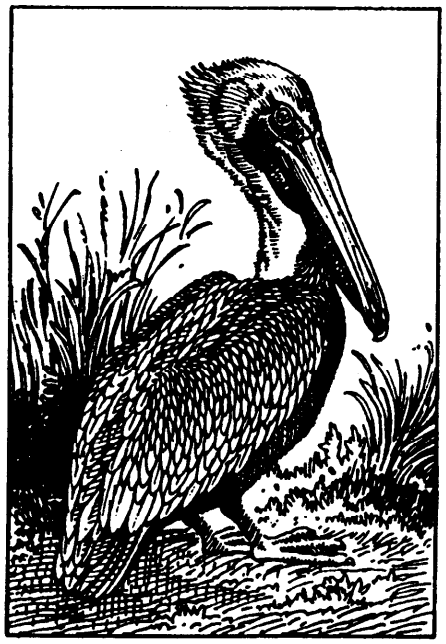
US Army Corps of Engineers
Waterways Experiment Station

Wetlands Research Program Technical Report WRP-DE-6

Flood Tolerance of Plant Species in Bottomland Forests of the Southeastern United States

by Russell F. Theriot



August 1993 – Final Report
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	Task		Task
CP	Critical Processes	RE	Restoration & Establishment
DE	Delineation & Evaluation	SM	Stewardship & Management

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Wetlands Research Program

Technical Report WRP-DE-6
August 1993

Flood Tolerance of Plant Species in Bottomland Forests of the Southeastern United States

by Russell F. Theriot

Environmental Laboratory

U.S. Army Corps of Engineers
Waterways Experiment Station
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Final report

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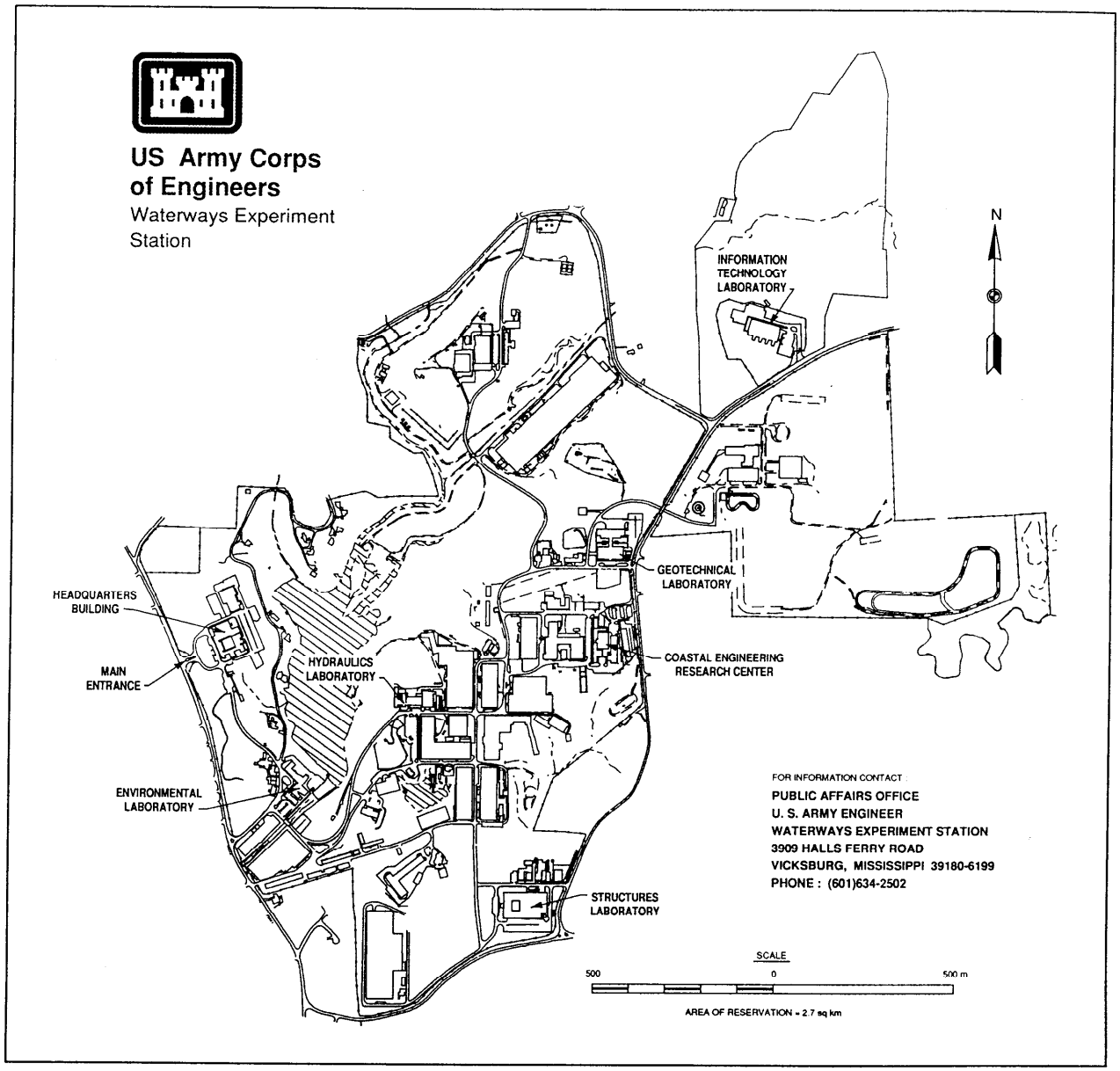

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Wetland Tolerance of Wetland Plants

Flood Tolerance of Plant Species in Bottomland Forests of the Southeastern United States (WRP-DE-6)

ISSUE:

Quantitative hydrologic information needed by Corps of Engineers Districts to make decisions concerning wetlands is most often not available. Therefore, an investigation began to identify a surrogate for hydrology. Based on the scientific literature, plant community analysis seemed to provide the best potential for providing a surrogate for hydrology.

RESEARCH:

The study area chosen was the forested bottomland systems of the Southeast United States. Data was provided from 17 study sites and used to develop numbers for the plant species encountered. Average numeric values were calculated for species from the entire study area and resulted in flood tolerance index (FTI) numbers which can be used to estimate the hydrology of an area.

SUMMARY:

Results of this study establish that at least for forested bottomland systems of the Southeastern United States it is possible to use plant community analysis to estimate hydrology. Statistical analysis indicates that FTI numbers for trees are best for hydrologic determination.

AVAILABILITY OF REPORT:

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About the Author:

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Preface

The work described in this report was authorized by Headquarters, U.S. Army Corps of Engineers (HQUSACE), for publication in the Delineation and Evaluation Task Area of the Wetlands Research Program (WRP). The work was performed by the U.S. Army Engineer Waterways Experiment Station (WES), Environmental Laboratory (EL). Principal Investigator was Dr. Russell F. Theriot. Mr. Sam Collinson (CECW-OR) was the WRP Technical Monitor at the time of publication.

Mr. Jesse A. Pfeiffer, Jr. (CERD-C), was the WRP Coordinator at the Directorate of Research and Development, HQUSACE; Dr. William L. Klesch (CECW-PO) served as the WRP Technical Monitors' Representative; Dr. Theriot was the Wetlands Program Manager. Mr. Ellis J. Clairain, Jr. (WES, EL), was the Task Area Manager.

Mr. Robert Pierce was the USACE Technical Monitor at the time the work was performed. Participants in the study include Dr. Dana Sanders, who provided technical assistance as research team leader; Drs. Ken Rodgers, Dan Evans, and Tom Heineke, who assisted with plant species identification; Blake Parker, who interpreted the soils data; Don Hill, who conducted geodetic surveys; Phil Jones and Jeff Irvin, who assisted with integrating the hydrologic data; Dr. Dara Wilber, who assisted with the statistical analysis; and Drs. Donal Hook, Bill Patrick, Helen Leitman, Sandra Brown, and William Mitch, who helped by providing insight through discussion of their research. The report was written under the general supervision of Dr. Robert M. Engler, EL Program Manager, Dr. John Keeley, Assistant Director, EL, and Dr. John Harrison, Director, EL.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander was COL Bruce K. Howard, EN.

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1 Introduction

Bottomland forests are found in the floodplains of rivers in the southeastern United States from eastern Texas to Virginia. They have distinct topographic features that are the result of historical hydrologic characteristics of the rivers, including periodic fluctuations in water levels and changes in stream course. Recognizable floodplain topographic features include first bottoms, second bottoms or terraces, uplands, riverfront, swamp, poorly drained flats, well-drained flats, and sloughs (Putnam, Furnival, and McKnight 1960). These features are characterized by different hydrologic regimes and can be identified as a hydrologic gradient transitional between permanent water and terrestrial uplands.

Many studies have previously described the forest communities associated with these floodplain features (Putnam, Furnival, and McKnight 1960; Broadfoot and Williston 1973; Chambless and Nixon 1975; Hodges and Switzer 1979; Mohler 1979; and Hupp and Osterkamp 1985). However, studies describing the relationship between plant species distribution and specific inundation/saturation regimes in bottomland forests are rare (Bedinger 1971; Mohler 1979; Huffman 1980; and Leitman, Sohm, and Franklin 1984). Even so, these studies all demonstrated that frequency and duration of inundation/saturation exert a controlling influence on the composition, structure, and distribution of wetland plant communities. As an example, Bedinger (1971) found a definite relationship between the distribution of plant species and the frequency and duration of flooding in the lower White River Valley, Arkansas. Using flood frequency and duration, he defined four species associations on the White River floodplain, each of which had a distinctly different tolerance to inundation. He concluded that based on plant species-flooding relationships, plant communities could be used as a basis to transfer flooding parameters to ungauged streams.

Plant Community Organization

The concept of community structure has been debated for decades. Clements (1916) first described communities as discrete, self-organizing entities that could be considered as discrete organisms. Gleason (1917) disagreed with Clements' organismal concept and proposed a hypothesis relating

to the individualistic occurrence of plants. His hypothesis has developed into the continuum concept, which indicates that plant species distribution is determined by the species' response to its environment. Whittaker (1967) and McIntosh (1980) later developed Gleason's ideas, expanding on the continuum concept. They maintain that since plant species adapt differently, no two occupy the same zone. This concept results in a continuum of overlapping species associations, each responding to subtly different environmental factors (e.g., water, soil pH, nutrients, and solar radiation). A continuum can be described for each factor in various increments or zones.

Zonation simply describes the different levels of an environmental gradient to which a species is responding. The reason zonation is so obvious in some ecosystems is that environmental gradients are "ecologically" steep and groups of species have fairly similar tolerances that tend to group them on these gradients (Mitsch and Gosselink 1986).

Gleason's individualistic hypothesis can be supported by several studies (Curtis and McIntosh 1951, Brown and Curtis 1952, Bray 1956, Whittaker 1956, Curtis 1959, Whittaker and Niering 1965, and Mohler 1979). These studies show that although species have different ecological amplitudes and, in fact, do not occupy the same niche, they organize as units based on similar ecological conditions. Moreover, intergrades caused by interspecific competition occur between defined types of plant associations. These intergrades can be attributed to continuous environmental variability in time or space or to environmental modification.

Bottomland Forest Community Organization

Van Der Valk (1981) developed a qualitative model of succession in freshwater wetlands based on the "individualistic" approach to vegetation proposed by Gleason. He based his approach on three key life history features of plant species: life-span, propagule longevity, and propagule establishment requirements. These features are all directly affected by the flooding on bottomland forests.

Brinson (1990), in discussing the "power line" designation for a wetland classification developed by Kangas (1990), considered the power and frequency of inundation as the way in which flood events organize the plant communities in riverine forests. He characterized the flood events as high, medium, and low power events with flood power and frequency of inundation being inversely proportional. High power flood events have a low frequency and determine patterns of the large floodplains features (e.g., oxbow lakes, relict levees, and low ridges and swales) that persist for hundreds to thousands of years. Medium power flood events, which occur at an intermediate frequency, affect ecosystem structures that exist from decades to hundreds of years. He identified tree species associations as an ecosystem component likely to be influenced at this scale. The low power, high-frequency flood

events occur annually and affect short-term patterns such as seed germination and seedling survival. His characterization emphasized the dramatic impact flooding has on the regeneration of vegetation in bottomland forests.

Grubb (1977) stated that scientists have failed to understand adequately how plant communities maintain themselves because of a failure to account for the phenomenon of regeneration in plant communities. Huenneke and Sharitz (1986), in a study of microsite abundance and distribution of woody seedlings in a South Carolina cypress-tupelo swamp, concluded that the availability and nature of microsites may affect the distribution and composition of the seedling and sapling strata, thus differentiating the "regeneration niche" described by Grubb.

Although plant species association is determined by a number of interacting environmental factors, it is generally agreed that flooding is the dominant environmental factor at work in bottomland forests, affecting regeneration and life under saturated soil conditions. Flooding persisting for more than a few days will prevent the replenishment of soil oxygen once the soil microbes and plant roots consume the available soil oxygen in the root zone during respiration. Only those plant species that have evolved a mechanism for living in reducing (anaerobic) soil conditions will survive such conditions. In most instances, recurring flooding provides a competitive advantage for plant species that are adapted to saturated and reduced soils.

Chemistry of wet soils (Pearsall and Mortimer 1939, Patrick and Mikkelsen 1971, Ponnamperuma 1972, Patrick and Delaune 1976; and Faulkner et al. 1991), and the various physiological effects on vegetation under reducing conditions are well documented (Cannon and Free 1920, Conway 1940, Dubinina 1961, Hosner and Boyce 1962, Hook and Brown 1973, Hook and Scholtens 1978, Vester 1972, and Hook and Crawford 1980).

Zonation of Bottomland Forests

The hydrologic gradient in bottomland forests ranges from zones of nearly continuous inundation/saturation in deep swamps to infrequent inundation/saturation events for brief periods on upland sites. Because different species respond to different timing and duration of inundation, a strong correlation exists between the distribution of a species and its associated hydrologic and soil-moisture conditions (Hosner and Boyce 1962; Dickson, Hosner, and Hosley 1965; Bedinger 1971, 1978; Larson et al. 1981; Best, Segal, and Wolfe 1990; and Faulkner et al. 1991). The National Wetlands Technical Council (NWTC) proposed the zonal classification of floodplain forests (Clark and Benforado 1981). The classification system defined six hydrologic zones based on frequency and duration of inundation and soil saturation (Figure 1) and provides the basis for testing in this study.

Larson et al. (1981) summarized the works of others on the occurrence of plant species in the Gulf Coastal Plain from 238 belt transects in Texas,

Louisiana, Arkansas, Mississippi, Alabama, and Florida according to their maximum tolerance to soil-moisture or hydrologic regimes. Larson and his cohorts developed a list of 79 tree and shrub species associated with one or more of the NWTC hydrologic zones. However, the list identifies only presence or absence of a species in a zone and does not identify the ecological amplitude or optimum position of each species along the hydrologic gradient.

Purpose and Objectives

The purpose of the study was to develop flood tolerance index (FTI) numbers that reflect the optimum position for plant species occurring along the hydrologic gradient in bottomland forests of the southeastern United States. The resulting FTI numbers can then be used to estimate the hydrologic regimes of similar ungauged areas using vegetation. Specific objectives were to develop methods for translating recorded hydrologic data into hydrologic zone elevations for southeastern bottomland forests, calculate weighted averages of plant species based on dominance, and determine methods for applying FTI numbers to species occurring in bottomland forests of the southeastern United States.

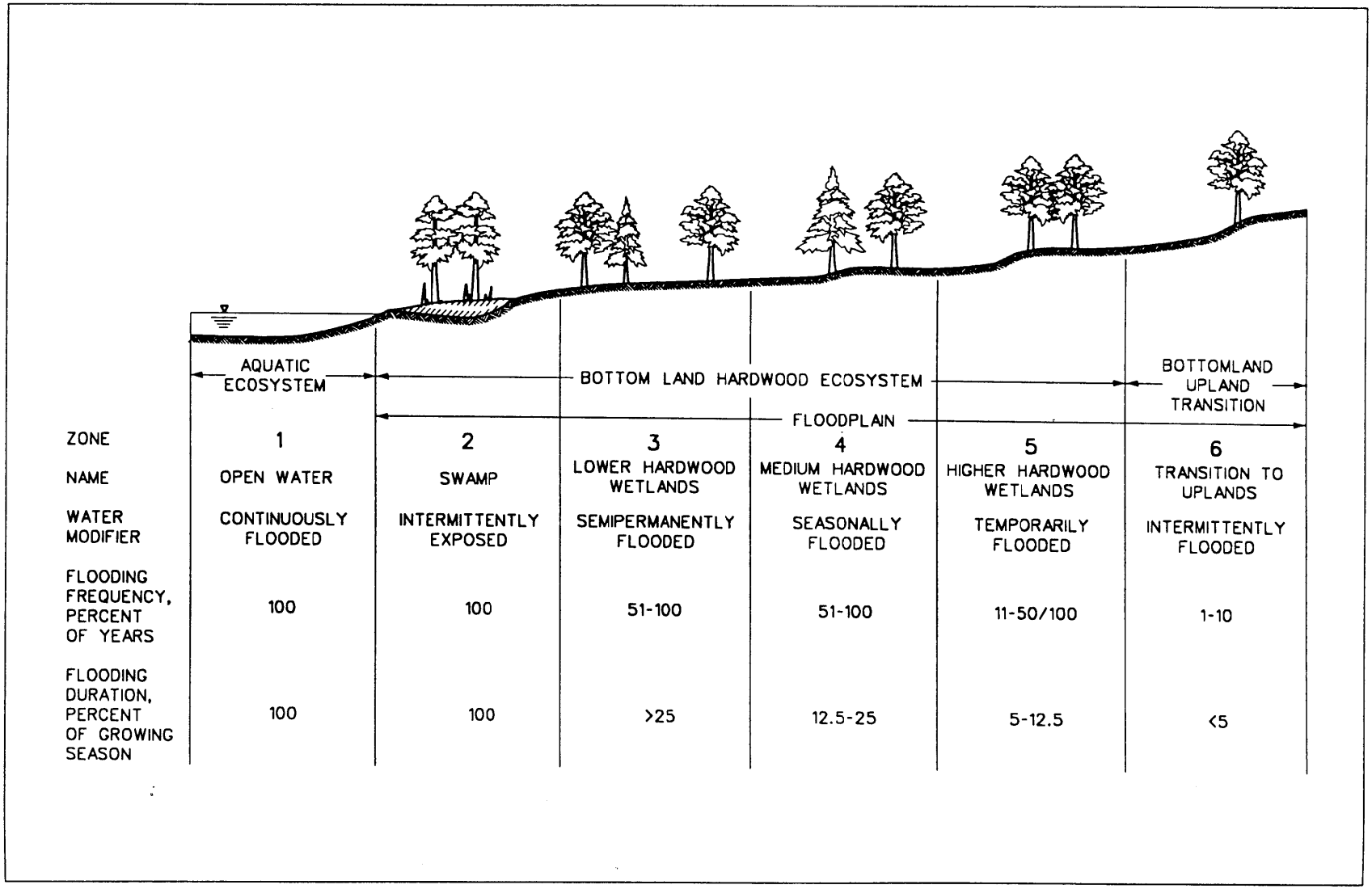

Figure 1. Zonal classification of bottomland forest wetlands (adapted from Clark and Benforado 1981)

2 Methods

Study Area

The study was conducted in portions of the subtropical ecoregion of the southeastern United States (Bailey 1980), including portions of eastern Texas and the Gulf and South Atlantic states. Northern limits of the area extended across northern Arkansas, Mississippi, Alabama, Georgia, and South Carolina. The study area included the states of Louisiana, Arkansas, Mississippi, and Alabama. Georgia and South Carolina were included, except for the piedmont region. Only the extreme eastern portion of Texas was included, as was the northern portion of Florida (Figure 2). The intent was to study natural undisturbed sites encompassing the largest possible area where the resulting FTI numbers would be applicable without including areas that would introduce too many additional species or different climatic variables.

Specific sites were selected according to the following criteria:

a. No major disturbance (e.g., timber harvesting, ditching, or diking) had occurred during the past 20 years.

b. Sufficient hydrologic data (10 to 20 years of daily stream gauge readings) accurately portraying water-level fluctuations on the site (considering ponding, tributary influence between site and gauge, etc.) were available.

c. No site changes (e.g., timber harvesting or ditching) were anticipated during the study period.

d. Soil data (e.g., soil surveys, soil series, and/or soil phases, texture, and permeability coefficients) were available.

e. Plant communities were characteristic (e.g., plant communities with few rarely occurring species) of the study area.

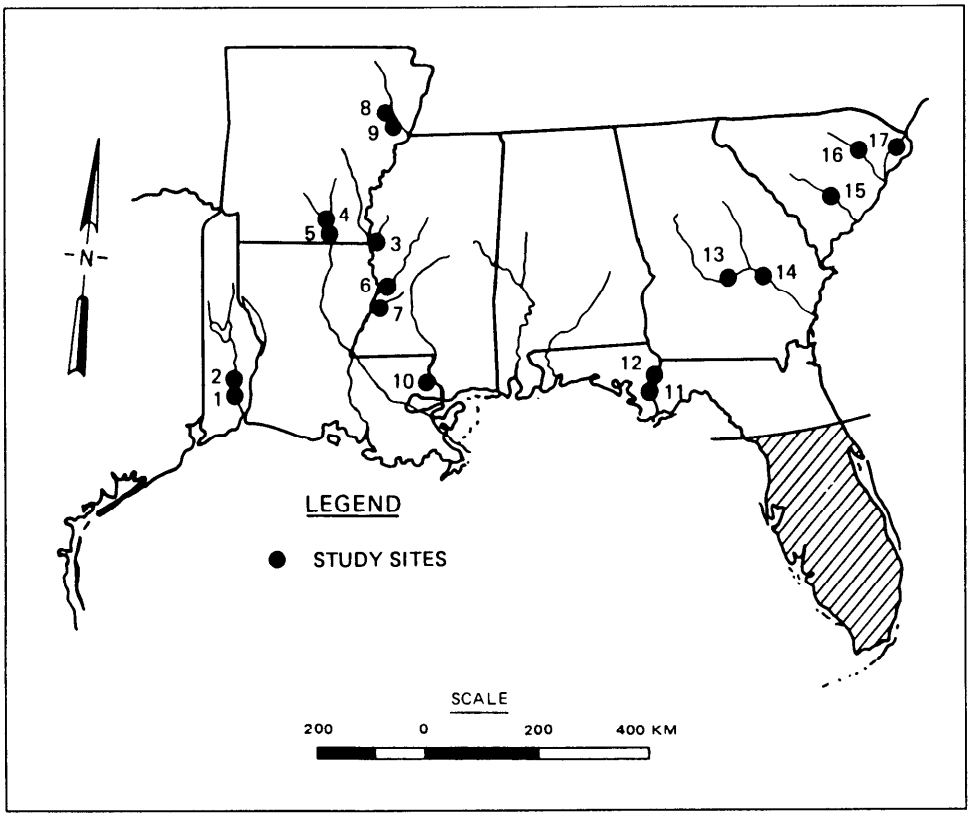

Figure 2. Study area and sites in the southeastern United States

Site Selection

Several hundred potential sites were considered, but most were eliminated because of insufficient stream gauge data. More than 50 sites were visited, but only 17 (Figure 2) satisfied all site criteria and were used in the study. Although all 17 sites met the selection criteria, not all hydrologic zones in each site were suitable for study. Some zones were too narrow, and others had been disturbed recently by agricultural or silvicultural practices.

Sites 1 and 2 were located in the Neches River basin in southeastern Texas. The Steele Bayou, Yazoo River, and Big Black River basins in Mississippi, respectively, were designated sites 3, 6, and 7. Sites 4 and 5 were located in the Ouachita River and sites 8 and 9 in the L'Anguille River basins in Arkansas. Site 10 was located in the Pearl River basin in Louisiana, and sites 11 and 12 in the Apalachicola River basin in Florida. Sites 13 and 14 were located in Georgia in the Ocmulgee River and Altamaha River basins, respectively. Sites 15, 16, and 17 were located in South Carolina in the Edisto, Lynches, and Waccamaw River basins, respectively.

All sites were characterized by a growing season of greater than 200 days and average annual rainfall ranging from 105 to 170 cm. The overstory typically ranged from cypress-tupelo or willow in depressions and low flats to

white oak-hickory or pine on the high ridges. Intermediate areas included overcup oak-bitter pecan, green ash, willow oak, and American elm overstory communities. The herbaceous understory was typically dense with diverse species of trees and shrubs, vines, and herbs. Appendix A includes a general description of each study site.

Determining Hydrologic Zone Elevations

Hydrologic data for each site were obtained either from the U.S. Geological Survey (flow data) or from the local Corps of Engineers District (stage or flow data). Data were analyzed using a FORTRAN computer program developed for determining hydrologic zone elevations in study sites where flooding occurred. The program output is the duration of inundation plus soil saturation of each hydrologic zone boundary, expressed as flow rate or stage data. Table 1 presents inundation/saturation frequency and duration for Zones 2 to 6.

Hydrologic zone elevations for each site were computed using the most recent 10 to 20 years of daily stream gauge data. When gauge data were provided as daily discharges (flow rate), a rating table (relationship between stage and discharge) was obtained to determine the corresponding stages (elevation).

Plant species show little or no adverse effects from flooding in the winter (dormant) season (Hall and Smith 1955; Bruckner, Bowersox, and Ward 1973). Therefore, hydrology during the dormant season was not used in this study to determine zones.

The dates of the first and last day of the growing season for each site were provided as input to the computer program. Growing season for this study was defined as the period between the last average occurrence of 32° F in the spring and the first average occurrence of 32° F in the fall. The program eliminated all nongrowing season data and ranked the remaining daily readings during the period of record from highest to lowest flow (or stage). Elevations corresponding to the 75, 25, 12.5, and 5 percent durations of inundation were computed. Because the resulting elevations did not include the period during which the soils remain saturated after a period of inundation, saturation effects were integrated. A general description of the soil series occurring in each zone of the study site was obtained from Soil Conservation Service (SCS) county soil surveys. An estimated range of permeabilities for the top 30 cm of the soil profile (i.e., defined for this study as the effective root zone) was determined. This range approximated the period required for the root zone to become saturated after inundation. The slowest value in the range of permeabilities was used to determine the minimum duration of inundation required to saturate the soil. A second range of soil permeabilities between the 30-cm and 90-cm depth was determined. The slowest permeability value of the soil profile between 30 and 90 cm was used to estimate the time required for draining of the root zone after dewatering. A mean daily transpiration factor for

Table 1
Hydrologic Zones Occurring in Bottomland Forests of the Southeastern United States

Zone	Name	Typical Inundation/Saturation Frequency[1]	Duration[2] percent
2	Semipermanently to permanently inundated or saturated	Annual (1 year frequency) 90 to 100 years/100 years	>75-100
3	Regularly inundated or saturated	51 to 90 years/100 years (>1-year to 2-year frequency)	>25-75
4	Seasonally inundated or saturated	51 to 90 years/100 years (>1-year to 2-year frequency)	>12.5-25
5	Irregularly inundated or saturated	11 to 50 years/100 years (well drained) (>10 years - 2-year frequency) 1 to 10 years/100 years (poorly drained) (100 years, 10-year frequency)	≥5-12.5
6	Intermittently inundated or saturated	1 to 10 years/100 years (100 years, 10-year frequency)	<5

Source: Adapted from Larson et al. (1981).
[1] Although typical inundation/saturation frequencies are provided for each zone, almost any frequency could be associated with any duration of inundation/saturation. Therefore, only duration of inundation/soil saturation was used to determine hydrologic zones.
[2] Duration based on the growing season.

floodplain forests of 5.6 mm (Brown 1981) also was incorporated for computing desaturation.

Permeability and transpiration coefficients were provided as program input, and new flow (or stage) values for hydrologic zone boundaries were derived that reflected both inundation and soil saturation. This iterative process required a computer search. The computer program added the days of saturation to the days of inundation, and the output was flow (or stage) values that represented the estimated boundary of each hydrologic zone, based on inundation and saturation. The gauge elevation was added to the stage for each zone to obtain the mean sea level elevation at the gauge. When the site was not immediately adjacent to the gauging station, the change in water surface elevation between the study area and the gauging station was determined using the best available water surface profile data. Appendix B explains how the computer program analyzes the hydrology data to produce zone boundaries.

Site Preparation and Data Collection

A temporary benchmark was established at each of the 17 sites by surveying from a permanent benchmark. A reconnaissance of the area was conducted for suitable sites, and mean sea level elevations for each hydrologic zone boundary were surveyed along the topographic gradient. The contours of each hydrologic zone boundary within the site were marked with surveyor flags. Fifty-five hydrologic zones were established on the 17 study sites. Sampling methods were adapted from methods described by Whittaker (1973), except where noted.

Sample plots were established parallel to the hydrologic zone boundary (Figure 3). Plots were positioned on the downslope side of the boundary with at least a 5-m buffer between the sample plots and the upper and lower boundary of the hydrologic zone. A belt transect (20 m wide by 40 m long) containing 10 sample subplots (8 m by 10 m) was established within each zone.

Small soil pits in each sample plot were dug with a tile spade to a depth necessary to identify the soil series. In all cases, a county soil survey was used to identify the mapped soil series, and information was obtained to verify the soil series on site. Assistance from the local SCS office was used to determine the correct soil series and soil permeability coefficients for each zone sampling site.

Vegetation was sampled by vegetative layer. All trees in each sample plot were identified by species, and the diameter at breast height (1.5 m) of individuals having a diameter of greater than or equal to 7.5 cm was measured and recorded to the nearest whole centimeter.

All saplings and shrubs (woody plants less than 7.5 cm in diameter, but greater than 1.0 m in height, excluding vines) in each sample plot were identified by species, and the height class of each individual was recorded. Saplings or shrubs with more than one stem clustered from a single root system were counted as individuals only when separation occurred at or below ground level. The following height classes were used: Class 1 = 1.0 to 2.0 m, Class 2 = 2.1 to 3.0 m, Class 3 = 3.1 to 4.0 m, Class 4 = 4.1 to 5.0 m, and Class 5 = >5.0 m.

All climbing woody vines greater than 1.0 m in height in each sample plot were identified by species, the stems of each species counted, and the height class of the highest individual on each tree or sapling/shrub recorded. The following height classes were used: Class 1 = 1.0 to 3.0 m, Class 2 = 3.1 to 6.0 m, Class 3 = 6.1 to 12.0 m, and Class 4 = >12.0 m. Vines were recorded when any portion of the plant occurred in, or overhung, the plot. Individual stems were recorded when separation from the root system occurred at or below ground level.

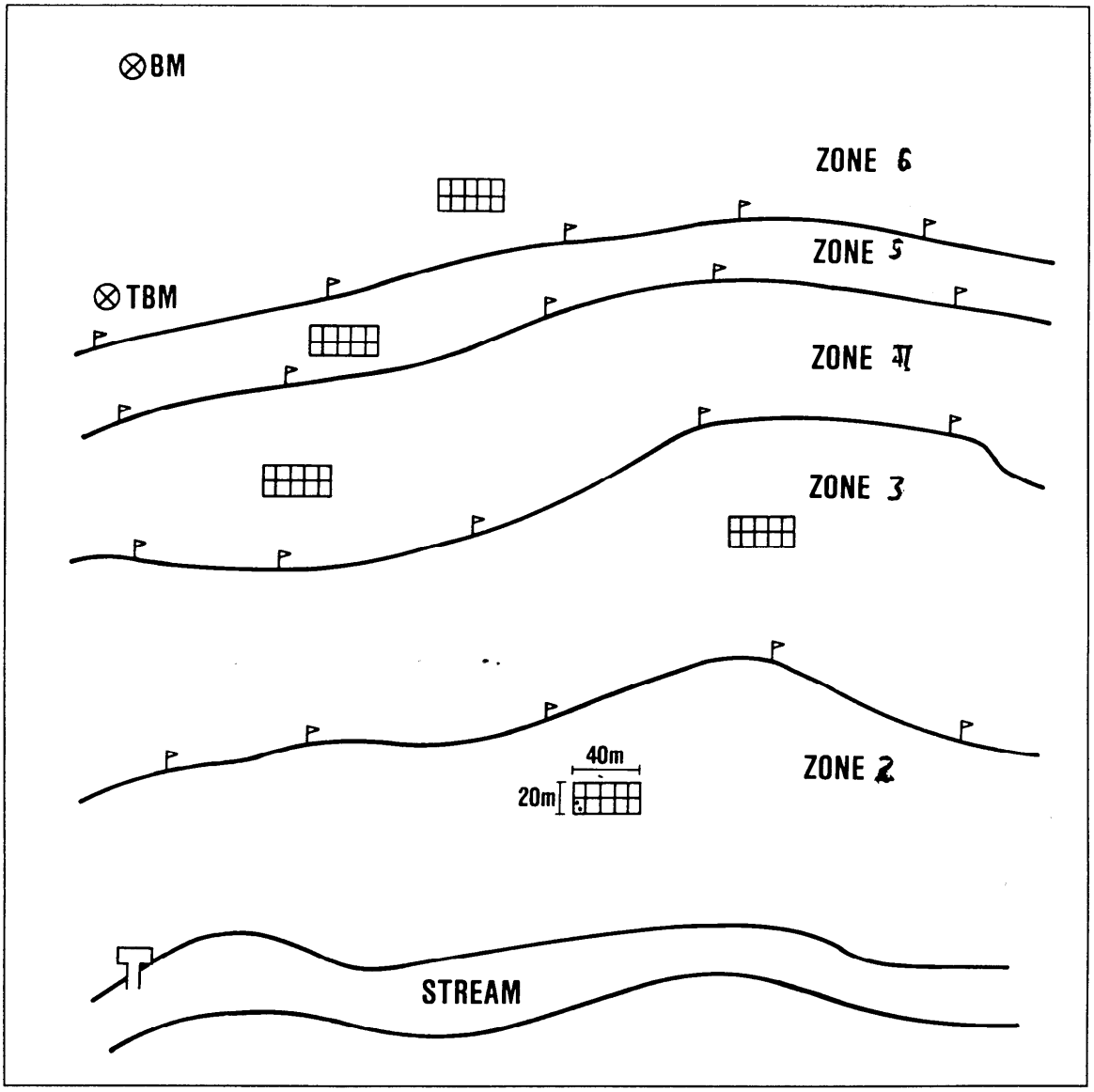

Figure 3. Representation of a typical research site

Percent cover was estimated for each species of herb and woody seedling (greater than 1.0 m in height) rooted in the plot in two randomly located 1.0-m^2 quadrats in each subplot using the Daubenmire (1968) cover class method.

Analyzing Vegetation Data

Importance values for species in all vegetation layers except the herbaceous layer were calculated by adding values for relative density, relative frequency, and relative dominance. Importance values for herbaceous species were

calculated by summing relative frequency and relative dominance. Importance values were used to determine the FTI number for each species.

When species could not be positively identified in the field, voucher specimens were collected and later identified. Species nomenclature was determined using the *National List of Scientific Plant Names* (U.S. Department of Agriculture 1982).

Calculating Species FTI Numbers

Changes in composition of biotic communities along environmental gradients can be addressed with several statistical techniques, the most notable being gradient analysis (Whittaker 1978). Gradient analysis can take several different forms depending on the objective of the analysis. Inferring environmental values (e.g., hydrologic zones) from vegetative species composition is called a "calibration problem" by Ter Braak and Prentice (1988) and is the appropriate approach for this study.

One method of calibration is to use weighted averaging (WA) to estimate environmental factors at sites based on species optima. If a species exhibits a unimodal distribution with respect to an environmental variable, its occurrence is concentrated around the peak of this function (Ter Braak and Prentice 1988). Species with similar optima will naturally tend to occur together. Therefore, an intuitive estimate of the environmental factor of a site is the average of the optima for the species present. The FTI numbers represent weighted averages of species occurrence.

Two additional statistical methods of calibrating an environment (hydrologic zone) with vegetation, recommended by Ter Braak and Prentice (1988), are cluster analysis and discriminant function analysis. These two methods were applied to test the reliability of the FTI numbers.

FTI numbers were calculated for each species occurring in each vegetation layer. A species could have three different FTI numbers at a given site, depending on its growth form. For example, *Quercus nigra* would have three different FTI numbers when present on a site as a tree, sapling, and seedling. Species FTI numbers for each site were computed by the following formula:

$$FTI_i = \frac{\Sigma_j(j \cdot IV_{ij})}{\Sigma_j IV_{ij}}$$

where

i = the i^{th} species

j = 2.5, 3.5...6.5 (hydrologic zone)[1]

IV_{ij} = importance value for species i in the hydrologic zone j

After species FTI numbers were computed for all species in all sites, the average FTI number ($\overline{FTI}$) for each species across all sites was calculated using the following formula:

$$\overline{FTI}_i = \frac{\sum_{j=i}^{n_i} FTI_{ij}}{n_i}$$

where

i = the i^{th} species

j = sites 1 to 17

FTI_{ij} = FTI number of species i at site j

n_i = number of sites at which species i occurred

[1] Because vegetation was sampled between zone boundaries, midrange zone numbers (e.g., 2.5 for Zone 2, 3.5 for Zone 3, etc.) for zones were used in calculating FTI numbers.

3 Results and Discussion

Flood Analysis of Study Sites

Twenty years of hydrologic data were used for all sites except sites 4, 5, and 14. Sites 4 and 5 had a 19-year hydrologic record, and site 14 had a 12-year record. Calculations of change in water surface elevation between the gauging station and site was necessary for sites 1, 2, 3, 5, 9, 12, and 17. All other sites were adjacent to the gauging station and did not require adjustments. Hydrologic analyses of sites 11 and 12 at the Apalachicola River were verified using information from another study (Leitman, Sohm, and Franklin 1984).

The hydrologic records for all sites were analyzed by season for five-year increments. In all cases, variation in flow through time was determined to be within normal seasonal and annual fluctuations. Therefore, it was assumed that the hydrologic record reflected normal conditions (i.e., no major drainage projects during the period of record had significantly impacted the plant community structure).

The hydrologic data also were analyzed to determine annual flood frequency and duration for each site. The boundaries between Zones 2 and 3 and between Zones 3 and 4 are flooded virtually every year (Table 2). The boundary between Zones 4 and 5 is flooded at least every other year, and the boundary between Zones 5 and 6 is flooded from once in 20 years to 3 out of every 4 years. Similar findings were reported by Clark and Benforado (1981) and Roelle et al. (1987).

In general, the average duration of a flood event by site ranged from 3 months to longer than 5 months for the Zone 2-3 boundary, from 3 weeks to greater than 2 months for the Zone 3-4 boundary, from 1 week to 1 month for the Zone 4-5 boundary, and from less than 1 day to 10 days for the Zone 5-6 boundary (Table 3).

As an example, a hydrograph of site 3 at Steele Bayou (Appendix C) for 20 years of data shows that flooding conditions vary greatly from one season to another and from one year to another. Also, flooding during the growing season usually occurs during early spring and is usually continuous with the

Table 2
Annual Flood Frequency (Percent of Years in Which Boundary Is Exceeded at Least Once During Growing Season for More Than Seven Days) for Zone Boundaries

Site	Zone Boundaries			
	2-3	3-4	4-5	5-6
1	100	90	70	10
2	100	90	70	10
3	100	100	85	25
4	100	94	61	20
5	100	85	55	20
6	100	96	77	20
7	100	100	92	75
8	100	100	96	60
9	100	100	96	65
10	100	100	83	70
11	100	100	95	70
12	100	100	95	70
13	100	100	90	65
14	100	100	92	67
15	100	90	85	55
16	100	100	100	70
17	100	100	90	70

nongrowing season flooding. Flooding rarely occurs late in the growing season. Unusual events such as the 1973 flood can greatly affect the calculated value of average events. For example, if the data for 1973 were excluded, the average duration per flood event at site 3 is reduced to 37 days, 25 days, 9 days and less than 1 day, from 143, 30, 14, and 6 days, for Zone boundaries 2 through 5, respectively (Table 4). Such an event has an especially large effect on average duration even over a 20-year period, especially in the higher zones.

Vegetation Data

Vegetation data were collected at each of the 55 hydrologically defined zones for the 17 study sites (Appendix D). Eleven stands were sampled in Zone 2, 15 stands in Zone 3, 14 stands in Zone 4, 4 stands in Zone 5, and

Table 3
Average Annual Duration of Flood Events (Days) for Zone Boundaries

Site	Zone Boundaries			
	2-3	3-4	4-5	5-6
1	119	21	12	<1
2	119	21	12	<1
3	143	30	14	6
4	92	41	19	7
5	93	51	24	8
6	152	44	22	9
7	153	50	25	10
8	139	20	15	<1
9	139	20	15	<1
10	141	32	14	3
11	143	20	16	8
12	143	20	18	6
13	162	29	15	8
14	159	53	24	5
15	162	52	25	9
16	174	58	8	<1
17	198	66	31	10
Study Area Average	143 $\pm$ 26	37 $\pm$ 18	18 $\pm$ 6	6 $\pm$ 3

11 stands in Zone 6. The total possible number of stands that could have been sampled for each zone was 17. Some zones were unsuitable for analysis due to disturbance or because they were too narrow to support sampling areas (Appendix A). Zone 5 was especially susceptible to disturbance. In some cases Zone 5 was cleared because it was dry enough to be farmed during the growing season. In other cases, Zone 5 was too narrow because it was located near the toe of a slope. Therefore, Zone 5 was sampled only at sites 3, 11, 12, and 14.

FTI numbers were calculated for 74 tree species, 118 species of saplings and shrubs, 31 species of woody vines, and 268 species of herbs and woody seedlings, representing 312 different plant species. Because some species occurred in more than one vegetative layer, the total number of species FTI numbers exceeded the total plant species identified.

