits, and ecology of various species of small mammals;
- ecology and reproductive biology of wood ducks;
- temporal changes in spatial structure of harvester ant metapopulations in response to habitat changes;
- foraging activity and responses to predation of ant populations;
- predation on small mammals by owls;
- relationship between structure and function in old-field communities;
- effects of gamma radiation on the reproduction and survival of small mammals;
- behavior, life histories, and reproduction of salamanders.

Ellenton Bay has been the site of numerous studies of metapopulation dynamics in reptiles, particularly freshwater turtles (Burke *et al.*, 1994); early turtle studies have been summarized by Gibbons (1990b). Herpetofaunal biodiversity surveys presently are being conducted in this Set-Aside using coverboard arrays and automated amphibian-call recorders. These studies will enable researchers to determine more accurately the terrestrial requirements of aquatic vertebrates and define the extent of terrestrial buffer zones necessary to protect some of these species.

Other research in this Set-Aside has included

studies of the hydrology, water chemistry, soils, zooplankton, vegetation, and fish of Ellenton Bay. Ellenton Bay was one of 18 Carolina bays on the SRS that were surveyed as part of a 1979-1980 study of surface water chemistry (Schalles *et al.*, 1989). Recent ecotoxicology studies examined the effects of acid deposition and metals on frog tadpoles (Jung and Jagoe, 1995). Mahoney *et al.* (1990) and DeBiase and Taylor (1993) surveyed this Set-Aside as part of studies of the zooplankton of Carolina bays on the SRS. Permanent transects for vegetation surveys have been installed in this Set-Aside and a Steven's water level recorder-Type A has been installed in Ellenton Bay (Keough *et al.*, 1990). Snodgrass *et al.* (1996) surveyed this Set-Aside in a study of landscape-level patterns of the distribution and density of fish species in isolated wetlands. Soils information also has been compiled for Ellenton Bay (DeStevens, 1994).

Recent research conducted in this Area has focused on successional processes in old-field communities (Collins and Pinder, 1990; Golley *et al.*, 1994; Pinder *et al.*, 1995), the ecology and life histories of ground-dwelling spiders, the effects of landscape spatial structure on movement patterns in rodents, the effects of vegetation changes on the spatial dynamics of harvester ant metapopulations, and the responses of old-field plants to resources directly available or as imposed by perennial grasses. Recent research has continued studies initiated more than 40 years ago on insect communities in old-fields (Cross *et al.*, 1997). This Set-Aside also is included in a survey of historically used study areas on the SRS from which a terrestrial rapid bioassessment protocol (RBP) will be developed (Jack Hayes pers. comm.). Small mammals collected from Field 3-412 are being used as reference "controls" in comparisons with animals collected at nearby coal fly-ash basins in studies of the genotoxic effects of heavy metals.

To date, 250 publications and reports have resulted from research conducted in the Field 3-412/Ellenton Bay Set-Aside Area.

Historical/Current/Future Influences:

The research conducted in this Set-Aside since 1951 has included many manipulative studies. Animal enclosures were constructed in the old-field habitats and a drift fence completely encircles Ellenton Bay. Wood duck nest boxes were erected in both Ellenton Bay and Woods Bay. Field enclosures have been constructed adjacent to Woods Bay and field laboratory and storage facilities are maintained in this Area.

The Field 3-412/Ellenton Bay Set-Aside Area is impacted more than any other Set-Aside by routine Site activities related to maintenance of roads and utility ROWs that pass through this Area. These activities can include mowing, application of herbicides, and trimming of vegetation under power lines and on river water distribution lines. In the past, such activities have resulted in some negative impacts to on-going ecological studies and in herbicide applications to blackberry and plum bushes, which have high value as wildlife forage. An agreement exists between SCE&G and SREL that SREL will trim vegetation under the utility line that crosses Ellenton Bay. This Set-Aside also contains a waste unit which is listed in the SRS Federal Facilities Agreement, Appendix E. The Georgia Fields Unit (631-19G) consists of a single empty 50-gallon barrel of unknown origin which is located in the northern portion of this Set-Aside (Fig. 1-2); this waste unit currently is being characterized by WSRC-ER. There has been no prescribed fire in this Set-Aside.

While the focus of this Set-Aside is not necessarily related to the water quality of UTRC, it should be noted that because the floodplain portion of this Set-Aside is within UTRC management Region 3, potential impacts to the creek and floodplain could result from upstream Site operations. In Region 3, effluent discharges from SRS operations are limited to those defined in the DOE-SR Upper Three Runs Creek Stream Management Policy, which states that "Additional low-impact effluents may be

discharged into Region 3, within regulatory limits. Every effort will be made to ensure that no significant adverse impact occurs to stream biota or water quality. The goal in managing Region 3 is to protect the aquatic community while allowing limited and controlled plant use of this segment." (DOE-SROO Stream Management Policy--Upper Three Runs; 9/11/95).

SRS Patrol Indexes: **I**-5,6 **J**-5,6 **K**-5,6

Site-Use Permits:

Experiment No. 1136d (1971-1974) Experimental population genetics of mice; P. Ramsey; SREL.

Experiment No. 1146 (1971-1974) The role of dispersal in the population dynamics of *Sigmodon*; R. Gardner; SREL.

SU-75-23-R Trapping line around Ellenton Bay at Field 3-412; Gibbons; SREL.

SU-76-12-R Pollen succession in sediments from Carolina bay; Smith and Thompson; SREL and USC-Aiken.

SU-76-100-R Wood duck nest box study; Brisbin; SREL.

SU-76-112-R Environmental factors influencing dispersal in small mammals; Smith; SREL.

SU-77-41-R Species assessment in selected habitats; Gibbons; SREL.

SU-77-42-R Trapping line around Ellenton Bay; Gibbons; SREL.

SU-77-56-R Vertebrate assessment of selected aquatic habitats; Gibbons; SREL.

SU-78-18-O Move SREL trailer; Gibbons, Smith, and Nestor; SREL.

SU-78-61-R Historic inputs of airborne pollutants to Carolina Bays; Alberts and Proctor; SREL.

SU-79-47-R Terrestrial activity of mole salamander; Semlitsch and Gibbons; SREL.

SU-79-74-R Baseline studies of flora and fauna; Janecek and Smith; SREL.

SU-80-23-R (and Amendment 2) Life history strategy of the yellow-bellied pond slider; Gibbons; SREL.

SU-83-12-R Study of purple martins; Brisbin; SREL.

SU-84-12-R Consequences of dispersal in *Sigmodon hispidis*; Smith and Novak; SREL.

SU-86-04-R Bottomland hardwood ecosystem processes study; Sharitz and McLeod; SREL.

SU-86-38-R Gene flow and recruitment in moles; Smith; SREL.

SU-87-13-R Determination of maternity of juvenile moles; Smith and Hartman; SREL.

SU-89-58-R (Amendment 1) Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-89-64-R Carolina bay hydrology; Pinder and Lide; SREL.

SU-92-36-R Influence of precipitation on Carolina bays; Jagoe; SREL.

SU-93-17-O Maintenance of site utility right-of-ways; McCormick; WSRC-F&S.

SU-96-03-R Ecology and life histories of ground-dwelling spiders; Taylor and Draney; SREL.

SU-96-69-O Site characterization of the Georgia Fields Unit (631-19G); Stasie; WSRC-E&CSD.

SU-97-09-R Response of old-field plants to plant and soil resource density and pattern; Collins; SREL.

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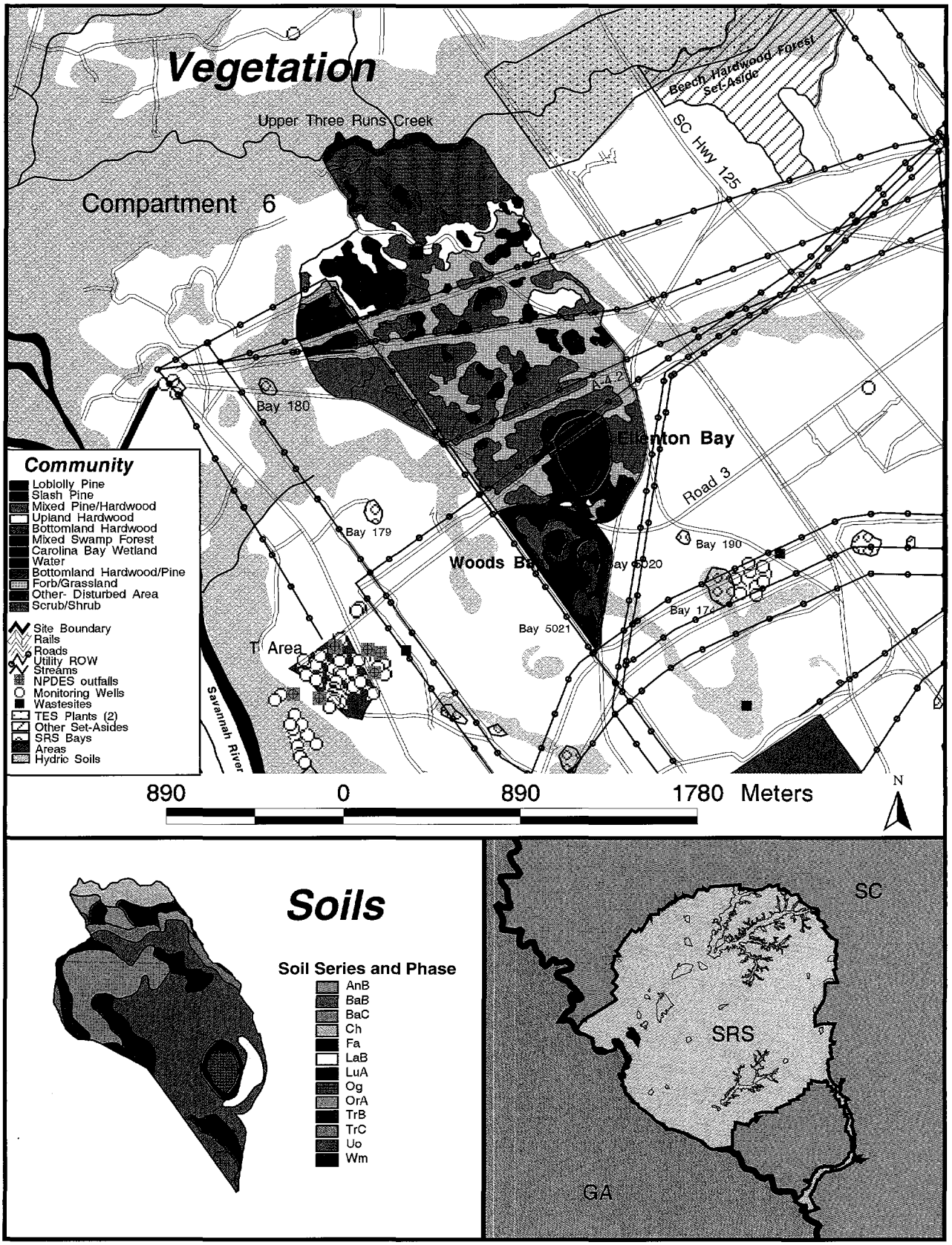

Figure 1-2. *Plant communities and soils associated with the Field 3-412/Ellenton Bay Set-Aside Area.*

AREA NO. 2
UGA OLD LABORATORY SITE

SET-ASIDE LOCATION ON THE SRS:

The University of Georgia (UGA) Old Laboratory Site Set-Aside is located in the northern portion of the SRS on the Aiken Plateau (Langley and Marter, 1973). Found in timber compartment 19 south of the Aiken barricade, this Set-Aside is bordered by SRS Road 2 and Tyler Bridge Road (Road 2-1) and is adjacent to the old SREL headquarters and the present-day facilities of the Savannah River Forest Station (SRFS), the University of South Carolina's South Carolina Institute of Archaeology and Anthropology, and the South Carolina Department of Natural Resources (SCDNR; Figs. 2 and 2-1).

SET-ASIDE DESCRIPTION:

This 113.1-acre (45.8 ha) Set-Aside Area is adjacent to the former location of the Savannah River Ecology Laboratory. Prior to the establishment of SREL's habitat reserve program, this Area was selected for studies of the plants and animals in old-field communities where experimental manipulations were allowed. Because of its proximity to SREL facilities, researchers conducted many field studies in this Area, as well as in other old-field habitats on the SRS. When the Set-Aside habitat reserve program was formalized in 1968, this Area became Reserve #10. This Area originally contained two experimental old-fields which totaled 62.8 acres (24.5 ha) and had margins consisting of hardwood hedgerows. A strip of pines 100 feet wide was planted along Road 2-1 as a buffer for these study areas. These old-field areas still contain abandoned animal-holding facilities, including pens for birds of prey, kennels for larger carnivores, and waterfowl pens and bass ponds which received a continuous flow of well water. While the kennels still are maintained and used, the enclosures are in disrepair. The western portion of these fields where the enclosures are located has become a mixed pine community with forbs and grasses; surrounding vegetation is hardwood hedgerows and longleaf pine (*Pinus palustris*) plantations. Plot markers, drift fences with buckets, litterfall collectors, and lysimeters were installed in these pine plantations for research purposes. In addition to the experimental old-fields, a 9-acre (3.6 ha) supplemental food field in the northwest portion of this Set-Aside has been cultivated periodically. A drift fence erected around this area has been removed and this region now is characterized by maturing mixed pines. Also within this Set-Aside are the remains of an abandoned radioecology research facility which contained a 1.5-acre (0.6 ha) experimental radiation field. This abandoned facility is located next to equipment storage facilities of the SCDNR and SRFS and is surrounded by an 8-ft high earthen berm and old fencing. Within the berm is a concrete block bunker that once housed a cesium-137 source; an attached control house allowed for remote manipulation of the source.

Presently, approximately 60% of this Set-Aside is in maturing loblolly (*P. taeda*) and longleaf pine saw timber. A small stand of introduced sand pine (*P. clausa*) is located in the southeast corner of this Set-Aside, adjacent to a parking lot. The 2-mile (3.2 km) boundary line of this Area is marked with metal DOE Research Set-Aside Area signs and white-blazed trees. A few remnant, white-banded boundary trees remain from SREL's 1969 posting of this Area.

WHAT THIS SET-ASIDE REPRESENTS:

This Set-Aside is one of the original ten SREL habitat reserves and was selected to complement the old-field habitat/plant succession studies at Field 3-412 (Area No. 1; Reserve #8) and Field 3-409 (Area No. 28). This relatively disturbed

Table 2-1. Vegetation communities of the UGA Old Laboratory Site Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Mixed Pine Field	16.78	6.79	14.84%
Loblolly Pine	1.48	0.60	1.31%
Longleaf Pine	66.19	26.79	58.54%
Sand Pine	0.36	0.15	0.32%
Mixed Pine/Hardwood	1.33	0.54	1.18%
Upland Hardwood	18.90	7.65	16.72%
Forb/Grassland	6.88	2.78	6.09%
Other—Disturbed Area	1.14	0.46	1.01%
Totals:	113.06	45.76	100.00%

Set-Aside provided field study sites where manipulative research could be carried out on old-fields and radioecology experiments could be conducted *in situ*. This Set-Aside represents old-field communities that have margins of hardwood hedgerows and plantation pines, neither of which are found in Field 3-412. In addition, this is the only Set-Aside not associated with Carolina bays or ponds that is predominantly in plantation pines, in particular, longleaf pine. This Set-Aside contains a maintained, fenced animal holding and equipment storage facility as well as abandoned animal holding enclosures similar to those in Field 3-412. As a Set-Aside, this Area is important because of the ecological research that was and continues to be conducted there. SREL has removed most historical research debris from this Set-Aside and all that remains are permanently installed enclosures. In 1993, the SRFS began using this Area as a field study site for environmental education programs.

History:

Prior to the establishment of the SRS in 1951, the majority of this Set-Aside was in agricultural fields, except for two hedgerows and a small ditched depression. Corn and cotton were the last crops planted in these fields. Surrounding areas included a significant amount of cut-over timberland and/or abandoned farm land. In 1961, the AEC established a permanent field laboratory next to this Set-Aside—the University of Georgia's Laboratory of Radiation Ecology. Two Army barracks were converted into laboratory space for UGA researchers; much of their research focused on radiation ecology. In 1963-1964, an irradiator containing 10,000 Curies of cesium-137 was constructed and placed into operation in the radiation experiment field within this Set-Aside. This was designed to be fixed or portable for irradiating ecosystems *in situ*. In 1973, the South Carolina Wildlife and Marine Resource's Heritage Trust Program (now the SCDNR) inventoried this Set-Aside Area as part of a Smithsonian Coastal Plain Theme Study.

In 1997, the Set-Aside Task Group transferred a two-acre (0.8 ha) portion of this Set-Aside to the SRFS for development of an environmental sciences field station for Historically Black Colleges and Universities (HBCU; Fig. 2-1; SU-90-22-C Amend. 2). The GIS coverage for this Set-Aside will be amended to reflect this acreage deletion.

Table 2-2. Soils of the UGA Old Laboratory Site Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	8.47	3.43	7.49%
Dothan sand, 0-2% slopes	DoA	16.99	6.88	15.03%
Dothan sand, 2-6% slopes	DoB	10.27	4.15	9.08%
Fuquay sand, 0-2% slopes	FuA	4.22	1.71	3.73%
Fuquay sand, 2-6% slopes	FuB	73.10	29.58	64.65%
Udorthents-urban land complex, gently sloping	Ur	0.03	0.01	0.03%
Totals:		113.07	45.76	100.00%

Set-Aside Plant Community Composition:

Eight plant communities comprise this Set-Aside, half of which are associated with pines of various species (Fig. 2-1). The old-field portions of this Area presently are in volunteer mixed pines (14.8%); the remainder of the Area is in plantation longleaf (58.4%), loblolly (1.3%), and sand pines (0.3%). There is a small component (1.2%) of mixed pine/hardwoods next to the site of the HBCU education facility and an upland hardwood component (16.7%) composed of hedgerows on the old-field margins. Forbs and grasses account for 6.2% and represent the remnant vegetation of the old-field community. The disturbed irradiated field and the kennel areas account for 1% of this Area (Table 2-1). The plantation longleaf pines were planted in 1962 (SRFS CISC stand database).

Sensitive Flora and Fauna:

Three reptile species of special concern are found in this Set-Aside, including the southern hognose snake (*Heterodon simus*), the eastern coral snake (*Micrurus f. fulvius*), and the pine snake (*Pituophis m. melanoleucus*; Table 4). There have been no sensitive plants documented from this Set-Aside; however the pink tickseed (*Coreopsis rosea*) was reported to be located nearby in Karen's Pond (Knox and Sharitz, 1990).

Set-Aside Soils:

The soil series found in this Set-Aside include the traditionally farmed soils of the Blanton, Dothan, and Fuquay series. These sandy, loamy soils range from the somewhat excessively well-drained to the well-drained, slowly permeable soils. They account for nearly 100% of this Area's soils; disturbed Udorthents are present in fractional amounts. See Fig. 2-1 for a soils mapping and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

This Set-Aside Area was one of the original areas set aside for ecological research on the SRS and many historical field studies were conducted here. The emphasis of this research has been on studies of old-field succession, small mammal populations, radioecology, the effects of radiation on plants and animals, and observations of animal behavior (Golley, 1965a, 1965b; and others). In the early years, UGA scientists and students used this Area for pilot projects that were then expanded to larger-scale field studies, many designed to complement research conducted in Field 3-412. These early field studies included investigations of the structure and function of old-field communities, the effect of gamma radiation on ecological systems, and the use of radionuclide tracers to measure ecological function (Golley and Loyal, 1965). Baseline

information was gathered from this Area by conducting observations and manipulations to determine the responses of ecosystems to environmental stresses such as plowing, drought, fire, and radiation. An irradiator was constructed in this Area to study the response of vegetation and animals to radiation under field conditions (Golley *et al.*, 1965b, 1965d; McCormick and Golley, 1966; Golley and Gentry,1969). Researchers also used radio-tracers to study relationships of organisms in food chains (Rose, 1969, 1979; Rose *et al.*, 1969). Enclosures were built to facilitate the study of predator-prey relationships and responses of small mammals to manipulations of habitat and food. These enclosures also were used for population studies of small mammals, particularly rodents (Gentry, 1968; Smith *et al.*, 1969; Wiegert, 1972). Studies of barn owl and screech owl predation on house and old field mice also were conducted in this Area (Kaufman, 1973, 1974a, 1974b; Kaufman and Wagner, 1973) and comparisons were made of the differential vulnerability to predation of two color phenotypes of mice on the soils of this reserve area and the soils of the old-field habitat in Field 3-412. Feral swine were maintained in one 0.8 ha enclosure; these swine represented both the SRS feral strain and a strain of feral swine from Georgia's Ossabaw Island (Brisbin *et al.*, 1977a, 1977b; Mayer and Brisbin, 1986). In addition, the old-field communities in this Area have been the site of research examining old-field succession and competitive strategies of old-field plants (Pinder, 1977; Odum *et al.*, 1984). Studies of elemental uptake by old-field plants (Haines, 1977, 1978) and the effects of acid precipitation on trees (Haines and Carlson, 1989) also were conducted. More recent research in this Set-Aside includes ecological studies of ground-dwelling spiders and the response of old-field plants to plant and soil resource density and pattern.

Other historical research was conducted nearby in a temporary pond named Karen's Pond, located across Tyler Bridge Road from this Set-Aside (Gibbons and Bennett, 1974). This pond actually is an old borrow pit that held water periodically and should be not confused with SRS Bay No. 184, which is south of Karen's Pond. There was some confusion as to whether or not this pond was part of the original Set-Aside reserve; 1960's photographs, maps, and correspondence included Karen's Pond as part of the original habitat reserve area. Boundary markings identifying it as part of the area were found in 1990 when the Set-Aside boundary was refurbished. However, Hillestad and Bennett (1982) did not include this pond within the Set-Aside, so it was not recognized as part of the Set-Aside Area when the Set-Aside Program expanded in 1989.

To date there are 46 publications and reports associated with this Aet-Aside Area.

Historical/Current/Future Influences:

Portions of this Set-Aside Area are adjacent to offices, chemical storage buildings, and equipment maintenance and storage facilities of SRS contractors. Primary Site Road 2 and a secondary gravel road border parts of this Set-Aside. Manipulative studies have been conducted within this Set-Aside Area and animal-holding facilities and an earthen berm for irradiation experiments were constructed here. Free-ranging populations of introduced fowl were studied in this Set-Aside at one time. An isolated, accidental fire occurred in an old-field portion of this Area in the 1980's. According to the SRFS historical burn GIS database, a portion of this Set-Aside was subjected to a prescribed fire in 1992.

SRS Patrol Index: C-17

Site-Use Permits:

Experiment No: 1145 (1971-1974) Injection of Zn65 into *Sigmodon* females; Smith and Gardner; SREL.

Experiment No: 1149 (1973) Effects of low concentrations of mercury on a predator-prey relationship; Kania; SREL.

Experiment No: 1203 (1966-indefinite) Behavior study

of southern harvester ant; Gentry; SREL.

Experiment No: 1241a (1971-1972) Nutrient filtration efficiencies of successional vegetation; Haines; SREL.

Experiment No: 1250 (1972-1974) Nutrient filtration efficiences of successional root networks; Haines and Beyers; SREL.

Experiment No: 1263 (1971-1974) Old field plant community structure; Pinder; SREL.

Experiment No: 7206 Reference collection of animal skeletons; Coombs; USA-Columbia, Archaeology.

SU-75-41-R Radiocesium levels in black vultures (*Coragyps atratus*) and turkey vultures (*Carthartes aura*); Vargo; SREL.

SU-75-55-R Resistance of vegetation to acid rain; Harris; SREL.

SU-76-08-R Resistance of vegetation to acid rain; Haines; SREL.

SU-76-100-R (and Amendments 1- 4 and Modification 2) SREL Wood duck box study; Brisbin and Kennamer; SREL.

SU-77-47-R Studies of feral bantam chickens; Brisbin; SREL.

SU-79-24-R Release of sand pine stand; Brendemuehl and McNab; SEFES and SRFS.

SU-79-74-R Baseline studies of flora and fauna; Janecek and Smith; SREL.

SU-79-74-R (and Amendment 2) Baseline studies of flora and fauna; Janecek and Smith; SREL.

SU-80-58-R Effects of flooding and sedimentation on *Ludwigia leptocarpa*; Sharitz; SREL.

SU-83-12-R Study of purple martins; Brisbin; SREL.

SU-86-45-R Resuspension of soil to agriculture plant species; Pinder; SREL.

SU-87-64-R Registration of locations of rare or threatened plant populations—SC status; Roecker and Sharitz; SRFS and SREL.

SU-90-22-C (Amendment 2) Construction site for new SRFS headquarters building; Smith; SRFS.

SU-93-48-F (Amendment 2) Natural Resource/ Environmental Education Program (NREEP); Blake and Lenzo; SRFS.

SU-96-03-R Ecology and life history variation of ground-dwelling spiders; Taylor and Draney; SREL.

SU-97-09-R Response of oldfield plants to plant and soil resource density and pattern; Collins; SREL.

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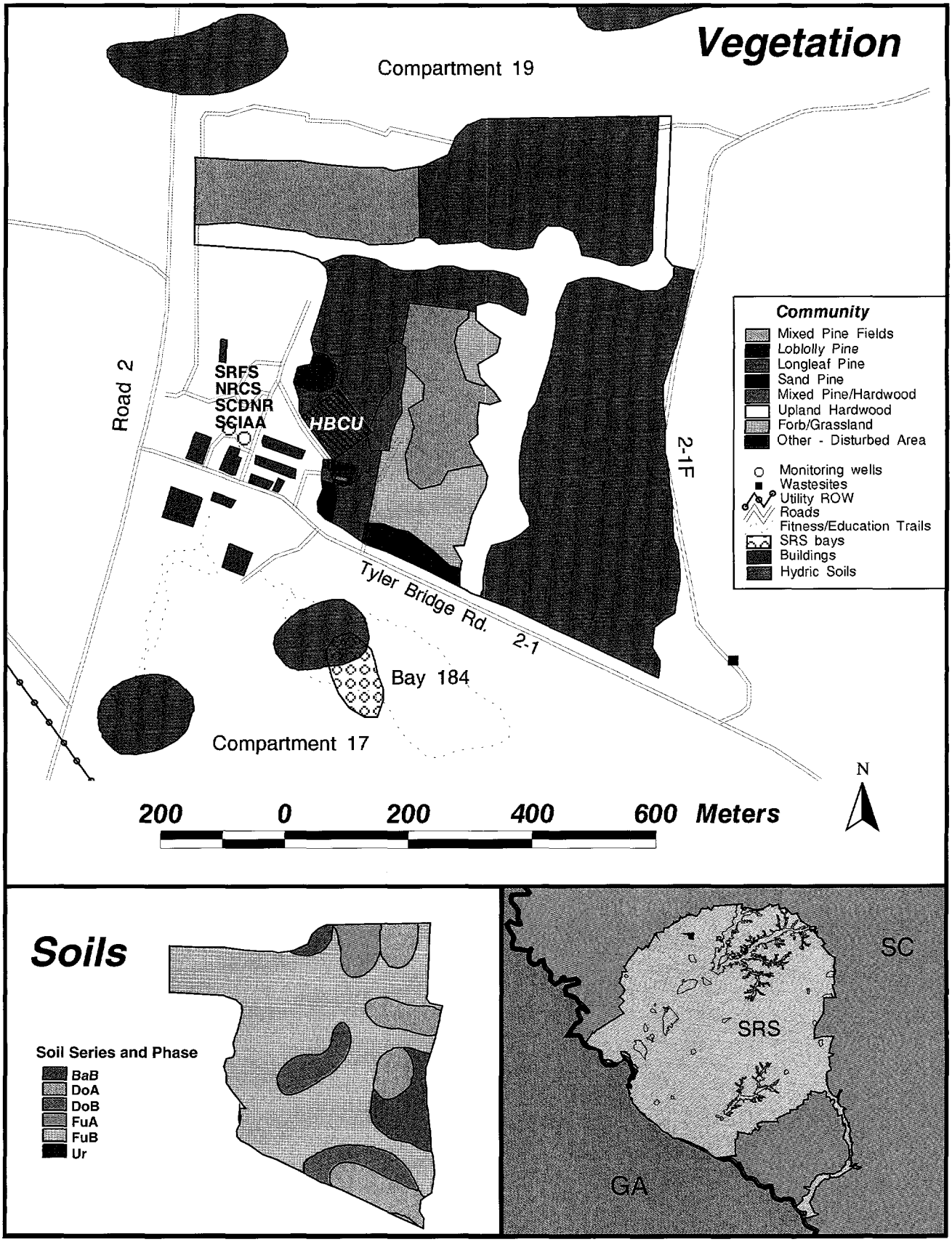

Figure 2-1. *Plant communities and soils associated with the UGA Old Lab Site Set-Aside Area.*

AREA NO. 3
SANDHILLS

SET-ASIDE LOCATION ON THE SRS:

The Sandhills Set-Aside Area is located in the northwest quadrant of the SRS, on the Aiken Plateau (Langley and Marter, 1973). Found in timber compartment 11 south of B Area and adjacent to the Three Rivers Authority Regional Landfill property, it is bordered by Road 2, Bush Road (C-1), and Road 2-14 (Figs. 2 and 3-2).

SET-ASIDE DESCRIPTION:

This relatively undisturbed Set-Aside is one of the original ten SREL habitat reserves (Reserve #1) which presently is a forest dominated by turkey oak (*Quercus laevis*) and longleaf pine (*Pinus palustris;* Fig. 3-1). It is 66.2 acres (26.8 ha) in size and has a boundary length of 1.4 miles (2.2 km). This mixed species sandhills habitat is situated on infertile, poor-to-marginally productive soils, a habitat type that once was common to the Aiken Plateau as well as the SRS. However, forest type conversion to longleaf pine plantations has reduced this community type to isolated patches within the SRS landscape. Estimates of the amount of this habitat type remaining on the SRS range from 750+ acres (303+ ha; SRFS CISC data) to approximately 1,970 acres (800 ha; Workman and McLeod, 1990). The boundary of this Set-Aside Area is marked with SREL Research Area and DOE Research Set-Aside Area signs.

WHAT THIS SET-ASIDE REPRESENTS:

SREL selected this Area in 1968 to represent the xeric conditions typical of sandhills habitats, which are remnants of ancient beach dunes. One of three sandhills communities in the Set-Aside Program, this Area and the Scrub Oak Natural Area (Area No. 29) serve as control replicates to the Sandhills Fire Site (Area No. 26), where fire ecology studies are conducted on sandhills communities.

HISTORY:

Prior to the acquisition of the SRS in 1951, agriculture and timber production were the primary land uses within and surrounding this Set-Aside. It appears that these marginal, well-drained soils either had been abandoned for agricultural use in the early 1900's or had undergone logging prior to that time. Photographs from 1951 show portions of the Sandhills Set-Aside Area being logged. Ongoing archaeological investigations at the nearby George Bush Site, a nineteenth-century plantation, may reveal some historic land-use patterns of the Sandhills Area.

SET-ASIDE PLANT COMMUNITY COMPOSITION:

This Set-Aside was subdivided into three community types primarily because it does not appear to be homogeneously scrub oak/pine (Fig. 3-2). This Area is composed of mixed scrub oak/pine (65.1%), longleaf pine (31.1%), and mixed pine/hardwood (3.8%; Table 3-1), with the upland hardwood species being water oak (*Quercus nigra*) and willow oak (*Q. phellos*). Dominant canopy species of this Set-Aside are post oak (*Q. stellata*), turkey oak (*Q. laevis*), scrub post oak (*Q. margaretta*), blue jack oak (*Q. incana*), and longleaf pine. While this Set-Aside is typical floristically of sandhills habitat in species content, it is somewhat atypical with respect to the age structure of the trees (Hillestad and Bennett, 1982). The longleaf pines at this site are young in comparison to the oak species and appear to be naturally seeded volunteers that have come in following timbering activities in the early 1950's. The oldest age class for the present overstory vegetation in this Area is unknown (SRFS CISC stand database). In 1973,

Table 3-1: Vegetation communities of the Sandhills Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Longleaf Pine	20.58	8.33	31.10%
Mixed Pine/Hardwood	2.51	1.02	3.79%
Sandhill Scrub Oak/Pine	43.08	17.43	65.11%
Totals:	66.17	26.78	100.00%

the South Carolina Wildlife and Marine Resource's Heritage Trust Program (now the SCDNR) inventoried the Sandhills Set-Aside Area as part of a Smithsonian Coastal Plain Theme Study.

Sensitive Flora and Fauna:

Two reptile species of special concern have been collected in this Area—the southern hognose snake (*Heterodon simus*) and the pine snake (*Pituophis m. melanoleucus*; Table 4). Yellow wild indigo (*Baptisia lanceolata*), a rare plant, has been reported from this Set-Aside (SU-92-41-R; Table 3).

Set-Aside Soils:

The Sandhills Set-Aside Area is comprised of three droughty soil series: the well-drained Troup series (34.5%), the somewhat excessively drained Blanton series (9.2%), and the excessively well-drained Lakeland series (56.3%; Table 3-2). See Fig. 3-2 for soils mapping of this Set-Aside and Appendix 3 for a soils description.

Figure 3-1. *Typical vegetation of the Sandhills Set-Aside Area.*

Table 3-2: Soils of the Sandhills Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	6.08	2.46	9.19%
Lakeland sand, 0-6% slopes	LaB	37.24	15.07	56.27%
Troup sand, 0-6% slopes	TrB	22.85	9.25	34.53%
Totals:		66.17	26.78	100.00%

Research Associated With This Set-Aside:

Because the Sandhills Set-Aside Area provides excellent habitat for many herpetofauna and insect species which are adapted to xeric conditions, research emphasis has been primarily on the herpetofauna and insects that inhabit this plant community. Reptile collecting and monitoring structures installed in this Set-Aside include partial drift fences and temporary artificial lizard refuge sites. Table 3-3 includes species of amphibians and reptiles documented from this Set-Aside; this list was compiled from researcher's surveys and species assessments for representative SRS habitats,which included the Sandhills Set-Aside. In addition, a list of families of insects of the Order Diptera was compiled from this Set-Aside (SREL Set-Aside files). A list of ant species was compiled from habitat surveys conducted in this Set-Aside by Van Pelt and Gentry (1985); Gentry and Whitford (1982) used this Area as a habitat type to estimate densities of termites in dead wood.

Research on the vegetation of this Area also has been conducted. As a comparison and control to the fire-maintained sandhills community of Area No. 26, this Set-Aside should help researchers determine the spatial and temporal dynamics of an undisturbed (unburned) community. Also, Vaitkus and McLeod (1995) applied small-scale additions of water and nutrients to two species of sandhills oaks to determine both photosynthetic and water use efficiency responses. To date, 12 publications and reports can be associated with this Set-Aside.

Historical/Current/Future Influences:

On September 3, 1978, a lightning-struck fire occurred at this Area, burning approximately 7.8 ha of the reserve. Fire breaks were constructed throughout the Area and still are in evidence today. A SRFS sanitation cut followed the burn and ten cords of pine pulpwood were salvaged. On October 6, 1978, the logging slash was sprayed with a 1% solution of lindane for control of ips and black turpentine beetles (Hillestad and Bennet, 1982). In 1992, an accidental fire from SRFS prescribed burning occurred on approximately one acre in the southeastern corner but was contained by a plowed line through the Area. There is a high potential for continued habitat fragmentation and isolation of this Area due to development of adjacent lands; the 1,200-acre (486 ha) Three Rivers Authority Regional Landfill is adjacent to this Set-Aside on Road 2-14.

SRS Patrol Indexes: **G**-8,9 **H**-9

Site-Use Permits:

Experiment No. 1241b (1971-1972) Nutrient filtration efficiencies of successional vegetation; Haines; SREL.

SU-77-41-R Species assessments in selected habitats; Gibbons; SREL.

SU-79-74-R Baseline studies of flora and fauna; Janecek and Smith; SREL.

SU-85-13-R Survey of terrestrial vertebrates; Gibbons and Knight; SREL.

SU-92-41-R Ecology of yellow wild indigo (*Baptista lanceolata*); Sharitz and Schnable; SREL.

Table 3-3. Amphibians and reptiles and documented from the Sandhills Set-Aside Area.

Common Name	Scientific Name
Salamanders	
Slimy salamander	*Plethodon glutinosus* (complex)
Frogs and Toads	
Bullfrog	*Rana catesbeiana*
Eastern narrowmouth toad	*Gastrophryne carolinensis*
Eastern spadefoot toad	*Scaphiophus holbrookii*
Southern toad	*Bufo terrestris*
Lizards and Skinks	
Green anole	*Anolis carolinensis*
Five-lined skink	*Eumeces fasciatus*
Southeastern five-lined skink	*Eumeces inexpectatus*
Broadheaded skink	*Eumeces laticeps*
Eastern fence lizard	*Sceloporus undulatus*
Ground skink	*Scincella lateralis*
Snakes	
Southern copperhead	*Agkistrodon contortrix*
Scarlet snake	*Cemophora coccinea*
Six-lined raceruner	*Cnemidophorus sexlineatus*
Northern black racer	*Coluber constrictor*
Canebrake rattlesnake	*Crotalus horridus*
Southern ringneck snake	*Diadophis punctatus*
Eastern hognose snake	*Heterodon platirhinos*
Southern hognose snake	*Heterodon simus*
Eastern kingsnake	*Lampropeltis getula*
Scarlet kingsnake	*Lampropeltis triangulum*
Rough green snake	*Opheodrys aestivus*
Pine snake	*Pituophis m. melanoleucus*
Carolina pigmy rattlesnake	*Sistrurus miliarius*
Redbellied snake	*Storeria occipitomaculata*
Southeastern crowned snake	*Tantilla coronata*
Rough earth snake	*Virginia striatula*
Turtles	
Eastern box turtle	*Terrapene carolina*

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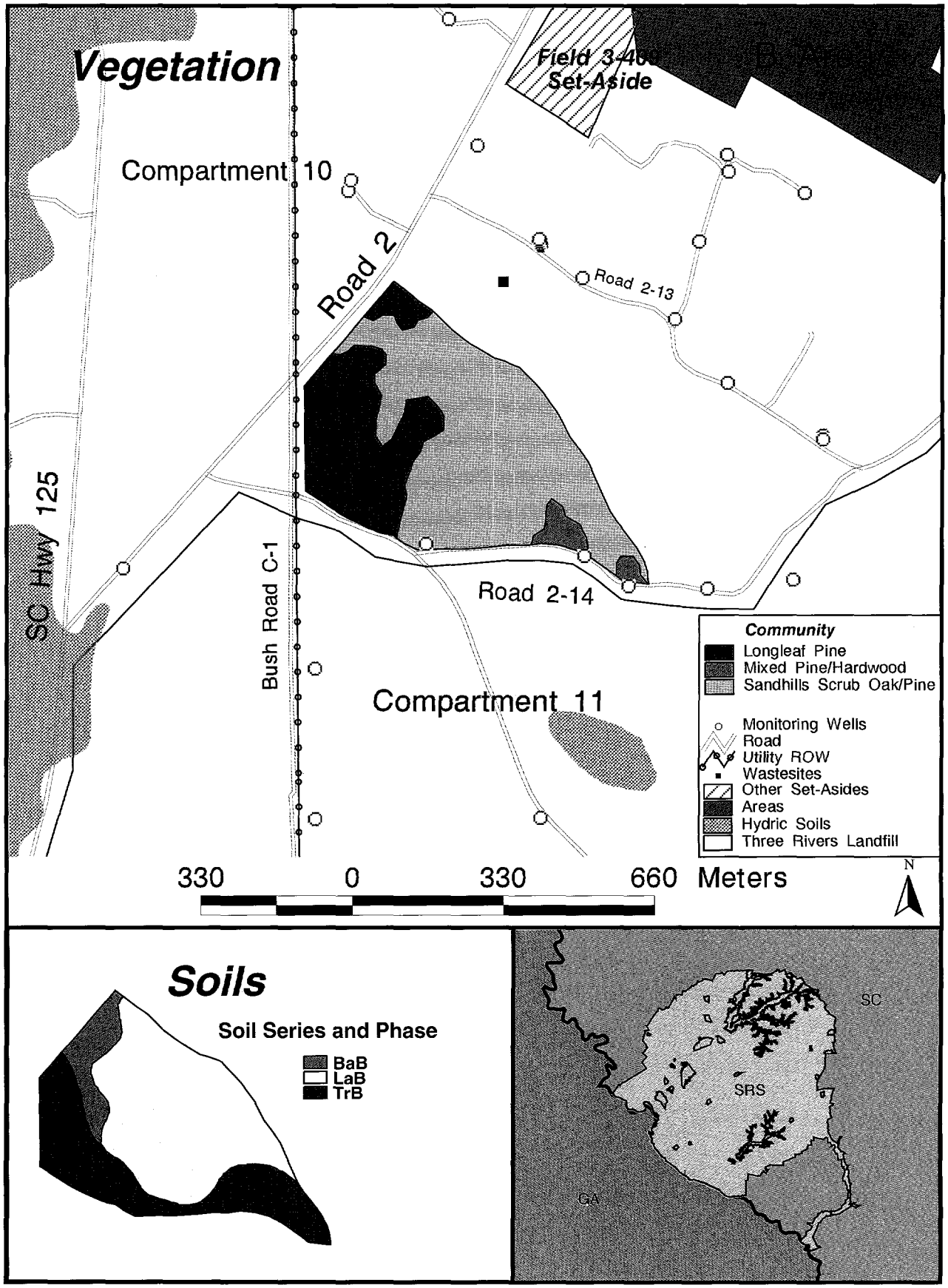

Figure 3-2. *Plant communities and soils associated with the Sandhills Set-Aside Area.*

AREA NO. 4
LOBLOLLY PINE STAND

SET-ASIDE LOCATION ON THE SRS:

The Loblolly Pine Stand Set-Aside Area is located along the north-central boundary of the SRS, north of Highway 278, near the E. P. Odum Wetland Set-Aside (Area No. 30). This Area is within the geologic province of the Aiken Plateau (Langley and Marter, 1973) and is found in timber compartment 23, where it borders privately owned land. Situated on the crest of a hill between Boggy Gut Creek and Upper Three Runs Creek, this Set-Aside lies outside of the portion of the general Site that is closed to public access. An Aiken County public road (Road 781.A) crosses through this Area north to south (Figs. 2 and 4-1).

SET-ASIDE DESCRIPTION:

The 22-acre (8.9 ha) Loblolly Pine Stand Set-Aside is one of the original ten SREL habitat reserve areas which were selected to complement the old-field habitat/plant succession studies at Field 3-412 (Area No. 1; Reserve Area #8) and Field 3-409 (Area No. 28). Known to researchers as Field 9-111, this Area became Reserve Area #3 when the Set-Aside habitat reserve program was formalized in 1968. It is a small, square-shaped Set-Aside which has undergone secondary successsion for the past 46 years. Presently, the Loblolly Pine Stand Set-Aside is an undisturbed pine forest. Hillestad and Bennett (1982) described this Area as an abandoned agricultural field that has been re-invaded by loblolly pines (*Pinus taeda*). The overstory is composed of volunteer loblolly pines with a few scattered oaks along the margins; there also are several areas of longleaf pine (*P. palustris*) along the western margin of this Set-Aside. The major understory species include flowering dogwood, sparkleberry, red maple, holly, poison ivy, and wild plum. Groundcover consists primarily of reindeer moss (Hillestad and Bennett, 1982). A county-maintained, well-traveled dirt road bisects this Area.

The 0.73-mile (1.18 km) boundary line of this Set-Aside is marked with white-blazed trees and metal DOE Research Set-Aside Area signs. A few remnant, white-banded boundary trees remain from SREL's original posting of this Area in 1969, and a few old SREL Reserve Area signs still can be found nailed to boundary trees.

WHAT THIS SET-ASIDE REPRESENTS:

Unlike Field 3-412, this Set-Aside is located well up on the Aiken Plateau and represents an old-field community with a soil type different from that characteristic of Field 3-412. It also differs from Field 3-412 in that the process of successional change in Field 9-111 has resulted in complete reversion to a forested community, composed primarily of loblolly pine. Field 9-111 is representative of an old-field that has undergone succession to a natural pine forest ; it also is unique because it is the only Set-Aside that has remained virtually undisturbed since 1951—neither forest management activities, site operations, nor manipulative research have been conducted in this Area. Field 3-409 is similar to Field 9-111 in that it is forested with natural pines, but Field 3-409 is composed predominantly of longleaf pine. In addition, prescribed fire and some vegetation removal have occurred in Field 3-409. The Loblolly Pine Forest Set-Aside has had only nonmanipulative research associated with it since 1951.

HISTORY:

When the SRS was established in 1951, this Area was part of an agricultural field that was under cultivation, with the last crop consisting of alternate rows of corn and peas (Cross, 1956). When the Site boundary was established, it split

Table 4-1. Vegetation communities of the Loblolly Pine Stand Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	21.95	8.88	100.00%
Totals:	21.95	8.88	100.00%

this field in half; the southern portion (on the SRS) was abandoned and subsequently was identified as Field 9-111. The portion of the field north of the Site boundary remains under cultivation. The majority of the surrounding lands were in mixed forest timberland when the Site was acquired. The dirt county road that runs through this Set-Aside was present in the 1950's. A farm pond on the Boggy Gut drainage south of this Area also was present in the 1950's but this pond no longer exists today. Ecological research in this field was initiated during the year following establishment of the SRS. The South Carolina Wildlife and Marine Resource's Heritage Trust Program (now the SCDNR) inventoried this Set-Aside Area in 1973 as part of a Smithsonian Coastal Plain Theme Study.

Set-Aside Plant Community Composition:

As a result of old-field succession, naturally seeded loblolly pines account for 100% of this Area's vegetation (Table 4-1). These volunteer trees re-invaded Field 9-111 and became established by 1958 (SRFS CISC stand data).

Sensitive Flora and Fauna:

To date, no sensitive flora or fauna have been documented from this Set-Aside Area (Tables 3 and 4).

Set-Aside Soils:

The well-drained sandy, loamy Troup sand series comprises 100% of the soils of this Area (Table 4-2). See Fig. 4-1 for soils mapping of this Set-Aside and Appendix 3 for a description of soils.

Research Associated With This Set-Aside:

Research associated with this Area traditionally has emphasized ecological studies of an old-field community undergoing successional change. Some of E. P. Odum's early work on secondary succession on abandoned crop lands was conducted in this Area, complementing old-field studies in Field 3-412. These studies were designed to investigate energy flow through the communities that develop on these lands, focusing in particular on net primary productivity during the first seven years of secondary succession (Odum, 1960). Monk (1966) studied the loblolly pines that eventually became established in this Area. Insect population studies associated with the plants colonizing the old-field in this Area were conducted by Cross (1955, 1956); these early old-field insect and plant community studies were updated by Cross *et al.* (1997). More recent research in this Area has included surveys of ground-dwelling spiders and investigations of the biogeographical distribution of toads (*Bufo* spp.) on the SRS. This Area also is included in a study which is addressing the role of production, consumption, and seed dispersal of fleshy fruits by neotropical migratory birds. To date, there are 12 publications and reports associated with this Area.

Historical/Current/Future Influences:

Research in this Set-Aside potentially is vulnerable to vandalism because of the remote location of this Area and the presence of a maintained, dirt county road which runs through

Table 4-2. Soils of the Loblolly Pine Stand Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Troup sand, 0-6% slopes	TrB	21.95	8.88	100.00%
Totals:		21.95	8.88	100.00%

the Set-Aside. In addition, off-site development could result in negative impacts to this Area. There is no history of prescribed burning of this Set-Aside by the SRFS although the potential exists for this Area to be burned by wildfire due to its remote location and the fuel load that exists as a result of the lack of recent fire.

SRS Patrol Indexes: D-23,24

Site-Use Permits:

SU-79-74-R Baseline studies of flora and fauna; Janecek and Smith; SREL.

SU-96-03-R Ecology and life history variation of ground-dwelling spiders; Taylor and Draney; SREL.

SU-96-08-R A study of the distribution of toads (*Bufo* spp.) on the SRS; Taylor and Hopkins; SREL.

SU-96-43-F The role of fleshy fruit production, consumption, and seed dispersal on promoting biological diversity; Blake, Levey, and Greenburg; SRFS, Univ. Florida, and SFES.

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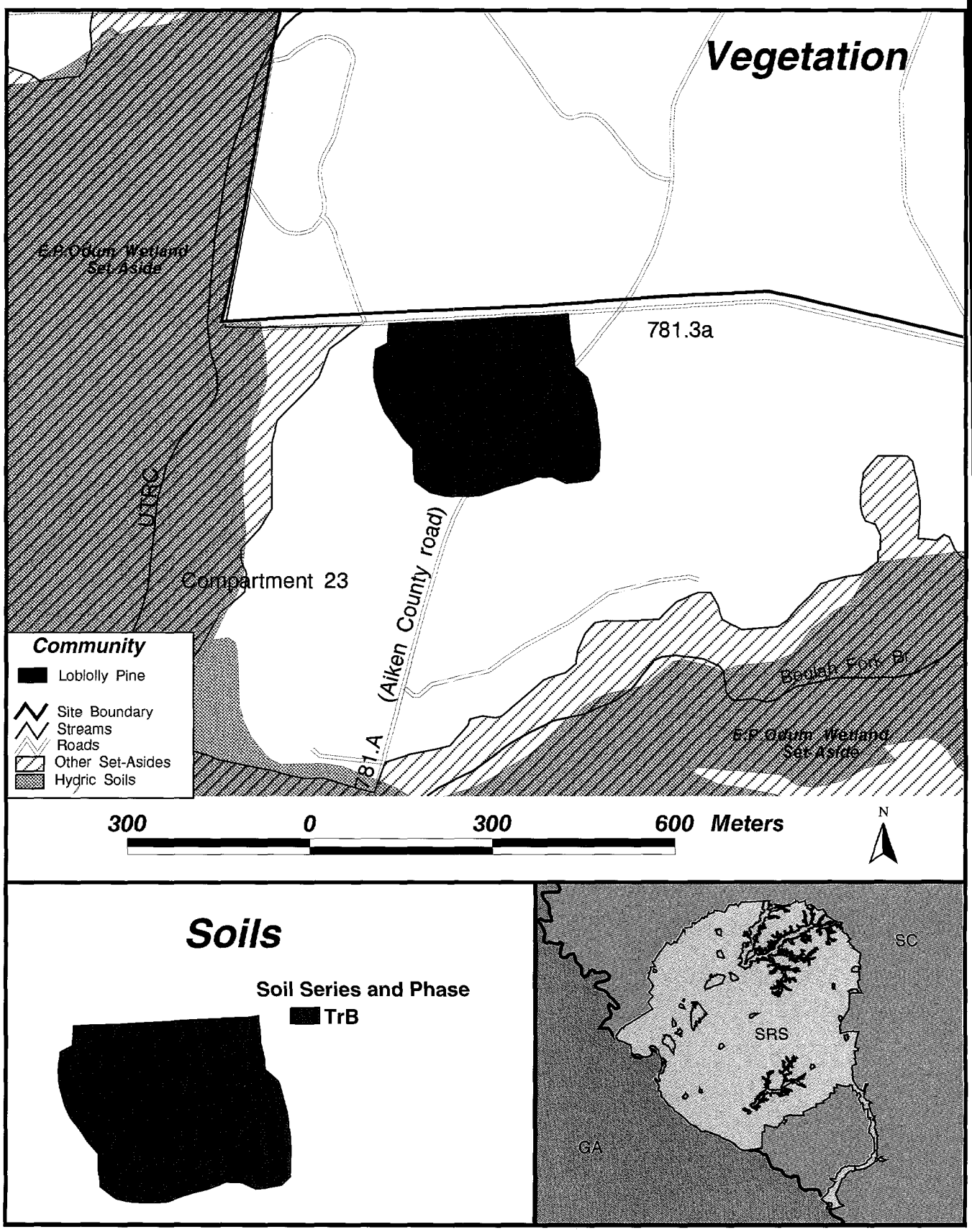

Figure 4-1. *Plant communties and soils associated with the Loblolly Pine Stand Set-Aside Area.*

AREA NO. 5
OAK-HICKORY FOREST #1

SET-ASIDE LOCATION ON THE SRS:

The Oak-Hickory Forest #1 Set-Aside Area is located in the north-central portion of the SRS on the Aiken Plateau (Langley and Marter, 1973). Found in timber compartments 52 and 53, this Set-Aside is located in the Mill Creek drainage, approximately 160 m upstream from the confluence of Mill Creek with Tinker Creek. Bordered on two sides by the E. P. Odum Wetland Set-Aside (Area No. 30), the Oak-Hickory Forest #1 Set-Aside lies south of Craig Road (SRS Road 2-1). Beaufort Road (SRS Road E-2) forms the western boundary of this Area (Figs. 2 and 5-1).

SET-ASIDE DESCRIPTION:

This Set-Aside Area is one of the ten original SREL habitat reserves (Reserve #7) and was selected for the program in the 1960's as a representative of an oak-hickory forest community. This Area primarily is composed of relatively undisturbed mixed upland and bottomland hardwood communities which are associated with moderate-to-steep slopes that grade down to the coves and floodplain of Mill Creek. Mill Creek is a third-order tributary of Tinker Creek that bisects the Set-Aside. Beaver activity and an abandonded mill pond produce ponded water within the floodplain in this Set-Aside.

This Area is relatively small in size (84.5 acres; 34.2 ha) compared with the 460-acre (186 ha) Oak-Hickory Forest #2 Set-Aside (Area No. 12) which supplements this habitat type in the Set-Aside Program. Most of Set-Aside Area No. 5 is comprised of the floodplain of Mill Creek, which is in management Region 1 of the Upper Three Runs/Tinker Creek drainage (also known as the E. P. Odum Wetland Set-aside—see Area No. 30 description). The Oak-Hickory Forest #1 Set-Aside actually contains only a small amount of oak-hickory hardwood forest types; approximately 25% of the total area of this Set-Aside is in this vegetation community. Hillestad and Bennett (1982) observed that this Area does not exhibit the typical floristic pattern of an oak-hickory forest, although the southwest ridge of this Set-Aside does contain the typical mockernut-hickory, white oak, and longleaf pine association characteristic of this community type. The majority of this Area is dominated by tulip trees, red maple, sweet bay, black gum, ironwood, and river birch. Cane, holly, and fetter bush are abundant in the understory. Additional descriptive information on the vegetation of this Area can be found in Van Pelt and Gentry (1985). A 2.4-m high earthen dam across the floodplain is all that remains of a mill pond that once was in this Area. It is estimated that this pond might have flooded about half of this Area at one time. This Set-Aside once was logged, as old stumps are evident throughout the upland portions of the Area (Hillestad and Bennett, 1982).

Whipple *et al.* (1981) characterized the oak-hickory portion of this Area as the *Carya tomentosa-Quercus alba* community, which is located on the mid-to-upper slopes that lead down to Mill Creek. A large proportion of this Set-Aside is in the *Nyssa sylvatica-Persea borbonia* community, which is located in the protected coves and the lower-to-middle portions of the steeper slopes. This community is confined to Mill Creek's floodplain, which either does not flood or does so only for brief periods.

Like Area No. 12 and the Scrub Oak Natural Area (Area No. 29), this Set-Aside shares common boundaries with the E. P. Odum Wetland Set-Aside (Area No. 30). The western and eastern boundaries of the Oak-Hickory Forest #1 Set-Aside are contiguous with those of the E. P. Odum Wetland Set-Aside Area. Consequently, the eastern and western

Table 5-1. Vegetation communities of the Oak-Hickory Forest #1 Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	2.98	1.21	3.53%
Mixed Pine/Hardwood	7.35	2.97	8.70%
Upland Hardwood	13.72	5.55	16.24%
Bottomland Hardwood	54.68	22.13	64.71%
Water	5.77	2.34	6.83%
Totals:	84.50	34.20	100.00%

boundaries of Area No. 5 are considered to be "internal" boundaries and are not posted, because it is not necessary to differentiate between these Set-Aside Areas. The external, up-slope boundary lines are marked with metal DOE Research Set-Aside Area signs and are maintained to prevent impacts from forest management activities, particularly prescribed fire. Fire is not allowed to burn down the slopes of this Area as it is in Area No. 30. The boundary length of Area No. 5 is considered to be contiguous with Area No. 30's boundary line and therefore is not tallied separately for refurbishment purposes. The original boundary line of Area No. 5 was established in 1969 and a few remnant, white-banded boundary trees remain from SREL's original posting, in addition to a few old SREL Reserve Area signs that still are nailed to boundary trees. This Area's boundary line in timber compartment 53 was GPSed by the SRFS in the summer of 1995 and this information was incorporated into the latest version of the Set-Aside GIS coverage.

What This Set-Aside Represents:

This Set-Aside Area was one of the original habitat reserves and was selected to represent oak-hickory forest communities found on transitional mesic slopes that merge with floodplain forests. While the majority of this Area is not oak-hickory forest, it still provides interesting research possibilities, as evidenced by the historical research that has been conducted here. This Area also is unique because the Mill Creek Elliptio, a rare freshwater mussel, is known to occur in the Mill Creek drainage. *Elliptio hepatica* is a morphologically distinct species considered to be both rare and endangered (Davis and Mulvey, 1993).

History:

Prior to the establishment of the SRS in 1951, this Set-Aside was a recovering cut-over forest with surrounding lands used for agriculture and timber production. Road E-2 existed prior to the 1950's. Since that time, this Area has remained relatively undisturbed by Site and forestry activities; only beaver activity has provided a natural disturbance, resulting in periodic ponding of water. In the 1960's this Area was placed in a reserve status to be used for ecological research. This habitat was referred to in the literature as an "eastern hardwood forest." In 1973, the South Carolina Wildlife and Marine Resource's Heritage Trust Program (now the SCDNR) inventoried this Set-Aside Area as part of a Smithsonian Coastal Plain Theme Study.

Set-Aside Plant Community Composition:

Five plant communities comprise the vegetation of this Area. Upland communities present on

Table 5-2. Soils of the Oak-Hickory Forest #1 Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	3.20	1.29	3.78%
Blanton sand, 6-10% slopes	BaC	28.44	11.51	33.65%
Pickney sand, frequently flooded	Pk	18.96	7.67	22.43%
Troup sand, 0-6% slopes	TrB	4.84	1.96	5.72%
Troup sand, 6-10% slopes	TrC	6.90	2.79	8.17%
Troup sand, 10-15% slopes	TrD	4.94	2.00	5.85%
Troup & Lucy sands, 15-25% slopes	TuE	5.02	2.03	5.94%
Troup & Lucy sands, 25-40% slopes	TuF	12.21	4.94	14.45%
Totals:		84.51	34.20	100.00%

the hilltops and slopes are represented by loblolly pine (*Pinus taeda*; 3.5%), mixed pine/hardwoods (8.7%), and upland hardwoods (16.2%). The majority (64.7%) of this Area is comprised of bottomland hardwoods found in the floodplain of Mill Creek or in the coves and hill seeps at the base of slopes. Water accounts for 6.8% of the Area and results from the abandoned mill dam or ponds created by beaver activity (Table 5-1). These forest communities all were established prior to acquisition of the SRS; the upland hardwood and bottomland hardwood forests date to 1922, the mixed pine/hardwoods to 1935, and the loblolly pines to 1933 (SRFS CISC stand database).

Sensitive Flora and Fauna:

Four sensitive plant species have been recorded from this Set-Aside, including the green-fringed orchid (*Platanthera lacera*), Chapman's sedge (*Carex chapmanii*), Nestronia (*Nestronia umbellula*), and the sandhill seedbox (*Nolina georgiana*; Table 3). The bobcat (*Lynx rufus*) is the only sensitive vertebrate species documented from this Area. The rare freshwater Mill Creek Elliptio mussel (*Elliptio hepatica*) occurs in the Mill Creek drainage (Table 4).

Set-Aside Soils:

The somewhat excessively drained Blanton sands found largely on the north side of the Mill Creek drainage make up 37.4% of the soils of this Area (Table 5-2). Three phases of the well-drained Troup sands are found on moderate slopes and account for 19.7% of the soils. The steep slopes are composed of the Troup and Lucy sands (20.4%) and the floodplain soils of Mill Creek are the frequently flooded Pickney sands (22.4%). See Fig. 5-1 for soils mapping and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

Much of the research associated with this Set-Aside has involved small mammal studies that were conducted at the Mill Creek grid. This was a 5.7-ha trapping grid located partly in a "mature cove hardwood forest" and partly in a "lowland hardwood swamp" (Gentry *et al.*, 1971a, 1971b). Studies of small mammal densities and population fluctuations and the development of census techniques for small mammals were the primary focus of published research from this Area (Gentry *et al.*, 1968; Kaufman *et al.*, 1971; Smith *et al.*, 1969, 1971, 1974; Ryszkowski *et al.*, 1971). Beyers *et al.*

(1971) measured the standing crop of elements in a small mammal community and O'Farrell *et al.* (1977) studied the reproductive biology of small mammals in this Area. More recent small mammal research was conducted on the southern short-tailed shrew (*Blarina carolinensis*; Whitaker *et al.*, 1994). Ant surveys also were conducted on this grid (Van Pelt and Gentry, 1985) and fish community studies were conducted in Mill Creek by Meffe and Sheldon (1987, 1990) and Snodgrass (1996). The most recent research initiated in this Area is related to investigations of the distribution of toads (*Bufo* spp.) on the SRS. Watershed studies not yet published by WSRC are being conducted upstream of this Set-Aside in an effort to characterize the geohydrology of the Mill Creek watershed in support of the Accelerated Production of Tritium (APT) facility siting. To date, there are 34 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

While the focus of this Set-Aside is not specifically the water quality of Mill Creek, it should be noted that this Set-Aside is within management Region 1 of the Upper Three Runs/ Tinker Creek drainage. Discharges from SRS operations are limited to those defined in the DOE-SR policy statement concerning Upper Three Runs Creek Stream Management. This policy states that "No wastewater effluents are anticipated to be discharged to Region 1. This region is reserved for research purposes." (DOE-SROO Stream Management Policy--Upper Three Runs, 9/11/95). A potential source of negative impacts to this Area could come from the development of the APT project located upstream of this Set-Aside; these potential impacts could affect the creek and its floodplain.

According to the SRFS GIS historical fire database, portions of the cove areas of this Set-Aside were subjected to prescribed burning in 1974. Beaver influence is obvious in the Mill Creek drainage and beaver trapping periodically is allowed at the road culvert when this activity is not in conflict with on-going aquatic research. Road E-2 may have some influence on Mill Creek's natural flow in that beavers have a tendency to block the culvert and cause water to pond. Much of the adjacent commercial forest recently has been clearcut and regenerated back to pine plantation.

SRS Patrol Index: I-20

Site-Use Permits:

SU-79-74-R Baseline studies of flora and fauna; Janecek and Smith; SREL.

SU-82-43-O Selective trapping of beaver; Gaines; SRFS.

SU-85-28-R Life history and population dynamics of SRP darters; Aho; SREL.

SU-86-35-R Fish community structure and dynamics in natural SRS streams; Meffe; SREL.

SU-87-64-R Registration of locations of rare or threatened plant populations based upon state of SC status; Roecker and Sharitz; SRFS and SREL.

SU-93-23-R Mole Research; Wike; WSRC-SRTC.

SU-96-08-R A study of the distribution of toads (*Bufo* spp.) on the SRS; Taylor and Hopkins; SREL.

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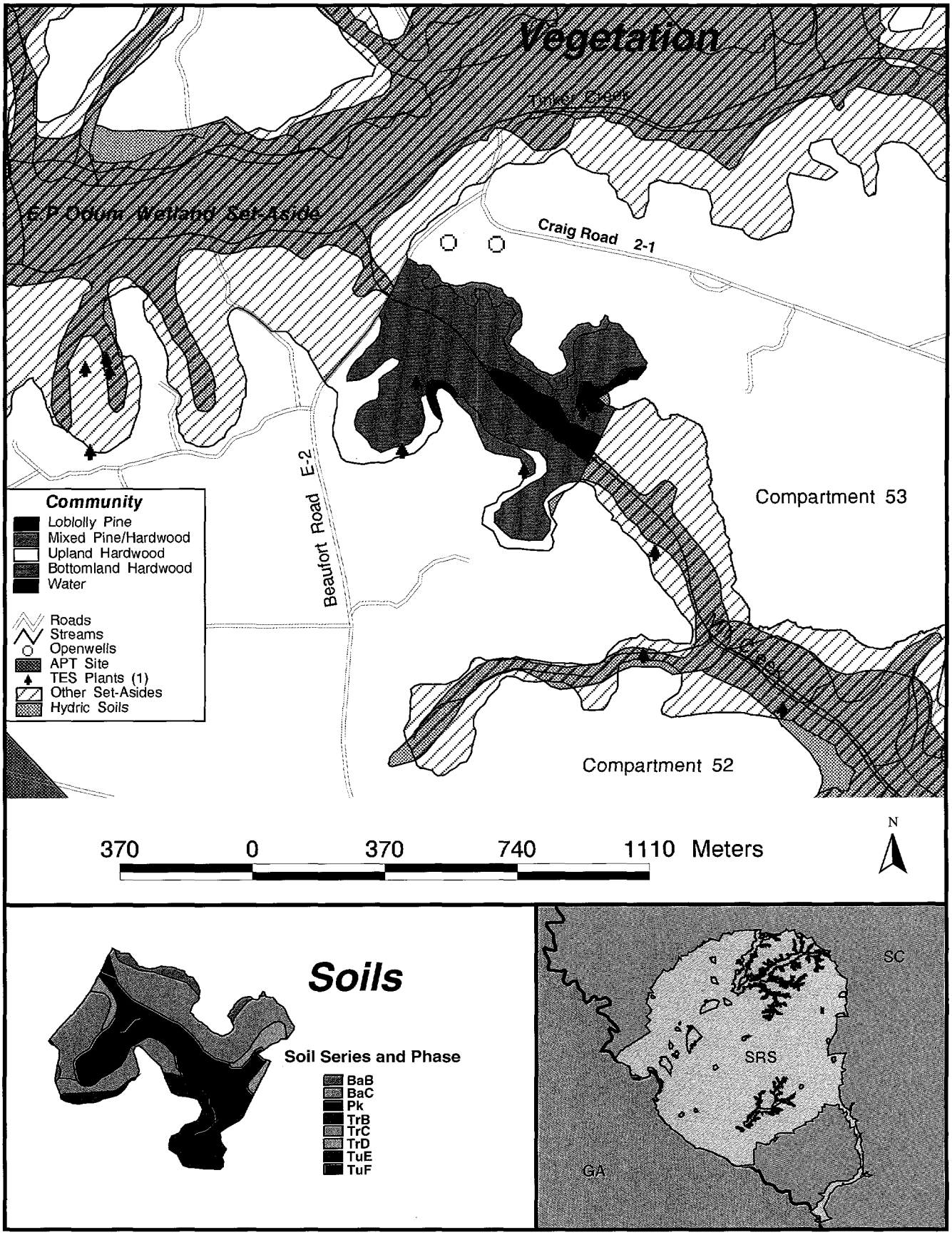

Figure 5-1. *Plant communities and soils associated with the Oak Hickory Forest #1 Set-Aside Area.*

AREA NO. 6
BEECH-HARDWOOD FOREST

SET-ASIDE LOCATION ON THE SRS:

The Beech-Hardwood Forest Set-Aside Area is located in the west-central portion of the SRS within the Brandywine Pleistocene Terrace (Langley and Marter, 1973). Found in timber compartment 14, this Area is directly downstream from the Three Rivers Landfill; it is bordered by Upper Three Runs Creek (UTRC) on the north, SC Highway 125 on the west, and South Carolina Electric and Gas (SCE&G) powerline rights-of-way (ROW) on the south and east (Figs. 2 and 6-1). Site roads A-5 and A-5a also serve as boundaries to portions of this Area.

SET-ASIDE DESCRIPTION:

This 119-acre (48.2 ha) Set-Aside is one of the original ten SREL habitat reserve areas (Reserve #6) and is characterized by relatively undisturbed mesic and bottomland hardwood forests associated with the bluffs of UTRC. Approximately half of this Area is within the floodplain of UTRC. This lower reach of UTRC is within management Region 3, as prescribed by the DOE-SR Upper Three Runs Creek Stream Management Policy, and thus is subject to some impacts from Site operations (see below). UTRC seldom floods within this Set-Aside but if flooding does occur, it lasts for very short periods. The bottomland communities in this Area form a fairly closed canopy and are confined to the eastern half of the UTRC floodplain and also to the stream bottoms of Mosquito Creek, a small feeder stream that drains into UTRC (Fig. 6-1). Hillestad and Bennett (1982) described this floodplain forest as being dominated by red maple, tulip poplar, sweet bay, and sweetgum, with tulip trees, black gum, and red maple being common along the stream bottom.

The remainder of the Beech-Hardwood Forest Set-Aside consists of the lower-to-middle portions of the steep slopes that overlook the ravines and the UTRC floodplain. The transitional slopes of the ravines are much greater in grade than are those in the floodplain forest and, consequently, the vegetation community shifts from lowland to more upland species over a short distance. Beech, loblolly pine, and hickory are found up-slope of the ravine bottoms; at higher elevations along the topographic gradient beech, loblolly pine, laurel oak, and sourwood become increasingly more abundant (Hillestad and Bennett, 1982). Holly, wax myrtle, wild azalea, and other understory species form a dense cover in the ravines, thinning out as the stream enters the floodplain forest. More than 44 species of plants have been recorded from this area (Hillestad and Bennett. 1982), including 11 species of vines (Collins and Wein, 1993). The 2.5-mile (3.97 km) boundary line of this Set-Aside is marked with metal DOE Research Set-Aside Area signs and white-blazed trees. Only a few remnant, white-banded boundary trees remain from SREL's 1969 posting of this Area.

WHAT THIS SET-ASIDE REPRESENTS:

As one of the original habitat reserves, this Set-Aside was selected to represent bottomland floodplain and ravine forest habitats associated with the lower reaches of the relatively nonimpacted UTRC. This Area is unique because some of the tree species found here are not common in the Coastal Plain and are more likely to be found in the Piedmont or Mountain physiographic provinces (Workman and McLeod, 1990). This Area also has a small number of beech trees (*Fagus grandifolia*), a species not found in abundance elsewhere on the SRS (Whipple *et al.*, 1981); the Boiling Springs Natural Area (Area No. 18) is the only other Set-Aside that has been documented to contain this

Table 6-1. Vegetation communities of the Beech-Hardwood Forest Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Mixed Pine/Hardwood	11.10	4.49	9.33%
Upland Hardwood	2.97	1.20	2.50%
Bottomland Hardwood	88.05	35.63	73.97%
Bottomland Hardwood/Pine	16.91	6.84	14.21%
Totals:	119.03	48.17	100.00%

species. Additionally, this Set-Aside represents two forest communities, *Nyssa sylvatica-Persea borbonia*, which is the only community containing *Fagus*, and the drier *Carya tomentosa-Quercus alba* community, which typically is found on mid-to-lower slopes (Whipple *et al.*, 1981). As one of original habitat reserves, this Area has been the site of historical research and continues to be used in current ecological studies.

History:

Prior to establishment of the SRS in 1951, this Area primarily was a cut-over floodplain forest with adjacent lands in timber or agriculture. Like the logging operations in the Mature Hardwood Forest Set-Aside (Area No. 14), this Area was logged by the Schofield Savannah Company in the 1920's and 1930's using a locomotive and railroad to haul the timber out to Ellenton (Fetters, 1990). This logging operation appears to have been restricted to the floodplain portion of this Set-Aside (Hillestad and Bennett, 1982). In 1973, the South Carolina Wildlife and Marine Resource's Heritage Trust Program (now the SCDNR) inventoried this Set-Aside Area as part of a Smithsonian Coastal Plain Theme Study.

Set-Aside Plant Community Composition:

The predominant vegetation community of this Set-Aside is bottomland hardwood (74%), which is located within UTRC's floodplain and along the Mosquito Creek drainage (Table 6-1; Fig. 6-1). Mixed bottomland hardwood/pine communities on the elevated portion of the floodplain account for 14% of the vegetation of this Area. The remainder of the vegetation is in mixed pine/hardwoods (9.3%) and upland hardwoods (2.5%), communities which are characteristic of the steep ravine slopes. The canopy vegetation of these communities dates to 1935 (SRFS CISC stand database).

Sensitive Flora and Fauna:

Three sensitive plant species are documented from this Set-Aside, including the Carolina bogmint (*Macbridea caroliniana*), the stalkless yellowcress (*Rorippa sessiliflora*), and trepocarpus (*Trepocarpus aethusae*; Table 3). Sensitive mammal species documented from this Area include the river otter (*Lutra canadensis*) and the bobcat (*Lynx rufus*; Table 4).

Set-Aside Soils:

There are seven soil series and phases in this Set-Aside. The soils that occur in the floodplain and upper stream drainage areas are the frequently flooded Pickney sands (35.2%). Within this wetter area is an inclusion of the somewhat excessively drained Blanton sand series; the B slope (BaB) of this series is within the floodplain and probably results from erosion and alluvial deposition from the Mosquito Creek drainage. This series and its two phases account for 10.7% of the soils of this Area. Soils of the higher

Table 6-2. Soils of the Beech-Hardwood Forest Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	12.57	5.09	10.56%
Blanton sand, 6-10% slopes	BaC	0.19	0.08	0.16%
Pickney sand, frequently flooded	Pk	41.87	16.94	35.17%
Troup sand, 0-6% slopes	TrB	16.78	6.79	14.10%
Troup & Lucy sands, 15-25% slopes	TuE	21.66	8.77	18.20%
Troup & Lucy sands, 25-40% slopes	TuF	23.44	9.48	19.69%
Vaucluse-Ailey complex, 6-10% slopes	VeC	2.52	1.02	2.12%
Totals:		119.03	48.17	100.00%

elevations along the ridges and slopes of Mosquito Creek are the Troup and Lucy sands (37.9%) and the Vaucluse-Ailey complex (2.1%). Loamy, well-drained Troup sand, the Area's most upland soil type, is found on the flatter ridge-tops (14.1 %; Table 6-2). See Fig. 6-1 for soils mapping of this Set-Aside and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

The earliest published research in this Set-Aside can be traced to Cross (1955), who surveyed this Area for species of dragonflies (Order Odonata). This Set-Aside was one of several of the old habitat reserves where field collections were made to map the distributions of ferns, lichens, mosses and ants on the SRS (Hillestad and Bennett, 1982; Van Pelt and Gentry, 1985). Research also has been conducted in this Area on the eastern mole (*Scalopus aquaticus*; Hartman and Krenz, 1993; Hartman, 1994,1995, 1996) and Collins and Wein (1993) documented some of the flora of this Set-Aside, particularly the understory vines. Current research is being conducted on the ecology of ground-dwelling spiders. Several Site-Use permits have been issued to conduct research on box turtles (*Terrepene carolina*) in this Area, but there is no record of any publications resulting from this work. To date, there are 17 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

While the focus of this Set-Aside is not specifically the water quality of UTRC, it should be noted that because this Set-Aside is within UTRC management Region 3, potential negative impacts to the creek and floodplain areas from upstream Site operations could occur. In Region 3, effluent discharges from SRS operations are limited to those defined in the DOE-SR policy concerning Upper Three Runs Creek Stream Management. This policy states that "Additional low-impact effluents may be discharged into Region 3, within regulatory limits. Every effort will be made to ensure that no significant adverse impact occurs to stream biota or water quality. The goal in managing Region 3 is to protect the aquatic community while allowing limited and controlled plant use of this segment." (DOE-SROO Stream Management Policy--Upper Three Runs, 9/11/95).

There is no history of prescribed fire in this Set-Aside Area. There is a potential for negative impacts to this Set-Aside from the Mosquito Creek tributary, which originates outside of the Set-Aside. This Set-Aside is bordered by two

powerline ROWs and SC Highway 125; dirt roads border portions of this Area.

SRS Patrol Indexes: I-6,7 J-6,7

Site-Use Permits:

SU-77-41-R Species assessments in selected habitats; Gibbons; SREL.

SU-79-74-R Baseline studies of flora and fauna; Janecek and Smith; SREL.

SU-83-28-R Study of the box turtle using telemetry; Vangilder; SREL.

SU-87-61-R Energetics of the box turtle research; Spotila and Congdon; SREL.

SU-87-63-R Registration of locations of rare or threatened plant populations based upon Federal or state of South Carolina status; Roecker and Sharitz; SRFS and SREL.

SU-92-63-R Stream fisheries characterization study; Paller; WSRC-SRTC.

SU-93-23-R Mole Research; Wike;WSRC-STRC.

SU-96-03-R Ecology and life history of ground-dwelling spiders; Taylor and Draney; SREL.

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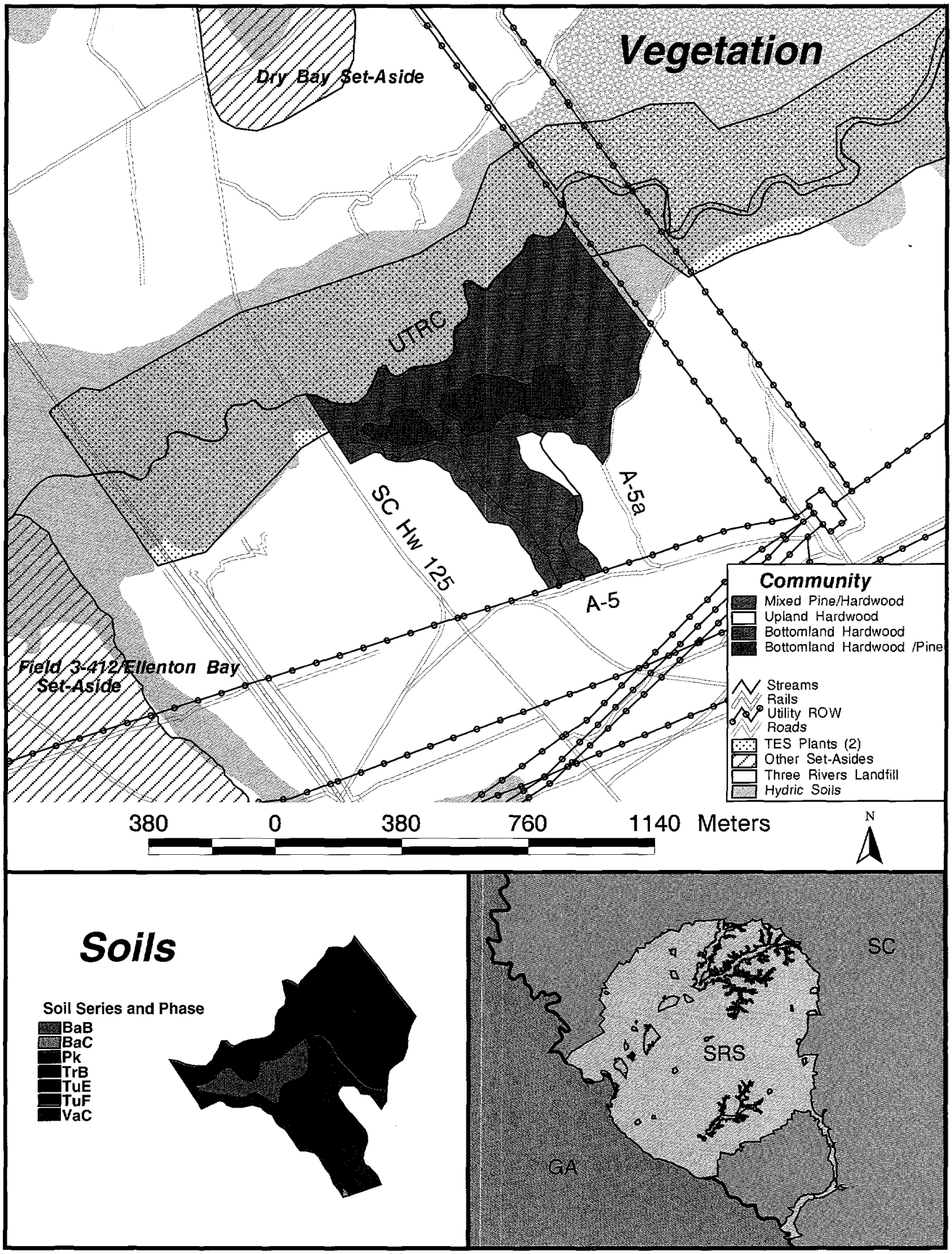

Figure 6-1. *Plant communities and soils associated with the Beech-Hardwood Forest Set-Aside Area.*

AREA NO. 7
MIXED SWAMP FOREST

SET-ASIDE LOCATION ON THE SRS:

The Mixed Swamp Forest Set-Aside is located in the southwest portion of the SRS in the Savannah River swamp, downstream of the thermally impacted Fourmile Branch delta. This Area is found in timber compartment 92 within the Wicomico Pleistocene Terrace, which is the floodplain of the Savannah River (Langley and Marter, 1973). This Set-Aside extends southeast from the edge of this floodplain at Hogbarn Road (Road A-13) toward the river (Figs. 2 and 7-2).

SET-ASIDE DESCRIPTION:

The 80.5-acre (32.6 ha) Mixed Swamp Forest Set-Aside Area is one of the original ten SREL habitat reserves (Reserve #5) selected to represent the mixed swamp forest communities of the Savannah River, a major southeastern river which floods annually. The majority of the Set-Aside is confined to the floodplain and, for the most part, these communities are relatively undisturbed, older growth mixtures of bottomland hardwood and swamp forests (Fig. 7-1). Hillestad and Bennett (1982) described this Area as being composed of aquatic, semi-aquatic and terrestrial habitats. These habitats are defined by three major communities which experience different flooding regimes, including a shallow bald cypress-tupelo gum pond, which dries periodically, mixed hardwood sloughs, which are seasonally flooded, and mixed hardwood ridges, which rarely are flooded. The dominant overstory species in this Area include bald cypress *(Taxodium distichum)*, tupelo gum (*Nyssa aquatica)*, black gum (*Nyssa sylvatica*), red maple (*Acer rubra*), sweetgum (*Liquidambar styraciflua*) and several oak species including willow oak (*Quercus phellos*), swamp chestnut oak (*Q. michauxii*), and water oak (*Q. nigra*). Understory and groundcover species vary with the flooding regime and range from switch cane (*Arundinaria gigantea*) and sedges (*Scirpus* spp.) in the damper regions to palmetto (*Sabal minor*) and grasses on the higher hardwood islands (Hillestad and Bennett, 1982). In addition to the portion of the Area in the floodplain, there is a narrow, transitional zone of mixed pine/ hardwoods that borders Hogbarn Road.

This Area contains one of the seven Whipple/ Good plots, Plot 5. These plots identified mixed species forests that represent a gradient from deeply flooded to somewhat dry conditions on the SRS (Good, 1981; Good and Whipple, 1982). Plot 5 is a square, one-hectare plot located near the Set-Aside boundary line on Hogbarn Road. This plot corresponds to plot #3 of Jones *et al.* (1994) and ranks third in order of elevational gradient of the seven Whipple/Good plots on the SRS. The dominant canopy vegetation of this plot is sweetgum, red maple, and bald cypress. Other species present in the canopy include black gum, laural oak (*Q. laurifolia*), and tupelo gum. Tree cores indicated that some of these canopy trees were 140 years old (Good, 1981).

The highest density of white-tailed deer (*Odocoileus virginianus*) and feral swine (*Sus scrofa domesticus*) on the SRS traditionally have been found in the Savannah River swamp. The abundance of hard mast trees throughout the hardwood islands provide acorn forage for these and other wildlife species. The 1.42-mile (2.28 km) boundary line of this Set-Aside is marked with metal DOE Research Set-Aside Area signs. Only a few remnant, white banded trees remain on the Hogbarn Road boundary from the original 1969 posting of this Area by SREL.

WHAT THIS SET-ASIDE REPRESENTS:

This Set-Aside is one of the original ten SREL habitat reserve areas selected in 1968 to represent a diversity of bottomland hardwood/floodplain

Table 7-1. Vegetation communities of the Mixed Swamp Forest Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Mixed Pine/Hardwood	2.70	1.09	3.35%
Bottomland Hardwood	48.06	19.45	59.69%
Mixed Swamp Forest	29.75	12.04	36.95%
Totals:	80.51	32.58	100.00%

forest communities of a southern river swamp system. Represented are aquatic, semi-aquatic, and terrestrial habitats associated with cypress-tupelo ponds, mixed hardwood sloughs, and mixed hardwood ridges. This Set-Aside is important because seasonally flooded hardwood forests are becoming increasingly rare habitats that are particularly vulnerable to habitat destruction and/or alteration due to drainage, water control projects, industrial or urban waste discharge, or power plant cooling effluents (Sharitz and Mitsch, 1993). Although Area Nos. 9A and 9B also are located in the Savannah River swamp, they represent primarily cypress-tupelo floodplain habitats.

Whipple *et al.* (1981) selected several study plots or stands in this Set-Aside to characterize the hardwood and swamp forest community types of the SRS. These stands included representatives of the *Nyssa sylvatica-Acer rubra*, *Nyssa aquatica -Fraxinus pennsylvania,* and *Taxodium distichum-Nyssa aquatica* communities. The *Quercus nigra-Carpinus caroliniana* community may exist in this Area as well (Whipple *et al.*, 1981). This variety of representative stands demonstrates the diversity of bottomland hardwood and swamp forest community types found in this Set-Aside.

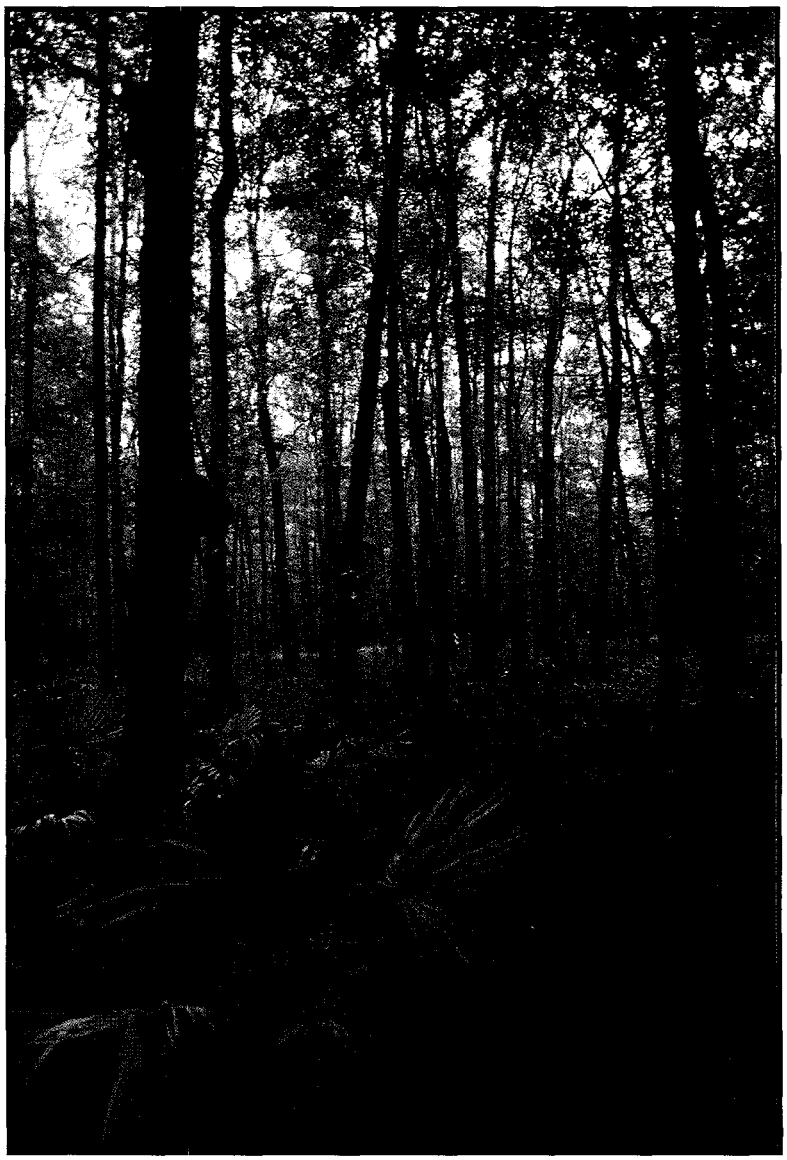

Figure 7-1. *Vegetation of the Mixed Swamp Forest Set-Aside Area.*

Table 7-2. Soils of the Mixed Swamp Forest Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Chastain clay, frequently flooded	Ch	42.61	17.25	52.93%
Orangeburg loamy sand, 6-10% slope	OrC	7.27	2.94	9.03%
Shellbluff loam, frequently flooded	Sh	22.75	9.21	28.25%
Tawcaw silty clay, frequently flooded	Ta	7.88	3.19	9.79%
Totals:		80.51	32.58	100.00%

This Area also was used as a local seed source by the SRFS for collection of cherrybark oak (*Q. pagoda*) acorns for revegetation and restoration efforts of the Pen Branch corridor and delta.

History:

This Area within the Savannah River swamp was logged for the first time in the earlier part of the twentieth century by the Leigh Banana Case Company (Fetters, 1990; Wike *et al.*, 1994). Most of this timber was used in the manufacture of fruit and vegetable hampers; select logs probably were used in the production of veneers of cypress, gum, and pine. Land directly adjacent to this Area was in agricultural fields prior to establishment of the SRS. Since acquisition of the SRS, no timber has been removed from this portion of the swamp. However, from 1955-1985, operation of C Reactor resulted in thermal impacts and sediment loading from elevated water levels in this region of the Savannah River swamp. In 1973 the South Carolina Wildlife and Marine Resource's Heritage Trust Program (now the SCDNR) inventoried this Set-Aside Area as part of a Smithsonian Coastal Plain Theme Study.

Set-Aside Plant Community Composition:

This Set-Aside primarily is comprised of two plant communities—bottomland hardwoods (59.7%) and mixed swamp forests (37%; Table 7-1). A small percentage (3.4%) of this Area supports a mixed pine/hardwood community which borders the floodplain terrace between Hogbarn Road and the swamp (Fig. 7-2). The age of the vegetation in this Area dates to 1907 (SRFS CISC stand database). Some of the dominant canopy trees may be older or younger than this date, depending upon the reference. Fetters (1990) mentioned that the logging companies were late to exploit the Savannah River swamp (1920's), whereas others record the swamp being logged as early as the late 1800's.

Sensitive Flora and Fauna:

There are three sensitive animal species documented from this Area (Table 4). The river otter (*Lutra canadensis*) and the bobcat (*Lynx rufus*) are two mammal species of special concern that have been observed in this Set-Aside. The bird-voiced tree frog (*Hyla avivoca*), an uncommon resident of most southern river swamps, is known to breed in the sloughs and ponds throughout the Savannah River floodplain (Hillestad and Bennett, 1982). To date, no sensitive plants have been documented from this Area (Table 3).

Set-Aside Soils:

Four soil series comprise this Area, with the majority being hydric, floodplain soils (Table 7-2). The poorly drained, flooded Chastain series (52.9%), which have higher clay content than the other floodplain soils, is associated with the swamp forest community. The loamy, well-

drained but frequently flooded Shellbluff (28.3%) and the somewhat poorly drained but frequently flooded Tawcaw series (9.8%) are more associated with the elevated bottomland hardwood community. The Orangeburg loamy sands (9%) are found along the Hogbarn Road terrace and support the upland transitional vegetation. See Fig. 7-2 for a soils mapping of this Set-Aside and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

Research in this Set-Aside primarily has been related to studies of the representative vegetation of the Area. The effect of thermal effluent and the increase in the water level of the swamp are of specific interest from an environmental and ecological standpoint. Sharitz *et al.* (1974) have studied the effects of thermal effluent from reactors on the flora of the Savannah River swamp system. They have shown that the only portions of the swamp which remained unaffected were those hardwood islands which rarely are flooded. Long-term studies evaluating the swamp's natural and disturbed vegetation continue (Schneider and Sharitz, 1988; Sharitz *et al.*, 1990). Schneider *et al.* (1989) examined the impact of upstream dam operations on the hydrologic regime of the Savannah River swamp, including this Area. Good (1981) and Good and Whipple (1982) established a permanent long-term vegetation sampling plot in this Set-Aside. This plot continues to be sampled periodically (Jones *et al.*, 1994); these researchers specifically are studying the dynamics of wetland forest recruitment and the effects of hydrologic regime on the survival and growth of woody species. In addition, an unpublished study examined the genetic structuring and diversity within populations of trees found in this Set-Aside. Wallace *et al.* (1982) sampled from this Area to characterize the mineral composition of floodplain vegetation.

The Savannah River swamp traditionally has been an area where remote sensing technology has been used to map swamp vegetation (Jensen *et al.*, 1983, 1984). In 1982, as a result of operation of C Reactor, further expansion of the Fourmile Branch delta into the downstream portions of the Savannah River swamp was documented (Gladden *et al.*, 1985; Wike *et al.*, 1994). These zones of expansion indicate that this Set-Aside may have been impacted from reactor operations. Other studies not related to vegetation or thermal ecology that used this Area include radiocesium uptake in feral hogs (Stribling, 1978) and recent studies of the nesting ecology of midstory neotropical migratory birds. To date there are 22 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

Feral hogs forage heavily in this Set-Aside and hunting and/or trapping of this nuisance animal is authorized under contract with the SRFS. All-Terrain Vehicles (ATVs) have been used in this activity and may negatively impact the vegetation of this Area. Because this Area is within the Savannah River swamp, impacts from forest management should not be of concern since timber compartment 92 traditionally has not been prescribed for timber management. There has been no prescribed burning of this Area since establishment of the SRS. There are several dams and reservoirs upstream of the Savannah River swamp which may influence the natural flooding regime of this Area. The expansion of the Fourmile Branch delta into this Area occurred in 1982.

SRS Patrol Index: P-3

Site-Use Permits:

SU-76-108-R Ecology of feral swine releases; Smith and Brisbin; SREL.

SU-77-46-R Studies of radio-telemetered female feral swine; Brisbin; SREL.

SU-78-67-R Movements and habitat utilization of feral swine; Sweeney and Crouch; SRFS and Clemson.

SU-78-74-R Forest mapping; Mcleod; SREL.

SU-79-74-R Baseline studies of flora and fauna; Janecek and Smith; SREL.

SU-80-26-R Sedimentary geology of the Savannah River floodplain; Hanson and Stevenson; SCIAA.

SU-92-34-R Genetic restructuring of forest tree communities; Schnable and Sharitz; SREL.

SU-95-29-F The influence of midstory species composition and density in midstory nesting neotropical migratory birds in bottomland hardwood forests of the Savannah River floodplain; Blake and Miller; SRFS and UGA.

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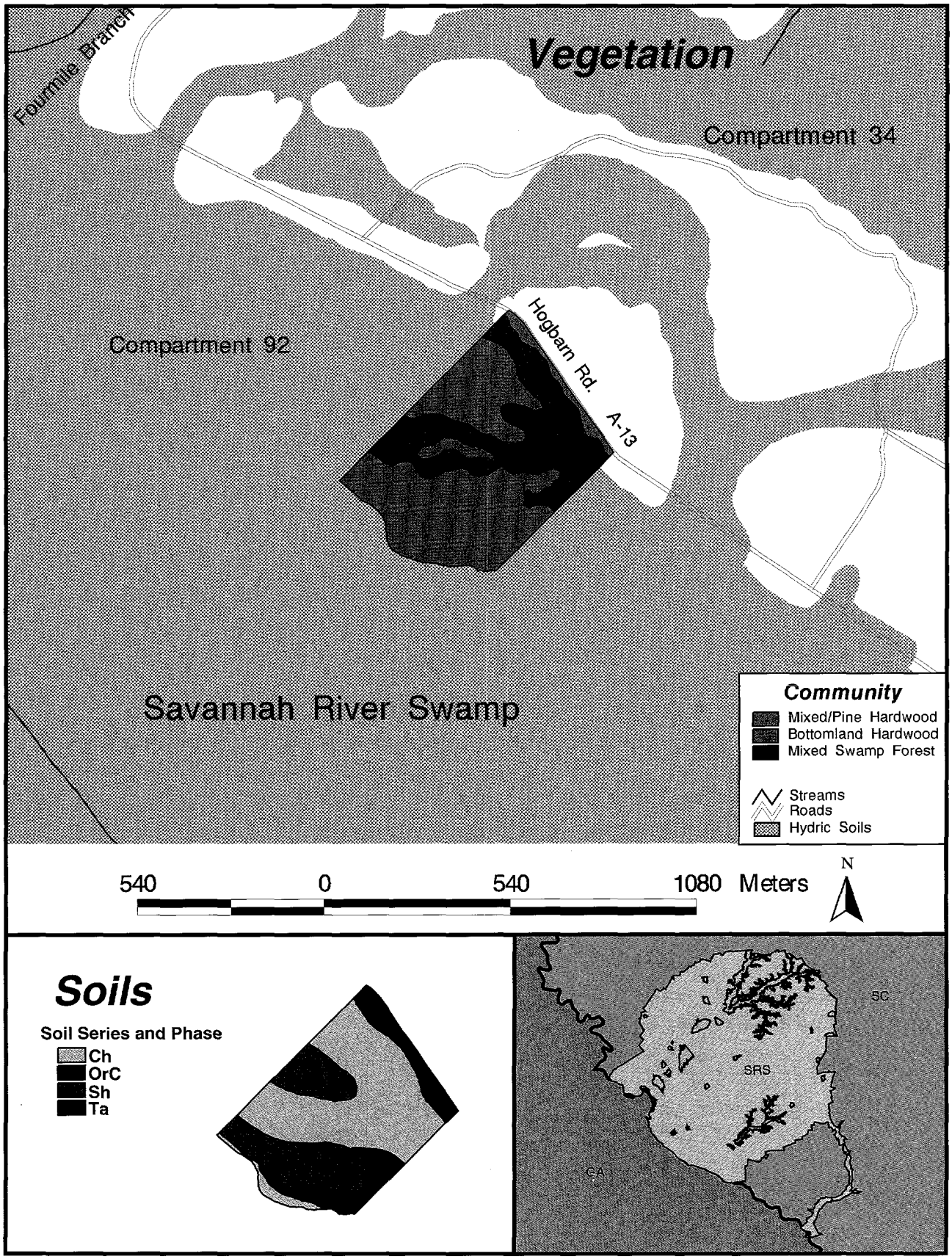

Figure 7-2. *Plant communities and soils associated with the Mixed Swamp Forest Set-Aside Area.*

AREA NO. 8
STEEL CREEK BAY

SET-ASIDE LOCATION ON THE SRS:

The Steel Creek Bay Set-Aside Area is located in the southeast quadrant of the SRS, within the Sunderland Pleistocene Terrace (Langley and Marter, 1973). This Area is found in timber compartment 45 between SC Highway 125 and the CSX rail line, where it is approximately 350 m west of Steel Creek on Roads A-17 and A-17.1 (Figs. 2 and 8-1).

SET-ASIDE DESCRIPTION:

The Steel Creek Bay Set-Aside is a 81.6-acre (33 ha) Area comprised of a semi-permanent, open-water/herbaceous pond surrounded by a partial buffer area of various pine and hardwood plant communities. This Area is one of the original ten SREL habitat reserves and was selected in the mid 1960's to represent a Carolina bay wetland habitat on the SRS. When the Set-Aside habitat reserve program was formalized in 1968, this Area became Reserve #4. Steel Creek Bay (Bay No. 143—see Schalles *et al.*, 1989 for numbering) is an historically man-altered wetland with an irregular shape, approximately 21.8 acres (8.8 ha) in size. It can be described as a shallow water pond whose interior is dominated by the aquatic macrophyte water lily (*Nymphaea odorata*). The outer margin of the central pool has an emergent herbaceous vegetation layer dominated by maidencane (*Panicum hemitomon*; Keough *et al.*, 1990) and cutgrass (*Leersia hexandara*). The vegetation comprising the buffer area of the pond includes both mixed upland and bottomland hardwood communities but there are examples of mesic hardwoods and planted pines as well. Steel Creek Bay was described by Hillestad and Bennett (1982) as having patches of open water with a maximum depth of about 0.6 m, with the remainder of the bay being shallow marsh. The vegetation was dominated by cattail, pickerelweed and rush; water lily and bladderwort were found in the interior pools. The margin of the bay was comprised of longleaf and loblolly pines, black gum, buttonbush, red maple, and wax myrtle.

Steel Creek Bay appears to be neither a true Carolina bay nor a natural pond, but rather an extended depressional area within the Sunderland Terrace that collects ponded water as result of a road embankment. Based on Rogers' (1990) mapping of the soils of this Area, it appears to have natural hydrological connections to the once thermally impacted Steel Creek (Fig. 8-1). Lide (1997) suggested that Steel Creek Bay is not a true Carolina bay by definition but rather is an integral and indistinct part of a natural drainage. Beaver (*Castor canadensis*) traditionally have been associated with this wetland and their activity aids in maintenance of water levels in the pond. The pond draws down in drought years but rarely dries completely.

This Set-Aside Area was one of the original reserve Set-Asides for which there was a change in area when the boundaries for all Set-Asides were established and refurbished. It was originally 11.7 ha of marsh and wetland habitat (Hillestad and Bennett, 1982) but additional buffer acreage was added to this Set-Aside in 1990 when the boundary was re-established. The resulting 65% increase in area includes wetland soils and primarily mixed bottomland hardwoods that extend up the drainage.

The 2.2-mile (3.47 km) boundary line for this Set-Aside is marked with metal DOE Research Set-Aside Area signs and white-blazed trees. Only a few remnant, white-banded boundary trees remain from SREL's posting of this Area in 1969. The 1990 marking of the expanded area was based on wetland soil criteria and aerial

Table 8-1. Vegetation communities of the Steel Creek Bay Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Slash Pine	1.52	0.62	1.86%
Mixed Pine/Hardwood	22.35	9.05	27.39%
Upland Hardwood	3.04	1.23	3.73%
Bottomland Hardwood	6.65	2.69	8.15%
Water	21.79	8.82	26.70%
Bottomland Hardwood/Pine	26.26	10.63	32.18%
Totals:	81.61	33.03	100.00%

photography overlays.

What This Set-Aside Represents:

This wetland Set-Aside represents a relatively undisturbed, semi-natural, bay-like pond. While this Area originally was selected to represent Carolina bay wetland habitats, it is not a true Carolina bay because Steel Creek Bay is not an isolated wetland and its geomorphology is not indicative of a true Carolina bay. Historically, Steel Creek Bay was selected for aquatic ecology research because it is bay-like in hydrology and function and it represented a wetland in the reserve habitat program which was unlike the abandoned Risher farm pond (Area No. 10) and Ellenton Bay of Area No. 1. This wetland Set-Aside is not surrounded by the recommended 200 m buffer area, which would help ensure that the terrestrial habitat adjacent to the wetland is not negatively impacted by Site operations and other activities. This wetland is known to contain fish. Steel Creek Bay has been recommended for inclusion in the EPA's ADID project for Carolina bays (Lide and Davis, 1993; EPA, 1994).

History:

Prior to establishment of the SRS in 1951, this Set-Aside was surrounded completely by agricultural fields. Road A-17 and its impoundment existed prior to establishment of the SRS and the present day Steel Creek Bay is basically the same in area and configuration as the pond that existed in the 1950's. The present-day forest vegetation along the bay's northern margin and at the head of the drainage appears to have been established prior to 1951. In 1973, the South Carolina Wildlife and Marine Resource's Heritage Trust Program (now the SCDNR) inventoried this Set-Aside Area as part of a Smithsonian Coastal Plain Theme Study.

Set-Aside Plant Community Composition:

There are six plant communities associated with this Set-Aside Area, including a small percentage of slash pine (*Pinus elliottii*; 1.9%) along the southeastern margin of the bay and a pure stand of upland hardwoods (3.7%; Table 8-1; Fig 8-1). These stands date to 1958 and 1948, respectively (SRFS CISC stand database). About 28% of this Set-Aside is in mixed pine/hardwood communities which are scattered along the northern margins and throughout the uppermost wetland area. Bottomland hardwoods and mixed bottomland hardwood/pine account for 40% of this Area's vegetation. There is no CISC data available to date these communities; however 1943 photography of the Site showed some stand development. The remainder (26.7%) of the Area is water, representing a marsh community

Table 8-2. Soils of the Steel Creek Bay Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Albany loamy sand, 0-6% slopes	AnB	2.99	1.21	3.66%
Blanton sand, 0-6% slopes	BaB	3.44	1.39	4.22%
Norfolk loamy sand, 2-6% slopes	NoB	2.07	0.84	2.54%
Pickney sand, frequently flooded	Pk	22.36	9.05	27.39%
Rembert sandy loam	Rm	3.41	1.38	4.18%
Wagram sand, 2-6% slopes	WaB	6.50	2.63	7.96%
Williman sand	Wm	40.84	16.53	50.05%
Totals:		81.61	33.03	100.00%

containing herbaceous and aquatic plants.

Sensitive Flora and Fauna:

The seven species of sensitive fauna found in the Steel Creek Bay Set-Aside include the bird-voiced tree frog (*Hyla avivoca*), the pig frog (*Rana grylio*), the spotted turtle (*Clemmys guttata*), the pine snake (*Pituophis m. melanoleucus*), the Carolina swamp snake (*Seminatix pygaea*), and the American alligator (*Alligator mississippiensi*). The wood stork (*Mycteria americana*), one of the two endangered bird species found on the SRS, occasionally forages in this Area. Other species of amphibians and reptiles which are considered rare by researchers on the SRS are found at Steel Creek Bay, including the carpenter frog (*Rana virgatipes*) and the glossy crayfish snake (*Regina rigida;* Gibbons and Patterson, 1978). No sensitive flora have been documented from this Area (Table 3).

Set-Aside Soils:

Of the seven soil series that comprise this Area, the majority (81.6%) are hydric and include the poorly drained Williman sands (50%), the frequently flooded Pickney sands (27.4%), and the Rembert sandy loams (4.2%). These soils are found in the drainage depression and the pond proper. The soils surrounding Steel Creek Bay include the poorly drained, transitional soils of the Albany series (3.7%) and the well-drained Norfolk loamy sands (2.5%) and Wagram sands (8%). The drier, somewhat excessively drained Blanton sands account for 4.2% of the soils in this Area (Table 8-2). See Fig. 8-1 for a soils mapping of this Set-Aside and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

Like most of the SREL habitat reserve areas, this Set-Aside has been and continues to be the site of a variety of ecological research studies. Research emphasis has been on studies of the breeding ecology of wood ducks (*Aix sponsa*) and on the bay's wetland/terrestrial herpetofauna. Some early research in this Area included ant surveys (Van Pelt and Gentry, 1985) and bird censuses (Norris, 1963). Much of the research complements historical research conducted at Ellenton Bay of the Field 3-412 Set-Aside (Area No. 1). Nest boxes have been monitored at Steel Creek Bay for 20 years as part of a long-term population survey and banding study of wood ducks and screech owls on the SRS (Harvey *et al.*, 1989a, 1989b; Hepp *et al.*, 1989; and Kennamer *et al.*, 1990). Steel Creek Bay also has been a site used frequently in studies of the

metapopulation dynamics of reptiles (Burke *et al.*, 1995). These long-term studies on reptile populations, particularly the slider turtle (*Trachemys scripta*), have been summarized by Gibbons (1990). Herpetofaunal biodiversity surveys currently being conducted in this Set-Aside employ coverboard arrays and data-loggers to record frog calls. This research is assessing the terrestrial requirements of aquatic vertebrates and will be used by researchers in determinations of the appropriate size of buffer zones needed to protect some of these species.

Other research in this Set-Aside includes studies of the bay's water chemistry, zooplankton, vegetation, and fish. Steel Creek Bay was one of 18 bays on the SRS surveyed as part of a 1979-1980 study of surface water chemistry (Schalles, 1989). Recent ecotoxicology studies conducted by Jung and Jagoe (1995) have examined the effects of acid deposition and metals on tadpoles. Mahoney *et al.* (1990) and DeBiase and Taylor (1993) surveyed this Set-Aside as part of zooplankton studies of the Carolina bays on the SRS. Permanent transects for vegetation surveys have been installed in this Set-Aside, as well as a Steven's water level recorder-Type A (Keough *et al.*, 1990). Snodgrass *et al.* (1996) surveyed this Set-Aside for fish to determine landscape level patterns of distribution and density of fish species in isolated wetlands on the SRS.

Long-term ecological studies continue to be conducted in this Set-Aside; research emphasizes wetlands ecology, with herpetofauna and waterfowl being the main organisms of interest. To date, there are 43 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

SRS gravel roads border portions of this Area and there is periodic maintenance to the culvert which crosses under Road A-17. Beaver control measures periodically are employed at this culvert, contracted by the SRFS. The hydrology of this Set-Aside likely is influenced by beaver activity as well as the road impoundment. There is no buffer area adjacent to this Set-Aside on Road A-17. There is no indication from the SRFS historical burn GIS database that there has been any prescribed fire in the wetland portion of this Set-Aside; however, the upper portions of the drainage were burned in 1981, 1984, and 1991.

SRS Patrol Indexes: U-7,8 V-7,8

Site-Use Permits:

SU-76-100-R SREL Wood duck nest box study; Brisbin; SREL.

SU-77-41-R (Amendment 1) Species assessment in selected habitats; Gibbons and Tuberville; SREL.

SU-79-10-R Habitat and movement patterns of wood ducks; Fendley and Costanzo; SRFS and CU.

SU-79-74-R Baseline studies of flora and fauna; Janecek and Smith; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-92-45-R Habitat use of kinosternid turtles; Gibbons and Burke; SREL.

SU-96-08-R A study of the distribution of toads (*Bufo* spp.) on the SRS ; Taylor and Hopkins; SREL

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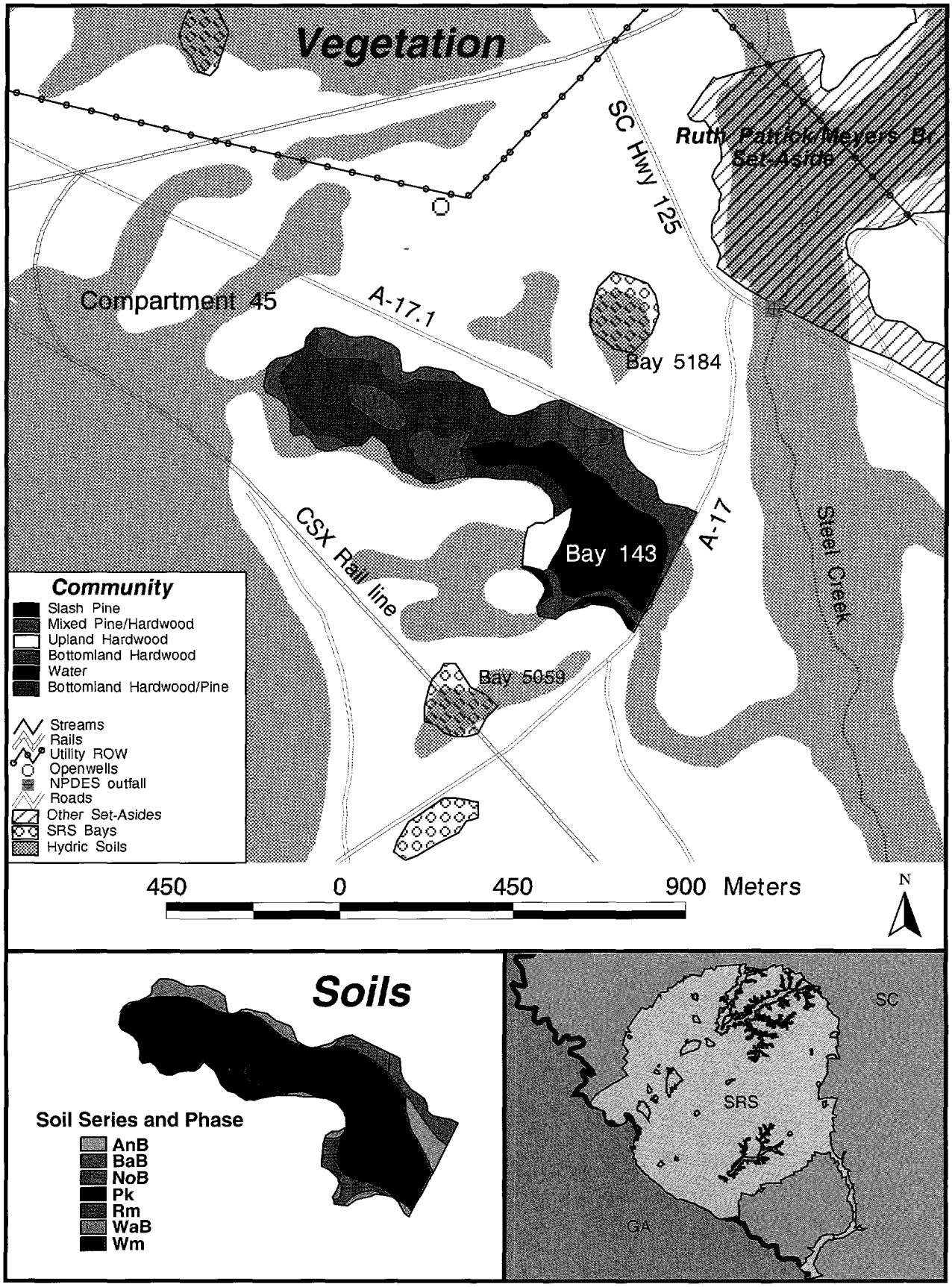

Figure 8-1. *Plant communities and soils associated with the Steel Creek Bay Set-Aside Area.*

Area No. 9
Cypress Grove
and Replacement Areas No. 9A and 9B
Stave Island and Georgia Power Sites

Set-Aside Locations on the SRS:

The Cypress Grove Set-Aside (Area No. 9) was a 22.5-acre (9.1 ha) tract located in the southwestern portion of the SRS, within the floodplain of the Savannah River. Because this Area was contaminated by site operations related to T Area, SREL and the Set-Aside Task Group requested and were granted two new areas as replacement Set-Asides for the original Cypress Grove (SU-79-74-R, Amendment 2, 1997). The Stave Island replacement site (Area No. 9A) is located in the Savannah River swamp equidistant between Pen Branch and Steel Creeks and east of Stave Island. The Georgia Power replacement site (Area No. 9B) is located in the Savannah River swamp at the confluence of Fourmile Branch and the Savannah River; its southwestern boundary is the Savannah River, approximately 750 meters NE of the Plant Vogtle cooling towers (Fig. 9-1). Both of these sites are located within timber compartment 92.

Set-Aside Descriptions:

The Cypress Grove Set-Aside Area was one of the original ten reserve areas on the SRS and was set aside as a representative of the swamp-forest community type. This Set-Aside was a narrow strip of flooded swamp located downstream of the industrial facilities of T Area and upstream of the intake for pump station No. 3 of the Site river water distribution system. This area was dominated by bald cypress (*Taxodium distichum*) and water tupelo (*Nyssa aquatica*). Cypress Grove was documented to be contaminated with organic solvents and contaminants resulting from TNX and CMX operations. Additionally, the vegetation in this tract no longer was representative of a mature swamp forest due to impoundment of water by Site facilities. Because of this impoundment of water, there appears to have been a significant loss of mature trees in this area in the last several decades. Boundary lines apparently never had been marked for this Set-Aside and efforts to re-establish the boundaries in the early 1990's were unsuccessful. Because of the impacts of Site operations to this Area, the original Cypress Grove Set-Aside was deleted from the Set-Aside Program in 1997 and replaced with two other areas, both located in the Savannah River swamp.

Both of the replacement tracts are representative of the swamp-forest (floodplain) community, but each differs in its particular attributes and it was difficult to select one site as more desirable than the other; consequently, both tracts were added to the Set-Aside Program. Vegetation of the Stave Island Site (replacement Area No. 9A) is primarily cypress/tupelo, probably less than 100 years old; this vegetation has been dated to 1907 by the SRFS (CISC stand data). Vegetation of the Georgia Power Site (replacement Area No. 9B) also is primarily cypress/tupelo, ranging from 10-200 years old; the age distribution is bimodal, with peaks occurring at 40-50 years and 120-130 years. In addition, there is a mixture of pines and bottomland hardwoods that occur along a slightly raised ridge within the site and on the natural levy that parallels the Savannah River.

What These Set-Asides Represent:

It was important that the Areas replacing the original Cypress Grove Set-Aside be representative of the swamp forest community type under the influence of the Savannah River swamp seasonal flooding regime. This

community type is under-represented in the Set-Aside Program and the representatives of uncontaminated swamp forest in the Program are, for the most part, not subjected to prolonged seasonal flooding such as that from the Savannah River. Both of the added tracts will meet this criterion.

History:

The area of the Savannah River swamp in which the Stave Island and Georgia Power replacement sites are located first was logged in the early part of the twentieth century by the Leigh Banana Case Company and the J. B. Morton Lumber Company (Fetters, 1990). No logging of this area occurred prior to that time due to the extreme inaccessibility of this portion of the swamp. Since establishment of the SRS, no timber has been harvested from this timber compartment. However, there have been 30 years of thermal impacts to the swamp as a result of reactor operations. In 1989 a tornado crossed Stave Island and a portion of the swamp now included in the Stave Island replacement Set-Aside Area.

Set-Aside Plant Community Composition:

The vegetation of both replacement Set-Aside Areas is cypress-tupelo, but the two sites differ from one another in the age distributions of their respective vegetation. In the future, SREL will update the accounts for these Areas and provide more specific information on the plant communities characteristic of each.

Sensitive Flora and Fauna:

No sensitive flora or fauna have been documented from the original Cypress Grove Set-Aside nor from the Stave Island or Georgia Power replacement Areas (Tables 3 and 4).

Set-Aside Soils:

The two replacement Areas are composed of the Chastain (Ch) and Tawcaw (Ta) soil series which are somewhat poorly and poorly drained silty and clayey floodplain soils. The Georgia Power Site also has a strip of Shellbluff (Sh) series soils which supports the natural levy to the river. This series consists of well-drained, moderately permeable soils that formed in loamy, floodplain sediments. See Appendix 3 for a description of soils.

Research Associated With These Set-Asides:

To date, no research has been documented from the original Cypress Grove Set-Aside (Hillestad and Bennett, 1982). Research from the Stave Island replacement tract includes several seedling and regeneration studies conducted by SREL researchers (Schneider and Sharitz, 1986, 1988; Huenneke and Sharitz, 1986, 1990) as well as investigations of tree population dynamics (Shea *et al.*, 1993; Jones *et al.*, 1994b). Additionally, significant research has been and continues to be conducted by SREL researchers on Stave Island, which is adjacent to this site. Stave Island research has focused on the dynamics of regeneration of woody plants, including investigations of seedfall, seedling dynamics, and seedling recruitment in floodplain forests (Jones and Sharitz, 1990; Jones *et al.*, 1994a). SREL research in the swamp adjacent to the Stave Island tract includes studies of primary production in floodplain forests (Megonigal *et al.*, 1997) and investigations of seed viability and buoyancy (Edwards *et al.*, 1994).

Research conducted at the Georgia Power Site has focused on seedling plots and vegetation transects and primarily has been conducted by SREL researchers (Repaske, 1981).

Historical/Current/Future Influences:

SREL will mark the boundaries of the replacement areas, where feasible, generate accurate acreage estimates, and update the Set-Aside GIS coverage. The hydrology of these

areas is influenced by seasonal flooding events and upstream dams and impoundments. In addition, the proximity of the Georgia Power Site to the Plant Vogtle nuclear power plant could result in negative impacts to this site as a result of plant operations.

SRS Patrol Indexes:

K-3,4 (Original Cypress Grove)
U-5 **V**-5,6 (Stave Island Site)
P-1 (Georgia Power Site)

Site-Use Permits for Original Cypress Grove:

SU-79-74-R Baseline studies of flora and fauna; Janecek and Smith; SREL.

SU-90-03-R TNX swamp monitoring wells; Glascock and Nichols; WSRC and SRTC.

SU-91-44-O TNX groundwater remediation project; Bennett; WSRC-F&S.

SU-94-50-O TNX area groundwater characterization; Cardoso-Neto; WSRC-ERD.

SU-96-07-O Characterization/remediation of TNX operable unit; Cardoso-Neto; WSRC-ERD.

Site Use Permits for Replacement Areas:

SU-79-74-R (Amendment 2) Baseline studies of flora and fauna; Janecek and Smith; SREL.

SU-79-93-R Effects of reactor cooling on cypress-tupelo; Repaske; SREL.

SU-80-26-R Sedimentary geology of the SR floodplain; Hanson and Stevenson; SCIAA.

SU-83-33-R Plant recruitment in swamp forest communities; Sharitz and Schneider; SREL.

SU-86-04-R Bottomland hardwood ecosystem processes study; Sharitz, Schneider, and Martin; SREL.

SU-87-50-R Productivity of bottomland forests; Sharitz and Jones; SREL.

SU-89-55-R Seedling recruitment in cypress-tupelo forests; Sharitz; SREL.

SU-90-57-R Effects of tornadic disturbance; McLeod, Sharitz, and Tucker; SREL.

SU-92-34-R Genetic structure of forest tree communities; Schnable and Sharitz; SREL.

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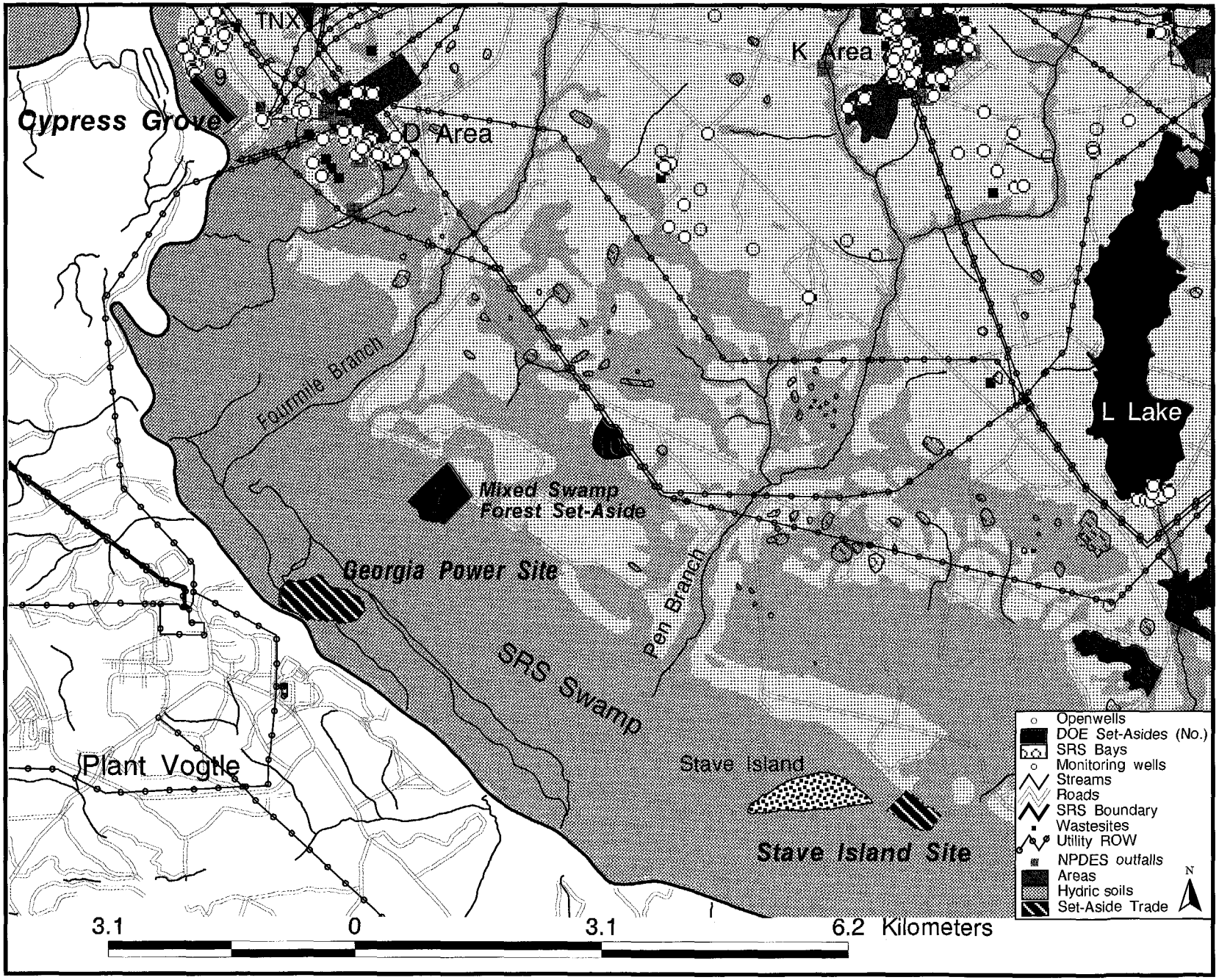

Figure 9-1. *Location of the original Cypress Grove Set-Aside and the Stave Island and Georgia Power replacement Areas.*

AREA NO. 10
RISHER POND AND EXPANSION

SET-ASIDE LOCATION ON THE SRS:

The Risher Pond Set-Aside Area is located in the southwest portion of the SRS and is within the Sunderland Pleistocene Terrace (Langley and Marter, 1973). Found in timber compartments 34 and 35, this Area is between Fourmile Branch and Pen Branch, where it is bordered by Risher Pond Road (Road A-13.2) and two South Carolina Electric and Gas (SCE&G) powerline rights-of-way (ROW; Figs. 2 and 10-2).

SET-ASIDE DESCRIPTION:

Risher Pond is an abandoned farm pond that originally was one of the ten SREL habitat reserve areas. As Reserve #9, this 4-acre (1.6 ha) Area had only a 3.5-m wide terrestrial border that buffered the pond. When the Set-Aside Program was expanded in the 1980's, this Set-Aside was modified to include a partial 200-m buffer area around the pond. With the expansion of the buffer area, this Set-Aside now totals 36.3 acres (14.7 ha). Risher Pond is a permanent freshwater pond approximately 3.2 acres (1.3 ha) in size which results from a natural drainage that has been impounded since the 1930's (Figs. 10-1, 10-2). It is an acidic, soft water pond that has remained virtually undisturbed since the 1950's, having been drained only once during that time. The pond has a maximum depth of 2.5 m and its water level fluctuates no more than a few centimeters seasonally or annually (Gibbons and Semlitsch, 1991). A 560-m drift fence encircles the pond; 56 metal buckets are placed at 20 m intervals in paired holes on opposite sides of the drift fence (Gibbons and Bennett, 1974).

The asymmetrical buffer area of this Set-Aside includes only a narrow strip of land around the northeast shore of Risher Pond. The northeast shore is parallel with and adjacent to SRS Road A-13.2 and supports a scrub/shrub vegetation community. A duel ROW for 115 KV and 230 KV transmission lines also borders the pond on this northern margin. This scrub/shrub cover provides some buffer and some degree of shade to the upper regions of the pond. Due to a long-standing agreement between SREL and SCE&G, this vegetation community is perpetuated because SCE&G has agreed to maintain the pond ROW by topping out the trees and shrubs rather than treating them with herbicides. This vegetation control is necessary on the pond margins to prevent vegetation from encroaching into the transmission lines.

Maturing pine plantations and mixed pine/hardwood communities are characteristic of the more extensive upland portions of the buffer area around the remainder of Risher Pond (Fig. 10-2). Mixed bottomland hardwood communities are found below the pond dam and within the old floodplain. The southwest, southeast, and northwest banks all are moderately overgrown with switch cane and wax myrtle; loblolly pine, sweetgum, and red maple are the dominant overstory species in this portion of the buffer area (Hillestad and Bennett, 1982). There is evidence that beavers inhabit this Set-Aside, as trees along the pond margins are damaged and the pond dam has holes where beavers have tunneled. Hillestad and Bennett (1982) reported that Risher Pond had no aquatic macrophytes growing within the pond; however, this plant community is well established today. The 0.98-mile (1.6 km) boundary line is marked with metal DOE Research Set-Aside Area signs and white-blazed trees. Only a few remnant white-banded boundary trees remain from SREL's 1969 posting of this Area.