Table 4
FTI Numbers of Species Commonly Occurring in Bottomland Forests

Scientific Name	Common Name	FTI Number
Trees		
Nyssa aquatica	Water tupelo	2.62
Salix nigra	Black willow	2.83
Fraxinus caroliniana	Pop-ash	2.87
Taxodium distichum	Bald cypress	2.97
Planera aquatica	Water elm	3.12
Acer drummondii	Drummond red maple	3.48
Forestiera acuminata	Swamp privet	3.48
Gleditsia aquatica	Water locust	3.50
Carya aquatica	Water hickory	3.54
Quercus lyrata	Overcup oak	3.73
Quercus laurifolia	Laurel oak	3.89
Betula nigra	River birch	4.01
Acer rubrum	Red maple	4.21
Ilex decidua	Possumhaw holly	4.35
Fraxinus pennsylvanica	Green ash	4.44
Ulmus americana	American elm	4.46
Quercus nuttallii	Nuttall's oak	4.50
Quercus phellos	Willow oak	4.81
Acer negundo	Box elder	4.83
Celtis laevigata	Sugarberry	4.84
Carpinus caroliniana	American hornbeam	4.84
Liquidambar styraciflua	Sweetgum	5.03
Platanus occidentalis	Sycamore	5.18
Nyssa sylvatica	Black gum	5.27
Carya illinoensis	Pecan	5.57
Quercus nigra	Water oak	5.73
Morus rubra	Red mulberry	5.75
Ilex opaca	American holly	5.79
Ulmus alata	Winged elm	6.43

(Sheet 1 of 4)

Table 4 (Continued)

Scientific Name	Common Name	FTI Number
Pinus taeda	Loblolly pine	6.41
Quercus alba	White oak	6.50
Sassafras albidum	Sassafras	6.50
Fagus grandifolia	American beech	6.50
Cornus florida	Flowering dogwood	6.50
Ostrya virginiana	American hophornbeam	6.50
Quercus stellata	Post oak	6.50
Quercus falcata	Southern red oak	6.50
Carya tomentosa	Mockernut hickory	6.50
Saplings and Shrubs		
Salix nigra	Black willow	2.83
Itea virginica	Virginia willow	2.83
Planera aquatica	Water elm	3.01
Cephalanthus occidentalis	Buttonbush	3.13
Styrax americana	Snowbell	3.41
Forestiera acuminata	Swamp privet	3.57
Cyrilla racemiflora	Titi	3.72
Celtis laevigata	Sugar berry	4.37
Crataegus viridis	Green hawthorn	4.46
Carya illinoensis	Pecan	5.00
Platanus occidentalis	Sycamore	5.05
Acer negundo	Box elder	5.20
Magnolia grandiflora	Southern magnolia	5.43
Liquidambar styraciflua	Sweetgum	5.52
Cornus drummondii	Rough leaf dogwood	5.69
Vaccinium elliottii	Elliott blueberry	5.82
Quercus nigra	Water oak	5.92
Sambucus canadensis	Elderberry	5.95
Halesia diptera	Silverbell	6.09
Morus rubra	Red mulberry	6.25
Cercis canadensis	Redbud	6.37

(Sheet 2 of 4)

Table 4 (Continued)

Scientific Name	Common Name	FTI Number
Vaccinium arboreum	Farkleberry	6.45
Gleditsia triacanthos	Honey locust	6.50
Quercus alba	White oak	6.50
Cornus florida	Flowering dogwood	6.50
Ilex vomitoria	Yaupon	6.50
Woody Vines		
Ipomoea wrightii	Morning glory	2.50
Smilax walteri	Walter's greenbriar	3.05
Brunnichia cirrhosa	Ladies' eardrops	3.58
Amplelopsis arborea	Peppervine	3.94
Campsis radicans	Trumpet creeper	4.05
Vitis palmata	Cat grape	4.07
Trachelospermum difforme	Star jasmine	4.18
Vitis riparia	Riverbank grape	4.27
Smilax laurifolia	Bamboo-vine	4.33
Cocculus carolinus	Carolina moonseed	4.37
Berchemia scandens	Rattan vine	4.55
Similax bona-nox	Saw greenbriar	4.75
Toxicodendron radicans	Poison ivy	4.82
Smilax rotundifolia	Common greenbriar	5.18
Vitis rotundifolia	Muscadine grape	5.71
Parthenocissus quinquefolia	Virginia creeper	5.93
Lonicera japonica	Japanese honeysuckle	6.50
Gelsimium sempervirens	Carolina jessamine	6.50
Herbs		
Ludwigia decurrens	Primrose-willow	2.50
Rorippa islandica	Yellowcress	2.50
Echinodorus cordifolius	Creeping burhead	3.00
Aster simplex	Lowland white aster	3.04
Boehmeria cylindrica	Small-spike falsenettle	3.34
Spermacoce glabra	Smooth buttonweed	3.50

(Sheet 3 of 4)

Table 4 (Concluded)

Scientific Name	Common Name	FTI Number
Saururus cernuus	Lizard-tail	3.65
Leersia lenticularis	Catchfly grass	3.67
Justicia ovata	Waterwillow	3.83
Urtica chamaedryoides	Nettle	4.42
Clematis virginiana	Virgins bower clematis	4.57
Eupatorium rugosum	White snakeroot	4.67
Cocculus carolinus	Snailseed	4.78
Viola missouriensis	Missouri violet	4.83
Hypericum hypericoides	St. Johnswort	5.25
Mitchella repens	Partridge berry	5.32
Arundinaria gigantea	Giant cane	5.34
Vitis rotundifolia	Muscadine	5.89
Gelsemium sempervirens	Carolina jessamine	6.31
Sanicula canadensis	Black snakeroot	6.39
Galium aparine	Catchweed bedstraw	6.50
Carex albolutescens	Sedge	6.50
Cynanchum laeve	Cynanchum	6.50
Lonicera sempervirens	Trumpet honeysuckle	6.50

(Sheet 4 of 4)

Appendix E contains a listing by stratum of the plant species identified in this study and the calculated FTI numbers with standard deviations provided for each species.

FTI numbers were calculated for all plants identified by species in this study, regardless of how frequently they occurred in the study. The FTI numbers calculated for species with few occurrences may be suspect. FTI numbers for some of the more commonly occurring species in the study are listed in Table 4. These species can generally be found along the moisture gradient in any bottomland hardwood forest in the southeastern United States in roughly the order from wettest to driest community as presented. Some species, such as Nuttall's oak, are common in only part of the region, and not all species can be expected on the same site because of the species' response to other environmental gradients.

Examples of FTI numbers by life stage for woody species are presented in Table 5. Although differences between FTI numbers for tree and sapling life stages are not great, FTI numbers for saplings tend to be slightly higher than for trees because saplings are generally more sensitive to flooding than trees. The sapling life stage also tends to occur in a broader range of zones than the tree life stage because of temporal variations in selective pressures (e.g., competition and response to flooding). FTI numbers of seedlings have little value in determining hydrologic zones because they only reflect seed dispersal potential and germination wherever seedbed conditions are favorable. For example, seedlings of least tolerant species (e.g., *Sassafras albidum*) occasionally occur in lower zones (Table D3, Zone 3), but the individuals do not survive to maturity unless the hydrologic regime is drastically altered.

Table 5
Variations in Species Flood Tolerance Index Numbers According to Life Stage

Scientific Name	Tree	Sapling	Seedling
Taxodium distichum	2.97	3.33	3.09
Gleditsia aquatica	3.50	3.15	3.27
Carya aquatica	3.54	3.70	3.69
Quercus lyrata	3.73	3.99	3.80
Fraxinus pennsylvanica	4.44	4.27	4.00
Quercus nuttallii	4.50	4.50	4.50
Acer negundo	4.83	5.20	5.58
Celtis laevigata	4.84	4.37	4.77
Liquidambar styraciflua	5.03	5.52	4.87
Quercus nigra	5.73	5.92	5.85
Sassafras albidum	6.50	6.50	6.07

The average importance value was plotted for each species in every zone where it occurred in the study. Although a species can be expected to occur in a number of zones, many had a peak occurrence in a particular zone (Figure 4). However, because this study did not analyze a continuous gradient, FTI numbers were calculated from mean importance values across the entire study and do not necessarily represent the maximum in ecological amplitude for a species.

Three general species distribution patterns are shown in Figure 4. The first pattern includes species such as water tupelo (NYAQ) and bald cypress (TADI), in which mean importance value is greatest in Zone 2 and the species no longer occurs after either Zone 3 or 4. This pattern is indicative of species having the strongest competitive advantage in areas of greatest duration of

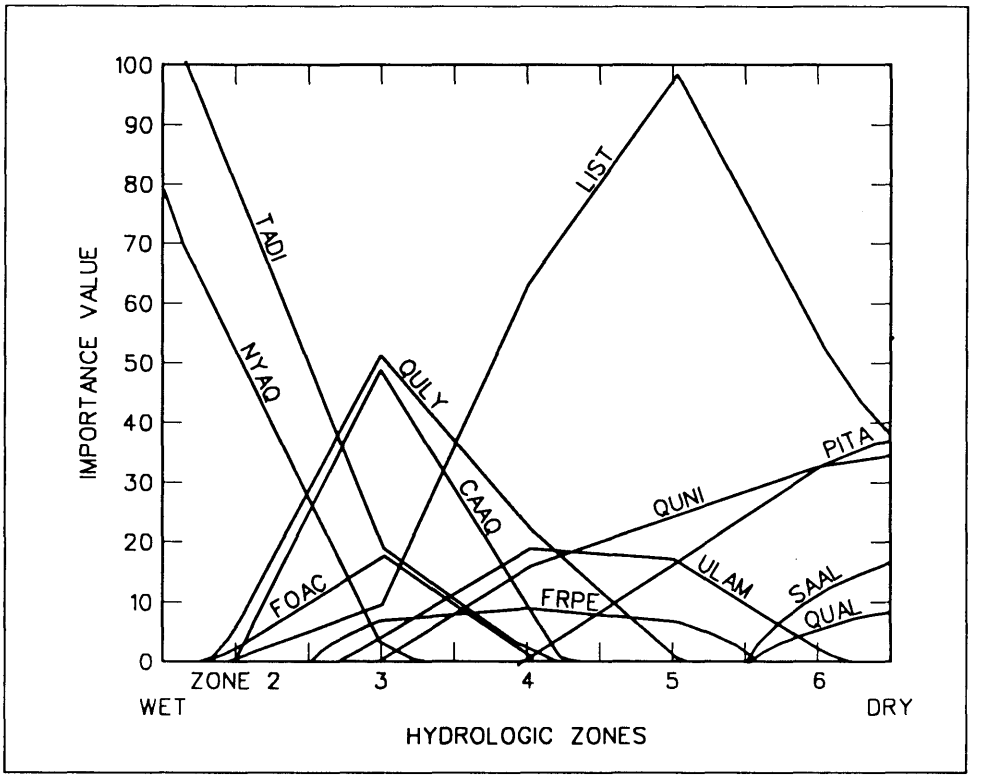

Figure 4. Ecological amplitude of some commonly occurring species; CAAQ: *Carya aquatica*; FOAC: *Forestiera acuminata*; FRPE: *Fraxinus pennsylvanica*; LIST: *Liquidambar styraciflua*; NYAQ: *Nyssa aquatica*; PITA: *Pinus taeda*; QUAL: *Quercus alba*; QULY: *Quercus lyrata*; QUNI: *Quercus nigra*; SAAL: *Sassafras albidum*; TADI: *Taxodium distichum*; and ULAM: *Ulmus americana*

inundation/soil saturation. The second pattern is typified by species such as water oak (QUNI), loblolly pine (PITA), sassafras (SAAL), and white oak (QUAL), in which the greatest mean importance value occurs in Zone 6 (uplands) and decreases from Zone 5 to 2. Hence, they have a stronger competitive advantage in areas where inundation/soil saturation is less than 5 percent of the growing season. However, some of these species (e.g., water oak and loblolly pine) may occasionally occur as dominants in wetlands. The third pattern is typified by species having the greatest mean importance values in Zones 3, 4, and 5. Species in this group sometimes occur as dominant species in either Zone 2 or 6, but are best adapted for occurrence at some point in Zones 3, 4, and 5. Species having the greatest mean importance values in Zone 3 are overcup oak (QULY) and bitter pecan (CAAQ), while American elm (ULAM) and sweetgum (LIST) develop the greatest mean importance values in Zones 4 and 5, respectively.

Other systems have been developed to identify the degree of wetness for which a species is best adapted (e.g., Hook 1984, Reed 1988). These systems used qualitative descriptions, such as "most tolerant" or "obligate hydrophyte,"

and are based primarily on the literature or "expert evaluations" and not on a single coordinated study. Species evaluations were also made by life forms in this study, and no such distinction was made in the other two systems. However, all three systems, including the FTI numbers, were developed to identify a degree of wetness for which a species is best adapted. They all have five categories that vary from wettest to driest. Therefore, an obvious comparison would be to compare species having an FTI integer of 2, with the most tolerant and obligate designation, an FTI integer of 3, with the highly tolerant and facultative wet description, etc.

Species identified in this study are listed along with corresponding FTI numbers and ratings of those species from the systems developed by Hook and Reed in Appendix E. Among selected tree species shown in Table 6, all species having an FTI number from 2 to 4 are obligate plants (OBL) in the *National List of Plant Species that Occur in Wetlands: Southeast (Region 2)* (Reed 1988) and have a water-logging-tolerance rating of most or highly tolerant (Hook 1984). All listed species except *Pinus taeda* that have an FTI number of 6 to 6.5 are facultative upland (FACU) species (Reed 1988) and are rated by Hook (1984) as the least-tolerant species. *P. taeda* (FTI-6.41) has an indicator status of facultative (FAC) and is rated by Hook as moderately tolerant of waterlogged soils. All species except *Betula nigra* that have an FTI number of 4 to 6 are facultative wet (FACW) or FAC and are rated as moderately or weakly tolerant. *B. nigra*, an obligate species, occurs on well-drained soils, often on natural berms. FTI numbers were computed only for bottomland forests and do not reflect occurrence in other wetland types (e.g., pocosins and Carolina bays); thus, slight deviations from the above pattern should be expected for some species. Also, some species may have genetic variants that possess varying degrees of flood tolerance. Hook et al. (1988) reported that interspecific variation in tolerant to waterlogging exists in loblolly pine (*Pinus taeda*). This variation may also be true of other species.

Although the system using the National Wetlands Inventory (NWI) indicator status (Reed 1988) does not allow comparison of hydrologic definitions, the actual average duration of flooding in this study compared with Hook's (1984) waterlogging tolerance rating definitions yields strong agreement. For example, assuming an average 225-day growing season, the most tolerant rating can be defined as approximately 200 days (Appendix E). The boundary between Zones 2 and 3 (which theoretically would be slightly drier because the designation most tolerant is best compared to Zone 2, not the boundary between Zones 2 and 3) has a duration of inundation/soil saturation that ranges from 92 to 198 days. Highly tolerant ranges from 30 to 90 days versus 20 to 66 days for the Zone 3-4 boundary. Weakly tolerant ranges from 1 to 4 weeks, while the Zone 4-5 boundary ranges from 8 to 31 days. "Least tolerant" is defined as waterlogging for a few days, but usually less than 2 percent of the growing season. Using the 225-day growing season, this condition could be assumed to be 3 or 4 days. The boundary between Zones 5 and 6 varied from less than 1 to 10 days.

Table 6
Comparison of Three Water-Tolerance Ratings for Selected Bottomland Forest Tree Species

Species	FTI[1] ± Standard Deviation	NWI[2] Status Region 2	Waterlogging Tolerance Rating Group[3]
Nyssa aquatica	2.62 ± 0.20	OBL	Most tolerant
Salix nigra	2.83 ± 0.58	OBL	Most tolerant
Fraxinus caroliniana	2.87 ± 0.41	OBL	Most tolerant
Taxodium distichum	2.97 ± 0.61	OBL	Most tolerant
Forestiera acuminata	3.48 ± 0.50	OBL	Most tolerant
Gleditsia aquatica	3.50 ± 0.00	OBL	Highly tolerant
Carya aquatica	3.54 ± 0.34	OBL	Highly tolerant
Quercus lyrata	3.73 ± 0.68	OBL	Highly tolerant
Betula nigra	4.01 ± 1.73	OBL	Moderately tolerant
Diospyros virginiana	4.13 ± 0.82	FAC	Moderately tolerant
Acer rubrum	4.21 ± 0.68	FAC	Moderately tolerant
Fraxinus pennsylvanica	4.44 ± 0.67	FACW	Moderately tolerant
Ulmus americana	4.46 ± 0.62	FACW	Moderately tolerant
Quercus phellos	4.81 ± 1.07	FACW	Moderately tolerant
Acer negundo	4.83 ± 0.47	FACW	Moderately tolerant
Carpinus caroliniana	4.84 ± 0.61	FAC	Weakly tolerant
Celtis laevigata	4.84 ± 0.56	FACW	Weakly tolerant
Liquidambar styraciflua	5.03 ± 0.65	FAC+	Moderately tolerant
Carya illinoensis	5.57 ± 1.01	FAC+	Weakly tolerant
Pinus taeda	6.41 ± 0.14	FAC	Moderately tolerant
Cornus florida	6.50 ± 0.00	FACU	Least tolerant
Fagus grandifolia	6.50 ± 0.00	FACU	Least tolerant
Quercus alba	6.50 ± 0.00	FACU	Least tolerant
Sassafras albidum	6.50 ± 0.00	FACU	Least tolerant

[1] Mean for all study sites.
[2] Taken from Reed (1988); see Appendix A.
[3] Taken from Hook (1984); see Appendix B.

Weighted Averaging

Weighted average estimates of species optima in this study were calculated as FTI values as previously described, with importance values used as the indicator of species abundance at each site.

The use of the weighted averaging approach requires that a number of conditions be met, including: (a) species exhibit unimodal abundance distributions; (b) species optima are equally spaced along the environmental variable; (c) species have equal tolerances of the environmental variable; and (d) species have equal maximum values for the environmental variable. Strict adherence to some of these conditions is not always possible. Additional considerations should also be noted. Species-rich samples should not occur at one end of the gradient. Environmental tolerances of species should not vary substantially. The standard deviation of FTI numbers is an estimate of tolerance in this analysis. Species with narrow tolerances have low FTI numbers and standard deviations, and those with wide tolerance have high standard deviations.

Some of the aforementioned conditions are not strictly met in this study. Although species richness was fairly even across the hydrologic gradient, few species had a peak abundance in Zone 5, perhaps because Zone 5 was undersampled (n = 4) relative to the other zones. The condition of a unimodal abundance distribution is upheld for tree species with peaks in hydrologic Zones 2, 3, and 6, but several species (e.g., *Ilex opaca, Quercus nigra, Nyssa sylvatica,* and *Liquidambar styraciflua*) exhibit bimodal distributions with peaks in Zones 4 and 6. Again, this pattern may have been influenced by fewer samples being taken in Zone 5. The condition of equal tolerances is also violated somewhat. For instance, those species with abundance peaks in Zones 2 and 6 have narrow tolerances; whereas, those that commonly occur in Zone 4 are also fairly common in other hydrologic zones as well. However, these deviations from the conditions for weighted averaging analysis do not necessarily render the FTI method invalid. Additional analyses were applied to help determine its validity.

Statistical Analysis of the Vegetation Data

To evaluate a method of identifying hydrologic zones based on vegetative associations, the analysis must be based on common species occurring within the region of interest. Species that occur infrequently may be excellent indicators of hydrologic conditions when present, but their limited abundance makes evaluating their usefulness in determining a hydrologic zone difficult. For this reason, species occurring relatively infrequently in this study were not used in testing the validity of the weighted averages (FTI numbers). More than half of the 74 tree species (n = 44) recorded had 20 or fewer individuals throughout the study region and, therefore, were not used in the analyses. The remaining 30 tree species accounted for 90.4 percent of the individual trees. One hundred and eighteen species of saplings and shrubs were recorded. Only those

29 species which represented at least one percent or more of the total and together accounted for 78 percent of the total saplings and shrubs data set were used in the statistical analysis. A total of 31 vine species were recorded; the 20 more common species accounted for 96.5 percent of all individuals and were the species analyzed statistically. The herbaceous ground-cover data set contained 268 species. Most occurred only rarely in this study, and only 30 species whose abundances equaled or exceeded 1 percent of the total herb individuals were included in the analysis. These species accounted for 48.9 percent of all individuals in this vegetative category.

Cluster Analyses

A method of calibration suggested by Ter Braak and Prentice (1988) is cluster analysis in which an environmental value (hydrologic zone) is predicted through use of species abundance indicators (relative frequency). In addition to relative frequency, cluster membership was used as a predictor of hydrologic zone. Species were clustered according to similar abundance distributions across the hydrologic gradient.

Cluster analysis was used to group the 30 tree species into five clusters based on the five hydrologic zones. Results (Figure 5) show that, with the exception of chinaberry (MEAZ) and deciduous holly (ILDE), five distinct groups can be discerned. Table 7 gives the relative frequencies of occurrence of each species in each hydrologic zone (species are grouped by cluster). Inspection of the data reveals why chinaberry and deciduous holly did not group readily. Chinaberry is the only species that occurs almost exclusively in Zone 5. Its occurrence is also restricted to a single site. The distribution of deciduous holly peaks in Zones 2 and 3, but not to the extent of other common species in these zones. Because chinaberry and deciduous holly did not group readily, they were eliminated from further analysis.

A closer inspection of Table 7 indicates that the five clusters have modal peaks that correspond, with varying amplitude, to the five hydrologic zones. Trees in cluster 1 are found almost exclusively in Zones 2 and 3. Likewise, trees in cluster 2 occur most commonly in Zone 3. Cluster 5 had the most restrictive distribution, with three of the four species occurring exclusively in Zone 6. The remaining clusters, 3 and 4, had less distinctive modes, but exhibited greater distributions in Zones 4 and 6.

Cluster analysis on the entire sapling and shrub data set did not produce distinct groupings (Figure 6). Silver bell (HADI) was not evaluated further because it occurred at a single site. The data set was split into the two sapling and shrub (bush) components, and cluster analysis was recalculated on each component. The saplings alone (n = 17) grouped more distinctly (Figure 7) than the shrubs (n = 11) (Figure 8). Shrubs, therefore, were not used in any further analyses. Saplings alone grouped into five distinct groups but not as

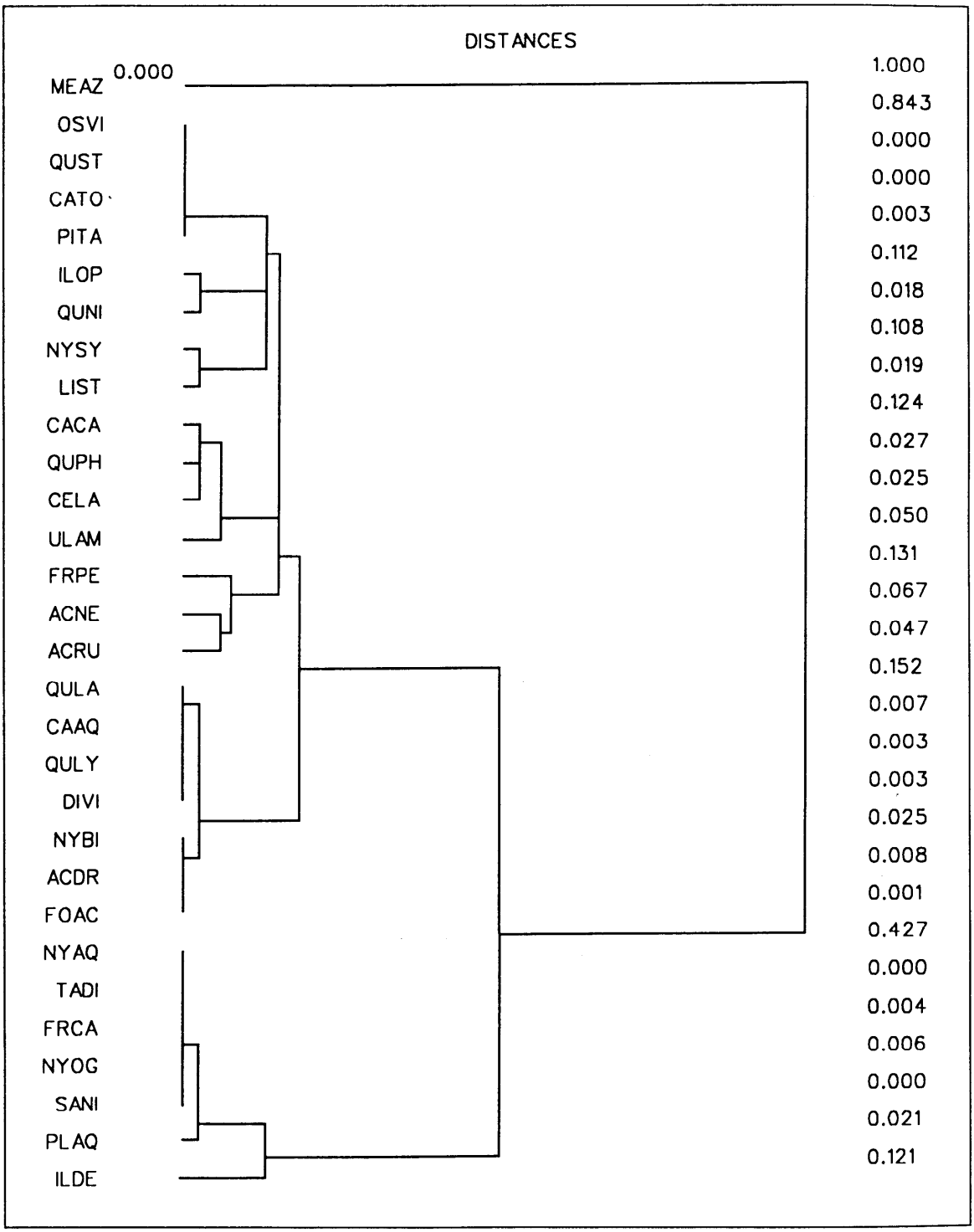

Figure 5. Cluster diagram for trees (Distance metric is 1-Pearson correlation coefficient, single linkage method - nearest neighbor)

Table 7
Relative Frequencies in Each Hydrologic Zone of Tree Species Used in the Statistical Analyses; Groupings of Species Correspond to Cluster Membership

Species	Hydrologic Zone					
	2	3	4	5	6	Cluster
NYAQ[1]	85.0	15.0	0	0	0	1
TADI	82.7	15.6	1.8	0	0	
FRCA	79.1	20.9	0	0	0	
NYOG	93.9	6.1	0	0	0	
SANI	96.5	3.5	0	0	0	
PLAQ	67.7	31.6	0.7	0	0	
QULA	0.9	70.1	26.2	0	2.8	2
CAAQ	0.8	80.0	19.2	0	0	
QULY	6.5	72.9	20.0	0.6	0	
DIVI	0	70.6	20.6	2.9	5.9	
NYBI	15.3	84.7	0	0	0	
ACDR	7.1	88.1	4.8	0	0	
FOAC	3.6	94.0	2.4	0	0	
CACA	0.6	2.8	63.7	17.0	15.9	3
QUPH	0	8.6	74.1	10.3	6.9	
CELA	2.0	9.8	62.8	21.6	3.9	
ULAM	1.9	21.2	50.0	25.0	1.9	
FRPE	0	45.2	42.9	11.9	0	
ACNE	0	31.1	53.3	4.4	11.1	
ACRU	6.8	38.4	52.0	1.4	1.4	
ILOP	0	0	41.7	0	58.3	4
QUNI	0	1.6	32.8	7.4	58.24	
NYSY	0	0	55.9	5.9	38.2	
LIST	0.3	6.0	45.4	14.9	33.3	
OSVI	0	0	0	0	100	5
QUST	0	0	0	0	100	
CATO	0	0	0	0	100	
PITA	0	0	7.3	0	92.7	

[1] Represents the first two letters of the plant genus and the first two letters of the species name, i.e., NYAQ stands for *Nyssa aquatica*. Species codes for all species are identified in Appendix E.

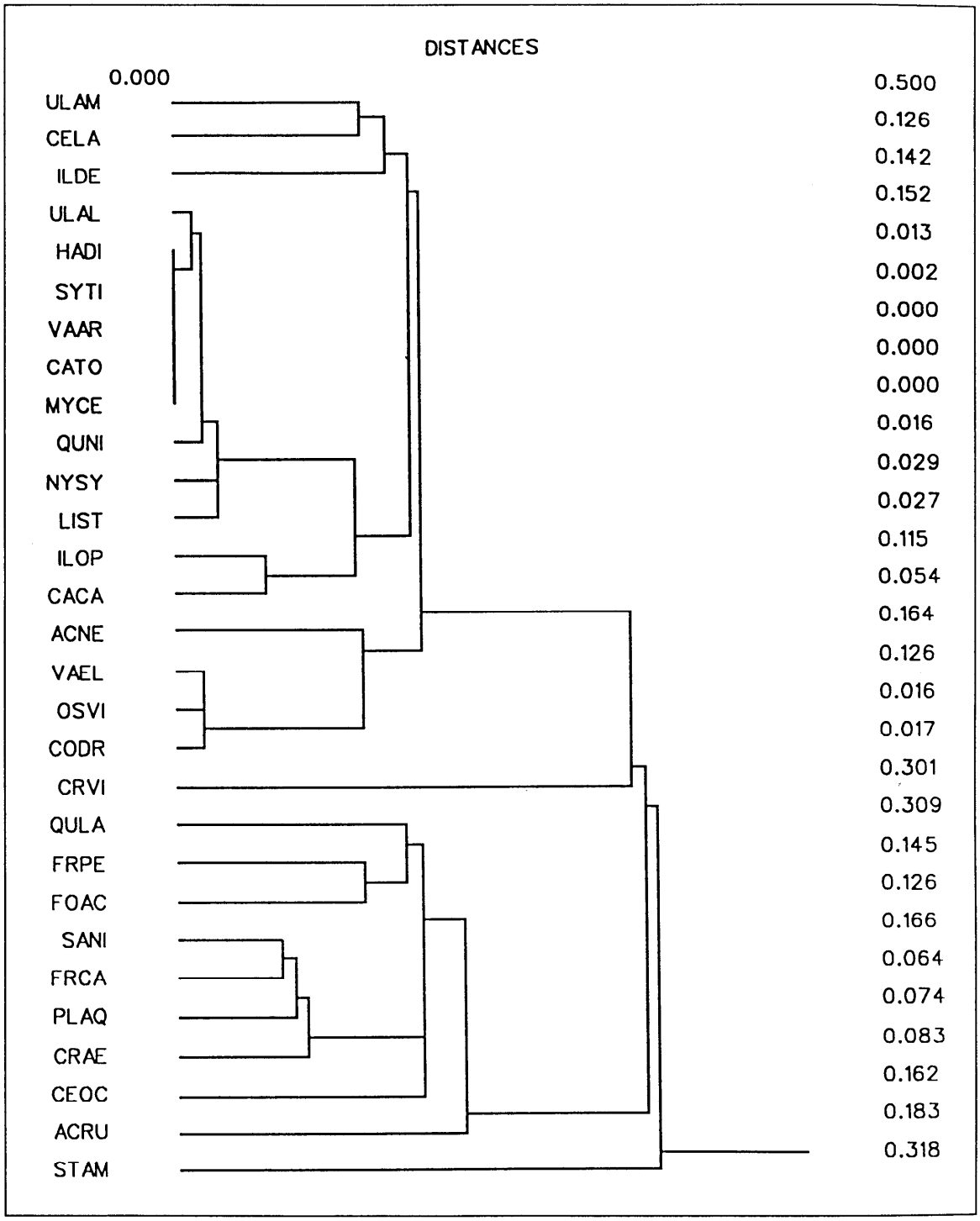

Figure 6. Cluster diagram for saplings and shrubs (Distance metric is 1-Pearson correlation coefficient, single linkage method - nearest neighbor)

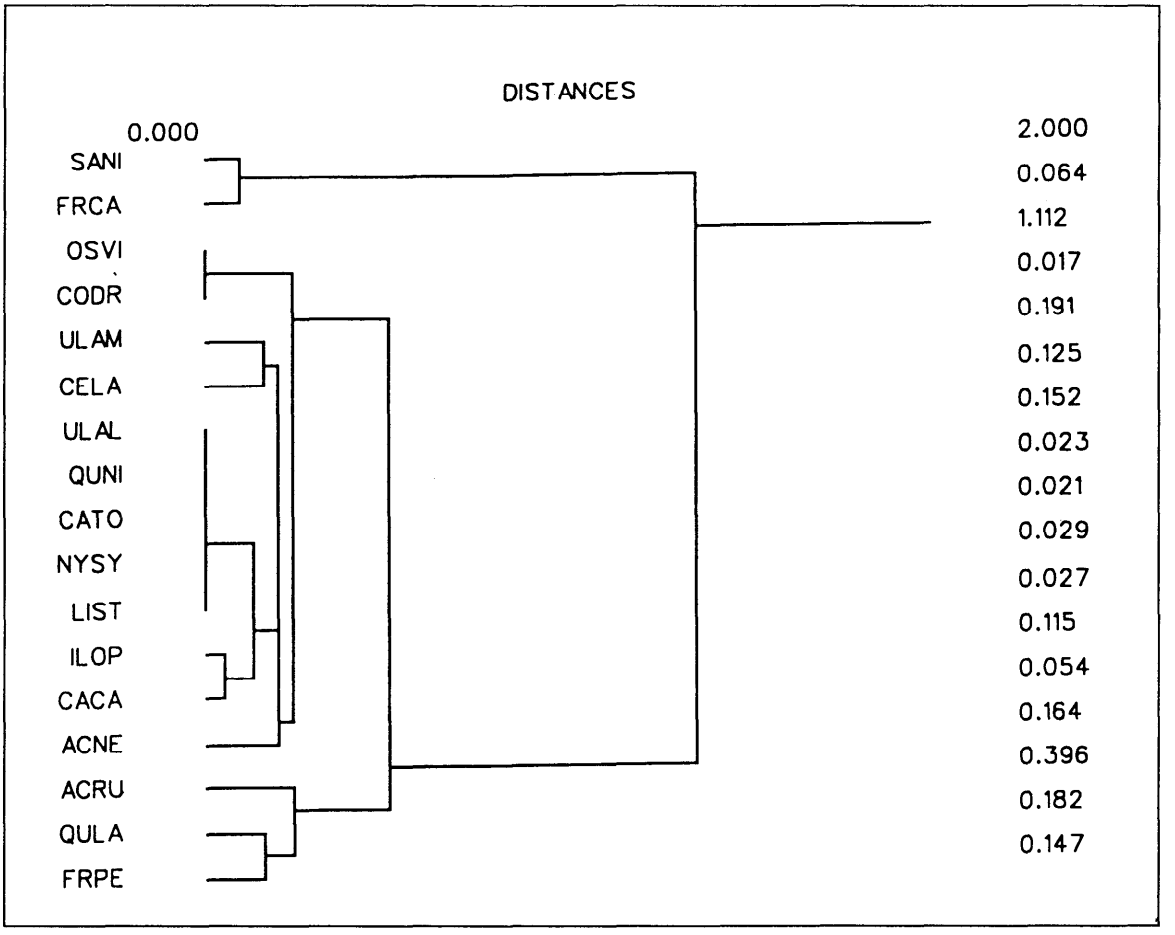

Figure 7. Cluster diagram for saplings alone (Distance metric is 1-Pearson correlation coefficient, single linkage method - nearest neighbor)

strongly as trees. The relative frequency of occurrence and cluster membership of the sapling species are given in Table 8.

The vine data produced five clusters, morning glory (IPWR) being a single species cluster corresponding to Zone 2 (Figure 9). Two vine species poison ivy (TORA) and trumpet creeper (CARA) were not included in larger clusters, largely because of their apparent wide tolerances of hydrologic conditions. Table 9 depicts the relative abundance distributions of each vine species across the hydrologic gradient within a cluster and illustrates a pattern similar to but not as strong as that of the tree species.

The herb data also did not cluster distinctly (Figure 10). Inspection of the abundance distributions of the herbaceous species reveals an absence of strong unimodal peaks that correspond to hydrologic zones; therefore, this vegetative type is less useful in classification. The lack of significant clustering of the shrub and herbaceous data sets was consistent with the results of ordination attempts of the ground layer at Neches River sites by Mohler (1979). Mohler concluded that the herbs and low shrubs were relatively unimportant

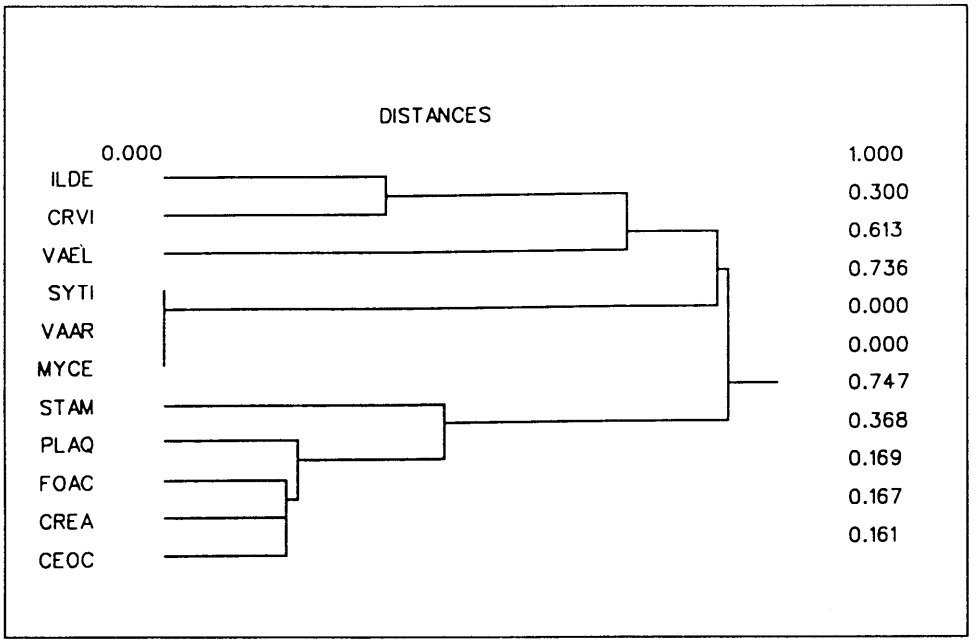

Figure 8. Cluster diagram for shrubs alone (Distance metric is 1-Pearson correlation coefficient, single linkage method - nearest neighbor)

components of the forest when compared to the trees. Clearly, the low shrubs and herbaceous species are more prone to bias due to successional processes and vegetative change caused by local disturbances which may be unrelated to the environmental gradient.

Results of cluster analyses suggest that cluster membership for tree data provide better indicators of hydrologic zones than saplings or vines. Shrubs and herbaceous species would be the least useful of all strata types.

Discriminant Function Analysis

Discriminant function analysis (DFA) is used to determine functions which allow one to classify an individual into one of the hydrologic zones using a number of independent variables. The independent variables in this analysis are the average importance values for each tree cluster and vine cluster in each zone. In cases where only one species in a cluster was present in a zone, that importance value alone was used. Table 10 lists the data set upon which this analysis was based.

Three analyses were performed using DFA. The first analysis developed a classification model using only the importance value from tree clusters. This model correctly classified 47 of 55 sites for an overall misclassification rate of 14.6 percent (Table 11). In all cases, errors involved an assignment to a neighboring zone. For instance, a single Zone 3 site was assigned to Zone 2, and three Zone 6 sites were assigned to Zone 5. The greatest error in

Table 8
Relative Frequency of Occurrence of Each Sapling Species in the Hydrologic Zones Along with Their Cluster Memberships

Species	2	3	4	5	6	Cluster
SANI	99.4	0.6	0.0	0.0	0.0	1
FRCA	61.0	21.2	2.7	0.0	15.1	
ACRU	1.4	35.8	35.1	4.6	23.0	2
FRPE	0.0	50.0	21.9	21.9	6.3	
QULA	4.7	53.3	36.7	3.6	1.8	
ULAM	0.0	2.0	42.1	32.2	23.7	3
CELA	0.0	13.1	47.5	19.5	19.9	
OSVI	0.0	0.0	0.0	71.2	28.8	4
CODR	0.0	0.0	1.5	80.0	18.5	
ULAL	0.0	0.0	0.8	17.7	81.5	5
QUNI	0.0	0.4	14.2	11.1	74.2	
CATO	0.0	0.0	0.0	0.0	100.0	
NYSY	0.0	0.0	24.7	22.7	52.6	
LIST	0.0	5.4	24.2	14.6	55.8	
ILOP	0.0	0.0	55.5	5.0	39.5	
CACA	0.2	1.4	40.6	15.7	42.0	

classification that occurred for Zone 4 sites was expected because of the greater tolerance of species for this zone. As previously shown (Figure 4), Zone 4 is that portion of the hydrologic gradient that has species common to all three distribution patterns identified. Three Zone 6 sites were assigned to Zone 5 primarily because of the lack of Zone 6 species being identified as commonly occurring. A better agreement would be expected if all species were used.

The second model examined the ability of vine cluster importance values to predict zone. Although vines did not cluster as well as trees, a DFA was examined because their cluster patterns were similar. However, this model correctly classified only 26 of 55 zones for a 52 percent misclassification. This model was not considered adequate, and the results of its classification are not presented.

A final model was generated to examine the effectiveness of using the average site FTI numbers of all observed tree species at a site for each of the 55 sites. This model correctly classified 45 of 55 sites for an overall misclassification rate of 18.2 percent (Table 12). All misclassifications were in an

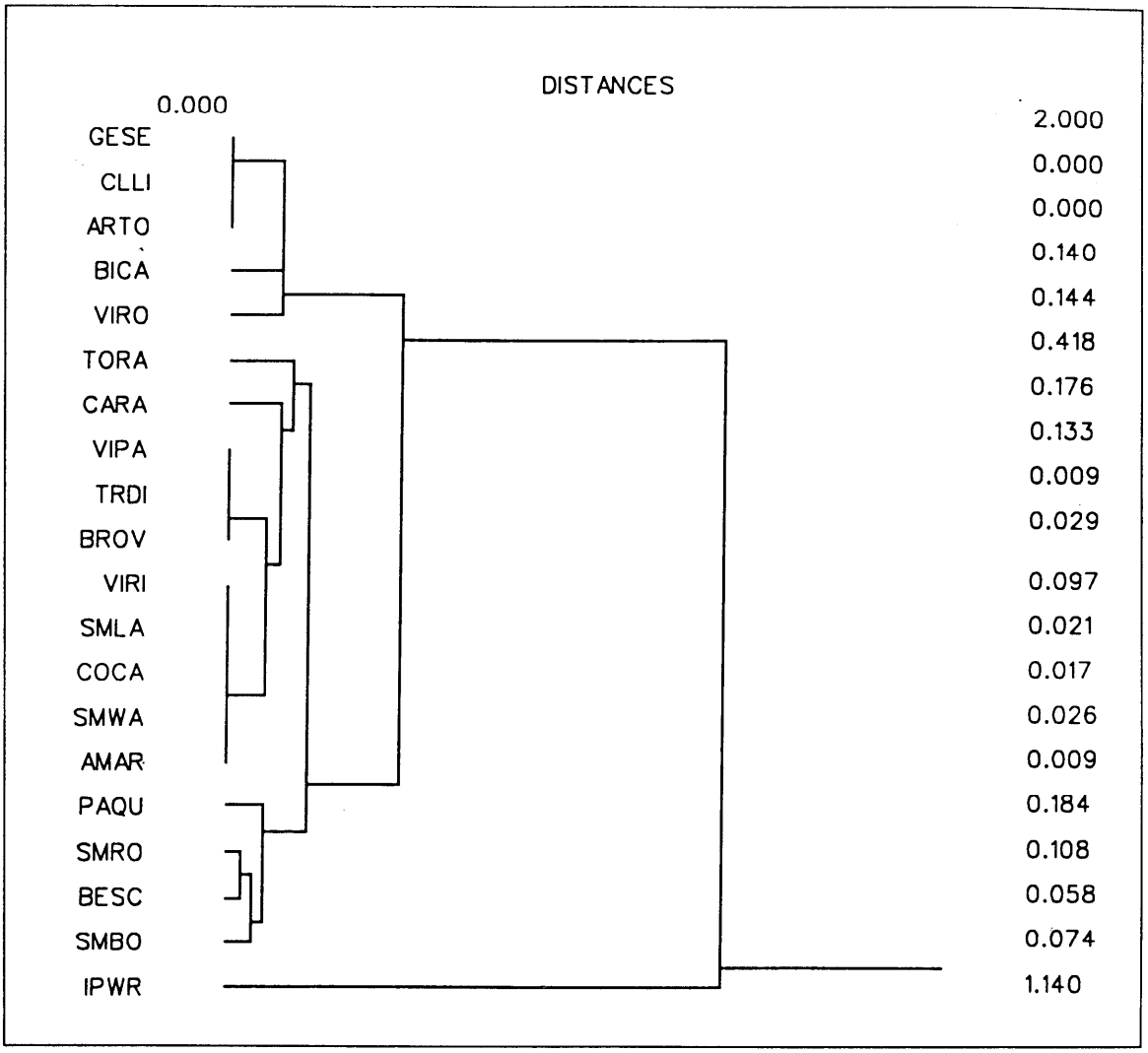

Figure 9. Cluster diagram for vines (Distance metric is 1-Pearson correlation coefficient, single linkage method - nearest neighbor)

adjacent zone. Zones 2, 3, and 5 were misclassified twice; Zone 4 was misclassified 3 times; and Zone 6 was misclassified only once. Using FTI numbers for all observed tree species improved the results obtained in the first DFA using the importance values of only the commonly occurring species.

In examining the data (Table 13), it appears that three of the misclassifications occur at site 10 (Pearl River, observations 27 to 30). The hydrology at this site was obtained from two gauges, and it is possible that an error was made in combining the hydrologic data from the two gauges. It seems ironic that the only zone correctly predicted at this site was Zone 4. Table 13 also shows the percentage probability of each of the 55 sites occurring in a zone.

Figure 11 shows the mean site FTI plotted against the observed and predicted hydrologic zones. As expected, mean FTI numbers were greater than

Table 9
Relative Frequencies in Each Hydrologic Zone of the Vine Species Used in Statistical Analyses

Species[1]	Hydrologic Zone					
	2	3	4	5	6	Cluster
IPWR	100	0	0	0	0	1
VIPA	0	64.1	30.5	5.5	0	2
TRDI	2.1	70.2	26.9	0	0.8	
BROV	13.4	65.2	17.8	3.6	0	
VIRI	1.0	33.3	43.8	7.6	14.3	3
SMLA	1.8	47.4	45.6	0	5.3	
COCA	0	41.9	52.9	0	5.2	
SMWA	9.1	36.4	53.8	0	0.7	
AMAR	13.2	37.2	46.3	0	3.3	
PAQU	1.5	55.9	2.2	40.4		4
SMRO	0	2.4	71.4	7.1	19.1	
BESC	4.6	13.7	61.1	14.5	6.1	
SMBO	6.7	13.3	43.3	26.7	10.0	
GESE	0	0	0	0	100	5
CLLI	0	0	0	0	100	
ARTO	0	0	0	0	100	
BICA	0	19.8	3.1	25.0	52.1	
VIRO	1.6	6.0	20.0	24.4	48.0	

[1] Groupings of species correspond to cluster membership.

the observed hydrologic zones at the low end (Zone 2) and less than the zones at the upper end (Zone 6) of the hydrologic gradient due to the lack of outlying zones (e.g., Zones 1 and 7) to pull these averages toward either extreme. Therefore, using DFA classification decision points show that average site FTI numbers as high as 3.45 would still be in Zone 2, and average site FTI numbers as low as 5.33 would still be in Zone 6. The lower end of the predicted Zone 4 (4.16) compares favorably with the observed (4.0). Zone 5 predicted and observed zone values are the same (5.0).

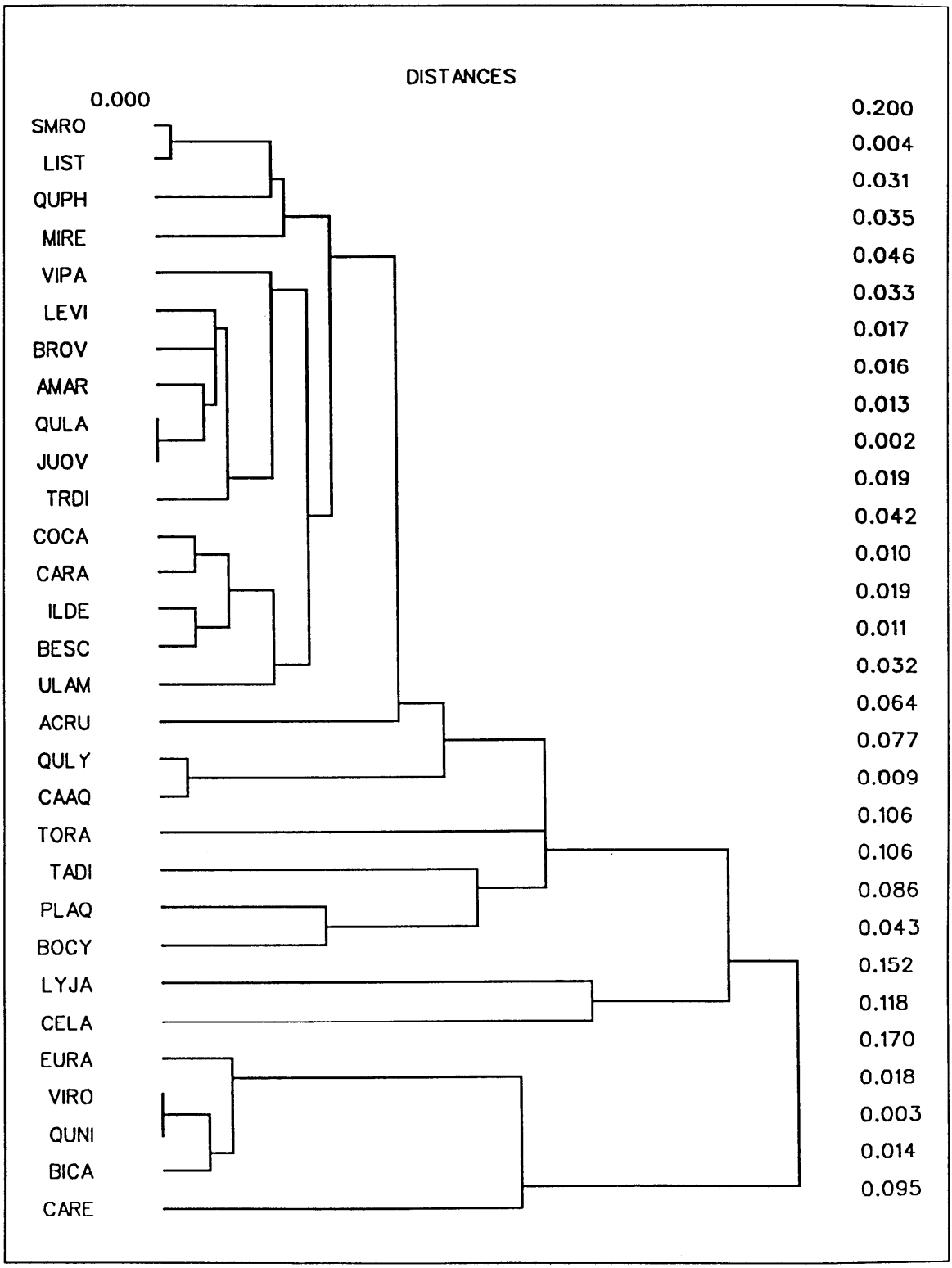

Figure 10. Cluster diagram for herbs (Distance metric is 1-Pearson correlation coefficient, single linkage method - nearest neighbor)

Table 10
Mean Importance Values for Species in Each Cluster Used in the DFA, Arranged by Zone/Sample

Zone	TC1[1]	TC2	TC3	TC4	TC5	VC2	VC3	VC4	VC5
2	78.77	0	0	0	0	0	0	0	0
2	70.26	0	0	0	0	0	0	0	0
2	65.12	0	0	0	0	0	0	0	0
2	91.7	8.26	8.32	0	0	64.06	0	203.9	0
2	62.38	0	0	0	0	0	0	0	0
2	83.49	21.16	9.48	5.66	0	0	103.24	0	162.5
2	73.45	6.19	0	0	0	141.17	38.76	53.5	0
2	68.41	12.58	0	0	0	112.22	32.13	0	11.33
2	58.62	32.76	0	0	0	0	41.32	0	0
2	58.12	4.19	0	0	0	0	300	0	0
2	74.99	33.22	3.34	0	0	300	0	0	0
3	29.57	39.47	0	8.4	0	101.56	63.02	33.87	0
3	30.3	47.5	0	19.12	0	68.2	47.04	0	0
3	0	50.08	26.13	0	0	12.98	65.86	8.65	0
3	0	71.81	0	0	0	100	0	0	0
3	24.37	66.92	7.92	0	0	93.14	0	4.89	0
3	22.84	84.85	22.59	0	0	51.13	16.28	5.57	0
3	99.86	25.52	6.41	0	0	82.8	45.12	0	0
3	30	47.29	11.72	0	0	53.87	32.81	18.92	0
3	0	85.22	13.67	11.78	0	19.27	28.8	22.65	58.54
3	32.72	54.74	10.42	0	0	89.33	78.78	0	53.11
3	7.39	48.01	16.18	37.94	0	4.2	34.88	0	12.78
3	39.94	56.21	14.8	15.66	0	0	233.26	0	0
3	10.06	99.1	47.87	13.23	0	0	144.56	47.53	5.97
3	44.79	43.95	17.52	0	0	130.77	0	0	0
3	11.06	48.2	36.72	0	0	0	0	0	0
4	0	15.04	65.41	31.36	0	135.02	0	28.46	23.4
4	0	6	52.66	40.82	0	76.47	5.96	7.9	59.12
4	0	72.7	41.12	20.82	0	13.16	24.22	8.55	8.83

(Continued)

[1] TC1 indicates tree cluster 1; VC2 indicates vine cluster 2.

Table 10 (Concluded)

Zone	TC1	TC2	TC3	TC4	TC5	VC2	VC3	VC4	VC5
4	5.94	40.19	66.29	48.27	0	30.2	68.16	25.77	0
4	16.64	31.88	155.17	34.4	0	73.4	79.8	0	0
4	0	8.35	52.08	72.63	0	5.46	13.51	42.44	0
4	0	0	40.72	126.62	0	30.46	28.14	28.88	0
4	0	17.68	21.24	81.27	0	5.74	25.98	5.97	76.54
4	10.3	12.76	18.17	187.41	0	40.49	13.95	9.71	81.55
4	0	55.18	33.31	35.37	0	5.21	44.58	60.2	25.9
4	0	7.69	19.56	67.09	0	0	0	16.41	84.39
4	0	68.09	27.28	27.85	14.53	9.97	58.12	6.32	0
4	0	0	42.94	31	18.46	0	125.37	0	150
4	0	28.79	56.29	0	0	44.81	22.4	88.65	0
5	0	0	22.97	76.73	0	4.34	17.4	16.49	9.3
5	0	0	26.84	64.91	0	15.28	0	10.36	51.22
5	0	5.81	13.86	64.23	0	6.84	0	14.87	73.04
5	0	6.02	39.94	28.87	0	0	39.86	9.59	155.82
6	0	0	35.05	29.44	26.42	0	0	0	150
6	0	0	10.82	21.19	53.32	0	0	27.3	136.35
6	0	0	35.32	33.28	0	0	24.69	26.87	52.85
6	0	5.66	5.8	71.55	0	0	3.75	14.2	54.37
6	0	4.61	26.58	50.91	0	5.3	0	17.08	49.18
6	0	0	11.79	15.8	34.58	0	11.21	14.04	55.3
6	0	0	6.06	12.3	36.91	0	52.25	10.44	49.67
6	0	16.54	0	20.22	69.98	0	0	0	96.96
6	0	0	0	29.17	154.4	4.35	6.12	4.35	114.03
6	0	0	0	59.44	89.43	0	0	0	0
6	0	0	0	71.67	120.16	0	0	90.37	5.84

Table 11
Predicted Hydrologic Zones (Columns) and Actual Zones (Rows) Based on DFA Results Using Only Tree Importance Values

Actual Hydrologic Zones	Predicted Hydrologic Zones[1]					
	2	3	4	5	6	Total
2	11	0	0	0	0	11
3	1	14	0	0	0	15
4	0	2	10	2	0	14
5	0	0	0	4	0	4
6	0	0	0	3	8	11
	12	16	10	10	8	55

[1] Misclassification rate = 14.6 percent.

Table 12
Predicted Hydrologic Zones (Columns) and Actual Zones (Rows) Based on DFA Results Using Average FTI Values for All Observed Tree Species at the Site

Actual Hydrologic Zones	Predicted Hydrologic Zones[1]					
	2	3	4	5	6	Total
2	9	2	0	0	0	11
3	0	13	2	0	0	15
4	0	2	11	1	0	14
5	0	0	2	2	0	4
6	0	0	0	1	10	11
	9	17	15	4	10	55

[1] Misclassification rate = 18.2 percent.

Table 13
Cross-Validation Results of Zone Membership Using Linear Discriminant Function Analysis

Observation	From Zone	To Zone	Posterior Probability of Membership In Zone		
			2 5	3 6	4
1	2	2	0.9876 0.0000	0.0124 0.0000	0.0000
2	3	3	0.1759 0.0000	0.8212 0.0000	0.0029
3	4	4	0.0000 0.1019	0.0062 0.0001	0.8919
4	6	6	0.0000 0.0075	0.0000 0.9924	0.0000
5	2	2	0.9876 0.0000	0.0124 0.0000	0.0000
6	3	3	0.2436 0.0000	0.7548 0.0000	0.0016
7	4	4	0.0000 0.0361	0.0376 0.0000	0.9263
8	6	6	0.0000 0.0007	0.0000 0.9993	0.0000
9	2	2	0.9801 0.0000	0.0199 0.0000	0.0000
10	3	3	0.0137 0.0001	0.8865 0.0000	0.0997
11	4	4	0.0000 0.0526	0.0202 0.0000	0.9273
12	5	5	0.0000 0.6341	0.0000 0.0993	0.2666
13	6	6	0.0000 0.0958	0.0000 0.9016	0.0026
14	3	3	0.1244 0.0000	0.8703 0.0000	0.0052
15	4	3[1]	0.0012 0.0025	0.5429 0.0000	0.4534
16	3	3	0.0597 0.0000	0.9245 0.0000	0.0158
17	4	4	0.0003 0.0075	0.2747 0.0000	0.7175

(Sheet 1 of 3)

[1] Misclassified observation.

Table 13 (Continued)

Observation	From Zone	To Zone	Posterior Probability of Membership in Zone 2 5	3 6	4
18	3	3	0.0806 0.0000	0.9092 0.0000	0.0103
19	4	4	0.0000 0.1909	0.0017 0.0005	0.8069
20	2	3[1]	0.1909 0.0000	0.8079 0.0000	0.0013
21	3	3	0.0748 0.0000	0.9138 0.0000	0.0114
22	4	4	0.0000 0.0594	0.0163 0.0000	0.9242
23	3	3	0.2436 0.0000	0.7548 0.0000	0.0016
24	4	4	0.0008 0.0036	0.4558 0.0000	0.5398
25	3	3	0.0150 0.0001	0.8945 0.0000	0.0904
26	6	6	0.0000 0.0002	0.0000 0.9998	0.0000
27	2	3[1]	0.0205 0.0000	0.9672 0.0000	0.0124
28	3	4[1]	0.0011 0.0027	0.4321 0.0000	0.5641
29	4	4	0.0000 0.1286	0.0039 0.0002	0.8673
30	6	5[1]	0.0000 0.6307	0.0000 0.0044	0.3649
31	2	2	0.8970 0.0000	0.1030 0.0000	0.0000
32	3	3	0.3105 0.0000	0.6886 0.0000	0.0009
33	4	4	0.0000 0.0526	0.0202 0.0000	0.9273
34	5	4[1]	0.0000 0.3664	0.0003 0.0060	0.6274
	4	3[1]	0.0014 0.0021	0.5719 0.0000	0.4246

(Sheet 2 of 3)

[1] Misclassified observation.

Table 13 (Concluded)

Observation	From Zone	To Zone	Posterior Probability of Membership in Zone		
			2 5	3 6	4
36	5	4[1]	0.0000 0.4502	0.0001 0.0119	0.5378
37	6	6	0.0000 0.0785	0.0000 0.9196	0.0019
38	2	2	0.9503 0.0000	0.0497 0.0000	0.0000
39	3	3	0.2436 0.0000	0.7548 0.0000	0.0016
40	4	4	0.0000 0.4057	0.0002 0.0047	0.5894
41	6	6	0.0000 0.0013	0.0000 0.9987	0.0000
42	2	2	0.9332 0.0000	0.0668 0.0000	0.0000
43	5	5	0.0000 0.6216	0.0000 0.0699	0.3085
44	6	6	0.0000 0.0013	0.0000 0.9987	0.0000
45	2	2	0.9503 0.0000	0.0497 0.0000	0.0000
46	3	4[1]	0.0001 0.0093	0.1163 0.0000	0.8743
47	6	6	0.0000 0.0015	0.0000 0.9985	0.0000
48	2	2	0.8729 0.0000	0.1271 0.0000	0.0000
49	3	3	0.2144 0.0000	0.7835 0.0000	0.0020
50	4	4	0.0000 0.1806	0.0020 0.0005	0.8170
51	6	6	0.0000 0.0011	0.0000 0.9989	0.0000
52	2	2	0.7969 0.0000	0.2031 0.0000	0.0000
54	4	5[1]	0.0000 0.7509	0.0000 0.0739	0.1753

(Sheet 3 of 3)

[1] Misclassified observation.

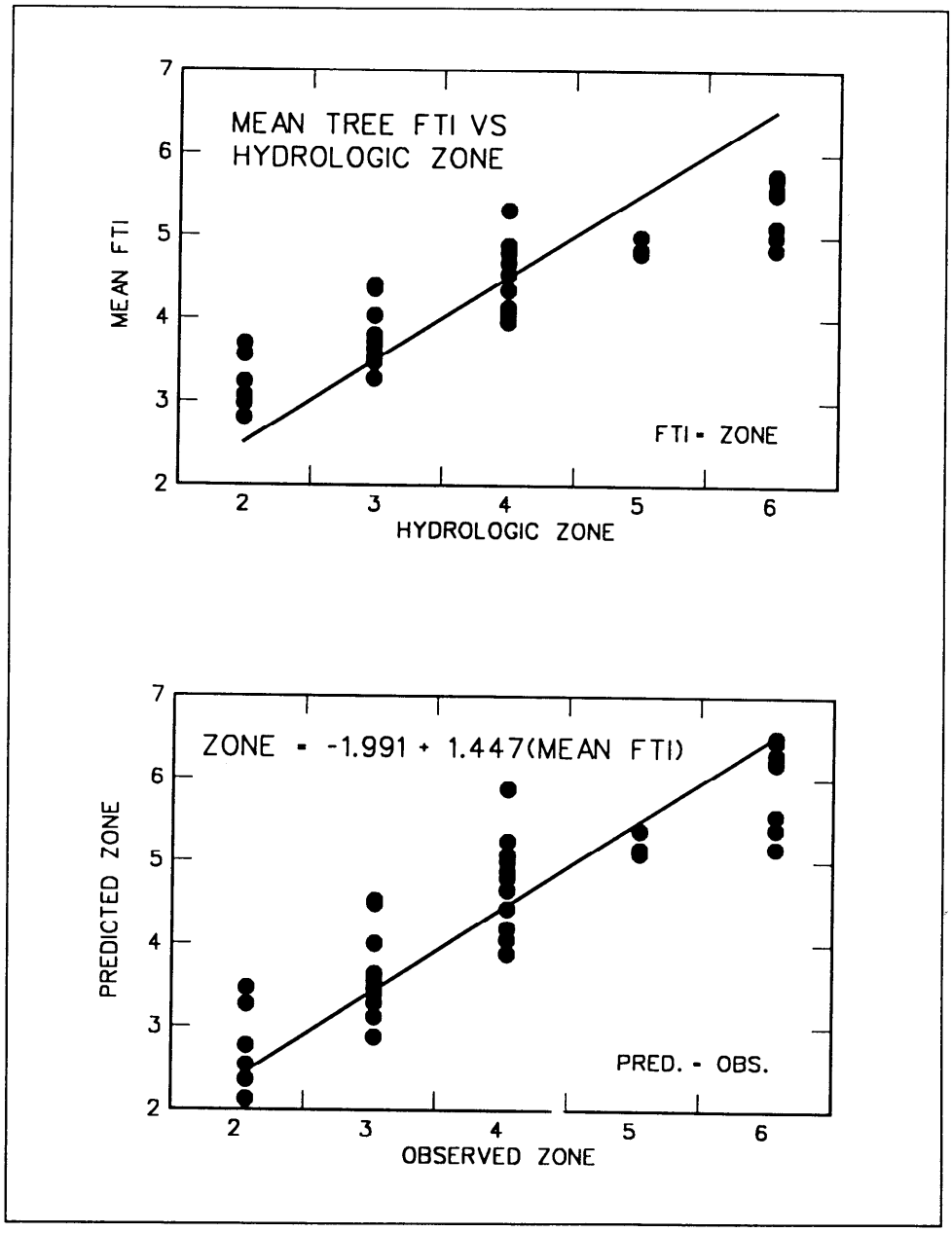

Figure 11. Mean tree FTI numbers plotted versus observed and predicted hydrologic zones for all 55 sites

Regional Variation in Species FTI Numbers

Because the 17 sites in this study occur over a broad geographic area, the possibility of regional differences in species FTI numbers was a concern. To test for possible differences, the sites were grouped into three regions: Gulf

Coast (sites 1, 2, 10, 11, 12), Mississippi Valley (sites 3 through 9), and Atlantic Coast (sites 13 through 17).

A two-factor analysis of variance (ANOVA) was used to test for differences in importance values between regions and clusters for trees. There was no significant interaction between region and cluster trees ($F = 0.71$, $p = 0.68$); therefore, importance values of species within a cluster do not differ among regions. There was a significant difference between regions ($F = 4.02$, $p = 0.019$), reflecting the fact that importance values of trees were greater in the Mississippi Valley, averaging 49.1 ± 47.6, than the Gulf Coast (37.5 ± 37.2) and Atlantic Coast (39.3 ± 34.4) regions. A number of factors may contribute to this phenomenon, including stand maturity and localized disturbances.

Another two-factor ANOVA also was used to determine whether the predicted zone values generated were more accurate in one region or another. The absolute value of the difference between the predicted and actual zones was used as the dependent variable. There was neither an interaction ($F = 1.44$, $p = 0.18$), nor a main effect ($F = 1.54$, $p = 0.22$) involving region, thus indicating that the hydrologic zones can be predicted with equal accuracy among the specified regions.

4 Summary and Conclusions

Bottomland hardwood forests are dynamic and complex systems. Frequent flooding from adjacent streams provides the forcing function that characterizes the affected plant communities. Frequency and duration of floodwater determine the extent of anaerobic soil conditions that directly affect plant populations. Plant species adapted for life in anaerobic soil conditions are located in the topographically lowest areas subject to long duration flooding. Species composition changes as the elevational and associated moisture gradient changes from wettest to driest and reflects species adaptations to the prevailing hydrologic regimes.

Determination of a hydrologic gradient often requires extensive data gathering over a long period. However, many studies have shown that a definite relationship exists between plant species and the timing, frequency, and duration of inundation and soil saturation (Larson et al. 1981). This study was undertaken to express quantitatively the optimum position of various plant species along a hydrologic gradient.

Previous studies have estimated the location of plant species and communities along a hydrologic gradient. Various systems have been proposed that use vegetation to predict the duration and/or frequency of flooding. However, previous studies were limited to a small geographic area, the developed systems are qualitative, and vegetation data used to predict the degree of flooding for the entire southeastern United States previously have been literature-based involving many studies with varying research designs.

Vegetation data resulting from this study related four vegetation strata and three life forms occurring in 55 stands at 17 sites throughout the southeastern United States. Hydrologic regimes were calculated for a 10- to 20-year period of record for each stand. A flood tolerance index (FTI) system of weighted averages based on importance values was developed, and FTI numbers were calculated for various life stages of each species identified in the study.

Three hundred and twelve species were identified for each of 4 strata in the study including 74 tree species, 188 species of saplings and shrubs, 31 species of woody vines, and 268 species of herbs and woody seedlings. Comparison of the FTI numbers with two other systems (Hook 1984, Reed 1988) using

vegetation to estimate wetness showed general agreement among the systems, especially for mature trees.

Cluster analysis and discriminant function analysis were used to evaluate the weighted averaging technique and explore the best method for using the FTI numbers in predicting hydrologic regimes.

Tree, sapling, and vine data clustered into distinct groups. Herbaceous and shrub data did not group distinctively. Tree and vine importance values for each cluster in a zone/sample (data taken in a single zone at a site) and FTI numbers for tree data were used as independent variables for the discriminant function analyses. Tree species were found to be more useful than saplings, shrubs, vines, or herbaceous species in predicting hydrologic zones. The tree data alone using importance values provided 85 percent accuracy. Tree data alone using FTI numbers was only slightly less accurate at 82 percent. All misclassifications assigned membership to a neighboring zone. Misclassifications are understandable for two important reasons. Zone 4 contains the more facultative species because as wetness decreases, other environmental conditions begin to exert greater influence. Also, since Zone 5 is so narrow compared to other zones and most species occurring in Zone 5 occur in greater abundance in either Zone 4 or 6, very little difference in the community structure exists between the top of Zone 4 and the bottom of Zone 6.

The accuracy of these predictions may be somewhat inflated, because hydrologic zone was a parameter used to derive species FTI numbers.

There were no regional (Gulf Coast, Lower Mississippi Valley, and Atlantic Coast) differences in the accuracy of the weighted averaging and predicted values. Therefore, a single FTI number calculated for each species can be used to predict zones for the entire study area.

The implication of this study is that the calculated FTI numbers can be used to estimate hydrologic regimes in bottomland forest systems of the southeastern United States. Trees were determined to be the most reliable vegetative growth form for determining hydrologic zones. However, this study was conducted in relatively undisturbed areas. Because trees can remain for decades following hydrologic disturbance, a modification of the method using saplings and seedlings may prove to be more reliable.

Techniques used in this study to develop FTI numbers in the southeastern United States may be applicable to regions of the country that have similar types of riverine forest systems.

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Appendix A
Site Descriptions and Map Locations

Neches River (Sites 1 and 2)

Location (Neches River Basin)

These sites are located in the National Big Thicket Preserve, Jack Gore Baygall unit, 6.4 km north of Evadale in Jasper County, Texas. Reference U.S. Geological Survey (USGS) map, Silsbee, Texas, N3015-W9400/15, 1955.

Hydrology data

Twenty years of hydrology data were obtained for a staff gauge on U.S. Highway 96 bridge at Evadale. Slope correction from gauge datum to study site was determined by using a water surface profile.

General vegetation

Plant communities range from *Taxodium distichum-Nyssa aquatica* in deep sloughs to *Quercus alba-Pinus taeda* and *Fagus grandifolia* on the nearby ridges. Intermediate communities consist of *Quercus lyrata, Carya aquatica, Quercus michauxii, Liquidambar styraciflua, Ulmus americana,* and *Carpinus caroliniana.*

Soils and climate

Soils vary from the very poorly drained Angelina series in sloughs to the moderately well-drained Spruger series on ridges. Other soil series encountered were Bleakwood, Urbo, and Attoyac. Average annual rainfall in the area is 170 cm, and the average growing season is 234 days.

Delineated zones

Zones 2, 3, 4, and 6 were delineated for both sites. Zone 5 was too narrow to reliably delineate because of its position on the slope of the floodplain terrace.

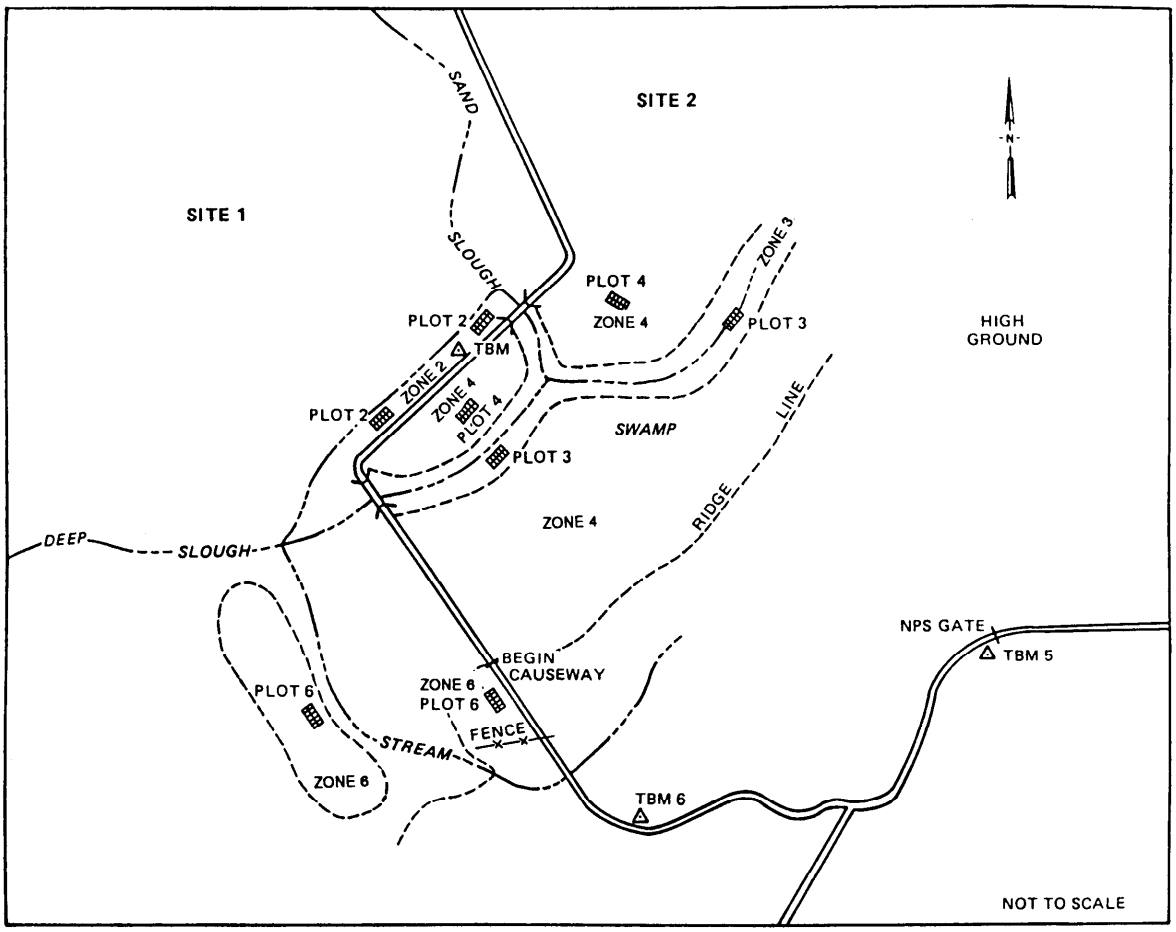

Figure A1. Neches River (sites 1 and 2)

Steele Bayou (Site 3)

Location (Yazoo River Basin)

This site is located in the Yazoo National Wildlife Refuge, 6.4 km northeast of Glen Allen in Washington County, Mississippi. Reference USGS map, Percy, Mississippi, N3300-W9052.5/7.5, 1967.

Hydrology data

Twenty years of hydrology data were obtained for a gauge on the bridge over Steele Bayou 6.4 km south of Grace, Mississippi. Slope correction from gauge datum to study site was determined by a water surface profile.

General vegetation

Plant communities ranged from a *Salix nigra-Taxodium distichum* community at lower elevations to a *Sassafrass albidum-Liquidambar styraciflua-Quercus nigra* community at the highest elevation. Intermediate communities are dominated by *Planera aquatica, Forestiera acuminata, Quercus lyrata, Carya aquatica, Fraxinus pennsylvanica, Celtis laevigata, Acer negundo,* and *Ulmus americana.*

Soils and climate

Soil series range from Sharkey at the lowest elevations to Dundee at the higher elevations. Average annual rainfall in the area is 132 cm, and the average growing season is 213 days.

Delineated zones

Zones 2 through 6 were delineated for study at this site.

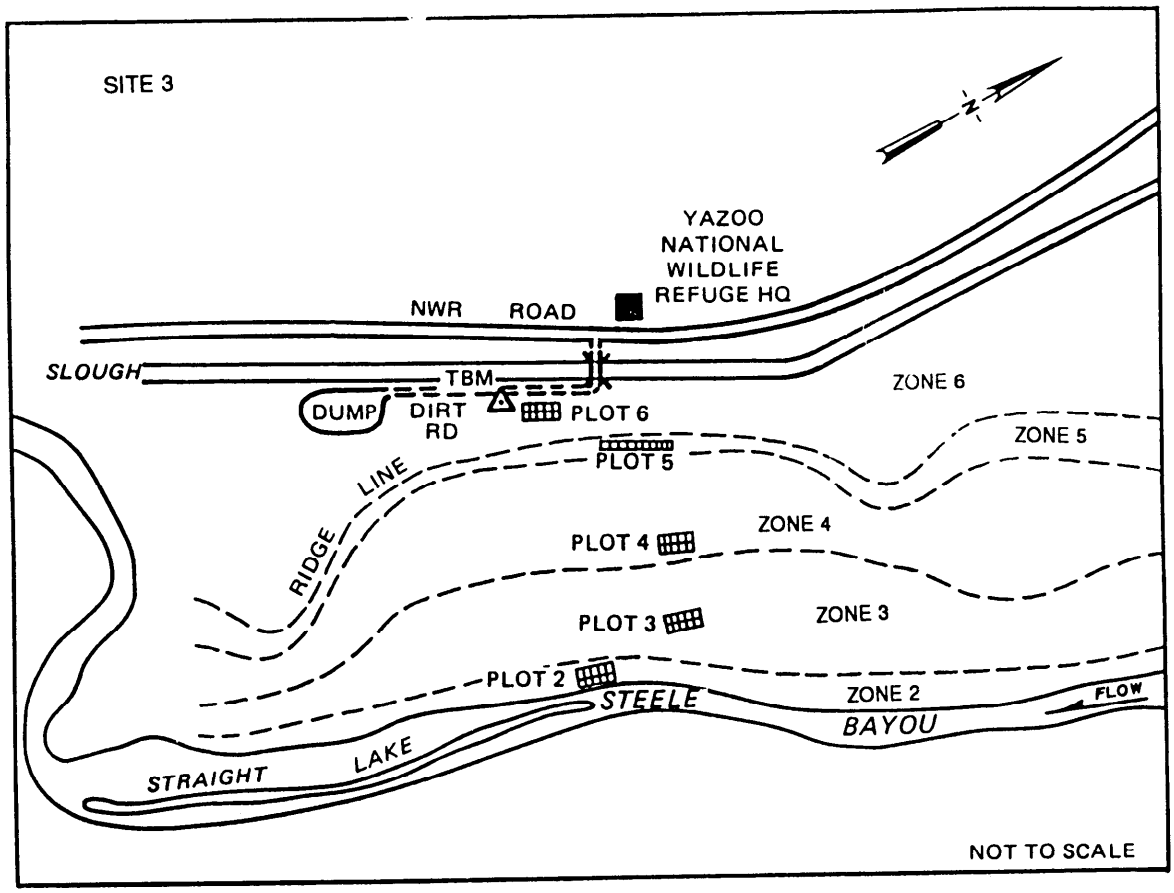

Figure A2. Steele Bayou (site 3)

Ouachita River (Sites 4 and 5)

Location (Ouachita River Basin)

These sites are located in the Felsenthal National Wildlife Refuge, 8 km west of Crossett and 0.8 km east of Felsenthal, respectively, in Union County, Arkansas. Reference USGS map, Felsenthal, Arkansas-Louisiana, N3300-W9200/15, 1981.

Hydrology data

Nineteen years of hydrology data were obtained for a gauge on a U.S. Highway 81 bridge, 8 km west of Crossett, Arkansas. A slope correction for site 5 was determined using a water surface profile. Site 4 was adjacent to the gauge, so no correction was necessary.

General vegetation

Plant communities range from a *Taxodium distichum-Cephalanthus occidentalis* dominated community in lower areas to a nearly monotypic stand of *Pinus taeda* in higher areas. Intermediate communities are dominated *Carya aquatica, Quercus lyrata, Diospyros virginiana, Quercus phellos, Quercus nuttallii,* and *Liquidambar styraciflua.*

Soils and climate

All encountered soils are in the Una series. Average annual rainfall is 140 cm, and the average growing season is 211 days.

Delineated zones

Only Zones 3 and 4 were delineated for both sites 4 and 5. Zone 2 was not used because the hydrology was not reflected by the gauge data. Zones 5 and 6 were not used because of major disturbances from recent silvicultural and agricultural practices.

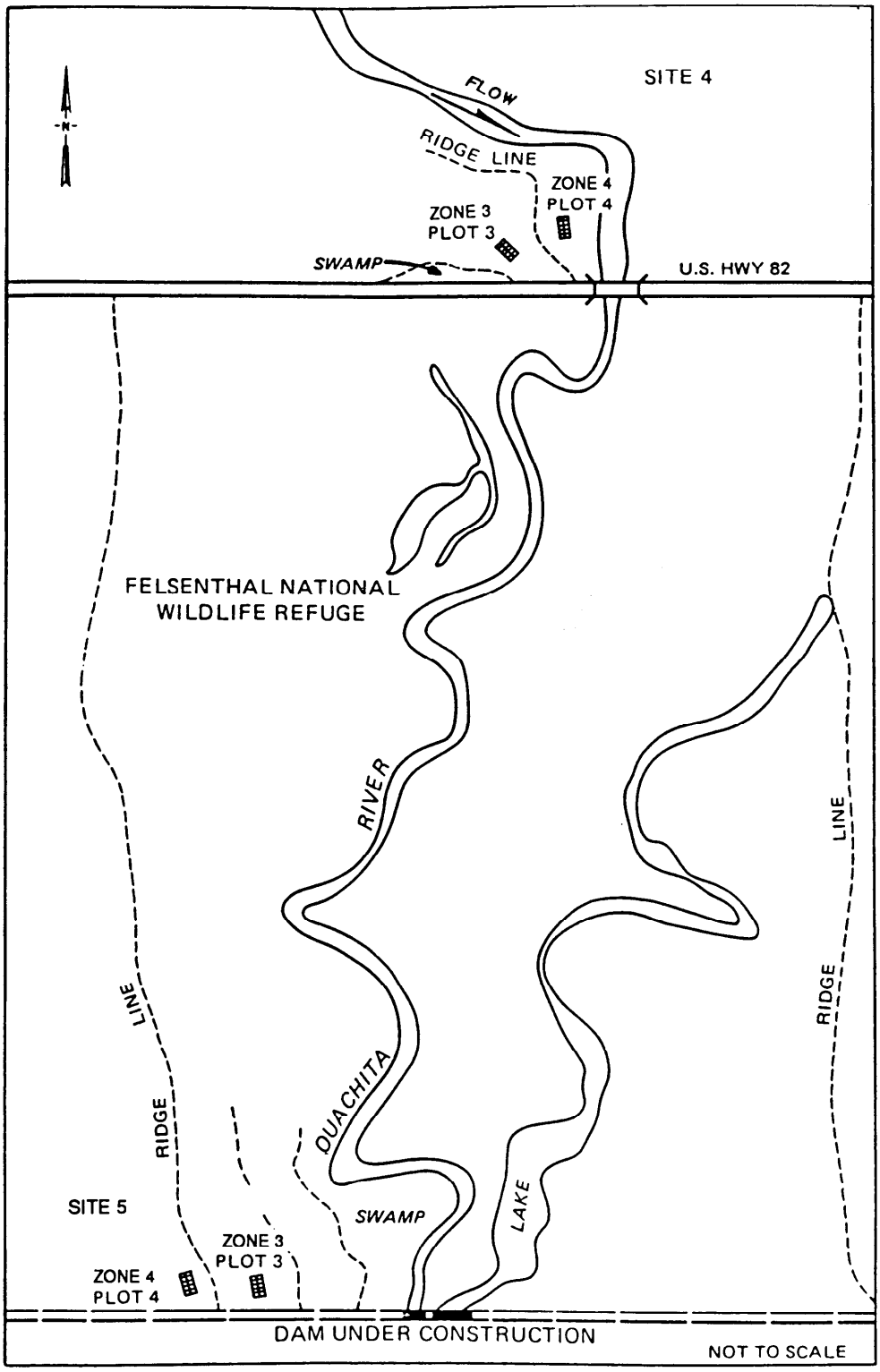

Figure A3. Ouachita River (sites 4 and 5)

Yazoo River (Site 6)

Location (Yazoo River Basin)

This site is located on the north side of the Yazoo River, 8 km west of the U.S. Highway 61 bridge and 12.0 miles north of Vicksburg, Mississippi, in Issaquena County. Reference USGS map, Long Lake, Mississippi-Louisiana, N3222.5-W9052.5/7.5, 1962.