WHAT THIS SET-ASIDE REPRESENTS:

This Set-Aside was selected for the habitat reserve program in the 1960's to represent an

Table 10-1. Vegetation communities of the Risher Pond Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	4.40	1.78	12.11%
Longleaf Pine	7.21	2.92	19.85%
Mixed Pine/Hardwood	4.53	1.83	12.47%
Bottomland Hardwood	12.14	4.91	33.42%
Water	3.24	1.31	8.92%
Bottomland Hardwood/Pine	3.23	1.31	8.89%
Scrub/Shrub	1.58	0.64	4.35%
Totals:	36.33	14.70	100.00%

abandoned farm pond community. It also historically was considered to be a water source for fire control on the Site. As a research Set-Aside, it represents a permanent aquatic habitat that traditionally has been a source of study organisms for various research projects. This farm pond supports a moderate population of aquatic and semi-aquatic turtles, including yellow-bellied sliders, snapping turtles, mud turtles, chicken turtles, and musk turtles. Mole, tiger, and marbled salamanders use the pond as a breeding site. This Set-Aside has a drift fence for monitoring the movements and habitat use of these animals; this drift fence is similar to those around Ellenton Bay (Area No. 1), Rainbow Bay (Area No. 16), Ginger's Bay (Area No. 19), Flamingo Bay (Area No. 21), and Dry Bay (Area No. 23). The buffer area around Risher Pond was enlarged in part to accomodate the expansion of ecological research into the terrestrial and bottomland habitats surrounding the pond and in part to protect the terrestrial nesting sites of the aquatic turtles that inhabit the pond. The expanded buffer area includes the aquatic-wetland-terrestrial continuum and ensures that the environs immediately around Risher Pond will not be impacted by most Site operations and forest management activites.

In addition to the herpetofaunal studies for which this Set-Aside is known, this Area also traditionally has been used by ecotoxicologists as a control pond where uncontaminated reference fish populations can be sampled for comparison with study organisms from areas contaminated with various heavy metals and radionuclides.

History:

Before the SRS was established in 1951, Risher Pond was an actively maintained farm pond which was surrounded for the most part by agricultural fields; only the wetland drainage below the pond dam was in lowland swamp deciduous forest. A hardwood hedgerow and inclusion existed on the western periphery of the pond; beyond this inclusion was a house and outbuildings which were outside the boundaries of the present day Set-Aside. Risher Pond was constructed in the 1930's. E.D. Risher, Sr., presumably connected with the Risher farm pond, was a logging skidder foreman and plant superintendent for the Leigh Banana Case Company during the period when the Savannah River Swamp was being logged (Fetters, 1990). In 1973, the South Carolina Wildlife and Marine Resource's Heritage Trust Program (now the SCDNR) inventoried this Set-Aside Area as part of a Smithsonian Coastal Plain Theme Study. A

Table 10-2. Soils of the Risher Pond Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	21.04	8.51	57.91%
Williman sand	Wm	12.02	4.86	33.09%
Water	W	3.27	1.32	9.01%
Totals:		36.33	14.70	100.00%

230 KV transmission line was constructed over the north end of the pond by SCE&G in the mid-1980's. Risher Pond was drained by researchers in 1984 to collect turtles and to study the effects of a drawdown on these animals. In 1989, the buffer area around the pond was expanded. Risher Pond is one of 28 ponds on the SRS (Schields *et al.*, 1982).

Set-Aside Plant Community Composition:

This Set-Aside is comprised of seven plant communities, one of which is the pond itself (Table 10-1). Within the terrestrial buffer area, plantations of loblolly (*Pinus taeda*; 12.1%) and longleaf pine (*P. palustris*; 19.9%) border two sides of the pond below the ROWs. These plantations date to 1957 and 1958, respectively (SRFS CISC stand database). Mixed pine/hardwoods (12.5%) are found on the southern margin of the pond and as inclusions within the pine plantations; these communities are the same age as the pines. Bottomland hardwood and bottomland hardwood/pine communities compose 42.3% of the Area and date to 1933. The scrub/shrub vegetation in the ROWs and on the road bank at the top of the pond accounts for

Figure 10-1. *Risher Pond.*

4.4 % of the Area; this vegetation is cut back to a height of 6-10 feet approximately every three years. Water associated with the pond accounts for the remaining 8.9% of the vegetation of this Area.

Sensitive Flora and Fauna:

Eleven species of sensitive fauna are documented to occur in the Risher Pond Set-Aside, including the eastern tiger salamander (*Ambystoma t. tigrinum*), the bird-voiced tree frog (*Hyla avivoca*), the Carolina gopher frog (*Rana capito*), the pickerel frog (*Rana palustris*), the eastern slender glass lizard (*Ophisaurus attenuatus longicaudis*), the pine snake (*Pituophis m. melanoleucus*), the southern hognose snake (*Heteron simus*), the Carolina swamp snake (*Seminatix pygaea*), the American alligator (*Alligator mississippiensi*), the bobcat (*Lynx rufus*), and the star-nose mole (*Condylura cristata*; Table 4). No sensitive flora have been documented from this Area (Table 3).

Set-Aside Soils:

Upland soils of the somewhat excessively drained Blanton sands comprise 58% of this Area (Table 10-2). The depressional, poorly drained Williman sands are wetland soils associated with the pond and floodplain area and account for 33.1% of the Set-Aside. The water of Risher Pond accounts for the remaining 9% of the soils of this Set-Aside. See Fig. 10-2 for soils mapping of this Set-Aside and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

The farm pond habitat of the Risher Pond Set-Aside has provided researchers with a site at which to conduct many long-term studies of the ecology of reptiles and amphibians (Gibbons *et al.*, 1976; Gibbons and Patterson, 1977, 1978; Gibbons, 1990a; Gibbons and Semlitsch, 1991). Some of these studies have used a drift fence method to determine the activity and movement patterns of particular species of reptiles and amphibians (Gibbons and Bennett, 1974; Burke *et al.*, 1995) and a number of studies have been conducted on the reproductive biology of turtles (Gibbons and Nelson, 1978; Gibbons *et al.*, 1982; Congdon *et al.*, 1983; Gibbons, 1983; Condon and Gibbons, 1985). Research on the reproductive biology of salamanders has been conducted at Risher Pond by Sever *et al.* (1996) and studies investigating the effects of fish competition and predation on salamanders has been conducted by Semlitsch (1987, 1988). Other species of amphibians (Semlitsch *et al.*, 1995) and reptiles (Nelson and Gibbons, 1972) also have been studied here. See Gibbons *et al.* (1976) for a list of herpetofaunal species collected from Risher Pond.

This pond also has served as a source of control stocks of fish for long-term genetic and contaminant studies. Risher Pond supports a population of mosquitofish (*Gambusia* spp.) with high levels of allozyme polymorphisms (Smith *et al.*, 1983; Wooten *et al.*, 1988; Lydeard *et al.*, 1991). Because these fish have never been exposed to elevated levels of heavy metals or other toxicants, these populations traditionally have been used for genetic and ecotoxicology studies (Diamond *et al.*, 1989, 1991; Heagler *et al.*, 1993; Jagoe *et al.*, 1996; Kramer *et al.*, 1992a, 1992b; Meffe *et al.*, 1995; Newman *et al.*, 1989; Newman and Heagler, 1991). In addition, studies comparing Risher Pond mosquitofish with populations from thermally impacted environments have been conducted by Meffe (1990), Meffe and Snelson (1993), and Nesbit and Meffe (1993).

This pond also once housed a temporary enclosure that was used as a point of release for red and gray foxes (Jeselnik and Brisbin 1980). Wild-trapped and captive-reared foxes were placed in this pen for a period of one or more months and then released into the surrounding area. Zooplankton surveys have been conducted in Risher Pond by DeBiase and Taylor (1993). Risher Pond also has been included in a recent study which is investigating the distribution of

toads (*Bufo* spp.) on the SRS. To date, there are 70 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

Two powerline ROWs which are maintained by SCE&G cross over Risher Pond. Rather than mowing and herbiciding the vegetation within these ROWs, SCE&G maintains these crossings within the Set-Aside Area by topping the trees; this allows for some natural shading of the pond edge. Beaver activity within the pond dam is obvious and eventually could threaten the integrity of this structure. Because the northeast end of the pond does not have a 200 m buffer, this portion of the Set-Aside is more likely to be impacted by ROW and road maintenance and forest management activities. Based upon the SRFS's historical burn GIS database, this Area was subjected to a prescribed burn in 1981.

SRS Patrol Indexes: P-5 Q-5

Site-Use Permits:

SU-79-74-R Baseline studies of flora and fauna; Janecek and Smith SREL.

SU-80-23-R, Amendments 1-3 Life history strategies of the yellow-bellied pond slider; Gibbons; SREL.

SU-85-05-C Survey proposed route for Vogtle-SCE&G 230KV tie-in transmission line; Cain and Jernigan; SCE&G and DOE.

SU-85-69-C Construct 230KV transmission line; Cain and Jernigan; SCE&G and DOE.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-92-35-R Environmental toxicology collection of fish; Jagoe; SREL.

SU-93-17-O Maintenace of site utility right-of-ways; McCormick; WSRC-F&S.

SU-96-08-R A study of the distribution of toads (*Bufo* spp.) on the SRS; Taylor and Hopkins; SREL.

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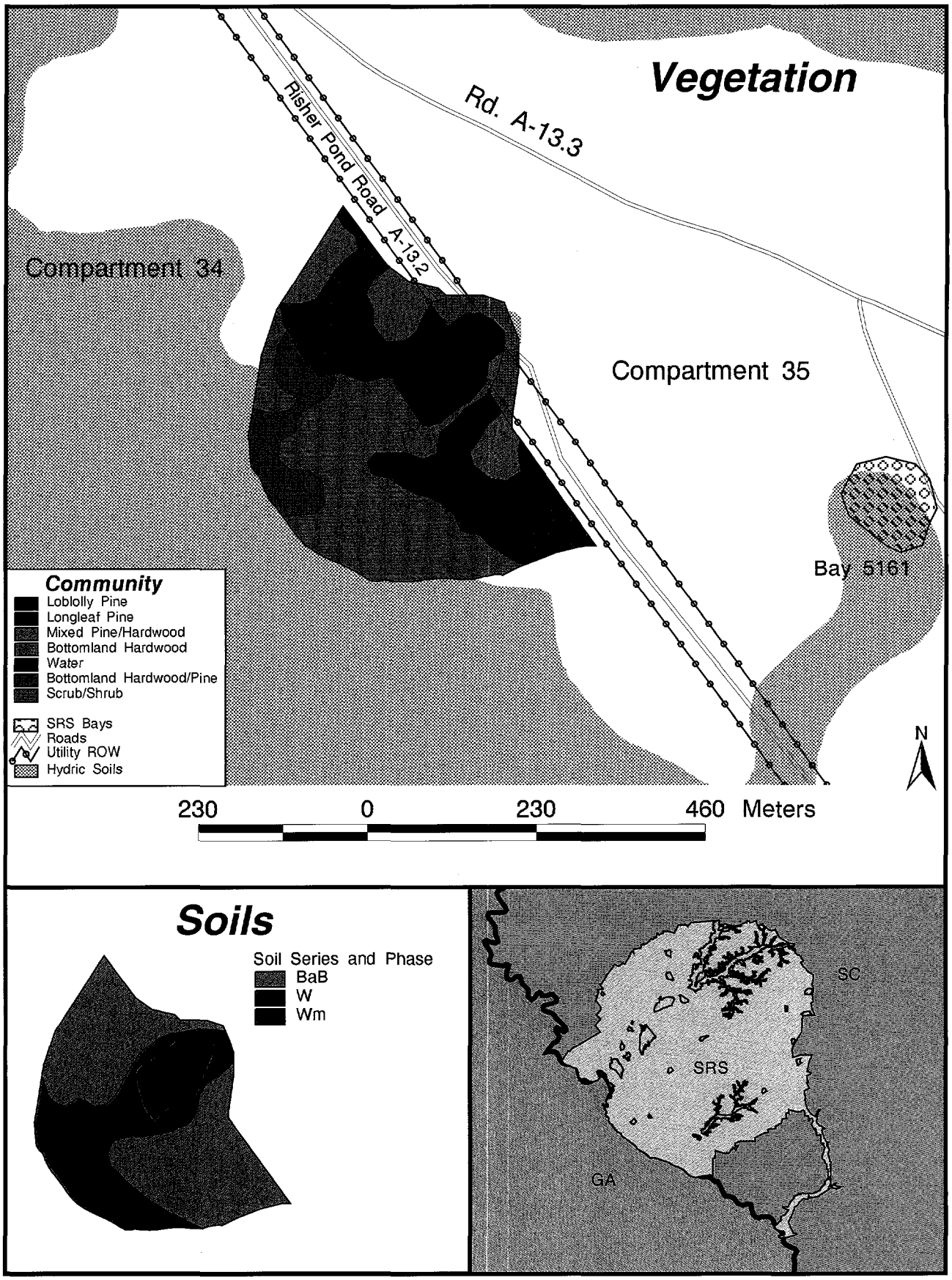

Figure 10-2. *Plant communities and soils associated with the Risher Pond Set-Aside Area.*

AREA NO. 11
RUTH PATRICK-MEYERS BRANCH

SET-ASIDE LOCATION ON THE SRS:

The Ruth Patrick-Meyers Branch Set-Aside is located east of L Lake in the southeast quadrant of the SRS. Meyers Branch originates from headwaters south of SRS Road B from the Dunbarton Bay complex located in the Aiken Plateau and flows southwesterly through the Brandywine and Sunderland Terraces until it converges as a tributary to Steel Creek north of S.C. Highway 125 (Langley and Marter, 1973; Figs. 2 and 11-1).

SET-ASIDE DESCRIPTION:

Meyers Branch is a second order stream whose watershed encompasses 12,565 acres (5,085 ha), approximately one half of the Steel Creek drainage. This Set-Aside occupies portions of six SRFS timber resource compartments: compartments 36,40,41,75,82, and 84. The boundaries of this Set-Aside were delineated and marked to include Meyers Branch and its tributaries, their associated 100-year floodplain and hydric soils, the most erodible adjacent slopes (15% or steeper slopes), and all upland hardwood and mixed species stands that are connected to the drainage. The combined total area for the Ruth Patrick-Meyers Branch Set-Aside is 1,868.9 acres (756.4 ha); the perimeter boundary length is 48.7 miles (78.4 km). The boundary of this Area is posted with metal DOE Research Set-Aside Area signs. Both the Steel Creek Bay and Cypress Bay Set-Asides (Area No.'s 8 and 24) are near this Set-Aside. There are numerous road and railroad crossings and utility rights-of-way (ROWs) in this Set-Aside. The closest industrial complexes are P and L Areas.

WHAT THIS SET-ASIDE REPRESENTS:

As a Set-Aside, the Meyers Branch drainage and associated riparian corridor represents a nonimpacted, integrated stream ecosystem. Meyers Branch is typical of a coastal plain blackwater stream in that it is low gradient, exhibits a sandy substrate bottom, and is heavily canopied with well-developed riparian vegetation. Meyers Branch is one of the least disturbed streams on the SRS. Because it originates and terminates entirely on the SRS, this stream is not subjected to any impacts from outside of the Site. This makes Meyers Branch invaluable as a reference study stream to assess impacts to other SRS streams.

HISTORY:

Prior to acquisition of the Site in 1951, agriculture and timber production were the primary land uses within and surrounding the drainage. For the most part, the marginal, well-drained lands adjacent to the drainage had been abandoned in the 1930's and 1940's for agricultural production and had instead been undergoing extensive selective logging. The age class distribution of vegetation in this area ranges from 3-78 years old. However, a relic bald cypress exists in the drainage which has been estimated to be over 600 years old. Numerous homesites and farm ponds were located on the Meyers Branch drainage, ranging from the town of Dunbarton, centered in the Dunbarton Bay complex, to the community of Meyers Mill, which was established along the railroad siding between SRS Road 9 and Steel Creek. (For historic information on these communities see Brooks and Crass, 1991 and Browder *et al.*, 1993).

SET-ASIDE PLANT COMMUNITY COMPOSITION:

The Ruth Patrick-Meyers Branch Set-Aside Area contains all of the major SRS plant communities

Table 11-1. Vegetation communities of the Ruth Patrick-Meyers Branch Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	29.13	11.79	1.56%
Slash Pine	10.33	4.18	0.55%
Mixed Pine/Hardwood	336.97	136.37	18.03%
Upland Hardwood	216.22	87.51	11.57%
Bottomland Hardwood	886.48	358.76	47.43%
Mixed Swamp Forest	93.45	37.82	5.00%
Water	47.84	19.36	2.56%
Bottomland Hardwood/Pine	215.25	87.11	11.52%
Forb/Grassland	17.13	6.93	0.92%
Other—Disturbed Area	16.10	6.52	0.86%
Totals:	1,868.90	756.36	100.00%

except the sandhills and Carolina bay communities (Table 2). A general breakdown of the vegetational compostion of the drainage indicates that 20% of the Set-Aside is in upland pine and pine/hardwood mix, 12% is upland hardwood, 59% is bottomland hardwood and mixed bottomland hardwood/pine, and 5% is swamp forest species. Roads, railroads, utility rights-of-way, and water account for the remaining 4% of the Set-Aside (Table 11-1). Vegetation in the upper reaches of Meyers Branch is primarily sweet gum-yellow poplar (*Liquidamber styraciflua-Liriodendron tulipifera*) while the lower reaches are dominated by red maple (*Acer rubum*), oaks (*Quercus* spp.), and bald cypress (*Taxodium distichum*). Transitional zones from xeric to mesic contain typical vegetation; however, the upland portions of the drainage have limited hardwood and mixed species habitat types. The vast majority of the vegetation surrounding this Set-Aside is in pine plantation. See Fig. 11-1 for an interpretation of the various vegetation community types that comprise this Set-Aside. A number of beaver ponds have been established on the drainage and, although this animal is considered to be a natural part of the stream ecosystem, selective trapping of beavers is conducted at road and railroad stream culverts. Trapping of feral hogs also is allowed in the Meyers Branch drainage primarily to reduce damage to pine plantations and competition with native species for mast.

Sensitive Flora and Fauna:

Six plant species listed on federal and/or South Carolina special status lists are documented from the Ruth Patrick-Meyers Branch Set-Aside (Table 3). They include bog-spice bush (*Lindera subcoriacea*), nestronia (*Nestronia umbellula*), wild indigo (*Baptisia lanceolata*), sandhill seedbox (*Nolina georgiana*), sandhills milk vetch (*Astragalus michauxii*), and Carolina bogmint (*Macbridea caroliniana*). There are no records sensitive animal species from this Area. However, the rare snail *Goniobasis proxima* is found in the Meyers Branch drainage (Wood, 1982); this gastropod is found in only six other locations in South Carolina (M. Mulvey per. comm.).

Set-Aside Soils:

There are 30 different soil series and phases associated with this Set-Aside. Soils vary from the uplands Blanton-Lakeland associations which are excessively drained, to the Troup-Pickney-Lucy association which are well-drained, to the very poorly drained soils of the bottomland. The poorly drained hydric soils associated with the floodplain include the Doravan, Eunola, Fluvaquents, Ochlockonee, Ogeechee, Pickney, and Williman series. These wetland soils account for approximately 43% of the soils of the Meyers Branch drainage. See Table 11-2 for a listing and Fig. 11-2 for soils mapping of the Set-Aside. Appendix 3 contains a description of soils.

Research Associated With This Set-Aside:

A significant amount of research has been and continues to be conducted within the Ruth Patrick-Meyers Branch Set-Aside Area. Meyers Branch traditionally has been the control stream for much of the research on Steel Creek. Its water quality serves as a comparison to the E. P. Odum Wetland Set-Aside (Upper Three Runs and Tinker Creeks) and currently is being used as a control/comparison for the Pen Branch Restoration Project. As the SRS moves toward watershed-based resource management plans, this Set-Aside can be evaluated for analyses of sub-watershed ecosystem processes. Some of the studies conducted in this Set-Aside include:

- nutrient flow in disturbed and undisturbed areas;
- surveys of clam densities;
- inventories of aquatic macroinvertebrate communities;
- microbial genetics;
- fish community structure and movement patterns;
- migratory bird surveys;
- beaver influence on fish populations;
- hyporheic studies.

Offsite investigators currently are cooperating with SREL on NERP-funded projects examining the productivity of bottomland hardwoods and the characteristics of wetland soils. In other studies, the upper reaches of Meyers Branch have been monitored to determine the effects of forestry herbicide treatments to adjacent pine regeneration stands.

To date, 56 publications and reports have been generated from research conducted in this Set-Aside Area.

Historical/Current/Future Influences:

This Set-Aside contains SRS primary Site roads, a portion of the Site perimeter fence line, SCE&G rights-of-way, railroad crossings, an abandoned railroad trestle, an NPDES outfall, beaver control measures, an abandoned farm pond dam, a pre-SRS trash dump, and a ditch draining a portion of the Dunbarton Bay complex into the Meyers Branch system. This ditch functions well during high rainfall periods and may influence the hydrology and water quality of Meyers Branch. In addition, there is the potential that runoff from the P Area coal fly-ash basins may enter Meyers Branch via this ditch.

SRS Patrol Indexes: **S**-11,12,13,14,15; **T**-11,12,13,14,15,16; **U**-8,9,10,11,12,13,14; **V**-8,9,10,11,12,13,14,15,16; **W**-12,13,14,15; **X**-15

Site-Use Permits:

Experiment No. 1254 (1973-indefinite) Effects of reactor effluents on plant communities; Sharitz; SREL.

SU-80-06-R Comparative physiological ecology of pond and bald cypress; Neufeld and Sharitz; SREL.

SU-83-56-R Meyers Branch ecological assessment and monitoring; Sharitz; SREL.

SU-84-03-R Meyers Branch watershed ecosystem; Kovacic; SREL.

SU-86-36-R Population and community dynamics of SRS fishes; Meffe; SREL.

Table 11-2. Soils of the Ruth Patrick-Meyers Branch Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Ailey sand, 2-6% slopes	AeB	4.39	1.78	0.24%
Blanton sand, 0-6% slopes	BaB	180.73	73.14	9.67%
Blanton sand, 6-10% slopes	BaC	10.54	4.27	0.56%
Dorovan muck, frequently flooded	Da	7.28	2.94	0.39%
Dothan sand, 0-2% slopes	DoA	2.49	1.01	0.13%
Dothan sand, 2-6% slopes	DoB	40.99	16.59	2.19%
Eunola fine sandy loam, 0-2% slopes	EnA	19.66	7.96	1.05%
Fluvaquents, frequently flooded	Fa	380.54	154.01	20.36%
Fuquay sand, 2-6% slopes	FuB	57.75	23.37	3.09%
Fuquay sand, 6-10% slopes	FuC	1.00	0.40	0.05%
Hornsville fine sandy loam, 0-2% slopes	HoA	7.90	3.20	0.42%
Lakeland sand, 0-6% slopes	LaB	10.47	4.24	0.56%
Lakeland sand, 6-10% slopes	LaC	12.22	4.94	0.65%
Lucy sand, 2-6% slopes	LuB	0.21	0.08	0.01%
Norfolk loamy sand, 0-2% slopes	NoA	0.41	0.16	0.02%
Ochlockonee loamy sand, occasionally flooded	Oa	6.31	2.55	0.34%
Ocilla loamy sand, 0-2% slopes	OcA	2.50	1.01	0.13%
Ogeechee sandy loam, ponded	Og	55.73	22.56	2.98%
Orangeburg loamy sand, 2-6% slopes	OrB	0.47	0.19	0.02%
Pickney sand, frequently flooded	Pk	330.31	133.68	17.67%
Troup sand, 0-6% slopes	TrB	69.15	27.98	3.70%
Troup sand, 6-10% slopes	TrC	24.72	10.01	1.32%
Troup sand, 10-15% slopes	TrD	84.99	34.39	4.55%
Troup & Lucy sands, 15-25% slopes	TuE	89.21	36.10	4.77%
Udorthents, friable substratum	Uo	17.30	7.00	0.93%
Vaucluse sandy loam, 2-6% slopes	VaB	0.01	0.00	0.00%
Vaucluse-Ailey complex, 6-10% slopes	VeC	187.40	75.84	10.03%
Vaucluse-Ailey complex, 10-15% slopes	VeD	236.41	95.68	12.65%
Wagram sand, 2-6% slopes	WaB	26.07	10.55	1.39%
Williman sand	Wm	1.57	0.63	0.08%
Water	W	0.23	0.09	0.01%
Totals:		1,868.93	756.37	100.00%

SU-87-50-R Productivity of bottomland hardwood forests; Sharitz; SREL.

SU-87-63-R Registration of locations of rare or threatened plant populations based upon Federal or state of South Carolina status; Roecker and Sharitz; SRFS and SREL.

SU-88-72-R The effects of the Asiatic Clam (*Corbicula fluminea*) on the Unionid clam (*Elliptio complanata*); McArthur; SREL.

SU-89-58-R (and Amendment 1) Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-91-55-R Multiple stable isotopes of riparian vegetation and detritus; McArthur; SREL.

SU-91-87-R Effects of herbicide on biodiversity and groundwater; Blake and Miller; SRFS and UGA.

SU-92-41-R Reproduction ecology of the yellow wild indigo (*Baptisia lanceolata*); Sharitz; SREL.

SU-92-64-R Transport of dissolved organic carbon through wetland soils; Bertsch; SREL.

SU-92-72-R Background wetlands soil study; Rogers; WSRC-SRTC.

SU-93-17-O Maintenance of site utility right-of-ways; McCormick; WSRC-F&S.

SU-93-21-R Hyporehic animal communities in sandy bottom streams; McArthur; SREL.

SU-93-32-R Migratory birds in Hardwood Forest; Blake and Chapman; SRFS and UGA.

SU-94-38-R Influence of beaver disturbance on physical habitat and fish assemblage structure; Meffe; SREL.

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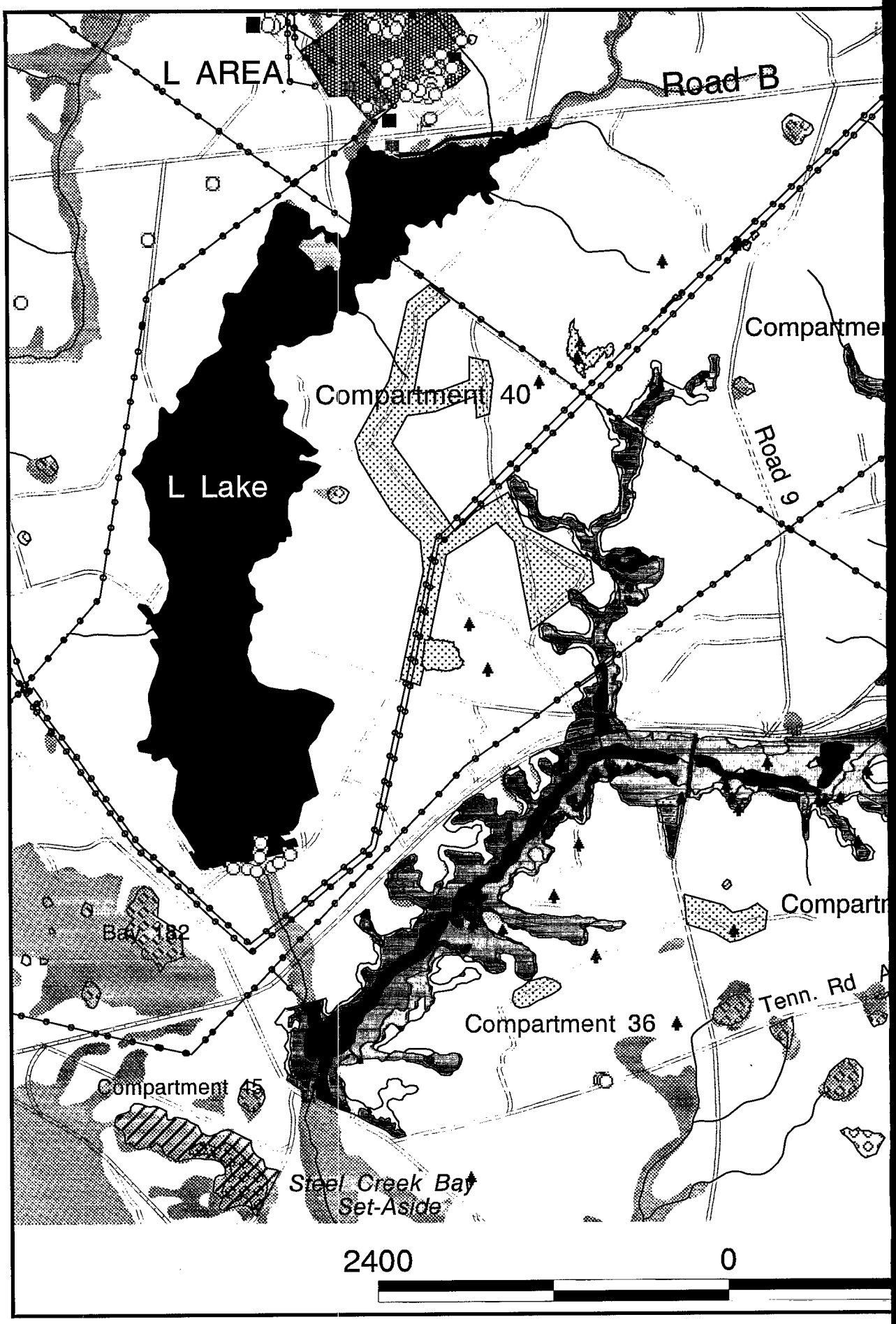
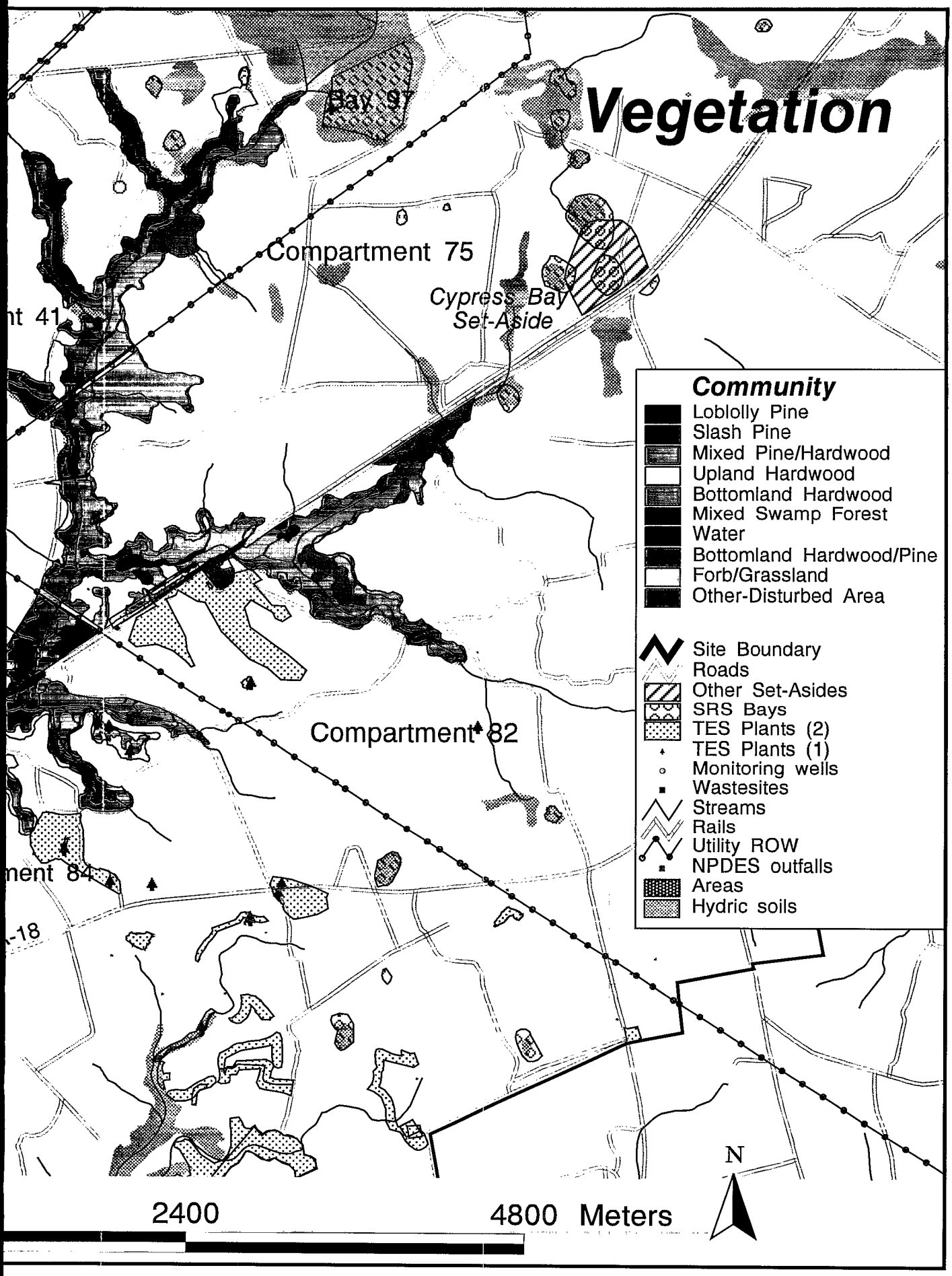


Figure 11-1. *Plant communities associated with the Ruth Patrick-Meyers Branch Set-Aside Area.*


Vegetation
Bay 97
Compartment 75
Cypress Bay
Set-Aside
Compartment 82
Community
Loblolly Pine
Slash Pine
Mixed Pine/Hardwood
Upland Hardwood
Bottomland Hardwood
Mixed Swamp Forest
Water
Bottomland Hardwood/Pine
Forb/Grassland
Other-Disturbed Area
Site Boundary
Roads
Other Set-Asides
SRS Bays
TES Plants (2)
TES Plants (1)
Monitoring wells
Wastesites
Streams
Rails
Utility ROW
NPDES outfalls
Areas
Hydric soils
N
2400
4800 Meters

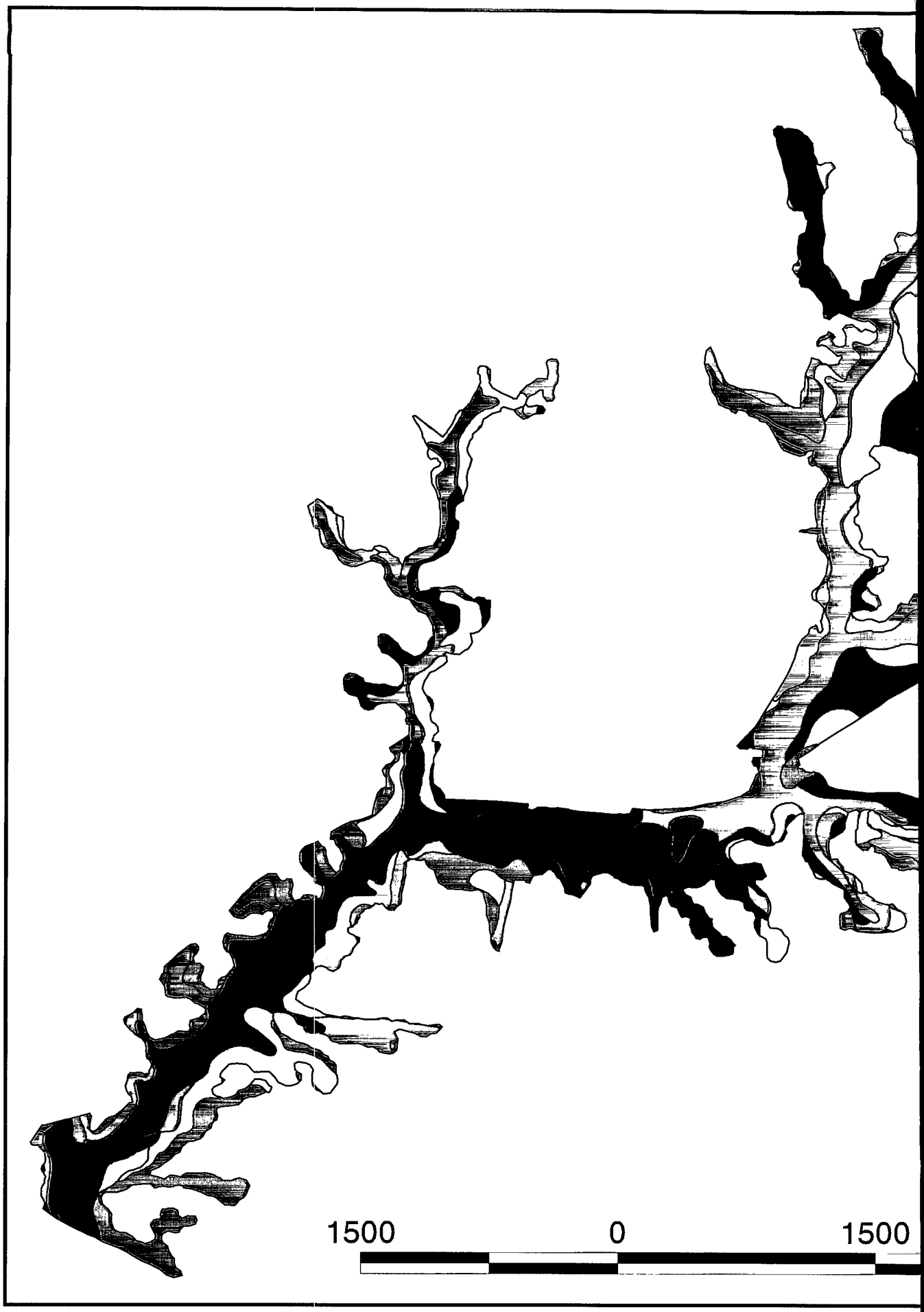
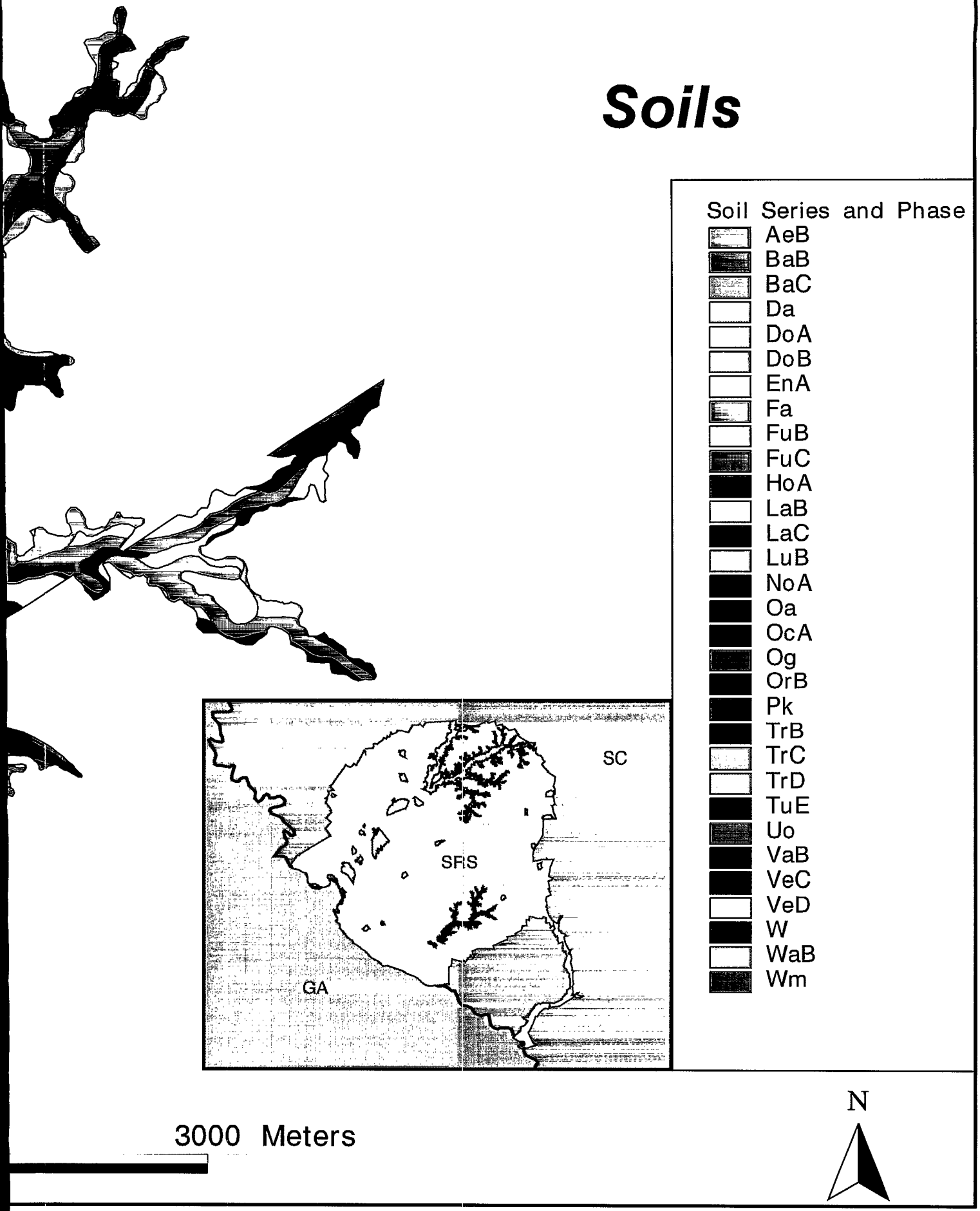


Figure 11-2. *Soils associated with the Ruth Patrick-Meyers Branch Set-Aside Area.*

Soils


Soil Series and Phase
AeB
BaB
BaC
Da
DoA
DoB
EnA
Fa
FuB
FuC
HoA
LaB
LaC
LuB
NoA
Oa
OcA
Og
OrB
Pk
TrB
TrC
TrD
TuE
Uo
VaB
VeC
VeD
W
WaB
Wm
SC
SRS
GA
3000 Meters
N

AREA NO. 12
OAK-HICKORY FOREST #2

SET-ASIDE LOCATION ON THE SRS:

The Oak-Hickory Forest #2 Set-Aside Area is located in the north-central portion of the SRS on the Aiken Plateau (Langley and Marter, 1973). Bordering the E. P. Odum Wetland Set-Aside (Area No. 30), this Set-Aside is west of the Advanced Tactical Training Academy (ATTA) range. The Oak-Hickory Forest #2 Set-Aside stretches lengthwise through timber compartments 32 and 33 and primarily is comprised of the eastern bluffs overlooking Upper Three Runs Creek (UTRC). The northern boundary of this Set-Aside is Road 8-1; the Set-Aside then extends southward, crosses Tyler Bridge Road (Road 2-1), and ends at a South Carolina Electric and Gas (SCE&G) utility line right-of-way (ROW) which parallels Road G-1 (Figs. 2 and 12-2). This Area encompasses all of the eastern hardwood slopes associated with UTRC between these road crossings.

SET-ASIDE DESCRIPTION:

This 460-acre (186.2 ha) Set-Aside Area is a long narrow stretch of land located along the eastern floodplain and bluffs of Upper Three Runs Creek. The predominant vegetation of this Set-Aside consists of mesic-to-upland hardwood communities associated with west-facing slopes. These transitional slopes are the result of topographic gradients from the bottomlands to the xeric ridge tops. The vegetation of this Area is a relatively undisturbed, oak-hickory forest community dominated by white oak (*Quercus alba*) and mockernut hickory (*Carya tomentosa*; McCort and Wein, 1988; Fig. 12-1). This Area also includes mixed mesic hardwood communities influenced either by UTRC's floodplain or by hill seeps associated with the moderate-to-steep slopes of UTRC's bluffs. Descriptions of these hardwood-dominated forest types can be found in other NERP publications (Jones *et al.*, 1981; Whipple *et al.*, 1981; and Workman and McLeod, 1990).

This Set-Aside contains one of the seven Whipple/Good plots (Plot 7) which identified mixed species forests that represent a gradient from deeply flooded to somewhat dry conditions on the SRS (Good, 1981; Good and Whipple, 1982). Plot 7 is a rectangular, one-hectare plot located on a bluff overlooking UTRC, approximately 310 m north of Tyler Bridge Road (Road 2-1). This plot corresponds to plot #7 of Jones *et al.* (1994) and ranks seventh (the driest) in order of elevational gradient of the seven Whipple/Good plots on the SRS. This plot had the highest number of tree species of all the Whipple/Good plots. The dominant canopy vegetation within this plot is white oak (*Quercus alba*), loblolly pine (*Pinus taeda*), and mockernut hickory (*Carya tomentosa*). Cores from this plot were aged at 30-75 years by Good (1981). Whipple *et al.* (1981) used this plot as a representative of the *Carya tomentosa -Quercus alba* forest community type. Another study plot used by Whipple *et al.* (1981) to characterize the hardwood forests of the SRS also is found in this Set-Aside; this plot was classified as a representative *Nyssa sylvatica-Persea borbonia* community type which is associated either with the UTRC floodplain or the ravines or coves associated with hill seeps and steep slopes.

This Set-Aside Area shares a common boundary with the E. P. Odum Wetland Set-Aside (Area No. 30). Much of the western boundary of Area No. 12 is constituted by UTRC; the remainder is an arbitrary, unmarked line, discernable only by a change in vegtation composition. This western boundary of Area No. 12 is not posted because it was not necessary to differentiate between this Set-Aside and Area No. 30; only the eastern boundary line of Area No. 12 is marked with metal DOE Research Set-Aside

Table 12-1. Vegetation communities of the Oak-Hickory Forest #2 Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	12.36	5.00	2.69%
Mixed Pine/Hardwood	49.55	20.05	10.77%
Upland Hardwood	214.66	86.87	46.67%
Bottomland Hardwood	149.88	60.66	32.59%
Bottomland Hardwood/Pine	28.68	11.61	6.24%
Other—Disturbed Area	4.83	1.95	1.05%
Totals:	459.96	186.15	100.00%

Area signs and/or white-blazed trees. This eastern boundary is maintained regularly to prevent impacts to the Set-Aside from forest management activities, particularly prescribed fire. Fire is not allowed to burn down the slopes of this Set-Aside as it is in Area No. 30. The boundary line of Area No. 12 is contiguous with the boundary line of Area No. 30. Where applicable, a 15% slope criterion was used to establish the boundary of this Area. Where there was no slope, such as in the southern-most tip of Area No. 12, only a 200-ft. (60 m) buffer of vegetation was maintained for UTRC. At this southern tip where Area Nos. 12 and 30 join, there was no application of the hydric soils criteria which were used when establishing the boundary for Area No. 30 (see Appendix 4). This probably was an oversight when the Area No. 12 boundary lines were defined because either Area No. 12 or Area No. 30 should have included all hydric soils associated with the UTRC drainage to ensure maximum protection to UTRC at this point of hydrologic connection (Fig. 12-2).

Figure 12-1. *Vegetation typical of hardwood slopes in the Oak-Hickory Forest #2 Set-Aside Area.*

Table 12-2. Soils of the Oak-Hickory Forest #2 Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Albany loamy sand, 0-6% slopes	AnB	9.13	3.69	1.98%
Blanton sand, 0-6% slopes	BaB	4.10	1.66	0.89%
Blanton sand, 6-10% slopes	BaC	1.14	0.46	0.25%
Eunola fine sandy loam, 0-2% slopes	EnA	9.34	3.78	2.03%
Fuquay sand, 2-6% slopes	FuB	0.54	0.22	0.12%
Hornsville fine sandy loam, 0-2% slopes	HoA	7.67	3.10	1.67%
Lucy sand, 2-6% slopes	LuB	0.43	0.17	0.09%
Lucy sand, 6-10% slopes	LuC	15.93	6.45	3.46%
Ocilla loamy sand, 0-2% slopes	OcA	3.00	1.22	0.65%
Orangeburg loamy sand, 2-6% slopes	OrB	1.24	0.50	0.27%
Pickney sand, frequently flooded	Pk	93.90	38.00	20.41%
Rembert sandy loam	Rm	0.56	0.23	0.12%
Troup sand, 0-6% slopes	TrB	12.30	4.98	2.67%
Troup sand, 6-10% slopes	TrC	12.76	5.16	2.77%
Troup sand, 10-15% slopes	TrD	35.24	14.26	7.66%
Troup & Lucy sands, 15-25% slopes	TuE	94.66	38.31	20.58%
Troup & Lucy sands, 25-40% slopes	TuF	119.19	48.24	25.91%
Vaucluse-Ailey complex, 10-15% slopes	VeD	8.26	3.34	1.80%
Wagram sand, 2-6% slopes	WaB	0.61	0.25	0.13%
Williman sand	Wm	29.98	12.13	6.52%
Totals:		459.97	186.15	100.00%

What This Set-Aside Represents:

This Set-Aside supplements the original SREL Reserve Area—Oak-Hickory Forest #1 Set-Aside (Area No.5), which is only 84.5 acres (34.2 ha). Area No. 12 represents hardwood forest types that are transitional between bottomland forests and drier upland pine or sandhills communities. Oak-hickory forests once were a dominant community type characteristic of bluffs and uplands along the streams of the Southeast. Most of these forests have been cut for agricultural and forestry purposes and undisturbed representative examples are rare, not only on the SRS but also in the Southeast. On the SRS, this community becomes less common closer to the Savannah River because the transitions from bottomlands to uplands are more abrupt and pine plantations often directly border the floodplain forest communities and restrict this upland oak-hickory community to a narrow zone (Whipple *et al.*, 1981). This Set-Aside is one of the few areas on the SRS with an extensive forest of this type. Much of this forest appears

to have been undisturbed since 1906 due to its steep slopes and inaccessibility (McCort and Wein, 1988). Portions of this Area were examined by Whipple *et al.* (1981) in a study of the hardwood forest communities of the SRS and permanent long-term vegetation sampling plots are located in this Set-Aside (Good, 1981, Good and Whipple, 1982; Jones *et al.*, 1994).

History:

The slopes of this Area were logged during the 1920's and 1940's where timber was accessible. The huge, twisted, steel logging cables that still are present on the bluffs serve as evidence of the efforts to log these steep slopes. Prior to establishment of the SRS in 1951, lands adjacent to this Set-Aside were used for timber production or agriculture . Within this Set-Aside, there were a few small patches on the ridge-tops and slightly sloped areas that were used for agriculture or as pasture.

Set-Aside Plant Community Composition:

Six vegetation communities are represented in this Set-Aside, 96.3% of which are in mixed upland and bottomland hardwoods (Fig. 12-2), including loblolly pine (2.7%), mixed pine/ hardwood (10.8%), upland hardwood (46.7%), bottomland hardwood (32.6%), bottomland hardwood/pine (6.2%), and disturbed area (1%; Table 12-1). The disturbed area includes Tyler Bridge Road (Road 2-1) and its ROW. The oldest vegetation for this Area is located in the wetter bottoms and dates to 1925; the youngest vegetation on the slopes dates to 1942 (SRFS CISC stand database).

Sensitive Flora and Fauna:

There are two sensitive plant species documented from this Set-Aside. The bog-spice bush (*Lindera subcoriacea*) is a species of concern for the region whereas the Oconee azalea (*Rhododendron flammeum*) is a South Carolina species of concern (Table 3). There have been no documented occurrences of sensitive fauna from this Set-Aside (Table 4).

Set-Aside Soils:

There are twenty soil series and phases associated with this Area. Approximately 62% of these soils are associated with the steeper hardwood slopes (Table 12-2). These include the Lucy sands, the Troup and Lucy sands, and the Vaucluse-Ailey complexes, all of which have phase slopes from 10-40%. On the slight-to-moderate mixed pine/hardwood slopes of this Area the Albany, Blanton, Fuquay, Lucy, Orangeburg, Troup, and Wagram soils account for 12.6% of the soils. Hydric soils of the Pickney, Rembert, and Williman series account for 27% of the Area's soils; associated with these are the sandy loams and loamy sands of the Hornville, Ocilla, and Eunola series (4.4%). See Fig. 12-2 for a soils mapping of this Set-Aside and Appendix 3 for a description of soils.

Research Associated With This Set-Aside:

Current research in the Oak-Hickory Forest Set-Aside #2 includes studies of forest community structure, soil geochemistry, small mammals, and the effects of forest management practices on biodiversity.

Both historical and current hardwood vegetation community studies have been conducted in this Area. Good (1981) and Good and Whipple (1982) established long-term monitoring plots to study forest species composition and soil moisture related to elevational gradients and flood-stress. Good (1981) selected seven one-hectare plots to represent relatively undisturbed, mature examples of the deciduous forest vegetation of the SRS within the Upper Three Runs Creek drainage and non-thermally impacted portions of the Savannah River swamp; these areas were characterized in Whipple *et al.* (1981). Whipple/Good Plot 7 is located in this Set-Aside. Other Whipple/Good plots are located in Set-Aside Area Nos. 7, 9A, 14, 15,

and 30. Inventory and assessment of these plots continues today (Jones *et al.*, 1994). Transects were installed in this Set-Aside to study the effects of topography and summer storms on soil solutions (Novak and Bertsch, 1991; Novak *et al.*,1992; Novak and Burras, 1994). More recent research has been conducted by Hartman and Krenz (1993) and Hartman (1994, 1995, 1996) on the eastern mole (*Scalopus aquaticus*).

Recent studies being conducted in this Set-Aside are examining the Area's ecology at landscape and ecosystem levels. Imm and McLeod (1994) are using this Area as a baseline in a study of the effects of differing forest management strategies on biodiversity at the timber compartment level. As part of this landscape study, these and other researchers are evaluating the diversity of the hardwood slopes of this Area and are defining the most prevalent canopy associations found across topographic gradients (Howard and Moyer, 1995; Imm *et al.*, 1995). Plots for soft mast inventories have been installed in this Set-Aside to support research on neotropical migrant birds in hardwood forest sites. In addition, trapping grids have been installed with wooden nest boxes as part of a study on the nesting ecology of southern flying squirrels (*Glaucomys volans*). To date there are 20 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

As a result of a severe windstorm in 1989, extensive clear-cut areas are adjacent to the eastern portion of this Set-Aside, in timber compartment 32. Slight blow-down damage also occurred within this Set-Aside and the SRFS inadvertently salvaged approximately three acres of pine timber in the northern portion of this Area. According to SRFS GIS historical data, a section of this Set-Aside north of Tyler Bridge Road (Road 2-1) was burned in 1980. This Area is relatively remote and is within Region 1 of UTRC (Area No. 30); therefore it is unlikely that this Set-Aside will be negatively impacted by Site operations.

SRS Patrol Indexes: **E**-21 **F**-19,20,21 **G**-18,19,20 **H**-17,18

Site-Use Permits:

SU-79-84-R Forest mapping; McLeod; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-89-69-R Characteristics of carbon export from upland bottomland soil into Upper Three Runs Creek; Bertsch; SREL.

SU-92-53-R Ecosystem response to forest management-timber; McLeod; SREL.

SU-93-08-R Life history and dispersal patterns of the southern flying squirrel; Chesser and Rhodes; SREL.

SU-93-23-R Mole research; Wike; WSRC-STRC.

SU-96-43-R The role of fleshy fruit production, consumption, and seed dispersal on promoting biological diversity; Blake and Levey; SRFS and Univ Florida.

Publications and Reports:

Good, B.J. 1981. The spatial patterns of dominant tree species in deciduous forests located along a topographic gradient in South Carolina. M.S. Thesis, Louisiana State University.

Good, B.J. and S.A. Whipple. 1982. Tree spatial patterns: South Carolina bottomland and swamp forests. Bull. Torrey Bot. Club 109:529-536. SREL Reprint # 837.

Hartman, G.D. 1994. Seasonal effects of sex ratios in moles collected by trapping. Amer. Midl. Nat. 133:298-303. SREL Reprint # 1950.

Hartman, G.D. 1995. Age determination, age structure, and longevity in the mole, *Scalopus aquaticus* (Mammalia: Insectivora). J. Zool. 237:107-1222. SREL Reprint # 1992.

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Imm, D.W., K.W. McLeod, and B.P. Moyer. 1995. Natural and anthropogenic patterns of composition and species diversity of forests of the Savannah River Site. Amer. J. Botany (ABSTRACTS) 82:6.

Jones, R.H., R.R. Sharitz, S.M. James, and P.M. Dixon. 1994. Tree population dynamics in seven South Caroina mixed-species forests. Bull. Torrey Bot. Club 12:360-368. SREL Reprint # 1912.

Jones, S.M., D.H. Van Lear, and S.K. Cox. 1981. Major forest community types of the Savannah River Plant: A field guide. Publication of the National Environmental Research Park Program. Aiken, SC. SRO-NERP-9.

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Langley, T.M. and W.L. Marter. 1973. The Savannah River Plant Site. Publication DP-1323. Savannah River Laboratory. E.I. duPont de Nemours and Co. Aiken, SC.

McCort, W.D. and G.R. Wein. 1988. A proposal for the establishment of additional set-aside areas for the Savannah River Plant National Environmental Research Park. Report submitted to DOE-SROO, Aiken, SC. 130 pp.

Novak, J.M. and P.M. Bertsch. 1991. The influence of topography on the nature of humic substances in soil organic matter at a site in the Atlantic coastal plain of South Carolina. Biogeochemistry 15:111-126. SREL Reprint # 1631.

Novak, J.M., P.M. Bertsch, and G.L. Mills. 1992. Carbon-13 NMR spectra of soil water-soluble organic carbon. J. Envir. Quality 21:537-539. SREL Reprint # 1675.

Novak, J.M. and L. Burras. 1994. Influence of summer storms on the solution geochemistry in a coastal plain hydrosequence. International J. Ecol. Environ. Sci. 20:15-30. SREL Reprint # 1903.

Novak, J.M., G.L. Mills, and P.M. Bertsch. 1992. Estimating the percent aromatic carbon in soil and aquatic humic substances using ultraviolet absorbance spectrometry. J. Environ. Quality 21:144-147. SREL Reprint # 1618.

Whipple, S.A., L.H. Wellman, and B.J. Good. 1981. A Classification of Hardwood Swamp Forests on the Savannah River Plant, South Carolina. Publication of the Savannah River National Environmental Research Park Program. SRO-NERP-6. Aiken, SC. 36 p.

Workman, S.W. and K.W. McLeod. 1990. Vegetation of the Savannah River Site: Major community types. Publication of the Savannah River National Environmental Research Park Program. SRO-NERP-19. Aiken, SC.

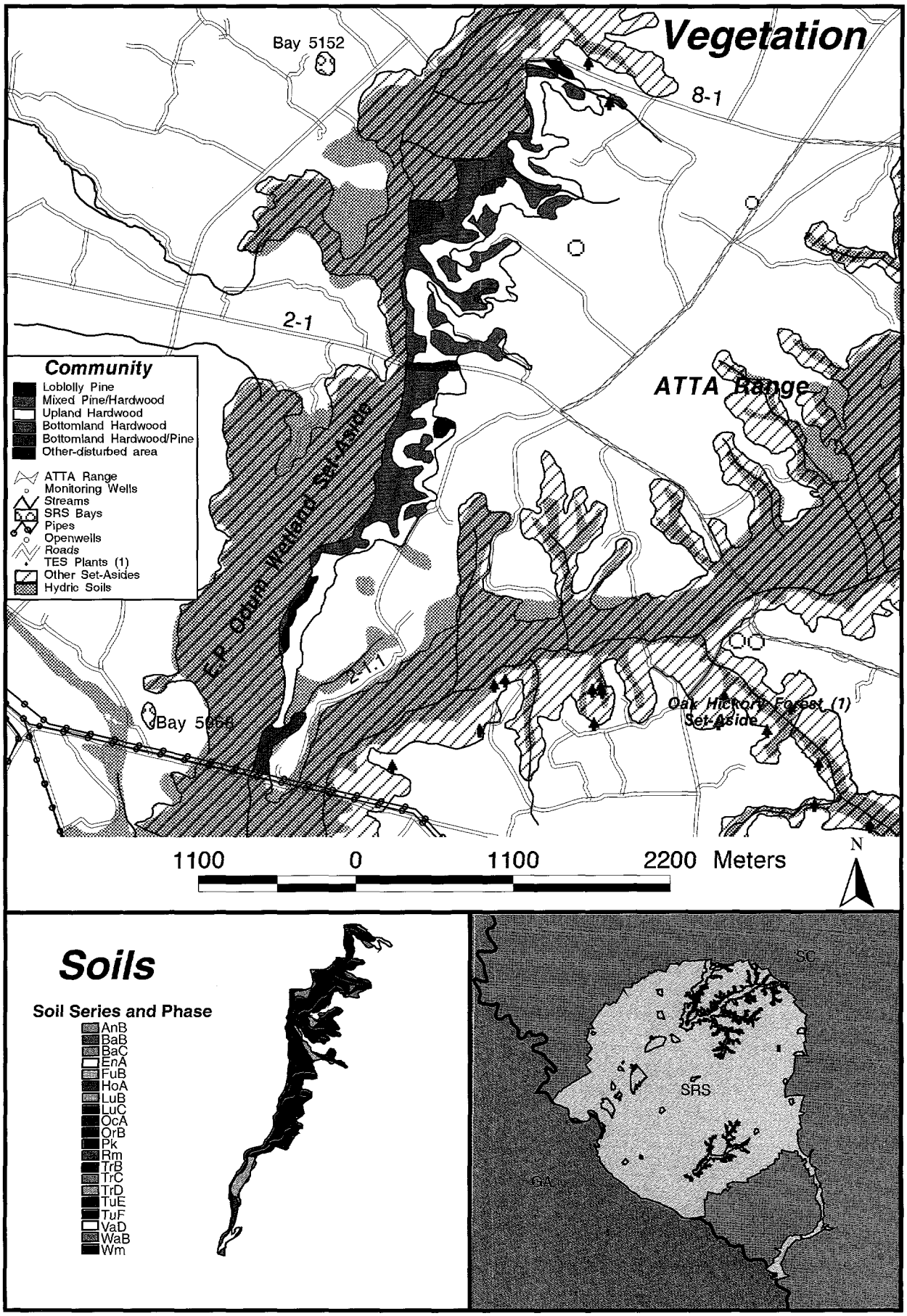

Figure 12-2. *Plant communties and soils associated with the Oak-Hickory Forest #2 Set-Aside Area.*

AREA NO. 13
ORGANIC SOILS

SET-ASIDE LOCATION ON THE SRS:

The Organic Soils Set-Aside Area is located in the northwest quadrant of the SRS on the Aiken Plateau (Langley and Marter, 1973), downstream of the Whipple/OHER Study Site Set-Aside (Area No. 15) and upstream of the Mature Hardwood Forest Set-Aside (Area No. 14). This Area is north of E and F Areas, in timber compartments 15 and 49. Upper Three Runs Creek (UTRC) flows through the Organic Soils Set-Aside and this Area is bordered by a South Carolina Electric and Gas (SCE&G) utility line right-of-way (ROW) on the east and by a rail line and Road C-2.1 on the south (Figs. 2 and 13-1).

SET-ASIDE DESCRIPTION:

This Set-Aside Area is 767.3 acres (310.5 ha) and contains a segment of Upper Three Runs Creek (UTRC). This stream segment specifically is within Region 2 of UTRC, which is described in the DOE's UTRC Stream Management Policy (see below). UTRC is a low gradient, black water stream with a shifting, sandy bottom (see Chapter 30). This Set-Aside can be described as a recovering second growth, fairly closed canopy, floodplain forest. The supportive soils are deep depth surface soils that are mucky and high in organic content. The vegetation primarily is composed of mesic-to-bottomland hardwood forests with good examples of upland hardwoods and mixed pine/hardwood communities on the transitional slopes peripheral to the Area. Whipple *et al.* (1981) characterized the dominant canopy vegetation of the bottomland hardwood communities found in this Set-Aside as being a mixture of sweetgum (*Liquidambar styraciflua*), black gum (*Nyssa sylvatica*), red maple (*Acer rubra*), and sweet bay (*Magnolia virginiana*). The sapling layer is dominated by red bay (*Persea bordonia*), among other species. In addition, Turner Branch, a small stream influenced by beavers (*Castor canadensis*), flows into this Set-Aside. The 5.41-mile (8.71 km) boundary line of this Area is marked with metal DOE Research Set-Aside Area signs.

WHAT THIS SET-ASIDE REPRESENTS:

The Organic Soils site is an important component of the Set-Aside Program because of the highly organic soils and the riparian habitat characteristic of the broad bottomland hardwood floodplain forest of this region of Upper Three Runs Creek. This Set-Aside represents a portion of the UTRC stream continuum, complementing other Set-Asides which are located up and downstream. In addition, this site was used by Whipple *et al.* (1981) as a representative black gum-red bay *(Nyssa sylvatica-Persea borbonia)* forest. These forests are characteristic of mesic sites that do not flood or do so only for short periods of time. They are restricted to protected coves, ravines, and lower-to-middle portions of steep slopes; such areas occur in the floodplain of UTRC on elevated sites that seldom flood. On the SRS, sites representative of this community type are restricted to Upper Three Runs Creek because most other former locations have been impacted by reactor discharges and other management activities, making this Area an important reference wetland. Because of its representative nature, current level of research activities, and long-term research status, this Area was included in the Set-Aside Program.