Hydrology data

Twenty years of hydrologic zone elevations were computed by analyzing flow data from gauges on the Mississippi River at Vicksburg, Mississippi, on the Yazoo River 2.4 km east of the site, and at the Steele Bayou control structure immediately adjacent to the study site.

General vegetation

Plant communities range from *Quercus lyrata-Carya aquatica* at lowest elevations to a *Liquidambar styraciflua-Ulmus americana-Celtis laevigata* association at the highest elevations. Other commonly occurring species include *Ilex decidua, Carya illinoensis,* and *Cercis canadensis.*

Soils and climate

Soils were determined to be in the Sharkey series. Average annual rainfall is 127 cm. The average growing season is 221 days.

Delineated zones for study

Only Zones 3 and 4 were delineated for this study. Zones 2, 5, and 6 were either too narrow or too disturbed to provide reliable data.

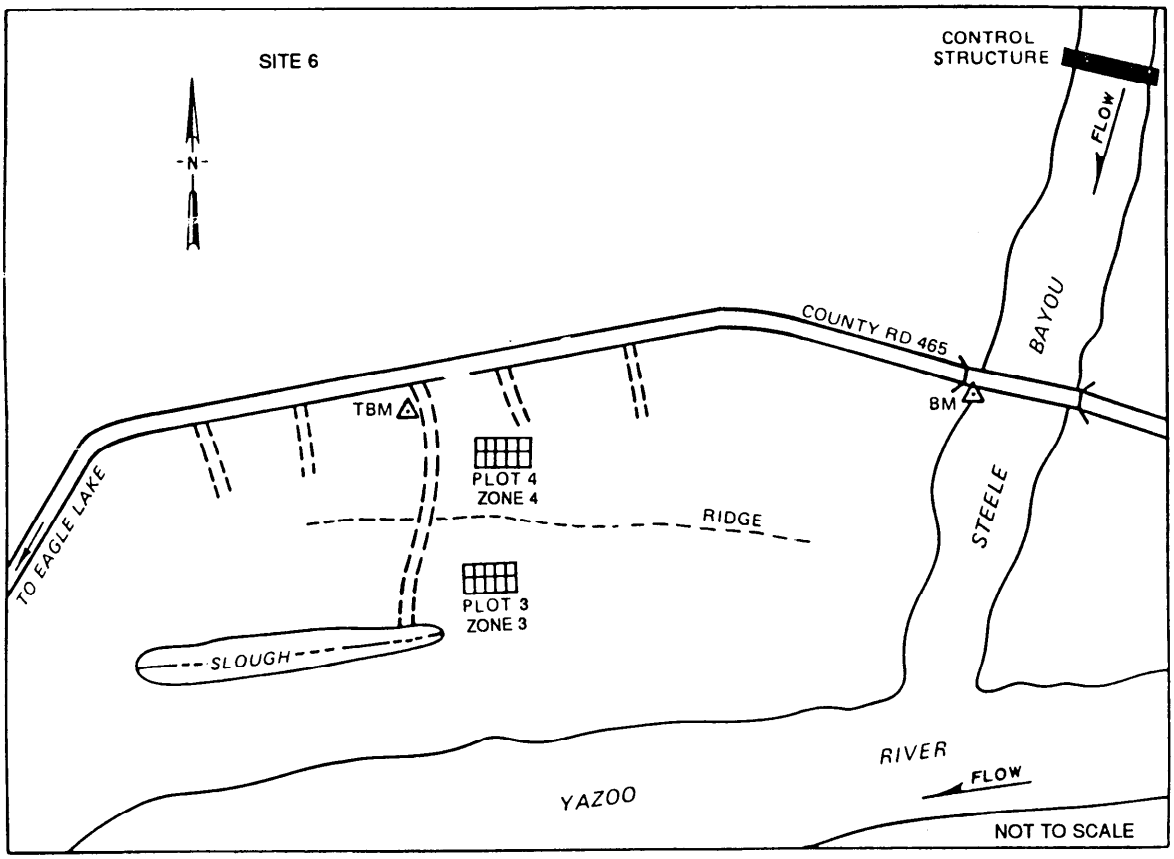

Figure A4. Yazoo River (site 6)

Big Black River (Site 7)

Location (Big Black River Basin)

The site is located on the south bank of the Big Black River adjacent to the Fisher Ferry bridge on Fisher Ferry Road, 24 km south-southeast of Vicksburg, Mississippi. The site is in Claiborne County, Mississippi. References USGS map, name N3207.5-W9045/7.5, 1963.

Hydrology data

Twenty years of hydrologic data were analyzed for a flow gauge on the U.S. Highway 80 bridge, 3.7 km east of Bovina, Mississippi. A slope correction from gauge location to site was determined by a water surface profile.

General vegetation

Plant communities range from *Taxodium distichum-Nyssa aquatica* at lower elevations to *Liquidambar styraciflua-Celtis laevigata-Ulmus americana* at higher elevations. Intermediate communities are dominated by *Planera aquatica, Carya aquatica, Quercus lyrata,* and *Fraxinus pennsylvanica.*

Soils and climate

Soils range from the Waverly series (depressional phase) in lowest elevations to the Faylaya series at higher elevations. Average annual rainfall for this area is 132 cm, and the average growing season is 226 days.

Delineated zones

Zones 2, 3, and 4 were delineated for study. Zones 5 and 6 were not delineated because of major vegetation disturbance induced by silvicultural and agricultural practices.

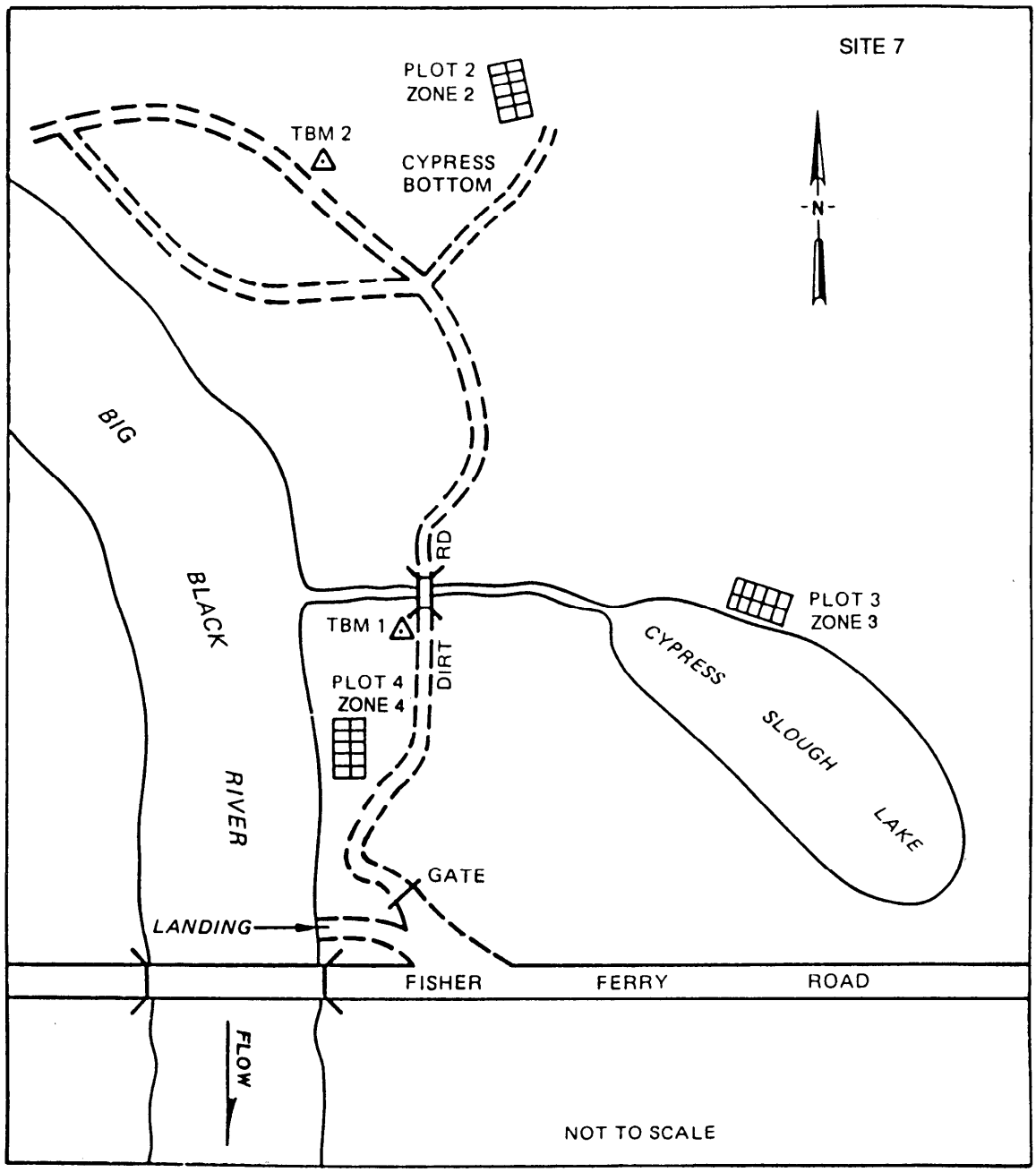

Figure A5. Big Black River (site 7)

L'Anguille River (Sites 8 and 9)

Location (L'Anguille River Basin)

Sites 8 and 9 are located on the west bank of L'Anguille River, 0.8 km east and 7.2 km southeast, respectively, of Palestine in St. Francis County, Arkansas. Reference USGS map, Marianna, Arkansas, N3445-W9045/15, 1957.

Hydrology data

Twenty years of hydrologic data were analyzed for a gauge located on the U.S. Highway 70 bridge, 0.8 km east of Palestine, Arkansas. A slope correction was computed for site 9 using a water surface profile. No slope correction was necessary for site 8 because it was adjacent to the gauge.

General vegetation

Plant communities range from *Taxodium distichum-Nyssa aquatica* dominated communities at the lowest elevations to a *Carya tomentosa-Quercus alba-Liquidambar styraciflua* dominated association on adjacent ridges. Intermediate communities are dominated by *Quercus lyrata, Carya aquatica, Diospyros virginiana, Fraxinus pennsylvanica,* and *Ulmus americana.*

Soils and climate

Soil series range from Zachary at lower elevations to Loring on adjacent ridges. Average annual rainfall is 132 cm, and the average growing season is 219 days.

Delineated zones

Zones 3 and 4 were delineated for site 8. Zones 3 and 6 were delineated for site 9. All other zones were unacceptable.

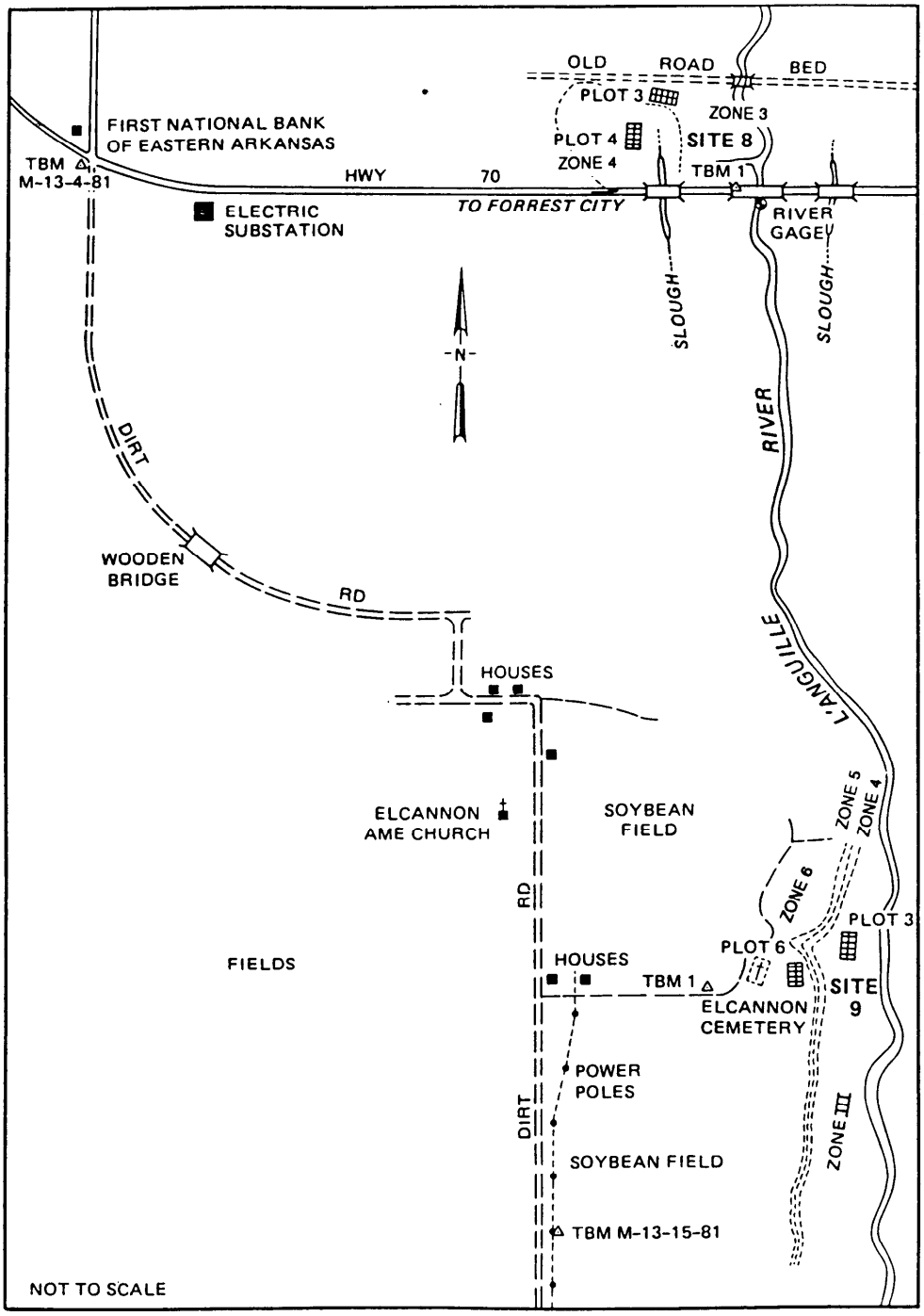

Figure A6. L'Anguille River (sites 8 and 9)

Pearl River (Site 10)

Location (Pearl River Basin)

This site is located in the Pearl River State Wildlife Management Area, 8 km north of Slidell in St. Tammany Parish, Louisiana. Reference USGS map Nicholson, Mississippi-Louisiana, N3022.5-W8937.5/7.5, 1955.

Hydrology data

Twenty years of hydrology data were analyzed for two gauges. First 10 years data were extrapolated to present gauge on the Southern Railway bridge at Pearl River, Louisiana. No slope correction was necessary because the site is adjacent to the gauge.

General vegetation

Plant communities range from *Taxodium distichum-Nyssa aquatica* dominated communities in sloughs to *Liquidambar styraciflua-Quercus nigra* dominated communities on low ridges. Intermediate communities are dominated by *Quercus laurifolia, Acer drummondii, Fraxinus pennsylvanica, Carpinus caroliniana,* and *Ilex opaca.*

Soils and climate

Soil series range from Rosebloom (depressional phase) in sloughs to Prentiss on ridges with Arkabutla at intermediate elevations. Average annual rainfall is 152 cm, and the average growing season is 237 days.

Delineated zones

Zones 2, 3, 4, and 6 were delineated. Zone 5 could not be reliably delineated because of topography.

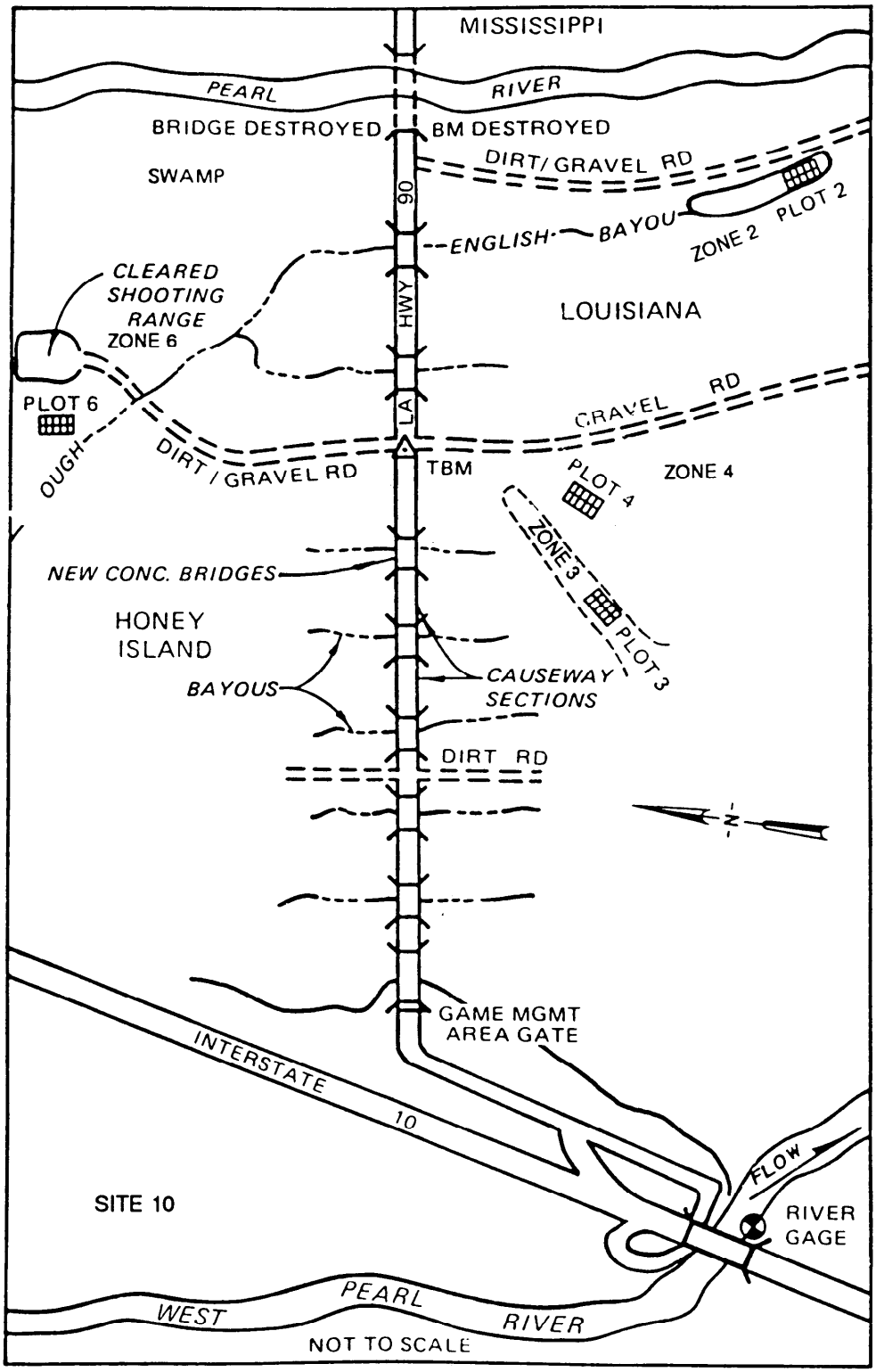

Figure A7. Pearl River (site 10)

Apalachicola River (Sites 11 and 12)

Location

Site 11 is located on the west bank of the Apalachicola River, immediately south of the Florida Highway 20 bridge, 1.6 km east of Blountstown in Calhoun County, Florida. Site 12 is located on the east bank of the river, 4.8 km north of Bristol in Liberty County, Florida. Reference USGS maps Blountstown, Florida, N3022.5-W8500/7.5, 1945, and Bristol, Florida, N3022.5-W8452.5/7.5, 1945, respectively.

Hydrology data

Twenty years of hydrology data for site 11 were analyzed for a gauge located 0.8 km south of Highway 20 bridge at the Neal Lumber Company Landing. Hydrology data for site 12 were analyzed from data from a previous study (Leitman et al. 1984).

General vegetation

Vegetation for both sites ranges from *Nyssa aquatica* dominated swamps at lower elevations to *Nyssa sylvatica-Juglans nigra-Sassafras albidum* dominated associations at higher elevations. Intermediate plant communities consist of *Fraxinus caroliniana, Gleditsia aquatica, Quercus lyrata, Carya aquatica, Ulmus americana, Melia azederach, Celtis laevigata,* and *Quercus nigra.*

Soils and climate

Soil series range from Bibb at lower elevation to Ochlochonee at higher elevations. Soils series occurring at intermediate elevations were Chastain, Enoree, Jena, and Chewacla. Average annual rainfall is 137 cm, and the average growing season is 267 days.

Delineated zones

Zones delineated for site 11 were 2, 3, 4, and 5. Essentially all of Zone 6 has been developed for agriculture. Zones delineated for site 12 were 4, 5, and 6. The hydrology of Zones 2 and 3 had been altered by an extensive network of beaver dams and was not reliable.

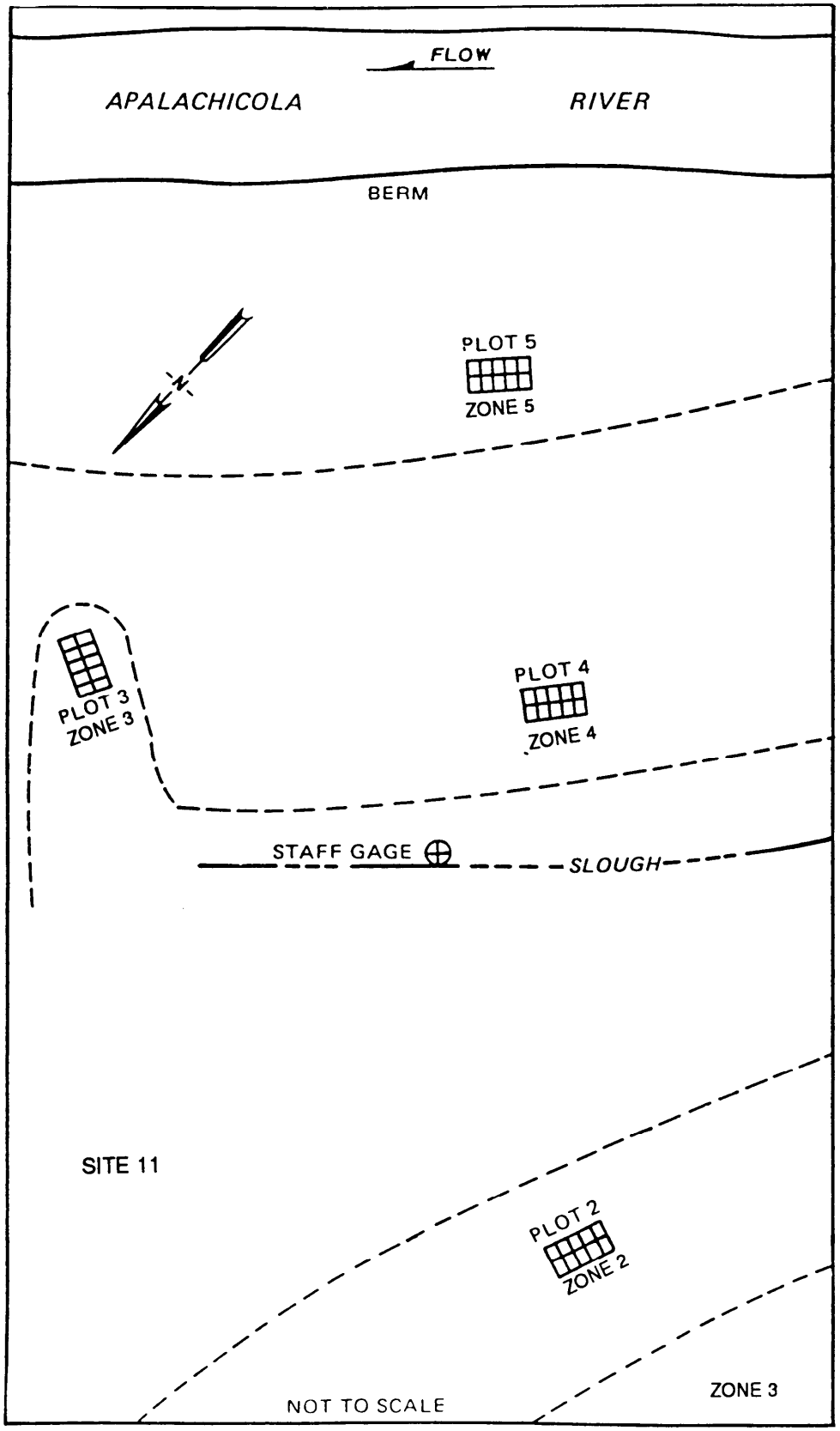

Figure A8. Apalachicola River (site 11)

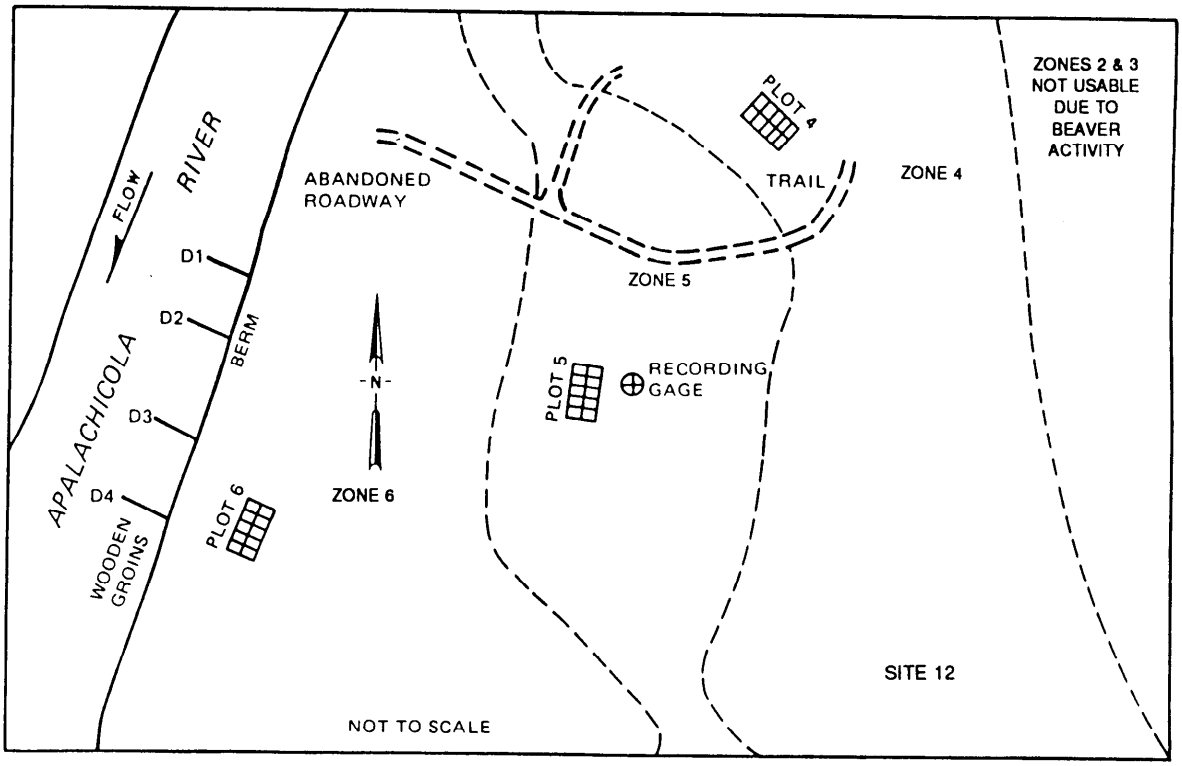

Figure A9. Apalachicola River (site 12)

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Ocmulgee River (Site 13)

Location (Ocmulgee River Basin)

This site is located across the river from Lumber City, and adjacent to the east side of Southern Railway and U.S. Highway 23 and 341 in Jeff Davis County, Georgia. Reference USGS map, Lumber City, Georgia, N3152.5-W8237.5/7.5, 1971.

Hydrology data

Twenty years of hydrology data were analyzed for a gauge on the U.S. Highway 23 and 341 bridge adjacent to the site. No slope correction was necessary.

General vegetation

The plant communities range from *Taxodium distichum-Nyssa aquatica* communities at the lowest elevations to a *Carya tomentosa-Quercus alba-Pinus glabra* dominated association at the higher elevations. Intermediate communities consist of *Planera aquatica, Quercus lyrata, Carya aquatica, Ulmus americana, Liquidambar styraciflua, Quercus phellos, Carpinus caroliniana,* and *Quercus nigra.*

Soils and climate

The soil series range from Bibb in the lowest areas to Riverview at the highest elevations. The Chastain series occurs at intermediate elevations. Average annual rainfall in this area is 117 cm, and the average growing season is 232 days.

Designated zones

Zones 2, 3, 4, and 6 were delineated for study. Zone 5 was too narrow to provide reliable data.

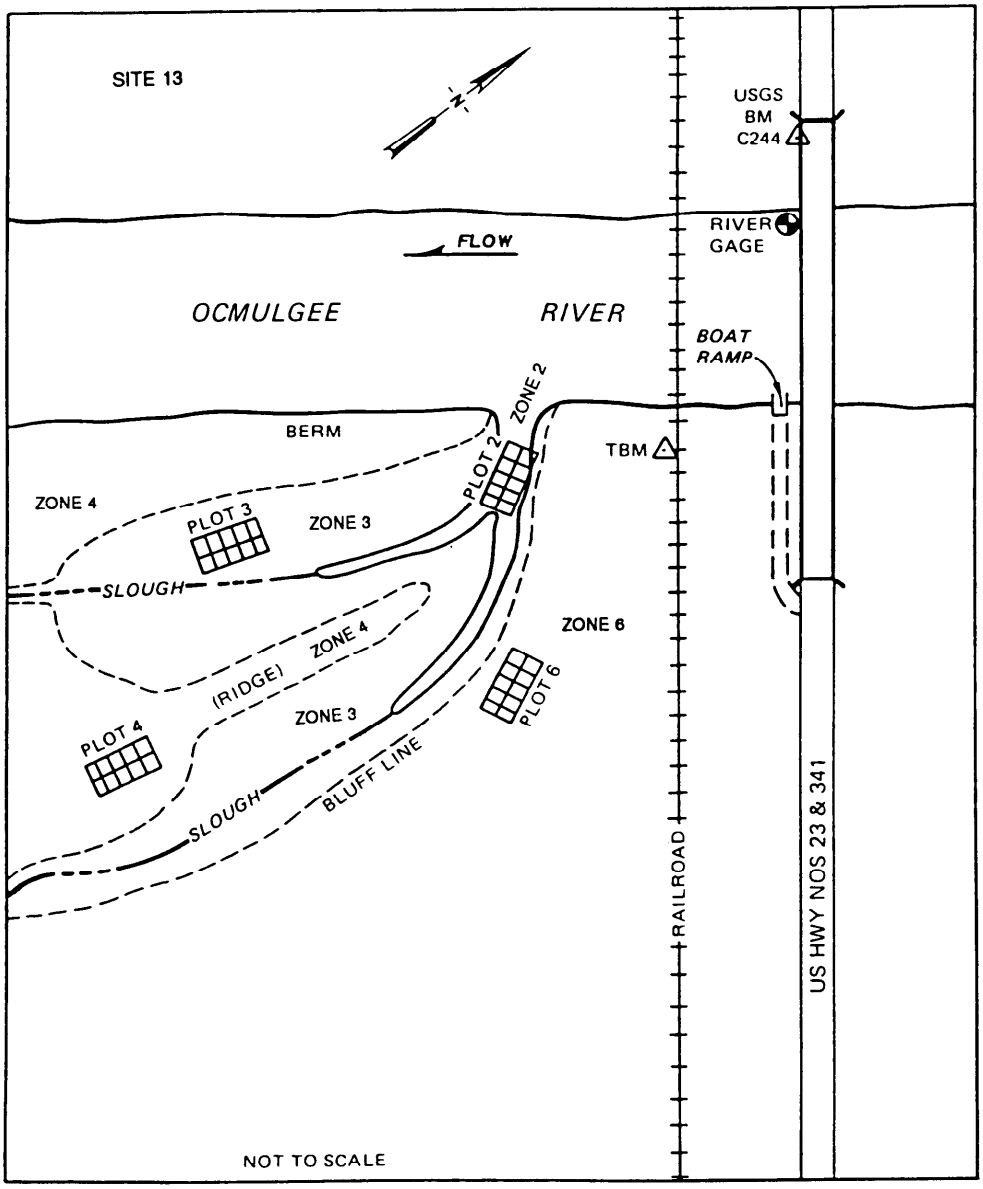

Figure A10. Ocmulgee River (site 13)

Altamaha River (Site 14)

Location (Altamaha River basin)

This site is located in the northeast quadrant at the intersection of U.S. Highway 1 and the Altamaha River, 50 km north of Baxley in Toombs County, Georgia. Reference USGS map, Baxley NE, Georgia, N3152.5-W8215/7.5, 1970.

Hydrology data

Twelve years of hydrology data were analyzed for a gauge on the U.S. Highway 1 bridge adjacent to the site. No slope correction was necessary.

General vegetation

Plant communities range from *Taxodium distichum-Nyssa aquatica* at lowest elevations to a *Juniperus virginiana-Quercus stellata-Carya tomentosa-Pinus taeda* community at highest elevations. Intermediate communities are dominated by *Fraxinus pennsylvanica, Quercus michauxii, Quercus phellos,* and *Carpinus caroliniana.*

Soils and climate

Soils range from the Osier series in lowest elevations to the Riverview series at highest elevations. The Chewacla series occurs at intermediate elevations. Average annual rainfall is 117 cm, and the average growing season is 232 days.

Designated zones

Zones delineated for this study site were 2, 5, and 6. Zones 3 and 4 had ridge and swale topography which prevented separating them reliably.

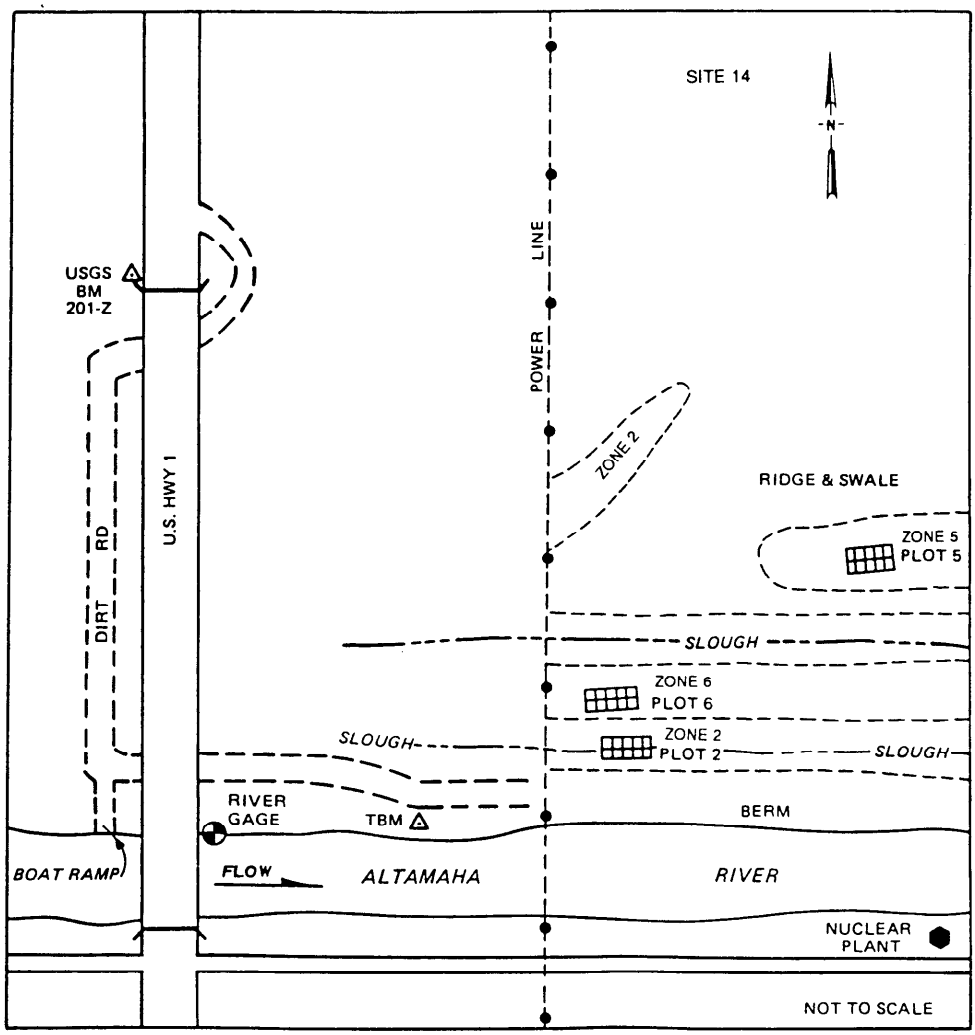

Figure A11. Altamaha River (site 14)

Edisto River (Site 15)

Location (Edisto River Basin)

This site is in Givhans Ferry State Park, north and west of South Carolina Highway 61 bridge, 4.8 km west of Givhans in Colleton County, South Carolina. Reference USGS map, Maple Cane Swamp, South Carolina, N3300-W8022.5/7.5, 1979.

Hydrology data

Twenty years of hydrology data were analyzed for a gauge on the South Carolina Highway 61 bridge adjacent to the site. No slope correction was necessary at this site.

General vegetation

Plant communities range from *Taxodium distichum-Nyssa aquatica-Fraxinus caroliniana* at lowest elevations to a *Pinus taeda-Quercus virginiana-Quercus nigra* dominated community at highest elevation. Species in communities at intermediate elevations include *Quercus lyrata, Quercus laurifolia, Planera aquatica, Liquidambar styraciflua, Quercus nigra,* and *Carpinus caroliniana.*

Soils and climate

Soil series range from Osier at lowest elevations to Chipley at highest elevations. The Torhunta soil series occurs at intermediate elevations. Average annual rainfall is 132 cm, and the average growing season is 213 days.

Delineated zones

Zones 2, 3, 4, and 6 were delineated, but Zone 5 was too narrow due to its topographic position.

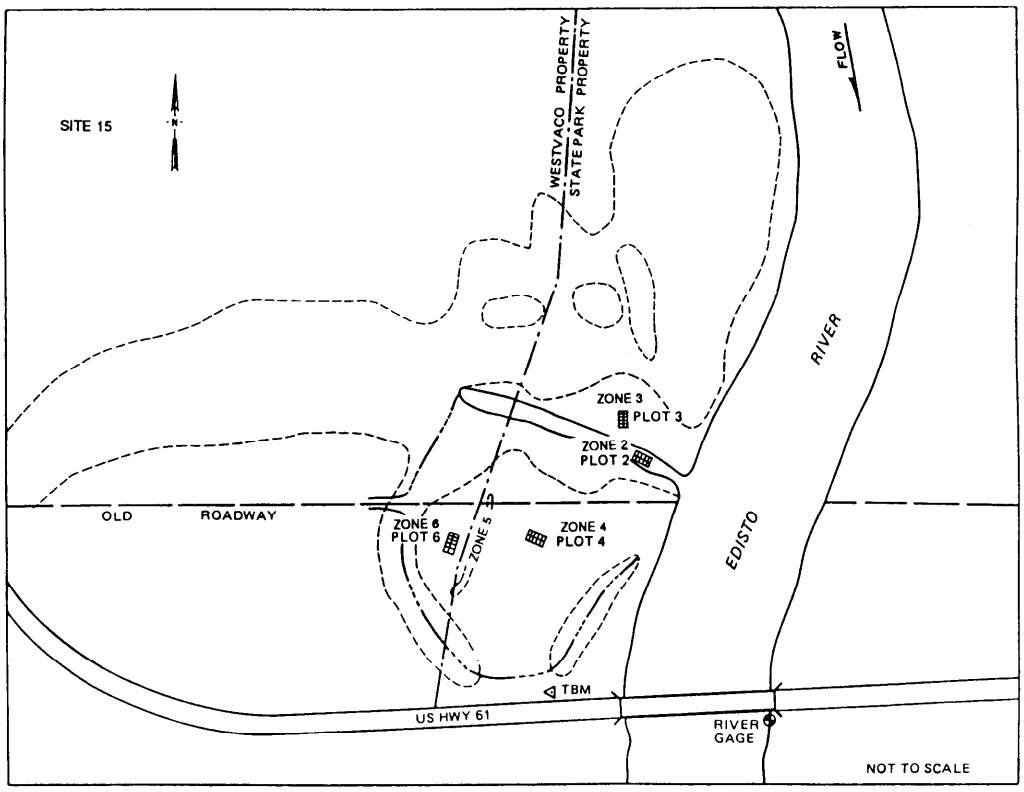

Figure A12. Edisto River (site 15)

Lynches River (Site 16)

Location (Lynches River Basin)

This site is located in Lynches River State Park, 1.6 km south of Effingham in Florence County, South Carolina. Reference USGS map, Florence West, South Carolina, N3400-W7945/15, 1940.

Hydrology data

Twenty years of hydrology data were analyzed for a gauge on the bridge on U.S. Highway 52, 1.6 km south of Effingham. A slope correction from gauge to site was determined by a water surface profile.