HISTORY:

Prior to establishment of the SRS in 1951, this Area primarily was a cut-over floodplain forest; adjacent land-use was for agriculture, pasture, and logged timberland. Portions of the interior floodplain of this Set-Aside were cut in the 1920's and 1940's, as evidenced by the road

Table 13-1. Vegetation communities of the Organic Soils Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	15.26	6.18	1.99%
Mixed Pine/Hardwood	26.86	10.87	3.50%
Upland Hardwood	43.78	17.72	5.71%
Bottomland Hardwood	501.16	202.82	65.31%
Water	16.56	6.70	2.16%
Bottomland Hardwood/Pine	163.70	66.25	21.33%
Totals:	767.32	310.54	100.00%

system present in 1951 aerial photography of the Site. A more recent bottomland hardwood clear-cut was undertaken in 1982 along the Turner Branch drainage where it enters the UTRC floodplain. The rail line and utility ROW bordering this Area were constructed after establishment of the Site.

Set-Aside Plant Community Composition:

This Set-Aside is comprised of six plant communities. The majority (86.6%) of the vegetation is floodplain forest composed of bottomland hardwoods and mixed bottomland hardwood/pine (Fig. 13-1). Only 2% of this Area is loblolly pine (*Pinus taeda*); the remaining land adjacent to the floodplain contains upland hardwood and mixed pine/hardwood communities (9.2%). Water within the floodplain is associated with beaver ponds and accounts for 2.2% of the Area. The oldest age class for the bottomland hardwood/pine community in this Set-Aside dates to 1904 (SRFS CISC stand database); the youngest age class is a mixed loblolly pine community dating to 1987.

Sensitive Flora and Fauna:

There have been no sensitive plants documented from this Set-Aside (Table 3). The American alligator (*Alligator mississippiensis*) is known to inhabit UTRC (Table 4).

Set-Aside Soils:

There are twelve soil series and phases associated with this Area--the majority (84%) represented by hydric soils. These poorly drained, flooded wetland soils include the Dorovan muck series (5.7%), Fluvaquents (7.9%), Pickney (68.4%), and the ponded Ogeechee series (2.1%; Table 13-2). The highly organic muck soils of the Dorovan series and the less organic Fluvaquents are associated with the Turner Branch drainage. There are 5.5 acres (2.2 ha; 0.7%) of disturbed area represented by the Udorthent series. These likely resulted from railroad construction after Site acquisition. Soils vary from the upland associations, which are excessively drained, to the well-drained to poorly drained transitional slopes. These include the Blanton, Fuquay, Lucy, Troup, Troup and Lucy sands, and the Vaucluse-Ailey complexes, which account for the remaining 15% of the Area's soils. See Fig. 13-1 for soils mapping of the Set-Aside and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

Research associated with this Set-Aside includes studies on water chemistry and water quality,

Table 13-2. Soils of the Organic Soils Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 6-10% slopes	BaC	1.40	0.57	0.18%
Dorovan muck, frequently flooded	Da	43.53	17.62	5.67%
Fluvaquents, frequently flooded	Fa	60.63	24.54	7.90%
Fuquay sand, 2-6% slopes	FuB	28.09	11.37	3.66%
Lucy sand, 2-6% slopes	LuB	0.07	0.03	0.01%
Ogeechee sandy loam, ponded	Og	15.91	6.44	2.07%
Pickney sand, frequently flooded	Pk	525.03	212.48	68.42%
Troup sand, 0-6% slopes	TrB	64.56	26.13	8.41%
Troup & Lucy sands, 15-25% slopes	TuE	4.91	1.99	0.64%
Udorthents, friable substratum	Uo	5.53	2.24	0.72%
Vaucluse-Ailey complex, 6-10% slopes	VeC	10.61	4.29	1.38%
Vaucluse-Ailey complex, 10-15% slopes	VeD	7.04	2.85	0.92%
Totals:		767.31	310.53	100.00%

stream fish ecology, vegetation, migratory bird nesting, and beaver ponds. Newman (1986) monitored the water chemistry and water quality of UTRC in the vicinity of this Set-Aside as part of the Comprehensive Cooling Water Study. Studies of fish assemblages in relation to habitat structure have been conducted by Meffe and Sheldon (1987) and more recently by Snodgrass (1996). This Area was selected as one of 58 study sites used to characterize the hardwood and swamp forests of the SRS by Whipple *et al.* (1981). This Set-Aside also is located upstream from Tims Branch, where soil contaminant studies were conducted by Batson (1994).

More recent studies conducted in this Set-Aside are examining biodiversity at landscape and ecosystem levels. This Area is one of several Set-Asides on the SRS included in studies of the nesting ecology of neotropical migrant birds in hardwood forests (Kilgo *et al.*, 1996a, 1996b). Bird census transects and plots for soft mast inventories have been installed in this Area. Also, Snodgrass (In Press) and Snodgrass and Meffe (In Press) have studied beaver ponds within watersheds, the patches created in streams by beavers, and the influence of beavers on assemblages of stream fish. To date, there are 16 publications associated with this Set-Aside.

Historical/Current/Future Influences:

While the focus of this Set-Aside is not specifically the water quality of UTRC, this Area is within management Region 2 of UTRC and potential negative impacts could occur to the creek and floodplain from upstream Site operations (specifically from E, F, H, S, and Z Areas). In Region 2 of UTRC, effluent discharges from SRS operations are limited to those defined in the DOE-SR Upper Three Runs Creek Stream Management Policy. This policy states that "Limited effluents may be discharged through tributaries to Region 2, within regulatory limits. Every effort will be made to ensure that the collective impact to stream communities is insignificant and water quality is maintained

within historic ranges." (DOE-SROO Stream Management Policy--Upper Three Runs; 9/11/95).

For a number of years, a deep, eroding ravine draining from F Area impacted this Set-Aside with run-off and sediment loading. Only recently have steps been taken to resolve this erosion problem. The potential exists for contaminants to leach from E Area into this Set-Aside. Wike *et al.* (1994) reported outcropping of contaminated groundwater from F and H Areas into UTRC. Beaver activity and ROW maintenance in the upstream portion of Turner Branch may influence and negatively impact this Set-Aside. Several regeneration cuts have been conducted by the SRFS adjacent to this Set-Aside and bottomland harvest cuts were conducted in this Area prior to its establishment as a Set-Aside. A small section of this Set-Aside was subjected to a prescribed fire in 1988; this was conducted in conjunction with a regeneration cut east of the Turner Branch drainage. A canoe trail once was prepared through this section of Upper Three Runs Creek. Potential impacts also are possible from the SRS railroad and the SCE&G powerline ROWs which border this Set-Aside. In particular, negative impacts could result from aerially applied herbicide treatments to the upstream ROW where it crosses UTRC.

SRS Patrol Indexes: **G**-12,13,14,15
H-12,13,14,15

Site-Use Permits:

SU-75-04-R Biological and chemical cycling of elements in streams; Smith and Geisy; SREL.

SU-75-20-R A telemetric study of the impact of reactor effluent concerning the American alligator and other ectotherms; Brisbin; SREL.

SU-83-17-R Turtle movement study; Gibbons and Congdon; SREL.

SU-83-29-R Monitoring of water quality; Gibbons; SREL.

SU-85-28-R Life history and population dynamics of SRP darter; Aho; SREL.

SU-86-36-R Population and community dynamics of SRP fishes; Aho; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-92-46-R Uranium Geochemistry in Tims Branch/ Upper Three Runs; Bertsch; SREL.

SU-92-72-R Background wetland soil study; Rogers; WSRC-SRTC.

SU-93-32-R Migratory birds in hardwood forests; Blake and Chapman; SRFS and Univ. of Georgia.

SU-94-38-R Influence of beaver disturbance on physical habitat and fish assemblage structure; Meffe and Snodgrass; SREL.

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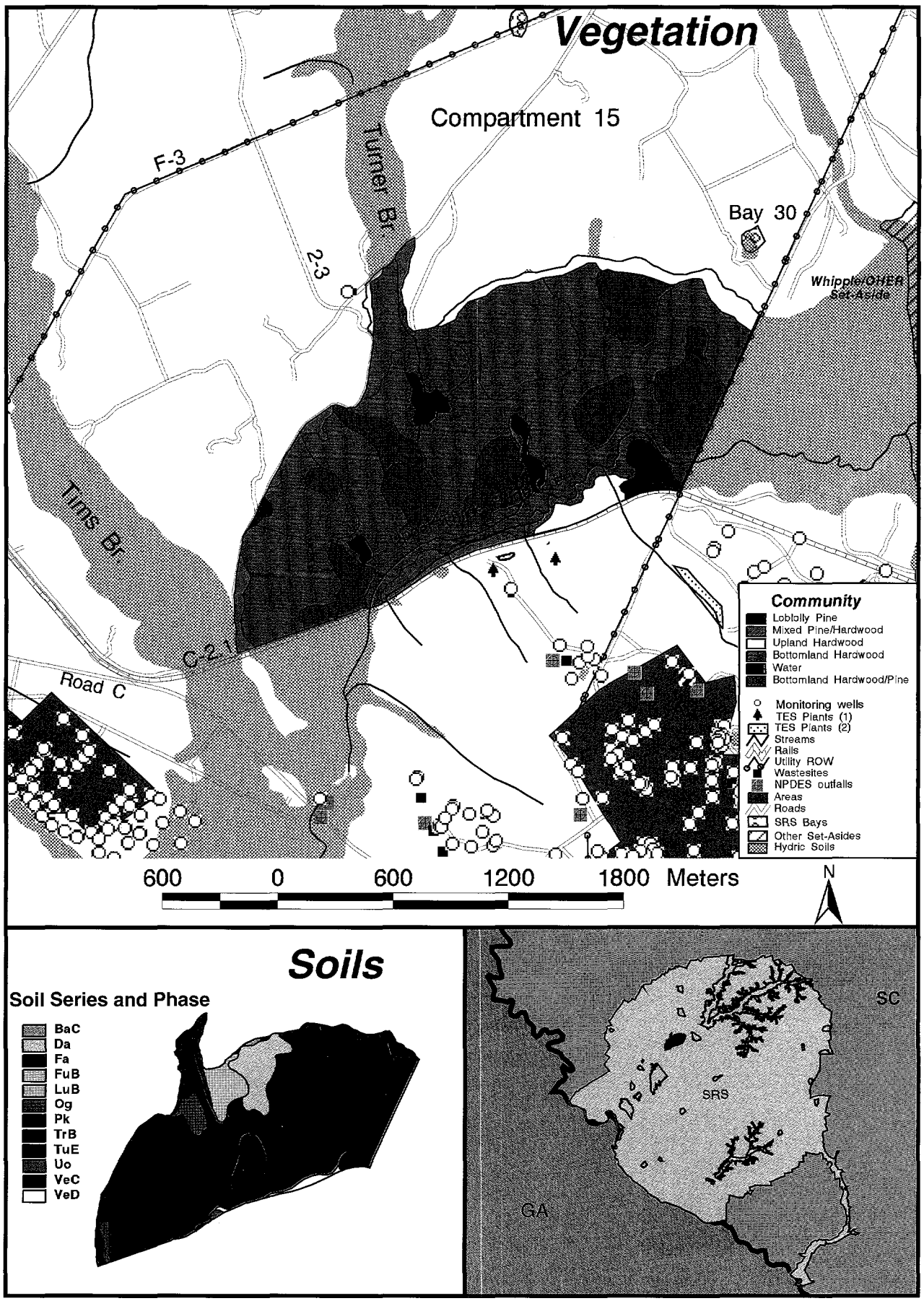

Figure 13-1. *Plant communities and soils associated with the Organic Soils Set-Aside Area.*

AREA NO. 14
MATURE HARDWOOD FOREST

SET-ASIDE LOCATION ON THE SRS:

The Mature Hardwood Forest Set-Aside Area is located in the west-central portion of the SRS, where it straddles the line separating the Brandywine Pleistocene Terrace from the Aiken Plateau (Langley and Marter, 1973). This Set-Aside is south of B Area, in timber compartments 13 and 48. Bisected by Upper Three Runs Creek (UTRC), this Area lies between two South Carolina Electric & Gas (SCE&G) utility line rights-of-way. This Area is bordered by the Three Rivers Landfill site on the west along Cato Road (2-11.2) and by the Burma Road borrow pit on a southeast corner (Figs. 2 and 14-2).

SET-ASIDE DESCRIPTION:

As the third largest of the DOE Set-Asides, this Area is 1,055.5 acres (427.2 ha) and includes a segment of UTRC, the creek's 100-year floodplain, and the adjacent valley slopes (15% or steeper grades) and the tributaries that drain them. The segment of UTRC that runs through this Set-Aside specifically is within Region 3 of UTRC as described in the DOE's UTRC Stream Management Policy (see below). UTRC is a low gradient, black water stream with a shifting, sandy bottom (see Chapter 30); within this reach, flooding is regular but not permanent. This Area can be described as a relatively undisturbed second growth, closed canopy floodplain forest (Fig. 14-1). Approximately 90% of this Set-Aside is composed of the bottomland hardwood/ floodplain and upland mixed pine/hardwood forest community types. Descriptions of these hardwood-dominated forest types are found in other NERP publications (Jones *et al.*, 1981; Whipple *et al.*, 1981; and Workman and McLeod, 1990).

This Area contains one of the seven Whipple/ Good plots (Plot 2), which were established as reference mixed-species forests that represent a gradient from deeply flooded to somewhat dry conditions on the SRS (Good, 1981; Good and Whipple 1982). Plot 2 is a rectangular, one-hectare plot located approximately 65 m east and upstream of Cato Road (2-11.2) and 22 m north of UTRC. A small side channel to UTRC is next to this plot. Plot 2 corresponds to plot #4 of Jones *et al.* (1994) and ranks fourth in order of elevational gradient of the seven Whipple/Good plots on the SRS. Good (1981) indicated that the overstory canopy of this plot primarily was composed of black gum (*Nyssa sylvatica*), sweetgum (*Liquidambar styraciflua*), and red maple (*Acer rubra*); cores taken from these trees dated the stand at 75 years of age. The adjacent mixed pine/hardwood and upland hardwood slopes on either side of the floodplain were classified by Whipple *et al.* (1981) as being representative of upland hardwood and mesic hardwood forests. The Oak Hickory Forest Set-Asides #1 and #2 (Area Nos. 5 and 12) have similar slope forest types. The 9-mile (14.47 km) boundary line of this Area is marked with metal DOE Research Set-Aside Area signs.

WHAT THIS SET-ASIDE REPRESENTS:

The Mature Hardwood Forest Set-Aside is an excellent example of a relatively undisturbed, maturing hardwood forest containing both seasonally flooded bottomland and transitional upland habitats associated with a stream floodplain. This Set-Aside contains some of the best examples of stands of maturing hardwoods which represent the range of ecological variation in hardwood forest types on the SRS. While the vegetation on the xeric and mesic slopes of this Set-Aside is similar to the upstream Oak-Hickory Set-Asides (Area Nos. 5 and 12), the floodplain forest type of this site is not represented elsewhere in a Set-Aside on the SRS. Thus, this site represents a subset of the stream continuum

Table 14-1. Vegetation communities of the Mature Hardwood Forest Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	61.87	25.04	5.86%
Longleaf Pine	12.52	5.07	1.19%
Slash Pine	42.96	17.39	4.07%
Mixed Pine/Hardwood	130.92	52.98	12.40%
Upland Hardwood	117.23	47.44	11.11%
Bottomland Hardwood	595.24	240.90	56.39%
Bottomland Hardwood/Pine	94.80	38.37	8.98%
Totals:	1,055.54	427.18	100.00%

from upper, to middle, to lower reaches of Upper Three Runs Creek on the SRS, with the research on this site emphasizing the floral and faunal characteristics of the lower portion of Upper Three Runs Creek.

This Set-Aside contains one of seven long-term vegetation study areas on the SRS that were installed in 1978 to facilitate the study of forest community structure along a soil moisture gradient (Good, 1981; Good and Whipple, 1982; Whipple *et al.*, 1981). With these permanent sampling plots, information on forest dynamics in unmanaged bottomland forests can be gathered over time to assess changes in forest composition as well as responses to climatic changes and anthropogenic stresses. In addition, this site was used by Whipple *et al.* (1981) as a representative black gum-red bay *(Nyssa sylvatica-Acer rubra)* community. On the SRS, any remaining sites representative of this community type are restricted to Upper Three Runs Creek because most other former locations have been impacted by reactor discharges and other management activities. Thus, this Set-Aside is an important reference wetland. Because of its representative nature, historical data base, current level of research activities, and long-term research status, this area was included in the Set-Aside Program.

Preservation of this Set-Aside is important because seasonally flooded hardwood forests are becoming increasingly rare habitats. These areas are particularly vulnerable to habitat destruction and/or alterations resulting from water control projects, industrial or urban waste discharge, or discharge of power plant cooling effluents.

History:

Prior to establishment of the SRS in 1951, this Area primarily was a cut-over floodplain forest with adjacent lands in timber production or agriculture. This area within the UTRC floodplain was logged in the earlier part of this century by the Schofield Savannah Company (Fetters, 1990). One small area on a ridge-top within the Set-Aside was used for agriculture and possibly as pasture.

Set-Aside Plant Community Composition:

There are seven plant communities that comprise this Area. Approximately 11% of this Area is in pines—both natural and plantation, including loblolly (*Pinus taeda*), longleaf (*P. palustris*), and slash pine (*P. elliottii*). Mixed pine/hardwood and upland hardwoods make up 23.5% of this Area; these communities are confined to the transitional slopes overlooking the floodplain

and ravines. The majority (65.4%) of the Set-Aside is in bottomland hardwood and mixed bottomland hardwood/pine (Fig. 14-2). Most of this bottomland timber was cut between 1918 and 1933. The oldest stand in the Set-Aside is an oak/hickory stand which dates to 1913 (SRFS CISC stand database). Most of the upland hardwood stands were logged in the 1940's while the majority of the pines were planted by the USFS after the Site was acquired. The slash pine plantation dates to 1969. There are natural stands of loblolly pine that date to the 1920's and 1930's.

Sensitive Flora and Fauna:

Three sensitive plant species currently are found in this Set-Aside, including the sandhill seedbox (*Nolina georgiana*), the Oconee azalea (*Rhododendron flammeum*), and nestronia (*Nestronia umbellula*; Table 3). American alligators (*Alligator mississippiensis*) are known to inhabit Upper Three Runs Creek (Table 4).

Set-Aside Soils:

There are eighteen soil series and phases associated with this Area. Soils vary from the ridge-top upland associations which are excessively drained, to the well-drained to poorly drained transitional slopes, to the very poorly drained soils of the bottomland. The Troup, Troup and Lucy sands, and the Vaucluse-Ailey complexes are found on slopes and account for 35% of this Area's soils. The flatter ridge-tops and transitional areas are comprised of the Albany, Blanton, Lucy, and Orangeburg series (3.3%). The majority of the soils are the poorly drained, hydric soils associated with stream floodplain and alluvial terraces and include the Eunola, Fluvaquents, Hornville, Ocilla, Ogeechee, Pickney, and Rembert series. These wetland, hydric soils account for approximately 61.7% of the soils in this Set-Aside. See Table 14-2 for a soils listing and Fig. 14-2 for soils mapping of this Set-Aside. Appendix 3 gives a soils description.

Research Associated With This Set-Aside:

Three areas of research can be associated with this Set-Aside, including small mammal

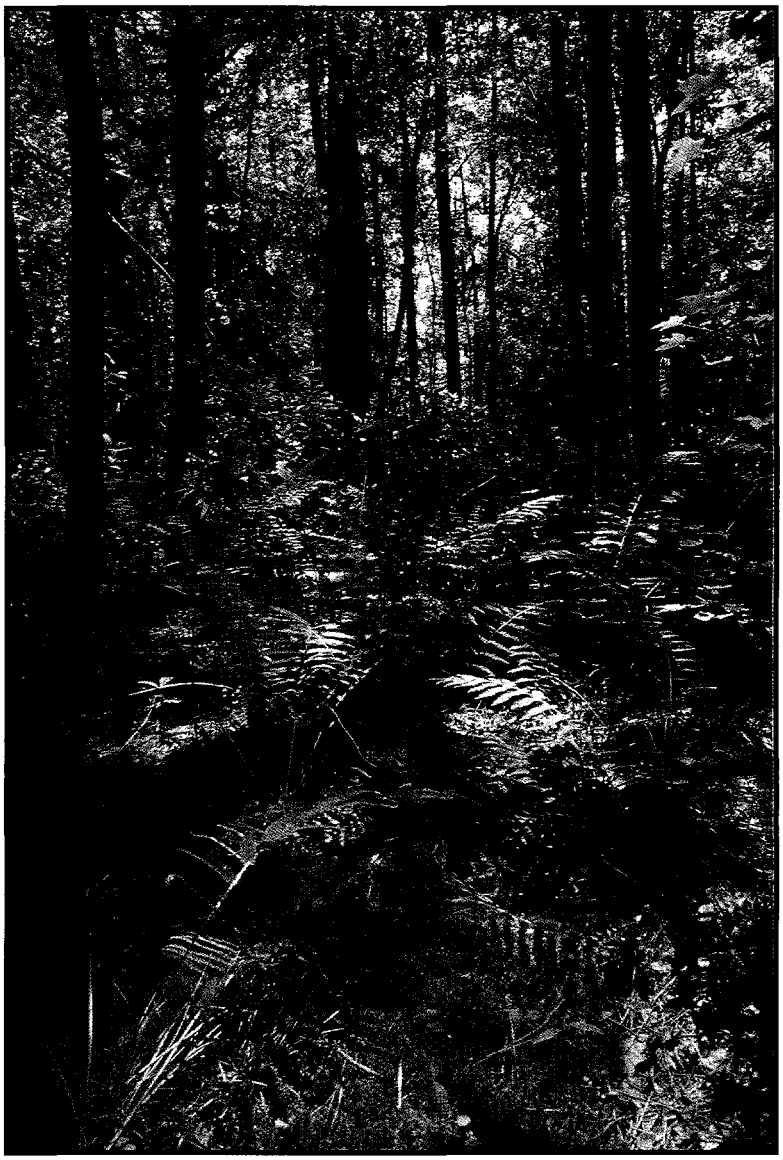

Figure 14-1. *Vegetation typical of the Mature Hardwood Forest Set-Aside Area.*

Table 14-2. Soils of the Mature Hardwood Forest Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Albany loamy sand, 0-6% slopes	AnB	2.24	0.91	0.21%
Blanton sand, 0-6% slopes	BaB	21.44	8.68	2.03%
Eunola fine sandy loam, 0-2% slopes	EnA	21.38	8.65	2.03%
Fluvaquents, frequently flooded	Fa	195.20	79.00	18.49%
Hornsville fine sandy loam, 0-2% slopes	HoA	2.94	1.19	0.28%
Lucy sand, 0-2% slopes	LuA	0.52	0.21	0.05%
Lucy sand, 2-6% slopes	LuB	0.77	0.31	0.07%
Ocilla loamy sand, 0-2% slopes	OcA	16.66	6.74	1.58%
Ogeechee sandy loam, ponded	Og	14.87	6.02	1.41%
Orangeburg loamy sand, 2-6% slopes	OrB	10.32	4.17	0.98%
Pickney sand, frequently flooded	Pk	364.18	147.39	34.50%
Rembert sandy loam	Rm	36.11	14.61	3.42%
Troup sand, 0-6% slopes	TrB	45.62	18.46	4.32%
Troup sand, 6-10% slopes	TrC	41.27	16.70	3.91%
Troup sand, 10-15% slopes	TrD	16.97	6.87	1.61%
Troup & Lucy sands, 15-25% slopes	TuE	221.14	89.50	20.95%
Troup & Lucy sands, 25-40% slopes	TuF	26.56	10.75	2.52%
Vaucluse-Ailey complex, 10-15% slopes	VeD	17.41	7.05	1.65%
Totals:		1,055.60	427.21	100.00%

population studies, long term vegetation monitoring studies, and studies of migratory bird habitat use. Early research dating to the 1960's examined methods to estimate densities of small mammal populations (Gentry *et al.*, 1968, 1971b, 1974; Kaufman *et al.*, 1971, 1978; Smith *et al.*, 1971, 1975). More recent research on the eastern mole (*Scalopus aquaticus*) was conducted by Hartman and Krenz (1993) and Hartman (1994, 1995, 1996). Good (1981) and Good and Whipple (1982) established long-term monitoring plots in this Area to study forest species composition and soil moisture related to elevational gradients and flood-stress. Good (1981) selected seven one-hectare plots to represent relatively undisturbed, mature examples of the deciduous forest vegetation of the SRS within the Upper Three Runs Creek drainage and non-thermally impacted portions of the Savannah River swamp. These areas are characterized in Whipple *et al.* (1981). Whipple/Good Plot 2 is located in this Set-Aside and is within the floodplain of UTRC, close to the western boundary of this Set-Aside. Other Whipple/Good plots are located in Area Nos. 7, 9A, 12, 15, and 30. Inventory and assessment of these plots continues today (Jones *et al.*, 1994).

More recent studies being conducted in this Set-Aside are examining landscape and ecosystem

level processes. This Set-Aside Area is one of several Set-Asides on the SRS being used to study the nesting ecology of neotropical migrant birds in hardwood forests (Kilgo *et al.*, 1996a, 1996b). Bird census transects have been installed, as have plots for soft mast inventories. To date there are approximately 28 publications and reports associated with this Area.

Historical/Current/Future Influences:

While the focus of this Set-Aside is not specifically the water quality of UTRC, it should be noted that because this Set-Aside is within Region 3 of UTRC, potential negative impacts could occur to the creek and floodplain from upstream Site operations. In Region 3, effluent discharges from SRS operations are limited to those defined in DOE-SR policy statement concerning Upper Three Runs Creek Stream Management. This policy states that "Additional low-impact effluents may be discharged into Region 3, within regulatory limits. Every effort will be made to ensure that no significant adverse impact occurs to stream biota or water quality. The goal in managing Region 3 is to protect the aquatic community while allowing limited and controlled plant use of this segment." (DOE-SROO Stream Management Policy--Upper Three Runs; 9/11/95).

Potential negative impacts to this Set-Aside could result from SCE&G's maintenance of the upstream utility line ROWs, related in particular to aerially applied herbicide treatments over UTRC. In addition, contamination of this Area could result from upstream Site operations and from the closed Road C landfill. The Burma Road borrow pit expansion also encroaches on the boundary of this Set-Aside. Any leachate outcropping from the Three Rivers Authority regional landfill, adjacent to this Set-Aside, has the potential to enter this Area via a stream head that originates on the landfill property and flows into this Area's floodplain. (Fig. 14-2). To date, there has been no baseline monitoring of this stream.

The floodplain portion of this Area has not been subjected to prescribed fire or timber harvesting activities since establishment of the SRS. However, all of the adjacent slopes within this Area's floodplain apparently were burned in 1995 (SRFS GIS data); verification of this burn is pending.

SRS Patrol Indexes: **H**-10 **I**-9,10,11 **J**-8,9,10,11

Site-Use Permits:

Experiment No. 1216 and 1217 (1968-1978) Removal trapping of small mammals; Gentry and Smith; SREL.

SU-75-04-R Biological and chemical cycling of elements in streams; Smith and Geisy; SREL.

SU-75-20-R A telemetric study of the impact of reactor effluent concerning the American alligator and other ectotherms; Brisbin; SREL.

SU-78-74-R Forest mapping; McLeod; SREL.

SU-79-84-R Forest mapping; McLeod; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-92-46-R Uranium geochemistry; Bertsch; SREL.

SU-92-63-R Stream fisheries characterization study; Paller; WSRC-SRTC

SU-93-23-R Mole research; Wike;WSRC-STRC

SU-93-32-R Migratory birds in hardwood forests; Blake and Chapman; SRFS and UGA.

SU-96-43-F The role of fleshy fruit production, consumption, and seed dispersal on promoting biological diversity; Blake, Levey, and Greenburg; SRFS, Univ. Florida, and SFES.

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Jones, R.H., R.R. Sharitz, S.M. James, and P.M. Dixon. 1994. Tree population dynamics in seven South Carolina mixed-species forests. Bull. Torrey Bot. Club 12:360-368. SREL Reprint # 1912.

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Kaufman, D.W., G.C. Smith, R.M. Jones, J.B. Gentry, and M.H. Smith. 1971. Use of assessment lines to estimate density of small mammals. Acta Theriologica 16:127-147. SREL Reprint # 282.

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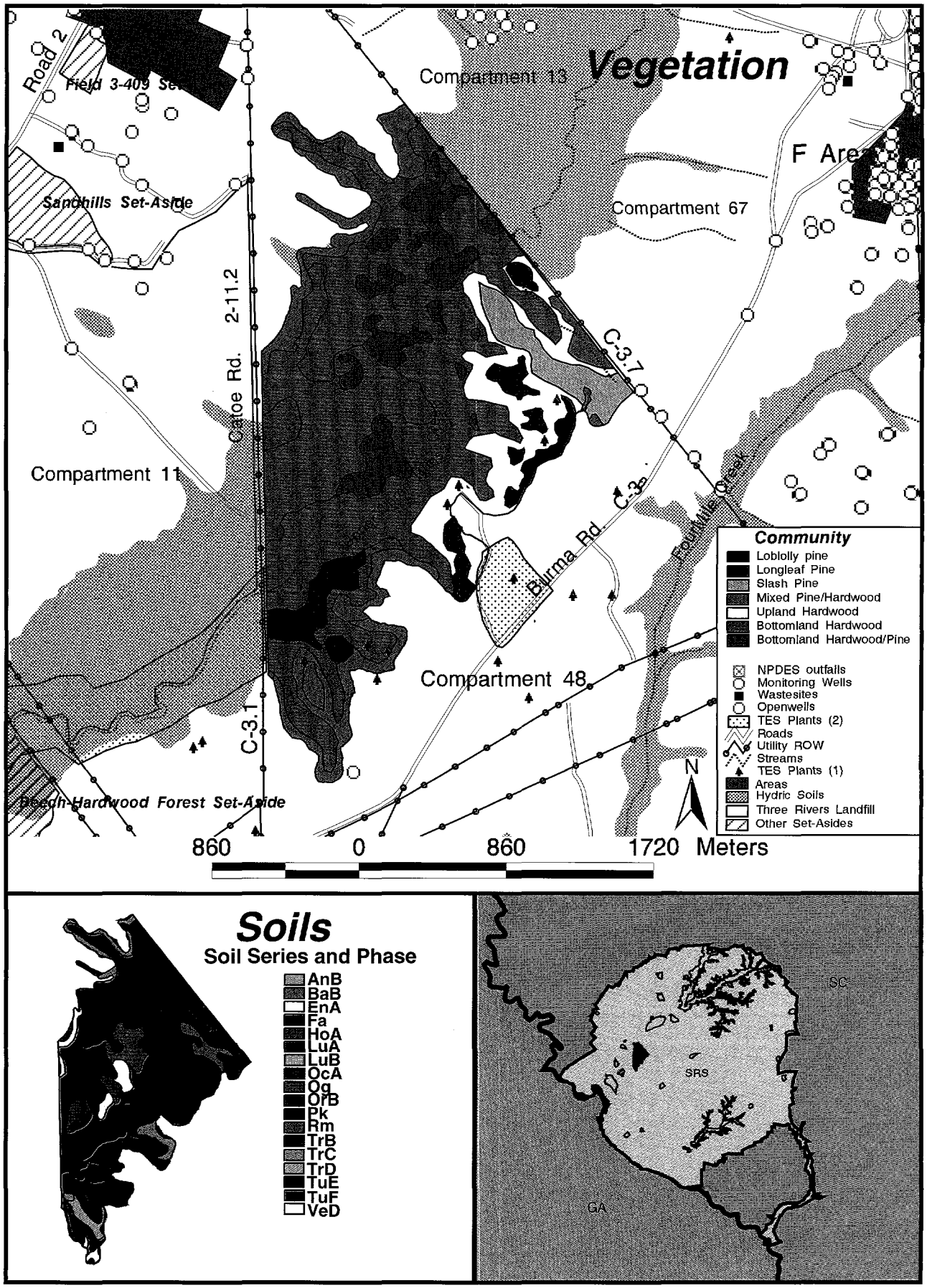

Figure 14-2. *Plant communities and soils associated with the Mature Hardwood Forest Set-Aside Area.*

AREA NO. 15
WHIPPLE/OHER STUDY SITE

SET-ASIDE LOCATION ON THE SRS:

The Whipple/OHER Study Site Set-Aside Area is located in the north-central portion of the SRS on the Aiken Plateau (Langley and Marter, 1973). This Area is within timber compartments 15 and 50, west of S and Z Areas, and is downstream of the E. P. Odum Wetland Set-Aside, below the confluence of McQueen Branch with Upper Three Runs Creek (Figs. 2 and 15-1). This Set-Aside is bordered by Road F on the north; a power line right-of way (ROW) makes up a portion of this Area's eastern border and an abandoned borrow pit is in proximity to the west.

SET-ASIDE DESCRIPTION:

This Set-Aside Area is 183.6 acres (74.3 ha) and is found within a fourth order reach segment of Upper Three Runs Creek (UTRC). This segment of UTRC specifically is within management Region 2 of UTRC as described in DOE-SR's UTRC Stream Management Policy (see below). UTRC is a low gradient, black water stream with a shifting, sandy bottom (see Chapter 30) that rarely experiences prolonged flooding within this reach. However, soil moisture usually is high in this Area during summer months. This Area can be described as a relatively undisturbed second growth, closed canopy floodplain forest. While this Set-Aside primarily is composed of a mixed bottomland hardwood, floodplain forest, it also has a buffer of adjacent hardwood slopes that are 15% or greater in grade. The Set-Aside portion of the stream that flows from Fire Pond into this Set-Aside includes mixed pine/ hardwood vegetation, providing transition from the uplands to the floodplain bottoms.

This Area contains one of the seven Whipple/ Good plots (Plot 3) which identified reference mixed species forests representing a gradient from deeply flooded to somewhat dry conditions on the SRS (Good, 1981; Good and Whipple, 1982). Plot 3 is a square, one-hectare plot located approximately 100 m downstream of the Road F bridge and 5 m west of UTRC. Plot 3, which corresponds to experimental plot #5 of Jones *et al.* (1994c), ranks fifth in order of elevational gradient of the seven Whipple/Good plots on the SRS. Plot 3 contains the highest percentages of evergreen species compared to the other six Whipple/Good plots. Good (1981) reported that the overstory canopy of this plot primarily was composed of sweet bay (*Magnolia virginiana*) and sweetgum (*Liquidambar styraciflua*), ranging in age from 30-100 years. Adjacent to this plot are SREL seed bucket and seedling monitoring plots. These seedling plots are referred to as the small river, unflooded forest sites by Jones and Sharitz (1990) and Jones *et al.* (1994a). In addition to the dominant tree species in Whipple/Good Plot 3, Jones *et al.* (1994a) recorded swamp tupelo (*Nyssa sylvatica* var. *biflora*) and three oak species (water oak, *Q. nigra*; laurel oak *Q. laurifolia*; and swamp chestnut oak, *Q. michauxii*) in the overstory. The 2.32-mile (3.73 km) boundary line of this Area is marked with metal DOE Research Set-Aside Area signs.

WHAT THIS SET-ASIDE REPRESENTS:

This Set-Aside represents one of seven long-term vegetation study areas on the SRS (Good, 1981; Good and Whipple, 1982). In addition, this site was used by Whipple *et al.* (1981) as a representative black gum-red bay (*Nyssa sylvatica-Persea borbonia*) forest. These forests are characteristic of mesic sites that flood for only short periods of time; they typically are restricted to protected coves, ravines, and lower-to-middle portions of steep slopes. Within this Set-Aside, such sites occur in the floodplain of UTRC on elevated slopes that seldom flood. On the SRS, any remaining sites representative of this

Table 15-1. Vegetation communities of the Whipple/OHER Study Site Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	1.10	0.45	0.60%
Mixed Pine/Hardwood	14.15	5.73	7.71%
Upland Hardwood	2.19	0.89	1.19%
Bottomland Hardwood	154.51	62.53	84.14%
Bottomland Hardwood/Pine	11.69	4.73	6.37%
Totals:	183.64	74.32	100.00%

community type are restricted to Upper Three Runs Creek because most other former locations have been impacted by reactor discharges and other management activities. Thus, this Set-Aside is an important reference wetland. Because of its representative nature, historical database, current level of research activities, and long-term research status, this area was included in the Set-Aside Program.

History:

Prior to Site acquisition in 1951, this Area was primarily a cut-over floodplain forest with adjacent land-use being agricultural, as pasture, and as logged timberland. It appears that much of the western portion of this Area had undergone logging in the decades prior to establishment of the SRS. A farm pond (Fire Pond) that pre-dates the SRS is located on the small stream that flows into the floodplain of this Set-Aside. Site Road F, which crosses UTRC, was constructed after Site acquisition. This Set-Aside acquired its name from the fact that research by Whipple (Good and Whipple, 1982; Whipple *et al.*, 1981) used long-term vegetation monitoring plots first established in this Area by Good (1981). Additionally, SREL conducted stream ecology research in this Area under the Wetland Ecosystem Processes Program funded from the DOE-HQ-Office of Health, Environment and Research (OHER); hence the name Whipple/ OHER Study Site for this Set-Aside Area.

Set-Aside Plant Community Composition:

Five plant communities comprise this Area. The vast majority of the vegetation (90.5%; Table 15-1) is a floodplain forest type which includes bottomland hardwoods, mixed bottomland hardwoods, and loblolly pine (*Pinus taeda*). Slopes adjacent to the floodplain are comprised of mixed pine/hardwoods, which account for 7.7% of this Area. Upland hardwoods account for 1.2% and loblolly pine 0.6%. This pine component recently has been reduced due to construction related to replacement of the Road F bridge over UTRC. The dominant canopy vegetation west of UTRC in timber compartment 15 dates to 1940; the vegetation east of UTRC in compartment 50 is older, dating to 1925 (SRFS CISC stand database).

Sensitive Flora And Fauna:

There have been no sensitive plants documented from this Set-Aside (Table 3). American alligators (*Alligator mississippiensis*) are known to inhabit UTRC (Table 4).

Set-Aside Soils:

This Set-Aside is comprised of seven soil series and phases. The majority (94.7%) of these soils are hydric and include the frequently flooded and ponded floodplain soils of the Pickney (81.5%)

Table 15-2. Soils of the Whipple/OHER Study Site Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 6-10% slopes	BaC	0.39	0.16	0.21%
Fluvaquents, frequently flooded	Fa	9.99	4.04	5.44%
Ogeechee sandy loam, ponded	Og	3.30	1.34	1.80%
Pickney sand, frequently flooded	Pk	160.60	65.00	87.45%
Troup & Lucy sands, 15-25% slopes	TuE	8.08	3.27	4.40%
Udorthents, firm substratum	Ud	0.87	0.35	0.47%
Vaucluse-Ailey complex, 10-15% slopes	VeD	0.41	0.17	0.22%
Totals:		183.64	74.32	100.00%

and the Ogeechee (1.8%) series (Table 15-2). The Fluvaquents (5.4%) primarily are associated with the stream flowing into the Set-Aside floodplain from Fire Pond. Vaucluse-Ailey (0.2%) soils comprise the northern slope of this stream. The Troup and Lucy sands (4.4%) form the steep, erosive slopes that are associated with the eastern bluffs of UTRC floodplain. Sandy soils of the Blanton series are present and, with the disturbed Udorthents, comprise the small fraction (0.7%) of the Area's upland soils. The Udorthents are the result of road construction. See Fig. 15-1 for soils mapping and Appendix 3 for a description of soils.

Research Associated With This Set-Aside:

Three areas of research can be associated with this Set-Aside, including small mammal population studies, long-term vegetation monitoring studies, and leaf litter decomposition studies, both on the forest floor and in the stream. Early research dating to the 1960's examined methods to estimate densities of small mammal populations (Gentry *et al.*, 1968, 1971b, 1974; Kaufman *et al.*, 1971, 1978; Smith *et al.*, 1971, 1975). Good (1981) and Good and Whipple (1982) established long-term monitoring plots in this Area to study forest species composition and soil moisture related to elevational gradients and flood-stress. Good (1981) selected seven one-hectare plots to represent relatively undisturbed, mature examples of the deciduous forest vegetation of the SRS within the Upper Three Runs Creek drainage and non-thermally impacted portions of the Savannah River swamp. These areas are characterized in Whipple *et al.* (1981). Whipple/Good Plot 3 is located in this Set-Aside, adjacent to UTRC. Other Whipple/Good plots are located in Areas 7, 9A, 12, 14, and 30. Inventory and assessment of these plots continues today (Jones *et al.*, 1994c).

This particular Set-Aside was studied by SREL in conjunction with the Wetland Ecosystem Processes Program. Environmental parameters such as microclimate, stream depth, nutrient levels, community dynamics, and hydrology were examined and this Area was compared with another downstream site which had a greater flooding frequency. Seedling recruitment plots were established adjacent to the Whipple/Good plot (Jones and Sharitz, 1990; Jones *et al.*, 1994b). These seedling census plots contain plastic seed buckets and were installed to study woody species regeneration in a floodplain forest. This ongoing study includes evaluations of seed production, seed bank, seedling establishment, and survival relative to hydrologic conditions. In addition, piezometers were installed in this Area to evaluate groundwater movement and stream hydrology (Sharitz and Martin, 1987); these piezometers were removed

in 1994.

A third area of research in this Set-Aside included leaf decomposition dynamics studies in UTRC (McArthur *et al.*, 1994; Rader *et al.*, 1994) and studies of elemental release by floodplain forest litter (Segal *et al.*, 1990; Jones *et al.*, 1994a). To date there are 26 publications and reports associated with this Area.

Historical/Current/Future Influences:

While the focus of this Set-Aside is not specifically the water quality of UTRC, it should be noted that because this Set-Aside is within Region 2 of UTRC, potential negative impacts could occur to the creek and floodplain from upstream Site operations (specifically S and Z Areas). In Region 2, effluent discharges from SRS operations are limited to those defined in the DOE-SR Upper Three Runs Creek Stream Management Policy. This policy states that "Limited effluents may be discharged through tributaries to Region 2, within regulatory limits. Every effort will be made to ensure that the collective impact to stream communities is insignificant and water quality is maintained within historic ranges." (DOE-SROO Stream Management Policy--Upper Three Runs; 9/11/95). There is a USGS water monitoring station located at the Road F bridge crossing at UTRC which monitors for flow rate (L. Eldridge pers. comm.).

SRS Road F borders this Set-Aside. Construction of this road through the UTRC floodplain may have influenced the hydrology and natural flooding regime of this Area. Powerline ROW maintenance directly upstream and over Fire Pond could influence the water quality of this Set-Aside, as could maintenance to the Fire Pond dam. There have been recent clearcuts established along the eastern boundary of this Area and future clearcutting is scheduled to be conducted along the western margin of this Set-Aside, within the floodplain of UTRC. Abandoned shallow peizometers have been removed but seed collecting buckets continue to be maintained and routinely are monitored. A canoe trail once was cut through this section of Upper Three Runs Creek. Development in the watershed upstream may influence the water quality and flooding regime of this Area. This Set-Aside has not been subjected to prescribed fire or timber removal since establishment of the SRS.

SRS Patrol Indexes: **H**-15,16 **I**-15,16

Site-Use Permits:

Experiment No. 1212 and 1213 (1968-1979) Removal trapping of small mammals; Smith and Gentry; SREL.

SU-75-04-R Biological and chemical cycling of elements in streams; Smith and Geisy; SREL.

SU-75-20-R A telemetric study of the impact of reactor effluent concerning the American alligator and other ectotherms; Brisbin; SREL.

SU-76-80-R Biology of the tree-hole mosquito larvae; Blessings; SREL.

SU-78-58-R Removal trapping of small mammals; Smith and Gentry; SREL.

SU-78-74-R Forest mapping; Mcleod; SREL.

SU-79-84-R Forest mapping; McLeod; SREL.

SU-86-04-R Bottomland Hardwood ecosystem processes study; Sharitz and Mcleod; SREL.

SU-87-55-R Fish community structure; Meffe; SREL.

SU-88-13-R Chickadee/Parid nestbox study; Brisbin; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-89-23-O Plantwide SRS dry hydrant system; Nelson; WSRC-CSWE.

SU-95-10-C Geotechnical borings at bridges; Starrett; USACOE.

SU-95-10-O (Amendment 1) Replacement of bridges; Starrett; USACOE.

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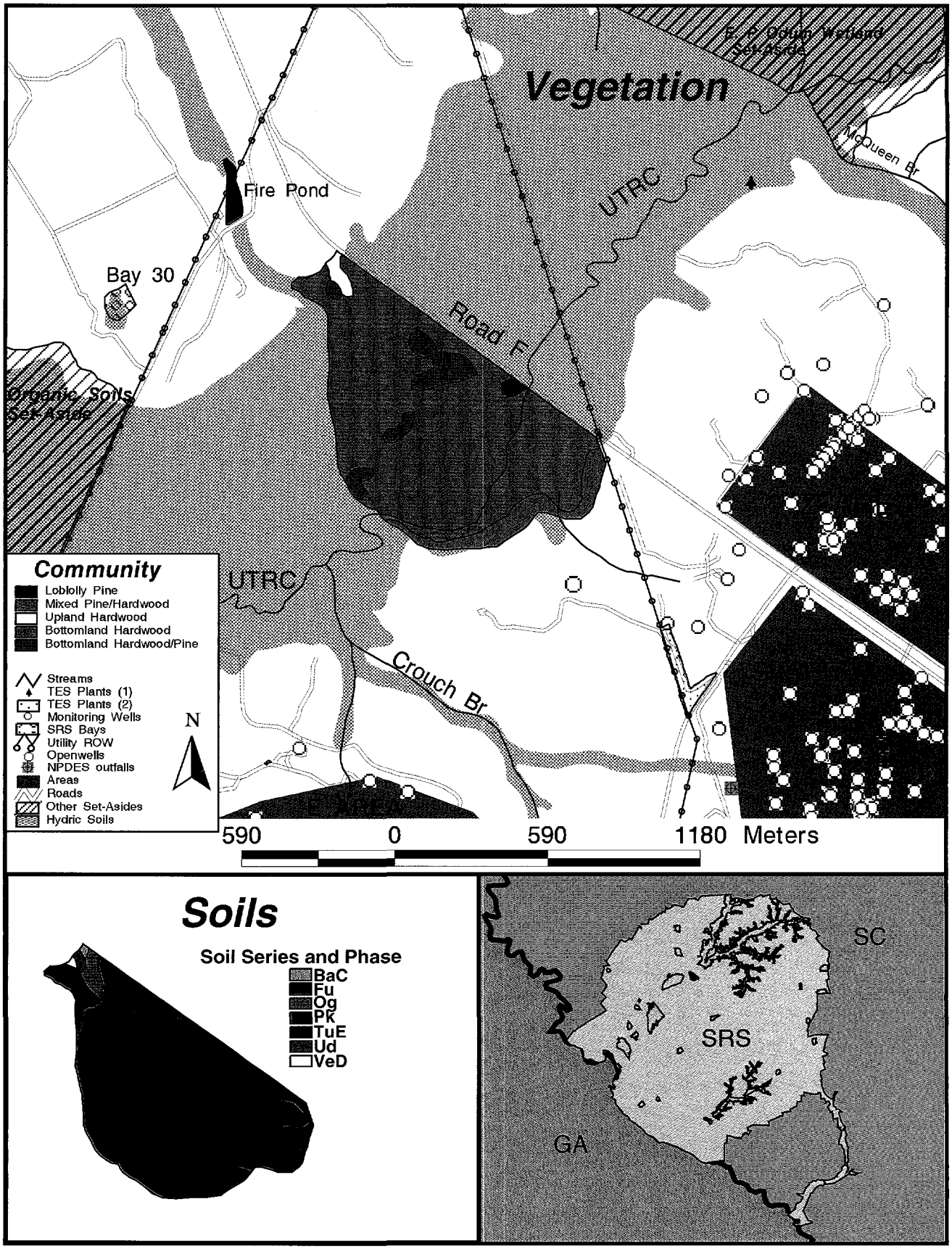

Figure 15-1. *Plant communities and soils associated with the Whipple/OHER Study Site Set-Aside Area.*

AREA NO. 16
RAINBOW BAY AMPHIBIAN RESERVE AREA

SET-ASIDE LOCATION ON THE SRS:

The Rainbow Bay Amphibian Reserve Area is located on the Aiken Plateau in the center of the SRS (Langley and Marter, 1973). Found in timber compartment 66, this Set-Aside Area is 120 m northeast of the Bush monument, which is the exact center of the SRS. An R Reactor waterline right-of-way (ROW) and Road C-5 border this Area on the north. Road C-5e.3 passes through the Area and Rainbow Bay is located at the junction of this road and Road C-5e.1 (Figs. 2 and 16-2). This Set-Aside is north of and adjacent to the well-characterized Nuclear Production Reactor (NPR) site.

SET-ASIDE DESCRIPTION:

This 87.5-acre (35.4 ha) Set-Aside Area is comprised of Rainbow Bay (Bay No. 189—see Schalles *et al.*, 1989 for numbering), a 200-m forested buffer area that encircles the entire bay, and a wedge-shaped corridor extending to a tributary of Fourmile Creek. This corridor was established to maintain a forested connection between Rainbow Bay, Bullfrog and Pickerel Ponds, and the Fourmile Creek drainage. Rainbow Bay is a 2.4-acre (1 ha) relatively undisturbed, isolated, wetland depression similar to a true Carolina bay, lacking only the geomorphological characteristics of a true bay (i.e, the northwest/southeast orientation and a sand rim). It can be described as an herbaceous/partially forested bay, with a hydroperiod more temporary than semi-permanent. Rainbow Bay is 150 m in length, has a maximum depth of slightly greater than 1 m, and has a variable hydroperiod (Taylor *et al.*, 1989). This bay typically fills in late fall or winter and dries in late spring or early summer (Pechmann *et al.*, 1989). Rainbow Bay has two shallow ditches. The primary ditch runs the length of the bay through a culvert under road C-5e.3; the second internal ditch connects to the primary central ditch. Pond cypress (*Taxodium ascendens*) grow along these ditches. A 440-m terrestrial drift fence with 88 pitfall traps (10-gallon buckets) encircles Rainbow Bay (Fig. 16-1). This aluminum flashing fence is 50 cm high, buried 10-15 cm in the ground, with 44 pitfall traps located at 10-m intervals on each side of the fence (Pechmann and Semlitsch, 1986).

At the time of Site acquisition, this bay was predominantly an open herbaceous community, but now is a more closed hardwood/shrub community (Kirkman *et al.*, 1996). Presently, the dominant herbaceous vegetation of the bay interior consists of emergent sedges (*Scirpus cyperinus*), rushes (*Juncus repens*), spike rush (*Eleocharis* spp.), knotweed (*Polygonum* spp.), and grasses (*Panicum* spp.). The periphery of the bay is dominated by sweetgum (*Liquidambar styraciflua*). Other plants common to the bay include cattail (*Typha latifolia*), button bush (*Cephalanthus occidentalis*), and black willow (*Salix nigra*). Slash pine (*Pinus elliottii*) and loblolly pine (*P. taeda*), with wax myrtle (*Myrica cerifera*), blackberry (*Rubus* spp.), and poison ivy (*Rhus* spp.) in the under story, predominate around the bay's perimeter (Pechmann and Semlitsch, 1986).

As part of this Set-Aside Area, a forested connection was added to maintain travel corridors for animal migrations between nearby wetlands and Rainbow Bay. Retaining this area, which includes ponds and stream drainage habitat, as part of the Set-Aside was necessary to protect the demographic and genetic exchange of amphibians between Rainbow Bay and surrounding habitats. The primary ditch from Rainbow Bay drains northeast to Bullfrog Pond, which is adjacent to the utility ROW. Bullfrog Pond is 1.2 acres (.5 ha) and appears to be a remnant natural wetland depression that has been

Table 16-1. Vegetation communities of the Rainbow Bay Amphibian Reserve Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	28.09	11.37	32.11%
Slash Pine	34.98	14.16	39.99%
Bottomland Hardwood	19.41	7.86	22.19%
Carolina Bay Wetland	2.06	0.83	2.36%
Water	1.90	0.77	2.17%
Other—Disturbed Area	1.03	0.42	1.18%
Totals:	87.47	35.40	100.00%

man-altered; soil was excavated in the 1950's to form a borrow pit. Scott (1990) constructed experimental animal enclosures in this pond and characterizes the dominant vegetation in the deeper portion of the pond as consisting of cattail and button bush, with sweetgum present in the shallower regions. Pickerel Pond is east of Bullfrog Pond and is a ponded depression associated with the tributary that drains into Fourmile Creek.

The forested buffer area and the connective corridor are predominantly vegetated with different-aged slash and loblolly pine plantations; the tributary to Fourmile Creek and the historical ditches primarily support mixed bottomland hardwood habitats. Within the buffer area, 60 m southeast of Rainbow Bay, is a 2,000 sq. m disturbed area which was cleared in 1988 and covered with gravel to serve as a parking area (Pechmann *et al.*, 1991). The 1.81-mile (2.92 km) boundary line for this Set-Aside is marked with metal DOE

Figure 16-1. *Drift fence at Rainbow Bay.*

Table 16-2. Soils of the Rainbow Bay Amphibian Reserve Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Dothan sand, 0-2% slopes	DoA	11.36	4.60	12.99%
Dothan sand, 2-6% slopes	DoB	47.35	19.16	54.14%
Fuquay sand, 0-2% slopes	FuA	0.28	0.11	0.32%
Ogeechee sandy loam, ponded	Og	13.07	5.29	14.95%
Vaucluse-Ailey complex, 6-10% slopes	VeC	15.40	6.23	17.61%
Totals:		87.46	35.39	100.00%

Research Set-Aside Area and yellow plastic SREL Research Area signs.

What This Set-Aside Represents:

The Rainbow Bay Amphibian Reserve Area is a Set-Aside which represents a relatively undisturbed bay/pond/woodland system in which herpetofaunal research has been conducted for nearly 20 years. This area has been used as a control site for Defense Waste Processing Facility (DWPF) studies and has been censused daily since 1978 for amphibians--more than 333,000 amphibians have been captured and marked to date. These studies have continued in conjunction with SREL's DWPF assessment and refuge pond mitigation research. Research at Rainbow Bay, the longest such study in the world, has been recognized by a National Academy of Sciences workshop as unique and extremely important for addressing concerns on the global decline of amphibians. Within the nearly 20 years of daily monitoring of Rainbow Bay's drift fence by SREL personnel, less than 20 days have been missed in this one-of-a-kind census effort (R. Estes pers. comm.). Studies from this Set-Aside Area helped initiate the expansion of the SRS Set-Aside Program in 1989, primarily as a result of research that suggested that large buffer zones are necessary to preserve the terrestrial environments for amphibian species. In addition, Rainbow Bay represents the only Set-Aside bay that is surrounded in its entirety by a forested buffer zone; it also is the only Set-Aside bay whose buffer area has not been subjected to clear-cutting or prescribed fire for over twenty years. Historically, this Area has served as a control for other bays which may have been subjected to various impacts related to Site operations. Ellenton Bay (Area No. 1) is the only other Set-Aside bay which has a buffer area that has not be subjected to recent forest management activities; however, Ellenton Bay's buffer area is in old-field succession and not pine plantation forests.

History:

Prior to establishment of the Savannah River Site in 1951, Rainbow Bay was surrounded completely by agricultural fields. The corridor connecting Rainbow Bay to the ponds and the Fourmile Creek drainage was in agricultural fields and mixed pine/hardwood communities. There is evidence of an old house within what is now the Set-Aside buffer area. The road located on eastern edge of the bay was present prior to establishment of the SRS. Rainbow Bay was selected in 1978 to serve as a control site for the Defense Waste Processing Facility (DWPF) construction because a nearby Carolina bay (Sun Bay; Bay No. 45) was eliminated as a result of this construction. Ecological studies were initiated at Rainbow Bay as part of a biological inventory related to DWPF construction and have continued as long-term studies monitoring amphibian populations in this area.

Set-Aside Plant Community Composition:

This Set-Aside is composed of four community types, including pine plantations (72.16%), bottomland hardwood (22.2 %), and Carolina bays and water (4.5%; Table 16-1). The fourth type, other/disturbed (1.2%), resulted from road construction and clearing. In the upland buffer area the older-aged loblolly and slash pine plantations were established in 1958 and 1954, respectively; the younger stand of loblolly pine was planted in 1975 (SRFS CISC stand database). The bottomland hardwoods date to 1949. Both pond and bald cypress (*Taxodium ascendens* and *T. distichum*) were planted experimentally in Rainbow Bay (Neufeld, 1984).

Sensitive Flora and Fauna:

Nine sensitive species of plants and animals have been located within this Set-Aside, including species listed on federal and/or South Carolina lists for special status (Tables 3 and 4). These include the green fringed orchid (*Platanthera lacera*), spathulate seedbox (*Ludwigia spathulata*), southern hognose snake (*Heterodon simus*), smooth earth snake (*Virginia valeriae*), eastern slender glass lizard (*Ophisaurus attenuta longicaudus*), gopher frog (*Rana capito*), eastern tiger salamander (*Ambystoma t. tigrinum*), star-nose mole (*Condylura cristata*), and the bobcat (*Lynx rufus*).

Set-Aside Soils:

There are five soil series and phases associated with this Area. Drier soils in the buffer area and in the corridor which support the pine communities are predominantly the well-drained sandy loams of the Dothan series (80%) and the Fuquay series (0.3%; Table 16-2). The Vaucluse-Ailey complex soils (17.6 %), which are typically found on transitional slopes and side slopes of drainages (Rogers, 1990), are associated with the Fourmile creek drainage. The remaining (15%) wetland soils associated with Rainbow bay, Bullfrog Pond, and the drainage are the ponded sandy loam Ogeechee series. See Fig. 16-2 for soil mapping of the Set-Aside and Appendix 3 for a description of soil types.

Research Associated With This Set-Aside:

Censusing of amphibian populations that use the breeding habitat in and around Rainbow Bay began on 21 September 1978 using drift fencing and pitfall techniques (Vitt *et al.*, 1982; Gibbons and Semlitsch, 1981, 1991). As a result of this biological inventory, sixty species of herpetofauna initially were recorded. A current list of species is found in Table 16-3. This early inventory has since been expanded to long-term studies designed to elucidate the structure and dynamics of breeding populations of amphibians over time (Pechmann and Semlitsch, 1986; Pechmann *et al.*, 1989, 1991; Scott, 1990; Semlitsch, 1981, 1983a, 1983b; Semlitch *et al.*, 1996; and others). As a result, these studies have aided researchers in addressing the issue of global declines of amphibian populations (Pechmann *et al.*, 1991) as well as the conservation efforts needed to protect both the aquatic and terrestrial habitats of temporary ponds and Carolina bays.

SREL studies at Rainbow Bay have demonstrated that it is an important breeding habitat for a large number of amphibian and reptile species that spend most of the year in terrestrial habitats. The primary focus of the research has been to examine natural variations in population numbers over time. In addition, amphibians breeding in Rainbow Bay have been found in Linda's Pond, demonstrating that some species will travel up to a kilometer from their breeding area. Information on the appropriate buffer zone widths for bay wetlands gained from these studies led to the determination in the late 1980's that the Set-Aside Program should be expanded. Nearly twenty years of data collection at Rainbow Bay have demonstrated that there is great year-to-year variation in amphibian populations. These studies will continue to evaluate natural fluctuations in population

Table 16-3. Amphibians and reptiles documented from the Rainbow Bay Amphibian Reserve Area.

Amphibians		**Lizards**	
Common Name	Scientific Name	Common Name	Scientific Name
Southern cricket frog	*Acris gryllus*	Green anole	*Anolis carolinensis*
Spotted salamander	*Ambystoma maculatum*	Six-lined racerunner	*Cnemidophorus sexlineatus*
Marbled salamander	*Ambystoma opacum*	Five-lined skink	*Eumeces fasciatus*
Mole salamander	*Ambystoma talpoideum*	Southeastern five-lined skink	*Eumeces inexpectatus*
Tiger salamander	*Ambystoma tigrinum*	Broad-headed skink	*Eumeces laticeps*
Oak toad	*Bufo quercicus*	Slender glass lizard	*Ophisaurus attenuatus*
Southern toad	*Bufo terrestris*	Eastern glass lizard	*Ophisaurus ventralis*
So. two-lined salamander	*Eurycea cirrigera*	Southern fence lizard	*Sceloperus undulatus*
Dwarf salamander	*Eurycea quadridigitata*	Ground skink	*Scincella laterale*
Narrow-mouthed toad	*Gastrophryne carolinensis*	**Snakes**	
Gray treefrog	*Hyla chrysoscelis*	Southern copperhead	*Agkistrodon contortrix*
Green treefrog	*Hyla cinerea*	Eastern cottonmouth	*Agkistrodon piscivorus*
Pine woods treefrog	*Hyla femoralis*	Scarlet snake	*Cemophora coccinea*
Barking treefrog	*Hyla gratiosa*	Southern black racer	*Coluber constrictor*
Squirrel treefrog	*Hyla squirella*	Canebrake (timber) rattlesnake	*Crotalus horridus*
Dwarf waterdog	*Necturus punctatus*	Southern ringneck snake	*Diadophis punctatus*
Red-spotted newt	*Notophthalmus viridescens*	Corn snake	*Elaphe gutatta*
Slimy salamander	*Plethodon glutinosus*	Gray rat snake	*Elaphe obsoleta*
Spring peeper	*Pseudacris crucifer*	Eastern mud snake	*Farancia abacura*
Southern chorus frog	*Pseudacris nigrita*	Eastern hognose snake	*Heterodon platyrhinos*
Ornate chorus frog	*Pseudacris ornata*	Southern hognose snake	*Heterodon simus*
Southern red salamander	*Pseudotriton ruber*	Eastern kingsnake	*Lampropeltis getulus*
Carolina gopher frog	*Rana capito*	Scarlet kingsnake	*Lampropeltis triangulum*
Bullfrog	*Rana catesbeiana*	Red-bellied water snake	*Nerodia erythrogaster*
Bronze frog	*Rana clamitans*	Banded water snake	*Nerodia fasciata*
Southern leopard frog	*Rana utricularia*	Rough green snake	*Opheodrys aestivus*
Eastern spadefoot toad	*Scaphiopus holbrooki*	Northern pine snake	*Pituophis melanoleucus*
Lesser siren	*Siren intermedia*	Northern brown snake	*Storeria dekayi*
Greater siren	*Siren lacertina*	Red-bellied snake	*Storeria occipitomaculata*
Turtles		Southeastern crowned snake	*Tantilla coronata*
Common snapping turtle	*Chelydra serpentina*	Eastern ribbon snake	*Thamnophis sauritus*
Eastern chicken turtle	*Deirochelys reticularia*	Eastern garter snake	*Thamnophis sirtalis*
Striped mud turtle	*Kinosternon bauri*	Rough earth snake	*Virginia striatula*
Eastern mud turtle	*Kinosternon subrubrum*	Smooth earth snake	*Virginia valeriae*
Stinkpot	*Sternotherus odoratus*		
Eastern box turtle	*Terrapene carolina*		
Yellow-bellied slider	*Trachemys scripta*		

numbers to provide DOE with accurate information that can be used to manage the natural resources of bay wetlands of the SRS. More recent studies are examining forest management practices and their influence on habitats that surround the Rainbow Bay Set-Aside. Specifically, studies are examining the effects of habitat type (clear-cut vs. forested) on amphibian survival and growth.

Rainbow Bay also is known for its diverse assemblage of zooplankton. Past research in this Set-Aside includes surveys of zooplankton (Mahoney *et al.*, 1990) and studies of the population dynamics of these fauna (Taylor *et al.*, 1988, 1990; DeBiase and Taylor, 1993). There have been a number of additional studies in this Set-Aside which were conducted in support of the amphibian population studies. These include rainfall and surface water chemistry effects on resident animals (Pickens and Jagoe, 1996), bacterial (Leff *et al.*, 1993a,1993b) and fish (Snodgrass *et al.*, 1996) assemblage studies, and biodiversity studies using cover boards (Grant *et al.*, 1992). There is minimal vegetation information for this Area because no transected vegetation survey has been conducted (Keough *et al.*, 1990). This Set-Aside bay has been recommended for inclusion in the EPA's ADID project for Carolina bays (Lide and Davis, 1993; EPA, 1994). To date, there are 79 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

Rainbow Bay has an historical ditch which may function to some degree because of the road's culvert connection. On at least one occasion, pickerel have been observed in Rainbow Bay (D. Scott pers. comm.). Waterway connections from the ditch to Bullfrog Pond and a tributary of Fourmile Creek may have allowed fish temporarily to inhabit the bay. The Rainbow Bay Set-Aside Area has had no recent history of fire or timber harvesting activities in proximity to the bay. Prescribed fire has been excluded from this Area since 1971 and a dense wax myrtle understory exists in parts of the buffer area which could result in an intense fire, should one occur. Areas adjacent to this Set-Aside recently have been clear-cut. Roads cross through this Area and there is heavy sediment input into Rainbow Bay from Road C-5e.1 during heavy rains. An SRS river water line ROW parallels the northern boundary line of this Area and is maintained periodically. Six subsurface monitoring wells were installed in this Set-Aside as part of the characterization of the nearby NPR Site. Meteorological monitoring equipment at this site has been disturbed on rare occasions, perhaps due to its proximity to the road. The proximity of the road to the bay also may influence the natural hydrology of the bay. This Area is adjacent to the highly characterized NPR site and may be subject to habitat fragmentation and isolation if this site is selected for future DOE missions.

SRS Patrol Indexes: M-14,15

Site-Use Permits:

SU-78-66-R Ecological inventory ISFS facility; Gibbons; SREL.

SU-79-47-R Terrestrial activity of mole salamander; Semlitsch and Gibbons; SREL.

SU-80-06-R Ecology of Pond and Bald cyress; Neufeld and Sharitz; SREL.

SU-82-17-R Terrestrial activity of the tiger salamander; Vitt and Semlitsch; SREL.

SU-86-31-R DWPF ecological studies of Rainbow Bay control site; Gibbons and Pechmann; SREL.

SU-87-63-R Registration of locations of rare or threatened plant populations based upon Federal or state of South Carolina status; Roecker and Sharitz; SRFS and SREL.

SU-89-58-R (Amendment 1) Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-91-88-R Rainbow Bay area amphibian study; Gibbons and Pechmann; SREL.

SU-91-88-R (Amendment 1) Rainbow Bay area amphibian study; Gibbons, Niewiarowski, and Scott; SREL.

SU-92-36-R Influence of precipitation in Carolina Bays; Jagoe; SREL.

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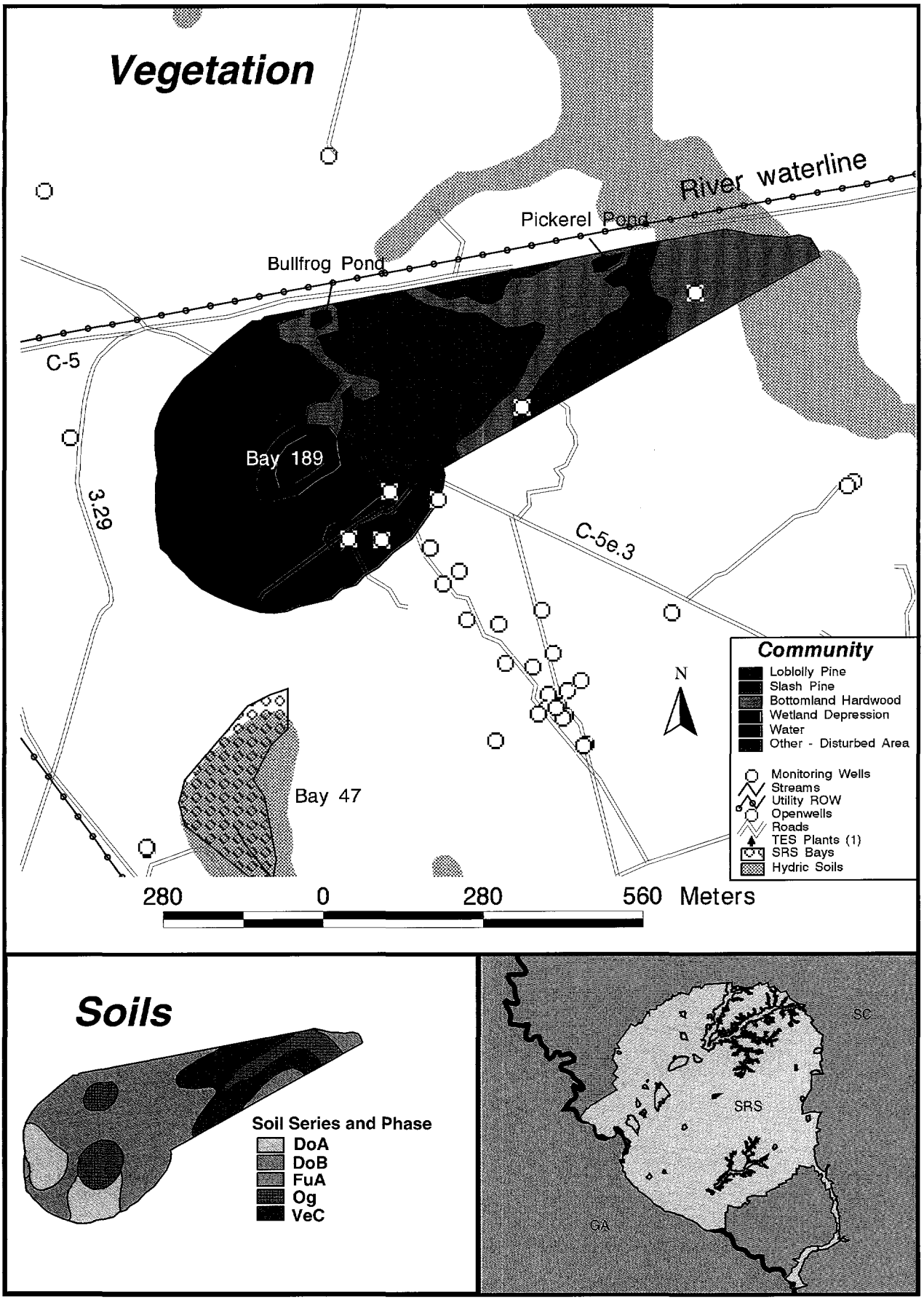

Figure 16-2. *Plant communities and soils of the Rainbow Bay Amphibian Reserve Area.*

AREA NO. 17
CRAIG'S POND AND SARRACENIA BAY

SET-ASIDE LOCATION ON THE SRS:

The Craig's Pond and Sarracenia Bay Set-Aside Area is located within the Brandywine Pleistocene Terrace on the eastern perimeter of the Savannah River Site (Langley and Marter, 1973). Portions of both of these Set-Aside bays are located off of the SRS, on property owned by Chem Nuclear and within the Barnwell County Industrial Park (Fig. 17-1); the Site boundary fence passes through both bays and serves to delimit a portion of the Set-Aside boundary. These bays are found in timber compartments 29 and 55, bordering Roads 8-8 and 8-8.11 (Figs. 2 and 17-2). Because these two Carolina bays are not wholly contained on the SRS, the following information refers only to the on-site portions of these wetlands.

SET-ASIDE DESCRIPTION:

The 142.9-acre (57.84 ha) Craig's Pond and Sarracenia Bay Set-Aside contains the paired Craig's Pond and Sarracenia Bay (Bay Nos. 77 and 78—see Schalles *et al.*, 1989 for numbering), which are semi-permanent, open-water, aquatic/herbaceous Carolina bays. A partial 200 m buffer area comprised of natural and recently planted plantation pines, mixed pine/hardwoods, and sandhill scrub oak/pine communities surrounds these bays. Craig's Pond is one of the largest true bays on the SRS, totaling 193 acres (78.2 ha), 64% of which is off-site. The on-site portion in the Set-Aside totals 68.1 acres (27.6 ha). Beyond the natural pine rim bordering Craig's Pond there are six zones or community types that have been well described (Kelley and Batson, 1955; Hodges, 1985; Schalles *et al.*, 1989; and Kirkman, 1992). The dominant canopy vegetation of the sand rim includes loblolly (*Pinus taeda*) and longleaf pine (*P. palustris*), black gum (*Nyssa sylvatica*), black jack oak (*Quercus marilandica*), turkey oak (*Q. laevis*), and sweet gum (*Liquidambar styraciflua*). Beyond this woody zone and across the hydrologic gradient are bands of herbaceous vegetation, each dominated by grass species. The first zone is dominated by broomsedge (*Andropogon virginicus*) and numerous herbs, including pitcher plants (*Sarracenia* spp.). Three-awn grass (*Aristida affinis*) also is in this zone, followed by maidencane (*Panicum hemitomon*) in the deeper water areas. Beyond this zone are found several species of sensitive plants (Table 3). The central pool of deeper water contains floating macrophytes such as water-lily (*Nymphaea odorata*) and *Nymphoides aquaticum.* Hodges (1985) described the deepest water community as a *Nymphaea odorata-Brasenia scherberi* (water shield) community. An external drainage ditch is located on the off-site portion of the southeast rim of Craig's Pond; this ditch possibly has connections to the Salkehatchie drainage via Bay No. 5147, which could allow fish to enter these otherwise isolated bay communities.

Sarracenia Bay lies aproximately 200 m to the west of Craig's Pond and is 9.9 acres (4.0 ha) in size; unlike Craig's Pond, the majority (70%) of this bay is on-site (6.9 acres; 2.8 ha). The upland rim area of Sarracenia Bay is occupied by mixed pine/hardwood vegetation. Hodges (1985) characterized Sarracenia Bay's interior wetland vegetation into four zones: the outermost zone consists of the *Aristida affinis-Andropogon virginicus* community type, followed by *Rhynchospora traceyi-Leersia hexandra* (cutgrass). The more aquatic, interior portion of the bay is composed of the *Nymphaea odorata-Eleocharis rabbinsii* (spike rush) type and the *N. odorata-Eleocharis equisetoides* type.

The 2.14-mile (3.44 km) boundary line of this Set-Aside Area is marked with metal DOE Research Set-Aside Area signs on trees and metal poles.

Table 17-1. Vegetation communities of the Craig's Pond/Sarracenia Bay Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	17.58	7.11	12.30%
Longleaf Pine	40.91	16.56	28.63%
Mixed Pine/Hardwood	11.55	4.67	8.08%
Carolina Bay Wetland	18.39	7.44	12.87%
Water	39.07	15.81	27.34%
Sandhill Scrub Oak/Pine	15.41	6.24	10.78%
Totals:	142.91	57.84	100.00%

What This Set-Aside Represents:

This Set-Aside consists of a pair of relatively intact, true Carolina bays which have central pools of aquatic vegetation and distinct zones of herbaceous vegetation out to the bay margins. Within these wetland vegetation communities are a number of sensitive plant populations. The hydroperiods of these bays are relatively extended and drawdown with complete drying occurs infrequently and only in periods of extended drought. This Area was selected as a Set-Aside primarily because it is part of the largest open- water Carolina bay on the SRS and for the opportunities it presents to study the ecological processes of the aquatic and terrestrial environs associated with relatively unimpacted bays. In addition, these bays, due to their similarities in configuration and position in the SRS landscape, can be considered sister to Mona Bay and Woodward Bay (Area No. 25) located directly north. Like Area No. 25, this Area also is representative of bay communities in which the adjacent buffer areas recently have been disturbed by clearcutting, intensive site preparation, and reforestation. This Set-Aside was established to preserve the integrity of this pair of bays and to offer protection to the sensitive plant populations associated with them.

History:

Prior to establishment of the SRS in 1951, the land around this Set-Aside primarily was cut-over scrub oak/pine forest. Agriculture was evident on the southwest margins of Craig's Pond; the margins of Sarracenia Bay were agricultural fields and pastures. No historical buildings were associated with this Area. Historically, Craig's Pond has significance because it was a known landmark, the only bay on the SRS recognized on survey maps dating to the early 1800's. At one time, all of Craig's Pond and Sarracenia Bay were part of the SRS. In 1971, the AEC transferred lands on the eastern margins of the SRS to the ownership of the Barnwell Nuclear Processing Facility, now known as the Barnwell County Industrial Area (Brisbin *et al.*, 1977). Chem Nuclear currently owns the off-site portions of these Carolina bays.

Set-Aside Plant Community Composition:

This Set-Aside is comprised of four community types—pine plantations and natural pine stands (40.93%), mixed pine/hardwood (8.1%), sandhill scrub oak/pine (10.8%), and Carolina bays and water (40.2%; Table 17-1). In the upland buffer area, longleaf pine (*P. palustris*) plantations were established in 1988 and 1989, while the mixed

Table 17-2. Soils of the Craig's Pond/Sarracenia Bay Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Albany loamy sand, 0-6% slopes	AnB	20.70	8.38	14.49%
Blanton sand, 0-6% slopes	BaB	11.10	4.49	7.76%
Lakeland sand, 0-6% slopes	LaB	29.81	12.06	20.85%
Ogeechee sandy loam, ponded	Og	47.76	19.33	33.42%
Rembert sandy loam	Rm	33.56	13.58	23.48%
Totals:		142.92	57.84	100.00%

pine/hardwood community dates to 1935 and the sandhills scrub oak/pine habitat dates to 1945 (SRFS CISC stand database). The ring of pines on the periphery of Craig's Pond dates to 1944; it is primarily loblolly pine (*P. taeda*) but also contains some longleaf pine and pond pine (*P. serotina*).

Sensitive Flora and Fauna:

The wetland habitats of Craig's Pond and Sarracenia Bay support a higher diversity of sensitive plant species than any other Set-Aside bay. Nine plant species of special concern are found in this Area. These include Elliott's croton (*Croton elliottii*), spathulate seedbox (*Ludwigia spathulata*), swamp lobelia (*Lobelia boykinii*), Collin's sedge (*Carex collinsi*), sandhill seedbox (*Nolina georgiana*), awned meadow-beauty (*Rhexia aristosa*), slender arrow-head (*Sagittaria isoetiformis*), beak-rush (*Rhynchospora tracyi*), and the dwarf bladderwort (*Utricularia olivacea*; Table 3). In addition, this Set-Aside is one

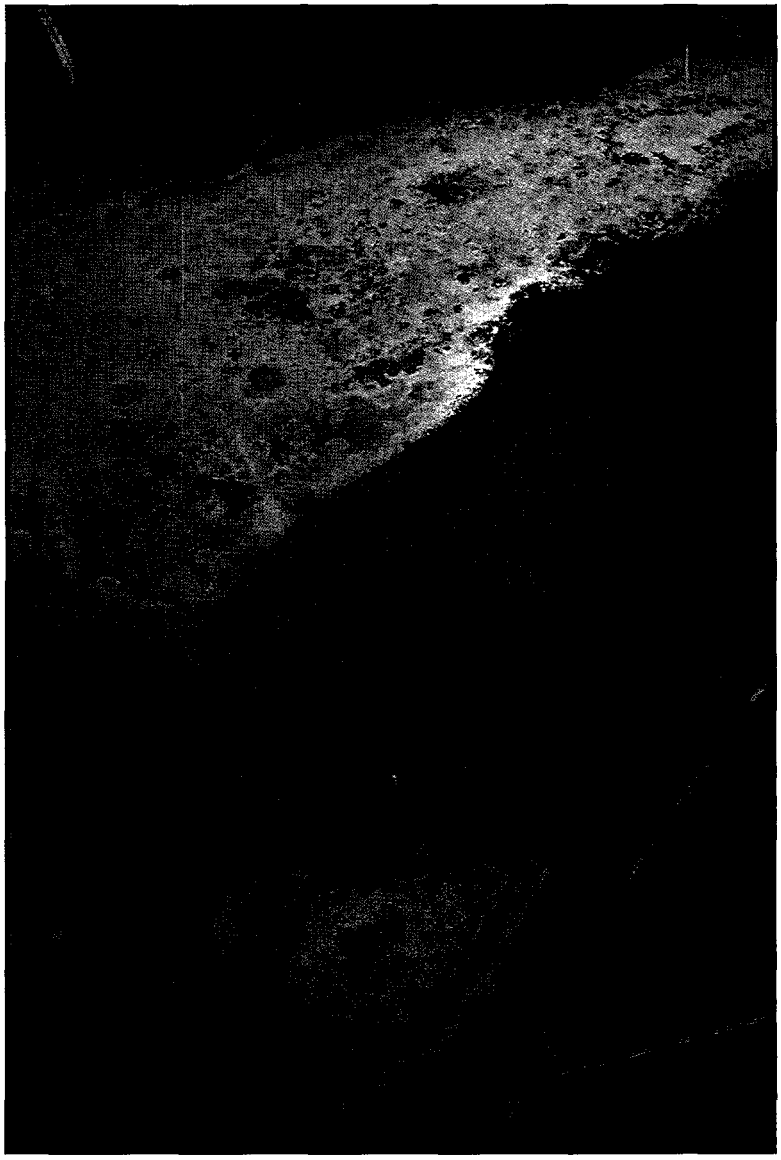

Figure 17-1. *Aerial view of Craig's Pond and Sarracenia Bay.*

of the few locations on the SRS where the insectivorous hooded pitcher plant (*Sarracenia minor*) is found.

On occasion, fish are known to occur in these two bays (Bennett and MacFarlane, 1983; Snodgrass *et al.*, 1996). The federally endangered Wood Stork (*Mycteria americana*) forages in Craig's Pond and Sarracenia Bay in the summer months when prey are concentrated; as many 130 birds have been recorded in a single day in this Set-Aside (Bryan *et al.*, 1996). Herpetofauna species of special concern that are recorded from this Area include the pig frog (*Rana grylio*), the American alligator (*Alligator mississippiensis*), and the Florida green water snake (*Nerodia floridana*; Table 4).

Set-Aside Soils:

There are five soil series associated with this Area, with an approximately equal ratio of xeric (43.1%) and hydric (56.9%) soil types. Soils in the transitional upland buffer area on the margins of the bay are the somewhat poorly drained, loamy sands of the Albany series (14.5%). The remaining soils in the buffer area are deep sands of the somewhat excessively drained sandy loams of the Blanton series (7.8%) and the excessively well-drained sands of the Lakeland series (20.9%; Table 17-2). Wetland depression, bay soils are the ponded sandy loams of the Ogeechee series (33.4%) and the sandy loams of the Rembert series (23.5%). See Fig. 17-2 for soil mapping of the Set-Aside and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

Vegetation studies in this Area by the Universities of South Carolina and Georgia date back to the early and mid 1950's. Researchers have described the herbaceous and aquatic plant species distributions of these bays and have related the zonal patterns to soil and hydrologic conditions (Kelley and Batson, 1955; Hodges, 1985; Kirkman, 1992). Permanent vegetation survey transects have been installed in these two bays and more recent vegetation work has been done by Keough *et al.* (1990), De Stevens (1994b), and Collins (1995). On the forested margin of Craig's Pond, a vegetation species composition survey was conducted along a 160-m transect to characterize the vegetational gradient that exists between the upland and wetland (Imm and McLeod, 1994). Within this zone, an experimental burn was conducted for enhancement of the pitcher plant population. Past and present research has been conducted on the ecology of the sensitive plants that inhabit these bays.

Mahoney *et al.* (1990) and DeBiase and Taylor (1993) used these bays to examine the community structure of zooplankton in SRS Carolina bays. Other recent research has been conducted on the geoarchaeology of the bay rims (Brooks *et al.*, 1996). Fish surveys by Snodgrass *et al.* (1996) suggest that these two bays have relatively high fish species richness when compared to other SRS bays. Herpetofaunal surveys and research are needed in this Area to determine possible metapopulation connections between this bay system and the paired Mona and Woodward Bays (Area No. 25) to the north. Steven's water level recorders-Type A have been installed in both of these bays. Both Craig's Pond and Sarracenia Bay have been recommended for inclusion in the EPA's ADID project for Carolina bays (Lide and Davis, 1993; EPA, 1994). To date, there have been 36 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

Three ditches are associated with Craig's Pond—two internal and one external. The external ditch is connected to the long pond (Bay No. 5147) on the Barnwell County Industrial Area property. During times of high water levels, fish occupy these bays, probably arriving via this ditched connection. This Set-Aside has the SRS boundary fence line as a border, placing the Area in proximity to potential negative impacts from

off-site development. Since the majority of these two bays are not on the SRS property, this wetland Set-Aside is vulnerable to impacts from off-site sources. Craig's Pond is used extensively by waterfowl as an overwintering site and the off-site portion of this bay historically has been hunted for waterfowl. The portion of Craig's Pond located off of the SRS has been designated as a Heritage Trust Site as part of a conservation easement program between the South Carolina Department of Natural Resources (SCDNR) and Chem Nuclear. Although the Set-Aside portion of Craig's Pond was evaluated for inclusion into this SCDNR program, it was not until January, 1995, that the Department of Energy, Chem Nuclear, and the SCDNR agreed symbolically to cut the boundary line crossing Craig's Pond to recognize the joint ownership of this unique wetland habitat. SREL researchers can access the off-site portion of Craig's Pond by obtaining clearance from Chem Nuclear security.

Additional impacts to this Set-Aside could result either from mechanical or chemical maintenance to the Site perimeter fence line. A plowed fireline inadvertently was placed in a portion of the upland buffer area of this Set-Aside in 1993. Much of the buffered area was clearcut just prior to establishment of the Set-Aside. An experimental burn was conducted on a wooded portion of the western margin of Craig's Pond in September, 1996, to evaluate the effects of fire on the pitcher plant population.

SRS Patrol Indexes: **Q**-25,26 **R**-25,26

Site-Use Permits:

SU-76-12-R Pollen succession in sediments from Carolina bays; Smith; SREL.

SU-78-61-R Historic inputs of airborne pollutant to Carolina bays; Alberts and Proctor; SREL.

SU-88-66-R Population biology of two species of plants (*Rhexia*); Sharitz and Landaal; SREL.

SU-88-77-R Elliott's Croton (*Croton elliottii*) study—research; Knox and Dixon; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-92-35-R Environmental toxicology collection of fish; Jagoe; SREL.

SU-93-23-R Tunnel of moles as movement corridors for vertebrates and invertebrates in selected habitats; Wike; WSRC-SRTC.

SU-95-15-R Geoarchaeology in Carolina Bay Set-Aside Areas; Brooks and Taylor; SCIAA and SREL.

SU-95-19-F The population biololgy of *Sagittaria isoetiformis*: Within-and between-patch dynamics of a rare aquatic perennial; Sharitz and Edwards; SREL.

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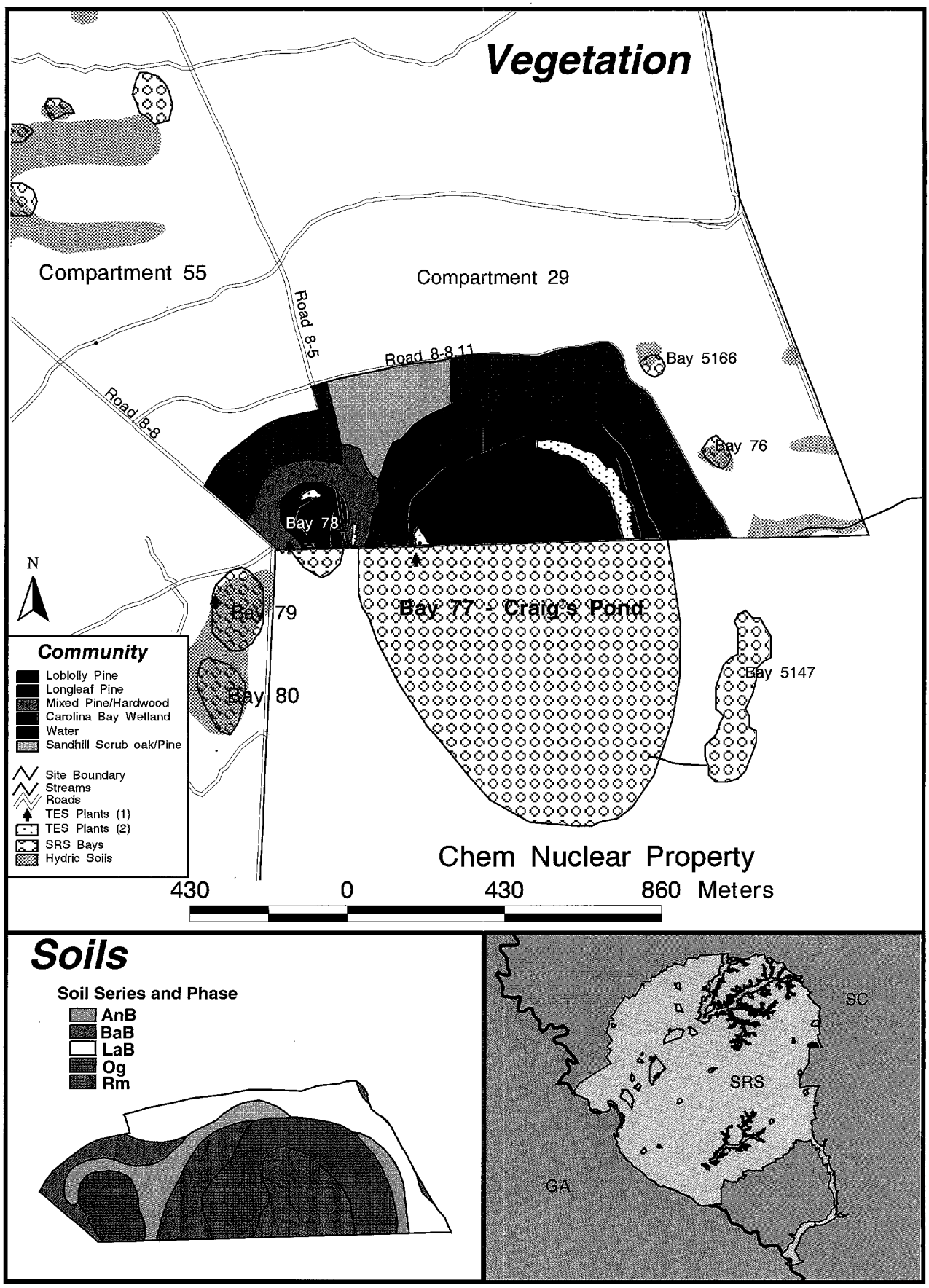

Figure 17-2. *Plant communities and soils associated with the Craig's Pond/Sarracenia Bay Set-Aside Area.*

AREA NO. 18
BOILING SPRINGS NATURAL AREA

SET-ASIDE LOCATION ON THE SRS:

The Boiling Springs Natural Area is located in a remote area of the Savannah River Site along Lower Three Runs Creek, just south of the Allendale/Barnwell County line. It is within the Brandywine Pleistocene terrace (Langley and Marter, 1973) and is the only DOE Set-Aside Area located in Allendale County. This Area is in SRFS timber compartment 87, approximately 300 m downstream from Stinson Bridge on secondary county road 17/39. The Boiling Springs Set-Aside is bordered by the SRS property line on the east and by Lower Three Runs Creek, a tributary of the Savannah River, on the west (Figs. 2 and 18-2). Access into the Area is by foot travel only. Visitors to this Set-Aside usually park on the right shoulder of Road 39 at the junction of Road 183 and hike downstream for approximately 300 m, crossing an unnamed stream. A dilapidated fence encloses the entire Area and an old AEC-USFS sign marks the entrance.

SET-ASIDE DESCRIPTION:

The Boiling Springs Natural Area is a small stand (approximately 8.46 acres; 3.42 ha) found within the poorly drained, alluvial floodplain of Lower Three Runs Creek. The Area is comprised of a once disturbed (cut-over), upland forest component and an undisturbed, mixed bottomland component that contains a remnant old-growth element with large, mature loblolly pines *(Pinus taeda)*, some more than 200 years old (Fig. 18-1). This stand includes a topographic gradient from an upland dominated by mockernut hickory (*Carya tomentosus*) and oaks *(Quercus* spp.) to a lowland dominated by sweet bay (*Magnolia virginiana*), beech *(Fagus grandifolia*), loblolly pine, and red maple (*Acer rubrum;* McCort and Wein, 1988). Batson *et al.* (1957) characterized the area as a mature beech-magnolia (*Fagus grandifolia-Magnolia grandifolia)* association that contained a score or more of loblolly pines with trunk diameters ranging in excess of five feet. Golley *et al.* (1965) observed that a portion of this Area contains a drier, upland forest type that shows signs of past disturbance. Within the old-growth segment, sweetgum (*Liquidambar styraciflua*), yellow poplar (*Liriodendron tulipifera*), and loblolly pine are predominant in the overstory. Jones *et al.* (1981) surveyed the area in 1977 and identified four community types, including a drier, upland forest type, a young second-growth bottomland hardwood stand, a second-growth beech-magnolia-loblolly pine/ bottomland hardwood stand on a well-drained soil, and an old-growth bottomland hardwood/ loblolly pine stand. The old-growth stand is approximately 1 ha in size and contains several very large loblolly pine and yellow poplar trees that were dated at more than 200 years old (Jones *et al.*, 1981). Structurally, this old-growth community is deteriorating as the older pines become senescent. There were only ten of these pines remaining in 1977, less than half the number Batson *et al.* (1957) recorded twenty years earlier. Currently, there are seven of these relic pines remaining. A wind storm on 24 April 1997 created a gap in the old growth element, resulting in the loss of one tree and damage to several others. Wike *et al.* (1994) provides environmental information on Lower Three Runs Creek. The 0.50-mile (0.90 km) Boiling Springs boundary line is marked with metal DOE Research Set-Aside Area signs.

WHAT THIS SET-ASIDE REPRESENTS:

This Set-Aside represents a small remnant of climax forest of the beech-magnolia-pine association where there is believed to have been no disturbance to the old-growth element for over 200 years. This Area was one of the original

Table 18-1. Vegetation communities of the Boiling Springs Natural Area.

Community Type	Total Acres	Total Hectares	%
Bottomland Hardwood	5.79	2.34	68.20%
Mixed Swamp Forest	1.16	0.47	13.66%
Bottomland Hardwood/Pine	1.54	0.62	18.14%
Totals:	8.49	3.44	100.00%

ecological study areas for which the AEC contracted with the University of South Carolina to conduct biological inventories in the early 1950's. Early publications resulting from this inventory (Batson *et al.*, 1957) classified this forest type as infrequently occurring in the South Carolina coastal plain. Hoy (1957) referred to this Area as the "Big Trees" and remarked that these trees were "giants as remnants of the forest primeval." At present, Boiling Springs is the only known intact, old-growth community that exists on the SRS. Ironically, this remnant stand is both the oldest plant community recorded for the SRS and the smallest in size of all the Set-Aside Areas.

The Boiling Springs Natural Area was registered in 1957 with the Society of American Foresters (SAF) national system of Natural Areas. It is one of two Natural Areas on the SRS that were added to the Set-Aside program in 1989, the other being the Scrub Oak Natural Area (Area No. 29). The Boiling Springs Set-Aside contains the least disturbed forest stand on the SRS; this forest has been preserved since 1957

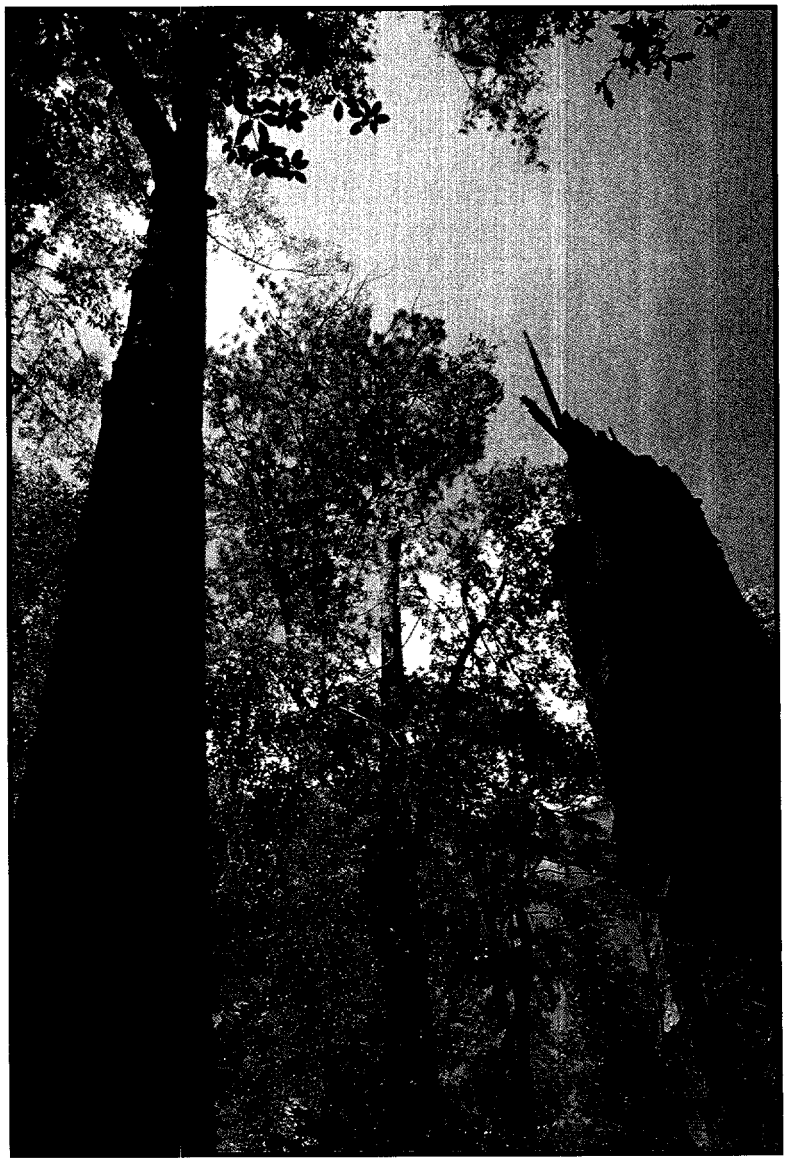

Figure 18-1. *Old growth component of the Boiling Springs Natural Area.*

Table 18-2. Soils of the Boiling Springs Natural Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Pickney sand, frequently flooded	Pk	4.30	1.74	50.83%
Vaucluse-Ailey complex, 10-15% slopes	VeD	4.16	1.68	49.17%
Totals:		8.46	3.42	100.00%

through the efforts of the U.S. Atomic Energy Commission, U.S. Forest Service, and The Nature Conservancy (Golley *et al.*, 1965).

History:

This Area was part of a tract formerly owned by E.S. Gantt, who recognized its unique features and reserved it as a natural recreation area for local rural inhabitants until it was acquired by the AEC (Batson *et al.*, 1957). Prior to being designated as a SAF Natural Area, this tract was set aside by the AEC and the USFS as a forest preserve. The Area's overstory vegetation probably originated 196-216 years ago following either a major catastrophic event such as wind and/or fire or simply from abandonment of agricultural activities (Jones *et al.*, 1981). The remote nature of this site and the steep adjoining slope limit accessibility to the Area and could represent reasons that it has escaped past logging. Today, the one dirt road that once gave access to this Area has been closed as a result of residential development.

Set-Aside Plant Community Composition:

This Set-Aside is comprised of three plant community types, including bottomland hardwood (68.2%), mixed swamp forest (13.7%), and bottomland hardwood/pine (18.1%; Table 18-1). Available SRFS CISC stand data date these stands to 1912 and 1921, although these dates do not reflect the ages of the dominant, older trees in the old-growth element. Jones *et al.* (1981) described this Area as having a three-layered canopy, consisting of understory, mature overstory, and senescent overstory. Additional detailed information on the composition of this Area's vegetation can be found in the reports and publications cited at the end of this account.

Sensitive Flora and Fauna:

There is one sensitive plant species documented from this Area, the rare nutmeg hickory (*Carya myristicaeformis*), although there is some doubt as to its proper identification (Knox and Sharitz, 1990; Table 3). The SRFS' Threatened/ Endangered/Sensitive plant survey has recorded this species just north of the Boiling Springs Natural Area, above Road 39. Hoy (1957) noted that a stand of spruce pine (*Pinus glabra*) was adjacent to this Area on the east, outside the Site boundary. No sensitive animal species have been documented from this Set-Aside.

Set-Aside Soils:

This Set-Aside has two soil types, both comprising equal percentages of the Area. These include the frequently flooded Pickney sand (50.8%), associated with the Lower Three Runs Creek floodplain, and the Vaucluse-Ailey complex which occurs along transitional and steep slopes and makes up the remaining 49.2% of the Area (Table 18-2).

Research Associated With This Set-Aside:

Four vegetation surveys of this Natural Area have been conducted over the last four and one half decades, in 1955, 1964, 1977, and 1986. Initial

ecological studies date back to 1955 when this area was referred to by University of South Carolina scientists as the Gantt Tract (Batson *et al.*, 1957). This Area is considered ecologically valuable because of the permanent plots established in 1963-1964 by Golley *et al.* (1965). Golley *et al.* (1965) compared the plant diversity of this Area with the first stage of old-field succession and showed that the Natural Area was four times more diverse than expected. These plots are part of a long-term database and were resampled by SREL in 1986. The 1986 resampling and planned future work are part of a long-term successional study in natural forest communities which provides a reference for comparison with forest dynamics in disturbed areas of the SRS. Recent investigations include a survey of ground-dwelling spiders. To date, there are 14 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

Located on the Lower Three Runs Creek drainage, this Set-Aside borders the SRS property line, which has had minimal to no maintenance in this region. In addition, because this Set-Aside is located in a remote, isolated section of the SRS, there is potential for public trespass. However, the potential for negative impacts from the public is probably small since access is by foot only. Adjacent forest management activities should not be of concern to this Set-Aside at this time because it has been a DOE policy for the SRFS not to manage the timber resources of the Lower Three Runs Creek floodplain. This "no management" policy resulted primarily from the presence of low levels of contamination within the Lower Three Runs Creek drainage and because of stand accessibility. However, there currently are active discussions between DOE-SR and SRFS to initiate management of this timber compartment (R. Pitts per. comm.). Winds associated with a severe thunderstorm on 24 April 1997 blew down several of the older trees in the old-growth element of this Area, resulting in a gap in the overstory.

At this time, the registration of an area as a SAF Natural Area leaves unclear the future management and/or research possibilities for this Area on the SRS. At the national level, the SAF Natural Areas Program is in a state of uncertainty, with oversight being deferred to the state in which the Natural Area is located (Greg Smith, SAF pers. comm.).

SRS Patrol Indexes: **DD**-19, **EE**-19

Site-Use Permits:

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-96-03-R Ecology and life history of ground-dwelling spiders; Taylor and Draney; SREL.

Publications and Reports:

Batson, W.T., W.R. Kelley, L.F. Swails, Jr., and F.F. Welbourne, Jr. 1957. An ecological study of the land plants and cold-blooded vertebrates of the Savannah River Project area. Part VII. Distributional studies of the flora. 3. The vegetation of a mature beech-magnolia forest within the Gantt Tract. Univ. South Carolina publ., Biology Series III, 2(2): 65-71.

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Odum, E.P. 1987. Early University of Georgia Research, 1952-1962. p. 43-83. In: The Savannah River and Its Environs. J.C. Corey (ed.). Proc. Symp. in Honor of Dr. Ruth Patrick. DP-1745, E.I. DuPont de Nemours and Co., Savannah River Laboratory, Aiken, SC. SREL Reprint # 1589.

Wike, L., R.W. Shipley, J.A. Bowers, A.L. Bryan, C.L. Cummins, B.R. del Carmen, G.P. Friday, J.E. Irwin, H. E. Mackey, Jr., J.J. Mayer, E.A. Nelson, M.H. Paller, V.A. Rogers, W.L. Specht, and E.W. Wilde. 1994. SRS Ecology Environmental Information Document. Westinghouse Savannah River Company Document No. WSRC-TR-93-496. Savannah River Site, Aiken, SC.

Wood, D.H. 1982. The Aquatic Snails (Gastropoda) of the Savannah River Plant, Aiken, South Carolina. Publication of the National Environmental Research Park Program. SRO-NERP-10. Aiken, SC. 46 p.

Workman, S.W. and K.W. McLeod. 1990. Vegetation of the Savannah River Site: Major community types. Publication of the Savannah River National Environmental Research Park Program. SRO-NERP-19. Aiken, SC.

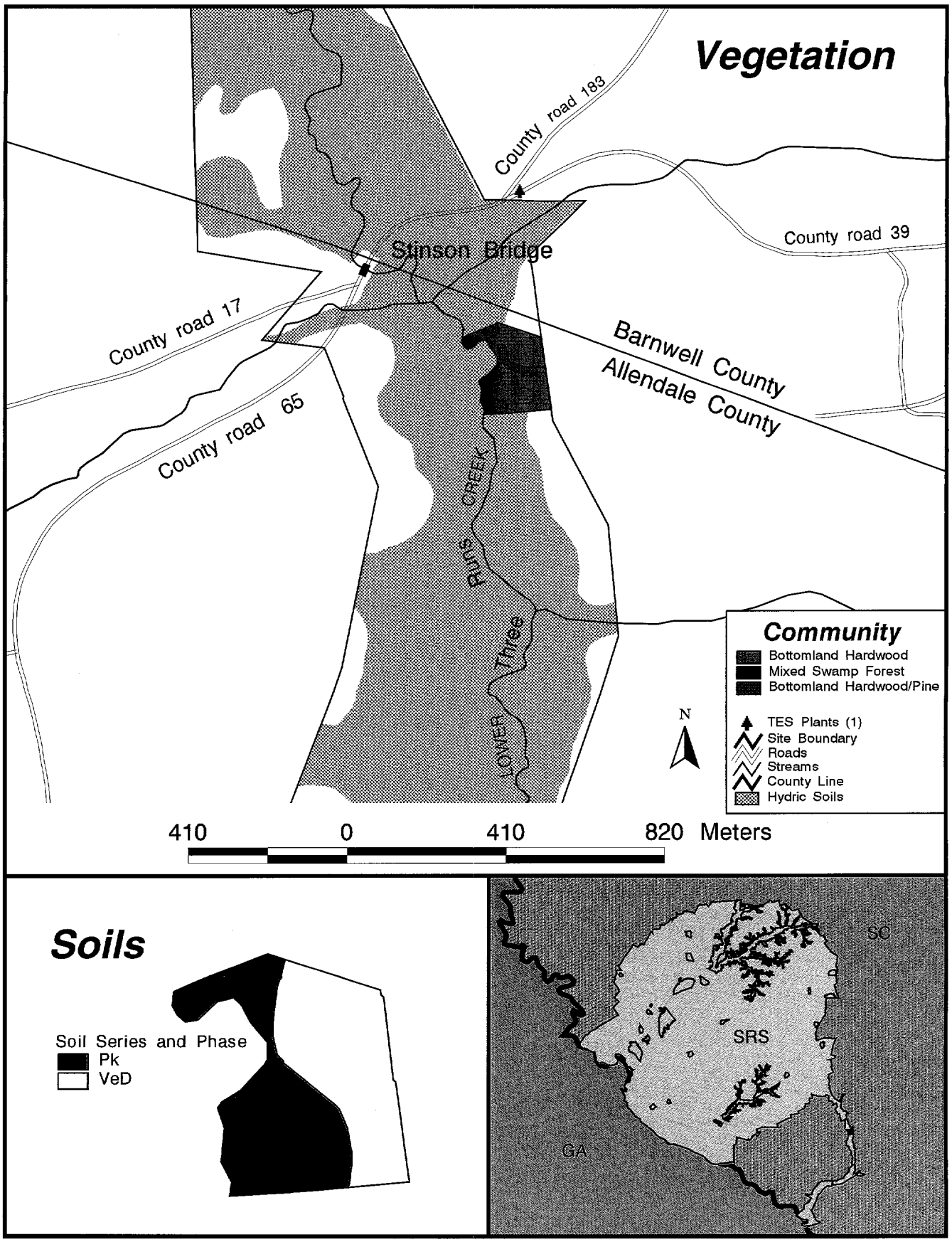

Figure 18-2. *Plant communities and soils of the Boiling Springs Natural Area.*

AREA NO. 19
GINGER'S BAY

SET-ASIDE LOCATION ON THE SRS:

The Ginger's Bay Set-Aside is located in the northwest quadrant of the SRS on the dividing line between the Sunderland Pleistocene Terrace and the Aiken Plateau (Langley and Marter, 1973). Ginger's Bay is near the town of Jackson and the SRS boundary, in timber compartment 3, adjacent to Road A at the intersection of Road A-1.2. This Set-Aside is bordered on the northwest by a telephone line right-of-way; access is by way of Site Gate 4 (Figs. 2 and 19-1).

SET-ASIDE DESCRIPTION:

This relatively small 38.5-acre (15.6 ha) Set-Aside is comprised of the temporary pond Ginger's Bay (Bay No. 17—see Schalles *et al.*, 1989 for numbering) and a partial 200-m buffer area of planted pines, mixed pine/hardwood, and upland-to-mesic hardwood communities (Fig. 19-1). The bay has virtually no buffer on the northwest side that borders Road A. Ginger's Bay is 3.7 acres (1.5 ha) and is a relatively intact bay-like wetland depression which lacks the morphology and orientation of a true Carolina bay. However, it appears that Ginger's Bay is a natural, isolated depression that has been impacted by road construction and historical ditching. The interior vegetation of the bay is dominated by shrubs, including buttonbush (*Cephalanthus occidentalis*) and willow (*Salix* spp.) in a matrix of herbaceous bulrush (*Scirpus* spp.) and smartweed (*Polygonum* spp.). The bay's margins primarily are forested with sweetgum (*Liquidambar styraciflua*) and red maple (*Acer rubra*), with the outermost portions being a mixture of pine (*Pinus* spp.) and oaks (*Quercus* spp.). The 0.94-mile (1.51 km) boundary line is marked with metal DOE Research Set-Aside Area signs.

WHAT THIS SET-ASIDE REPRESENTS:

Like Rainbow Bay (Area No. 16), this temporary pond Set-Aside is one of the few Areas that has multiple plant communities associated with its basin. In addition, a significant portion (74%) of the bay's adjacent terrestrial habitat includes a relatively undisturbed mixture of pine/hardwood and upland mesic hardwood components. No other bay Set-Aside has a buffer area of this vegetation type. This Area was selected as a Set-Aside primarily due to the long-term amphibian studies being conducted there. These studies have included the installation of a drift fence and aluminum enclosures within the bay's interior; therefore it is the only Set-Aside bay in which manipulative experiments have been conducted. These studies have documented that the largest known breeding population of the marbled salamander (*Ambystoma opacum*) in the United States is found at this site.

HISTORY:

Pre-site land-use in and around this Area was primarily agriculture, pecan orchards, and timbering. Outbuildings were located in the northern portion of the Area and were assumed to be associated with these land uses. Road A was estabished prior to establishment of the SRS.

SET-ASIDE PLANT COMMUNITY COMPOSITION:

This Set-Aside is comprised of four community types—pine plantations (12.7%), mixed pine/hardwood (21.4%), upland hardwood (52.8%), and depressional wetlands and water (13.16%; Table 19-1). In the upland buffer area, the loblolly pine (*P. taeda*) plantation and portions of the mixed pine/hardwood community were established in 1980, while the mixed pine/hardwood community connected to the bay,

Table 19-1. Vegetation communities of the Ginger's Bay Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	4.90	1.98	12.72%
Mixed Pine/Hardwood	8.23	3.33	21.36%
Upland Hardwood	20.33	8.23	52.76%
Depressional Wetland	3.10	1.25	8.05%
Water	1.97	0.80	5.11%
Totals:	38.53	15.59	100.00%

adjacent to Road A, dates to 1955. The upland hardwoods date to the early-to-mid 1950's (SRFS CISC stand database); the mesic portion of this predominantly hardwood community appears to have been logged prior to Site acquisition.

Sensitive Flora and Fauna:

Table 4 lists two sensitive species of amphibians and one sensitive reptile species that are known to occur in this Set-Aside. These include the eastern tiger salamander (*Ambystoma t. tigrinum*), which is on the South Carolina list of special concern, the Carolina gopher frog (*Rana capito*), formerly considered a candidate species for federal listing, and the spotted turtle (*Clemmys guttata*), listed with South Carolina as a species of special concern. Other sensitive fauna documented from this Area include the star-nosed mole (*Condylura cristata*) and the bobcat (*Lynx rufus*). There have been no sensitive flora documented from this Area.

Set-Aside Soils:

Two soil series comprise this Area. Upland soils are entirely of the well-drained, sandy loam Fuquay series (73.3 %); wetland depression soils are the ponded Ogeechee sandy loam series (26.7%; Table 19-2). See Fig. 19-1 for soil mapping of the Set-Aside and Appendix 3 for a soils description. This figure shows these hydric soils connecting the bay with other wetlands to the southeast; however, 1951 photography indicates that this wetland connection was due primarily to a single ditch.

Research Associated With This Set-Aside:

Research by SREL in this Set-Aside has consisted primarily of studies of the ecology of several amphibian species (Scott 1990, 1992, 1994; Jackson *et al.*, 1989; Krenz and Scott 1994). Because amphibian populations are noted for extreme year-to-year and site-to-site variation in population size and species composition, the salamander populations at Ginger's Bay have been subjected to experimental manipulations designed to study the mechanisms underlying these population fluctuations. Manipulations of the marbled salamander population were initiated in large-scale field enclosures at Ginger's Bay in September 1985. Three blocks of experimental enclosures were constructed within Ginger's Bay in the 1980's, with enclosure sizes varying among blocks from 30-41 m^2. Pens are constructed from aluminum flashing which is approximately 30 inches (76 cm) high and is buried about 6 inches (15 cm) in the ground. A drift fence encircles the entire bay and several temporary holding tanks are located within the Set-Aside, both inside and outside of the drift

Table 19-2. Soils of the Ginger's Bay Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Fuquay sand, 0-2% slopes	FuA	28.22	11.42	73.27%
Ogeechee sandy loam, ponded	Og	10.29	4.17	26.73%
Totals:		38.51	15.59	100.00%

fence. Ginger's Bay has the largest documented population of marbled salamanders in the southeastern United States. In some years over 5,000 individuals have been captured, marked, and released on a single night as they moved into the bay during the fall breeding season in October; during these years the total breeding population has been estimated at over 12,000 and as many as 21,000 metamorphs have been produced in a single year.

Experiments from 1985 to 1988 collectively demonstrated the significant effects that the number of larvae in a pond (larval density) have on important larval traits such as survival and size. Subsequent experiments documented that conditions in the aquatic environment continue to affect individuals even after they leave the pond (that is, after losing gills and moving to life on land). The extent to which populations are influenced by conditions in the forests surrounding the wetland is largely unknown. However, a population model based on the experimental and observational data suggests that the terrestrial habitat conditions may have stronger impacts on the population dynamics than do some aquatic parameters. Because the natural history of *A. opacum* at Ginger's Bay has been so well-studied (including nesting behavior, reproductive behavior, and genetic structure), researchers can aid in developing management plans and risk assessments for critical wetland habitats such as Ginger's Bay.

This bay also has been part of a research effort examining the community dynamics of zooplankton in Carolina bays on the SRS (Mahoney *et al.* 1990). No vegetation, soil, or water chemistry data exist at this time for this Set-Aside bay. The bay within this Set-Aside has been recommended for inclusion in the EPA's ADID project for Carolina bays (Lide and Davis, 1993; EPA, 1994). To date, there are 25 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

Because this Set-Aside is close to the SRS boundary and the town of Jackson, the potential exists for research in this Area to be vandalized and for the Area to be impacted by off-site trespassers. One such "trespasser" was Ginger, a Norwegian shepard, for whom the bay was named. In addition, because this wetland depression borders an SRS perimeter fence, chemical maintenance to the fence line could negatively impact this bay. Vehicular traffic on Road A has been noted to kill amphibians and reptiles migrating to and from the bay The hydrology and fauna of this bay wetland continue to be influenced by historical ditching. Rogers (1990) mapped hydric soils that trail to the southeast of the bay's depression, suggesting that this wetland has a natural connection to a drainage. However, within these mapped soils is an historical ditch which does not penetrate the bay's interior and appears to have no external drainage influence on the bay. Rather, the historical ditch which drains the bay to the west continues to function, allowing green sunfish (*Lepomis cyanellus)* to migrate into the bay during periods of high water (D. Scott pers. comm.). The prescribed fire history for Ginger's Bay includes a 1980 burn of the entire buffer area. There has been recent reforestation activity adjacent to this Set-Aside.

SRS Patrol Indexes: B-8,9 C-8,9

Site-Use Permits:

SU-86-02-R Investigations of the wetland habitats of two salamander species; Gibbons and Scott; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-96-08-R A study of the distribution of toads on the SRS; Taylor and Hopkins; SREL.

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Krenz, J.D. 1995. Fitness traits related to genetic heterozygosity in natural and experimental populations of the marbled salamander, *Ambystoma opacum*. Ph.D. Dissertation, University of Georgia, Athens.

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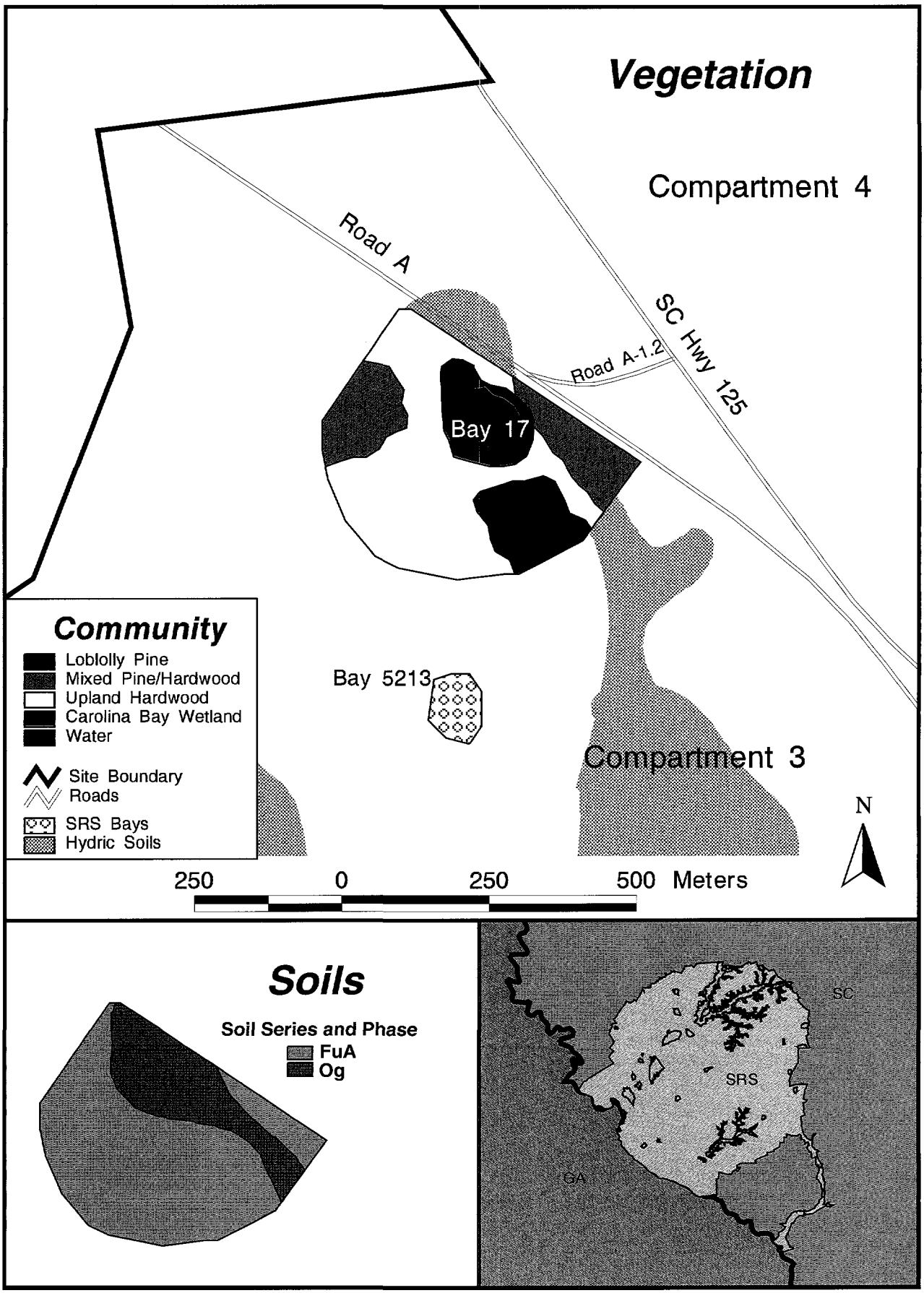

Figure 19-1. *Plant communities and soils associated with the Ginger's Bay Set-Aside Area.*

AREA NO. 20
THUNDER BAY

SET-ASIDE LOCATION ON THE SRS:

The Thunder Bay Set-Aside is located within the Brandywine Pleistocene Terrace in the east central portion of the SRS (Langley and Marter, 1973). It is found near the SRS boundary in timber compartment 77, at the junction of Roads B-7 and B-7.2. Its southern boundary is bordered by the SRS rail line north of Mary's Branch, a first-order tributary to Lower Three Runs Creek (Figs. 2 and 20-1).

SET-ASIDE DESCRIPTION:

This 82.2-acre (33.3 ha) Set-Aside is comprised of the semi-permanent, open-water, herbaceous Carolina bay Thunder Bay (Bay No. 83—see Schalles *et al.*, 1989 for numbering), and a partial 200-m buffer area containing different species and ages of plantation pines. Within the buffer area are small inclusions of mixed pine/ hardwood and bottomland hardwood communities. Thunder Bay is 10.9 acres (4.4 ha) and can be described as an open-water semi-permanent pond that is only known to dry during periods of extended drought. The interior is dominated by the aquatic macrophyte water lily (*Nymphaea odorata*) and water shield (*Brasenia schreberi*). In the outer margins of the central pool are the emergent herbaceous maidencane (*Panicum hemitomon*) and cutgrass (*Leersia hexandara*; Schalles and Shure, 1989; Lide, 1991). Also within this outer zone are young volunteer pines that seeded in during an extended dry period in the mid-1980's; these subsequently have died from prolonged inundation. The outer margins of this basin contain maturing pines which were thinned just prior to establishment of this Area as a Set-Aside in 1989. Disturbance of the vegetation in the bay's margin as a result of this thinning operation still is evident. Remnants of an historical ditch on the southwest margin of the bay are present; however, this ditch has ceased to function, even during periods of high water levels. Additional detailed descriptions of this bay can be found in Schalles *et al.* (1989), Lide *et al.* (1995), and Brooks *et al.* (1996). The 1.56-mile (2.51 km) boundary line of this Area is marked with the metal DOE Research Set-Aside Area signs.

WHAT THIS SET-ASIDE REPRESENTS:

Thunder Bay is an isolated, intact Carolina bay which supports aquatic and herbaceous vegetation due to its extended hydroperiod. It is more semi-permanent than temporary and is known to have standing water throughout most years (Schalles *et al.*, 1989). Similar aquatic/ herbaceous Carolina bay Set-Asides with extended hydroperiods are Ellenton Bay, Craig's Pond, Flamingo Bay, and Dry Bay (Areas No. 1, 17, 21, and 23, respectively). This Area also represents a bay with a relatively undisturbed buffer area. Within this Set-Aside are a number of sensitive wetland plant populations (Knox and Sharitz, 1990). This Set-Aside was established to offer protection to the sensitive plant populations found in the bay as well as because of the long term hydrologic research associated with Thunder Bay. This bay has more hydrological characterization data associated with it than does any other Set-Aside bay.

HISTORY:

Prior to acquisition of the SRS in 1951, the majority of the area in and around Thunder Bay was in agricultural production; however, some of this area was undergoing old-field succession just prior to the establishment of the SRS. The Thunder Bay Set-Aside is one of six bays surveyed by the Savannah River Archaeology Research Program (SRARP) to determine whether there was evidence of prehistoric occupation of the bay rim (Brooks *et al.*, 1996).

Table 20-1. Vegetation communities of the Thunder Bay Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	16.54	6.69	20.12%
Longleaf Pine	1.58	0.64	1.92%
Slash Pine	48.96	19.81	59.55%
Mixed Pine/Hardwood	3.63	1.47	4.42%
Bottomland Hardwood	0.54	0.22	0.66%
Carolina Bay Wetland	5.81	2.35	7.07%
Water	5.15	2.08	6.26%
Totals:	82.21	33.27	100.00%

Set-Aside Plant Community Composition:

This Set-Aside is comprised of four community types—pine plantations (81.6%), mixed pine/hardwood (4.42%), bottomland hardwood (0.66%), and Carolina bays and water (13.33%; Table 20-1). In the upland buffer area the older-aged slash (*Pinus elliottii*) and loblolly pine (*P. taeda*) were established pre-site (1949), while the younger stands of loblolly and longleaf (*P. palustris*) were planted in 1987 and 1964, respectively (SRFS CISC stand database). Kirkman (1992) provides detailed descriptions of the vegetation of Thunder Bay.

Sensitive Flora and Fauna:

Four species of plants found at this site are listed on federal and/or South Carolina lists of species of special status. They are the slender arrowhead (*Sagittaria isoetiformis*), the Florida bladderwort (*Uticularia floridana*), the drowned horned rush (*Rhynchospora inundata*), and the beak rush (*Rhynchospora tracyi*; Table 3). Two sensitive faunal species have been sited in this wetland habitat, but only as occassional visitors: the American alligator (*Alligator mississippiensis*) and the wood stork (*Mycteria americana*; Table 4). Beavers (*Castor canadensis*) have been known to construct lodges in this bay during extended periods of high water levels.

Set-Aside Soils:

There are only three soil series associated with this Area. Soils in the upland buffer area are predominantly the somewhat excessively drained sandy loams of the Blanton series (55%) and the well-drained sandy loams of the Fuquay series (21.6%; Table 20-2). Wetland depression soils are the hydric, poorly drained Williman series (23.4%). See Fig. 20-1 for soil mapping of the Set-Aside and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

Like Ellenton Bay (Area No. 1), Rainbow Bay (Area No. 16), and Craig's Pond (Area No. 17), Thunder Bay has been the site of long-term studies dating back to the mid 1970's. Research in Thunder Bay has emphasized studies of the bay's hydrology. This bay was studied extensively by Schalles (1979) and Lide (1991) and a wealth of background information on hydrology, soils, water chemistry, vegetation, and zooplankton is available. Mahoney *et al.* (1990) included Thunder Bay in their examination of the community structure of zooplankton in 23

Table 20-2. Soils of the Thunder Bay Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	45.22	18.30	55.02%
Fuquay sand, 2-6% slopes	FuB	17.75	7.18	21.60%
Williman sand	Wm	19.21	7.78	23.38%
Totals:		82.18	33.26	100.00%

Carolina bays on the SRS. More recent research has included investigations of the geoarchaeology of the bay's rim (Brooks *et al.*, 1996) and studies of bacterial assemblages found in the bay (Leff *et al.*, 1991). Schalles and Shure (1989) surveyed Thunder Bay for aquatic invertebrates and herpetofauna in the 1970's. A Steven's water level recorder-Type F has been used periodically to collect data, and permanent vegetation survey transects have been installed (Keough *et al.*, 1990). A topographic survey of Thunder Bay was undertaken and a 10-cm contour map has been developed. Groundwater and subsurface water monitoring wells are installed in this Set-Aside and the off-site Chem Nuclear facility north of this Area historically has used this groundwater monitoring data (R. Lide pers. comm.; Cahill, 1982). These wells currently are inactive and have locked well caps. This Set-Aside bay has been recommended for inclusion in the EPA's ADID project for Carolina bays (Lide and Davis, 1993; EPA, 1994). To date there are 36 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

This Area is bordered by a rail line which is connected to off-site industrial facilities. Due to its remote location on the SRS, this Set-Aside is not protected by a gate on the Site boundary. The potential for impacts to this Area from trespassing and vandalism was realized in 1990 when All Terrain Vehicles (ATVs) were driven through the bay's interior. This entire Area was subjected to prescribed burns by the SRFS in 1982. Timber stands within the bay's perimeter were thinned just prior to the Area being designated a Set-Aside. A beaver lodge was observed in the bay in 1994.

SRS Patrol Indexes: U-21,22

Site-Use Permits:

SU-76-57-R Groundwater level adjacent to a Carolina bay; Schalles and Shure; Emory Univ.

SU-78-61-R Historic inputs of airborne pollutants to Carolina bays; Alberts and Proctor; SREL.

SU-87-63-R Registration of locations of rare or threatened plant populations based upon Federal or state of South Carolina status; Roecker and Sharitz; SRFS and SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-89-64-R Carolina bay hydrology; Pinder and Lide; SREL.

SU-92-36-R Influence of precipitation on Carolina bays; Jagoe; SREL.

SU-95-15-R Geoarchaeology in Carolina bay Set-Asides; Brooks and Taylor; SCIAA and SREL.