General vegetation

Plant communities range from *Taxodium distichum-Nyssa aquatica* at the lowest elevations to *Quercus falcata-Quercus stellata-Carya tomentosa* at higher elevations. Species occurring in communities at intermediate elevations include *Quercus lyrata, Quercus laurifolia, Liquidambar styraciflua,* and *Quercus phellos.*

Soils and climate

Soil series range from Chastain at lowest elevations to Chipley at highest elevations, with the Wehadkee series at intermediate elevations. Average annual rainfall is 107 cm, and the average growing season is 237 days.

Delineated zones

Zones 2, 3, and 6 were delineated for study. Zones 4 and 5 were too narrow to delineate because of their topographic positions.

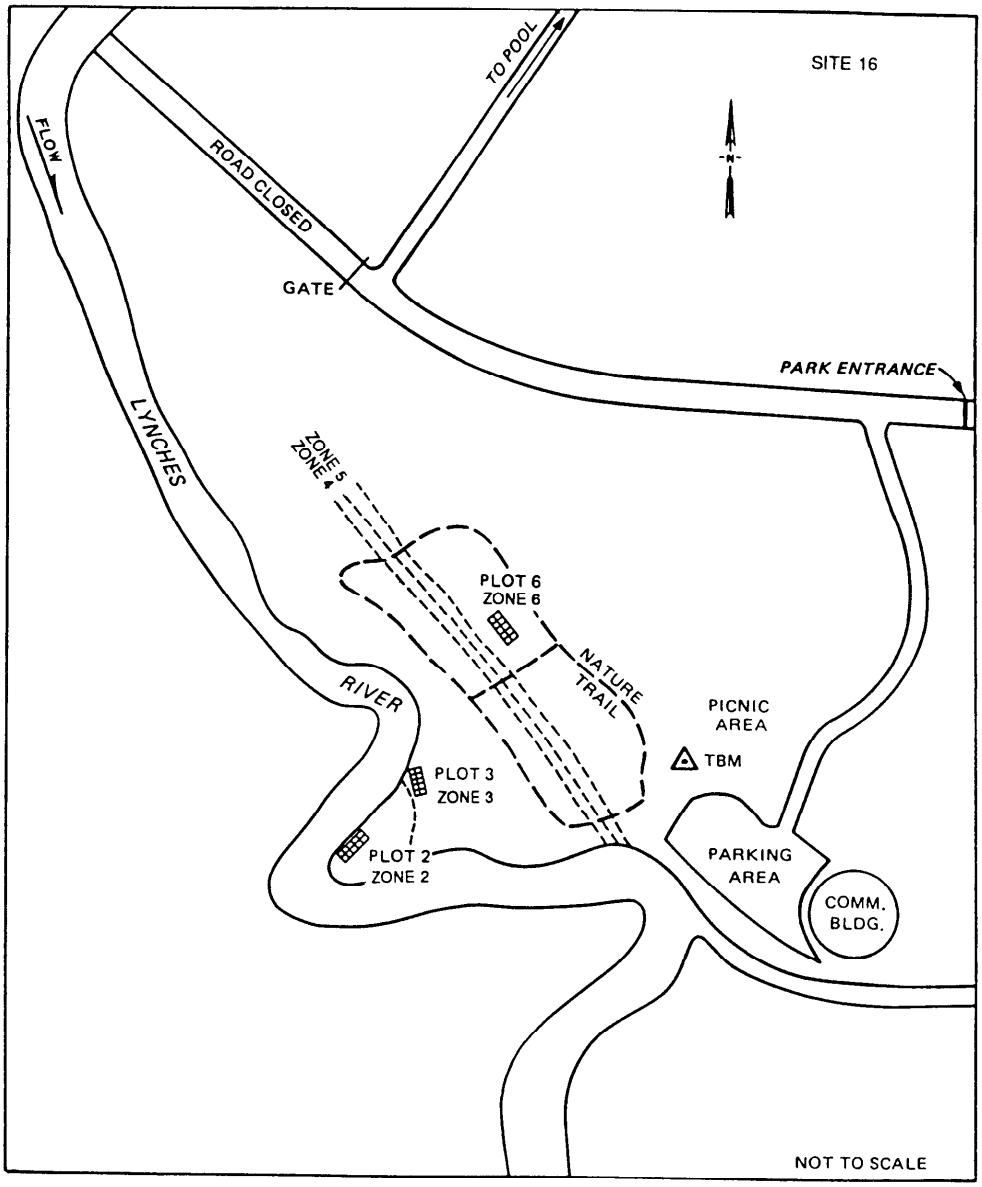

Figure A13. Lynches River (site 16)

Waccamaw River (Site 17)

Location (Waccamaw River Basin)

This site is located 3.2 km southeast of Longs in Horry County, South Carolina. Reference USGS map, Longs, South Carolina-North Carolina, N3352.5-W7837.5/7.5, 1947.

Hydrology data

Twenty years of hydrology data were analyzed for a gauge on the bridge on State Highway 9, 3.4 km southeast of Longs, South Carolina. No slope correction was necessary.

General vegetation

Plant communities range from a *Fraxinus caroliniana* dominated swamp at the lowest elevation to a *Pinus taeda-Quercus nigra-Liquidambar styraciflua* dominated community at the highest elevation. Vegetation dominated by *Quercus laurifolia, Magnolia virginiana, Acer rubrum,* loblolly bay, *Ilex opaca, Quercus phellos,* and *Quercus michauxii* occurs at intermediate elevations.

Soils and climate

Soils range from the very poorly drained Rutledge series at the lowest elevations to the moderately well-drained Chipley series at highest elevation. Soils at intermediate elevations include the Rembert and Leon series. Average annual rainfall is 107 cm, and the average growing season is 248 days.

Delineated zones

Zones 2, 3, 4, and 6 were delineated for this site. Zone 5 was too narrow to delineate because of its topographic position.

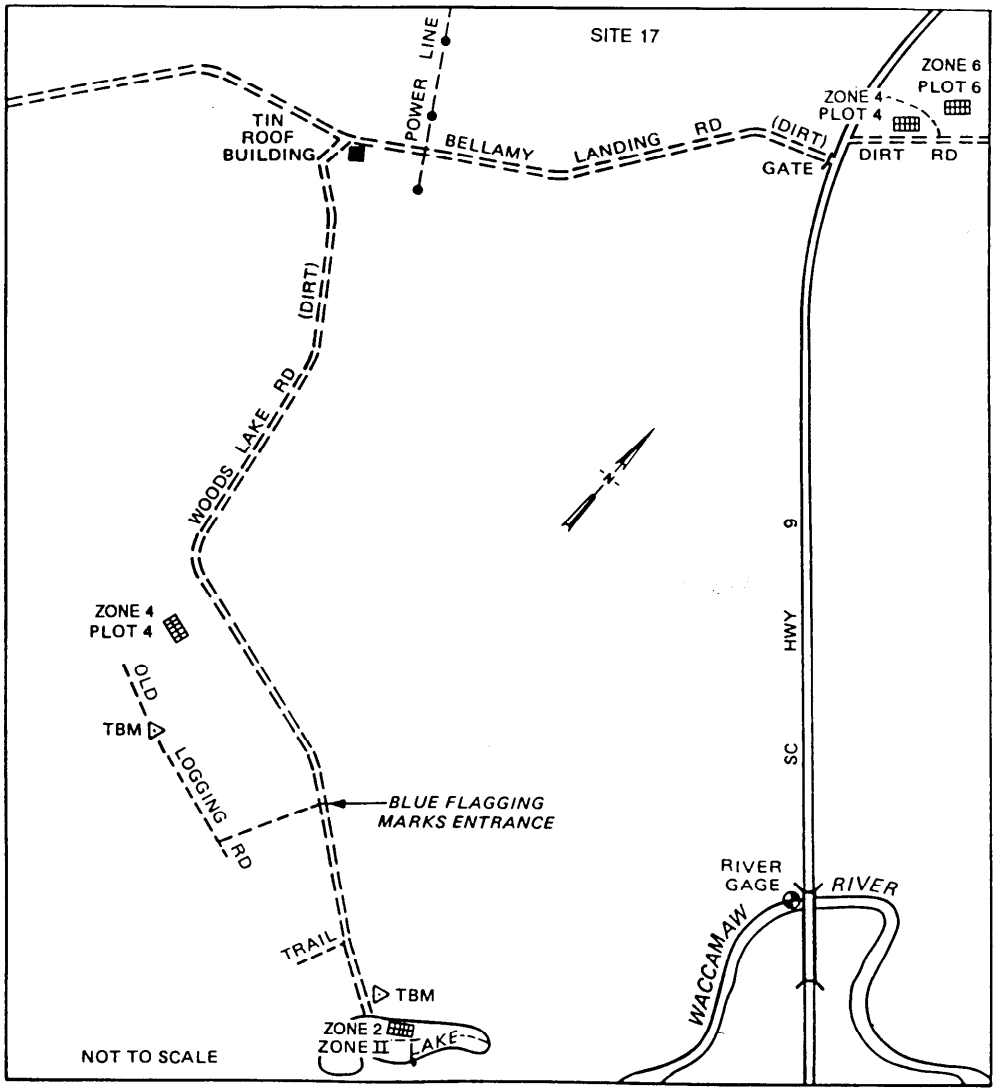

Figure A14. Waccamaw River (site 17)

Appendix B
Guide for Computer Program for Analyzing Hydrologic Data

Introduction

Program development

The FORTRAN computer program was developed to streamline hydrologic data manipulation for hydrologic zone boundary determinations.

Overview of program capabilities

The program defines the lower limits of four hydrologic zone boundaries, enabling determination of five zones. Recognizing the inherent variability of some input parameters, the program allows input of a range of parameters values, thus yielding a range of boundary values. The program reads either standard formatted U.S. Geological Survey (USGS) flow rate or Corps of Engineers stage data.

Basis for Hydrologic Zone Delineation

Definitions

Hydrologic zones. The program assumes the following definitions for hydrologic zone boundaries:

Zone	Definition
2	Soil inundated or saturated on average greater than 75 percent of the growing season.
3	Soil inundated or saturated on average between 75 and 25 percent of the growing season.

Zone	Definition
4	Soil inundated or saturated on average between 25 and 12.5 percent of the growing season.
5	Soil inundated or saturated on average between 12.5 and 5 percent of the growing season.
6	Soil inundated or saturated on average less than 5 percent of the growing season.

Inundation. Inundation is defined as the physical overtopping of the soil by the adjacent stream water surface.

Saturation. A soil is saturated when it will no longer absorb water without losing an equal amount.

Growing season. The growing season is defined as the average frostfree period. It is the period between the last average occurrence of 32° F in the spring, and the first average occurrence of 32° F in the fall.

Separation of Data into Growing Seasons

The program used the starting and ending dates of the growing season and the daily flow rates or daily stage data at each site for a period of 10 to 20 years as input. Henceforth, the terms "flow rate" and "stage" are interchangeable, depending on the form of input data.

The program read flow rate data into a matrix FL(I,J), where I is an index designating year, and J designated the Julian date. For example, FL(3,3) designated the flow rate of January 3 of the third year of data and FL(3,33) designated February 2 of the third year. Two matrices, K5GS(I) and KEGS(I), were created that contained Julian dates of the beginning and end of the growing season in each year I. These dates varied because of leap years.

The program then created two more matrices: FLGS(I,J) and NDGS(I). FLGS(I,J) contained flow rates in year I, on date J from the beginning of the growing season. For example, FLGS(2,3) designated the flow rate on the third day of the growing season in the second year of data. NDGS(I) is the number of days in the growing season of the I^{th} year. Again, the number of days varied because of leap years.

Computation of Days Inundated

Computation of days inundated at a given flow rate proceeded as follows:

a. Growing season flow rates for the entire entered record were ranked from highest to lowest. This procedure was accomplished by

transferring all data in the FLGS(I,J) matrix into a single subscripted matrix RANK(K), and then the program ranked the data in RANK using a bubble sorting routine. RANK(1) represented the greatest flow rate for the entire record. RANK(NQ) was the lowest flow rate, where NQ was the total number of growing season flow rates in the entire record.

b. The number of days a given flow rate was exceeded (i.e., effecting inundation above that flow rate) within the growing season record was equal to the flow rate's ranking. A flow rate in RANK(10) was equalled or exceeded 10 times within the historic record and corresponded to 10 days of inundation.

Computation of Days Saturated

General. The model for the program was a simplified water balance. The soil root zone for wetland plant species was considered to be a water bucket where:

a. Depth of the bucket was the critical depth of the saturated zone (e.g., 25 cm).

b. When water overtopped the bucket (i.e., during inundation), the bucket filled at a rate PKW (inches/hour).

c. When inundation ceased, the bucket drained at a rate PKD (inches/hour).

d. DEVAPR inches of water were lost daily out the top of the bucket by evapotranspiration.

e. When the bucket was partially full (i.e., not empty or overtopped by inundation), a day of saturation was counted.

Inputs. The following inputs were required for computing days of saturation:

a. PKD = rate of percolation of water through the soil column, which was estimated from soil conservation service county soil surveys.

b. PKW = rate at which inundation restores the soil zone to full saturation (inches/hour). (*Note: PKW is different from PKD when the underlying soil layer was less porous than the upper soil layer. The soil would wet at the permeability rate of the upper layer, but would drain at the permeability rate of the underlying soil layer*).

c. CDSZ = critical depth of the saturated zone, which was the depth of wetland plant root zone (10 in. or 26.4 cm).

d. DEVAPR = average daily evapotranspiration rate for the site (inches/day).

Discussion. This model has no pretense of absolute accuracy; it does not include rainfall, contributions of water from upslope drainage, residual soil moisture held by soil after gravity drainage, and possibly other sources of water.

Program algorithm, for a "fixed" flow rate. The following describes the program algorithm for a "fixed" flow rate (used at each zone boundary) for computation of days saturated:

a. For each year, the program started at CDSZ/24*PKW days before the growing season, with an empty "bucket," and used the general scheme described above to find the depth of water in the root zone at the start of the growing season. A flow rate in the record greater than the "fixed" flow rate filled the "bucket," while a lesser flow rate drained the "bucket."

b. For each year, the program then checked each growing season flow rate versus the "fixed" flow rate using this starting water depth and either filled or drained the bucket as appropriate. Each day when the bucket was partially full counts as a day saturated.

c. Days saturated for each year were added into a single total for that "fixed" flow rate.

d. A flowchart showing program logic for computation of days saturated is provided in Figure B1.

Computation of Frequency of Inundation

Frequency of inundation was not used in defining hydrologic zone boundaries. However, it was used for discussion purposes.

Frequency of inundation for a given flow rate was determined by:

a. Counting the number of growing seasons in the historic record during which the flow rate for a particular hydrologic zone was exceeded at least once for a minimum of seven days.

b. Dividing the total number of years in the record into "a," and multiplying by 100.

For example: A flow rate of 20,000 cubic feet per second (560 meters per second) is exceeded in only two growing seasons of a 20-year record. This flow rate has a frequency of inundation of 2/20 x 100 = 10 percent.

Computation of Parameters in Tabular Output

Tabular output appeared as follows:

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Boundary Flowrate	Days Inun-Dated	Duration Inundated	Freq Inun-Dated	Days Saturated	Days Saturated Plus Days Inundated	Duration Saturated and Inundated
38852.	33.	4.3	100.0	5.	38.	5.0

All of the above have already been explained except columns (3), (6) and (7).

a. Column 3 - $\text{Duration inundated} = \frac{\text{days inundated}}{\text{total growing season}} \times 100.$

b. Column 6 - Days saturated plus days inundated = Columns 2 + 5.

c. Column 7 -

$$\frac{\text{Duration saturated and inundated}}{} = \frac{\text{days inundated + days saturated}}{\text{total growing season days}} \times 100.$$

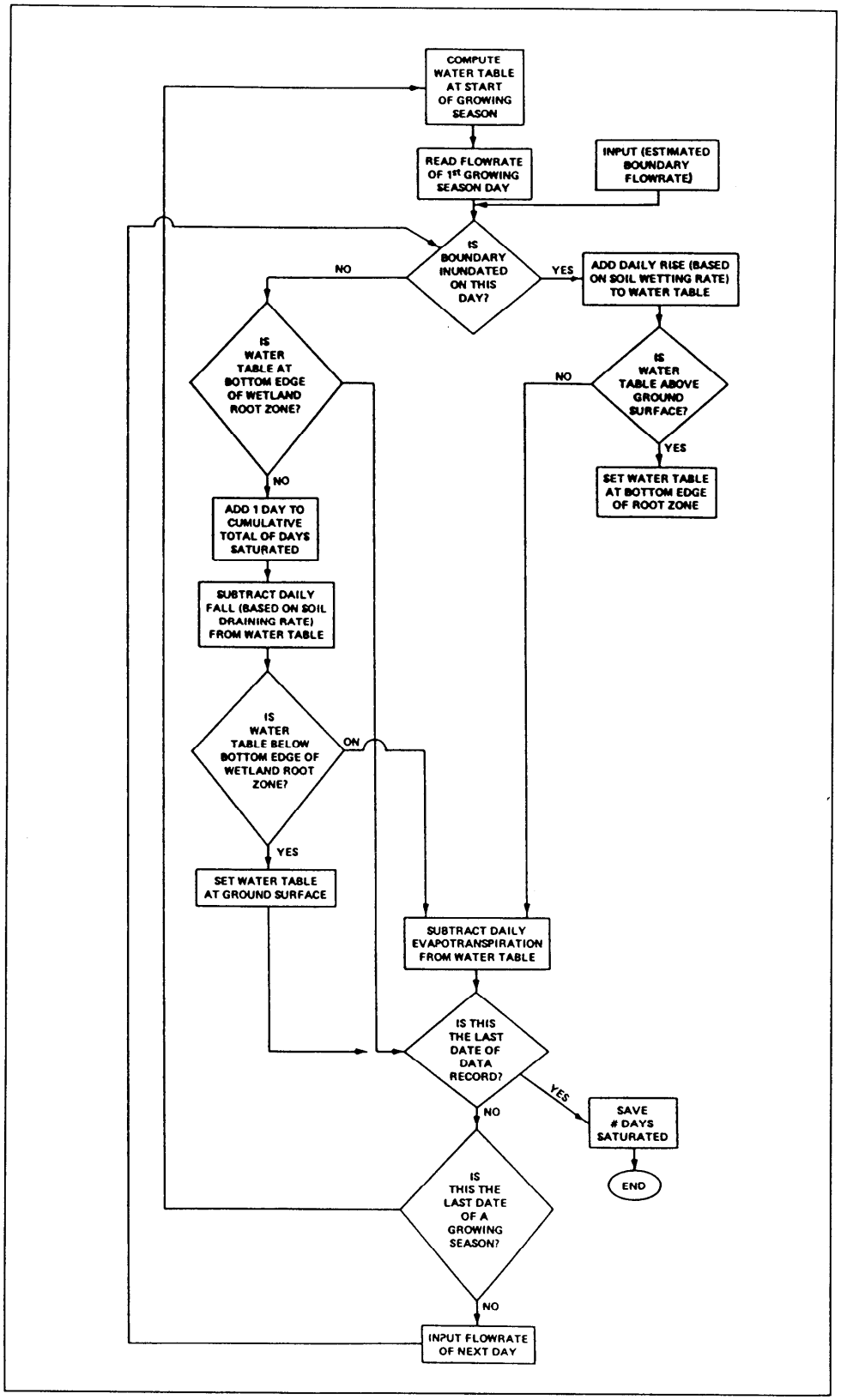

Figure B1. Program logic for computation of days saturated

Example Summary Table of
Boundary Flowrates

Zone V	Zone IV	Zone III	Zone II
155.	144.	128.	63.

NSMGS= 3 NSDGS= 3 NEMGS=11 NEDGS=11 PKW=.90000 PKD=.90000
CDSZ=10.0 DEVAP=.200

Boundary Flowrate	Days Inun-dated	Duration Inundated	Freq Inun-dated	Days Saturated	Days Saturated Plus Days Inundated	Duration Saturated and Inundated
155.	22.	4.3	100.0	2.	24.	4.7
144.	48.	9.4	100.0	7.	55.	10.8
128.	116.	22.8	100.0	11.	127.	25.0
63.	375.	73.8	100.0	11.	386.	76.0

Appendix C
Hydrograph for Steele Bayou (Site 3)

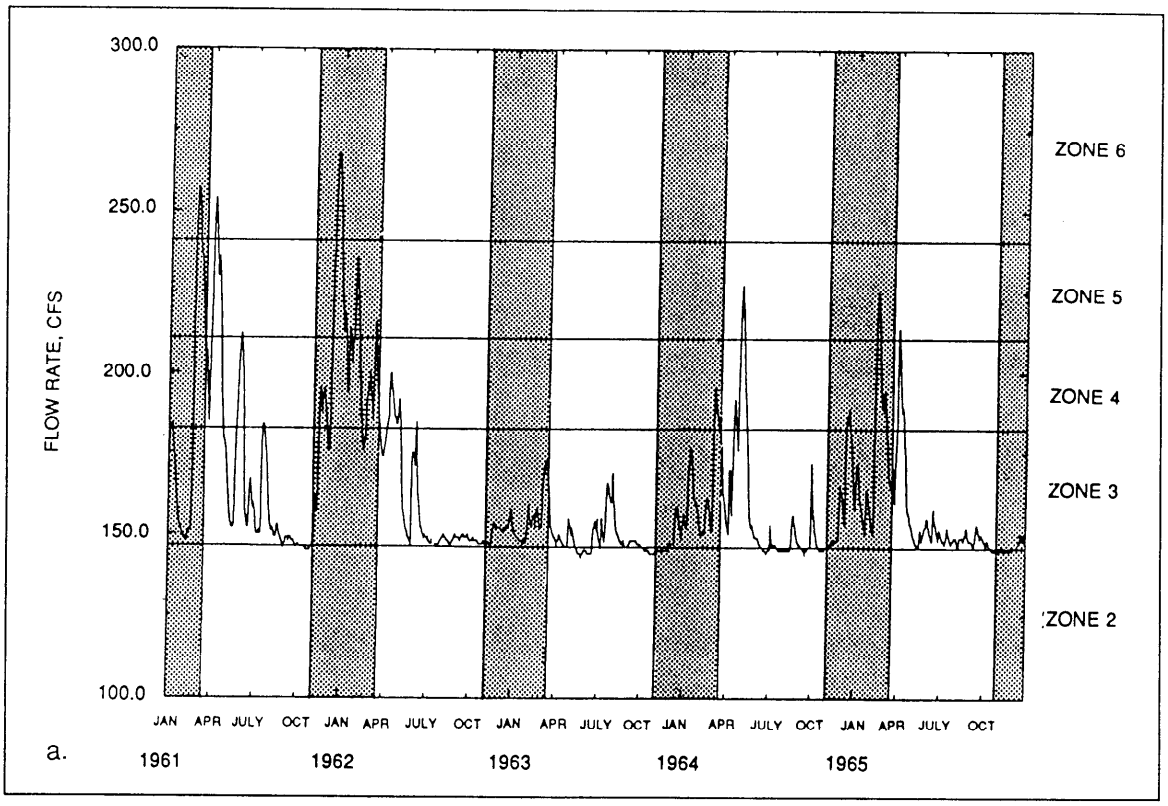

Figure C1. Hydrograph for Steele Bayou (site 3); the shaded areas represent the nongrowing season, a:1961-1965, b:1966-1970, c:1971-1975, and d:1976-1980 (Sheet 1 of 4)

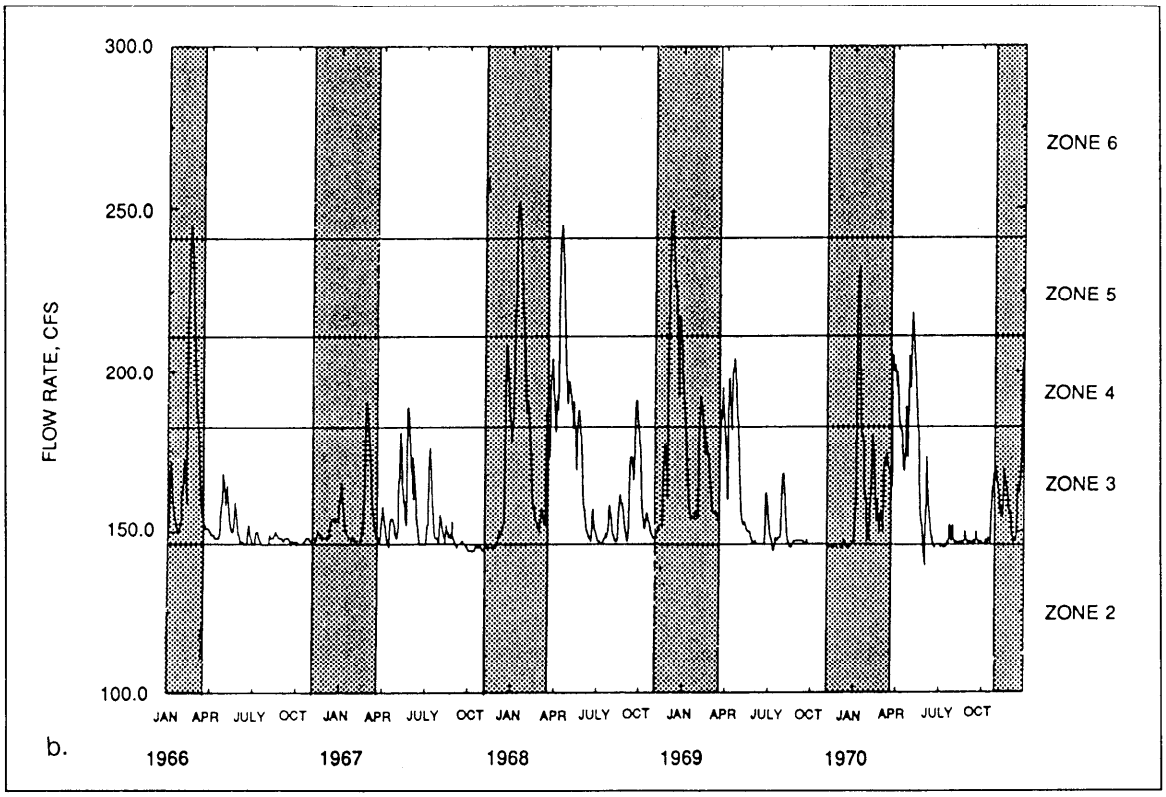

Figure C1. (Sheet 2 of 4)

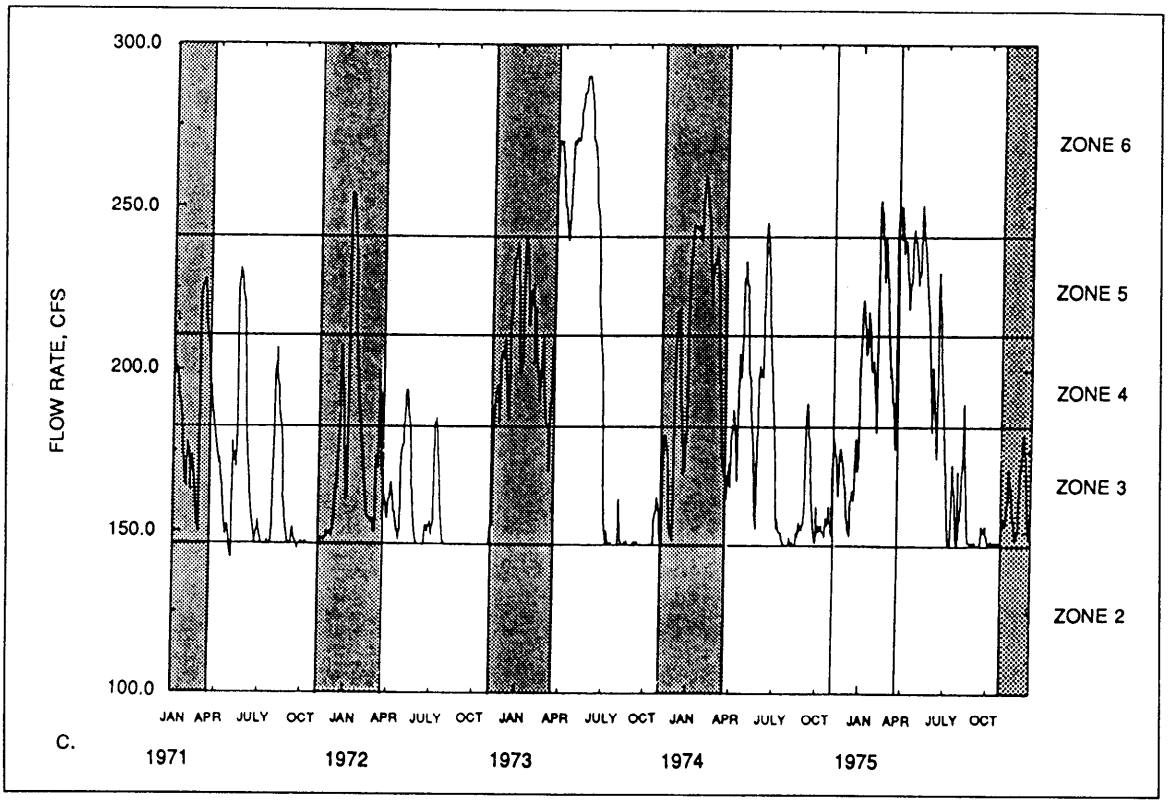

Figure C1. (Sheet 3 of 4)

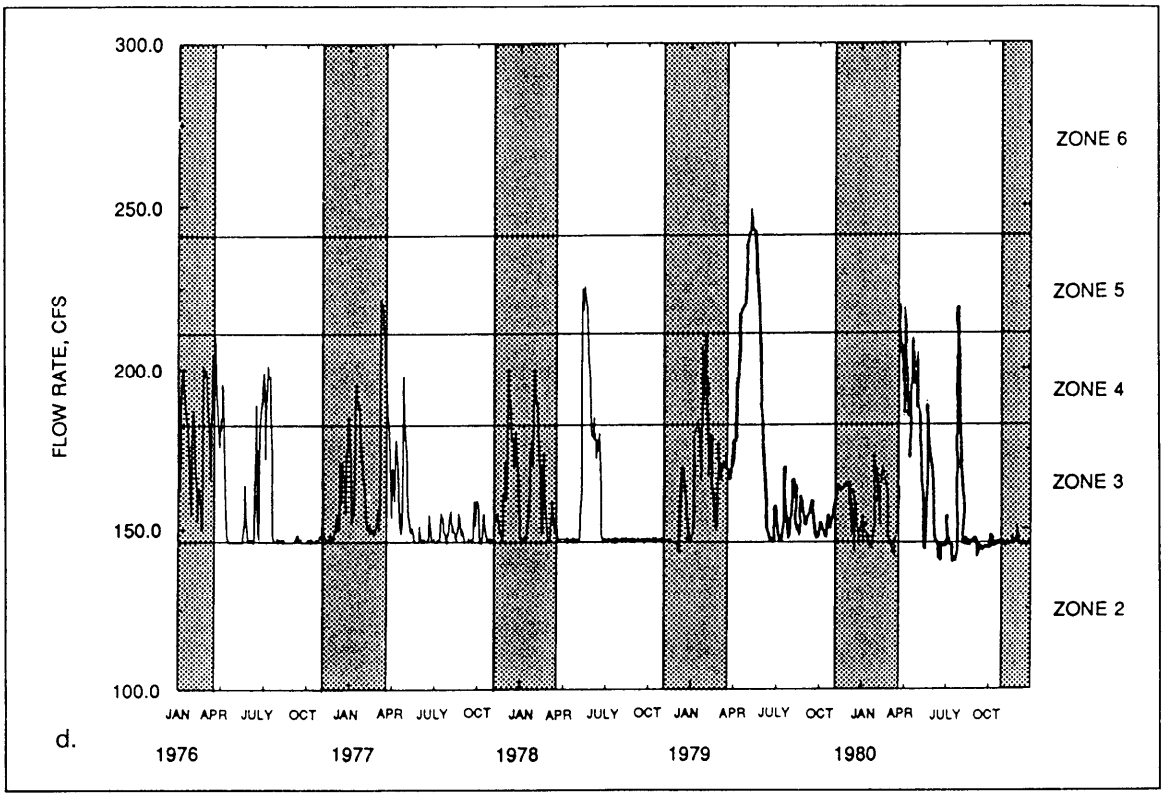

Figure C1. (Sheet 4 of 4)

Appendix D
Importance Values for Species by Zone and Vegetation Layer

Table D1
Importance Values for Species Occurring at Site 1, Arranged by Zone and Vegetation Layer

Species[1]	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 2			
Trees				
Taxodium distichum	31.8	44.0	42.2	118.0
Nyssa aquatica	31.8	16.7	49.2	97.8
Planera aquatica	18.2	31.8	7.3	57.3
Fraxinus caroliniana	13.6	6.0	0.9	20.5
Cephalanthus occidentalis	4.6	1.5	0.4	6.4
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Planera aquatica	45.4	47.0	49.7	142.1
Cephalanthus occidentalis	27.3	29.4	24.1	80.8
Fraxinus caroliniana	18.2	17.7	19.7	55.6
Taxodium distichum	9.1	5.9	6.5	21.5
	100.0	100.0	100.0	300.0
Woody Vines				
None present				
Herbs and Woody Seedlings				
Styrax americana	33.3	--	33.4	66.7
Planera aquatica	33.4	--	33.3	66.7
Cephalanthus occidentalis	33.3	--	33.3	66.6
	100.0		100.0	200.0
	Zone 3			
Trees				
Quercus lyrata	17.8	13.6	25.6	57.0
Quercus laurifolia	8.9	6.8	25.1	40.8
Carya aquatica	11.7	9.1	18.2	39.0
Diospyros virginiana	11.7	18.1	5.8	35.6
Fraxinus caroliniana	14.8	15.9	3.9	34.6
Planera aquatica	11.7	11.4	5.1	28.2
Taxodium distichum	11.7	11.4	2.9	26.0
Acer drummondii	5.9	9.1	10.0	25.0

[1] No FTI numbers were calculated for plants not identified by species.

Table D1 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Liquidambar styraciflua	2.9	2.3	3.2	8.4
Gleditsia aquatica	2.9	2.3	0.2	5.4
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Acer drummondii	9.1	29.1	21.1	59.3
Ilex decidua	12.1	16.9	21.1	50.1
Planera aquatica	15,2	12.3	14.7	42.2
Taxodium distichum	18.3	10.8	10.6	39.7
Fraxinus caroliniana	12.1	12.3	13.2	37.6
Cephalanthus occidentalis	12.1	6.2	8.1	26.4
Styrax americana	12.1	7.7	6.0	25.8
Crataegus viridis	6.0	3.1	3.1	12.2
Carpinus caroliniana	3.0	1.6	2.1	6.7
	100.0	100.0	100.0	300.0
Woody Vines				
Brunnichia cirrhosa	106.6	33.3	36.9	36.4
Vitis palmata	33.3	26.3	36.4	96.5
Ampelopsis arborea	25.0	21.0	17.0	63.0
Smilax rotundifolia	8.4	15.8	9.7	33.9
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Justicia ovata	26.7	--	42.4	69.1
Quercus laurifolia	18.4	--	27.5	45.9
Planera aquatica	8.3	--	4.6	12.9
Fraxinus caroliniana	10.3	--	2.4	12.7
Brunnichia cirrhosa	4.1	--	8.3	12.4
Diodia virginiana	6.1	--	4.1	10.2
Carya aquatica	6.1	--	4.1	10.2
Saururus cernuus	2.0	--	3.0	5.0
Vitis palmata	2.0	--	0.4	2.4
Ulmus americana	2.0	--	0.4	2.4
Smilax walteri	2.0	--	0.4	2.4
Smilax sp.	2.0	--	0.4	2.4
Crataegus viridis	2.0	--	0.4	2.4
Carex sp.	2.0	--	0.4	2.4
Ampelopsis arborea	2.0	--	0.4	2.4
Acalypha gracilens	2.0	--	0.4	2.4
Acer drummondii	2.0	--	0.4	2.4
	100.0		100.0	200.0
	Zone 4			
Trees				
Carpinus caroliniana	37.1	50.1	21.1	108.3

Table D1 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Liquidambar styraciflua	14.8	19.2	35.8	69.8
Ulmus americana	11.1	5.8	5.8	22.7
Quercus michauxii	3.7	1.9	12.1	17.7
Quercus laurifolia	3.7	1.9	10.3	15.9
Diospyros virginiana	7.4	5.8	1.8	15.0
Nyssa sylvatica	7.4	5.8	1.3	14.5
Quercus lyrata	3.7	1.9	8.6	14.2
Crataegus viridis	7.4	3.8	1.0	12.2
Ilex opaca	3.7	3.8	2.2	9.7
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Ilex decidua	38.8	63.1	64.8	166.7
Carpinus caroliniana	37.7	21.7	22.6	72.0
Nyssa sylvatica	11.1	4.3	5.1	20.5
Sebastiania fruticosa	5.6	4.3	1.4	11.3
Quercus lyrata	5.6	2.2	2.5	10.3
Cartaegus viridis	5.6	2.2	2.5	10.3
Ilex Opaca	5.6	2.2	1.1	8.9
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis palmata	50.0	37.5	47.5	135.0
Toxicodendron radicans	14.3	43.7	31.7	89.7
Bignonia capreolata	14.3	9.4	8.9	32.6
Berchemia scandens	14.3	6.3	7.9	28.5
Vitis rotundifolia	7.1	3.1	4.0	14.2
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Justicia ovata	10.7	--	18.0	28.7
Bignonia capreolata	10.7	--	16.0	26.7
Quercus laurifolia	5.8	--	9.5	15.3
Mitchella repens	5.0	--	9.6	14.6
Carpinus caroliniana	7.9	--	9.6	12.6
Toxicodendron radicans	5.0	--	6.6	11.6
Ulmus americana	7.2	--	2.9	10.1
Crataegus viridis	4.3	--	3.3	7.6
Viola sp.	3.5	--	1.8	5.3
Liquidambar styraciflua	3.5	--	1.5	5.0
Aristolochia serpentaria	3.5	--	1.5	5.0
Lysimachia radicans	1.4	--	3.6	5.0
Smilax walteri	2.1	--	2.4	4.5
Vitis palmata	2.8	--	1.2	4.0
Dichanthelium commutatum	2.8	--	1.2	4.0
Ampelopsis arborea	1.4	--	2.1	3.5
Viola missouriensis	2.1	--	0.9	3.0

Table D1 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Quercus lyrata	2.0	--	0.9	3.0
Aster lateriflorus	2.1	--	0.9	3.0
Trachelospermum difforme	0.7	--	1.8	2.5
Justicia americana	0.7	--	1.8	2.5
Campsis radicans	0.7	--	1.8	2.5
Quercus michauxii	1.4	--	0.6	2.0
Oxalis stricta	1.4	--	0.6	2.0
Ilex opaca	1.4	--	0.6	2.0
Eupatorum sp.	1.4	--	0.6	2.0
Celtis laevigata	1.4	--	0.6	2.0
Acer rubrum	1.4	--	0.6	2.0
Vernonia gigantea	0.7	--	0.3	1.0
Smilax bona-nox	0.7	--	0.3	1.0
Sebastiania fruticosa	0.7	--	0.3	1.0
Nyssa aquatica	0.7	--	0.3	1.0
Mikania scandens	0.7	--	0.3	1.0
Botrychium biternatum	0.7	--	0.3	1.0
Acalypha gracilens	0.7	--	0.3	1.0
Acer drummondii	0.7	--	0.3	1.0
	100.0		100.0	200.0
	Zone 6			
Trees				
Liquidambar styraciflua	18.6	20.7	11.5	50.8
Carpinus caroliniana	18.6	20.7	3.4	42.7
Quercus nigra	9.3	6.9	18.6	34.8
Quercus falcata var. pagodifolia	9.3	6.9	14.3	30.5
Ostrya virginiana	11.5	13.9	3.0	28.4
Quercus phellos	4.7	3.4	19.3	27.4
Pinus taeda	4.7	3.4	16.3	24.4
Ilex opaca	7.0	8.6	5.2	20.8
Quercus alba	7.0	6.9	6.0	19.9
Nyssa sylvatica	4.7	5.2	1.5	11.4
Morus rubra	2.3	1.7	0.5	4.5
Cornus florida	2.3	1.7	0.4	4.4
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Carpinus caroliniana	33.2	30.1	36.6	99.9
Ostrya virginiana	27.8	23.3	27.8	78.9
Ilex opaca	11.1	16.7	12.2	40.0
Liquidambar styraciflua	11.1	13.3	8.9	33.3
Nyssa sylvatica	5.6	10.0	8.5	24.1

(Sheet 4 of 5)

Table D1 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Cornus florida	5.6	3.3	4.1	13.0
Aralia spinosa	5.6	3.3	1.9	10.8
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	66.7	75.0	75.0	216.7
Bignonia capreolata	33.3	25.0	25.0	83.3
	100,0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Quercus nigra	17.8	--	27.3	45.1
Bignonia capreolata	5.1	--	12.3	17.4
Toxicodendron radicans	9.0	--	4.4	13.4
Parthenocissus quinquefolia	6.4	--	3.1	9.5
Mitchella repens	3.8	--	5.1	8.9
Carpinus caroliniana	5.1	--	2.5	7.6
Pinus taeda	2.6	--	4.5	7.1
Smilax rotundifolia	3.8	--	1.9	5.7
Quercus phellos	3.8	--	1.9	5.7
Dichanthelium commutatum	3.8	--	1.9	5.7
Ilex opaca	3.8	--	1.9	5.7
Carex sp.	3.8	--	1.9	5.7
Vitis rotundifolia	1.3	--	3.9	5.2
Rubus sp.	1.3	--	3.9	5.2
Ilex vomitoria	1.3	--	3.9	5.2
Ascyrum hypericoides	1.3	--	3.9	5.2
Carex sp.	1.3	--	3.9	5.2
Viburnum dentatum	2.6	--	1.3	3.9
Ostrya virginiana	2.6	--	1.3	3.9
Oplismenus hirtellus	2.6	--	1.3	3.9
Berchemia scandens	2.6	--	1.3	3.9
Vaccinium elliottii	1.3	--	0.6	1.9
Ampelamus albidus	1.3	--	0.6	1.9
Quercus falcata var. pagodifolia	1.3	--	0.6	1.9
Quercus alba	1.3	--	0.6	1.9
Prunus serotina	1.3	--	0.6	1.9
Nyssa sylvatica	1.3	--	0.6	1.9
Ilex coriacea	1.3	--	0.6	1.9
Crataegus marshallii	1.3	--	0.6	1.9
Chasmanthium sessiliflorum	1.3	--	0.6	1.9
Chasmanthium laxum	1.3	--	0.6	1.9
Arundinaria gigantea	1.3	--	0.6	1.9
	100.0		100.0	200.0