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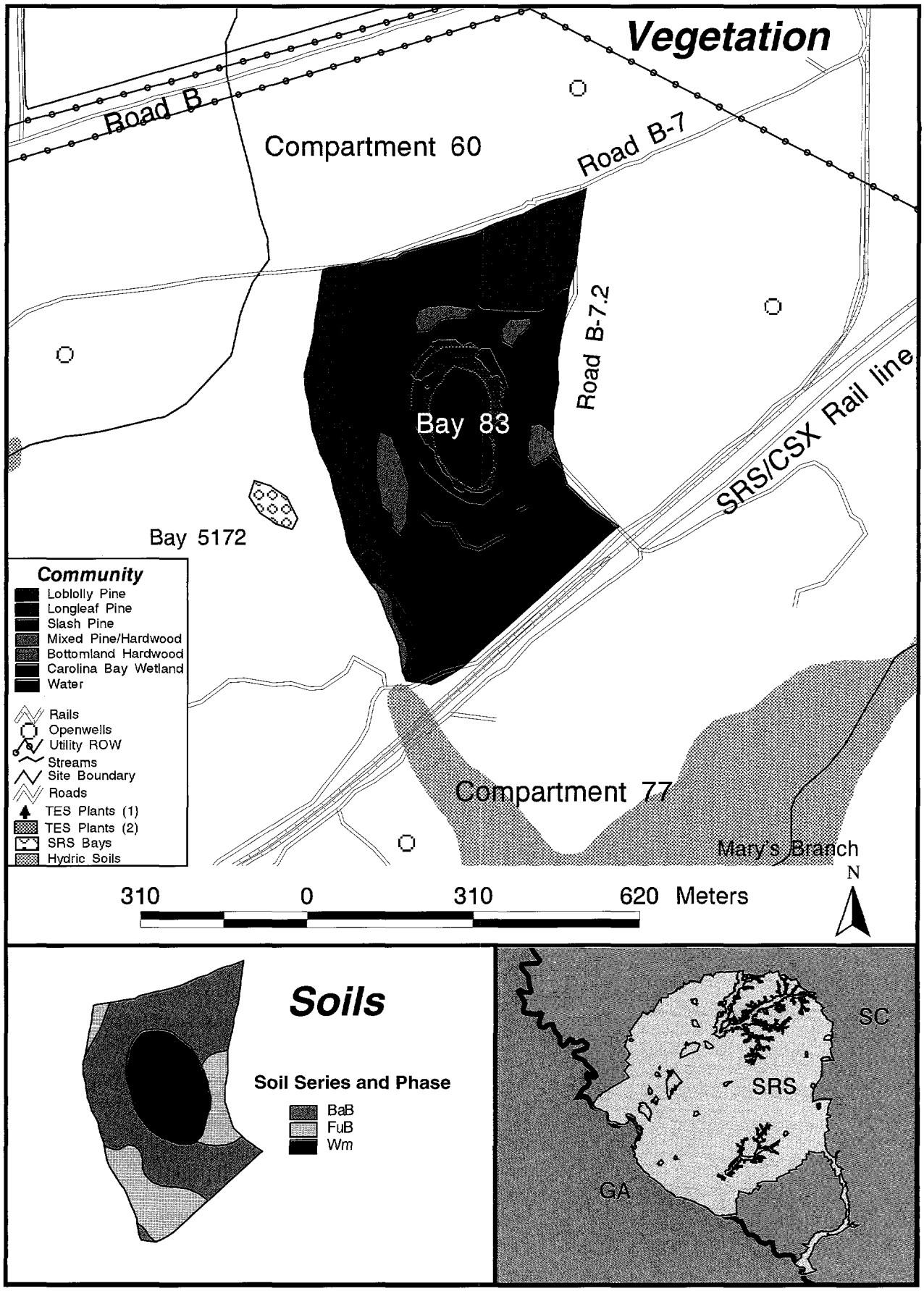

Figure 20-1. *Plant communities and soils associated with the Thunder Bay Set-Aside Area.*

AREA NO. 21
FLAMINGO BAY

SET-ASIDE LOCATION ON THE SRS:

Located on the Aiken Plateau in the northwest quadrant of the SRS, the Flamingo Bay Set-Aside Area is found in timber compartment 16 (Langley and Marter, 1973). It is bordered on two sides by Roads F and powerline right-of-way (ROW) Road F-0 (Figs. 2 and 21-2).

SET-ASIDE DESCRIPTION:

The 165.8-acre (67 ha) Flamingo Bay Set-Aside Area is a relatively undisturbed, intact Carolina bay with a buffer area that is forested with different-aged pine plantations. Flamingo Bay (SRS Bay No. 3--see Schalles *et al.*, 1989) is classified as an aquatic habitat with various plant community associations (Brooks *et al.,* 1996). The interior basin of the bay contains a deep pool area that is devoid of vegetation; the shallower portions contain both aquatic and herbaceous vegetation as well as wetland trees and shrubs. Excluding the sand rim, the wetland portion of the bay is 14.0 acres (5.7 ha). Within the context of the SRS landscape, Flamingo Bay is one of the few true Carolina bays that infrequently experiences a complete draw down. The boundary line of this Set-Aside is marked with both white paint blazes and metal DOE Research Set-Aside Area signs and totals 2.2 miles (3.54 km) in length.

WHAT THIS SET-ASIDE REPRESENTS:

As a Set-Aside, this Area represents an isolated, semi-permanent rather than temporary, wetland pond. It is unique both for its lack of historical ditching and for the plant community associations within its wetland boundaries. Because the bay has an extended hydroperiod, making the hydrology predictable, Flamingo Bay is valuable as a site for long-term ecological studies (Fig. 21-1).

HISTORY:

Prehistoric human (paeleoindian) use of Flamingo Bay dates back to 10,000 B.P. (Brooks *et al.*, 1996). Historical (1780's -1950's) use of the bay and adjacent areas primarily was for agricultural, live stock, and timber production. Flamingo Bay is not ditched and the entire periphery was in agricultural cultivation at the time of Site acquisition. A search of historical records has been conducted to determine prior ownership of Flamingo Bay and the surrounding areas (K. Krawczynski, SREL Set-Aside files).

SET-ASIDE PLANT COMMUNITY COMPOSITION:

There are four community types that comprise this Set-Aside: pine (64.4%), upland hardwood (15.8%), bottomland hardwood (10.8%), and Carolina bay wetland and water (15%; Table 21-1). The pine plantations in the buffer regions are loblolly (*Pinus taeda*; 35.9%) and slash (*P. elliottii*; 28.5%). Some upland hardwoods, primarily oak (*Quercus* spp.), are associated with the bay rim and old fencelines (Fig. 21-2). Within the outer portions of the bay's interior are bottomland hardwoods such as blackgum (*Nyssa sylvatica biflora*), red maple (*Acer rubra*), sweetgum (*Liquidambar styraciflua*), and loblolly pine (Brooks *et al.*, 1996). The oldest age classes for the hardwood and pine components are 69 and 43 years, respectively (SRFS CISC stand database). Presently, the bay's aquatic and herbaceous vegetation within the Carolina bay wetland community includes submerged and floating macrophytes such as smartweed (*Polygonum* sp.), American lotus (*Nolumbo lutea*), panic grasses (*Panicum* spp.) and buttonbush (*Cephalanthus occidentalis*; Brooks *et al.*, 1996).

Table 21-1. Vegetation communities of the Flamingo Bay Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	59.59	24.12	35.94%
Slash Pine	47.24	19.12	28.49%
Upland Hardwood	26.21	10.61	15.81%
Bottomland Hardwood	17.82	7.21	10.75%
Carolina Bay Wetland	14.24	5.76	8.59%
Water	0.71	0.29	0.43%
Totals:	165.81	67.10	100.00%

Sensitive Flora and Fauna:

There is one sensitive plant species reported from this Set-Aside--the pink tickseed (*Coreopsis rosea*), which is listed as regionally threatened by South Carolina (Table 3). The Carolina gopher frog (*Rana capito*) and the southern hognose snake (*Heterodon simus*), former federal candidate species, have been documented from this Set-Aside. Also, the eastern tiger salamander (*Ambystoma t. tigrinum*), which is on the South Carolina list of species of special concern, and the American alligator (*Alligator mississippiensis*), listed federally and by South Carolina as threatened due to similarity of appearance with the endangered American crocodile (*Crocodylus acutus*), are known to inhabit Flamingo Bay (Table 4). No fish have been reported to inhabit this bay.

Set-Aside Soils:

Ten soil series and phases comprise this Area. Soils that comprise the upland buffer area of this Set-Aside are primarily the somewhat excessively well-drained sandy loams to the well-drained loams. These include the Blanton, Lucy, Orangeburg, Dothan, Fuquay, Troup and Vaucluse-Ailey series (85%; Table 21-2). Hydric soils associated with the bay depression are Rembert and Ocilla series (15%; Table 21-2). See Fig. 21-2 for soil mapping of the Set-Aside and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

This Set-Aside Area has been the site of ongoing ecological research for the past twenty-six years. These long-term studies have concentrated on the breeding ecology of the bay's herpetofauna (turtles and salamanders) and the SRS's resident waterfowl, the wood duck (*Aix sponsa*). Researchers also have studied the species richness of Flamingo Bay's zooplankton. A new species of calanoid copepod (a small planktonic crustacean) was described from specimens collected from Flamingo Bay (DeBiase and Taylor, 1993). *Aglaodiaptomus atomicus* is one of the most common calanoid copepod species found in Carolina bays on the SRS. It also is present in other Set-Aside bays, including Sarracenia Bay, Craig's Pond, Ellenton Bay, Thunder Bay, and Dry Bay. This species has not yet been collected from bays or other ephemeral wetlands located off of the SRS.

Interdisciplinary studies between the University of South Carolina's Institute of Archaelogy and Anthropology and SREL have been initiated to determine possible correlations between sediment cores and prehistoric cultural occupation and use of the sand rim of Flamingo Bay.

Table 21-2. Soils of the Flamingo Bay Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	38.08	15.41	22.96%
Blanton sand, 6-10% slopes	BaC	3.78	1.53	2.28%
Dothan sand, 0-2% slopes	DoA	18.37	7.43	11.08%
Fuquay sand, 2-6% slopes	FuB	31.53	12.76	19.02%
Lucy sand, 2-6% slopes	LuB	14.05	5.68	8.47%
Ocilla loamy sand, 0-2% slopes	OcA	3.32	1.34	2.00%
Orangeburg loamy sand, 2-6% slopes	OrB	27.87	11.28	16.81%
Rembert sandy loam	Rm	21.22	8.59	12.80%
Troup sand, 0-6% slopes	TrB	0.27	0.11	0.16%
Vaucluse-Ailey complex, 6-10% slopes	VeC	7.35	2.97	4.43%
Totals:		165.82	67.11	100.00%

In 1990, a permanent transect was installed in the bay for both vegetation and hydrologic surveys. A drift fence encompasses a portion of the bay's perimeter and is used in numerous ongoing herpetological studies. Several turtle-holding enclosures are located in the forest buffer of this Area. Using automated recording systems, researchers have recorded 11 species of anurans at Flamingo Bay. A Steven's water level recorder-Type F has been installed in the bay to monitor Flamingo Bay's fluctuating water level. This Set-Aside is used by the SRFS for educational tours. To date, there are 51 publications and reports associated with this Set-Aside Area.

Historical/Current/Future Influences:

Although this Area is bordered by an SRS primary road and a utility ROW, potential negative impacts to this Set-Aside are considered minimal if utility line and Road F maintenance activities are confined to the rights-of-way. Within the Set-Aside buffer area, educational tour group activities periodically are evaluated

Figure 21-1. *Flamingo Bay.*

for impacts to research. The older pine stands in the buffer area were burned by SRFS in 1983 prescribed burn.

SRS Patrol Indexes: E-15,16 F-15,16

Site-Use Permits:

SU-75-25-R Small mammal response to pine succession; Smith; SREL.

SU-76-100-R (and Modification 2); Wood duck nest box study; Brisbin; SREL.

SU-77-08-R Population structure of aquatic turtles; Gibbons; SREL.

SU-80-23-R Life history strategy of the yellow-bellied pond slider; Gibbons; SREL.

SU-80-63-R Reproductive strategy of the mole salamander; Gibbons; SREL.

SU-82-51-R Nitrogen availability and nitrogen cycling on the SRP; Mathews; WSRC-SRTC.

SU-83-17-R Turtle movement study; Gibbons; SREL.

SU-85-22-O Collection of 490 cubic yards of soil from three different soil types; Adriano; SREL.

SU-87-64-R Registration of locations of rare or threatened plant populations based upon state of South Carolina status; Roecker and Sharitz; SRFS and SREL.

SU-89-40-R SCS soil survey data sites; Rogers; WSRC-SRTC.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-89-64-R Carolina bay hydrology; Pinder and Lide; SREL.

SU-92-40-R Water finding abilities of turtles; Gibbons; SREL.

SU-92-72-R Background wetlands soil study; Rogers; WSRC-SRTC.

SU-93-48-F NREEP education and outreach nature trails; amendments 1-2; Blake and Graves; SRFS and USC-Aiken.

SU-95-15-R Geoarchaeology in Carolina Bay Set-Aside Areas; Brooks and Taylor; SCIAA and SREL.

SU-96-08-R A study of the distribution of toads on the SRS; Taylor and Hopkins; SREL.

SU-96-34-O Surface Geologic Mapping of the SRS; Denham; WSRC/SRTC/WM&ET/ESS.

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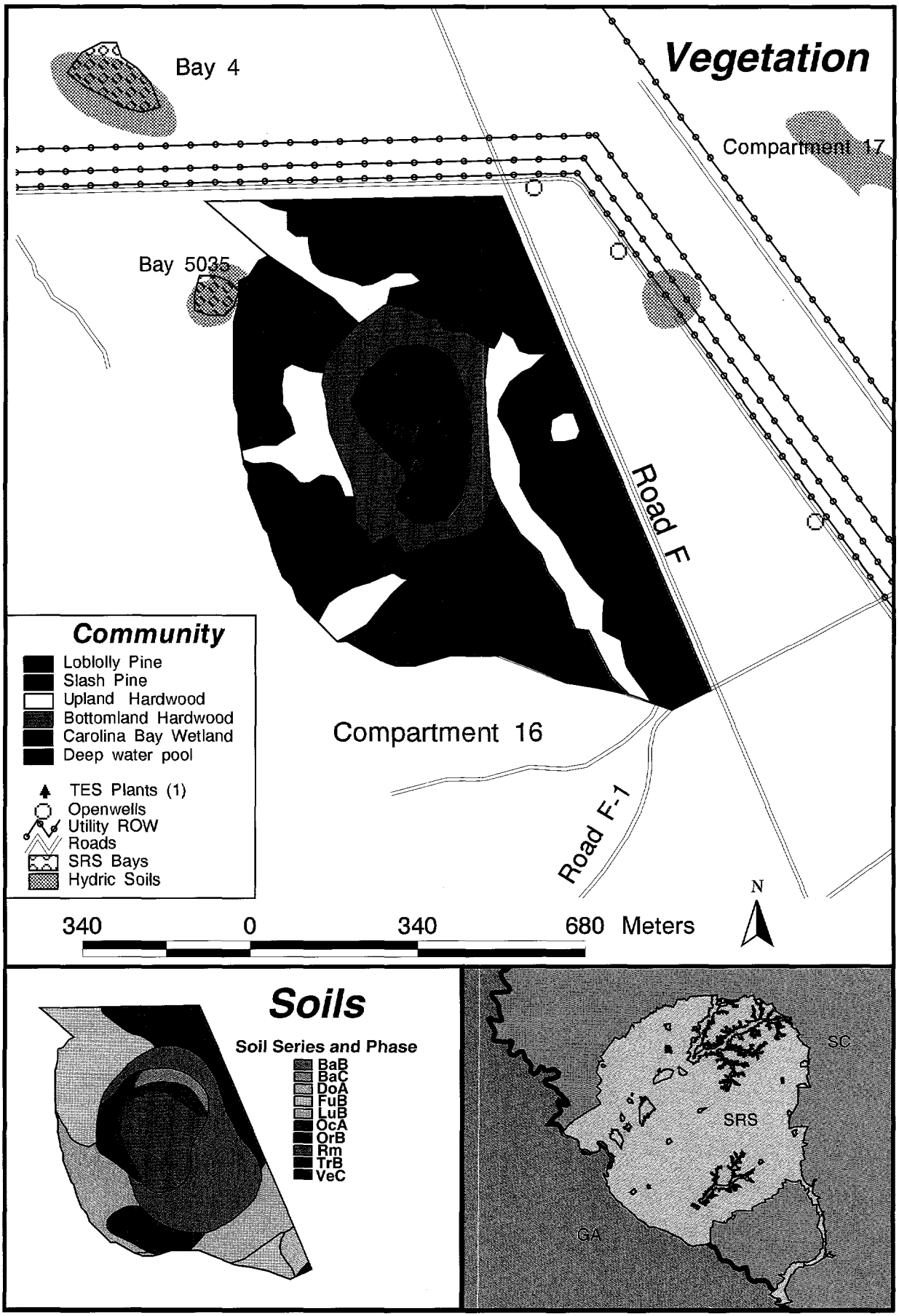

Figure 21-2. *Plant communities and soils associated with the Flamingo Bay Set-Aside Area.*

AREA NO. 22
LITTLE CYPRESS BAY

SET-ASIDE LOCATION ON THE SRS:

Located within the Brandywine Pleistocene Terrace in the northeast quadrant of the SRS, this Set-Aside is found in timber compartment 56 (Langley and Marter, 1973). East of Par Pond, this Area is bordered by the Savannah River Site's eastern boundary on Moore Road (G-2) and is adjacent to the Barnwell County Industrial Park (Figs. 2 and 22-1).

SET-ASIDE DESCRIPTION:

This 68.4-acre (27.7 ha) Set-Aside is comprised of Little Cypress Bay (Bay No. 64—see Schalles *et al.*, 1989 for numbering) and a relatively undisturbed 200-m buffer zone of maturing pine and upland hardwood communities. Little Cypress Bay is a 9.9-acre (4.0 ha) herbaceous bay with a partial forest of pond cypress (*Taxodium ascendens*). There is no evidence of historical ditching associated with this bay. The bay's 1.8-acre (0.7 ha) herbaceous interior is dominated by maidencane (*Panicum hemitomon*; Keough *et al.*, 1990); the remainder of the wetland depression is primarily in volunteer loblolly pine (*Pinus taeda*). The majority of the vegetation in the buffer area was established through natural succession since the time of Site acquisition and has not undergone subsequent clearcutting and reforestation. The hardwoods primarily are associated with an old homesite. There are good examples of mixed species communities in this buffer region and remnant bay depressions are north and east of the buffer area. The 1.3-mile (2.14 km) boundary line is marked with metal DOE Research Set-Aside Area signs. In June, 1996, the SRFS delineated this boundary using GPS, resulting in a +2.97 acre (1.2 ha) difference in the Set-Aside's total area as compared to SREL's GIS coverage (Davis *et al.*, 1996).

WHAT THIS SET-ASIDE REPRESENTS:

Little Cypress Bay is a relatively undisturbed Carolina bay which represents a wetland habitat whose interior basin is dominated by herbaceous vegetation but also is sparsely forested with pond cypress. This site was selected for the Set-Aside Program because pond cypress is less common in the Upper Coastal Plain than bald cypress (*T. distichium*; McCort and Wein, 1988). In addition, this wetland forest type, which has an herbaceous component, is uncommon on the SRS and is not represented by other bay wetland Set-Asides.

HISTORY:

Prior to establishment of the SRS in 1951, agriculture, live stock grazing, and timber production were the predominant land-use activities in and around this Area. A pre-SRS homesite and outbuildings were located within the southern portion of the Set-Aside.

SET-ASIDE PLANT COMMUNITY COMPOSITION:

This Set-Aside is comprised of four community types—loblolly pine (70.5%), mixed pine/hardwood (6.1%), upland hardwoods (20.1%), and Carolina bay wetland (29.3%; Table 22-1). A 200-meter buffer area was established around the majority of this bay; within this upland area the oldest age classes for the pines and the upland hardwoods are 49 and 47 years, respectively (SRFS CISC database).

SENSITIVE FLORA AND FAUNA:

Elliott's croton (*Croton ellottii*) is a sensitive plant species located in Little Cypress Bay (Table 3). There have been no sensitive fauna documented from this Set-Aside (Table 4).

Table 22-1. Vegetation communities of the Little Cypress Bay Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	48.20	19.51	70.48%
Mixed Pine/Hardwood	4.15	1.68	6.07%
Upland Hardwood	14.27	5.78	20.87%
Carolina Bay Wetland	1.77	0.72	2.59%
Totals:	68.39	27.68	100.00%

However, except for fish, vertebrate surveys have not been conducted (Snodgrass *et al.*, 1996).

Set-Aside Soils:

There are five soil series and phases associated with this Area. Soils in the upland pine and hardwood communities range from the somewhat excessively drained Blanton to the well-drained Fuquay and Lucy loamy sand series (81.2%; Table 22-2). Hydric soils confined to the bay depression of this Area are the poorly drained Ogeechee series (18.8%; Table 22-2). See Fig. 22-1 for soil mapping of the Set-Aside and Appendix 3 for a soils description.

Reseach Associated With This Set-Aside:

The majority of the research conducted in this Set-Aside Area has been related to characterizing the hydrology, soils, vegetation, and zooplankton of Little Cypress Bay. This Set-Aside bay was recommended for inclusion in the EPA's ADID project for Carolina bays (Lide and Davis, 1993; EPA, 1994). A Steven's water level recorder-Type F has been installed in the bay to monitor the hydrology. In 1990, a permanent transect was installed in the bay for both vegetation and hydrologic surveys (Keough *et al.*,1990). To date, 19 publications and reports have been associated with this Set-Aside.

Historical/Current/Future Influences:

The forested buffer areas of this Set-Aside were subjected to prescribed burns by the SRFS in 1977 and 1987. Because this Set-Aside borders the SRS boundary, the potential exists for negative impacts from off-site sources. The Barnwell Industrial Park is adjacent to this Area.

SRS Patrol Indexes: S-22,23

Site-Use Permits:

SU-87-63-R Registration of locations of rare or threatened plant populations based upon Federal or state of South Carolina status; Roecker and Sharitz; SRFS and SREL.

SU-88-77-R Elliott's Croton (*Croton Elliottii*) study; Knox and Dixon; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

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Table 22-2. Soils of the Little Cypress Bay Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	20.33	8.23	29.72%
Fuquay sand, 0-2% slopes	FuA	3.45	1.40	5.05%
Fuquay sand, 2-6% slopes	FuB	21.28	8.61	31.12%
Lucy sand, 2-6% slopes	LuB	10.50	4.25	15.35%
Ogeechee sandy loam, ponded	Og	12.83	5.19	18.76%
Totals:		68.39	27.68	100.00%

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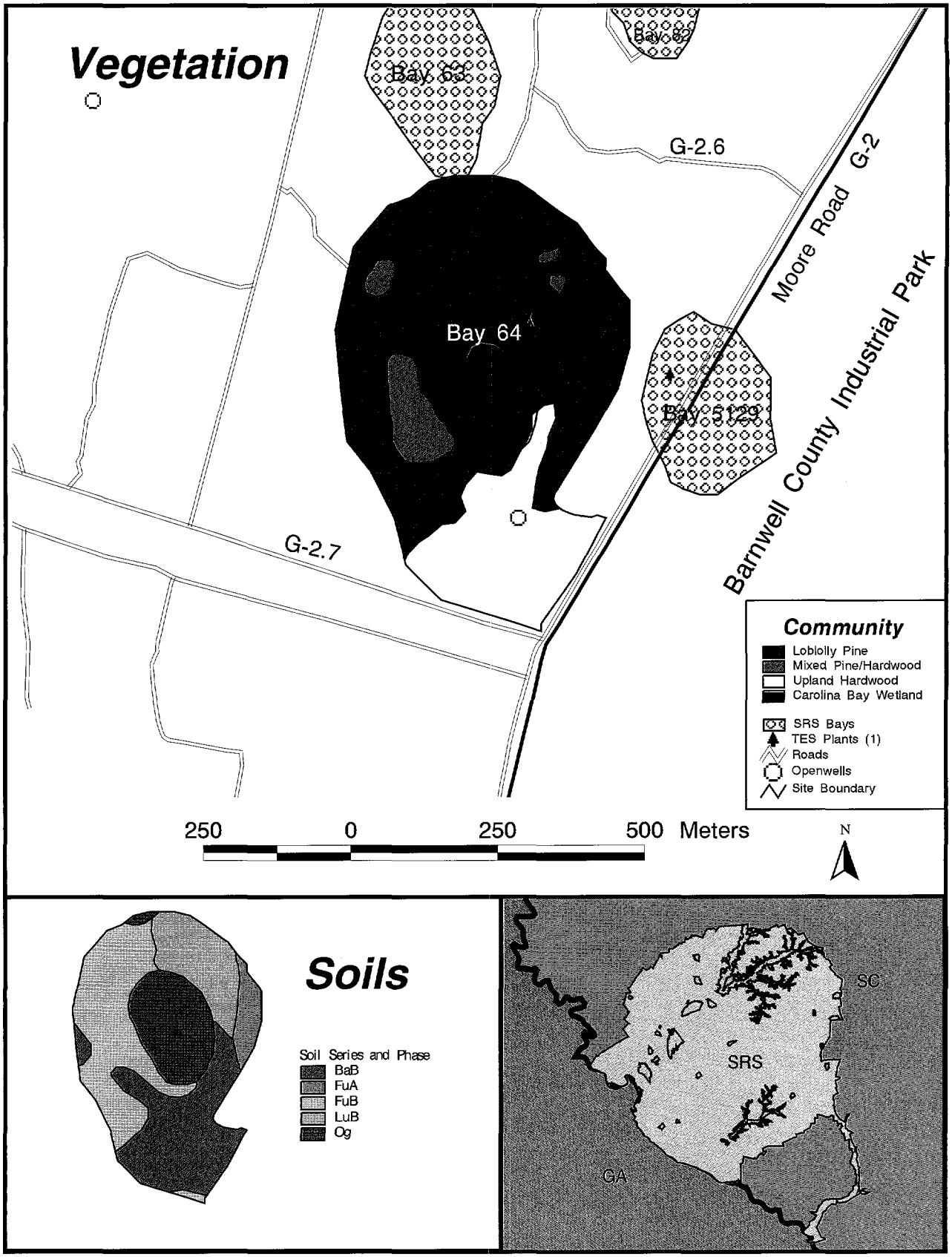

Figure 22-1. *Plant communities and soils associated with the Little Cypress Bay Set-Aside Area.*

AREA NO. 23
DRY BAY

SET-ASIDE LOCATION ON THE SRS:

The Dry Bay Set-Aside is located in the west-central portion of the SRS on the dividing line between the Aiken plateau and the Brandywine Pleistocene Terrace (Langley and Marter, 1973). Found in timber compartment 11, this Area is bordered by SC Hwy 125 and powerline right-of-way (ROW) Road A-2 and is adjacent to the Three Rivers Authority Regional Landfill (Figs. 2 and 23-1).

SET-ASIDE DESCRIPTION:

The 91.4-acre (37 ha) Dry Bay Set-Aside is comprised of the largely open-water Dry Bay (Bay No. 31—see Schalles *et al.*, 1989 for numbering) and a partial 200-m buffer area of both relatively undisturbed and recently reforested pine plantations. Also within the buffer area are small inclusions of upland and bottomland hardwood communities. Dry Bay is a 12.4-acre (5 ha) aquatic/herbaceous bay which has bottomland hardwood and swamp tree species around its periphery. This bay rarely draws down completely despite its being connected to a depressional wetland (Bay No. 5219) by an historical ditch (Fig. 23-1); however, the ditch does alter the natural hydrology of this bay. Dry Bay's interior vegetation primarily is dominated by maidencane (*Panicum hemitomon*) and floating macrophytes (*Nymphaea* spp.; Keough *et al.*, 1990). Although Dry Bay is relatively intact, it has virtually no buffer on the west side due to its proximity to SC Hwy 125; this highway could be detrimental to the persistence of populations of organisms that migrate into and out of the bay. The 1.62-mile (2.6 km) boundary line of this Set-Aside is marked with metal DOE Research Set-Aside Area signs on trees and security fence posts along SC Hwy 125.

WHAT THIS SET-ASIDE REPRESENTS:

The Dry Bay Set-Aside represents a semi-permanent, herbaceous bay wetland with an extended hydroperiod. It is recognized by research ecologists at SREL as an important refuge for many aquatic and semi-aquatic organisms. Similar to some other herbaceous bays in the Set-Aside Program (e.g., Area Nos. 17 and 25), this Area also represents a bay community which has adjacent buffer areas that recently have been disturbed by clearcutting and reforestation activities. Ecologically, it is one of the most diverse wetlands on the SRS. Fifty-five different species of amphibians and reptiles use this wetland, including the largest known population of the chicken turtle (*Deirochelys reticularia*). This Area is one of the few places on the SRS where both species of cricket frogs (*Acris gryllus* and *A. crepitans*) are known to co-occur and it is the only Set-Aside bay where the secretive pine woods snake (*Rhadinaea flavilata*) has been collected; this snake also has been collected at one other location on the SRS. Many of the amphibian and reptile species documented from this Area are considered rare or uncommon by researchers (Table 23-3). Fish were documented in Dry Bay prior to a drought in 1986 (Bennett and McFarlane, 1983) but no fish species currently are known to inhabit this bay (Snodgrass *et al.*, 1996). SREL's Outreach Program often uses this Set-Aside for interpretive nature talks when conducting field tours of the SRS.

HISTORY:

Prior to establishment of the SRS in 1951, agriculture was the predominant land-use activity around Dry Bay. A drainage ditch has existed since prior to the 1940's and there were several homesites and outbuildings located within this Area. SC Hwy 125, which lies along the gradient

Table 23-1. Vegetation communities of the Dry Bay Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	28.40	11.49	31.07%
Slash Pine	25.03	10.13	27.39%
Mixed Pine/Hardwood	6.99	2.83	7.65%
Upland Hardwood	5.70	2.31	6.24%
Bottomland Hardwood	13.46	5.45	14.73%
Carolina Bay Wetland	11.82	4.78	12.93%
Totals:	91.40	36.99	100.00%

between the Sunderland and Brandywine Terraces, borders Dry Bay and has been a major thoroughfare since colonial times.

Set-Aside Plant Community Composition:

This Set-Aside is comprised of five vegetation community types, including pine plantations (58.5%), mixed pine/hardwood (7.7 %), upland hardwood (6.2%), bottomland hardwood (14.7%), and Carolina bay wetlands (12.9%; Table 23-1). The pine plantations are slash (*Pinus elliottii*) and loblolly (*P. taeda*) and have establishment dates of 1953 and 1989, respectively (SRFS CISC stand database). The mixed pine/hardwood and upland communities pre-date establishment of the SRS. Dry Bay primarily supports herbaceous vegetation but also supports shrubs such as buttonbush (*Cephalanthus occidentalis*) and willow (*Salix* spp.; Keough *et al.*, 1990; De Stevens, 1994). A narrow strip of bottomland hardwoods and bald cypress (*Taxodium dishichum*) exists in the outer margins of this Set-Aside (Workman and McLeod, 1990).

Sensitive Flora and Fauna:

Three amphibian, six reptile, and two mammal species considered to be sensitive fauna on the SRS are documented from this Set-Aside Area, including the eastern tiger salamander (*Ambystoma t. tigrinum*), the Carolina gopher frog (*Rana capito*), the pig frog (*Rana grylio*), the American alligator (*Alligator mississippiensis*), the spotted turtle (*Clemmys guttata*), the southern hognose snake (*Heterodon simus*), the Florida green water snake (*Nerodia floridana*), the smooth earth snake (*Virginia valeriae*), the pine woods snake (*Rhadinaea flavilata*), the southeastern big-eared bat (*Plecotus refinesquii*), and the river otter (*Lutra canadensis*; Tables 4 and 23-3). There have been no sensitive plant species recorded from this Area.

Set-Aside Soils:

This Area is comprised of seven soil series and phases. Soils that comprise the upland buffer area are the somewhat excessively drained sandy loams to the well-drained fine loams. These include the Blanton, Troup, Wagram, and Orangeburg series (71.2 %; Table 23-2). Bay soils include the hydric Ogeechee and Rembert series (28.8%; Table 23-2). See Fig. 23-1 for soil mapping of this Set-Aside and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

Research emphasis in this Set-Aside primarily

Table 23-2. Soils of the Dry Bay Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	5.79	2.34	6.33%
Ogeechee sandy loam, ponded	Og	19.67	7.96	21.52%
Orangeburg loamy sand, 0-2% slopes	OrA	3.89	1.58	4.26%
Orangeburg loamy sand, 2-6% slopes	OrB	7.57	3.06	8.28%
Rembert sandy loam	Rm	6.64	2.69	7.26%
Troup sand, 0-6% slopes	TrB	9.87	3.99	10.80%
Wagram sand, 2-6% slopes	WaB	37.98	15.37	41.55%
Totals:		91.41	36.99	100.00%

has been on long-term (>20 years) studies of Carolina bay herpetofauna. More recent research has focused on the buffer areas and terrestrial habitat requirements of aquatic organisms (turtles) that use Dry Bay. Other research includes studies of wood duck (*Aix sponsa*) nesting ecology and the characterization of Dry Bay's hydrology, soils, vegetation, and zooplankton. A drift fence encompasses the bay and coverboard arrays are located in the buffer areas. A permanent vegetation transect has been installed as well as a Steven's water level recorder-Type F (Keough *et al.*,1990). This Area also traditionally has been an important stop for educational tour groups. This Set-Aside bay was recommended for inclusion in the EPA's ADID project for Carolina bays (Lide and Davis, 1993; EPA, 1994) To date, 41 publications and reports have been associated with this Set-Aside.

SREL researchers recently have compiled a species list for the herpetofauna known to inhabit and/or utilize the Dry Bay Set-Aside (Table 23-3). Species in bold type are considered by researchers to be species of conservation concern.

Historical/Current/Future Influences:

The construction of a nine-county regional landfill in the vicinity of the Dry Bay Set-Aside may have serious impacts on the fauna that use this bay wetland. The potential for hydrological contamination from the landfill is an obvious concern, but general encroachment on the habitat surrounding this Set-Aside also is a significant concern. Many of the herpetofauna that use Dry Bay for breeding purposes live the majority of the year in the surrounding uplands. Some salamander species of the genus *Ambystoma* are known to range several hundred meters into the surrounding uplands and research conducted at Dry Bay has shown that nesting turtles use the open areas provided by the powerline right-of-way. Some species of turtles that hibernate terrestrially range as far as 300 m from the wetland, entering the area north of the powerline, beyond the boundaries of the current Set-Aside Area. Because of this use by study animals of habitats located outside the Set-Aside boundary, the potential exists for indirect negative impacts to the research conducted in this Area and to the populations of organisms that occur there. In addition, SC Highway 125 is responsible for a significant number of road mortalities and this probably will increase with increased landfill truck traffic.

Prescribed burns were conducted in the forested buffer areas of this Set-Aside in 1971, 1984, and 1986. Nuisance feral hogs have been known to wallow at the bay's edge and prey upon turtle nests.

Table 23-3. Amphibians and reptiles documented from the Dry Bay Set-Aside Area. Species in bold are considered by researchers to be rare or species of conservation concern.

Amphibians		Reptiles	
Common Name	Scientific Name	Common Name	Scientific Name
Two-toed salamander	*Amphiuma means*	**American alligator**	***Alligator mississippiensis***
Greater siren	*Siren lacertina*	Snapping turtle	*Chelydra serpentina*
Marbled salamander	*Ambystoma opacum*	Eastern mud turtle	*Kinosternon subrubrum*
Mole salamander	*Ambystoma talpoideum*	Striped mud turtle	*Kinosternon baurii*
Tiger salamander	***Ambystoma tigrinum***	Musk turtle	*Sternotherus odoratus*
Dwarf salamander	*Eurycea quadridigitata*	**Spotted turtle**	***Clemmys guttata***
Slimy salmander	*Plethodon glutinosus*	Chicken turtle	*Deirochelys reticularia*
Southern toad	*Bufo terrestris*	Yellow-bellied slider	*Trachemys scripta*
Spadefoot toad	*Scaphiopus holbrookii*	Florida cooter	*Pseudemys floridana*
Northern cricket frog	*Acris crepitans*	Green anole	*Anolis carolinensis*
Southern cricket frog	*Acris gryllus*	Eastern fence lizard	*Sceloporus undulatus*
Cope's gray treefrog	*Hyla chrysocelis*	Six-lined racerunner	*Cnemidophorus sexlineatus*
Green treefrog	*Hyla cinerea*	Slender glass lizard	*Ophisaurus attenuatus*
Pine woods treefrog	*Hyla femoralis*	Five-lined skink	*Eumeces fasciatus*
Barking treefrog	***Hyla gratiosa***	Southeastern five-lined skink	*Eumeces inexpectatus*
Squirrel treefrog	*Hyla squirella*	Broadhead skink	*Eumeces laticeps*
Spring peeper	*Pseudacris crucifer*	Ground skink	*Scincella lateralis*
Southern chorus frog	*Pseudacris nigrita*	**Southern hognose snake**	***Heterodon simus***
Ornate chrous frog	*Pseudacris ornata*	Worm snake	*Carphophis amoenus*
Eastern narrow-mouthed toad	*Gastrophryne carolinensis*	Black racer	*Coluber constrictor*
Carolina gopher frog	***Rana capito***	Ringneck snake	*Diadophis punctatus*
Bullfrog	*Rana catesbeiana*	Rat snake	*Elaphe obsoleta*
Green frog	*Rana clamitans*	**Rainbow snake**	***Farancia erytrogramma***
Pig frog	***Rana grylio***	**Mud snake**	***Farancia abacura***
Leopard frog	*Rana utricularia*	Coachwhip snake	*Masticophis flagellum*
		Florida green water snake	***Nerodia floridana***
		Red-bellied watersnake	*Nerodia erythrogaster*
		Banded watersnake	*Nerodia fasciata*
		Rough green snake	*Ophreodrys aestivus*
		Eastern ribbon snake	*Thamnophis sauritus*
		Scarlet kingsnake	*Lampropeltis triangulum*
		Cottonmouth	*Agkistrodon piscivorous*
		Canebrake rattlesnake	*Crotalus horridus atricaudatus*
		Pine woods snake	***Rhadinaea flavilata***
		Pine snake	*Pituophis melanoleucus*
		Smooth earth snake	*Virginia valeriae*

SRS Patrol Indexes: H-1,7

Site-Use Permits:

SU-77-41-R Species assessment in selected habitats; Gibbons; SREL.

SU-80-23-R Life history strategies of the yellow-bellied pond slider; Gibbons; SREL.

SU-84-27-R Dry Bay trapping of aquatic and terrestrial animals; Gibbons and Morreale; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

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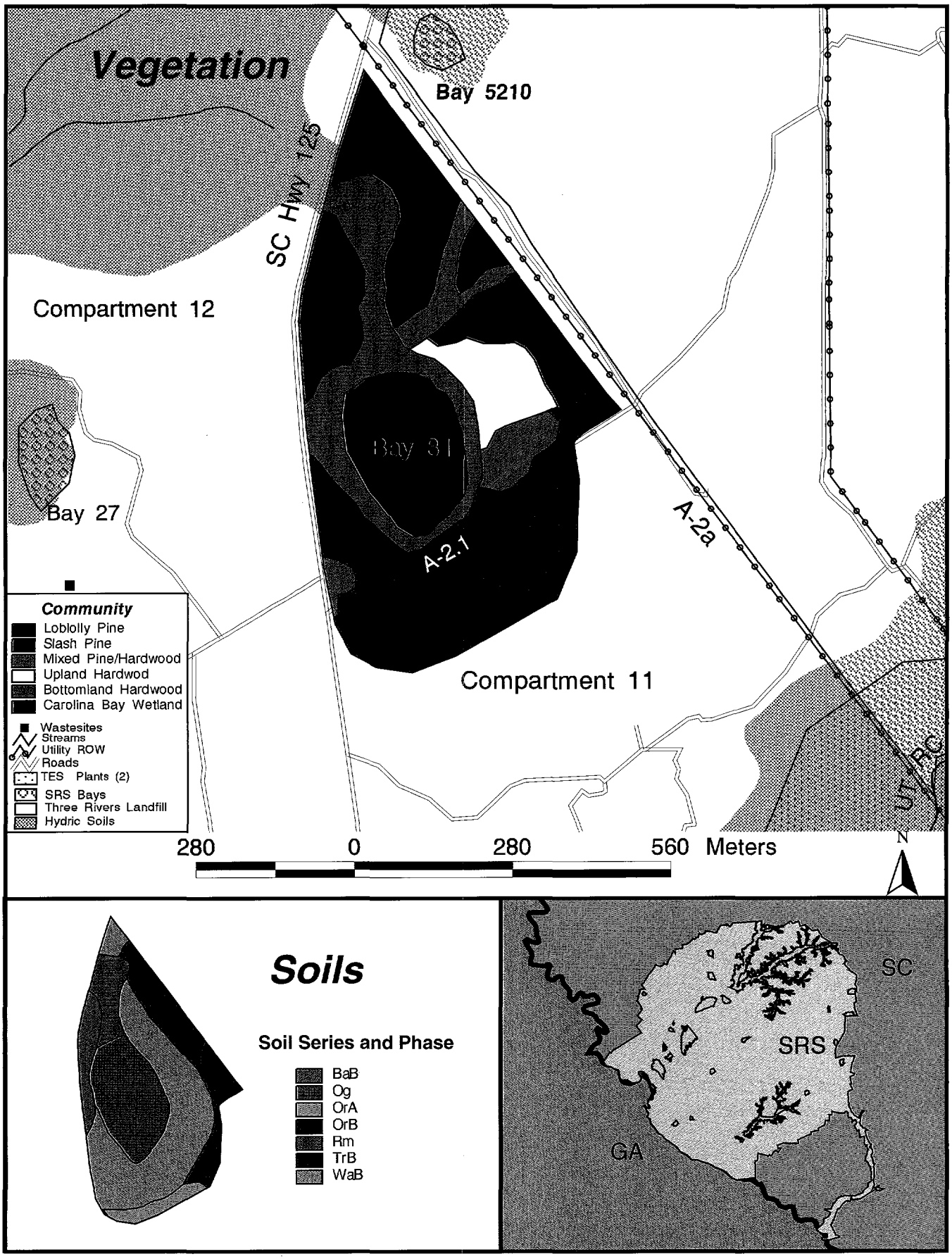

Figure 23-1. *Plant communities and soils associated with the Dry Bay Set-Aside Area.*

AREA NO. 24
CYPRESS BAY

SET-ASIDE LOCATION ON THE SRS:

Located on the Aiken Plateau in the southeast quadrant of the SRS, this Set-Aside is found in timber compartment 75, west of Gate 21 off of SRS Road B-6 (Langley and Marter, 1973). This Area is bordered by the CSX Seaboard Coast Line Railroad tracks, southeast of the old town of Dunbarton (Figs. 2 and 24-1).

SET-ASIDE DESCRIPTION:

The 66-acre (26.7 ha) Cypress Bay Set-Aside is a partial assemblage of three bays (Bay Nos. 91, 92, and 93; see Schalles *et al.*, 1989 for numbering). This Area includes Bay No. 92, with a 200-meter buffer area of maturing loblolly pines (*Pinus taeda*), some of which were planted prior to establishment of the SRS, and portions of Bay Nos. 91 and 93. The basins of these forested bays are ringed with older bottomland hardwoods and pine and all have evidence of historical disturbance from ditching or SRS rail line construction. The focal bay of this Area is Cypress Bay (Bay No. 92), which is a relativley small (3.1 acres, 1.3 ha), undisturbed bay (Schalles *et al.*, 1989). As the name implies, it is unique in containing a relatively dense stand of small-to- medium sized pond cypress (*Taxodium ascendens*). A number of the smaller diameter trees have died and fallen into the bay. The portion of Bay No. 93 contained within this Set-Aside serves as a control (uncut) quadrant for wetland restoration activities presently being conducted in Bay No. 93. The boundary line of the Cypress Bay Set-Aside is marked with white painted blazes on trees and is 1.2 miles (1.93 km) long.

WHAT THIS SET-ASIDE REPRESENTS:

This Carolina bay Set-Aside represents one of the few true bays on the SRS with an interior plant community that is forested with cypress. In addition, minimal harvesting of timber in the upland buffer areas has occurred since Site acquisition, leaving the area surrounding Cypress Bay relatively intact. Active wetland restoration research activities are associated with one of the bays partially contained within this Set-Aside.

HISTORY:

Prior to establishment of the SRS in 1951, agriculture and timber production were the predominant land-use activities in and around these bays. There is a history of logging in the bays and 1880's agricultural census records indicate that rice farming may have been conducted in the bay wetlands (B. Taylor pers. comm.)

SET-ASIDE PLANT COMMUNITY COMPOSITION:

This Set-Aside is comprised of four community types—pine plantations (57%), bottomland hardwood (4.7%), Carolina bay wetland(15%), and bottomland hardwood/pine (23.3%; Table 24-1). A 200-meter buffer area was established around the majority of these bays; the oldest age class for the pines within this upland area is 55 years old (SRFS CISC stand database). A ring of sweetgum (*Liquidambar styraciflua*) and other mixed pine/hardwood species is adjacent to the bay depression; these trees date to 1929 (SRFS CISC stand database). The bottomland hardwood community in the southeast corner of this Set-Aside is actually remnant vegetation of Bay No. 5122 (Fig. 24-1); this vegetation is all that remains of Bay No. 5122.

SENSITIVE FLORA AND FAUNA:

No sensitive flora or fauna have been documented from this Set-Aside (Tables 3 and

Table 24-1. Vegetation communities of the Cypress Bay Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	36.36	14.72	57.03%
Bottomland Hardwood	2.97	1.20	4.66%
Carolina Bay Wetland	9.57	3.87	15.01%
Bottomland Hardwood/Pine	14.86	6.01	23.31%
Totals:	63.76	25.80	100.00%

4).

Set-Aside Soils:

Four soil series and phases comprise this Area. The hydric soil series within the bay are Rembert and the surrounding upland vegetation is on the well to moderately well-drained Dothan series. There are approximately four acres of Udorthents—disturbed soils associated with the spoil from railroad bed excavation. See Fig. 24-1 for soils mapping of the Set-Aside and Appendix 3 for a description of soils.

Reseach Associated With This Set-Aside:

The majority of the research conducted within this Set-Aside Area has been related to characterizing the hydrology, vegetation, and zooplankton of Cypress Bay and Bay No. 93. A Steven's water level recorder-Type F and a permanent transect were installed in Cypress Bay for both hydrologic and vegetation surveys (Keough *et al.*, 1990). Hydrological monitoring of surface and sub-surface water levels continues to be conducted monthly for Cypress Bay. Investigations into the mortality of the cypress trees in Cypress Bay suggests that the bay's hydrology may have been altered due to the contruction of the railroad line in the 1950's (J. Young per. comm.); these investigations are ongoing. The Set-Aside portion of Bay No. 93 serves as the control quadrant for a joint Carolina bay restoration project between SREL and the SRFS (Sharitz and Wein, 1995; Taylor *et al.*, 1996). Reese and Moorhead (1996) have investigated the characteristics of the soil properties of this restored bay system. Recently, a study of the distribution of toads on the SRS was initiated in this Set-Aside Area.

Cypress Bay was recommended for inclusion in the EPA's ADID project for Carolina bays (Lide and Davis, 1993; EPA, 1994). To date, 21 publications and reports have been associated with this Set-Aside.

Historical/Current/Future Influences:

The southern tip of Cypress Bay was obliterated due to railroad bed and right-of-way construction in the 1950's. This disturbance may have altered the hydrology of this Set-Aside and mortality of the cypress trees in Cypress Bay may continue to occur. In November, 1993, the ditch in Bay No. 93 was plugged, raising the water level of this bay and potentially affecting the hydrology of Cypress Bay and Bay No. 91. The last record of prescribed fire in the buffer area was in 1987.

SRS Patrol Indexes: U-16,17 V-16,17

Site-Use Permits:

SU-80-06-R Comparative physiological ecology of pond and bald cypress; Neufeld and Sharitz; SREL.

Table 24-2. Soils of the Cypress Bay Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Dothan sand, 0-2% slopes	DoA	24.50	9.92	38.44%
Dothan sand, 2-6% slopes	DoB	19.90	8.05	31.22%
Rembert sandy loam	Rm	15.17	6.14	23.79%
Udorthents, friable substratum	Uo	4.18	1.69	6.55%
Totals:		63.75	25.80	100.00%

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-92-29-R (Amendment 1) Carolina bay ecological restoration project; Jarvis and Wein; SRFS and SREL.

SU-96-08-R A study of the distribution of toads on the SRS; Taylor and Hopkins; SREL.

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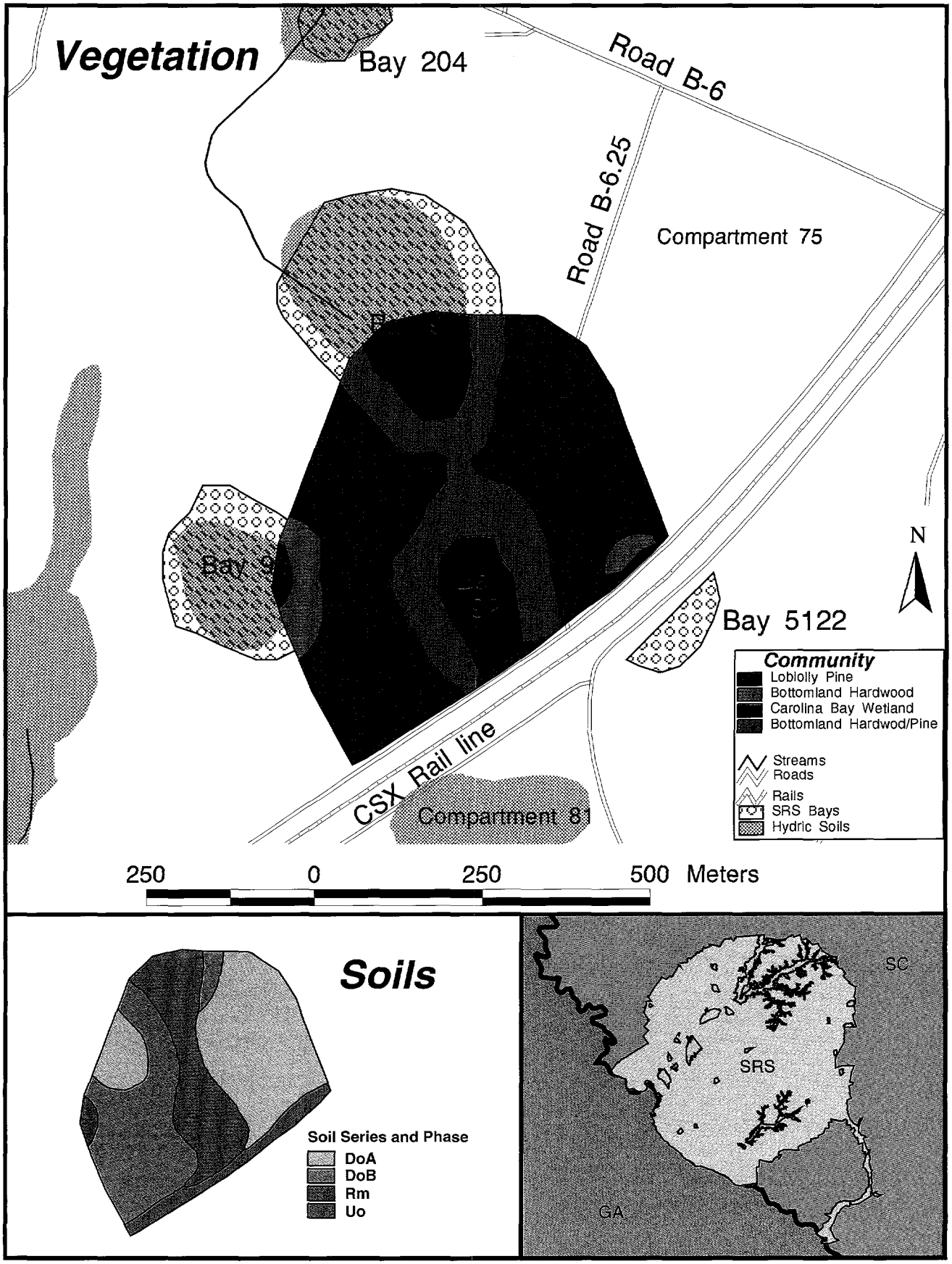

Figure 24-1. *Plant communities and soils associated with the Cypress Bay Set-Aside Area.*

AREA NO. 25
MONA BAY AND WOODWARD BAY

SET-ASIDE LOCATION ON THE SRS:

Located on the Aiken Plateau in the northeast quadrant of the SRS, this Set-Aside is found in timber compartment 29 and lies north of Road 8-3.1a, along the eastern boundary line of the SRS (Langley and Marter, 1973; Figs. 2 and 25-1).

SET-ASIDE DESCRIPTION:

The 156.7-acre (63.4 ha) Mona Bay/Woodward Bay Set-Aside is an isolated assemblage of three Carolina bays (temporary ponds), surrounded primarily by a buffer area of recently established and maturing pine plantations. The paired Mona and Woodward Bays (Bay Nos. 66 and 67, respectively, see Schalles *et al.*, 1989 for numbering), are relatively intact bays with shallow water depths, dominated by open herbaceous vegetation (Knox and Sharitz, 1990; Brooks *et al.*, 1996). Mona Bay is 27.9 acres (11.3 ha) in size and rivals Ellenton Bay (Bay No. 176, Set-Aside Area No.1) as the second largest intact bay on the SRS (only a portion of Craig's Pond, Area No. 17, is on SRS property). Woodward Bay, adjacent to Mona Bay on the west, is 17.3 acres (7.0 ha) and exhibits a shorter hydroperiod than Mona Bay (Brooks *et al.*, 1996); it is the shallowest of all the herbaceous Set-Aside bays. A third bay, Bay No. 65, is a remnant bay depression which lies to the northeast of Mona Bay. The hydrology of Bay No. 65 has been altered severely by historical ditching and recent reforestation activity to the point that it ceases to function as a wetland. The 1.96-mile (3.16 km) boundary line for this Set-Aside is marked with metal DOE Research Set-Aside Area signs.

WHAT THIS SET-ASIDE REPRESENTS:

This Set-Aside Area represents a paired assemblage of relatively intact Carolina bays which are temporary rather than semi-permanent wetland pond communities. This Set-Aside also includes a bay that is a candidate for future restoration (Bay No. 65). Like the paired Craig's Pond and Sarracenia Bay, located approximately 1 mile (0.6 km) south of this Area, Mona and Woodward Bays contain areas of open water and aquatic and herbaceous vegetation communities. Within these wetland communities are a number of sensitive plant populations (Table 3). This Area also represents bay communities which have adjacent buffer areas that recently have been disturbed through clearcutting and reforestation activities. This Set-Aside was established to preserve the integrity of this bay assemblage and to offer protection to the sensitive plant populations found in these bays.

HISTORY:

Prior to establishment of the SRS in 1951, agriculture, raising live stock, and timber production were the predominant land-use activities in and around these bays. A homesite and outbuildings were located on the periphery of Bay No. 65. The bays have evidence of historical ditching (Brooks *et al.*, 1996).

SET-ASIDE PLANT COMMUNITY COMPOSITION:

This Set-Aside is comprised of three community types—pine plantations (70.1%), mixed pine/hardwood (0.59%), and Carolina bays and water (29.3%; Table 25-1). A 200-meter buffer area was established around the majority of these bays; within this upland area pines range in age from 10 to 49 years (SRFS CISC stand database). Hodges (1985) characterized the interior vegetation community types of Mona Bay as planted pines (*Pinus* spp.), *Andropogon virginicus-Panicum hemotomon, Rhynchospora*

Table 25-1. Vegetation communities of the Mona Bay and Woodward Bay Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	13.56	5.49	8.65%
Longleaf Pine	96.33	38.99	61.47%
Mixed Pine/Hardwood	0.93	0.38	0.59%
Carolina Bay Wetland	22.16	8.97	14.14%
Water	23.73	9.60	15.14%
Totals:	156.71	63.42	100.00%

tracyi-Manisuris rugosa, Leersia hexandra, Panicum hemitomon, and *Hydrochloa caroliniensis.*

Sensitive Flora and Fauna:

Four sensitive aquatic plant species have been recorded for this Area, including Elliott's croton (*Croton ellottii*), the rare beak-rush (*Rhynchospora tracyi*), the slender arrow head (*Sagittaria isoetiformis*), and the Florida bladderwort (*Utricularia floridana;* Table 3). The Florida green water snake (*Nerodia floridana*), which is on the South Carolina list of species of special concern, has been recorded from this Set-Aside Area (Table 4). In addition, eastern tiger salamanders (*Ambystoma t. tigrinum*), rare on the SRS, have been collected in Woodward Bay.

Set-Aside Soils:

This Area has seven soil series associated with it. Soils in the upland pine communities include the xeric, excessively to well-drained Blanton, Lakeland, Fuquay, and Dothan series (67.5%; Table 25-2). Hydric soils confined to the bays of this Area include the poorly drained Williman, Fluvaquents, and Remberts series (32.5%; Table 25-2). See Fig. 25-1 for soil mapping of the Set-Aside and Appendix 3 for a soils description.

Reseach Associated With This Set-Aside:

The majority of the research conducted in this Set-Aside Area has been related to characterizing the hydrology, zooplankton, and vegetation of Mona and Woodward Bays. Other research includes upland wetland archaeological studies. Mona and Woodward Bays were recommended for inclusion in the EPA's ADID project for Carolina bays (Lide and Davis, 1993; EPA, 1994). Steven's water level recorders-Type A have been installed in these bays to monitor hydrological changes. In 1990, a permanent transect was established in these bays for both vegetation and hydrologic surveys. To date, 21 publications and reports have been associated with this Set-Aside.

Historical/Current/Future Influences:

In 1987, significant portions of the periphery of Mona and Woodward Bays were clearcut, site-prepared with mechanical and chemical treatments, and replanted to longleaf pine (*Pinus palustris*). A 66-ft.(20 m) buffer of vegetation was retained around the bays, adjacent to these treatments. Potential negative impacts from current or past SRS operations are considered minimal due to the remoteness of this Area and the distance to Site facilities. However, because this Set-Aside is adjacent to the SRS boundary,

Table 25-2. Soils of the Mona Bay and Woodward Bay Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	89.03	36.03	56.81%
Dothan sand, 0-2% slopes	DoA	0.24	0.10	0.15%
Fluvaquents, frequently flooded	Fa	10.04	4.06	6.41%
Fuquay sand, 2-6% slopes	FuB	3.89	1.58	2.48%
Lakeland sand, 0-6% slopes	LaB	12.70	5.14	8.10%
Rembert sandy loam	Rm	21.58	8.74	13.77%
Williman sand	Wm	19.23	7.78	12.27%
Totals:		156.71	63.42	100.00%

the potential exists for impacts from wildfire from private lands, as well as from industrial development near the Site boundary. The older uncut stands last were subjected to a prescribed burn in 1980.

SRS Patrol Indexes: **O**-26,27 **P**-26,27

Site-Use Permits:

SU-87-63-R Registration of locations of rare or threatened plant populations--based upon Federal or state of South Carolina status; Roecker and Sharitz; SRFS and SREL.

SU-88-77-R Elliott's Croton (*Croton elliottii*) study—research; Knox and Dixon; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-92-40-R Water finding abilities of turtles; Gibbons and Yeomans; SREL.

SU-95-15-R Geoarchaeology in Carolina Bay Set-Aside Areas; Brooks and Taylor; SCIAA and SREL.

SU-95-19-R The population biololgy of *Sagittaria isoetiformis*: Within- and between-patch dynamics of a rare aquatic perennial; Sharitz and Edwards; SREL.

Publications and Reports:

Boileau, M.G. and B.E. Taylor. 1994. Chance events, habitat age, and genetic structure of pond populations. Arch. Hydrobiol. 132:191-202. SREL Reprint # 1918.

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Brooks, M.J., B.E. Taylor, and J.A. Grant. 1996. Carolina bay geoarchaeology and holocene landscape evolution on the upper coastal plain of South Carolina. Geoarchaeology 11:481-504. SREL Reprint # 2132.

Chmielewski, R.M. 1996. Hydrologic analysis of Carolina bay wetlands at the Savannah River Site. M.S. Thesis. University of Wisconsin-Milwaukee.

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Kirkman, L.K. 1992. Cyclical vegetation dynamics in Carolina bay wetlands. Ph.D. Dissertation. University of Georgia, Athens.

Kirkman, L.K., R.F. Lide, G. Wein, and R.R. Sharitz. 1996. Vegetation changes and land-use legacies of depression wetlands of the western Coastal Plain of South Carolina: 1951-1992. Wetlands 16:564-576. SREL Reprint # 2140.

Knox, J.N. and Sharitz, R.R. 1990. Endangered,

threatened, and rare vascular flora of the Savannah River Site. Publication of the Savannah River National Environmental Research Park Program. SRO-NERP-20. Aiken, SC.

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Poiani, K.A and P.M. Dixon. 1995. Seed banks of Carolina bays: Potential contributions from surrounding landscape vegetation. Amer. Midl. Nat. 143:140-154. SREL Reprint # 197.

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Shields, J.D., N.D. Woody, A.S. Dicks, G.J. Hollod, J. Schalles, and G.J. Leversee. 1982. Location and areas of ponds and Carolina bays at the Savannah River Plant. DP-1525 (Rev.1). E.I. duPont de Nemours and Co. Savannah River Laboratory. Aiken, SC.

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Workman, S.W. and K.W. McLeod. 1990. Vegetation of the Savannah River Site: Major community types. Publication of the Savannah River National Environmental Research Park Program. SRO-NERP-19. Aiken, SC.

U.S. Environmental Proctection Agency. 1994. High Risk Geographic Areas Targeted for Wetland Advanced Identification. EPA 904-R-94-005.

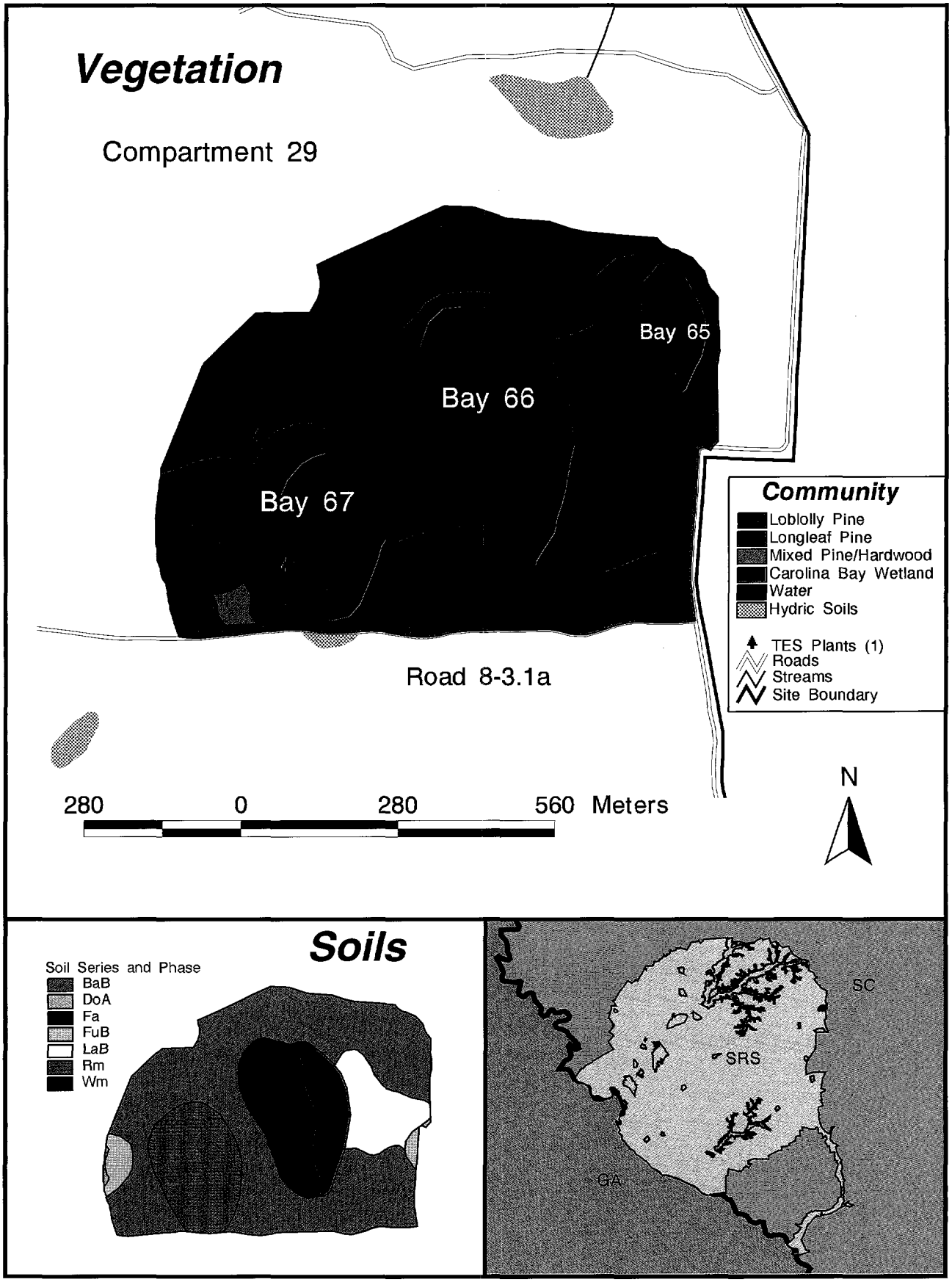

Figure 25-1. *Plant communities and soils associated with the Mona Bay and Woodward Bay Set-Aside Area.*

AREA NO. 26
SANDHILLS FIRE SITE

SET-ASIDE LOCATION ON THE SRS:

The Sandhills Fire Site is located within the Brandywine Pleistocene Coastal Terrace in the northeast quadrant of the SRS (Langley and Marter, 1973). Found in timber compartment 56, this Area is east of the North Arm of Par Pond, off of Road 8.81 (Figs. 2 and 26-1).

SET-ASIDE DESCRIPTION:

The Sandhills Fire Site is a mixed-species sandhills habitat situated on infertile, poor-to-marginally productive soils. This habitat type once was common to this region of the United States as well as to the SRS; however, forest type conversion to longleaf pine plantations has reduced this community type to isolated patches within the SRS landscape. Presently, this Area exists as a remnant patch of scrub oak/longleaf pine (turkey oak, *Quercus laevis*/longleaf pine, *Pinus palustris*) surrounded primarily by young longleaf pine plantations. A connective corridor of mixed older pines to the west links this Set-Aside to similar sandhills habitat as well as to the Par Pond drainage. This Set-Aside is 45.4 acres (18.4 ha) and has a boundary length of 1.2 miles (1.9 km). The boundary line is marked with white painted blazes on trees. This Area is divided into three blocks for burn treatments, with permanent survey plots in each block. Experimental prescribed fires periodically have been introduced to these blocks to evaluate the effects of seasonal burns on soils and vegetation.

WHAT THIS SET-ASIDE REPRESENTS:

The Sandhills Fire Site was included in the Set-Aside Program because it represents a fire-maintained sandhills community and because of the ongoing long-term studies on the effects of fire and secondary succession in a dry sandhills community. This site provides an opportunity to determine a time sequence of vegetation recolonization following fire. Both natural and human-induced fires are common in this type of community and may be necessary for this vegetation type to persist (McCort and Wein, 1988). The Sandhills Fire Site is one of three sandhills communities in the Set-Aside Program; both the Sandhills Set-Aside (Area No. 3) and the Scrub Oak Natural Area (Area No. 29) serve as additional unburned control replicates for studies on the effects of fire and soil properties on community productivity and wildlife use.

HISTORY:

Prior to establishment of the SRS in 1951, agriculture and timber production were the primary land-uses within and surrounding this Set-Aside. It appears that these marginal, well-drained soils either had been abandoned for agicultural production in the early 1900's or had undergone logging in the early part of this century. The oldest age classes for the dominant vegetation in this Set-Aside currently are not listed with the SRFS's CISC database. Prior to experimental burns in the early 1980's, this Area had no history of fire since Site acquisition (Workman, 1982).

SET-ASIDE PLANT COMMUNITY COMPOSITION:

This Set-Aside Area is comprised entirely of the sandhills scrub oak/pine vegetation community (100%;Table 26-1). For the most part, sparse pines occur among scrub oak hardwoods. Dominant canopy species of this Set-Aside are post oak (*Quercus stellata*), turkey oak (*Q. laevis*), scrub post oak (*Q. margaretta*), blue jack oak (*Q. incana*), and longleaf pine (*Pinus palustris*; Workman, 1982).

Table 26-1. Vegetation communities of the Sandhills Fire Site Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Sandhill Scrub Oak/Pine	45.41	18.38	100.00%
Totals:	45.41	18.38	100.00%

Sensitive Flora and Fauna:

Presently there are no sensitive plant species documented from this Set-Aside. The pine snake (*Pituophis m. melanoleucus*) has been documented from the Sandhills Fire Site (Table 4).

Set-Aside Soils:

Soils of the Sandhills Fire Site are entirely of the excessively well-drained, deep sandy Lakeland series (100%; Table 26-2). See Fig. 26-1 for soils mapping of this Set-Aside and Appendix 3 for a soils description.

Research Associated With This Set-Aside:

Fire ecology research in this Set-Aside has focused on the effects of seasonal fire on elemental cycling and succession in the scrub oak/pine sandhills community. Permanent sampling plots were established in this research area to evaluate seasonal burns on community structure, plant species diversity, and ecosystem processes pertaining to resource availability. Burns were conducted in August 1980 and January 1981 (Workman, 1982), and again in December 1993 and September 1994 (Imm and McLeod, 1995). The scheduled sampling regime is preburn, one year post burn, and then third, seventh, and eleventh year postburn. Greenhouse experiments are ongoing to evaluate the Area's seedbank to determine whether vegetation development following fire is related to nutrient uptake and spatial distribution (Collins and Foré, 1996). Additional complementary studies were conducted adjacent to this Area by McLeod (1982). These studies described the mass/size relationships in turkey oak/longleaf pine communities where estimates of the total nutrient inventories were determined in the tree components of these sandhills species. To date, there are 9 reports and publications associated with this Set-Aside.

Historical/Current/Future Influences:

On both a local and regional scale, this habitat type is dwindling, either due to forest type conversion or fire suppression. On 20 February 1997, an accidental fire from SRFS prescribed burning burned approximately 95% of this Set-Aside.

SRS Patrol Index: P-24

Table 26-2. Soils of the Sandhills Fire Site Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Lakeland sand, 0-6% slopes	LaB	45.41	18.38	100.00%
Totals:		45.41	18.38	100.00%

Site-Use Permits:

SU-80-57-R Scrub Oak Burning Study; Mcleod; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

Publications and Reports:

Collins, B.S. and S. Foré. 1996. Fire and sandhills vegetation. 1996 Savannah River Ecology Laboratory Annual Technical Progress Report. p. 72.

Gibbons, J.W., V.J. Burke, J.E. Lovich, R.D. Semlitsch, T.D. Tuberbville, J.R. Bodie, J.L. Greene, P.H. Niewiarowski, H.H. Whiteman, D.E. Scott, J.H.K. Pechmann, C.R. Harrison, S.H. Bennett, J.D. Krenz, M.S. Mills, K.A. Buhlmann, J.R. Lee, R.A. Seigel, A.D. Tucker, T.M. Mills, T. Lamb, M.E. Dorcas, J.D. Congdon, M.H. Smith, D.H. Nelson, M.B. Dietsch, H.G. Hanlin, J.A. Ott, and D.J. Karapatakis. 1997. Perceptions of species abundance, distribution, and diversity: Lessons from four decades of sampling on a government-managed reserve. Envir. Mgmt. 21:259-268. SREL Reprint # 2153.

Imm, D.W., K.W. McLeod, S.W. Workman, and P. Camill. Eleven years of post-fire change in summer and winter sandhill ridges of the Upper Coastal Plain. Bull. Torrey Bot. Club. *In press.*

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Langley, T.M. and W.L. Marter. 1973. The Savannah River Plant Site. Publication DP-1323. Savannah River Laboratory. E.I. duPont de Nemours and Co. Aiken, SC.

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McLeod, K.W. 1982. Mass/size relationships in turkey oak-longleaf pine forests are described. 1982 Savannah River Ecology Laboratory Annual Technical Progress Report. p. 98.

Workman, S.W. 1982. Short term vegetation and nutrient responses to seasonal burns in *Quercus laevis-Pinus palustris* forest stands of South Carolina. M.S. Thesis, Western Washington University.

Workman, S.W. and K.W. McLeod. 1990. Vegetation of the Savannah River Site: Major community types. Publication of the Savannah River National Environmental Research Park Program. SRO-NERP-19. Aiken, SC.

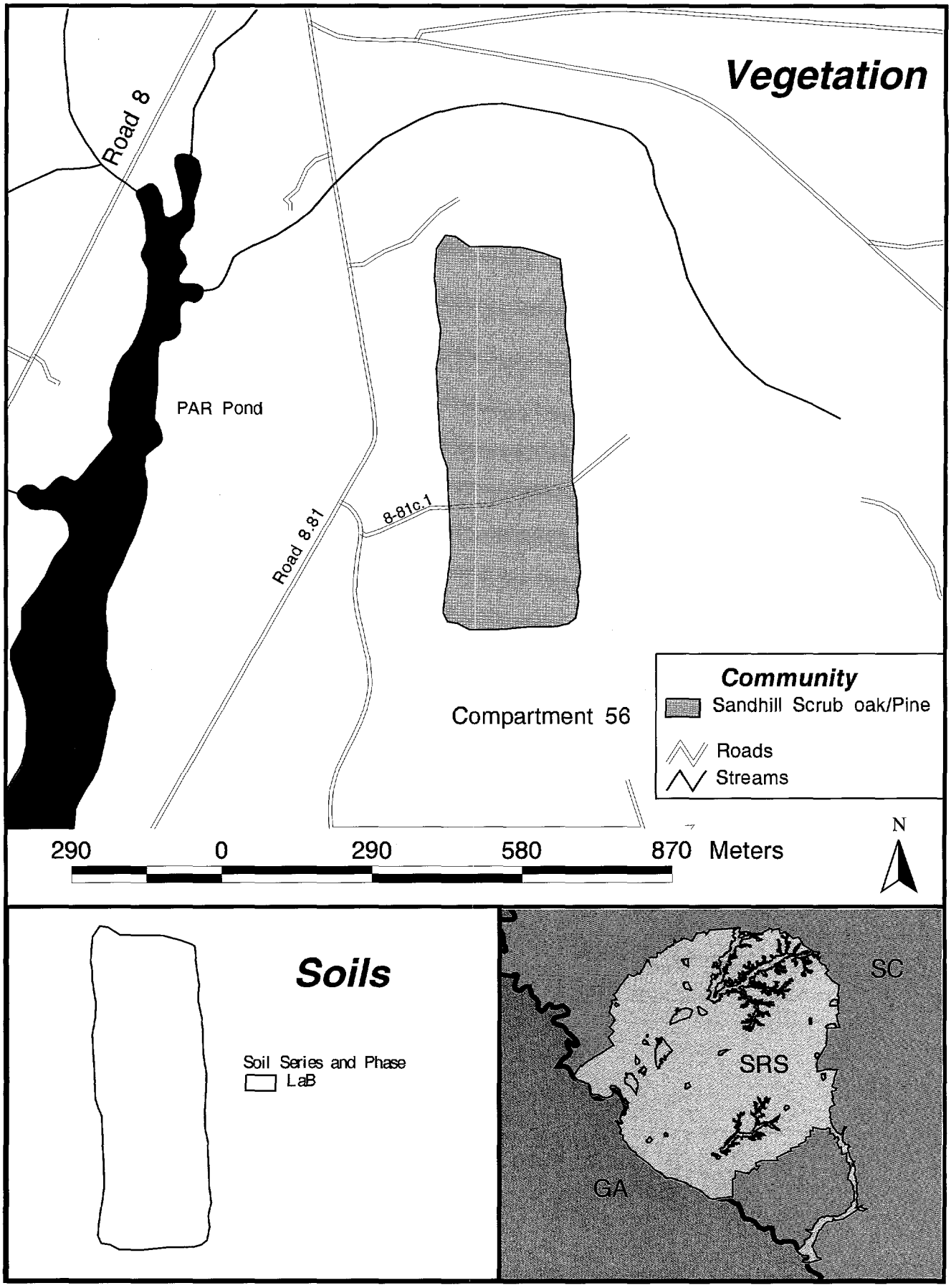

Figure 26-1. *Plant communities and soils associated with the Sandhills Fire Site Set-Aside Area.*

AREA NO. 27
ROAD 6 BAY

SET-ASIDE LOCATION ON THE SRS:

The Road 6 Bay Set-Aside is located in the southwest quadrant of the SRS within the Brandywine Pleistocene Terrace (Langley and Marter, 1973). It is found in timber compartment 72 at the junction of Roads 6 and 5.6 and is approximately 0.6 miles (0.97 km) northwest of K Area (Figs. 2 and 27-2).

SET-ASIDE DESCRIPTION:

This 83.7-acre (33.9 ha) Set-Aside is comprised of the largely forested bay-like depression Road 6 Bay (Bay No. 176—see Schalles *et al.*, 1989 for numbering) and a partial 200-m buffer of different-aged pine plantations. Within the buffer area are inclusions of upland and bottomland hardwood communities. The primary forest species of the bay is pond cypress (*Taxodium ascendens*); the interior area is dominated by a dense herbaceous cover. Road 6 Bay is not a true Carolina bay and therefore is difficult to define in terms of basin size and morphology. Rather than an isolated wetland depression, this possible streamhead depression has been altered with historical ditching but appears to have had a natural connection to Indian Grave Branch, a tributary of Pen Branch. The bay depression is approximately 5.9 acres (2.38 ha), not including the outer ring of bottomland hardwoods; the inner herbaceous, open-water portion is approximately 1.9 acres (0.77 ha). It is more semi-permanent than temporary and is known to have standing water for at least some period in most years (Schalles *et al.*, 1989). The hydrology of Road 6 Bay may be unnaturally influenced by ponding of water resulting from the road culvert and associated runoff. The seasonal water depth of this bay can be unusually high, as evidenced by the high buttressing and adventitious roots of the inner cypress trees. Standing in the open middle of the bay, one has a sense of being in a cathedral due to the towering cypress (Fig. 27-1). The 1.43-mile (2.3 km) boundary line of this Set-Aside is marked with white-blazed trees and metal DOE Research Set-Aside Area signs.

WHAT THIS SET-ASIDE REPRESENTS:

The Road 6 Bay Set-Aside is unique in that it represents a small bay-like depression that is dominated by pond cypress, has an herbaceous and open-water interior, and has a highly fluctuating water level. The cypress forest within the bay is characteristic of only a few bays on the SRS and, like Cypress Bay (Area No. 24), Road 6 Bay contains pond cypress and may have unnatural impacts to its hydrology. Keough *et al.* (1990) indicated that this bay had the lowest number of plant species recorded when looking at vegetation species richness for all Set-Aside bays.

HISTORY:

Prior to establishment of the SRS in 1951, Road 6 Bay appeared to be a ditched drainage streamhead that contained pond cypress. With the exception of the drainage connection to Indian Grave Branch, it was entirely surrounded by agricultural fields. Timber harvesting was evident in the outer-most portion of the Set-Aside Area at the time of Site acquisition. No historical buildings were associated with this Area.

SET-ASIDE PLANT COMMUNITY COMPOSITION:

This Set-Aside is comprised of six community types—pine plantations (76.7%) , mixed pine/ hardwood (0.88%), upland hardwood(4.22%), bottomland hardwood (9.62 %), bottomland hardwood/pine (1.6%) and bay-like depression/ water (7.04%; Table 27-1). In the upland buffer

Table 27-1. Vegetation communities of the Road 6 Bay Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	1.50	0.61	1.79%
Slash Pine	62.68	25.37	74.87%
Mixed Pine/Hardwood	0.74	0.30	0.88%
Upland Hardwood	3.53	1.43	4.22%
Bottomland Hardwood	8.06	3.26	9.62%
Bay-like Depression	5.34	2.16	6.38%
Water	0.55	0.22	0.66%
Bottomland Hardwood/Pine	1.32	0.53	1.58%
Totals:	83.72	33.88	100.00%

area the slash pine (*Pinus elliottii*) was planted in 1958 and the loblolly pine (*P. taeda*) was planted in 1972 (SRFS CISC stand database). The bottomland hardwood community encircling the cypress stand is primarily sweetgum (*Liquidambar styraciflua*) and appears to have been established at the time of Site acquisition. The pond cypress stand dates to 1925. The dense herbaceous interior is dominated by three species: *Erechtities hyperacifolia*, *Boehmeria cylindrica*, and *Polygonum punctatum* (Keough *et al.*, 1990).

Figure 27-1. *Pond cypress in Road 6 Bay.*

Table 27-2. Soils of the Road 6 Bay Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	8.35	3.38	9.97%
Dothan sand, 2-6% slopes	DoB	41.05	16.61	49.03%
Fuquay sand, 2-6% slopes	FuB	19.05	7.71	22.76%
Orangeburg loamy sand, 0-2% slopes	OrA	3.55	1.44	4.24%
Rembert sandy loam	Rm	6.73	2.72	8.03%
Vaucluse sandy loam, 2-6% slopes	VaB	2.92	1.18	3.49%
Vaucluse-Ailey complex, 6-10% slopes	VeC	2.07	0.84	2.47%
Totals:		83.71	33.88	100.00%

Sensitive Flora and Fauna:

Presently, there are no sensitive floral or faunal species documented from this Set-Aside Area.

Set-Aside Soils:

There are seven soil series and associations that comprise this Area. Soils in the upland buffer area range from the excessively drained sandy loams to the well-drained fine loams. These include the Blanton, Dothan, Fuquay, and Orangeburg series (86%; Table 27-2). Wetland depression soils include the hydric Rembert series (8.03%). Also associated with the bay depression are the Vaucluse and Vaucluse-Ailey complex soils (5.96 %; Table 27-2), which typically are found on transitional slopes and side slopes of drainages (Rogers, 1990). These two soil associations found in this Set-Aside may be a result of Road 6 construction and culvert placement; however, if natural to the landscape, their presence may indicate that this wetland is not an isolated depression as are most true Carolina bays, but rather that these soils are associated with a wetland depression at the head of a drainage or tributary. See Fig. 27-2 for soil mapping of this Set-Aside and Appendix 3 for a description of soils.

Research Associated With This Set-Aside:

Research in the Road 6 Bay Set-Aside primarily has consisted of vegetation and zooplankton surveys and monitoring of the bay's hydrology. A Steven's water level recorder-Type A has been installed in the bay, as have permanent vegetation transects. Fish surveys (Snodgrass *et al.*, 1996) have documented amphibian use of the wetland; larvae of marbled (*Ambystoma opacum*) and mole salamanders (*A. talpoideum*) have been collected here, as have adult greater sirens *(Siren lacertina)*. The bay of this Set-Aside has been recommended for inclusion in the EPA's ADID project for Carolina bays (Lide and Davis, 1993; EPA, 1994). To date, 15 publications and reports have been associated with this Set-Aside.

Historical/Current/Future Influences:

Prescribed burning by the SRFS was conducted in a portion of this Area in 1990. The culvert on Road 6 and potential runoff from this roadway are likely influences on the hydrology of this wetland and may explain the large fluctuations of the basin's water level. This Set-Aside is relatively close to the K Area reactor facilities.

SRS Patrol Indexes: N-9,10

Site-Use Permits:

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

Publications and Reports:

DeBiase, A.E. and B.E. Taylor. 1993. New occurrences of *Eurytemora affinis* and *Epischura fluviatilis*, freshwater calanoid copepod species of the Family Temoridae, in South Carolina. Am. Midl. Nat. 130:386-392. SREL Reprint # 1784.

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Lide, R.E. 1997. When is a depressional wetland a Carolina bay? *In press.* Southeastern Geographer.

Lide R.F. and C.E. Davis. 1993. EPA Advanced Identification (ADID) Project: Carolina bays at the Savannah River Site. Savannah River Ecology Laboratory Report No. SREL-45 UC-66e.

Mahoney, D.L., M.A. Mort, and B.E. Taylor. 1990. Species richness of Calanoid copepods, cladocerans and other branchiopods in Carolina bay and temporary ponds. Am. Midl. Nat. 123:244-258. SREL Reprint # 1428.

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U.S. Environmental Proctection Agency. 1994. High Risk Geographic Areas Targeted for Wetland Advanced Identification. EPA 904-R-94-005.

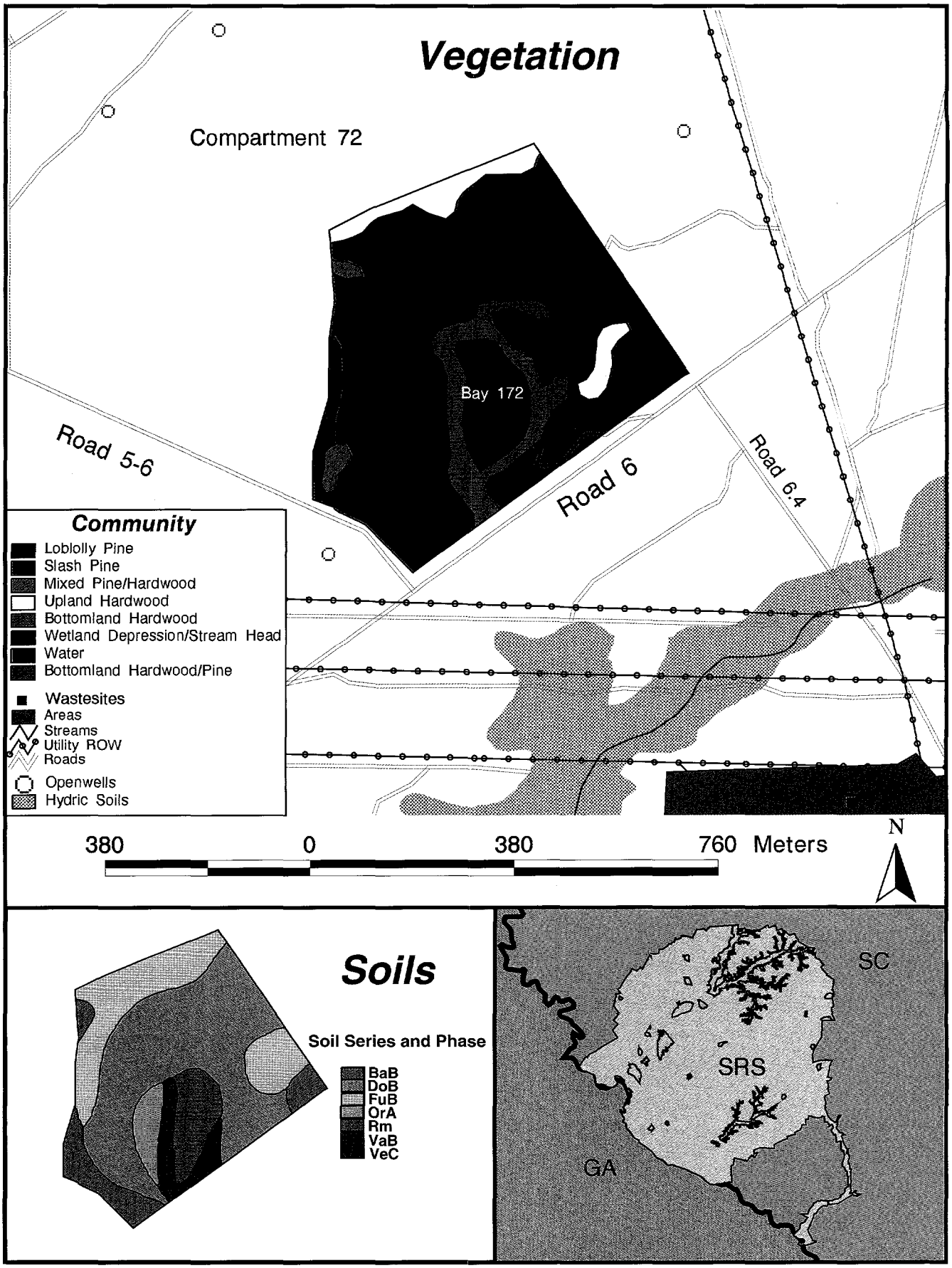

Figure 27-2. *Plant communities and soils of the Road 6 Bay Set-Aside Area.*

AREA NO. 28
FIELD 3-409

SET-ASIDE LOCATION ON THE SRS:

The Field 3-409 Set-Aside Area is located in the northwest quadrant of the SRS within the Aiken Plateau (Langley and Marter, 1973). Found in timber compartment 11, this Area is adjacent to B Area, is bordered by Road 2, and is approximately 470 m northeast of the Sandhills Set-Aside (Area No. 3; Figs. 2 and 28-1).

SET-ASIDE DESCRIPTION:

This small 14.2-acre (5.8 ha) relatively disturbed, rectangularly-shaped Set-Aside is comprised of a section of an abandoned field (agricultural field numbered 3-409 in 1951) and a strip of mixed pines bordering Road 2. The section of Field 3-409 contained within this Set-Aside has undergone plant community succession from an herbaceous old-field in 1951 to a present day pine forest habitat. Originally, Field 3-409 was approximately 30 acres (12.1 ha) in total size and last was used to grow watermelons (Odum and Hight, 1957). The margin of the Set-Aside along Road 2 contains older pines which were planted prior to Site acquisition and which are not part of the present day pine-dominated old field. The current Set-Aside Area primarily is a maturing longleaf pine (*Pinus palustris*) community with approximately 1.5 acres (0.6 ha) of open canopy containing forbs and grasses. In addition, a small patch of mixed pine/hardwoods is located within this Area. Field 3-409 is located on dry, sandy soils similar to those in portions of the Loblolly Pine Stand Set-Aside (Field 9-111 within Area No. 4), unlike the more fertile soils of Field 3-412 in the Ellenton Bay Set-Aside Area (Area No. 1). Historical literature (Cross, 1956; Odum, 1960) describes these old-field soils as being the deep sands of the Lakeland series, like those of the nearby Sandhills Set-Aside. However, Rogers (1990) classified the majority of the soils of this Area as being in the Troup series. The 0.7-mile (1.0 km) boundary line of this Area is marked with white painted blazes on trees and with metal DOE Research Set-Aside Area signs.

WHAT THIS SET-ASIDE REPRESENTS:

The Field 3-409 Set-Aside represents an abandoned, old-field community that has undergone natural succession for 46 years and presently is a mixed pine, open forest. A remnant old-field portion remains, with annual needle grass (*Aristida tuberculosa*) in the understory. Because this site is on a different soil type than Field 3-412, it provides an important comparison for long-term studies of community successional processes. Although this particular field once was dominated primarily by herbaceous vegetation, today it primarily is a natural pine forest. Prior to this Area being established as a Set-Aside, it inadvertently was subjected to a prescribed burn, with fire breaks plowed through the Area. Another disturbance was an experimental manipulation where there was an isolated, small-scale removal of volunteer slash pine saplings (*P. elliottii*) in an attempt to maintain a segment of the original old-field conditions (J. Pinder pers. comm.). Nonetheless, this Set-Aside was included in the Set-Aside Program because of its associated historical research and because it serves as a replicate to the old-field studies conducted in Fields 9-111 and 3-412.

HISTORY:

Prior to establishment of the SRS in 1951, this Set-Aside was used for agriculture and timber production, as were surrounding lands. A homestead was located on the northern edge of the Area. The margin of pines bordering Road 2 dates to 1930, with the remainder of the pines being volunteer invaders. While the majority of

Table 28-1. Vegetation communities of the Field 3-409 Set-Aside Area.

Community Type	Total Acres	Total Hectares	%
Longleaf Pine	12.59	5.10	88.54%
Mixed Pine/Hardwood	0.19	0.08	1.34%
Forb/Grassland	1.44	0.58	10.13%
Totals:	14.22	5.75	100.00%

the SRS was being reforested to pine by the SRFS the 1950's, Field 3-409 was one of the original old-fields selected by research ecologists for studies of plant succession and thus was not replanted.

Set-Aside Plant Community Composition:

This Set-Aside is comprised of three plant community types. Maturing pines dominate this Area, making up 88.5% of the vegetation. The majority of these pines are longleaf, but loblolly (*P. taeda*) and slash pine also have become established in this old-field. The mixed pine/hardwood patch is 1.3% of the Area and the remnant old-field (forb/grassland) is 10.1% (Table 28-1). The margin of pines that borders the original old-field dates to 1930 (SRFS CISC stand database).

Sensitive Flora and Fauna:

There have been no sensitive flora or fauna documented from this Area.

Set-Aside Soils:

Field 3-409 is composed of four soil series. They range from the somewhat excessively drained sandy loams to the well-drained fine loams. These include the Blanton sand (1.2%), Fuquay sand (2.2%), and Orangeburg loamy sand (9.4%). Troup sands comprise the majority of the Area's soils (87.3%; Table 28-2). See Fig. 28-1 for soil mapping of this Set-Aside and Appendix 3 for a description of soils.

Research Associated With This Set-Aside:

Research conducted in this Set-Aside dates back to the 1950's, when emphasis was on studies of the development of plant community structure Odum (1960), nutrient dynamics Odum *et al.* (1984), and use of old-fields by orthopterans (Cross, 1956), harvester ants (Golley and Gentry, 1964; Van Pelt, 1966; Gentry and Stiritz, 1972), birds (Johnston 1956; Odum and Hight, 1957), and field mice (Davenport, 1960, 1964). Odum (1960) observed the general patterns of succession on 600 reference fields; measurements of productivity and soil characteristics were made on thirty of these study fields. These fields represented the eight major agriculture soil series. More intensive research was conducted on two study fields which represented two of the major soils and the two physiographic subregions of the SRS—Field 3-409 and Field 3-412. The more recent study of Odum *et al.* (1984) examined the status of soil nutrients in Field 3-409 since the cessation of farming. Early researchers studying orthopteran insects continue to publish their findings on this old-field community (Cross *et al.*, 1997). To date, there are 18 publications and reports associated with this Set-Aside.

Historical/Current/Future Influences:

This Set-Aside was established without a significant buffer and recent expansion of B Area has encroached on this Area, resulting in fragmentation of the northern portion. Research

Table 28-2. Soils of the Field 3-409 Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Blanton sand, 0-6% slopes	BaB	0.17	0.07	1.18%
Fuquay sand, 2-6% slopes	FuB	0.31	0.12	2.15%
Orangeburg loamy sand, 0-2% slopes	OrA	1.34	0.54	9.40%
Troup sand, 0-6% slopes	TrB	12.41	5.02	87.27%
Totals:		14.22	5.75	100.00%

manipulations in the form of pine sapling removal were done on a small scale in the 1980's in an attempt to preserve the old-field, open canopy characteristics. This vegetation removal was conducted adjacent to the remnant patches of old-field habitat. Prescribed fire inadvertently was allowed into this Area in 1986 and plowed firebreaks were cut through the Set-Aside.

SRS Patrol Index: G-9

Site-Use Permits:

Experiment No. 1201 (1959-indefinite) Life history study of southern harvester ant; Gentry; SREL.

SU-78-29-R Ecological studies of harvester ants in old field habitats; Gentry; SREL.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

Publications and Reports:

Cross, W.H. 1956. The arthropod component of old field succession: Herb stratum population with special emphasis on the Orthoptera. Ph.D. Dissertation, University of Georgia, Athens. 127 p.

Cross, W.H., W.M. Cross, P.R. Jackson, P.M. Dixon, and J.E. Pinder, III. 1997. Corresponding development of plant and phytophagous orthopteran communities during southeastern old-field succession. Amer. Midl. Nat. 137:188-193. SREL Reprint # 2145.

Davenport, L.B., Jr. 1960. Structure and energy requirements of *Peromyscus polionotus* populations in the old-field ecosystem. Ph.D. Dissertation, University of Georgia.

Davenport, L.B., Jr. 1964. Structure of two *Peromyscus polionotus* populations in old-field ecosystems at the AEC Savannah River Plant. J. Mamm. 45:95-113. SREL Reprint # 46.

Gentry, J.B. and K.L. Stiriz. 1972. The role of the Florida harvester ant, *Pogonomyrmex badius*, in old field mineral nutrient relationships. Environmental Entomology 1:39-41. SREL Reprint # 290.

Golley, F.B. and J.B. Gentry. 1964. Bioenergetics of the southern harvester ant, *Pogonomyrmex badius*. Ecology 45:217-225. SREL Reprint # 50.

Johnston, D.W. 1956. A preliminary study of subspecies of Savannah Sparrows at the Savannah River Plant, South Carolina. Auk 73:454-456. SREL Reprint # 5.

Langley, T.M. and W.L. Marter. 1973. The Savannah River Plant Site. Publication DP-1323, Savannah River Laboratory, E.I. duPont de Nemours and Co., Aiken, SC.

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Odum, E.P., C.E. Connell, and L.B. Davenport. 1962. Population energy flow of three primary consumer components of old-field ecosystems. Ecology 43:88-96. SREL Reprint # 30.

Odum, E.P. and G.L. Hight. 1957. The use of mist nets in population studies of winter fringillids on the AEC Savannah River Area. Bird Banding 28:203-213. SREL Reprint # 9.

Odum, E.P., J.E. Pinder, III, and T.A. Christiansen. 1984. Nutrient losses from sandy soils during old-field succession. Am. Midl. Nat. 111:148-154. SREL Reprint # 884.

Rogers, V. 1990. Soil Survey of the Savannah River Plant Area, Parts of Aiken, Barnwell, and Allendale Counties, South Carolina. A publication of the U.S. Department of Agriculture-Soil Conservation Service. 127 pp.

Van Pelt, A.F. 1966. Activity and density of old-field ants of the Savannah River Plant, South Carolina. J. Elisha Mitchell Sci. Soc. 82:35-43. SREL Reprint # 103.

Van Pelt, A. and J.B. Gentry. 1985. The Ants (Hymenoptera: Formicidae) of the Savannah River Plant, South Carolina. Publication of the Savannah River National Environmental Research Park Program. SR-NERP-14. Aiken, SC. 56 p.

Weiner J.G. and M.H. Smith. 1981. Studies of the aquatic and terrestrial environments of the Savannah River Plant, South Carolina: A Bibliography. A Publication of the Savannah River National Environmental Research Park Program. SR-NERP-7. Aiken, SC. 131 p.

Workman, S.W. and K.W. McLeod. 1990. Vegetation of the Savannah River Site: Major community types. Publication of the Savannah River National Environmental Research Park Program. SRO-NERP-19. Aiken, SC.

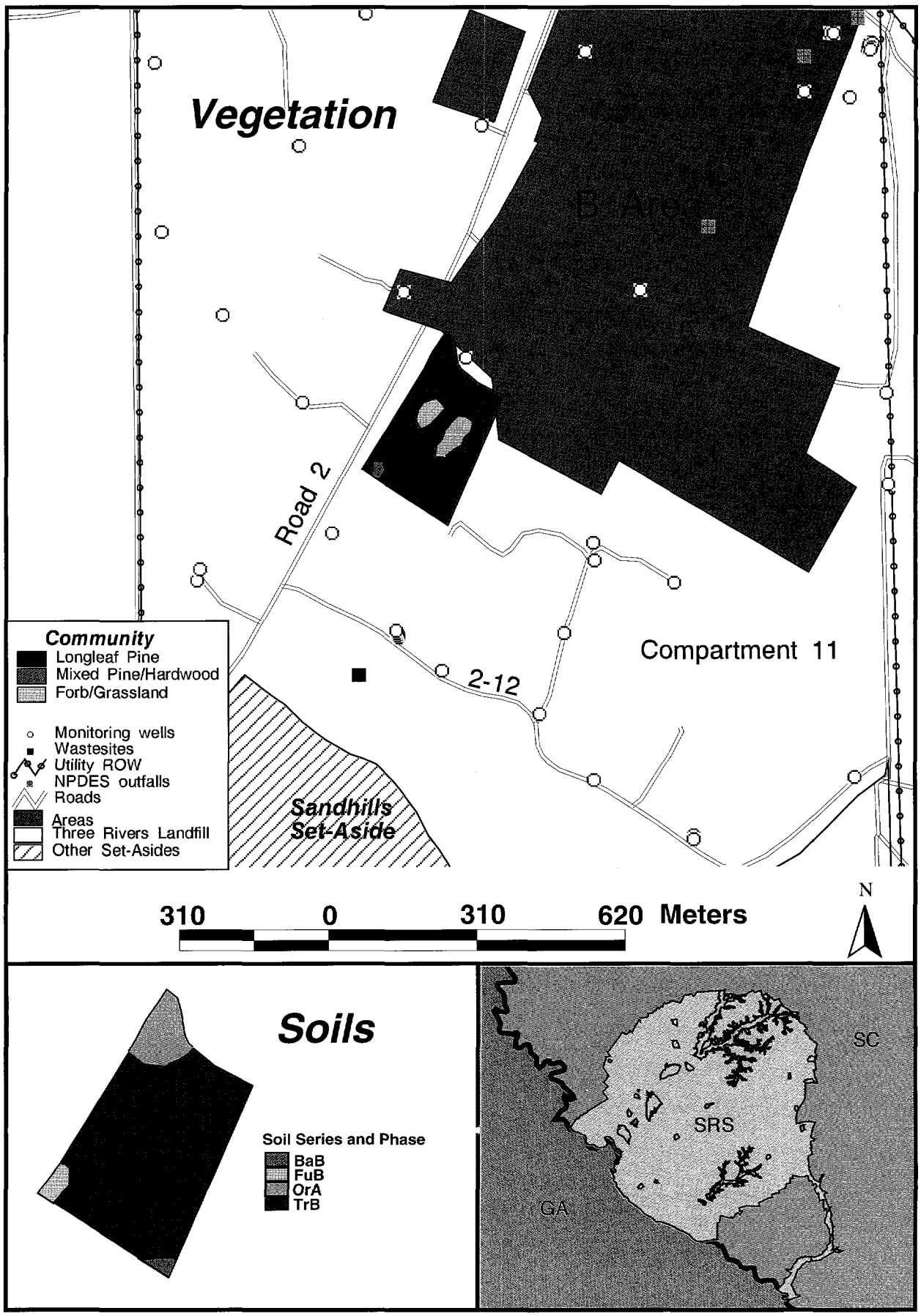

Figure 28-1. *Plant communities and soils associated with the Field 3-409 Set-Aside Area.*

AREA NO. 29
SCRUB OAK NATURAL AREA

SET-ASIDE LOCATION ON THE SRS:

The Scrub Oak Natural Area is located in the northeast quadrant of the SRS, northwest of the Aiken/Barnwell County line in the Aiken Plateau (Langley and Marter, 1973; Figs. 2 and 29-1). Found in timber compartment 28, this Area is bordered by Tinker Creek on the north, ascends a mesic hardwood slope to the top of a sand ridge, crosses Road 8.11, and is bordered on the south by SRS Road 8.11.

SET-ASIDE DESCRIPTION:

The Scrub Oak Natural Area was registered in 1968 with the Society of American Foresters (SAF) national system of Natural Areas. It is one of two SAF Natural Areas on the SRS that were added to the Set-Aside program in 1989, the other being the Boiling Springs Natural Area (Area No. 18). The Scrub Oak Natural Area is 53.5 acres (21.7 ha) in size and has a perimeter boundary of 1.4 miles (2.25 km), with a portion of that boundary being shared with the E. P. Odum Wetland Set-Aside (Area No. 30).

This mixed-species sandhills habitat is situated on infertile, poor-to-marginally productive soils, a habitat type that once was common to the Aiken Plateau as well as the SRS. However, forest type conversion to longleaf pine plantations has reduced this community type to isolated patches within the SRS landscape. Estimates of the amount of this habitat type remaining on the SRS range from 750+ acres (303+ ha; SRFS CISC database) to approximately 1,970 acres (800 ha; Workman and McLeod, 1990). Fortunately, this area is bordered on the east by approximately 170 acres (68.8 ha) of similar scrub oak habitat in which there is extensive on-going ecological research. Because this Natural Area had been established prior to being included in the SRS Set-Aside Program and some remnant painted boundary markings remained, no specific criteria were required to determine the Set-Aside boundary line. The boundary now is posted with metal DOE Research Set-Aside Area signs and there are Natural Area signs that mark the boundary crossing and the southern corners of the Area on Road 8.11.

WHAT THIS SET-ASIDE REPRESENTS:

Representative of the sandhills turkey oak/ longleaf pine community type suited to the deep, xeric sands of the Aiken Plateau, this Set-Aside serves as an excellent example of the scrub oak/ longleaf pine ecosystem, undisturbed for the last 81 years. It complements the Sandhills Set-Aside (Area No. 3) and was established to replicate this community type within the Set-Aside Program. In addition, the Scrub Oak Natural Area and the Sandhills Fire Site (Area No. 26) serve as replicate areas for studies on the effects of fire and soil properties on productivity and wildlife use of sandhills communities on the SRS.

HISTORY:

Prior to acquisition of the site by the AEC in 1951, agriculture and timber production were the primary land-uses within and surrounding this Set-Aside. It appears that these marginal, well-drained soils on the top of the sand ridge either had been abandoned for agricultural use in the early 1900's or had undergone logging prior to that time. The oldest age class for the present overstory vegetation in this Area is 81 years old (SRFS CISC database). In 1973, the South Carolina Wildlife and Marine Resource's Heritage Trust Program (now the SCDNR) inventoried the Scrub Oak Natural Area as part of a Smithsonian Coastal Plain Theme Study. In 1989, SREL established four test sampling plots in the scrub oak/longleaf pine portion of this Set-Aside for inventory purposes and to represent

Table 29-1. Vegetation communities of the Scrub Oak Natural Area.

Community Type	Total Acres	Total Hectares	%
Mixed Pine/Hardwood	6.39	2.59	11.94%
Upland Hardwood	7.63	3.09	14.25%
Bottomland Hardwood	2.60	1.05	4.86%
Water	3.01	1.22	5.62%
Sandhill Scrub Oak/Pine	17.07	6.91	31.89%
Sandhill Pine/Scrub Oak Forest	16.83	6.81	31.44%
Totals:	53.53	21.66	100.00%

the range of plant species types and densities found in this Area.

Set-Aside Plant Community Composition:

Three major plant community types comprise this Set-Aside: sandhills or upland scrub oak/ longleaf pine (63.3%), upland hardwood (14.3%), and mixed hardwood/pine (12%). A small area of bottomland/marsh type (4.9%) is present, and Kennedy's Pond (water) accounts for approximately 5.6% of the area (Table 29-1). Dominant canopy species of this Set-Aside are post oak (*Quercus stellata*), turkey oak (*Q. laevis*), scrub post oak (*Q. margaretta*), blue jack oak (*Q. incana*), longleaf pine (*Pinus palustris*), and loblolly pine (*P. taeda*; Ed Berg pers. com.).

Sensitive Flora and Fauna:

There are no known sensitive flora or fauna documented from this Set-Aside (Tables 3 and 4). However, a population of the plant Nestronia (*N. umbellula*) is adjacent to the western boundary (Fig. 29-1). One of the colony sites for the endangered Red-cockaded Woodpecker (RCW; *Picoides borealis*) also is adjacent to the Scrub Oak Natural Area.

Set-Aside Soils:

Soils of the Scrub Oak Natural Area are predominantly of the excessively well-drained Lakeland and Troup series (89%), while a few acres in the abandoned Kennedy's Pond of Tinker Creek are classified as hydric Fluvaquents (10.5%; Table 29-2). See Fig. 29-1 for soil mapping of the Set-Aside and Appendix 3 for a description of soils.

Research Associated With This Set-Aside:

In addition to the historical inventories conducted in this Set-Aside mentioned above, a recent survey of ground dwelling spiders has been conducted. To date, 7 publications and reports can be associated with this Set-Aside.

Historical/Current/Future Influences:

At this time, the significance of an area being registered as an SAF Natural Area on the SRS is unclear in terms of future management and research possibilities. At the national level, the SAF Natural Areas program is in a state of uncertainty, with oversight being deferred to the state in which the Natural Area is located (Greg Smith, SAF pers. comm.). Activities occurring

Table 29-2. Soils of the Scrub Oak Natural Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Fluvaquents, frequently flooded	Fa	5.58	2.26	10.42%
Lakeland sand, 0-6% slopes	LaB	21.23	8.59	39.65%
Troup sand, 0-6% slopes	TrB	20.96	8.48	39.16%
Troup sand, 6-10% slopes	TrC	5.61	2.27	10.48%
Vaucluse-Ailey complex, 6-10% slopes	VeC	0.14	0.06	0.26%
Williman sand	Wm	0.02	0.01	0.03%
Totals:		53.53	21.67	100.00%

adjacent to this Set-Aside include RCW habitat manipulations with fire and herbicides, aquatic studies in the Kennedy Pond area of Tinker Creek, and a study of the population genetic structure of turkey oaks (see SU-89-82-R). A small section in the southwest corner of this Natural Area accidentally was treated with herbicides by the SRFS when conducting RCW habitat treatments; consequently, this portion of the Natural Area was not included in the Set-Aside Program.

SRS Patrol Indexes: K-28 L-28

Site-Use Permits:

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-89-82-R Population genetic structure of turkey oak (*Quercus laevis*); Berg and Sharitz; SREL.

SU-96-03-R Ecology and life history variation of ground-dwelling spiders; Taylor and Draney; SREL.

Publications and Reports:

Golley, F.B., J.B. Gentry, L.D. Caldwell, and L.B. Davenport, Jr. 1965. Number and variety of small mammals on the AEC Savannah River Plant. J. Mamm. 46:1. SREL Reprint # 67.

Jenkins, J.E. and E. E. Provost. 1964. The population status of the larger vertebrates on the A.E.C. Savannah River Plant Site. USAEC report TID-19562, Oak Ridge National Laboratory, Oak Ridge, Tenn.

Langley, T.M. and W.L. Marter. 1973. The Savannah River Plant Site. Publication DP-1323. Savannah River Laboratory. E.I. duPont de Nemours and Co. Aiken, SC.

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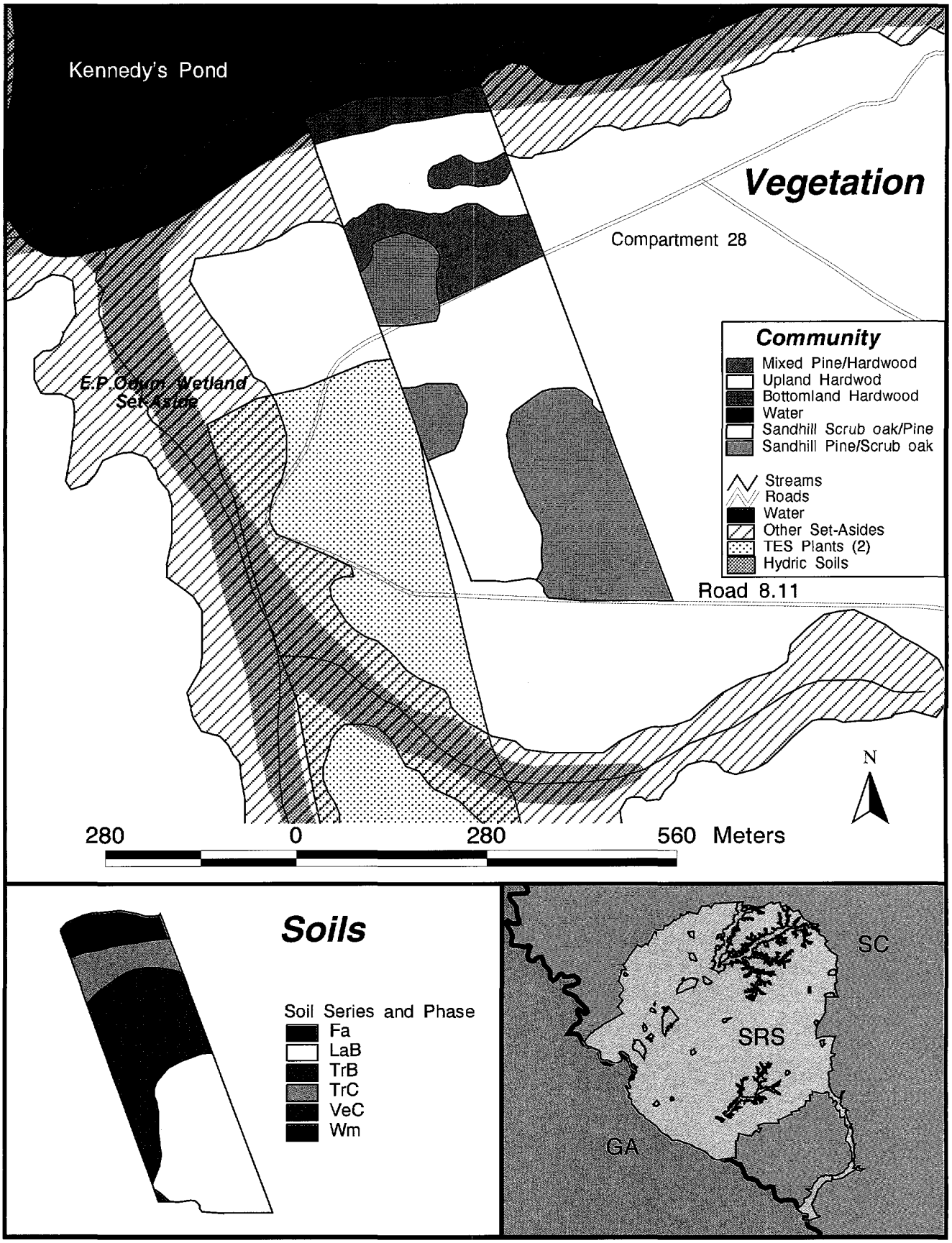

Figure 29-1. *Plant communities and soils associated with the Scrub Oak Natural Area.*

Area No. 30
E. P. Odum Wetland
Upper Three Runs Creek/Tinker Creek Drainages

Set-Aside Location on the SRS:

Located in Aiken and Barnwell Counties, the E. P. Odum Wetland Set-Aside Area (Region 1 of the Upper Three Runs Creek/Tinker Creek drainages), arises from and drains the sandhills of the Aiken Plateau from the north central portion of the SRS where Upper Three Runs and Tinker Creeks converge, to where these two creeks and their tributaries enter the Site boundary at five different locations (Langley and Marter, 1973; Figs. 2 and 30-2).

Set-Aside Description:

Upper Three Runs Creek (UTRC) is a relatively non-impacted, fifth order stream with the largest watershed of any SRS stream; UTRC is the only stream system on the SRS that originates outside of SRS boundaries. Known as "Region 1" of the Upper Three Runs Creek /Tinker Creek drainage, this Set-Aside Area specifically is defined within the confines of the SRS boundary as Upper Three Runs Creek and its tributaries upstream of the confluence of Tinker Creek, to include Tinker Creek and its tributaries from the upstream bank of McQueen Branch to the source of Tinker Creek at the Site boundary. Tinker Creek, a third order tributary to UTRC, has two major tributaries of its own—Reedy Branch and Mill Creek; however those portions of the Mill Creek drainage above SRS Road 8-8.3 and closest to the R Area seepage basin were not included in the Set-Aside. This Set-Aside originally was named the Upper Three Runs Creek/Tinker Creek Set-Aside but was renamed the E. P. Odum Wetland Set-Aside Area in 1995.

As the keystone of DOE's Research Set-Aside Areas on the SRS, the E. P. Odum Wetland is the largest, with a total area of 7,362 acres (2,979 ha). Its perimeter boundary length totals 166.8 miles (268.4 km). This Set-Aside makes up portions of 15 SRFS timber resource compartments: compartments 18, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 33, 51, 52, and 53. The boundaries of this Set-Aside were delineated and marked to include UTRC, Tinker Creek, all associated tributaries, their associated 100-year floodplains and hydric soils, and the most erodible adjacent slopes (15% or steeper slopes). Five criteria were developed by SREL and SRFS for delineating boundary lines to buffer this Set-Aside. These criteria include creeks and floodplains, tributaries, soils, adjacent slopes and erosive gullies, and vegetation. A detailed explanation of the field criteria used to establish boundary lines for this area is available in Appendix 4. Boundaries were posted on trees with white painted blazes for certain sections and with metal DOE Research Set-Aside Area signs for the remaining sections. This Set-Aside shares common boundaries with the Oak Hickory Forest #1 and #2 Set-Asides (Areas No. 5 and 12, respectively) and with the Scrub Oak Natural Area (Area No. 29). The Loblolly Pine Stand Set-Aside (Area No. 4) is adjacent at the Site boundary (Fig. 30-2).

Upper Three Runs and Tinker Creeks are low gradient, blackwater streams which have shifting, sandy substrates. Their waters are a dark tea color from the tannic acids that leach from dissolved organic matter (leaf litter/woody debris) found in the stream. These waters are derived primarily from underground, spring-fed sources (Dublin-Midville aquifer system) which makes them different from the other SRS streams. These subsurface sources feed the numerous tributaries of these creeks with cold

waters which flow through dense canopied floodplain forests where nutrients are released and cool water temperatures are maintained. The water chemistry of these streams is characterized by low conductivity, low hardness, and low pH values. These creek systems are capable of maintaining low levels of disturbance during flooding events and, as a result, a high diversity of in-stream habitat types such as debris dams and rooted macrophytes are found throughout the creek channels. Morse *et al.* (1980), Specht (1987), Floyd *et al.* (1993), and Wike *et al.* (1994) provide additional descriptive material for UTRC. The Comprehensive Cooling Water Study (Newman, 1986) provides detailed descriptions of UTRC's physical characteristics and general water chemistry.

Numerous on-site secondary road crossings are found throughout this Set-Aside, as well as two state highway crossings (SC Hwy 278), Aiken County dirt road 781.4, five active utility rights-of-way (ROW), and an abandoned utility ROW. The closest on-site industrial complexes to the E. P. Odum Wetland are S and Z Areas, the Advanced Tactical Training Area (ATTA) range, and R Area. The Cedar Creek residential development and golf course are located off-site on an upstream tributary of UTRC and there are a number of farm ponds located on Tinker Creek, upstream of the Site boundary. There are four permitted stormwater discharge outfalls within proximity of the UTRC/Tinker Creek drainages (US-1, US-3, GA-1, and GA-3). Currently there is only one U.S. Geological Survey (USGS) monitoring station within this reach of UTRC; this station monitors for stream flow.

What This Set-Aside Represents:

As a Set-Aside, the UTRC and Tinker Creek drainages and their associated riparian corridors represent a relatively non-impacted, integrated stream ecosystem. As with Meyers Branch of the Ruth Patrick-Meyers Branch Set-Aside (Area No. 11), these streams are typical of coastal plain blackwater systems in that they are low gradient, exhibit a sandy substrate, and are heavily canopied with well developed riparian vegetation (Fig. 30-1). Unlike the other major SRS drainages, this portion of the Upper Three Runs Creek system has not received any thermal or chemical discharges from SRS operations, making the UTRC aquatic ecosystem extremely valuable from both resource and research perspectives. UTRC is known internationally in the scientific community as an outstanding biological resource. This riverine ecosystem has one of the most species-rich assemblages of aquatic insects in North America, if not in the world. Aquatic entomologists characterize the uniqueness of its aquatic fauna as astounding (Morse, 1981). More than 575 species of aquatic insects have been documented to inhabit these streams, including several rare and unusual species, some of which are found nowhere else in the world (Morse *et al.*, 1980, 1983; Floyd *et al.*, 1993). This high species diversity makes UTRC second only to southern Germany's Breitenback Creek in numbers of aquatic insect species recorded. There likely are a number of factors attributing to this high diversity of aquatic insects in UTRC, but the primary factors include a stable flow rate and cooler than normal ambient water temperatures. The cooler than normal water temperatures allow typically more northern and mountain species of aquatic fauna to coexist with endemic southern species. Because the headwaters of UTRC and Tinker Creek are spring-fed and primarily forested, these creeks have stable flow rates; in terms of flow predictability, UTRC ranks a "close second" of all the 57 streams in the USGS National Hydrologic Bench-Mark Stream network (Morse pers.com.; Poff and Ward, 1989). UTRC was a USGS Bench-Mark stream from 1967 to 1993; this status was terminated due to development in the drainage north of the SRS boundary.

Upper Three Runs Creek is toxicologically the most sensitive stream on the SRS, making it ideal for studies on the applicability of EPA criteria to SRS streams (McCort and Wein, 1988) and it has been suggested for use as a standard reference for other streams in the upper Coastal Plain (Morse *et al.*, 1980). The protected status

of Region 1 of UTRC and Tinker Creeks may allow these streams to serve as refugia for aquatic insect recolonization. These streams also could prove useful in system comparisons for both Site and regional biomonitoring. For all of these reasons, the Upper Three Runs/Tinker Creek area is considered by scientists as an outstanding example of an unpolluted, sandhills riverine system.

Since the establishment of the SRS, the Site's overall management policy has considered Upper Three Runs Creek as a "control" stream which should receive as little impact from SRS operations as possible. The establishment of the Region 1 section of UTRC as a formal Set-Aside Area was done primarily for the on-site protection and preservation of the hydrologic conditions of the Upper Three Runs and Tinker Creek watersheds. DOE's purpose in establishing this Set-Aside was twofold: it is a reference/control system for operational or energy related ecological research and it serves to facilitate DOE's need for basic ecological research on stream chemistry and the associated diversity of flora and fauna. It is DOE's stated goal that no wastewater effluents be discharged into this Set-Aside Area and that this region be reserved for research purposes (DOE-SROO Stream Management Policy--Upper Three Runs, 09/11/95).

Protection of the floodplain and slopes of UTRC and Tinker Creek will maintain the system's integrity as well as provide a continuum of floral and faunal species extending from the stream through the bottomland hardwood and riparian zones to the upland terrestrial areas. Since becoming a Set-Aside, all forest management activities have ceased within this Area.

History:

While it is incorrect to call UTRC a "pristine" stream, the present high quality of UTRC and Tinker Creek is due largely to DOE's continuing commitment to maintain these creeks as the Site's control streams. Since development of the SRS began in 1951, the only Site facility to be developed within the Region 1 portion of this watershed was the ATTA range and only limited timber removal has occurred within this Set-Aside. However, prior to establishment of the SRS, this drainage experienced pronounced anthropogenic impacts which date back to the Paleo-Indian environs (ca. 12,000 BP). Prehistoric use of prescribed fire and the cultivation of alluvial terraces would have resulted in ecological disturbances to the drainage. Historically (1750-1950), the practices of farming, timbering, raising livestock, and millpond construction within the drainage no doubt had substantial impacts on the natural flora, fauna, and hydrology of these streams. Both prehistoric and historic impacts have been well documented (Sassaman *et al.,* 1990, Stephenson *et al.,* 1993, and Browder *et al.*, 1993).

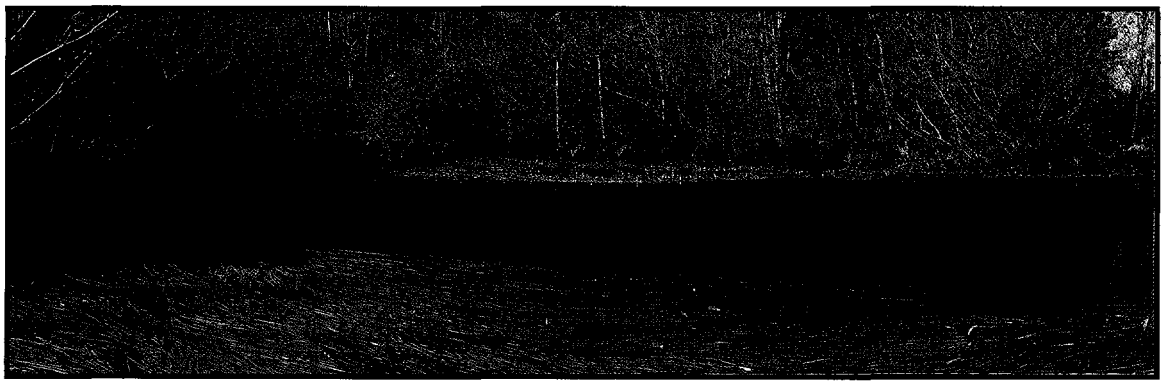

Figure 30-1. *Macrophyte beds typical of the upper reaches of Upper Three Runs Creek.*

Table 30-1. Vegetation communities of the E. P. Odum Wetland Set-Aside

Community Type	Total Acres	Total Hectares	%
Loblolly Pine	588.04	237.98	7.99%
Longleaf Pine	1.04	0.42	0.01%
Slash Pine	2.10	0.85	0.03%
Mixed Pine/Hardwood	1,272.00	514.79	17.28%
Upland Hardwood	755.97	305.95	10.27%
Bottomland Hardwood	3,220.61	1,303.40	43.75%
Water	165.90	67.14	2.25%
Bottomland Hardwood/Pine	1,269.82	513.90	17.25%
Forb/Grassland	30.89	12.50	0.42%
Other—Disturbed Area	55.50	22.46	0.75%
Totals:	7,361.87	2,979.39	100.00%

Set-Aside Plant Community Composition:

This Set-Aside is represented by four different plant communities: 8% of the Set-Aside is in pine, 17% in mixed pine/hardwood, 10% in upland hardwood, and 61% in bottomland hardwood and mixed bottomland hardwood/ pine. Roads, railroads, utility ROWs, and water account for the remaining 3+% of the Set-Aside (Table 30-1). Fig. 30-2 displays an interpretation of the various vegetation community types that comprise this Set-Aside. The ages for the dominant vegetation in the drainage range from 3 to 109 years old (SRFS CISC database). Vegetation plot data from Good (1981), Whipple *et al.* (1981), and Jones *et al.* (1994) indicate that the predominant hardwood communities in this region of UTRC range from the drier mixed hardwood (*Carya tomentosa-Quercus alba*) communities on slopes adjacent to the floodplain, to the mesic black gum-red bay (*Nyssa sylvatica-Persea borbonia*) communities in the seldom-flooded portions of the floodplain to the more flooded areas of black gum-red maple (*Nyssa sylvatica-Acer rubrum*) communities. These communities usually are dominated by a mixture of sweet gum (*Liquidambar styraciflua*), yellow-poplar (*Liriodendron tulipifera*), oaks (*Quercus* spp.), and loblolly pine (*Pinus taeda*). Dense stands of alder (*Alnus perrulata*) are common on the banks of UTRC and Tinker Creek. The percentages of upland hardwood in this Set-Aside are low because the Oak-Hickory Forest Set-Asides (Areas No. 5 and 12) share common boundaries with Area No. 30 and account for this community. The majority of the vegetation surrounding this Set-Aside is in pine plantation. A number of beaver ponds have been established in the drainage; no beaver trapping is allowed in this Set-Aside. Hunting and trapping of nuisance feral hogs is allowed in the drainages primarily for control purposes, as this introduced species causes damage to commercial pine plantations and is an intense competitor with native wildlife for mast. Deer and hog herd control is accomplished by public hunts.

Sensitive Flora and Fauna:

The bottomland wetland and riparian environments of the E. P. Odum Wetland Set-

Aside are as important as the streams themselves. Within the floodplain and adjacent steep slopes, eight plant species are found that are listed on federal and/or South Carolina lists of species of special status (Table 3). These include the sandhill seedbox (*Nolina georgiana*), milk pea (*Astragalus villosus*), bog spice bush (*Lindera subcoriacea*), Nestronia (*Nestronia umbellula*), green fringed orchid (*Platanther lacera*), Oconee azalea (*Rhododendron flammeum*), spathulate seedbox (*Ludwigia spatulata*), and Chapman's sedge (*Carex chapmanii*). Sensitive plant surveys now are conducted on a compartment-by-compartment basis by the SRFS to locate populations of sensitive plants. Initial sensitive plant surveys were conducted by SREL in the mid 1980's (Knox and Sharitz, 1990). See Hyatt (1994) for specific species listed by the SRFS.

Active colonies of the federally endangered red-cockaded woodpecker (*Picoides borealis*) are located in proximity to Tinker Creek but at present no known colonies are located in this Set-Aside. Rare fresh water mussels such as the Mill Creek Elliptio (*Elliptio hepatica*) and the red mucket mussel (*Lampsilis radiata splendida*) occur in the Upper Three Runs Creek system (Table 4). These freshwater mussels are valuable as biological indicators of environmental pollutants (Davis and Mulvey, 1993). The queen snake (*Regina septemvittata*) has been documented to occur only in this Set-Aside on the SRS (Gibbons per. comm.) River otters (*Lutra canadensis*) and bobcats (*Lynx rufus*) have been sited in this Area and American alligators (*Alligator mississippiensis*) are known to inhabit UTRC.