Table D2
Importance Values for Species Occurring at Site 2, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 2			
Trees				
Nyssa aquatica	36.0	30.9	73.4	140.3
Taxodium distichum	28.0	41.9	21.9	91.8
Planera aquatica	20.0	20.0	3.8	43.8
Fraxinus caroliniana	8.0	3.6	0.5	12.1
Cephalanthus occidentalis	8.0	3.6	0.4	12.0
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Planera aquatica	44.4	54.5	38.4	137.3
Cephalanthus occidentalis	33.3	27.3	34.2	94.8
Fraxinus caroliniana	22.3	18.2	37.4	67.9
	100.0	100.0	100.0	300.0
Woody Vines				
None present				
Herbs and Woody Seedlings				
None present				
	Zone 3			
Trees				
Acer drummondii	13.8	30.9	23.9	68.6
Fraxinus caroliniana	20.7	21.8	8.0	50.5
Quercus laurifolia	10.3	90.1	28.4	47.8
Quercus lyrata	17.3	12.7	17.5	57.5
Taxodium distichum	13.8	10.9	2.5	27.2
Carya aquatica	10.3	5.5	10.3	26.1
Liquidambar styraciflua	6.9	3.6	8.6	19.1
Planera aquatica	6.9	5.5	0.8	13.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Fraxinus caroliniana	25.9	35.5	40.5	101.9
Acer drummondii	19.3	23.7	22.7	65.7
Styrax americana	12.9	16.1	11.8	40.8
Cephalanthus occidentalis	12.9	7.5	9.4	29.8
Cornus foemina	3.2	8.6	9.8	21.6
Taxodium distichum	12.9	4.3	2.7	19.9
Sapium sebiferum	6.5	2.1	1.2	9.8
Carya aquatica	3.2	1.1	1.3	5.6

(Sheet 1 of 5)

Table D2 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Planera aquatica	3.2	1.1	0.6	4.9
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis palmata	37.5	33.3	40.2	111.0
Campsis radicans	25.0	33.3	48.2	106.5
Ampelopsis arborea	35.0	22.3	9.8	57.1
Brunnichia cirrhosa	12.5	11.1	1.8	25.4
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Quercus laurifolia	21.1	--	40.8	61.9
Justicia ovata	21.0	--	13.7	34.7
Saururus cernuus	8.1	--	12.6	20.7
Lysimachia radicans	8.1	--	6.2	14.3
Quercus lyrata	8.1	--	4.1	12.2
Smilax walteri	3.2	--	6.6	9.8
Styrax americana	4.8	--	3.3	8.1
Brunnichia cirrhosa	4.8	--	3.3	8.1
Leersia sp.	1.6	--	2.5	4.1
Ampelopsis arborea	1.6	--	2.5	4.1
Fraxinus caroliniana	3.2	--	0.8	4.0
Vitis palmata	1.6	--	0.4	2.0
Toxicodendron radicans	1.6	--	0.4	2.0
Diodia virginiana	1.6	--	0.4	2.0
Crataegus viridis	1.6	--	0.4	2.0
Cephalanthus occidentalis	1.6	--	0.4	2.0
Campsis radicans	1.6	--	0.4	2.0
Aster sp.	1.6	--	0.4	2.0
Asclepias perennis	1.6	--	0.4	2.0
Acer drummondii	1.6	--	0.4	2.0
	100.0		100.0	200.0
	Zone 4			
Trees				
Carpinus caroliniana	30.0	51.3	11.6	92.9
Liquidambar styraciflua	30.0	23.6	29.4	83.0
Quercus michauxii	10.1	6.9	26.9	43.9
Nyssa sylvatica	6.7	2.8	22.5	32.0
Ulmus americana	3.3	2.8	6.2	12.3
Ilex decidua	6.7	4.2	0.6	11.5
Ilex opaca	3.3	2.8	1.4	7.5
Acer drummondii	3.3	2.8	0.8	6.9
Carya aquatica	3.3	1.4	0.4	5.1
Crataegus viridis	3.3	1.4	0.2	4.9
	100.0	100.0	100.0	300.0

(Sheet 2 of 5)

Table D2 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Saplings and Shrubs				
Carpinus caroliniana	49.9	61.8	64.9	176.6
Ilex decidua	38.9	34.0	32.4	105.3
Crataegus viridis	5.6	2.1	2.0	9.7
Sebastiania fruticosa	5.6	2.1	0.7	8.4
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis palmata	32.2	19.3	24.9	76.4
Berchemia scandens	22.6	29.6	18.8	71.0
Toxicodendron radicans	9.7	27.4	25.4	62.5
Vitis rotundifolia	19.4	17.0	22.7	59.1
Campsis radicans	9.7	4.5	5.0	129.2
Cocculus carolinus	3.2	1.1	1.6	5.9
Ampelopsis arborea	3.2	1.1	1.6	5.9
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Berchemia scandens	15.2	--	25.0	40.2
Mitchella repens	8.2	--	13.8	22.0
Vitis palmata	9.6	--	7.5	17.1
Sebastiania fruticosa	4.2	--	11.9	16.1
Justicia ovata	6.9	--	8.9	15.8
Toxicodendron radicans	6.9	--	4.4	11.3
Ulmus americana	5.6	--	1.7	7.3
Smilax walteri	5.6	--	1.7	7.3
Quercus laurifolia	5.6	--	12.7	7.3
Quercus michauxii	2.8	--	3.1	5.9
Nyssa sylvatica	2.8	--	3.1	5.9
Carpinus caroliniana	4.2	--	1.3	5.5
Aster sp.	4.2	--	1.3	5.5
Vernonia gigantea	1.4	--	2.7	4.1
Lysimachia radicans	1.4	--	2.7	4.1
Diodia virginiana	1.4	--	2.7	4.1
Bignonia capreolata	1.4	--	2.7	4.1
Liquidambar styraciflua	2.8	--	0.9	3.7
Celtis laevigata	2.8	--	0.9	3.7
Viola missouriensis	1.4	--	0.4	1.8
Polygonum virginianum	1.4	--	0.4	1.8
Parthenocissus quinquefolia	1.4	--	0.4	1.8
Campsis radicans	1.4	--	0.4	1.8
Botrychium sp.	1.4	--	0.4	1.8
	100.0		100.0	200.0
	Zone 6			
Trees				
Ostrya virginiana	24.9	46.2	9.8	80.9

Table D2 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Fagus grandifolia	9.4	7.7	32.4	49.5
Quercus alba	12.5	13.5	16.2	42.2
Quercus nigra	9.4	5.8	11.1	26.3
Pinus taeda	9.4	5.8	10.5	25.7
Ilex opaca	12.5	7.7	3.0	23.2
Cornus florida	9.4	5.7	0.7	15.8
Liquidambar styraciflua	6.3	3.8	4.0	14.1
Carya glabra	3.2	1.9	6.5	11.5
Quercus phellos	3.1	1.9	5.8	10.8
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Vaccinium elliottii	16.4	30.8	18.3	65.5
Ilex opaca	14.4	17.1	13.7	45.2
Ostyra virginiana	14.4	11.4	18.1	43.9
Ilex vomitoria	6.1	8.0	6.6	20.7
Cornus florida	8.2	4.5	7.5	20.2
Vaccinium arboreum	6.1	4.5	6.5	17.1
Nyssa sylvatica	4.1	4.5	6.5	15.1
Chionanthus virginicus	6.1	3.4	3.8	13.3
Quercus phellos	4.1	2.3	3.9	10.3
Liquidambar styraciflua	4.1	2.3	1.0	7.4
Fagus grandifolia	2.0	2.3	2.9	7.2
Symplocos tinctoria	2.0	2.3	1.4	5.7
Sassafras albidum	2.0	1.2	2.0	5.1
Carpinus caroliniana	2.0	1.1	2.0	5.1
Acer rubrum	2.0	1.1	2.0	5.1
Quercus laurifolia	2.0	1.1	1.6	4.7
Aralia spinosa	2.0	1.1	1.6	4.7
Quercus alba	2.0	1.1	0.6	3.7
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	71.4	77.8	81.0	230.2
Gelsemium sempervirens	14.3	11.1	17.1	42.5
Smilax rotundifolia	14.3	11.1	1.9	27.3
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Mitchella repens	11.8	--	19.5	31.3
Quercus nigra	13.8	--	15.7	29.5
Smilax pumila	8.8	--	15.3	24.1
Sebastiania fruticosa	5.9	--	9.0	14.9
Chasmanthium laxum	5.9	--	9.0	14.9
Carex sp.	5.0	--	4.4	9.4
Ostyra virginiana	6.8	--	2.0	8.8
Vitis rotundifolia	5.0	--	2.9	7.9

Table D2 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Dichanthelium commutatum	4.0	--	2.6	6.6
Ilex vomitoria	2.0	--	4.5	6.5
Smilax rotundifolia	5.0	--	1.4	6.4
Carya glabra	3.0	--	2.3	5.3
Diospyros virginiana	1.0	--	1.8	2.8
Chasmanthium sessiliflorum	1.0	--	1.8	2.8
Aralia spinosa	1.0	--	1.8	2.8
Vaccinium arboreum	2.0	--	0.6	2.6
Quercus phellos	2.0	--	0.6	2.6
Callicarpa americana	2.0	--	0.6	2.6
Bignonia capreolata	2.0	--	0.6	2.6
Acer rubrum	2.0	--	0.6	2.6
Viburnum dentatum	1.0	--	0.3	1.3
Sassafras albidum	1.0	--	0.3	1.3
Toxicodendron radicans	1.0	--	0.3	1.3
Prunus umbellata	1.0	--	0.3	1.3
Paspalum sp.	1.0	--	0.3	1.3
Liquidambar styraciflua	1.0	--	0.3	1.3
Fagus grandifolia	1.0	--	0.3	1.3
Crataegus marshalli	1.0	--	0.3	1.3
Chionanthus virginicus	1.0	--	0.3	1.3
Aristolochia serpentaria	1.0	--	0.3	1.3
	100.0		100.0	200.0

(Sheet 5 of 5)

Table D3
Importance Values for Species Occurring at Site 3, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 2			
Trees				
Salix nigra	76.9	94.6	97.1	268.6
Cephalanthus occidentalis	7.7	3.6	1.5	12.8
Taxodium distichum	7.7	0.9	1.0	9.6
Planera aquatica	7.7	0.9	0.4	9.0
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Salix nigra	62.6	88.3	93.2	244.1
Planera aquatica	18.8	3.2	2.2	24.2
Forestiera acuminata	6.2	6.5	3.9	16.6
Cephalanthus occidentalis	6.2	1.3	0.5	8.0
Taxodium distichum	6.2	0.7	0.2	7.1
	100.0	100.0	100.0	300.0
Woody Vines				
Ipomoea wrightii	46.1	75.5	73.6	195.2
Ipomoea lacunosa	30.8	15.6	17.8	64.2
Cardiospermum halicacabum	23.1	8.9	8.6	40.6
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Forestiera acuminata	9.9	--	19.1	29.0
Ipomoea wrightii	5.3	--	17.2	22.5
Cardiospermum halicacabum	6.7	--	11.5	18.2
Boehmeria cylindrica	9.3	--	7.5	16.8
Aster simplex	7.3	--	5.5	12.8
Cyperus erythrorhizos	5.3	--	6.0	11.3
Amaranthus rudis	5.3	--	6.0	11.3
Planera aquatica	6.7	--	2.6	9.3
Acalypha rhomboidea	6.0	--	2.6	8.6
Ricciocarpus natans	5.3	--	2.1	7.4
Cephalanthus occidentalis	4.0	--	1.5	5.5
Campsis radicans	2.0	--	3.5	5.5
Paspalum fluitans	2.7	--	2.4	5.1
Rorippa islandica	3.3	--	1.3	4.6
Ipomoea lacunosa	1.3	--	1.9	3.2
Sesbania exaltata	2.0	--	0.8	2.8
Melothria pendula	2.0	--	0.8	2.8
Diodia virginiana	2.0	--	0.8	2.8
Vitis palmata	0.7	--	1.6	2.3
Polygonum hydropiperoides	1.3	--	0.5	1.8

(Sheet 1 of 8)

Table D3 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Justicia ovata	1.3	--	0.5	1.8
Echinodorus cordifolius	1.3	--	0.5	1.8
Commelina communis	1.3	--	0.5	1.8
Taxodium distichum	0.7	--	0.3	1.0
Spermacoce glabra	0.7	--	0.3	1.0
Sida sp.	0.7	--	0.3	1.0
Salix nigra	0.7	--	0.3	1.0
Paspalum urvillei	0.7	--	0.3	1.0
Nyssa aquatica	0.7	--	0.3	1.0
Ludwigia decurrens	0.7	--	0.3	1.0
Heliotropium indicum	0.7	--	0.3	1.0
Eragrostis hypnoides	0.7	--	0.3	1.0
Celtis laevigata	0.7	--	0.3	1.0
Brunnichia cirrhosa	0.7	--	0.3	1.0
	100.0		100.0	200.0
	Zone 3			
Trees				
Forestiera acuminata	27.7	32.8	20.3	80.8
Carya aquatica	20.7	20.7	28.7	70.1
Acer negundo	17.3	24.1	3.1	44.5
Quercus lyrata	17.3	8.6	18.0	43.9
Celtis laevigata	3.4	5.2	24.2	32.8
Gleditsia aquatica	3.4	1.7	3.9	9.0
Fraxinus pennsylvanica	3.4	3.5	0.9	7.8
Planera aquatica	3.4	1.7	0.5	5.6
Diospyros virginiana	3.4	1.7	0.4	5.5
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Acer negundo	29.2	40.6	45.4	115.2
Forestiera acuminata	25.0	25.3	20.2	70.5
Fraxinus pennesylvanica	20.9	23.1	20.9	64.9
Celtis laevigata	12.5	6.6	7.6	26.7
Carya aquatica	8.3	3.3	4.4	16.0
Ulmus americana	4.1	1.1	1.5	6.7
	100.0	100.0	100.0	300.0
Woody Vines				
Cocculus carolinus	40.0	40.0	26.4	106.4
Toxicodendron radicans	10.0	18.8	39.0	67.8
Ampelopsis arborea	20.0	17.5	14.5	52.0
Vitis riparia	10.0	13.8	15.4	39.2

Table D3 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Brunnichia cirrhosa	10.0	6.2	2.7	18.9
Parthenocissus quinquefolia	5.0	2.5	1.2	8.7
Trachelospermum difforme	5.0	1.2	0.8	7.0
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Forestiera acuminata	34.1	--	34.4	68.5
Cocculus carolinus	17,0	--	21.6	38.6
Vitis riparia	10.6	--	7.7	18.3
Cephalanthus occidentalis	2.1	--	11.5	13.6
Brunnichia cirrhosa	6.4	--	6.2	12.6
Ampelopsis arborea	4.3	--	5.4	9.7
Acalypha rhomboidea	4.3	--	5.4	9.7
Sida sp.	4.3	--	1.5	5.8
Boehmeria cylindrica	4.3	--	1.5	5.8
Sassafras albidum	2.1	--	0.8	2.9
Ipomoea lacunosa	2.1	--	0.8	2.9
Celtis laevigata	2.1	--	0.8	2.9
Amaranthus rudis	2.1	--	0.8	2.9
Acer rubrum	2.1	--	0.8	2.9
	100.0		100.0	200.0
Zone 4				
Trees				
Quercus lyrata	29.4	20.8	84.2	134.4
Acer negundo	35.2	54.1	11.2	100.5
Liquidambar styraciflua	11.8	8.3	0.7	20.8
Ulmus americana	5.9	4.2	2.3	12.4
Carya aquatica	5.9	4.2	1.0	11.1
Morus rubra	5.9	4.2	0.3	10.4
Fraxinus pennsylvanica	5.9	4.2	0.3	10.4
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Carya aquatica	24.3	43.7	35.8	103.8
Acer negundo	21.2	33.3	41.7	96.2
Ulmus americana	12.1	6.3	5.8	24.2
Celtis laevigata	12.1	6.3	5.6	24.0
Fraxinus pennsylvanica	12.1	4.8	6.0	22.9
Liquidambar styraciflua	6.1	2.4	2.0	10.5
Acer drummondii	6.1	1.6	1.6	9.3
Cornus drummondii	3.0	0.8	0.9	4.7
Quercus lyrata	3.0	0.8	0.6	4.4
	100.0	100.0	100.0	300.0

Table D3 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Woody Vines				
Toxicodendron radicans	31.1	72.5	92.0	195.6
Cocculus carolinus	21.9	14.1	3.1	39.1
Trachelospermum difforme	12.5	4.8	0.7	18.0
Berchemia scandens	9.4	2.6	1.5	13.5
Ampelopsis arborea	6.3	2.2	0.9	9.4
Vitis rotundifolia	6.3	1.3	1.2	8.8
Brunnichia cirrhosa	6.3	1.7	0.3	8.3
Campsis radicans	3.1	0.4	0.2	3.7
Smilax rotundifolia	3.1	0.4	0.1	3.6
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Toxicodendron radicans	29.8	--	74.3	104.1
Cocculus carolinus	14.9	--	9.2	24.1
Ampelopsis arborea	12.8	--	6.0	18.8
Trachelospermum difforme	8.5	--	2.1	10.6
Brunnichia cirrhosa	8.5	--	2.1	10.6
Ilex decidua	4.3	--	1.1	5.4
Clematis virginiana	4.3	--	1.1	5.4
Celtis laevigata	4.3	--	1.1	5.4
Vitis rotundifolia	2.1	--	0.5	2.6
Ulmus americana	2.1	--	0.5	2.6
Smilax rotundifolia	2.1	--	0.5	2.6
Cephalanthus occidentalis	2.1	--	0.5	2.6
Campsis radicans	2.1	--	0.5	2.6
Berchemia scandens	2.0	--	0.5	2.6
	100.0		100.0	200.0
Zone 5				
Trees				
Liquidambar styraciflua	31.7	34.5	68.5	134.7
Carya illinoensis	18.2	20.7	16.7	55.6
Celtis laevigata	18.2	20.7	4.9	43.8
Quercus shumardii	9.1	6.9	6.1	22.1
Quercus nigra	9.1	6.9	2.7	18.7
Ulmus americana	9.1	6.9	0.9	16.9
Acer negundo	4.6	3.4	0.2	8.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Cornus drummondii	21.6	59.2	58.3	139.1
Ilex decidua	17.4	15.3	15.9	48.6
Celtis laevigata	15.2	6.4	7.2	28.8
Ulmus americana	15.2	5.1	5.8	26.1
Acer negundo	6.5	6.4	6.0	18.9

Table D3 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Cercis canadensis	6.5	1.9	1.5	9.9
Crataegus viridis	4.4	1.9	2.4	8.7
Fraxinus pennsylvanica	4.4	1.3	0.9	6.6
Liquidambar styraciflua	4.4	1.3	0.7	6.4
Acer rubrum	2.2	0.6	1.0	3.8
Quercus shumardii	2.2	0.6	0.3	3.1
	100.0	100.0	100.0	300.0
Woody Vines				
Toxicodendron radicans	29.7	82.5	89.6	201.8
Campsis radicans	18.5	3.4	1.6	23.5
Berchemia scandens	14.8	5.1	1.1	21.0
Vitis riparia	11.1	2.8	3.5	17.4
Vitis rotundifolia	11.1	1.7	0.9	13.7
Parthenocissus quinquefolia	7.4	2.8	1.8	12.0
Ampelopsis cordata	3.7	1.1	1.4	6.2
Brunnichia cirrhosa	3.7	0.6	0.1	4.4
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Toxicodendron radicans	11.7	--	37.3	49.0
Viola floridana	7.1	--	11.9	19.0
Berchemia scandens	4.5	--	9.9	14.4
Ulmus americana	8.4	--	3.9	12.3
Ampelopsis arborea	3.8	--	8.5	12.3
Celtis laevigata	6.5	--	3.3	9.8
Acer negundo	4.5	--	1.5	6.0
Parthenocissus quinquefolia	2.6	--	3.1	5.7
Campsis radicans	2.6	--	3.1	5.7
Vitis rotundifolia	3.8	--	1.3	5.1
Ageratina altissima	3.8	--	3.1	5.7
Liquidambar styraciflua	3.3	--	0.9	3.5
Cornus drummondii	1.3	--	2.7	4.0
Clematis viorna	2.6	--	0.9	3.5
Aster simplex	2.6	--	0.9	3.5
Acalypha rhomboidea	2.6	--	0.9	3.5
Smilax rotundifolia	2.0	--	0.6	2.6
Sanicula canadensis	2.0	--	0.6	2.6
Oxalis stricta	2.0	--	0.6	2.6
Geum canadense	2.0	--	0.6	2.6
Boehmeria cylindrica	2.0	--	0.6	2.6
Vitis sp.	1.3	--	0.4	1.7
Quercus shumardii	1.3	--	0.4	1.7
Polygonum virginianum	1.3	--	0.4	1.7
Ilex decidua	1.3	--	0.4	1.7
Eupatorium serotinum	1.3	--	0.4	1.7
Brunnichia cirrhosa	1.3	--	0.4	1.7

Table D3 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Vitis riparia	0.7	--	0.2	0.9
Vernonia gigantea	0.7	--	0.2	0.9
Unknown	0.7	--	0.2	0.9
Trachelospermum difforme	0.7	--	0.2	0.9
Rubus trivialis	0.7	--	0.2	0.9
Quercus phellos	0.7	--	0.2	0.9
Quercus nigra	0.7	--	0.2	0.9
Dichanthelium commutatum	0.7	--	0.2	0.9
Mikania scandens	0.7	--	0.2	0.9
Platanthera flava	0.7	--	0.2	0.9
Fraxinus pennsylvanica	0.7	--	0.2	0.9
Forestiera acuminata	0.7	--	0.2	0.9
Clematis virginiana	0.7	--	0.2	0.9
Carex sp.	0.7	--	0.2	0.9
Aster sp.	0.7	--	0.2	0.9
	100.0		100.0	200.0
	Zone 6			
Trees				
Sassafras albidum	33.3	45.4	36.6	115.3
Acer negundo	14.3	15.2	22.0	51.5
Liquidambar styraciflua	19.0	18.2	3.2	40.4
Quercus nigra	4.8	3.0	18.4	26.2
Celtis laevigata	4.8	3.0	11.4	19.2
Cercis canadensis	9.5	6.1	2.1	17.7
Quercus falcata var. pagodifolia	9.5	6.1	0.6	16.2
Carya illinoensis	4.8	3.0	5.7	13.5
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Acer negundo	10.5	43.3	36.2	90.0
Liquidambar styraciflua	14.8	13.8	18.4	47.0
Sambucus canadensis	11.9	11.9	9.6	33.4
Ulmus americana	13.3	8.4	9.3	31.0
Ilex decidua	7.5	5.4	6.4	19.3
Cercis canadensis	7.5	3.8	5.2	16.5
Aralia spinosa	7.5	4.2	4.6	16.3
Callicarpa americana	6.0	2.7	2.2	10.9
Quercus falcata var. pagodifolia	6.0	1.5	2.0	9.5
Celtis laevigata	4.5	1.5	1.8	7.8
Diospyros virginiana	3.0	0.8	1.2	5.0
Fraxinus pennsylvanica	1.5	1.1	0.8	3.4
Morus rubra	1.5	0.4	1.0	2.9
Cornus drummondii	1.5	0.4	0.6	2.5

Table D3 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Quercus nigra	1.5	0.4	0.4	2.3
Ulmus crassifolia	1.5	0.4	0.3	2.2
	100.0	100.0	100.0	300.0
Woody Vines				
Toxicodendron radicans	26.5	69.2	71.7	167.4
Vitis rotundifolia	26.5	13.6	12.7	52.8
Vitis riparia	26.5	8.0	11.5	46.0
Parthenocissus quinquefolia	14.7	8.4	3.8	26.9
Cocculus carolinus	2.9	0.4	0.2	3.5
Campsis radicans	2.9	0.4	0.1	3.4
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Toxicodendron radicans	8.9	--	30.4	39.3
Sanicula canadensis	9.4	--	18.6	28.0
Ageratina altissima	9.9	--	13.8	23.7
Viola floridana	9.4	--	7.9	17.3
Geum canadense	9.4	--	6.1	15.5
Galium circaezans	6.8	--	2.9	9.7
Vernonia gigantea	4.2	--	4.2	8.4
Polygonum virginianum	3.2	--	2.6	5.8
Acer negundo	3.2	--	2.2	5.4
Vitis rotundifolia	3.6	--	1.5	5.1
Platanthera flava	2.3	--	1.9	5.1
Parthenocissus quinquefolia	2.6	--	1.3	3.9
Ulmus americana	3.2	--	0.5	3.7
Smallanthus uvedalia	2.2	--	1.3	3.5
Oxalis stricta	2.2	--	0.3	2.5
Carya illinoensis	1.6	--	0.3	1.9
Smilax glauca	1.0	--	0.2	1.2
Rubus trivialis	1.0	--	0.2	1.2
Quercus nigra	1.0	--	0.2	1.2
Lactuca sp.	1.0	--	0.2	1.2
Ampelamus albidus	1.0	--	0.2	1.2
Cercis canadensis	1.0	--	0.2	1.2
Campsis radicans	1.0	--	0.2	1.2
Botrychium virginianum	1.0	--	0.2	1.2
Aralia spinosa	1.0	--	0.2	1.2
Phytolacca americana	1.0	--	0.2	1.2
Viola sp.	0.5	--	0.5	1.0
Cornus drummondii	0.5	--	0.5	1.0
Trachelospermum difforme	0.5	--	0.1	0.6
Smilax rotundifolia	0.5	--	0.1	0.6
Sambucus canadensis	0.5	--	0.1	0.6
Rubus sp.	0.5	--	0.1	0.6
Quercus shumardii	0.5	--	0.1	0.6

Table D3 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Parietaria pensylvanica	0.5	--	0.1	0.6
Galium aparine	0.5	--	0.1	0.6
Erigeron philadelphicus	0.5	--	0.1	0.6
Elytraria caroliniensis	0.5	--	0.1	0.6
Cocculus carolinus	0.5	--	0.1	0.6
Aster simplex	0.5	--	0.1	0.6
Acalypha rhomboidea	0.5	--	0.1	0.6
	100.0		100.0	200.0

(Sheet 8 of 8)

Table D4
Importance Values for Species Occurring at Site 4, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 3			
Trees				
Carya aquatica	33.3	29.1	59.6	122.0
Quercus lyrata	25.0	32.7	23.1	80.8
Diospyros virginiana	25.0	14.6	5.7	45.3
Forestiera acuminata	12.5	20.0	6.7	39.2
Gleditsia aquatica	4.2	3.6	4.9	12.7
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Forestiera acuminata	20.7	40.7	43.3	104.7
Quercus lyrata	27.6	17.2	19.8	64.6
Diospyros virginiana	17.2	12.5	13.8	43.5
Planera aquatica	13.8	15.6	10.4	39.8
Carya aquatica	6.9	6.2	7.1	20.2
Cephalanthus occidentalis	10.4	6.2	3.3	19.9
Crataegus viridis	3.4	1.6	2.3	7.3
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis palmata	53.4	35.0	52.8	141.2
Brunnichia cirrohosa	33.3	59.8	44.6	137.7
Trachelospermum difforme	13.3	5.2	2.6	21.1
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Quercus lyrata	28.6	--	34.6	63.2
Brunnichia cirrhosa	14.3	--	26.1	40.4
Panicum rigidulum	5.7	--	13.2	18.9
Planera aquatica	8.6	--	6.3	14.9
Forestiera acuminata	10.0	--	3.9	13.9
Trachelospermum difforme	8.6	--	3.4	12.0
Diodia virginiana	7.1	--	2.8	9.9
Taxodium distichum	5.7	--	2.2	7.9
Acalypha rhomboidea	4.3	--	1.7	6.0
Carya aquatica	1.4	--	3.5	4.9
Cephalanthus occidentalis	2.9	--	1.1	4.0
Vitis palmata	1.4	--	0.6	2.0
Styrax americana	1.4	--	0.6	2.0
	100.0		100.0	200.0

(Sheet 1 of 3)

Table D4 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 4			
Trees				
Quercus phellos	16.7	16.3	33.3	66.3
Carya aquatica	16.7	18.6	22.5	57.8
Quercus lyrata	20.0	27.8	8.9	56.7
Liquidambar styraciflua	13.3	11.7	23.3	48.3
Quercus nuttallii	20,0	16.3	10.8	47.1
Crataegus viridis	6.7	4.7	0.5	11.9
Diospyros virginiana	3.3	2.3	0.4	6.0
Planera aquatica	3.3	2.3	0.3	5.9
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Styrax americana	20.4	58.7	46.7	125.8
Ilex decidua	18.2	15.6	24.0	57.8
Quercus lyrata	11.4	8.0	10.6	30.0
Quercus nuttallii	9.1	5.4	6.5	21.0
Diospyros virginiana	11.4	4.3	3.5	19.2
Planera aquatica	6.8	1.6	2.9	11.3
Cephalanthus occidentalis	6.8	1.6	1.1	9.5
Crataegus viridis	4.5	1.1	1.8	7.4
Cornus foemina	4.5	1.1	1.0	6.6
Quercus phellos	2.3	1.6	1.1	5.0
Forestiera acuminata	2.3	0.5	0.4	3.2
Carya aquatica	2.3	0.5	0.4	3.2
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis riparia	22.5	24.8	34.6	81.9
Trachelospermum difforme	20.0	33.7	17.2	70.9
Ampelopsis arborea	15.0	21.4	18.0	54.4
Berchemia scandens	15.0	9.7	19.6	44.3
Campsis radicans	7.5	3.4	4.9	15.8
Vitis palmata	7.5	2.1	3.0	12.6
Smilax bona-nox	5.0	1.4	0.9	7.3
Brunnichia cirrhosa	5.0	1.4	0.6	7.0
Smilax glauca	2.5	2.1	1.2	5.8
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Liquidambar styraciflua	10.2	--	13.8	24.0
Campsis radicans	6.9	--	14.1	22.4
Styrax americana	8.3	--	14.1	22.4
Ampelopsis arborea	4.8	--	14.1	18.9
Berchemia scandens	9.0	--	5.5	14.5
Dioclea multiflora	4.8	--	6.8	11.6

(Sheet 2 of 3)

Table D4 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Trachelospermum difforme	6.2	--	4.3	10.5
Ilex decidua	6.9	--	3.0	9.9
Vitis palmata	5.5	--	4.0	9.5
Quercus phellos	4.8	--	3.7	8.5
Brunnichia cirrhosa	5.5	--	2.4	7.9
Quercus nuttallii	4.8	--	2.1	6.9
Diodia virginiana	4.8	--	2.1	6.9
Smilax glauca	2.8	--	1.2	4.0
Forestiera acuminata	2.8	--	1.2	4.0
Acalypha rhomboidea	2.8	--	1.2	4.0
Vitis riparia	2.1	--	0.9	3.0
Rubus trivialis	1.4	--	0.6	2.0
Planera aquatica	1.4	--	0.6	2.0
Smilax rotundifolia	0.7	--	0.3	1.0
Smilax bona-nox	0.7	--	0.3	1.0
Panicum rigidulum	0.7	--	0.3	1.0
Geum canadense	0.7	--	0.3	1.0
Crataegus viridis	0.7	--	0.3	1.0
Cocculus carolinus	0.7	--	0.3	1.0
	100.0		100.0	200.0

(Sheet 3 of 3)

Table D5
Importance Values for Species Occurring at Site 5, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 3			
Trees				
Carya aquatica	45.0	54.4	37.2	136.6
Quercus lyrata	25.0	18.2	41.6	84.8
Forestiera acuminata	15.0	20.5	3.2	38.7
Taxodium distichum	5.0	2.3	17.1	24.4
Quercus phellos	5,0	2.3	0.6	7.9
Diospyros virginiana	5.0	2.3	0.3	7.6
	10.0	100.0	100.0	300.0
Saplings and Shrubs				
Amorpha fruticosa	16.1	28.6	22.1	66.8
Cephalanthus occidentalis	13.2	15.5	14.3	43.0
Forestiera acuminata	11.8	12.6	16.4	40.8
Diospyros virginiana	13.2	10.9	14.1	38.2
Carya aquatica	10.3	7.21	11.7	29.2
Crataegus viridis	11.8	8.1	6.3	26.2
Planera aquatica	5.9	5.9	4.7	16.5
Styrax americana	5.9	4.5	3.6	14.0
Ilex decidua	5.9	3.6	2.3	11.8
Quercus phellos	4.4	2.7	3.5	10.6
Quercus lyrata	1.5	0.4	1.0	2.9
	100.0	100.0	100.0	300.0
Woody Vines				
Trachelospermum difforme	31.3	71.3	59.7	162.3
Brunnichia cirrhosa	31.3	13.1	17.5	61.9
Vitis palmata	24.9	13.6	16.7	55.2
Campsis radicans	9.4	1.6	4.7	15.7
Berchemia scandens	3.1	0.4	1.4	4.9
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Quercus lyrata	11.7	--	21.8	33.5
Arundinaria gigantea	10.7	--	22.5	33.2
Trachelospermum difforme	11.7	--	16.4	28.1
Brunnichia cirrhosa	8.3	--	5.7	14.0
Amorpha fruticosa	7.7	--	5.5	13.2
Carya aquatica	7.1	--	5.3	12.4
Forestiera acuminata	5.9	--	4.7	10.6
Cephalanthus occidentalis	5.3	--	3.7	9.0
Planera aquatica	5.9	--	1.9	7.8
Ilex decidua	4.7	--	1.5	6.2

(Sheet 1 of 3)

Table D5 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Crataegus viridis	3.0	--	3.0	6.0
Campsis radicans	2.4	--	1.8	4.2
Vitis palmata	2.4	--	0.8	3.2
Leersia oryzoides	2.4	--	0.8	3.2
Styrax americana	1.8	--	0.6	2.4
Diospyros virginiana	0.6	--	1.2	1.8
Quercus phellos	1.2	--	0.4	1.6
Panicum rigidulum	1.2	--	0.4	1.6
Clematis sp.	1.2	--	0.4	1.6
Carex torta	1.2	--	0.4	1.6
Spermacoce glabra	0.6	--	0.2	0.8
Mimosa strigillosa	0.6	--	0.2	0.8
Liquidambar styraciflua	0.6	--	0.2	0.8
Diodia virginiana	0.6	--	0.2	0.8
Bidens frondosa	0.6	--	0.2	0.8
Berchemia scandens	0.6	--	0.2	0.8
	100.0		100.0	200.0
	Zone 4			
Trees				
Quercus phellos	37.1	47.2	70.8	155.1
Liquidambar styraciflua	14.8	11.1	8.5	34.4
Quercus nuttalii	14.8	11.1	8.0	33.9
Carya aquatica	11.1	11.1	9.7	31.9
Taxodium distichum	7.4	8.3	0.9	16.6
Bumelia lycioides	7.4	5.6	1.6	14.6
Crataegus viridis	7.4	5.6	0.5	13.5
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Forestiera acuminata	33.2	59.1	64.6	156.9
Planera aquatica	27.8	15.4	11.5	54.7
Diospyros virginiana	11.1	10.3	13.0	34.4
Crataegus viridis	11.1	5.1	5.1	21.3
Amorpha fruticosa	5.6	5.1	2.2	12.9
Taxodium distichum	5.6	2.5	2.5	10.6
Styrax americana	5.6	2.5	1.1	9.2
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis palmata	42.8	53.4	51.6	147.8
Vitis riparia	28.6	13.3	37.9	79.8
Brunnichia cirrhosa	14.3	20.0	6.3	40.6
Trachelospermum difforme	14.3	13.3	4.2	31.8
	100.0	100.0	100.0	300.0

Table D5 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Herbs and Woody Seedlings				
Quercus phellos	21.7	--	37.6	59.3
Brunnichia cirrhosa	17.1	--	14.6	31.7
Quercus nuttallii	10.3	--	13.6	23.9
Arundinaria gigantea	9.3	--	6.3	15.5
Trachelospermum difforme	8.0	--	3.4	11.4
Vitis palmata	4.5	--	4.4	8.9
Diodia virginiana	4,5	--	1.9	6.4
Styrax americana	3.4	--	1.4	4.8
Crataegus viridis	3.4	--	1.4	4.8
Amorpha fruticosa	3.4	--	1.4	4.8
Vitis riparia	1.1	--	3.0	4.1
Planera aquatica	1.1	--	3.0	4.1
Cephalanthus occidentalis	1.1	--	3.0	4.1
Smilax rotundifolia	2.3	--	1.0	3.3
Liquidambar styraciflua	2.3	--	1.0	3.3
Trifolium sp.	1.1	--	3.0	4.1
Lespedeza sp.	1.1	--	0.5	1.6
Ilex decidua	1.1	--	0.5	1.6
Carex joorii	1.1	--	0.5	1.6
Boehmeria cylindrica	1.1	--	0.5	1.6
Bidens frondosa	1.1	--	0.5	1.6
	100.0		100.0	200.0

Table D6
Importance Values for Species Occurring at Site 6, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 3			
Trees				
Quercus lyrata	44.5	57.2	55.4	157.1
Carya aquatica	27.8	17.8	28.6	74.2
Forestiera acuminata	11.1	10.7	1.5	23.3
Planera aquatica	11.1	10.7	1.0	22.8
Celtis laevigata	5.5	3.6	13.5	22.6
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Celtis laevigata	30.0	42.8	42.8	115.6
Fraxinus pennsylvanica	35.0	32.1	28.0	95.1
Forestiera acuminata	10.0	14.3	20.3	44.6
Taxodium distichum	10.0	5.4	4.5	19.9
Planera aquatica	5.0	1.8	2.4	9.2
Ilex decidua	5.0	1.8	1.0	7.8
Cephalanthus occidentalis	5.0	1.8	1.0	7.8
	100.0	100.0	100.0	300.0
Woody Vines				
Campsis radicans	27.1	49.4	50.8	127.3
Trachelospermum difforme	18,.9	18.5	14.3	51.7
Brunnichia cirrhosa	18.9	16.4	15.2	50.5
Ampelopsis arborea	13.5	6.2	8.2	27.9
Cocculus carolinus	10.8	6.8	7.2	24.8
Vitis riparia	5.4	1.3	1.0	7.7
Berchemia scandens	2.7	0.7	2.2	5.6
Toxicodendron radicans	2.7	0.7	1.1	4.5
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Campsis radicans	11.7	--	40.7	52.4
Clematis crispa	10.2	--	11.8	22.0
Brunnichia cirrhosa	8.8	--	12.6	21.4
Boehmeria cylindrica	10.9	--	6.2	17.1
Ampelopsis arborea	6.6	--	8.5	15.1
Vitis riparia	8.0	--	7.0	15.0
Trachelospermum difforme	8.0	--	4.6	12.6
Planera aquatica	8.8	--	1.9	10.7
Quercus lyrata	4.4	--	1.2	5.6
Leersia virginica	3.6	--	0.5	4.1
Forestiera acuminata	3.6	--	0.5	4.1
Celtis laevigata	2.2	--	0.9	3.1

(Sheet 1 of 3)

Table D6 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Cocculus carolinus	1.5	--	0.8	2.3
Asclepias perennis	1.5	--	0.8	2.3
Urtica chamaedryoides	1.5	--	0.2	1.7
Toxicodendron radicans	1.5	--	0.2	1.7
Cephalanthus occidentalis	1.5	--	0.2	1.7
Bidens discoidea	0.5	--	0.2	1.7
Vitis cinerea	0.7	--	0.7	1.4
Taxodium distichum	0.7	--	0.1	0.8
Senecio glabellus	0.7	--	0.1	0.8
Fraxinus pennsylvanica	0.7	--	0.1	0.8
Carya aquatica	0.7	--	90.1	0.8
Bidens cernua	0.7	--	0.1	0.8
	100.0		100.0	200.0
	Zone 4			
Trees				
Liquidambar styraciflua	15.5	13.8	43.4	72.7
Celtis laevigata	23.1	30.6	6.8	60.5
Acer negundo	23.1	25.0	6.6	54.7
Ulmus americana	15.4	13.9	11.8	41.1
Carya illinoensis	7.7	5.5	27.0	40.2
Cercis canadensis	3.8	2.8	2.2	8.8
Quercus lyrata	3.8	2.8	1.7	8.3
Cornus drummondii	3.8	2.8	0.3	6.9
Ilex decidua	3.8	2.8	0.2	6.8
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Celtis laevigata	21.4	37.7	37.9	97.0
Ulmus americana	11.9	18.9	22.0	52.8
Acer negundo	14.3	12.3	14.9	41.5
Fraxinus pennsylvanica	11.9	4.7	2.9	19.5
Ilex decidua	9.5	4.7	3.7	17.9
Crataegus viridis	9.5	5.7	2.7	17.9
Liquidambar styraciflua	4.8	5.7	6.5	17.0
Carya illinoensis	7.1	3.8	4.1	15.0
Acer rubrum	2.4	3.8	3.3	9.5
Cornus drummondii	2.4	0.9	1.2	4.5
Quercus phellos	2.4	0.9	0.4	3.7
Cornus foemina	2.4	0.9	0.4	3.7
	100.0	100.0	100.0	300.0
Woody Vines				
Parthenocissus quinquefolia	15.6	44.7	36.8	97.1
Smilax rotundifolia	17.3	22.7	8.5	48.5
Toxicodendron radicans	10.3	11.0	20.2	41.5