Set-Aside Soils:

There are 36 different soil series and phases associated with the E. P. Odum Wetland Set-Aside Area (Table 30-2). Soils vary from the uplands Blanton-Lakeland associations, which are excessively drained, to the Troup-Pickney-Lucy associations, which are well-drained to poorly drained, to the very poorly drained soils of the bottomland. These poorly drained, hydric soils associated with stream floodplain and terraces include the Dorovan, Eunola, Fluvaquents, Hornville, Ochlockonee, Ogeechee, Pickney, Smithboro, and Williman series. These wetland soils account for approximately 58% of the soils in this Set-Aside. The steep slopes with Troup and Lucy sands are well-drained soils found on the southeast banks of UTRC and Tinker Creek; they account for approximately 12% of the Set-Aside drainage. See Fig. 30-3 for soils mapping of the Set-Aside and Appendix 3 for a description of soils.

Research Associated With This Set-Aside:

On both regional and global scales, the water quality and chemistry of these streams is uncommon and worthy of focus. As a research area, this Set-Aside offers opportunities to expand a body of ecological knowledge on soft blackwater stream systems. The primary focus of this Set-Aside has been and continues to be ecological research associated with stream systems that exhibit high water quality.

An extensive sampling program for aquatic insects has been conducted by Morse *et al.* (1980, 1983) since 1976 and, more recently, by Floyd *et al.* (1993). Although scientists have documented more than 575 species of aquatic insects in this Set-Aside, this figure does not include other species of invertebrates. Some estimates range from 650-700 species when round worms, crayfish, and other large crustaceans and mussels are included.

Many long-term research studies continue to be conducted in this Set-Aside. To date, over 100 scientific articles, theses, dissertations, and reports have been published on this Set-Aside. Some of the research studies conducted in this Set-Aside include:

- inventories of aquatic macroinvertebrate communities;
- studies of fish community structure and movement patterns;

Table 30-2. Soils of the E. P. Odum Wetland Set-Aside Area.

Soil Description	Soil Symbol	Total Acres	Total Hectares	%
Ailey sand, 2-6% slopes	AeB	8.82	3.57	0.12%
Albany loamy sand, 0-6% slopes	AnB	190.07	76.92	2.58%
Blanton sand, 0-6% slopes	BaB	221.99	89.84	3.02%
Blanton sand, 6-10% slopes	BaC	347.77	140.75	4.72%
Dorovan muck, frequently flooded	Da	359.95	145.67	4.89%
Dothan sand, 2-6% slopes	DoB	17.48	7.08	0.24%
Eunola fine sandy loam, 0-2% slopes	EnA	95.94	38.83	1.30%
Fluvaquents, frequently flooded	Fa	936.76	379.11	12.72%
Fuquay sand, 0-2% slopes	FuA	8.16	3.30	0.11%
Fuquay sand, 2-6% slopes	FuB	125.66	50.86	1.71%
Fuquay sand, 6-10% slopes	FuC	29.86	12.08	0.41%
Hornsville fine sandy loam, 0-2% slopes	HoA	59.86	24.23	0.81%
Lakeland sand, 0-6% slopes	LaB	59.99	24.28	0.81%
Lakeland sand, 6-10% slopes	LaC	25.06	10.14	0.34%
Lucy sand, 2-6% slopes	LuB	4.71	1.90	0.06%
Lucy sand, 6-10% slopes	LuC	23.41	9.47	0.32%
Norfolk loamy sand, 2-6% slopes	NoB	2.00	0.81	0.03%
Ochlockonee loamy sand, occasionally flooded	Oa	0.43	0.17	0.01%
Ocilla loamy sand, 0-2% slopes	OcA	51.24	20.74	0.70%
Ogeechee sandy loam, ponded	Og	96.96	39.24	1.32%
Orangeburg loamy sand, 0-2% slopes	OrA	0.85	0.34	0.01%
Orangeburg loamy sand, 2-6% slopes	OrB	2.22	0.90	0.03%
Orangeburg loamy sand, 6-10% slope	OrC	9.11	3.69	0.12%
Pickney sand, frequently flooded	Pk	2,457.23	994.46	33.38%
Rembert sandy loam	Rm	46.20	18.70	0.63%
Smithboro loam	Sm	8.88	3.59	0.12%
Troup sand, 0-6% slopes	TrB	107.18	43.37	1.46%
Troup sand, 6-10% slopes	TrC	131.29	53.13	1.78%
Troup sand, 10-15% slopes	TrD	232.59	94.13	3.16%
Troup & Lucy sands, 15-25% slopes	TuE	559.62	226.48	7.60%
Troup & Lucy sands, 25-40% slopes	TuF	298.35	120.74	4.05%
Vaucluse sandy loam, 2-6% slopes	VaB	6.19	2.51	0.08%
Vaucluse-Ailey complex, 6-10% slopes	VeC	281.22	113.81	3.82%
Vaucluse-Ailey complex, 10-15% slopes	VeD	359.89	145.65	4.89%
Wagram sand, 2-6% slopes	WaB	7.07	2.86	0.10%
Williman sand	Wm	187.05	75.70	2.54%
Water	W	0.63	0.26	0.01%
Totals:		7,361.69	2,979.32	100.00%

- soft mast inventories;
- migratory bird surveys;
- breeding bird censuses;
- coarse woody debris studies;
- Mill Creek watershed studies;
- forest dynamics studies ;
- studies of small mammal populations;
- Wood Duck nesting studies;
- studies of biological and chemical cycling of stream elements;
- investigations of seasonal fluctuations of soil acids;
- studies of carbon transport from upland and bottomland soils;
- archaeological investigations;
- stream microbial studies;
- movement patterns of brown water snakes.

The water quality of UTRC (at SC Hwy 278) has been monitored by the WSRC Environmental Monitoring Section since 1973. In 1990, this sampling location was moved approximately one mile downstream to provide a better indication of contaminants in UTRC which are originating north of the SRS (Wike *et al.*, 1994). Monthly sampling for physical and biological water quality parameters and metals is conducted. Water samples also are collected quarterly and analyzed for pesticides, herbicides, and PCBs (L. Eldridge pers. comm.). The annual SRS environmental reports contain these water quality monitoring data.

Historical/Current/Future Influences:

Protection Concerns

Because this Set-Aside drains such a large area and the watershed originates off-site and enters the SRS at various locations, the potential exists for negative impacts to this Set-Aside from off-site pollutants due to agricultural runoff, residential development, or industrialization of the watershed. Circumstantial evidence indicates that negative impacts to the stream are occurring as a result of the cumulative effects of non-point source pollutants from off-site (W. Specht pers. comm.). Wike *et al.* (1994) reported a general decline in the mean number of macroinvertebrate taxa per monitoring station in 1990 as a result of unknown perturbation(s). While these monitoring stations were downstream of Region 1, it was suggested that possible perturbations

Aquatic Insects in Upper Three Runs Creek

More than 575 species of insects that live in or near the water have been found in Upper Three Runs Creek or its tributaries. These include:

Mayflies — **Order Ephemeroptera**
- ◊ ***4 species documented from nowhere else in the world***

Stoneflies — **Order Plecoptera**
- ◊ ***8 species documented from nowhere else in South Carolina***

Dobsonflies — **Order Megaloptera**
- ◊ ***1 species documented from nowhere else in South Carolina***

Caddisflies — **Order Trichoptera**
- ◊ ***8 species documented from nowhere else in the world***
- ◊ ***1 species documented from nowhere else in South Carolina***

Beetles — **Order Coleptera**
- ◊ ***5 species documented from nowhere else in South Carolina***

Midge Flies — **Order Diptera**
- ◊ ***62 species documented from nowhere else in South Carolina***

might include toxic inputs to UTRC from areas upstream of the SRS.

In addition, potential on-site negative impacts could result from siltation runoff from the ATTA range into the Reedy Branch system. This runoff problem currently is being addressed by the NRCS and the SRFS. The potential also exists for lead contamination to enter this wetland from the adjacent ATTA firing range. Other potential negative impacts to this Area could result from development of the Accelerator Production of Tritium (APT) project if that mission comes to the SRS. Also, off-site state highways and county roads, periodic chemical treatments to Site boundary and internal perimeter fencelines, SRS road and bridge maintenance (e.g., runoff deposition at Cox Bridge, Tyler Bridge, and Beaufort road crossings), and periodic South Carolina Electric and Gas (SCE&G) utility line ROW maintenance could have negative influences on this Set-Aside.

Education:

SREL has located a conference and educational center adjacent to this Set-Aside in the vicinity of Phelps Pond, north of S.C. Highway 278. This facility was sited at this location in part to enhance the development of education/outreach programs highlighting studies of the biota of the Upper Three Runs Creek floodplain, as well as to use the 68-acre (27.5 ha) property as a model for developing natural vegetation habitats. A low-impact nature trail will be developed to provide access to UTRC. Future development of this property should not pose any threat to this Set-Aside but rather should enhance the adjacent habitat since one goal of this project is to re-establish the natural vegetation best suited to the area. In addition, the SRFS has developed both a nature trail and a board walk for educational purposes in this Set-Aside for use by school groups participating in studies of wetland habitats associated with beaver activities.

SRS Patrol Indexes: **C**-23; **D**-22,23; **E**-19, 20,21,22,23,24,25; **F**-18,19,20,21, 22, 23, 24, 25; **G**-17,18,19,21,22,23,24,26,27; **H**-17,18, 19,20,21,22,23,24,25,26,27; **I**-19, 20,21,22, 23,24,25,26,27,28; **J**-19,20,21 ,22,23,24,25, 26,27,28; **K**-19,20,21,22,23,24, 25,26,27,28; **L**-18,19,20,21,22,23,24,25,26, 27,28; **M**-18,19,20,21; **N**-18

Site-Use Permits:

Experiment No. 1214 and 1215 (1968-1979) Removal trapping of small mammals; Smith and Gentry; SREL.

Experiment No. 1254 (1973-indefinite) Effects of reactor effluents on plant communities; Sharitz; SREL.

Experiment No. 1264 (1973-1974) Sampling of dragonfly nymph populations; Gentry and Smith; SREL.

SU-75-04-R Biological and chemical cycling of elements in streams; Smith and Geisy; SREL.

SU-76-79-R Sampling of dragonfly nymph populations; Gentry and Smith; SREL.

SU-76-95-R Continuation of dye study in plant streams and swamps; Kiser; WSRC-SRTC.

SU-76-100-R SREL Wood duck Nest Box Study; Brisbin; SREL.

SU-77-28-R Install 40 wood duck nest boxes; Roth; SRFS.

SU-77-41-R Species assessments in selected habitats; Gibbons; SREL.

SU-77-56-R Vertebrate assessment of selected aquatic habitats; Gibbons; SREL.

SU-77-67-R Demography of lizard populations; Gibbons; SREL.

SU-78-14-R Silvicultural biomass energy farm; Fege; DOE.

SU-78-48-R Ecology and management of Red-Cockaded woodpecker; Gibbons and Jackson; SREL and Mississippi State University.

SU-78-64-R Archeological excavations at Tinker Creek; Hanson; SCIAA.

SU-78-74-R Forest mapping; Mcleod; SREL.

SU-78-76-R Leaf litter decomposition responses to dissolved organic nitrogen in a blackwater stream Geisey and Allred; SREL.

SU-79-84-R Forest mapping; McLeod; SREL.

SU-80-20-R Microcosm study of macroinvertebrates on leaf litter; Mayack and Thorp; SREL.

SU-80-43-O Environmental monitoring on Upper Three Runs Creek; Rabon; WSRC.

SU-82-43-O Selective trapping of beaver; Gaines; SRFS.

SU-83-29-R Monitoring water quality; Gibbons; SREL.

SU-83-66-R Aquatic research in Upper Three Runs Creek; Mathews and Morse; WSRC-SRTC.

SU-85-13-R Survey of terrestrial vertebrates; Gibbons and Knight; SREL.

SU-85-28-R Life history and population dynamics of SRP darter; Aho; SREL.

SU-86-35-R Fish community structure and dynamics in natural SRS stream; Meffe; SREL.

SU-86-36-R Population and community dynamics of SRS fishes; Meffe; SREL.

SU-86-41-R Biogeochemical cycling of certain rare enery-related metals; Adriano; SREL.

SU-87-06-R Seasonal fluctuations of phenolic acids in soils; Mills and Dalton; SREL.

SU-87-55-R Fish community structure; Meffe; SREL.

SU-87-58-C Advanced tactical training area (ATTA); Bolton; COE.

SU-87-61-R Energetics of box turtle research; Spotila and Congdon; SREL.

SU-87-63-R Registration of locations of rare or threatened plant populations based upon Federal or state of South Carolina status; Roecker and Dixon; SRFS and SREL.

SU-87-64-R Registration of locations of rare or threatened plant populations based upon state of South Carolina status; Roecker and Sharitz; SRFS and SREL.

SU-88-62-R Fish predation as a determinant of macroinvertebrate biomass and community structure; McArthur and Lovell; SREL.

SU-89-23-O Plantwide SRS dry hydrant systems; Keaton; WSRC.

SU-89-58-R Additional NERP Set-Asides; Janecek and Smith; SREL.

SU-89-69-R Characteristics of carbon transport from upland and bottomland soil into Upper Three Runs Creek; Novak; SREL.

SU-90-35-R Tinker Creek archeological study; Sassamen; SCIAA.

SU-92-13-R Colonization of natural and artificial leaf packs; McArthur and Lindell; SREL.

SU-92-33-R Breeding bird census; Jarvis; SRFS.

SU-92-35-R Environmental toxicology collection of fish; Jagoe; SREL.

SU-92-48-O Geohydrology field training site; Price; WSRC-ESH.

SU-92-53-R Ecosystem response to forest management—timber; McLeod and Imm; SREL.

SU-92-63-R Stream fisheries characterization study; Paller; WSRC-SRTC.

SU-92-72-R Background wetlands soil study; Rogers; WCRS-SRTC.

SU-93-17-O Maintenance of site utility right-of-ways; McCormick; WSRC-F&S.

SU-93-08-R Life history and dispersal patterns of the southern flying squirrel; Chesser and Rhodes; SREL.

SU-93-19-R Aquatic insect research; McArthur and Voelz; SREL.

SU-93-21-R Invertebrate research in sandy bottom streams; McArthur and Voelz; SREL.

SU-93-32-R Migrating birds in hardwood forests; Blake; SRFS.

SU-93-48-F, Amendments 1-2 NREEP education and outreach nature trails; Blake and Graves; SRFS and USC-Aiken.

SU-94-19-R Sampling for volatile organic compounds; K. Dixon; SRTC/WSRC.

SU-94-61-O Investigations of aerial gamma anomalies; M. Denham; SRTC-WSRC.

SU-95-03-F Decomposition of coarse woody debris by site class and species; Blake and McMinn; SRFS and SEFES.

SU-96-43-F. The role of fleshy fruit production, consumption, and seed dispersal on promoting biological diversity; Blake, Levey, and Greenburg; SRFS, Univ. Florida, and SFES.

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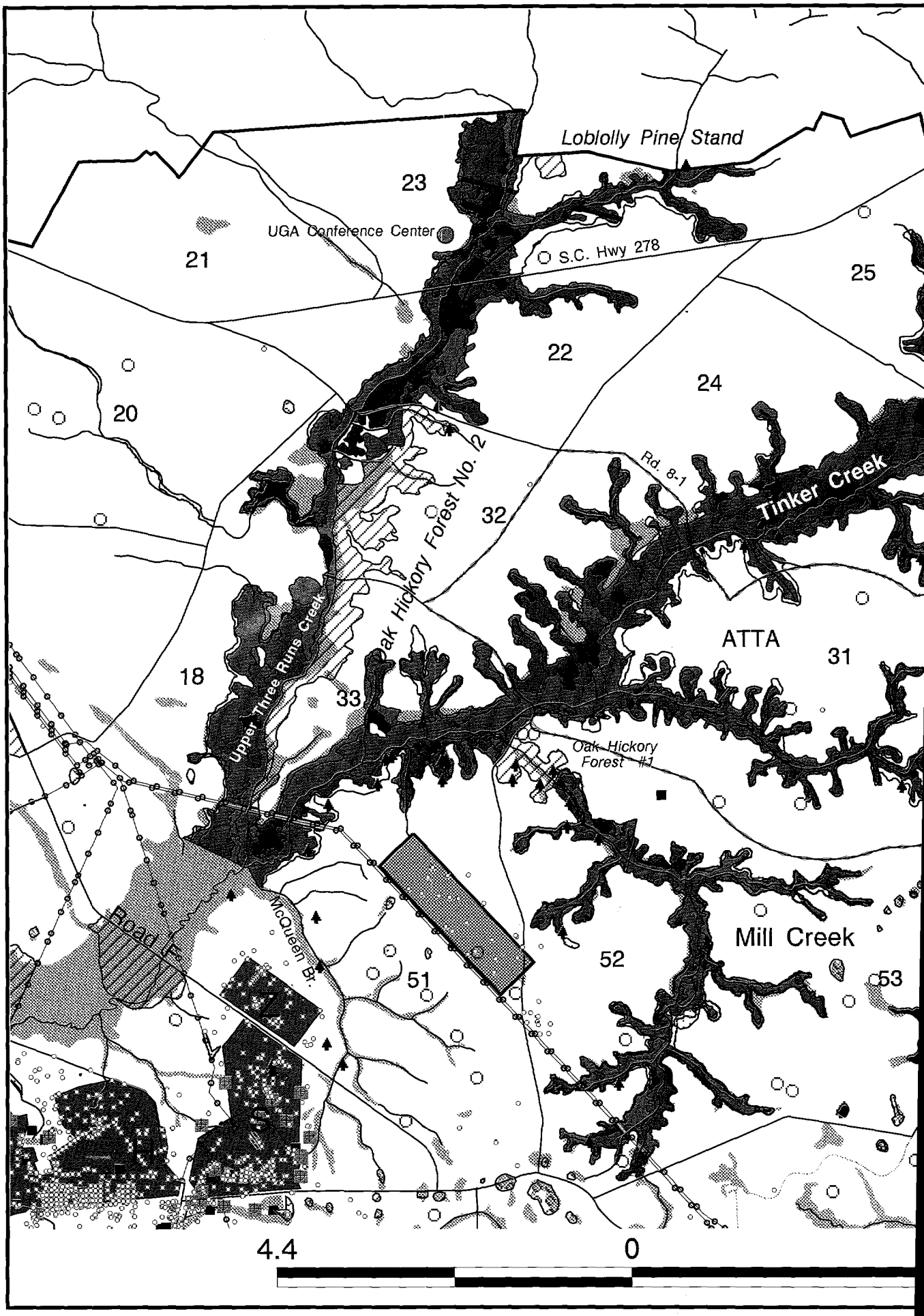
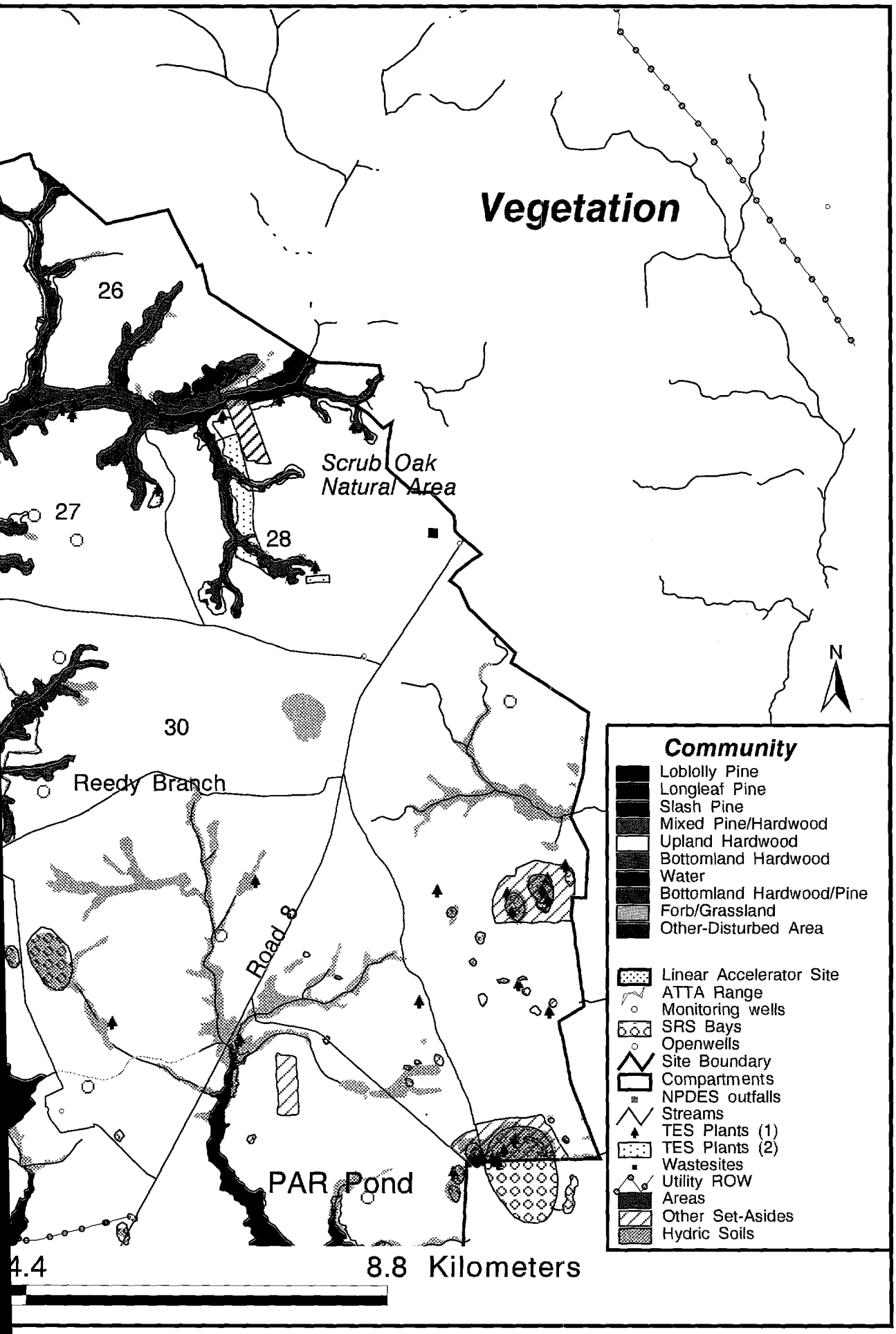


Figure 30-2. *Plant communities associated with the E. P. Odum Wetland Set-Aside Area.*


Vegetation
26
27
28
30
Scrub Oak
Natural Area
Reedy Branch
Road 8
PAR Pond
N
Community
Loblolly Pine
Longleaf Pine
Slash Pine
Mixed Pine/Hardwood
Upland Hardwood
Bottomland Hardwood
Water
Bottomland Hardwood/Pine
Forb/Grassland
Other-Disturbed Area
Linear Accelerator Site
ATTA Range
Monitoring wells
SRS Bays
Openwells
Site Boundary
Compartments
NPDES outfalls
Streams
TES Plants (1)
TES Plants (2)
Wastesites
Utility ROW
Areas
Other Set-Asides
Hydric Soils
4.4
8.8 Kilometers

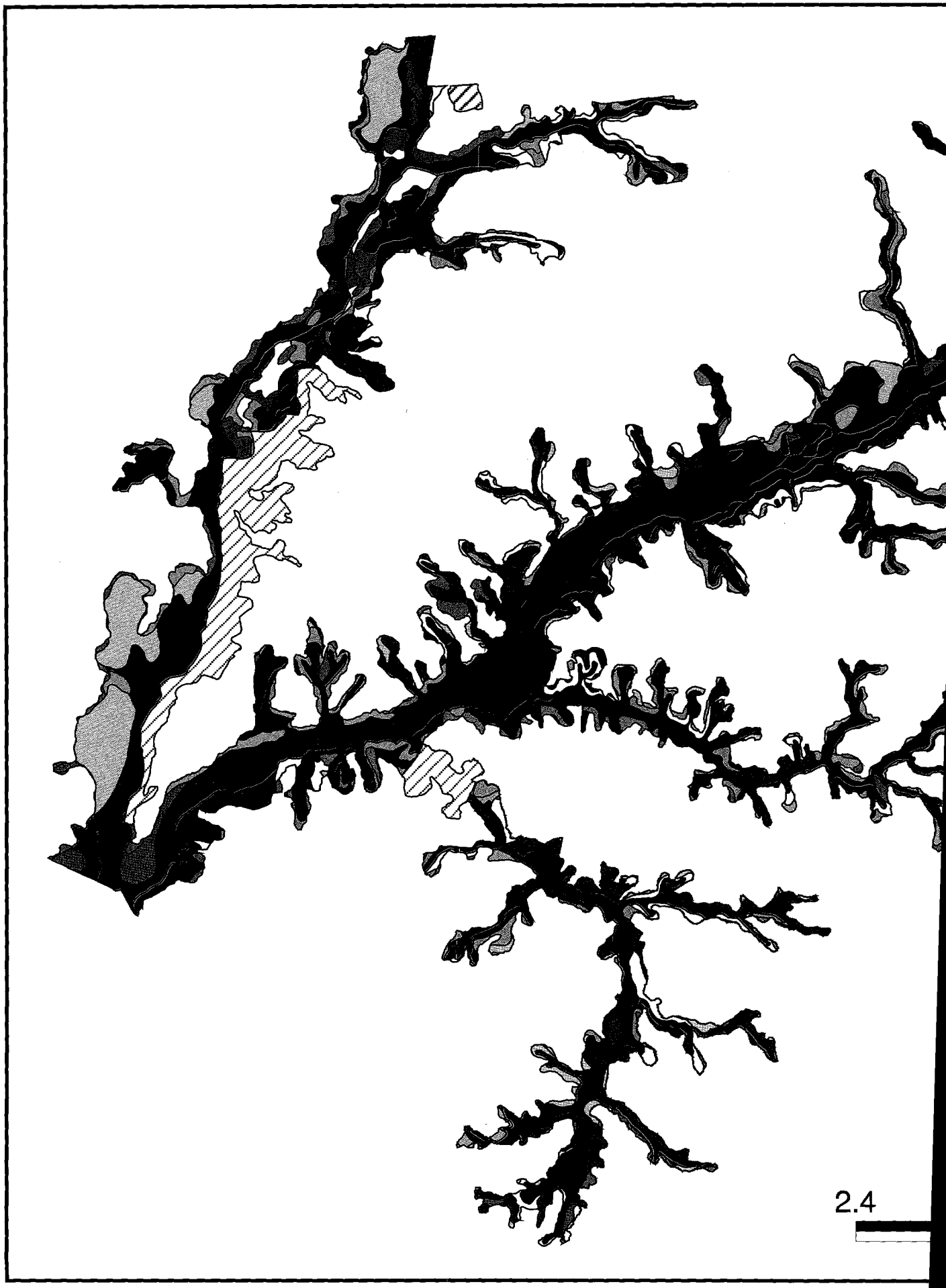
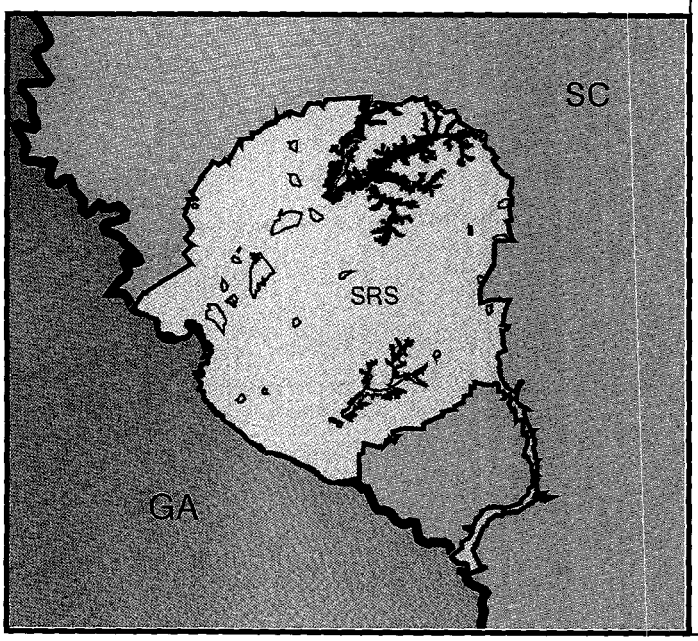


Figure 30-3. *Soils associated with the E. P. Odum Wetland Set-Aside Area.*

Soils



Soil Series and Phase

- AeB
- AnB
- BaB
- BaC
- Da
- DoB
- EnA
- Fa
- FuA
- FuB
- FuC
- HoA
- LaB
- LaC
- LuB
- LuC
- NoB
- Oa
- OcA
- Og
- OrA
- OrB
- OrC
- Pk
- Rm
- Sm
- TrB
- TrC
- TrD
- TuE
- TuF
- VaB
- VeC
- VeD
- W
- WaB
- Wm

0 2.4 4.8 Kilometers

N

APPENDIX 1

SAVANNAH RIVER SITE
SET-ASIDE TASK GROUP CHARTER

Statement of Purpose

The Savannah River Site (SRS) Set-Aside Task Group has been established to provide a forum for discussing and resolving issues related to the SRS Set-Aside Program and to assist DOE in the management of the resources of the SRS in an environmentally sound manner. The Group will provide technical advice to the U.S. Department of Energy Savannah River Field Office/Environmental Division (DOE-SR/ED) for the Site's Set-Aside Program.

Membership

U.S. Department of Energy, Savannah River Field Office (DOE-SR)/Environmental Division
DOE-SR/Site Use Coordinator
Westinghouse Savannah River Company-Savannah River Technology Center (WSRC-SRTC)
WSRC-Environmental Protection Department
South Carolina Wildlife and Marine Resources Department (SCWMRD)
Savannah River Ecology Laboratory (SREL)
U.S. Forest Service-Savannah River Forest Station (USFS-SRFS)

Objectives

The Set-Aside Task Group objectives consist of the following:

- Resolution of conflicts as outlined in "Set-Aside Protection and Management at the Savannah River Site"
- Exchange information and familiarize SRS organizations with issues related to the SRS Set-Aside Program
- Ensure that the Set-Aside Program meets the objectives in "Set-Aside Protection and Management at the Savannah River Site"
- Provide technical advice to DOE-SR/ED, the Natural Resources Coordinating Committee (NRCC), and Site contractors on issues related to the Set-Aside Program
- Coordinate the Set-Aside Program with the SRS mission
- Address short and long-term effects of research and management options on the Set-Aside Program

Chairperson

SREL as lead organization will provide the Task Group Chairperson. The Set-Aside Task Group chairperson will be responsible for the following:

- Calling all meetings, establishing agendas, and facilitating activities related to the Set-Aside Task Group
- Ensuring arrangements are made for meeting space and materials
- Coordinating the development and implementation of the SRS Set-Aside Program
- Submitting reports of the Set-Aside Task Group activities and recommendations to the NRCC, DOE-SR/ED and other Site organizations

Meetings

The Set-Aside Task Group will meet on a quarterly basis or as needed. The frequency of meetings will periodically be reviewed and may be revised based on the working experience of the Group.

The activities of the Set-Aside Task Group will be documented in meeting notes to be recorded and distributed upon approval by the committee and DOE-SR/ED to the members and Site organizations.

Charter Review

This charter shall be reviewed by members of the Set-Aside Task Group in conjunction with the NRCC and may be revised after a 1-year period based on working experience.

Effective Date

This charter will be effective when signed by the following parties and will remain in effect until further review.

Agreed to on this date:

Carl L. Strojan — July 28, 1992

C. L. Strojan, Chairperson
Set-Aside Task Group

Date

A.B. Gould — 7/28/92

A.B. Gould, Chairperson
Natural Resources Coordinating Committee

Date

APPENDIX 2

Set-Aside Protection and Management at the Savannah River Site

Background

U.S. Department of Energy (DOE) Order 4300.lB ("Real Property Management"), dated 7-1-87, states that "suitable" DOE property may be "designated as a national environmental research park" and may be "...set aside for the exclusive use of nonmanipulative research for definite or indefinite periods of time." The Savannah River Site (SRS) was designated the nation's first National Environmental Research Park (NERP) in 1972. The NERP program is dedicated to the study of the interaction of man-managed environments with natural systems. In accordance with the NERP philosophy, Set-Aside areas have been created on the SRS. These areas were defmed by the Set-Aside Review Committee in 1986 as "those areas that are placed in a protected status by virtue of their unique features or representative nature and in which active or passive research may be conducted." Set-Aside areas provide researchers with representative natural areas, unaffected by site operations or management, that can be compared to man-managed areas. As such, the protection and management philosophy of Set-Aside areas should include the following:

- Set-Aside areas are for research, not for intensive management objectives.
- Set-Aside areas should receive as little management as possible.
- Set-Aside areas should be protected to remain as natural as possible with little or no human influence.
- Set-Aside areas are primarily for non-manipulative research. No research should be conducted on a Set-Aside area that would alter the long-term value of the Set-Aside.

Policy Goals

The Savannah River Ecology Laboratory (SREL) is charged with developing and implementing a Set-Aside research and management program under the administrative responsibility of the U.S. Department of Energy-Savannah River Field Office, Environmental and Laboratory Programs Division (DOE-SR/E&LPD). As of May 14, 1992, 29 areas totalling 1 1,445 acres have been designated Set-Asides under the Savannah River Site (SRS) National Environmental Research Park (NERP) Set-Aside program. These areas have been permanently set aside for the purpose of ecological study because they: (1) contain unique communities of plants and animals worthy of preservation, or (2) represent excellent examples of indigenous ecological communities, such as Carolina bays and scrub oak forests. Because these Set-Aside areas are protected from public intrusion, they provide SRS scientists with opportunities to conduct long-term ecological research in virtually-undisturbed natural areas.

A Set-Aside Task Group has been established under the auspices of the Natural Resources Coordinating Committee. This Set-Aside Task Group is responsible for: (1) evaluating potential Set-Aside areas and recommending to the NRCC that they be set aside; (2) promoting information exchange between parties so conflicts that arise over research and management proposed for Set-
Asides may be resolved; and (3) recommending any policies or procedures developed for identifying, monitoring, protecting, or managing Set-Asides.

Program Objectives

- SREL will maintain an accurate and readily-accessible inventory of Set-Aside areas to ensure that these areas are not inadvertently included in Site Use activities that are contrary to the policy goals outlined above.

- SREL, in cooperation with SRFS, will ensure that all Set-Aside boundaries are clearly marked and that these boundary markings are periodically refurbished, preferably on a cycle of 7 years or less.

- The Set-Aside Task Group will promote Site-wide awareness of the significance of these Set-Asides: the goals will be to make all individuals whose activities might impact Set-Asides aware of the importance of these areas and to make the boundary markings instantly recognizable to these individuals.

- SRFS will control wildfires in Set-Asides with the same procedures and methods that are used in the general forest area.

- SRFS will conduct ground and aerial surveillance of Set-Asides as needed to monitor for presence of forest pests, nuisance animals (e.g., feral hogs and beaver), and plant diseases. SREL and SRFS will cooperate to treat and protect these areas from nuisance animal, insect, and disease problems unless specifically in conflict with research objectives.

- Deer and feral hog hunts will be permitted in Set-Asides unless they specifically conflict with research objectives or jeopardize threatened, endangered, or rare species.

- SRFS will carry out prescribed burning of Set-Asides at the request of SREL to control fuel buildup, prevent excessive wildfire damage, or, when appropriate, to improve habitat of threatened and endangered species. Prescribed burning will be conducted only when it is compatible with research objectives.

- Any use of herbicides or mechanical vegetation control on transmission line rights-of-way (or elsewhere) in Set-Asides proposed through the Site Use System will require review and approval by the Set-Aside Task Group.

- Arterial secondary roads and woods roads that have more than a single function (i.e., that serve SRS needs other than research) will receive normal maintenance by SRFS. SREL and the SRFS will coordinate the management (maintenance or closure) of woods roads specifically serving Set-Aside areas.

- SRFS, in cooperation with SREL, will coordinate timber salvage operations (if mutually agreed upon) in Set-Aside areas in the event of disease or insect infestations, fires, or other natural "disasters."

- SRFS, in cooperation with SREL and the U.S. Department of Agriculture, Soil Conservation Service, will implement essential erosion control measures in Set-Aside areas.

Strategies and Standards

- Management activities that serve to protect habitat for threatened and endangered species as required by the Endangered Species Act will take priority over all other activities.

- Protection of wetlands will be taken into consideration when planning or implementing any Set-Aside research activities or management policies. Secretary of Energy Watkins issued a memorandum on June 12, 1989 endorsing President Bush's commitment to "no net loss" of wetlands and pledging DOE's support of this goal.

- When extensive lowland or wetland Set-Aside areas (e.g., Upper Three Runs Creek Set-Aside) lie adjacent to upland timber stands, SRFS and SREL will cooperate to minimize the need to plow fire lines around the perimeter of the Set-Aside.

- SREL will verify Set-Aside boundaries using Global Positioning System equipment and create a Geographic Information System layer indicating these updated and verified boundaries.

- SREL will maintain a file on each Set-Aside containing all pertinent maps, aerial photographs, and biological surveys.

- All research planned for Set-Asides will be coordinated with SREL and will require submission and approval of an SR-88 Application & Permit for Site Use.

Conflict Resolution

- Should conflicts arise over the appropriate research or management strategy for a particular Set-Aside, the SREL and other appropriate Set-Aside Task Group representatives will meet and attempt to arrive at a solution that is acceptable to all concerned parties.

- Should SREL and the other Set-Aside Task Group representatives be unable to reach a resolution, the matter will be brought to the attention of the Set-Aside Task Group.

- Should the Set-Aside Task Group be unable to reach an acceptable compromise on an issue, the matter will be brought before the Natural Resources Coordinating Committee for resolution.

Chairperson, Set-Aside Task Group — Date: 3 May 1993

Concur:

Chairperson, Natural Resources Coordinating Committee — Date: 5 May '93

APPENDIX 3

CLASSIFICATION AND DESCRIPTION OF SET-ASIDE AREA SOILS

Soil series descriptions taken from:

Rogers, V. 1990. Soil Survey of the Savannah River Plant Area, Parts of Aiken, Barnwell, and Allendale Counties, South Carolina. A publication of the U.S. Department of Agriculture-Soil Conservation Service. 127 pp.

Ailey Series (Ae)

The Ailey series consists of well-drained, slowly permeable soils that formed in thick beds of unconsolidated sandy and clayey material in the Sand Hills. These soils are on long, narrow ridgetops and short, complex hill slopes. Slopes range from 2-15%. Ailey soils are classified as loamy, siliceous, thermic Arenic Hapludults.

Albany Series (An)

The Albany series consists of somewhat poorly drained, moderately rapidly permeable soils that formed in thick beds of unconsolidated sandy and loamy sediment of the upper Coastal Plain. These soils are on low toe slopes and in nearly level sandy areas that are transitional to more poorly drained soils. Slopes range from 0-6%. Albany soils are classified as loamy, siliceous, thermic Grossarenic Paleudults.

Blanton Series (Ba)

The Blanton series consists of somewhat excessively drained, moderately permeable soils that formed in sandy and loamy sediments of the Coastal Plain and Sand Hills. These soils are on low ridges and side slopes and in broad swales adjacent to the lower side slopes. Slopes range from 0-10%. These soils are classified as loamy, siliceous, thermic Grossarenic Paleudults.

Chastain Series (Ch)

The Chastain series consists of poorly drained, slowly permeable soils that formed in clayey sediment on flood plains of the larger streams, mostly near the Savannah River. The sediment is a mixture of marine and Piedmont soil material. Slopes generally are 0-1%. Chastain soils are classified as fine, mixed, acid, thermic Typic Fluvaquents.

Dorovan Series (Da)

The Dorovan series consists of very poorly drained, moderately permeable soils that formed in organic material near streams of the Coastal Plain. These soils are on the flood plains of major streams and typically are near toe slopes. Slopes are 0-1%. Dorovan soils are classified as dysic, thermic Typic Medisaprists.

Dothan Series (Do)

The Dothan series consists of well-drained, moderately slowly permeable soils that formed in thick beds of unconsolidated sandy and loamy marine sediment. These soils are on broad ridgetops and fairly smooth side slopes of the Coastal Plain and are intermingled with other soils of the Sand Hills. Slopes range from 0-6%. Dothan soils are classified as fine-loamy, siliceous, thermic Plinthic Paleudults.

Eunola Series (Eu)

The Eunola series consists of moderately well-drained, moderately permeable soils that formed in loamy marine deposits of the upper Coastal Plain. These soils are on stream terraces directly above the flood plain. Slopes are 0-2%. Eunola soils are classified as fine-loamy, siliceous, thermic Aquic Hapludults.

Fluvaquents (Fa)

The Fluvaquents consist of poorly drained, moderately permeable soils that formed along the flood plain of small streams and drainageways in sandy sediment of the Coastal Plain and Sand Hills. These soils are in long, narrow, low areas and are frequently flooded. Slopes generally are less than 1%.

Fuquay Series (Fu)

The Fuquay series consists of well-drained, slowly permeable soils that formed in loamy marine sediment on the upper Coastal Plain and the Sand Hills. These soils are on broad ridges and side slopes. Slopes range from 0 -10%. Fuquay soils are classified as loamy, siliceous, thermic Arenic Plinthic Paleudults.

Hornsville Series (Ho)

The Hornsville series consists of moderately well- drained, moderately slowly permeable soils that formed in marine and river deposits on the Coastal Plains. These soils are on broad flats on uplands and low, nearly level ridges on stream terraces and are adjacent to well drained upland soils. Slopes are 0-2%. Hornsville soils are classified as clayey, kaolinitic, thermic Aquic Hapludults.

Lakeland Series (La)

The Lakeland series consists of excessively drained, rapidly permeable soils that formed in sandy marine sediment on the Coastal Plain and in areas intermingled with the Sand Hills. These soils are on broad ridges and side slopes. Slopes range from 0-10%. Lakeland soils are classified as thermic, coated Typic Quartzipsamments.

Lucy Series (Lu)

The Lucy series consists of well-drained, moderately permeable soils that formed in beds of marine sediment on relatively high ridgetops and on side slopes in the Sand Hills and the upper Coastal Plain. Slopes range from 0-40%. Lucy soils are classified as loamy, siliceous, thermic Arenic Paleudults.

Norfolk Series (No)

The Norfolk series consists of well-drained, moderately permeable soils that formed in thick beds of unconsolidated loamy sediment. These soils are on broad ridgetops and smooth side slopes on uplands of the Coastal Plain. Slopes range from 0-6%. Norfolk soils are classified as fine-loamy, siliceous, thermic Typic Paleudults.

Ochlockonee Series (Oa)

The Ochlockonee series consists of well-drained, moderately permeable soils that formed in mostly sandy sediment of the Coastal Plain. These soils are on flood plains and in low areas adjacent to small drainageways that do not have a well defined channel in most areas. They are subject to very brief, occasional flooding during periods of high rainfall. Slopes are less than 2%. Ochlockonee soils are classified as coarse-loamy, siliceous, acid, thermic Typic Udifluvents.

Ocilla Series (Oc)

The Ocilla series consists of somewhat poorly drainged, moderately permeable soils that formed in marine and river deposits on the Coastal Plain. These soils are on low-lying upland flats and low stream terraces and toe slopes. Slopes are 0-2%. Ocilla soils are classified as loamy, siliceous, thermic Aquic Arenic Paleudults.

Ogeechee Series (Og)

The Ogeechee series consists of poorly drained, moderately permeable soils that formed from loamy marine deposits of the Coastal Plain. These soils are mainly in depressions. Slopes are 0-1%. Ogeechee soils are classified as fine-loamy, siliceous, thermic Typic Ochraquults.

Orangeburg Series (Or)

The Orangeburg series consists of well drained, moderately permeable soils that formed in loamy marine sediment on the Coastal Plain. These soils are on broad ridgetops; moderately long, smooth side slopes; and gently rolling breaks below gentle side slopes and nearly level ridgetops. Slopes range from 0-10%. Orangeburg soils are classified as fine-loamy, siliceous, thermic Typic Paleudults.

Pickney Series (Pk)

The Pickney series consists of very poorly drained, rapidly permeable soils that formed in stream sediment. These soils are on the flood plain along major streams, typically in areas where the stream has no well drained channel. Slopes are less than 1%. Pickney soils are classified as sandy, siliceous, thermic Cumulic Humaquepts.

Rembert Series (Rm)

The Rembert series consists of poorly drained, slowly permeable soils that formed in clayey marine deposits. These soils are in depressions

on uplands and along low stream terraces. Slopes are 0-1%. Rembert soils are classified as clayey, kaolinitic, thermic Typic Ochraquults.

Shellbluff Series (Sh)

The Shellbluff series consists of well-drained, moderately permeable soils that formed in loamy sediment on flood plains of the larger streams, mostly near the Savannah River. The sediment is a mixture of marine and Piedmont soil material. These soils are frequently flooded. Slopes are 0 to about 1%. Shellbluff soils are classified as fine-silty, mixed, thermic Fluventic Dystrochrepts.

Smithboro Series (Sm)

The Smithboro series consists of somewhat poorly drained, slowly permeable soils that formed in marine and stream sediments on the Sand Hills, Coastal Plain, and Piedmont. These soils are on upland flats and in stream divides. Slopes are 0-2%. Smithboro soils are classified as clayey, kaolinitic, thermic Aeric Paleaquults.

Tawcaw Series (Ta)

The Tawcaw series consists of somewhat poorly drained, slowly permeable soils that formed in silty and clayey sediment. These soils are on flood plains along the larger streams, mostly near the Savannah River. The sediment is a mixture of marine and Piedmont soil material. These soils are frequently flooded. Slopes are 0-1%. Tawcaw soils are classified as fine, kaolinitic, thermic Fluvaquentic Dystrochrepts.

Troup Series (Tr)

The Troup series consists of well-drained, moderately permeable soils that formed in sandy and loamy sediment of the Coastal Plain and Sand Hills. These soils are on broad, high ridges and long, smooth side slopes. Slopes range from 0-40%. Troup soils are classified as loamy, siliceous, thermic Grossarenic Paleudults.

Udorthents (Ur)

Udorthents consist of mostly well-drained soils that formed in heterogeneous materials, which are the spoil or refuse from excavations and major construction operations. The soil material has been removed, mixed, and moved. It occurs in such irregular patterns on the landscape that classification below the Great Group is not practical.

Vaucluse Series (Va)

The Vaucluse series consists of well-drained, slowly permeable and moderately slowly permeable soils that formed in thick beds of unconsolidated sand and clay of the Sand Hills. These soils are on long, narrow ridgetops and short, complex side slopes. Slopes range from 2-15%. Vaucluse soils are classified as fine-loamy, siliceous, thermic Typic Hapludults.

Wagram Series (Wa)

The Wagram series consists of well-drained, moderately permeable soils that formed in beds of loamy marine sediment. These soils are on relatively broad ridgetops and side slopes of the Coastal Plain. Slopes range from 0-6%. Wagram soils are classified as loamy, siliceous, thermic Arenic Paleudults.

Williman Series (Wm)

The Williman series consists of poorly drained, moderately permeable soils that formed in sandy and loamy marine sediment of the Coastal Plain. These soils are in low, broad, flat areas; in depressions on the uplands; and along some small drainageways. Slopes are less than 2%. Williman soils are classified as loamy, siliceous, thermic Arenic Ochraquults.

Table A3-1. Classification of soils in Set-Aside Areas.

Soil Name	Soil Symbol	Total Acres	Total Hectares	%
Ailey sand, 2-6% slopes	AeB	13.21	5.35	0.09%
Albany loamy sand, 0-6% slopes	AnB	244.91	99.11	1.75%
Blanton sand, 0-6% slopes	BaB	952.91	385.64	6.80%
Blanton sand, 6-10% slopes	BaC	405.76	164.21	2.90%
Chastain clay, frequently flooded	Ch	73.95	29.93	0.53%
Dorovan muck, frequently flooded	Da	410.76	166.24	2.93%
Dothan sand, 0-2% slopes	DoA	73.95	29.93	0.53%
Dothan sand, 2-6% slopes	DoB	177.04	71.65	1.26%
Eunola fine sandy loam, 0-2% slopes	EnA	146.32	59.22	1.04%
Fluvaquents, frequently flooded	Fa	1,634.61	661.53	11.67%
Fuquay sand, 0-2% slopes	FuA	44.33	17.94	0.32%
Fuquay sand, 2-6% slopes	FuB	378.95	153.36	2.71%
Fuquay sand, 6-10% slopes	FuC	30.86	12.49	0.22%
Hornsville fine sandy loam, 0-2% slopes	HoA	78.37	31.71	0.56%
Lakeland sand, 0-6% slopes	LaB	236.53	95.73	1.69%
Lakeland sand, 6-10% slopes	LaC	37.28	15.09	0.27%
Lucy sand, 0-2% slopes	LuA	37.28	15.09	0.27%
Lucy sand, 2-6% slopes	LuB	30.72	12.43	0.22%
Lucy sand, 6-10% slopes	LuC	39.34	15.92	0.28%
Norfolk loamy sand, 0-2% slopes	NoA	0.41	0.16	0.00%
Norfolk loamy sand, 2-6% slopes	NoB	4.07	1.65	0.03%
Ochlockonee loamy sand, occasionally flooded	Oa	6.74	2.73	0.05%
Ocilla loamy sand, 0-2% slopes	OcA	76.72	31.05	0.55%
Ogeechee sandy loam, ponded	Og	307.06	124.27	2.19%
Orangeburg loamy sand, 0-2% slopes	OrA	98.37	39.81	0.70%
Orangeburg loamy sand, 2-6% slopes	OrB	49.67	20.10	0.35%
Orangeburg loamy sand, 6-10% slope	OrC	16.39	6.63	0.12%
Pickney sand, frequently flooded	Pk	4,018.73	1,626.40	28.69%
Rembert sandy loam	Rm	208.24	84.28	1.49%
Shellbluff loam, frequently flooded	Sh	22.75	9.21	0.16%
Smithboro loam	Sm	8.88	3.59	0.06%
Tawcaw silty clay, frequently flooded	Ta	13.31	5.38	0.10%
Troup sand, 0-6% slopes	TrB	437.27	176.96	3.12%
Troup sand, 6-10% slopes	TrC	235.39	95.26	1.68%
Troup sand, 10-15% slopes	TrD	374.73	151.65	2.68%
Troup & Lucy sands, 15-25% slopes	TuE	1004.30	406.44	7.17%
Troup & Lucy sands, 25-40% slopes	TuF	479.75	194.16	3.43%
Udorthents, firm substratum	Ud	0.87	0.35	0.01%
Udorthents, friable substratum	Uo	35.50	14.37	0.25%
Udorthents-urban land complex, gently sloping	Ur	0.03	0.01	0.00%
Vaucluse sandy loam, 2-6% slopes	VaB	9.13	3.69	0.07%
Vaucluse-Ailey complex, 6-10% slopes	VeC	506.69	205.06	3.62%
Vaucluse-Ailey complex, 10-15% slopes	VeD	633.57	256.41	4.52%
Wagram sand, 2-6% slopes	WaB	78.22	31.66	0.56%
Williman sand	Wm	327.14	132.39	2.34%
Water	W	4.13	1.67	0.03%
	Totals:	14,005.10	5,667.93	100.01%

APPENDIX 4

SET-ASIDE BOUNDARY ESTABLISHMENT AND MAINTENANCE

BOUNDARY LINE ESTABLISHMENT

The following assumptions were made when boundary lines were delineated and marked:

- The primary mission of the SRS will receive priority over other land uses.
- Boundary lines do not necessarily reflect ecologically viable units but instead often are based upon preexisting administrative constraints. Consequently, roads, railways, utility rights-of-way, etc. often are coincident with Set-Aside boundaries.
- Disturbance to undeveloped land on the SRS will be minimized.
- Multiple-use land use principles will be stressed.
- Buffer zones will be considered when siting facilities.
- Infrastructure (roads and utilities) in or adjacent to Set-Aside Areas will continue to receive routine, scheduled maintenance. However, conditional constraints apply where appropriate if the potential exists for negative impacts to integrity of the Set-Asides.
- Potential conflicts with Set-Aside boundaries will be triggered through the SRS Site-Use coordination and approval process.
- Archaeological sites were protected, where possible, by inclusion within Set-Aside Areas.
- Set-Aside Areas are withdrawn from routine activities of timber production (including timber harvest and the use of fire, chemicals, and mechanical site preparation) and are not considered as part of the commercial forest of the SRS general site; no forest products will be removed from Set-Aside Areas.
- Newly regenerated pine plantations were excluded from inclusion into boundaried areas., with the exception of buffer zones (where applicable) for Carolina bay Set-Asides.
- No buffer zones will be maintained between Set-Aside boundaries and proposed SRFS forest management activities in adjacent timber stands.
- A vegetated buffer width of one chain (66 ft.) will be maintained by SRFS adjacent to or around streams, creeks, and recognized Carolina bays. Where a buffer was not observed, upsloped lines were established if a slope greater than 14% was present.
- No vegetated buffer will be maintained adjacent to intermittent streams.
- Set-Asides will be protected from prescribed burning within the adjacent commercial forest by plowing fire breaks at Set-Aside boundaries, with Set-Aside No. 30 (UTRC/TC) being excluded from line plowing.
- Harvesting of timber will take place without slope restrictions.
- Upland hardwood and bottomland floodplain forests will continue to be harvested.
- Conversion from mixed species stands to pine plantations will continue.
- Forest and management "typing" for timber stands does not necessarily represent the actual vegetation composition of the stand; such stand typing is for dominant and codominant commercial species.
- Annotated boundary lines on aerial photo overlays are accurate.

Criteria, developed in cooperation with the Savannah River Forest Station (SRFS), were applied when boundary lines were delineated and marked for the Upper Three Runs/Tinker Creek (E.P. Odum Wetland) Set-Aside Area. These criteria addressed creeks and floodplains, tributaries, soils, adjacent slopes and erodible gullies, and vegetation as follows:

- Creeks and floodplains: This included Upper Three Runs Creek, Tinker Creek, Mill Creek, and Reedy Branch, and their 100 year floodplains. In the event the 100 year floodplains of Upper Three Runs and Tinker Creeks did not span a minimum distance of three chains (200 feet; 61 meters) from the creek channel, and if the creek channel abutted a level bluff exhibiting no flooding or ponding influence due either to slope, hill seep, or overbank flooding, then a 200-foot buffer distance was applied.

- Tributaries: This included all named and unnamed tributaries, all perennial and intermittent feeder streams, originating

headwaters, and any free flowing drainage ditches which give alternative and additional alluvial influence to floodplain hydrology. Where slope criterion was not applied, boundary lines were established a minimum distance of one chain (66 ft.) from the tributary or ditch.

- Soils: The SRS Soil Survey was used extensively in evaluating areas for the inclusion of both erosive and hydric soils into the Set-Aside. Hydric soils—those soils associated with floodplain hydrology and exhibiting hydric conditions from flooding, ponding, or slope—were used as a basis for inclusion of areas into the Set-Aside. The soil series included are the Dorovan, Fluvaquents, Ogeechee, Pickney, Rembert, Smithboro, and Williman series. Soils isolated by floodplain soils also were included. Isolated soils in floodplains are the Ailey, Albany, Eunola, and Hornville series.

- Slopes and gullies: Sloping areas adjacent to floodplain and wetland tributaries that exceeded a 14% grade were included in the Set-Aside. Usually, the boundary line bordered on the break between a D and E slope; that is, a 10-15% slope and a 15-25% slope, respectively. Some areas on less than a 15% slope that exhibited erosive gullies from historical pre-site agricultural and logging practices also were included.

- Vegetation: Hydrophytic vegetation with wetland indicator status of obligate wetland, facultative wetland, or facultative groupings, was evaluated to determine wetland boundaries and soil types when slope criterion did not apply. Transitional vegetation communities showing a diverse species mixture typically found on mesic slopes were included into the Set-Aside. Plantation pines were not included and Set-Aside boundary lines usually were delineated by these stands.

Similar criteria were used for the establishment of boundaries for the Ruth Patrick (Meyers Branch) Set-Aside, with the inclusion of any upland hardwood communities associated with the drainage. All other Set-Aside boundary lines were dtermined based upon 1986 aerial photos with boundary lines drawn on laminant overlays.

Boundary Line Maintenance

As custodian of the Set-Asides, SREL oversees the implementation of the SRS Set-Aside Management and Protection Plan. This plan states that SREL, in cooperation with SRFS, will ensure that boundaries are clearly marked and that markings are periodically refurbished, preferably on a cycle of seven years or less. This will be accomplished both by implementing a routine boundary monitoring program and by conducting line inspections on a case by case basis. The boundary monitoring program ensures that boundary lines for **all** Set-Asides will be inspected and refurbished within the seven year cycle. As a standard measure, a minimum of 40 miles of line and at least four Set-Aside Areas will be monitored for boundary refurbishment each year. On a case by case basis, when there is proposed activity or land use adjacent to a Set-Aside boundary, that boundary line will be field checked and upgraded to ensure that it is clearly marked to reduce the possibility of negative impacts to the Set-Aside Area from proposed adjacent activities. In the case of a catastrophic event impacting a Set-Aside boundary line, the SRFS will notify SREL of the location of the impacted area. In addition, a case by case assessment is necessary for the E. P. Odum Wetland (Upper Three Runs/Tinker Creek) and the Ruth Patrick (Meyers Branch) Set-Asides due to their lengthy boundaries. Because the first 80 miles (128 km) of Set-Aside boundary line initially were flagged and then marked with white painted blazes, SREL will establish as a first priority the refurbishment of these lines with posted signs.

As the custodial organization, SREL owns the Site-Use permits for Set-Aside boundaries (SU-79-74-R and SU-89-58-R). Through the Site-Use Coordination and Approval Program and the established procedures of DOE-SR orders DII43 0x.1 Draft, any potential interference or encroachment on Set-Aside area boundaries will be evaluated by SREL's Set-Aside Coordinator. Any proposed activity to be conducted in a Set-Aside, whether educational instruction, or SRS operational facility maintenance, which has the potential for impacts into or upon a Set-Aside area, or any research associated with a Set-Aside, must have an approved Site-Use Permit. If a Site-Use permit is requested by SREL to conduct research, an Environmental Evaluation Checklist will accompany the approved Site Use permit.

A log book will be maintained in the office of the Set-Aside Research Coordinator to record the following information: (a) the Site-Use Permit number, title, and the organizational activity that may impact Set-Aside boundaries, and (b) SREL comments to the Site-Use Permit application as part of the Site-Use coordination review process.

APPENDIX 5
GIS COVERAGES USED

Coverage Name: AREAS
Description: Industrial areas of the SRS. No metadata currently is available.
Administrator: Michelle W. Davalos, SRFS-GIS.
Figure legend name: Areas

Coverage Name: BOUNDARIES
Description: Administrative and political boundaries such as SRS, county, state, etc.
Administrator: Don Coulter, SRFS-Engineering.
Figure legend name: Site

Coverage Name: BUILDINGS
Description: SRS buildings, along with limited off-site buildings.
Administrator: Michelle W. Davalos, SRFS-GIS.
Figure legend name: Buildings

Coverage Name: COUNTIES
Description: County boundaries.
Administrator: SRFS GISDBA.
Figure legend name: County line

Coverage Name: DRAFTROADS
Description: SRS roads. No metadata currently is available.
Administrator: Michelle W. Davalos, SRFS-GIS.
Figure legend name: Roads

Coverage Name: NPDES
Description: NPDES (National Pollution Discharge Elimination System) points for the Savannah River Site, with 1984 names and proposed 1996 names.
Administrator: Larry Koffman, Westinghouse EPD (725-1038).
Figure legend name: NPDES outfall

Coverage name: OPENWELLS
Description: Old wells from pre-1951 residential areas. Most wells were discovered in an open status between 1969 and the present. Some have been filled or guarded since discovery but are still included in this coverage. Original map came from Bob Crais and Roger Pitts, SRFS Safety group.
Administrator: Michelle W. Davalos, SRFS-GIS.
Figure legend name: Open Wells

Coverage Name: PIPES
Description: Pipelines and power transmission lines.
Administrator: Don Coulter, SRFS-Engineering.
Figure legend name: Utility ROW

Coverage Name: PLANTS
Description: Threatened, endangered, and sensitive plant locations of the SRS and associated data. Note: TES Plants (1) Points—no metadata available, see metadata for TES Plants (2) Polygons.
Administrator: Tona Berret, SRFS-Wildlife.
Figure legend name(s): TES Plants (1); TES Plants (2)

Coverage Name: RAILS
Description: Railroads.
Administrator: Don Coulter, SRFS-Engineering.
Figure legend name: Rails

Coverage Name: ROADS
Description: Roads and trails.
Administrator: Don Coulter, SRFS-Engineering.
Figure legend name: Roads

Coverage name: SET-ASIDE AREAS
Description: GIS Dataset—Version 3 (1996) of Set-Aside boundary lines for 30 DOE Research Set-Aside Areas. The metadata for this coverage currently is being updated to reflect changes made to GIS Version 2.
Administrator: Charlie Davis, SREL.
Figure legend name: Set-Aside and Other Set-Asides

Coverage Name: SITE
Description: SRS boundary map based on SRFS compartment coverage.
Administrator: Deno Karapatakis, SREL.
Figure legend name: Site

Coverage Name: SOILS
Description: NRCS Soil Survey Map of SRS.
Administrator: Bobby McGee, NRCS.
Figure legend name: Soil series and phase

Coverage Name: SRSBAYS
Description: Carolina bays and similar, natural depression wetlands of the SRS (historic and current).
Administrator: Robert Lide, SREL.
Figure legend name: SRS Bays

Coverage Name: STREAMS
Description: All water courses which are depicted as single lines, including streams, canals, ditches, etc. Larger streams which are depicted as polygons are included in the LAKES coverage.
Administrator: Cliff Jones, SW&A.
Figure legend name: Streams

Coverage Name: TRAILS
Description: Forest Service-maintained trails of the SRS.
Administrator: Ron Bonar, SRFS-Timber.
Figure legend name: Fitness/Education Trails

Coverage name: WASTESITES
Description: Waste sites included in the Remedial Feasibility Investigation/Remedial Investigation (RFI/RI) and Site Evaluation (SE) programs are included in this coverage. Spill sites are not included. Westinghouse Environmental Protection Division should be contacted for further information and a complete list of waste sites. Point of contact in EPD, as of 9/93, is Joan Lang (725-9003). According to Lang, data used to create this coverage is a "fairly good composite list of physical units." Note: The GIS location for the Georgia Fields Unit (631-19G) Wastesite in Set-Aside Area No. 1 was inaccurate and was graphically relocated to a more accurate location.
Administrator: Roger Pitts, SRFS-Environment.
Figure legend name: Wastesites

Coverage Name: WATERBODIES
Description: All water bodies, natural and manmade, including streams depicted with double lines; e.g. the Savannah River.
Administrator: Cliff Jones, SRFS-SW&A.
Figure legend name: Waterbodies (not to be confused with WATER under Community groupings)

Coverage Name: WELLS95
Description: SRS monitoring well inventory as reported in ESH-EMS-950419, "Environmental Protection Department's Well Inventory (U) (through the second quarter of 1995)", October 1995. Note that only wells with coordinates are included in this coverage, whereas ESH-EMS-950419 lists several hundred wells without coordinates.
Administrator: Larry Koffman, EPD-EMS GIS Lab (725-1038).
Figure legend name: Monitoring Wells

Coverage: WETSOILS
Description: Hydric soils and waterbodies as an indicator of wetlands; delineation of wetlands on SRS utilizing NRCS Soil Survey Map and waterbodies.
Administrator: Deno Karapatakis, SREL.
Figure legend name: Hydric soils

The following coverages were used for information only and were not used for figure production:

Coverage Name: STANDS
Description: Timber compartment and stand boundaries.
Administrator: Rick Davalos, SRFS-Timber.
Figure legend name: None. The CISC (Continuous Inventory of Stand Conditions) stand database (1996) associated with the STANDS coverage was used for information on stand ages and conditions.

Coverage Name: HR_BURNS—Hazard-Reduction Burn History
Description: Locations of hazard-reduction (rough reduction) burns.
Administrator: Pete Myers, SRFS-Fire.

Figure legend name: None. This coverage was used to determine history of prescribed fire in Set-Aside Areas.

NOTE:

No GIS coverage exists for the Three Rivers Regional Landfill. This feature was graphically produced for Figs. 3-2, 6-1, 14-2, 23-1, and 28-1.