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Table D6 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Vitis cinerea	10.3	4.8	15.1	30.2
Berchemia scandens	10.3	4.8	6.5	21.6
Smilax hispida	10.3	3.4	4.4	18.1
Ampelopsis arborea	8.7	2.4	4.5	15.6
Cocculus carolinus	6.9	2.4	2.3	11.6
Brunnichia cirrhosa	5.2	1.4	0.6	7.2
Trachelospermum difforme	1.7	1.4	0.6	3.7
Smilax bona-nox	1.7	0.7	0.2	2.6
Campsis radicans	1.7	0.3	0.3	2.3
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Toxicodendron radicans	8.5	--	24.0	32.5
Smilax rotundifolia	18.3	--	13.7	32.0
Parthenocissus quinquefolia	11.3	--	20.7	32.0
Urtica chamaedryoides	11.3	--	14.3	25.6
Clematis crispa	14.2	--	4.8	19.0
Rubus trivialis	4.2	--	3.9	8.1
Cocculus carolinus	4.2	--	3.9	8.1
Boehmeria cylindrica	4.2	--	3.9	8.1
Brunnichia cirrhosa	2.8	--	3.5	6.3
Senecio glabellus	4.2	--	1.4	5.6
Acalypha rhomboidea	4.2	--	1.4	5.6
Aster simplex	2.8	--	1.0	3.8
Ulmus americana	1.4	--	0.5	1.9
Trachelospermum difforme	1.4	--	0.5	1.9
Smilax hispida	1.4	--	0.5	1.9
Morus rubra	1.4	--	0.5	1.9
Leersia virginica	1.4	--	0.5	1.9
Ilex decidua	1.4	--	0.5	1.9
Celtis laevigata	1.4	--	0.5	1.9
	100.0		100.0	200.0

Table D7
Importance Values for Species Occurring at Site 7, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 2			
Trees				
Taxodium distichum	50.0	62.6	79.1	191.7
Nyssa aquatica	25.0	21.9	20.0	66.9
Planera aquatica	10.0	6.2	0.4	16.6
Ulmus americana	5.0	3.1	0.2	8.3
Celtis laevigata	5.0	3.1	0.2	8.3
Forestiera acuminata	5.0	3.1	0.1	8.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Styrax americana	16.7	50.0	55.5	122.2
Cephalanthus occidentalis	33.3	25.0	20.4	78.7
Itea virginica	33.3	16.7	11.1	61.1
Taxodium distichum	16.7	8.3	13.0	38.0
	100.0	100.0	100.0	300.0
Woody Vines				
Berchemia scandens	25.0	83.4	95.5	203.9
Brunnichia cirrhosa	50.0	11.1	3.0	64.1
Campsis radicans	25.0	5.5	1.5	32.0
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Boehmeria cylindrica	14.4	--	28.1	42.5
Onoclea sensibilis	3.8	--	24.6	28.4
Taxodium distichum	17.2	--	10.9	28.1
Planera aquatica	12.5	--	4.2	16.7
Forestiera acuminata	12.5	--	4.2	16.7
Nyssa aquatica	9.6	--	4.9	14.5
Cephalanthus occidentalis	3.8	--	4.6	8.4
Brunnichia cirrhosa	3.8	--	3.0	6.8
Saururus cernuus	1.9	--	4.0	5.9
Campsis radicans	2.9	--	2.6	5.5
Asclepias perennis	12.9	--	2.3	4.2
Vitis vulpina	2.9	--	1.0	3.9
Leersia sp.	1.0	--	2.0	3.0
Quercus lyrata	1.9	--	0.6	2.5
Leersia virginica	1.9	--	0.6	2.5
Triadenum walteri	1.0	--	0.3	1.3
Trachelospermum difforme	1.0	--	0.3	1.3
Styrax americana	1.0	--	0.3	1.3

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Table D7 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Smilax rotundifolia	1.0	--	0.3	1.3
Pluchea camphorata	1.0	--	0.3	1.3
Nyssa sylvatica	1.0	--	0.3	1.3
Carya aquatica	1.0	--	0.3	1.3
Berchemia scandens	1.0	--	0.3	1.3
	100.0		100.0	200.0
	Zone 3			
Trees				
Planera aquatica	38.6	66.0	52.9	157.5
Taxodium distichum	15.4	9.4	17.5	42.3
Forestiera acuminata	19.2	11.3	2.9	33.4
Quercus lyrata	7.7	3.8	16.5	28.0
Carya aquatica	7.7	3.8	3.7	15.2
Acer saccharinum	3.8	1.9	4.6	10.3
Crataegus viridis	3.8	1.9	1.2	6.9
Celtis laevigata	3.8	1.9	0.7	6.4
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Forestiera acuminata	25.0	36.7	47.3	109.0
Taxodium distichum	16.7	28.3	23.7	68.7
Cephalanthus occidentalis	20.7	16.7	11.3	48.7
Planera aquatica	16.7	8.3	6.4	31.4
Acer saccharinum	8.3	3.3	4.5	16.1
Nyssa aquatica	4.2	3.3	2.3	9.8
Celtis laevigata	4.2	1.7	3.4	9.3
Salix nigra	4.2	1.7	1.1	7.0
	100.0	100.0	100.0	300.0
Woody Vines				
Brunnichia cirrhosa	36.8	58.7	56.0	151.5
Cocculus carolinus	15.8	27.3	24.4	67.5
Vitis riparia	15.8	3.3	3.7	22.8
Ampelopsis cordata	10.5	4.1	7.8	22.4
Wisteria frutescens	5.3	3.3	6.2	14.8
Trachelospermum difforme	10.5	2.5	1.1	14.1
Campsis radicans	5.3	0.8	0.8	6.9
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Leersia virginica	10.4	--	19.0	29.4
Planera aquatica	14.8	--	8.4	23.2
Brunnichia cirrhosa	10.4	--	7.2	17.6
Commelina virginica	4.4	--	11.3	15.7
Leersia sp.	6.0	--	7.8	13.8

Table D7 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Aster sp.	6.0	--	6.9	12.9
Saururus cernuus	4.4	--	8.5	12.9
Taxodium distichum	5.1	--	3.6	8.7
Forestiera acuminata	5.1	--	2.5	7.6
Onoclea sensibilis	3.7	--	3.2	6.9
Lindernia dubia	3.7	--	2.1	5.8
Cocculus carolinus	2.9	--	2.1	5.0
Justicia ovata	2.2	--	2.8	5.0
Echinodorus cordifolius	2.2	--	2.8	5.0
Quercus lyrata	2.9	--	0.8	3.7
Boehmeria cylindrica	2.9	--	0.8	3.7
Cephalanthus occidentalis	2.2	--	0.6	2.8
Carya aquatica	2.2	--	0.6	2.8
Trachelospermum difforme	0.7	--	1.3	2.0
Smilax rotundifolia	0.7	--	1.3	2.0
Pluchea camphorata	0.7	--	1.3	2.0
Lysimachia radicans	0.7	--	1.3	2.0
Hibiscus laevis	0.7	--	1.3	2.0
Celtis laevigata	0.7	--	1.3	2.0
Acer rubrum	1.5	--	0.4	1.9
Spilanthes americana	0.7	--	0.2	0.9
Toxicodendron radicans	0.7	--	0.2	0.9
Asclepias perennis	0.7	--	0.2	0.9
Ammannia coccinea	0.7	--	0.2	0.9
	100.0		100.0	200.0
	Zone 4			
Trees				
Liquidambar styraciflua	21.8	28.2	76.6	126.6
Celtis laevigata	39.2	48.7	6.5	94.4
Fraxinus pennsylvanica	13.0	7.7	10.6	31.3
Ulmus americana	13.0	7.7	1.2	21.9
Acer negundo	8.7	5.1	1.5	15.3
Acer saccharinum	4.3	2.6	3.6	10.5
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Celtis laevigata	52.5	82.0	86.0	220.5
Planera aquatica	15.8	9.0	6.5	31.3
Ulmus americana	15.8	4.5	4.5	24.8
Quercus lyrata	5.3	1.5	1.4	8.2
Fraxinus pennsylvanica	5.3	1.5	0.8	7.6
Forestiera acuminata	5.3	1.5	0.8	7.6
	100.0	100.0	100.0	300.0

Table D7 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Woody Vines				
Toxicodendron radicans	11.5	31.9	60.1	103.5
Smilax rotundifolia	17.3	20.5	14.2	52.0
Cocculus carolinus	19.3	19.0	11.1	49.4
Trachelospermum difforme	17.3	11.1	4.3	32.7
Brunnichia cirrhosa	15.5	8.7	4.1	28.3
Smilax hispida	5.8	3.6	2.3	11.7
Campsis radicans	3.8	2.0	1.3	7.1
Ampelopsis arborea	3.8	1.6	1.6	7.0
Smilax bona-nox	3.8	1.2	0.7	5.7
Wisteria frutescens	1.9	0.4	0.3	2.6
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Cocculus carolinus	8.2	--	9.7	17.9
Leersia virginica	7.7	--	11.5	19.2
Aster sp.	5.4	--	13.1	18.5
Commelina virginica	5.8	--	13.8	19.6
Brunnichia cirrhosa	5.4	--	7.8	13.2
Boehmeria cylindrica	6.7	--	6.2	12.9
Trachelospermum difforme	6.7	--	5.3	12.0
Toxicodendron radicans	5.4	--	4.3	9.7
Campsis radicans	3.4	--	6.1	9.5
Leersia sp.	4.8	--	4.2	9.0
Smilax rotundifolia	5.4	--	3.1	8.5
Spermacoce glabra	4.4	--	1.7	6.1
Ampelopsis arborea	2.9	--	1.9	4.8
Vitis vulpina	2.9	--	1.3	4.2
Planera aquatica	2.0	--	1.7	3.7
Acer rubrum	2.9	--	0.7	3.6
Viola sp.	2.0	--	0.5	2.5
Smilax hispida	1.5	--	1.0	2.5
Cardiospermum halicacabum	1.5	--	1.0	2.5
Smilax bona-nox	1.5	--	0.4	1.9
Onoclea sensibilis	1.5	--	0.	1.9
Celtis laevigata	1.5	--	0.4	1.9
Vitis riparia	1.0	--	0.2	1.2
Polygonum hydropiperoides	1.0	--	0.2	1.2
Mikania scandens	1.0	--	0.2	1.2
Iva annua	1.0	--	0.2	1.2
Passiflora lutea	0.5	--	0.7	1.2
Justicia ovata	0.5	--	0.7	1.2
Brunnichia cirrhosa	0.5	--	0.7	1.2
Ulmus americana	0.5	--	0.1	0.6
Taxodium distichum	0.5	--	0.1	0.6
Solanum carolinense	1.5	--	0.1	0.6
Smilax glauca	0.5	--	0.1	0.6

Table D7 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Pluchea camphorata	0.5	--	0.1	0.6
Melothria pendula	0.5	--	0.1	0.6
Matelea gonocarpa	0.5	--	0.1	0.6
Cephalanthus occidentalis	0.5	--	0.1	0.6
Cayaponia quinqueloba	0.5	--	0.1	0.6
Aristolochia serpentaria	0.5	--	0.1	0.6
	100.0		100.0	200.0

Table D8
Importance Values for Species Occurring at Site 8, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 3			
Trees				
Planera aquatica	21.8	29.7	10.2	61.7
Quercus lyrata	13.0	16.7	31.0	60.7
Forestiera acuminata	13.0	19.0	5.3	37.3
Carya aquatica	15.2	9.5	9.1	33.8
Salix nigra	8.7	4.8	19.3	32.8
Taxodium distichum	10.9	7.1	9.9	27.9
Gleditsia aquatica	4.3	4.8	10.2	19.3
Fraxinus pennsylvanica	8.7	4.8	2.1	15.6
Acer saccharinum	2.2	2.4	2.1	6.7
Ulmus americana	2.2	1.2	0.8	4.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Planera aquatica	52.9	44.5	51.4	148.8
Forestiera acuminata	35.3	48.1	42.9	126.3
Fraxinus pennsylvanica	11.8	7.4	5.7	24.9
	100.0	100.0	100.0	300.0
Woody Vines				
Campsis radicans	50.0	50.0	69.2	169.2
Brunnichia cirrhosa	50.0	50.0	30.8	130.8
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Forestiera acuminata	43.7	--	32.9	76.6
Cephalanthus occidentalis	12.4	--	34.0	46.4
Planera aquatica	18.8	--	14.2	33.0
Brunnichia cirrhosa	18.8	--	14.2	33.0
Vitis palmata	6.3	--	4.7	11.0
	100.0		100.0	200.0
	Zone 4			
Trees				
Quercus phellos	28.7	34.1	36.2	99.0
Quercus lyrata	17.8	14.9	28.1	60.8
Fraxinus pennsylvanica	17.8	21.3	10.8	49.9
Quercus nuttallii	10.7	10.6	6.0	27.3
Ulmus americana	10.7	6.4	3.0	20.1
Carya aquatica	7.1	8.5	3.9	19.5

(Continued)

Table D8 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 3			
Trees				
Quercus lyrata	28.5	39.6	26.4	94.5
Fraxinus pennsylvanica	14.3	20.7	24.2	59.2
Carya aquatica	17.8	13.2	9.5	40.5
Ulmus americana	17.8	13.2	9.1	40.1
Quercus palustris	7.2	5.7	12.9	25.8
Taxodium distichum	3.6	1.9	5.6	11.1
Quercus phellos	3.6	1.9	5.3	10.8
Diospyros virginiana	3.6	1.9	4.4	9.9
Gleditsia aquatica	3.6	1.9	2.6	8.1
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Forestiera acuminata	50.0	50.0	70.0	170.0
Cephalanthus occidentalis	50.0	50.0	30.0	130.0
	100.0	100.0	100.0	300.0
Woody Vines				
None present				
Herbs and Woody Seedlings				
Leersia sp.	23.5	--	65.1	88.6
Forestiera acuminata	20.7	--	6.5	27.2
Leersia virginica	5.6	--	10.2	15.8
Vitis palmata	9.7	--	5.3	15.0
Planera aquatica	9.7	--	3.0	12.7
Asclepias perennis	5.6	--	1.7	7.3
Ageratina altissima	4.2	--	1.3	5.5
Clematis crispa	4.2	--	1.3	5.5
Acalypha rhomboidea	2.8	--	1.3	4.1
Quercus lyrata	2.8	--	0.9	3.7
Carya aquatica	2.8	--	0.9	3.7
Brunnichia cirrhosa	2.8	--	0.9	3.7
Ulmus americana	1.4	--	0.4	1.8
Parthenocissus quinquefolia	1.4	--	0.4	1.8
Lysimachia radicans	1.4	--	0.4	1.8
Ampelopsis arborea	1.4	--	0.4	1.8
	100.0		100.0	200.0

Table D9
Importance Values for Species Occurring at Site 9, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 6			
Trees				
Carya tomentosa	38.4	45.5	36.3	120.2
Liquidambar styraciflua	30.7	40.0	34.9	105.6
Quercus nigra	15.4	7.3	15.0	37.7
Quercus alba	7.7	3.6	5.0	16.3
Quercus velutina	3.9	1.8	6.8	12.5
Fraxinus americana	3.9	1.8	2.0	7.7
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Carya tomentosa	22.3	38.2	42.2	102.7
Aralia spinosa	11.1	22.5	17.9	512.5
Cercis canadensis	15.7	10.3	9.7	35.7
Morus rubra	11.1	7.8	9.0	27.9
Cornus florida	9.0	4.4	4.8	18.2
Liquidambar styraciflua	4.4	3.5	4.6	12.5
Ulmus alata	4.4	3.5	3.2	11.1
Sassafras albidum	4.4	2.6	2.6	9.6
Quercus lyrata	2.2	0.9	1.1	4.2
Ulmus rubra	2.2	0.9	0.7	3.8
Rhus glabra	2.2	0.9	0.7	3.8
Quercus velutina	2.2	0.9	0.7	3.8
Prunus serotina	2.2	0.9	0.7	3.8
Nyssa sylvatica	2.2	0.9	0.7	3.8
Callicarpa americana	2.2	0.9	0.7	3.8
Acer rubrum	2.2	0.9	0.7	3.8
	100.0	100.0	100.0	300.0
Woody Vines				
Parthenocissus quinquefolia	37.5	64.0	73.3	174.8
Toxicodendron radicans	33.3	29.0	19.5	81.8
Vitis aestivalis	12.5	3.0	4.4	19.9
Smilax glauca	8.3	2.0	1.4	11.7
Smilax rotundifolia	4.2	1.0	0.7	5.9
Bignonia capreolata	4.2	1.0	0.7	5.9
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Toxicodendron radicans	4.8	--	16.1	20.9
Carya tomentosa	5.2	--	12.7	17.9
Dioclea multiflora	6.0	--	10.1	16.1
Chasmanthium sessiliflorum	5.2	--	7.9	13.1
Parthenocissus quinquefolia	6.0	--	5.3	11.3
Cercis canadensis	3.7	--	6.8	10.5
Dichanthelium commutatum	5.6	--	3.3	8.9

(Sheet 1 of 4)

Table D9 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Aralia spinosa	1.9	--	6.1	8.0
Sabatia calycina	3.7	--	2.0	5.7
Galium circaezans	3.3	--	1.9	5.2
Vitis rotundifolia	3.1	--	1.6	4.7
Carex flaccidula	3.0	--	1.0	4.0
Ampelopsis brevipedunculata	1.9	--	2.0	3.9
Morus rubra	1.1	--	2.2	3.3
Desmodium glabellum	1.9	--	1.3	3.2
Ageratina altissima	2.3	--	0.7	3.0
Chasmanthium laxum	0.8	--	2.1	2.9
Vitis aestivalis	1.5	--	1.1	2.6
Lactuca floridana	1.9	--	1.3	3.2
Ulmus rubra	1.9	--	0.6	2.5
Rubrus argutus	1.1	--	1.0	2.1
Quercus phellos	1.5	--	0.5	2.0
Desmodium passiflorum	1.5	--	0.5	2.0
Carex cephalophora	1.5	--	2.1	2.9
Sambucus canadensis	0.8	--	0.9	1.7
Elytraria carolinensis	0.8	--	0.9	1.7
Campsis radicans	0.8	--	0.9	1.7
Rubus occidentalis	1.1	--	0.4	1.5
Ilex decidua	1.1	--	0.4	1.5
Crataegus sp.	1.1	--	0.4	1.5
Acer rubrum	1.1	--	0.4	1.5
Smilax bona-nox	0.4	--	0.8	1.2
Quercus stellata	0.4	--	0.8	1.2
Vernonia gigantea	0.8	--	0.2	1.0
Smilax glauca	0.8	--	0.2	1.0
Rubus sp.	0.8	--	0.2	1.0
Quercus alba	0.8	--	0.2	1.0
Prunus serotina	0.8	--	0.2	1.0
Unknown	0.8	--	0.2	1.0
Oxalis debilis	0.8	--	0.2	1.0
Unknown	0.8	--	0.2	1.0
Galium sp.	0.8	--	0.2	1.0
Unknown	0.8	--	0.2	1.0
Cornus florida	0.8	--	0.2	1.0
Bignonia capreolata	0.8	--	0.2	1.0
Viola triloba	0.4	--	0.1	0.5
Viola papilionacea	0.4	--	0.1	0.5
Vitis palmata	0.4	--	0.1	0.5
Ulmus americana	0.4	--	0.1	0.5
Trachelospermum difforme	0.4	--	0.1	0.5
Trepocarpus aethusae	0.4	--	0.1	0.5
Smilax rotundifolia	0.4	--	0.1	0.5
Unknown	0.4	--	0.1	0.5
Sassafras albidum	0.4	--	0.1	0.5

Table D9 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Quercus palustris	3.6	2.1	11.7	17.4
Diospyros virginiana	3.6	2.1	0.3	6.0
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Ulmus americana	24.0	35.8	41.5	101.3
Ilex decidua	28.0	35.8	32.2	96.0
Crataegus viridis	24.0	16.4	14.3	54.7
Fraxinus pennsylvanica	16.0	6.0	5.6	27.6
Diospyros virginiana	4.0	4.5	5.0	13.5
Quercus phellos	4.0	1.5	1.4	6.9
	100.0	100.0	100.0	300.0
Woody Vines				
Campsis radicans	41.7	36.4	43.7	121.8
Berchemia scandens	25.0	36.4	27.3	88.7
Vitis palmata	16.7	13.6	14.5	44.8
Vitis riparia	8.3	9.1	13.7	31.1
Cocculus carolinus	8.3	4.5	0.8	13.6
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Campsis radicans	16.4	--	37.5	53.9
Trachelospermum difforme	15.1	--	16.3	31.4
Viola papilionacea	12.3	--	15.1	27.4
Planera aquatica	11.0	--	4.9	15.9
Leersia virginica	8.2	--	6.8	15.0
Cocculus carolinus	4.1	--	5.0	9.1
Carex squarrosa	5.5	--	2.4	7.9
Quercus phellos	4.1	--	1.8	5.9
Ilex decidua	2.7	--	1.2	3.9
Diospyros virginiana	2.7	--	1.2	3.9
Carya aquatica	2.7	--	1.2	3.9
Berchemia scandens	2.7	--	1.2	3.9
Vitis palmata	1.4	--	0.6	2.0
Taxodium distichum	1.4	--	0.6	2.0
Smilax glauca	1.4	--	0.6	2.0
Quercus lyrata	1.4	--	0.6	2.0
Dioscorea quaternata	1.4	--	0.6	2.0
Crataegus viridis	1.4	--	0.6	2.0
Clematis crispa	1.4	--	0.6	2.0
Brunnichia cirrhosa	2.7	--	1.2	3.9
	100.0		100.0	200.0

Table D9 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Rubus sp.	0.4	--	0.1	0.5
Quercus nigra	0.4	--	0.1	0.5
Polygonum scandens	0.4	--	0.1	0.5
Paspalum sp.	0.4	--	0.1	0.5
Oxalis debilis	0.4	--	0.1	0.5
Leersia virginica	0.4	--	0.1	0.5
Leersia sp.	0.4	--	0.1	0.5
Juniperus virginiana	0.4	--	0.1	0.5
Galium uniflorum	0.4	--	0.1	0.5
Galium trifidum	0.4	--	0.1	0.5
Unknown	0.4	--	0.1	0.5
Galium circaezans	0.4	--	0.1	0.5
Eupatorium sp.	0.4	--	0.1	0.5
Elytraria carolinensis	0.4	--	0.1	0.5
Dioscorea quaternata	0.4	--	0.1	0.5
Desmodium sp.	0.4	--	0.1	0.5
Desmodium paniculatum	01.4	--	0.1	0.5
Celtis laevigata	0.4	--	0.1	0.5
Unknown	0.4	--	0.1	0.5
Callicarpa americana	0.4	--	0.1	0.5
Carex albolutescens	0.4	--	0.1	0.5
Agrimonia pubescens	0.4	--	0.1	0.5
	100.0		100.0	200.0

(Sheet 4 of 4)

Table D10
Importance Values for Species Occurring at Site 10, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 2			
Trees				
Taxodium distichum	33.4	40.2	59.7	133.3
Ilex decidua	13.3	28.3	3.0	44.6
Nyssa aquatica	13.3	6.0	14.6	33.9
Nyssa biflora	13.3	9.0	10.5	32.8
Acer drummondii	10.1	4.5	1.6	16.2
Quercus lyrata	6.7	3.0	4.9	14.6
Acer rubrum	3.3	6.0	4.7	14.0
Liquidambar styraciflua	3.3	1.5	0.9	5.7
Carpinus caroliniana	3.3	1.5	0.1	4.9
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Styrax americana	25.6	32.8	31.6	90.0
Ilex decidua	23.0	26.7	31.8	81.5
Ilex amelanchier	10.3	20.0	16.9	47.2
Itea virginica	12.8	10.3	7.6	30.7
Acer drummondii	12.8	4.2	4.3	21.3
Quercus lyrata	7.7	3.0	4.3	15.0
Cephalanthus occidentalis	2.6	1.8	2.1	6.5
Taxodium distichum	2.6	0.6	0.7	3.9
Carpinus caroliniana	2.6	0.6	0.7	3.9
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	62.5	50.0	50.0	162.5
Ampelopsis arborea	25.0	40.0	38.2	103.2
Campsis radicans	12.5	10.0	11.8	34.3
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Styrax americana	28.5	--	42.1	70.6
Ampelopsis arborea	10.6	--	18.8	29.4
Quercus lyrata	7.1	--	4.6	11.7
Planera aquatica	7.1	--	4.6	11.7
Cephalanthus occidentalis	7.1	--	2.3	5.9
Viburnum dentatum	3.6	--	2.3	5.9
Taxodium distichum	3.6	--	2.3	5.9
Nyssa biflora	3.6	--	2.3	5.9
Nyssa aquatica	3.6	--	2.3	5.9

(Sheet 1 of 6)

Table D10 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Ilex decidua	3.6	--	2.3	5.9
Forestiera acuminata	3.6	--	2.3	5.9
Ageratina altissima	3.6	--	2.3	5.9
Campsis radicans	3.6	--	2.3	5.9
Carpinus caroliniana	3.6	--	2.3	5.9
Brunnichia cirrhosa	3.6	--	2.3	5.9
Acer rubrum	3.6		2.3	5.9
	100.0		100.0	200.0
	Zone 3			
Trees				
Nyssa biflora	41.6	61.0	48.8	151.4
Acer drummondii	33.3	20.8	35.8	89.9
Liquidambar styraciflua	4.2	3.9	9.4	17.5
Diospyros virginiana	4.2	6.5	3.6	14.3
Carpinus caroliniana	8.3	3.9	1.5	13.7
Crataegus aestivalis	4.2	2.6	0.3	7.1
Quercus nigra	4.2	1.3	0.6	6.1
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Styrax americana	18.5	38.7	38.8	96.0
Nyssa biflora	16.3	14.1	20.2	50.6
Acer drummondii	16.3	17.6	16.5	50.4
Arundinaria gigantea	9.2	4.4	3.0	16.6
Itea virginica	2.3	7.1	3.8	13.2
Carpinus caroliniana	7.0	2.6	3.0	12.6
Ilex decidua	4.7	3.5	3.8	12.0
Liquidambar styraciflua	4.7	2.6	2.4	9.7
Taxodium distichum	4.7	1.7	1.6	8.0
Fraxinus pennsylvanica	4.7	1.7	0.9	7.3
Diospyros virginiana	4.7	1.7	0.9	7.3
Cephalanthus occidentalis	2.3	1.7	2.3	6.3
Quercus laurifolia	2.3	1.7	1.7	5.7
Ulmus americana	2.3	0.9	1.1	4.3
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	27.5	33.3	43.2	104.0
Toxicodendron radicans	17.2	34.9	30.5	82.6
Berchemia scandens	13.8	10.1	11.1	35.0
Ampelopsis arborea	13.8	8.7	6.3	28.8
Brunnichia cirrhosa	10.4	5.8	3.1	19.3
Bignonia capreolata	6.9	2.9	3.2	13.0

Table D10 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Smilax rotundifolia	6.9	2.9	0.5	10.3
Campsis radicans	3.5	1.4	2.1	7.0
Herbs and Woody Seedlings				
Nyssa biflora	15.3	--	16.1	31.4
Berchemia scandens	12.8	--	14.5	27.3
Saururus cernuus	10.2	--	13.2	23.4
Styrax americana	12.8	--	7.1	19.9
Ampelopsis arborea	7.7	--	11.7	19.4
Toxicodendron radicans	5.1	--	10.3	15.4
Itea virginica	5.1	--	10.3	15.4
Lysimachia radicans	5.1	--	2.8	7.9
Bignonia capreolata	5.1	--	2.8	7.9
Ilex decidua	2.6	--	1.4	4.0
Campsis radicans	2.6	--	1.4	4.0
Carya aquatica	2.6	--	1.4	4.0
Brunnichia cirrhosa	2.6	--	1.4	4.0
Boehmeria cylindrica	2.6	--	1.4	4.0
Aristolochia serpentaria	2.6	--	1.4	4.0
Arundinaria gigantea	2.6	--	1.4	4.0
Acer rubrum	2.6	--	1.4	4.0
	100.0		100.0	200.0
	Zone 4			
Trees				
Carpinus caroliniana	25.1	36.5	12.6	74.2
Quercus laurifolia	15.6	11.6	28.0	55.2
Quercus nigra	12.5	11.6	28.8	52.9
Acer rubrum	15.6	17.3	15.5	48.4
Nyssa sylvatica	12.5	7.7	7.1	27.3
Liquidambar styraciflua	9.4	9.6	7.0	26.0
Ulmus americana	3.1	1.9	0.4	5.4
Ilex decidua	3.1	1.9	0.4	5.4
Fraxinus pennsylvanica	3.1	1.9	0.2	5.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Carpinus caroliniana	14.0	23.9	28.7	66.6
Liquidambar styraciflua	1.0	22.4	21.6	58.0
Acer rubrum	12.4	22.1	20.7	55.2
Quercus laurifolia	9.4	8.6	7.8	25.8
Quercus nigra	6.3	5.6	6.4	18.3
Cornus foemina	9.4	4.1	3.9	17.4
Nyssa sylvatica	9.4	3.7	3.0	16.1
Viburnum dentatum	1.6	2.6	2.0	6.2

Table D10 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Diospyros virginiana	3.1	1.5	1.0	5.6
Fraxinus pennsylvanica	3.1	0.8	1.5	5.4
Ulmus americana	3.1	0.8	0.7	4.6
Ilex amelanchier	3.1	0.8	0.7	4.6
Ilex opaca	3.1	0.8	0.6	4.5
Magnolia grandiflora	1.6	0.4	0.3	2.3
Crataegus marshallii	1.6	0.4	0.3	2.3
Cephalanthus occidentalis	1.6	0.4	0.2	2.2
	100.0	100.0	100.0	300.0
Woody Vines				
Berchemia scandens	34.4	24.7	41.0	100.1
Toxicodendron radicans	10.3	29.0	13.5	52.8
Vitis rotundifolia	17.3	13.0	16.3	46.6
Ampelopsis arborea	10.4	13.0	21.2	44.6
Campsis radicans	10.4	10.1	4.7	25.2
Smilax rotundifolia	10.4	7.2	2.7	20.3
Brunnichia cirrhosa	3.4	1.5	0.3	5.2
Bignonia carpreolata	3.4	1.5	0.3	5.2
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Quercus laurifolia	11.9	--	17.5	29.4
Itea virginica	6.7	--	17.5	24.2
Mitchella repens	5.0	--	15.1	20.1
Acer rubrum	10.2	--	9.2	19.4
Lysimachia radicans	7.7	--	6.1	13.8
Toxicodendron radicans	5.9	--	4.9	10.8
Smilax rotundifolia	6.7	--	3.2	9.9
Carex sp.	6.7	--	3.2	9.9
Chasmanthium sessiliflorum	1.7	--	6.6	8.3
Saururus cernuus	3.4	--	3.7	7.1
Ampelopsis arborea	3.4	--	3.7	7.1
Campsis radicans	4.2	--	2.0	6.2
Bignonia capreolata	3.4	--	1.6	5.0
Berchemia scandens	3.4	--	1.6	5.0
Quercus phellos	2.5	--	1.2	3.7
Brunnichia cirrhosa	2.5	--	1.2	3.7
Liquidambar styraciflua	0.8	--	2.5	3.3
Ascyrum hypericoides	0.8	--	2.5	3.3
Rubus trivialis	1.7	--	0.8	2.5
Nyssa sylvatica	1.7	--	0.8	2.5
Justicia ovata	1.7	--	0.8	2.5
Vitis rotundifolia	0.8	--	0.4	1.2
Quercus nigra	0.8	--	0.4	1.2
Dichanthelium commutatum	0.8	--	0.4	1.2
Ilex decidua	0.8	--	0.4	1.2

Table D10 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Ageratina altissima	0.8	--	0.4	1.2
Diospyros virginiana	0.8	--	0.4	1.2
Cornus foemina	0.8	--	0.4	1.2
Clematis crispa	0.8	--	0.4	1.2
Carpinus caroliniana	0.8	--	0.4	1.2
Arundinaria gigantea	0.8	--	0.4	1.2
	100.0		100.0	200.0
	Zone 6			
Trees				
Liquidambar styraciflua	29.5	35.5	72.9	137.9
Carpinus caroliniana	20.7	21.6	3.0	45.3
Ilex opaca	17.6	16.9	6.4	40.9
Halesia diptera	14.7	16.9	2.4	34.0
Quercus nigra	5.9	3.1	10.3	19.3
Acer rubrum	2.9	1.5	3.5	7.9
Nyssa sylvatica	2.9	1.5	1.1	5.5
Ilex decidua	2.9	1.5	0.2	4.6
Diospyros virginiana	2.9	1.5	0.2	4.6
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Carpinus caroliniana	14.7	26.9	28.6	70.2
Halesia diptera	14.7	25.9	27.7	68.3
Ilex decidua	13.2	15.9	15.1	44.2
Ilex opaca	14.7	8.5	7.5	30.7
Ilex vomitoria	5.9	6.5	6.3	18.7
Quercus nigra	10.3	2.8	3.3	16.4
Poncirus trifoliata	7.3	4.3	3.4	15.0
Viburnum dentatum	4.4	5.4	4.7	14.5
Crataegus marshallii	5.9	1.7	1.6	9.2
Ulmus americana	2.9	0.6	0.6	4.1
Vaccinium elliottii	1.5	0.6	0.4	2.5
Acer rubrum	1.5	0.3	0.4	2.2
Prunus serotina	1.5	0.3	0.2	2.0
Magnolia grandiflora	1.5	0.3	0.2	2.0
	100.0	100.0	100.0	300.0
Woody Vines				
Toxicodendron radicans	28.1	49.5	50.0	127.6
Vitis rotundifolia	21.9	28.9	33.7	84.5
Parthenocissus quinquefolia	12.5	3.3	3.3	19.1
Berchemia scandens	9.4	5.0	4.4	18.8
Campsis radicans	6.2	5.0	6.3	17.5
Bignonia capreolata	9.4	3.3	1.1	13.8
Smilax rotundifolia	9.4	3.3	0.7	13.4

Table D10 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Trachelospermum difforme	3.1	1.7	0.5	5.3
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Toxicodendron radicans	19.2	--	25.0	44.2
Halesia diptera	16.2	--	19.7	35.9
Viburnum dentatum	5.9	--	6.8	12.7
Carpinus caroliniana	5.9	--	6.8	12.7
Berchemia scandens	2.9	--	9.1	12.0
Ilex decidua	4.4	--	6.0	10.4
Carex blanda	5.9	--	3.0	8.9
Ilex opaca	2.9	--	5.3	8.2
Quercus nigra	4.4	--	2.2	6.6
Campsis radicans	4.4	--	2.2	6.6
Bignonia capreolata	4.4	--	2.2	6.6
Vitis rotundifolia	2.9	--	1.5	4.4
Poncirus trifoliata	2.9	--	1.5	4.4
Crataegus marshallii	2.9	--	1.5	4.4
Carya glabra	2.9	--	1.5	4.4
Botrychium biternatum	2.9	--	1.5	4.4
Viola papilionacea	1.5	--	0.7	2.2
Smilax bona-nox	1.5	--	0.7	2.2
Morus rubra	1.5	--	0.7	2.2
Lespedeza sp.	1.5	--	0.7	2.2
Carex sp.	1.5	--	0.7	2.2
Ampelopsis arborea	1.5	--	0.7	2.2
	100.0		100.0	200.0

(Sheet 6 of 6)

Table D11
Importance Values for Species Occurring at Site 11, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 2			
Trees				
Nyssa ogeche	41.2	70.4	54.5	166.1
Nyssa aquatica	17.6	11.4	21.7	50.7
Taxodium distichum	17.6	6.8	14.9	39.3
Fraxinus pennsylvanica	11.8	4.6	8.3	24.7
Planera aquatica	11.8	6.8	0.6	19.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Planera aquatica	100.0	100.0	100.0	300.0
Woody Vines				
None present				
Herbs and Woody Seedlings				
Quercus lyrata	15.1	--	17.2	32.3
Gratiola virginiana	16.4	--	12.8	29.2
Cynoctonum mitreola	9.6	--	18.5	28.1
Leersia lenticularis	8.2	--	11.9	20.1
Carya aquatica	9.6	--	7.5	17.1
Planera aquatica	8.2	--	6.4	14.6
Taxodium distichum	6.8	--	5.3	12.1
Vitis palmata	4.1	--	3.2	7.3
Asclepias perennis	4.1	--	3.2	7.3
Pilea pumila	2.7	--	2.1	4.8
Phanopyrum gymnocarpon	2.7	--	2.1	4.8
Nyssa aquatica	2.7	--	2.1	4.8
Spilanthes americana	1.4	--	1.1	2.5
Smilax hispida	1.4	--	1.1	2.5
Nyssa ogeche	1.4	--	1.1	2.5
Gleditsia aquatica	1.4	--	1.1	2.5
Forestiera acuminata	1.4	--	1.1	2.5
Commelina diffusa	1.4	--	1.1	2.5
Cephalanthus occidentalis	1.4	--	1.1	2.5
	Zone 3			
Trees				
Carya aquatica	18.6	16.7	34.1	69.4
Forestiera acuminata	14.8	31.2	4.6	50.6
Nyssa aquatica	11.1	10.3	22.0	43.4
Fraxinus caroliniana	14.8	16.7	4.0	35.5

(Sheet 1 of 5)

Table D11 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Nyssa ogeche	7.4	4.2	14.6	26.2
Quercus lyrata	7.4	4.2	10.5	22.1
Planera aquatica	7.4	6.2	1.0	14.6
Gleditsia aquatica	7.4	4.2	2.9	14.5
Fraxinus pennsylvanica	3.7	2.1	5.9	11.7
Crataegus viridis	3.7	2.1	0.2	6.0
Cephalanthus occidentalis	3.7	2.1	0.2	6.0
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Forestiera acuminata	26.8	56.8	55.5	139.1
Fraxinus caroliniana	11.4	13.3	17.0	41.7
Planera aquatica	15.4	13.3	12.9	41.6
Cephalanthus occidentalis	15.4	5.6	5.5	26.5
Carya aquatica	7.7	3.3	3.7	14.7
Fraxinus pennsylvanica	7.7	3.3	2.2	13.2
Crataegus viridis	3.9	1.1	1.4	6.4
Quercus lyrata	3.9	1.1	1.2	6.2
Nyssa ogeche	3.9	1.1	0.3	5.3
Gleditsia aquatica	3.9	1.1	0.3	5.3
	100.0	100.0	100.0	300.0
Woody Vines				
Brunnichia cirrhosa	27.0	27.5	21.8	76.3
Vitis riparia	19.2	27.5	29.4	76.1
Ampelopsis arborea	23.1	13.7	22.0	58.8
Vitis palmata	7.7	13.7	10.2	31.6
Campsis radicans	11.5	7.8	12.2	31.5
Smilax bona-nox	7.7	7.8	3.4	18.9
Cocculus carolinus	3.8	2.0	1.0	6.8
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Carya aquatica	18.0	--	25.7	43.7
Quercus lyrata	11.0	--	16.1	27.1
Leersia lenticularis	9.0	--	11.7	20.7
Brunnichia cirrhosa	12.0	--	7.2	19.2
Aster sp.	7.0	--	4.2	11.2
Ampelopsis arborea	5.0	--	6.1	11.1
Phanopyrum gymnocarpon	4.0	--	5.5	9.5
Gleditsia aquatica	5.0	--	3.0	8.0
Smilax bona-nox	3.0	--	4.9	7.9
Forestiera acuminata	4.0	--	2.4	6.4
Asclepias perennis	4.0	--	2.4	6.4
Toxicodendron radicans	3.0	--	1.8	4.8
Planera aquatica	3.0	--	1.8	4.8
Tragia sp.	2.0	--	1.2	3.2

Table D11 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Lygodium japonicum	2.0	--	1.2	3.2
Carex sp.	2.0	--	1.2	3.2
Saururus cernuus	1.0	--	0.6	1.6
Quercus nigra	1.0	--	0.6	1.6
Justicia ovata	1.0	--	0.6	1.6
Cynoctonum mitreola	1.0	--	0.6	1.6
Commelina virginica	1.0	--	0.6	1.6
Celtis laevigata	1.0	--	0.6	1.6
	100.0		100.0	200.0
	Zone 4			
Trees				
Liquidambar styraciflua	24.3	52.8	38.5	115.6
Quercus nigra	18.2	9.9	19.0	47.1
Carya aquatica	9.1	7.1	17.9	34.1
Carpinus caroliniana	15.1	12.8	4.3	32.2
Ulmus americana	9.1	4.2	9.3	22.6
Diospyros virginiana	6.1	2.9	5.1	14.1
Crataegus viridis	6.1	2.9	0.3	9.3
Fraxinus pennsylvanica	3.0	1.5	4.3	8.8
Ilex decidua	3.0	2.9	0.4	6.3
Platanus occidentalis	3.0	1.5	0.6	5.1
Quercus lyrata	3.0	1.5	0.3	4.8
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Ilex decidua	24.0	30.5	27.1	81.6
Crataegus viridis	20.0	28.8	29.2	78.0
Carpinus caroliniana	20.0	16.9	19.4	56.3
Acer rubrum	8.0	8.5	8.3	24.8
Quercus lyrata	12.0	5.1	3.7	20.8
Liquidambar styraciflua	8.0	3.4	4.2	15.6
Cornus foemina	4.0	3.4	4.2	11.6
Celtis laevigata	4.0	3.4	3.9	11.3
	100.0	100.0	100.0	300.0
Woody Vines				
Toxicodendron radicans	21.7	51.8	49.3	122.8
Vitis rotundifolia	30.4	19.3	26.8	76.5
Campsis radicans	30.4	19.3	13.2	62.9
Vitis riparia	8.7	7.2	10.1	26.0
Berchemia scandens	4.4	1.2	0.4	6.0
Brunnichia cirrhosa	4.4	1.2	0.2	5.8
	100.0	100.0	100.0	300.0

Table D11 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Herbs and Woody Seedlings				
Lygodium japonicum	15.5	--	58.5	74.0
Toxicodendron radicans	12.5	--	5.9	18.4
Campsis radicans	5.2	--	3.5	8.7
Brunnichia cirrhosa	6.2	--	2.0	8.2
Smilax bona-nox	5.2	--	1.7	6.9
Justicia ovata	5.2	--	1.7	6.9
Ilex decidua	5.2	--	1.7	6.9
Botrychium biternatum	5.2	--	1.7	6.9
Vitis rotundifolia	3.1	--	2.8	5.9
Sebastiania fruticosa	3.1	--	2.8	5.9
Oplismenus hirtellus	3.1	--	2.8	5.9
Celtis laevigata	3.1	--	2.8	5.9
Quercus nigra	3.1	--	1.0	4.1
Liquidambar styraciflua	3.1	--	1.0	4.1
Sambucus canadensis	1.0	--	2.1	3.1
Onoclea sensibilis	1.0	--	2.1	3.1
Melia azedarach	2.1	--	0.7	2.8
Aster sp.	2.1	--	0.7	2.8
Woodwardia sp.	1.0	--	0.3	1.3
Ulmus alata	1.0	--	0.3	1.3
Smilax rotundifolia	1.0	--	0.3	1.3
Smilax glauca	1.0	--	0.3	1.3
Quercus lyrata	1.0	--	0.3	1.3
Phytolacca americana	1.0	--	0.3	1.3
Panicum sp.	1.0	--	0.3	1.3
Panicum rigidulum	1.0	--	0.3	1.3
Geum canadense	1.0	--	0.3	1.3
Ageratina altissima	1.0	--	0.3	1.3
Diospyros virginiana	1.0	--	0.3	1.3
Commelina virginica	1.0	--	0.3	1.3
Carex sp.	1.0	--	0.3	1.3
Boehmeria cylindrica	1.0	--	0.3	1.3
Acer negundo	1.0	--	0.3	1.3
	100.0		100.0	200.0
	Zone 5			
Trees				
Liquidambar styraciflua	28.2	36.7	59.2	124.1
Carpinus caroliniana	18.7	15.4	4.6	38.7
Ulmus americana	12.5	11.5	6.9	30.9
Celtis laevigata	9.4	5.8	15.6	30.8
Ilex decidua	9.4	11.5	2.1	23.0
Platanus occidentalis	3.1	1.9	6.0	11.0
Ulmus rubra	3.1	5.8	2.0	10.9
Crataegus viridis	6.3	3.8	0.4	10.5

Table D11 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Cornus foemina	3.1	3.8	0.5	7.4
Acer rubrum	3.1	1.9	1.9	6.9
Quercus nigra	3.1	1.9	0.8	5.8
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Ilex decidua	52.6	80.0	79.0	211.6
Crataegus viridis	10.5	5.0	5.1	20.6
Quercus nigra	10.5	5.0	4.7	20.2
Carpinus caroliniana	10.5	3.3	3.9	17.7
Ulmus americana	5.3	3.3	3.5	12.1
Ulmus rubra	5.3	1.7	1.9	8.9
Cornus foemina	5.3	1.7	1.9	8.9
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	21.0	28.8	36.1	85.9
Toxicodendron radicans	13.2	34.2	28.9	76.3
Campsis radicans	21.0	16.7	12.3	50.0
Bignonia capreolata	15.8	9.0	11.8	36.6
Vitis palmata	10.5	3.8	4.9	19.2
Berchemia scandens	7.9	2.3	1.8	12.0
Brunnichia cirrhosa	5.3	3.2	2.8	11.3
Smilax bona-nox	5.3	2.0	1.4	8.7
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Lygodium japonicum	26.9	--	83.4	110.3
Campsis radicans	12.1	--	4.1	16.2
Toxicodendron radicans	9.4	--	2.6	12.0
Botrychium biternatum	9.4	--	1.5	10.9
Smilax bona-nox	6.7	--	2.1	8.8
Carex sp.	5.3	--	1.9	7.2
Celtis laevigata	4.1	--	0.6	4.7
Carya aquatica	4.1	--	0.6	4.7
Aster sp.	4.1	--	0.6	4.7
Thelypteris kunthii	2.7	--	0.4	3.1
Bignonia capreolata	2.7	--	0.4	3.1
Berchemia scandens	2.7	--	0.4	3.1
Vitis rotundifolia	1.4	--	0.2	1.6
Rubus trivialis	1.4	--	0.2	1.6
Polygonum virginianum	1.4	--	0.2	1.6
Panicum sp.	1.4	--	0.2	1.6
Ilex decidua	1.4	--	0.2	1.6
Eupatorium sp.	1.4	--	0.2	1.6
Decumaria barbara	1.4	--	0.2	1.6
	100.0		100.0	200.0

Table D12
Importance Values for Species Occurring at Site 12, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 4			
Trees				
Liquidambar styraciflua	50.0	69.0	68.5	187.5
Ulmus americana	15.0	6.8	11.5	33.3
Quercus lyrata	5.0	4.4	6.3	15.7
Celtis laevigata	5.0	4.4	4.5	13.9
Taxodium distichum	5.0	2.2	4.7	11.9
Melia azedarach	5.0	4.4	2.5	11.9
Forestiera acuminata	5.0	4.4	0.4	9.8
Planera aquatica	5.0	2.2	1.4	8.6
Acer rubrum	5.0	2.2	0.2	7.4
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Ilex decidua	24.3	52.4	45.6	122.3
Liquidambar styraciflua	21.3	12.4	19.2	52.9
Celtis laevigata	15.2	8.6	5.8	29.6
Forestiera acuminata	3.0	6.3	9.6	18.9
Fraxinus pennsylvanica	6.1	3.7	4.4	14.2
Sebastiania fruticosa	6.1	5.0	2.4	13.5
Sambucus canadensis	3.0	2.5	1.0	6.5
Taxodium distichum	3.0	1.3	1.9	6.2
Quercus lyrata	3.0	1.3	1.9	6.2
Platanus occidentalis	3.0	1.3	1.9	6.2
Halesia diptera	3.0	1.3	1.6	5.9
Ulmus alata	3.0	1.3	1.6	5.9
Acer rubrum	3.0	1.3	1.6	5.9
Lindera benzoin	3.0	1.3	1.2	5.5
	100.0	100.0	100.0	300.0
Woody Vines				
Toxicodendron radicans	21.4	39.5	44.1	105.0
Vitis rotundifolia	23.8	28.5	29.2	81.5
Brunnichia cirrhosa	19.0	10.5	11.0	40.5
Campsis radicans	14.3	8.1	7.4	29.8
Smilax bona-nox	11.9	7.6	2.4	21.9
Vitis riparia	4.8	4.1	5.2	14.0
Smilax rotundifolia	2.4	1.1	0.4	3.9
Berchemia scandens	2.4	0.6	0.4	3.4
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Leersia lenticularis	12.3	--	13.7	26.0

(Sheet 1 of 6)

Table D12 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Toxicodendron radicans	8.2	--	17.6	25.8
Smilax bona-nox	8.2	--	16.8	25.0
Carya aquatica	9.2	--	8.6	17.8
Aster sp.	10.3	--	6.1	16.4
Celtis laevigata	8.2	--	4.9	13.1
Lygodium japonicum	6.1	--	6.8	12.9
Campsis radicans	6.1	--	6.8	12.9
Quercus nigra	6.1	--	3.7	9.9
Carex sp.	5.1	--	3.0	8.1
Quercus lyrata	4.1	--	2.4	6.5
Fraxinus pennsylvanica	3.1	--	1.8	4.9
Triadenum walteri	2.0	--	1.2	3.2
Smilax hispida	2.0	--	1.2	3.2
Ilex decidua	2.0	--	1.2	3.2
Carex intumescens	2.0	--	1.2	3.2
Berchemia scandens	2.0	--	1.2	3.2
Ulmus americana	1.0	--	0.6	1.6
Pilea pumila	1.0	--	0.6	1.6
Diospyros virginiana	1.0	--	0.6	1.6
	100.0		100.0	200.0
	Zone 5			
Trees				
Liquidambar styraciflua	26.8	25.4	32.5	84.7
Melia azedarach	23.4	37.1	10.9	71.4
Quercus nigra	6.7	5.9	31.3	43.9
Ulmus americana	10.0	5.9	17.4	33.3
Carpinus caroliniana	6.7	5.9	3.4	16.0
Halesia diptera	3.3	3.9	0.7	7.9
Celtis laevigata	3.3	3.9	0.5	7.7
Fraxinus pennsylvanica	3.3	2.0	0.9	6.2
Acer negundo	3.3	2.0	0.8	5.9
Morus rubra	3.3	2.0	0.6	5.9
Diospyros virginiana	3.3	2.0	0.5	5.8
Ilex decidua	3.3	2.0	0.3	5.6
Crataegus viridis	3.3	2.0	0.2	5.5
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Ilex decidua	13.6	32.2	32.8	78.6
Celtis laevigata	9.5	10.6	10.0	30.1
Crataegus viridis	9.5	8.1	7.8	25.4
Sambucus canadensis	9.5	9.3	5.2	24.0
Liquidambar styraciflua	6.8	6.8	8.6	22.2
Fraxinus pennsylvanica	8.1	4.9	4.6	17.6
Quercus nigra	5.5	3.1	4.2	12.8

Table D12 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Ulmus rubra	4.1	4.3	3.7	12.1
Halesia diptera	2.8	3.7	5.4	11.9
Ulmus alata	5.5	3.1	3.0	11.6
Callicarpa americana	5.5	3.1	2.7	11.3
Lindera benzoin	2.8	2.4	2.3	7.5
Nyssa sylvatica	1.4	1.2	1.8	4.4
Carpinus caroliniana	1.4	1.2	1.8	4.4
Ulmus americana	1.4	0.6	0.9	2.9
Melia azedarach	1.4	0.6	0.9	2.9
Carya illinoensis	1.4	0.6	0.9	2.9
Acer rubrum	1.4	0.6	0.9	2.9
Bumelia lanuginosa	1.4	0.6	0.7	2.7
Quercus michauxii	1.4	0.6	0.6	2.6
Ilex opaca	1.4	0.6	0.4	2.4
Acer negundo	1.4	0.6	0.4	2.4
Morus rubra	1.4	0.6	0.2	2.2
Diospyros virginiana	1.4	0.6	0.2	2.2
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	25.6	46.7	50.3	122.6
Toxicodendron radicans	23.1	36.8	39.5	99.4
Bignonia capreolata	12.8	6.4	4.1	23.3
Smilax rotundifolia	12.8	4.6	2.6	20.0
Smilax bona-nox	10.3	2.7	1.0	14.0
Berchemia scandens	7.7	1.4	1.6	10.7
Brunnichia cirrhosa	7.7	1.4	0.9	10.0
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Lygodium japonicum	9.6	--	31.4	41.0
Polygonum sp.	3.0	--	12.1	15.1
Toxicodendron radicans	8.1	--	5.3	13.4
Oplismenus hirtellus	5.3	--	6.9	12.2
Quercus nigra	5.3	--	5.7	11.0
Sambucus canadensis	5.3	--	4.0	9.3
Rubus argutus	5.3	--	2.3	7.6
Rubus trivialis	3.7	--	3.3	7.0
Bignonia capreolata	3.7	--	3.3	7.0
Aster sp.	4.4	--	2.0	6.4
Ilex decidua	3.0	--	3.0	6.0
Elytraria carolinensis	3.0	--	3.0	6.0
Smilax bona-nox	3.7	--	1.6	5.3
Geum canadense	3.7	--	1.6	5.3
Celtis laevigata	3.7	--	1.6	5.3
Botrychium biternatum	3.7	--	1.6	5.3
Ulmus alata	3.0	--	1.3	4.3

Table D12 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Carex sp.	3.0	--	1.3	4.3
Liquidambar styraciflua	2.2	--	1.0	3.2
Argeratina altissima	2.2	--	1.0	3.2
Smilax rotundifolia	1.5	--	0.7	2.2
Panicum sp.	1.5	--	0.7	2.2
Morus rubra	1.5	--	0.7	2.2
Acer negundo	1.5	--	0.7	2.2
Solidago altissima	0.7	--	0.3	1.0
Quercus phellos	0.7	--	0.3	1.0
Phytolacca americana	0.7	--	0.3	1.0
Lindera benzoin	0.7	--	0.3	1.0
Lespedeza sp.	0.7	--	0.3	1.0
Duchesnia indica	0.7	--	0.3	1.0
Diospyros virginiana	0.7	--	0.3	1.0
Crataegus viridis	0.7	--	0.3	1.0
Cornus foemina	0.7	--	0.3	1.0
Commelina diffusa	0.7	--	0.3	1.0
Cocculus carolinus	0.7	--	0.3	1.0
Callicarpa americana	0.7	--	0.3	1.0
Brunnichia cirrhosa	0.7	--	0.3	1.0
	100.0		100.0	200.0
	Zone 6			
Trees				
Liquidambar styraciflua	30.4	59.2	44.4	134.0
Betula nigra	9.1	6.8	7.2	23.1
Carya illinoensis	3.0	1.7	16.9	21.6
Ulmus alata	6.1	3.4	11.5	21.0
Juglans nigra	9.1	5.1	6.4	20.6
Halesia carolina	9.1	5.1	1.4	15.6
Melia azedarach	9.1	5.1	1.3	15.5
Sassafras albidum	6.1	3.4	1.2	10.7
Quercus nigra	3.0	1.7	4.3	9.0
Bumelia lanuginosa	3.0	1.7	2.0	6.7
Ulmus americana	3.0	1.7	1.7	6.4
Diospyros virginiana	3.0	1.7	0.9	5.6
Celtis laevigata	3.0	1.7	0.5	5.2
Halesia diptera	3.0	1.7	0.3	5.0
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Ulmus alata	10.7	22.6	18.2	51.5
Liquidambar styraciflua	8.5	10.	15.6	34.5
Celtis laevigata	9.7	12.3	10.3	32.3
Quercus nigra	8.5	8.5	9.6	26.6
Callicarpa americana	8.5	7.6	5.9	22.0

Table D12 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Halesia carolina	5.4	4.2	7.1	16.7
Sebastiania fruticosa	5.4	6.6	3.5	15.5
Lindera benzoin	6.5	4.2	3.3	14.0
Acer negundo	5.4	3.8	2.8	12.0
Halesia diptera	4.3	2.8	4.8	11.9
Ilex decidua	4.3	3.8	3.0	11.1
Cornus foemina	4.3	3.8	3.0	11.1
Ulmus americana	3.2	1.9	2.2	7.3
Melia azedarach	3.2	1.4	2.4	7.0
Juglans nigra	2.2	0.9	1.6	4.7
Gleditsia triacanthos	2.2	0.9	1.0	4.1
Betula nigra	q.q	0.9	1.6	3.6
Sambucus canadensis	1.1	0.9	1.3	3.3
Platanus occidentalis	1.1	0.5	0.8	2.4
Ilex opaca	1.1	0.5	0.6	2.2
Acer rubrum	1.1	0.5	0.6	2.2
Quercus phellos	1.1	0.5	0.5	2.1
Bumelia lanuginosa	1.1	0.5	0.3	1.9
	100.0	100.0	100.0	300.0
Woody Vines				
Clematis ligusticifolia	16.0	23.7	25.9	65.6
Bignonia capreolata	17.9	24.1	21.4	63.4
Aristolochia tomentosa	14.3	15.6	15.4	45.3
Vitis rotundifolia	17.9	11.1	14.1	43.1
Toxicodendron radicans	8.9	13.0	14.8	36.7
Smilax rotundifolia	12.5	9.0	4.9	26.4
Campsis radicans	7.1	1.9	2.5	11.5
Ampelopsis arborea	1.8	1.2	0.8	3.8
Lonicera japonica	1.8	0.2	0.1	2.1
Parthenocissus quinquefolia	1.8	0.2	0.1	2.1
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Oplismenus hirtellus	7.7	--	27.2	34.9
Bignonia capreolata	9.3	--	9.0	18.3
Carex sp.	7.1	--	10.4	17.5
Ageratina altissima	9.3	--	7.9	17.2
Panicum sp.	8.7	--	3.5	12.2
Quercus nigra	4.6	--	6.9	11.5
Acer negundo	5.1	--	5.2	10.3
Hyptis mutabilis	4.1	--	4.8	8.9
Sebastiania fruticosa	4.1	--	3.8	7.9
Elytraria carolinensis	4.1	--	2.7	6.8
Sambucus canadensis	3.6	--	2.5	6.1
Toxicodendron radicans	4.1	--	1.6	5.7
Celtis laevigata	3.6	--	1.4	5.0

Table D12 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Geum canadense	3.1	--	1.2	4.3
Ulmus alata	1.5	--	1.7	3.2
Quercus phellos	1.5	--	1.7	3.2
Rubus trivialis	2.0	--	0.8	2.8
Lindera benzoin	2.0	--	0.8	2.8
Viburnum cassinoides	1.5	--	0.6	2.1
Dichondra carolinensis	1.5	--	0.6	2.1
Callicarpa americana	0,5	--	1.3	1.8
Smilax rotundifolia	1.0	--	0.4	1.4
Lygodium japonicum	1.0	--	0.4	1.4
Bumelia lanuginosa	1.0	--	0.4	1.4
Clematis ligusticifolia	1.0	--	0.4	1.4
Vitis rotundifolia	0.5	--	0.2	0.7
Sassafras albidum	0.5	--	0.2	0.7
Toxicodendron radicans	0.5	--	0.2	0.7
Polygonum sp.	0.5	--	0.2	0.7
Paspalum sp.	0.5	--	0.2	0.7
Parthenocissus quinquefolia	0.5	--	0.2	0.7
Onoclea sensibilis	0.5	--	0.2	0.7
Lonicera japonica	0.5	--	0.2	0.7
Lindera benzoin	0.5	--	0.2	0.7
Lactuca serriola	0.5	--	0.2	0.7
Ilex decidua	0.5	--	0.2	0.7
Cercis canadensis	0.5	--	0.2	0.7
Agrostis hyemalis	0.5	--	0.2	0.7
Amaranthus tuberculatus	0.5	--	0.2	0.7
	100.0		100.0	200.0

Table D13
Importance Values for Species Occurring at Site 13, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 2			
Trees				
Planera aquatica	30.8	44.4	25.5	100.7
Taxodium distichum	30.8	22.2	42.3	95.3
Nyssa aquatica	15.4	13.3	30.1	58.8
Fraxinus caroliniana	19.2	17.8	2.0	39.0
Quercus lyrata	3.8	2.3	0.1	6.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Fraxinus caroliniana	37.5	44.4	54.5	136.4
Planera aquatica	50.0	27.8	30.1	107.9
Styrax americana	12.5	27.8	15.4	55.7
	100.0	100.0	100.0	300.0
Woody Vines				
Brunnichia cirrhosa	50.0	50.0	41.2	141.1
Campsis radicans	12.5	20.0	34.1	66.6
Smilax bona-nox	12.5	23.3	17.7	53.5
Ampelopsis arborea	25.0	6.7	7.1	38.8
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Dichanthelium commutatum	22.0	--	17.5	39.5
Ampelopsis arborea	12.2	--	19.9	32.1
Brunnichia cirrohosa	9.8	--	18.0	27.8
Ulmus americana	14.6	--	11.7	26.3
Nyssa aquatica	9.8	--	7.8	17.6
Carex sp.	7.3	--	5.8	13.1
Carya aquatica	7.3	--	5.8	13.1
Styrax americana	4.9	--	3.9	8.8
Quercus lyrata	4.9	--	3.9	8.8
Planera aquatica	2.4	--	1.9	4.3
Liquidambar styraciflua	2.4	--	1.9	4.3
Aster sp.	2.4	--	1.9	4.3
	100.0		100.0	200.0
	Zone 3			
Trees				
Quercus lyrata	21.1	35.8	18.1	75.0
Nyssa aquatica	18.2	15.1	18.6	51.9
Planera aquatica	15.2	11.3	21.2	47.7

(Sheet 1 of 5)

Table D13 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Betula nigra	12.1	9.4	17.3	38.8
Carya aquatica	15.2	11.3	7.8	34.3
Taxodium distichum	3.0	5.7	9.4	18.1
Acer rubrum	6.1	5.7	2.6	14.4
Ulmus americana	6.1	3.8	3.4	13.3
Fraxinus pennsylvanica	3.0	1.9	1.6	6.6
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Quercus lyrata	40.0	38.4	50.5	128.9
Fraxinus caroliniana	20.0	30.8	23.9	74.7
Nyssa aquatica	20.0	15.4	18.3	53.7
Planera aquatica	10.0	7.7	4.6	22.3
Styrax americana	10.0	7.7	2.7	20.4
	100.0	100.0	100.0	300.0
Woody Vines				
Brunnichia cirrhosa	33.3	20.0	36.0	89.3
Vitis riparia	22.3	35.0	23.0	80.3
Ampelopsis arborea	33.3	30.0	14.0	77.3
Vitis rotundifolia	11.1	15.0	27.0	53.1
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Dichanthelium commutatum	16.6	--	14.9	31.5
Ampelopsis arborea	9.4	--	19.6	29.0
Ulmus americana	14.3	--	12.7	27.0
Quercus lyrata	14.3	--	12.7	27.0
Carya aquatica	14.3	--	12.7	27.0
Boehmeria cylindrica	7.1	--	6.4	13.5
Campsis radicans	4.8	--	4.2	9.0
Aster sp.	4.8	--	4.2	9.0
Quercus laurifolia	2.4	--	2.1	4.5
Panicum sp.	2.4	--	2.1	4.5
Mikania scandens	2.4	--	2.1	4.5
Forestiera acuminata	2.4	--	2.1	4.5
Eupatorium serotinum	2.4	--	2.1	4.5
Brunnichia cirrhosa	2.4	--	2.1	4.5
	100.0		100.0	200.0
	Zone 4			
Trees				
Liquidambar styraciflua	33.4	37.6	27.9	98.9
Quercus nigra	20.0	22.9	53.2	96.1
Carpinus caroliniana	16.7	21.2	4.1	42.0
Fraxinus pennsylvanica	6.7	3.3	3.7	13.7

Table D13 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Ulmus americana	3.3	3.3	4.8	11.4
Quercus phellos	6.7	3.3	1.1	11.1
Quercus lyrata	3.3	3.3	1.1	7.7
Quercus falcata var. *pagodifolia*	3.3	1.7	2.7	7.7
Nyssa sylvatica	3.3	1.7	1.2	6.2
Ilex decidua	3.3	1.7	0.2	5.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Carpinus caroliniana	36.0	64.4	66.3	166.7
Ilex decidua	24.0	16.9	16.1	57.0
Ulmus americana	16.0	8.5	8.8	33.3
Quercus michauxii	4.0	1.7	1.8	7.5
Nyssa sylvatica	4.0	1.7	1.8	7.5
Liquidambar styraciflua	4.0	1.7	1.8	7.5
Acer rubrum	4.0	1.7	1.8	7.5
Styrax americana	4.0	1.7	1.1	6.8
Quercus nigra	4.0	1.7	0.5	6.2
	100.0	100.0	100.0	300.0
Woody Vines				
Toxicodendron radicans	45.4	67.7	69.6	182.7
Vitis rotundifolia	36.4	22.0	26.0	84.4
Berchemia scandens	9.1	5.9	1.6	16.6
Smilax rotundifolia	9.1	4.4	2.8	16.3
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Sabal minor	5.5	--	25.2	30.7
Ulmus americana	10.9	--	8.6	19.5
Smilax rotundifolia	10.9	--	8.6	19.5
Carpinus caroliniana	9.6	--	7.6	17.2
Quercus nigra	8.2	--	6.5	14.7
Dichanthelium commutatum	8.2	--	6.5	14.7
Botrychium biternatum	8.2	--	6.5	14.7
Acer rubrum	8.2	--	6.5	14.7
Toxicodendron radicans	6.8	--	5.4	12.2
Carex sp.	4.1	--	3.2	7.3
Panicum sp.	2.7	--	2.2	4.9
Bignonia capreolata	2.7	--	2.2	4.9
Vitis rotundifolia	1.4	--	1.1	2.5
Mitchella repens	1.4	--	1.1	2.5
Liquidambar styraciflua	1.4	--	1.1	2.5
Ilex decidua	1.4	--	1.1	2.5
Elytraria carolinensis	1.4	--	1.1	2.5
Carya tomentosa	1.4	--	1.1	2.5

Table D13 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Berchemia scandens	1.4	--	1.1	2.5
Aster sp.	1.4	--	1.1	2.5
Aster sp.	1.4	--	1.1	2.5
Aristolochia serpentaria	1.4	--	1.1	2.5
	100.0		100.0	200.0
	Zone 6			
Trees				
Pinus glabra	18.3	23.8	22.9	65.0
Pinus taeda	15.8	12.7	33.4	61.9
Carya tomentosa	10.5	16.4	9.5	36.4
Ulmus alata	13.2	12.7	1.6	27.5
Quercus falcata var. pagodifolia	5.3	5.4	16.6	27.3
Liquidambar styraciflua	7.9	7.3	7.7	22.9
Nyssa sylvatica	7.9	5.5	1.1	14.5
Quercus alba	5.3	3.6	3.7	12.6
Carpinus caroliniana	5.3	5.4	1.1	11.8
Quercus nigra	5.3	3.6	1.2	10.1
Quercus stellata	2.6	1.8	0.9	5.3
Morus rubra	2.6	1.8	0.3	4.7
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Carpinus caroliniana	12.7	28.3	31.6	72.6
Ulmus alata	12.7	15.7	18.0	46.4
Vaccinium arboreum	7.7	14.9	11.6	34.2
Crataegus marshallii	9.0	7.7	6.0	22.7
Ilex decidua	7.7	5.5	6.4	19.6
Asimina parviflora	9.0	5.0	4.6	18.6
Carya tomentosa	6.4	3.1	3.7	13.2
Vaccinium elliottii	3.8	4.5	3.4	11.7
Arundinaria gigantea	3.8	3.6	1.8	9.2
Nyssa sylvatica	3.8	2.3	2.9	9.0
Cornus drummondii	2.6	1.8	1.3	5.7
Liquidambar styraciflua	2.6	1.3	1.4	5.3
Quercus michauxii	2.6	1.3	1.3	5.2
Pinus taeda	2.6	0.9	1.3	4.8
Quercus falcata var. pagodifolia	2.6	0.9	0.7	4.2
Ulmus americana	1.3	0.4	0.7	2.4
Quercus phellos	1.3	0.4	0.7	2.4
Quercus nigra	1.3	0.4	0.7	2.4
Amelanchier arborea	1.3	0.4	0.7	2.4
Ilex opaca	1.3	0.4	0.4	2.1
Carya glabra	1.3	0.4	0.3	2.0

Table D13 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Asimina triloba	1.3	0.4	0.3	2.0
Malus coronaria	1.3	0.4	0.2	1.9
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	27.7	40.9	44.9	113.5
Toxicodendron radicans	27.7	30.8	25.1	83.6
Gelsemium sempervirens	16.6	12.8	14.0	43.4
Smilax rotundifolia	5.6	5.1	6.3	17.0
Vitis riparia	5.6	2.6	3.0	11.2
Smilax glauca	5.6	2.6	3.0	11.2
Berchemia scandens	5.6	2.6	3.0	11.2
Bignonia capreolata	5.6	2.6	0.7	8.9
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Arundinaria gigantea	12.9	--	27.8	40.7
Carex sp.	10.9	--	8.9	19.8
Chasmanthium sessiliflorum	7.6	--	7.2	14.8
Vaccinium arboreum	5.4	--	9.0	14.4
Bignonia capreolata	8.7	--	4.7	13.4
Panicum sp.	7.6	--	4.2	11.8
Crataegus marshallii	4.3	--	5.5	9.8
Smilax glauca	5.4	--	3.0	8.4
Toxicodendron radicans	5.4	--	3.0	8.4
Mitchella repens	3.3	--	4.9	8.2
Quercus nigra	4.3	--	2.4	6.7
Ulmus alata	3.3	--	1.8	5.1
Smilax bona-nox	3.3	--	1.8	5.1
Smilax rotundifolia	1.1	--	3.7	4.8
Ilex opaca	1.1	--	3.7	4.8
Carpinus caroliniana	2.2	--	1.2	3.4
Acer rubrum	2.2	--	1.2	3.4
Vitis riparia	1.1	--	0.6	1.7
Vaccinium elliottii	1.1	--	0.6	1.7
Ulmus americana	1.1	--	0.6	1.7
Solanum carolinense	1.1	--	0.6	1.7
Sebastiania fruticosa	1.1	--	0.6	1.7
Sabal minor	1.1	--	0.6	1.7
Quercus Phellos	1.1	--	0.6	1.7
Quercus michauxii	1.1	--	0.6	1.7
Malus coronaria	1.1	--	0.6	1.7
Cornus foemina	1.1	--	0.6	1.7
	100.0		100.0	200.0

Table D14
Importance Values for Species Occurring at Site 14, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 2			
Trees				
Planera aquatica	31.6	51.0	34.0	116.6
Nyssa aquatica	15.8	9.8	34.1	59.7
Fraxinus caroliniana	26.3	25.5	7.8	59.6
Taxodium distichum	10.5	7.8	20.6	38.9
Forestiera acuminata	10.5	3.9	0.4	14.8
Carya aquatica	5.3	2.0	3.1	10.4
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Forestiera acuminata	42.8	63.1	69.1	175.0
Fraxinus caroliniana	28.6	26.3	20.5	75.4
Planera aquatica	14.3	5.3	5.2	24.8
Nyssa aquatica	14.3	5.3	5.2	24.8
	100.0	100.0	100.0	300.0
Woody Vines				
Brunnichia cirrhosa	47.0	73.9	85.4	206.3
Ampelopsis arborea	29.4	18.7	8.9	57.0
Trachelospermum difforme	11.8	4.7	1.7	18.2
Vitis rotundifolia	5.9	1.8	3.6	11.3
Vitis riparia	5.9	0.9	0.4	7.2
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Leersia lenticularis	13.9	--	23.5	37.4
Brunnichia cirrhosa	17.3	--	12.8	30.1
Ampelopsis arborea	8.1	--	19.2	27.3
Boehmeria cylindrica	12.7	--	9.4	22.1
Pluchea camphorata	7.0	--	5.2	12.2
Taxodium distichum	5.7	--	4.2	9.9
Planera aquatica	4.6	--	3.4	8.0
Trachelospermum difforme	3.4	--	2.5	5.9
Panicum sp.	3.4	--	2.5	5.9
Nyssa aquatica	3.4	--	2.5	5.9
Commelina diffusa	3.4	--	2.5	5.9
Ulmus americana	2.4	--	1.7	4.1
Toxicodendron radicans	2.4	--	1.7	4.1
Carex sp.	2.4	--	1.7	4.1
Vitis riparia	1.1	--	0.8	1.9
Ulmus alata	1.1	--	0.8	1.9
Panicum rigidulum	1.1	--	0.8	1.9

Table D14 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Ilex decidua	1.1	--	0.8	1.9
Forestiera acuminata	1.1	--	0.8	1.9
Eupatorium serotinum	1.1	--	0.8	1.9
Ageratina altissima	1.1	--	0.8	1.9
Carya aquatica	1.1	--	0.8	1.9
Bidens discoidea	1.1	--	0.8	1.9
	100.0		100.0	200.0
	Zone 5			
Trees				
Carpinus caroliniana	22.0	36.9	10.0	68.9
Quercus phellos	15.6	11.1	28.7	55.4
Liquidambar styraciflua	15.6	18.5	10.8	44.9
Quercus nigra	6.2	5.6	12.3	24.1
Fraxinus pennsylvanica	9.5	7.4	1.6	18.5
Quercus michauxii	6.2	3.7	8.5	18.4
Pinus glabra	3.1	3.7	11.2	18.0
Nyssa sylvatica	6.2	3.7	7.7	17.6
Ulmus americana	6.3	3.7	7.0	17.0
Quercus lyrata	3.1	1.9	1.0	6.0
Ulmus alata	3.1	1.9	0.6	5.6
Pinus elliottii	3.1	1.9	0.6	5.6
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Carpinus caroliniana	20.5	25.8	28.3	74.6
Ilex decidua	12.7	19.2	19.2	51.1
Ulmus alata	12.7	19.2	17.0	48.9
Ulmus rubra	10.3	9.0	9.2	28.5
Fraxinus pennsylvanica	10.3	6.7	7.5	24.5
Quercus michauxii	10.3	6.7	6.5	23.5
Liquidambar styraciflua	10.3	5.6	6.1	22.0
Arundinaria gigantea	5.1	4.5	2.5	12.1
Quercus phellos	2.6	1.1	1.4	5.1
Quercus nigra	2.6	1.1	1.4	5.1
Cornus drummondii	2.6	1.1	0.9	4.6
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	42.9	54.3	58.6	155.8
Toxicodendron radicans	19.0	23.9	19.5	62.4
Vitis riparia	19.0	10.9	10.0	39.9
Campsis radicans	14.3	8.7	9.3	32.3
Smilax rotundifolia	4.8	2.2	2.6	9.6
	100.0	100.0	100.0	300.0

Table D14 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Herbs and Woody Seedlings				
Carex sp.	17.6	--	24.1	41.7
Smilax rotundifolia	8.8	--	12.0	20.8
Bignonia capreolata	11.4	--	8.8	20.2
Quercus nigra	6.3	--	5.0	11.3
Dichanthelium commutatum	6.3	--	5.0	11.3
Arundinaria gigantea	2.5	--	7.1	9.6
Sabal minor	5.0	--	4.0	9.0
Quercus phellos	5.0	--	4.0	9.0
Panicum sp.	5.0	--	4.0	9.0
Rubus trivialis	3.8	--	3.0	6.8
Toxicodendron radicans	3.8	--	3.0	6.8
Dicliptera brachiata	3.8	--	3.0	6.8
Viola missouriensis	2.5	--	2.0	4.5
Aster sp.	2.5	--	2.0	4.5
Aristolochia serpentaria	2.5	--	2.0	4.5
Vitis rotundifolia	1.2	--	1.0	2.2
Vaccinium elliottii	1.2	--	1.0	2.2
Smilax glauca	1.2	--	1.0	2.2
Smilax bona-nox	1.2	--	1.0	2.2
Planera aquatica	1.2	--	1.0	2.2
Morus rubra	1.2	--	1.0	2.2
Carya aquatica	1.2	--	1.0	2.2
Brunnichia cirrhosa	1.2	--	1.0	2.2
Botrychium biternatum	1.2	--	1.0	2.2
Berchemia scandens	1.2	--	1.0	2.2
Ampelopsis arborea	1.2	--	1.0	2.2
	100.0		100.0	200.0
	Zone 6			
Trees				
Juniperus virginiana	24.4	23.5	34.4	82.3
Carya tomentosa	15.2	23.5	14.7	53.4
Quercus stellata	12.1	14.9	14.9	41.9
Ulmus alata	9.1	6.4	4.3	19.8
Quercus nigra	9.1	6.4	1.5	17.0
Pinus glabra	3.0	4.3	8.8	16.1
Pinus taeda	3.0	2.1	10.4	15.5
Quercus falcata var. pagodifolia	6.1	4.2	1.4	11.7
Liquidambar styraciflua	3.0	4.2	4.0	11.2
Nyssa sylvatica	3.0	2.1	3.6	6.0
Quercus phellos	3.0	2.1	0.9	6.0

Table D14 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Malus angustifolia	3.0	2.1	0.4	5.5
Fraxinus americana	3.0	2.1	0.4	5.5
Quercus michauxii	3.0	2.1	0.3	5.4
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Vaccinium arboreum	11.4	42.4	43.1	96.9
Ilex decidua	12.8	8.8	10.2	31.8
Arundinaria gigantea	5.7	15.6	9.3	30.6
Juniperus virginiana	8.6	5.6	7.3	21.5
Ulmus alata	8.6	5.6	6.2	20.4
Quercus falcata var. pagodifolia	8.6	4.8	6.4	19.8
Cornus drummondii	8.6	4.4	4.1	17.1
Fraxinus americana	5.7	2.4	2.4	10.5
Cercis canadensis	5.7	2.4	1.8	9.9
Carya tomentosa	2.9	1.6	2.4	6.9
Asimina parviflora	4.3	1.2	0.9	6.4
Quercus stellata	2.9	0.8	1.2	4.9
Quercus nigra	2.9	0.8	1.1	4.8
Quercus michauxii	2.9	0.8	0.8	4.5
Vaccinium elliottii	1.4	0.8	0.3	2.5
Quercus phellos	1.4	0.4	0.6	2.4
Prunus umbellata	1.4	0.4	0.6	2.4
Malus angustifolia	1.4	0.4	0.6	2.4
Carpinus caroliniana	1.4	0.4	0.4	2.2
Asimina triloba	1.4	0.4	0.3	2.1
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	25.0	28.0	47.6	100.6
Toxicodendron radicans	20.0	25.0	22.4	67.4
Cocculus carolinus	25.0	18.8	8.5	52.3
Bignonia capreolata	10.0	9.4	7.2	26.6
Gelsemium sempervirens	5.0	6.3	10.5	21.8
Smilax bona-nox	5.0	6.3	1.9	13.2
Parthenocissus quinquefolia	5.0	3.1	1.3	9.4
Berchemia scandens	5.0	3.1	0.6	8.7
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Chasmanthium sessiliflorum	13.8	--	28.5	42.3
Bignonia capreolata	17.2	--	13.86	30.8
Quercus falcata var. pagodifolia	6.0	--	9.4	15.4
Arundinaria gigantea	5.2	--	8.9	14.1
Aster sp.	7.8	--	5.4	13.2

Table D14 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Carex sp.	6.9	--	4.3	11.2
Quercus nigra	6.0	--	3.8	9.8
Quercus phellos	5.2	--	3.3	8.5
Panicum sp.	5.2	--	3.3	8.5
Ulmus alata	3.4	--	2.2	5.6
Sabal minor	3.4	--	2.2	5.6
Vaccinium arboreum	1.7	--	3.9	5.6
Rubus trivialis	1.7	--	1.1	2.8
Robinia nana	1.7	--	1.1	2.8
Oxalis stricta	1.7	--	1.1	2.8
Mitchella repens	1.7	--	1.1	2.8
Conoclinium coelestinum	1.7	--	1.1	2.8
Dicliptera brachiata	1.7	--	1.1	2.8
Cocculus carolinus	1.7	--	1.1	2.8
Smilax glauca	0.9	--	0.5	1.4
Rubus argutus	0.9	--	0.5	1.4
Pinus glabra	0.9	--	0.5	1.4
Juniperus virginiana	0.9	--	0.5	1.4
Gelsemium sempervirens	0.9	--	0.5	1.4
Castanea pumila	0.9	--	0.5	1.4
Berchemia scandens	0.9	--	0.5	1.4
	100.0		100.0	200.0

Table D15
Importance Values for Species Occurring at Site 15, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 2			
Trees				
Taxodium distichum	24.4	42.7	41.1	108.2
Quercus lyrata	14.6	6.9	35.8	57.3
Fraxinus caroliniana	22.0	25.6	7.0	54.6
Planera aquatica	19.5	12.8	10.1	42.4
Nyssa aquatica	14.6	10.3	4.4	29.3
Nyssa biflora	4.9	1.7	1.6	8.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Fraxinus caroliniana	45.4	60.9	60.4	166.7
Styrax americana	31.8	33.3	35.0	100.1
Itea virginica	9.1	4.2	2.6	15.9
Planera aquatica	9.1	1.1	1.5	11.7
Taxodium distichum	4.6	0.5	0.5	5.6
	100.0	100.0	100.0	300.0
Woody Vines				
Toxicodendron radicans	25.0	58.8	51.6	135.4
Smilax walteri	25.0	17.9	24.6	67.5
Campsis radicans	12.5	17.9	21.1	51.5
Smilax hispida	25.0	3.6	1.8	30.4
Smilax laurifolia	12.5	1.8	0.9	15.2
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Boehmeria cylindrica	11.3	--	17.8	29.1
Vitis palmata	13.2	--	15.6	28.8
Smilax hispida	16.9	--	8.3	25.2
Justicia ovata	5.7	--	13.3	19.0
Aster simplex	7.5	--	10.8	18.3
Toxicodendron radicans	3.8	--	9.6	13.4
Hypoxis leptocarpa	3.8	--	9.6	13.4
Fraxinus caroliniana	7.5	--	5.4	12.9
Leersia virginica	9.4	--	3.0	12.4
Planera aquatica	5.7	--	1.8	7.5
Campsis radicans	3.8	--	1.2	5.0
Acer rubrum	3.8	--	1.2	5.0
Vitis rotundifolia	1.9	--	0.6	2.5
Styrax americana	1.9	--	0.6	2.5

(Sheet 1 of 5)

Table D15 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Ilex decidua	1.9	--	0.6	2.5
Crataegus viridis	1.9	--	0.6	2.5
	100.0		100.0	100.0
	Zone 3			
Trees				
Quercus laurifolia	21.2	26.0	35.5	82.7
Liquidambar styraciflua	24.3	18.0	23.2	65.5
Ilex decidua	18.2	30.0	2.6	50.8
Quercus phellos	9.1	6.0	27.8	42.0
Quercus lyrata	6.1	6.0	1.2	13.3
Carpinus caroliniana	6.1	4.0	0.8	10.9
Quercus nigra	3.0	2.0	5.5	10.5
Taxodium distichum	3.0	2.0	2.4	7.4
Ulmus americana	3.0	2.0	0.6	5.6
Acer rubrum	3.0	2.0	0.2	5.2
Carya aquatica	3.0	2.0	0.2	5.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Ilex decidua	21.7	52.5	58.7	132.9
Quercus laurifolia	15.2	7.9	11.7	34.8
Styrax americana	10.9	10.1	6.0	27.0
Vaccinium elliottii	10.9	7.4	4.9	23.2
Sebastiania fruticosa	6.5	6.5	3.7	16.7
Acer rubrum	8.7	3.7	3.0	15.4
Crataegus viridis	4.3	3.3	3.6	11.2
Liquidambar styraciflu	4.3	2.8	3.9	11.0
Nyssa aquatica	4.3	1.9	2.1	8.3
Viburnum dentatum	2.2	1.4	0.9	4.5
Ulmus americana	2.2	0.5	0.5	3.2
Quercus lyrata	2.2	0.5	0.3	3.0
Crataegus marshallii	2.2	0.5	0.3	3.0
Fraxinus caroliniana	2.2	0.5	0.2	2.9
Carpinus caroliniana	2.2	0.5	0.2	2.9
	100.0	100.0	100.0	300.0
Woody Vines				
Toxicodendron radicans	30.1	83.0	93.5	206.6
Smilax walteri	23.3	8.1	3.5	34.9
Bignonia capreolata	16.7	4.1	1.1	21.9
Campsis radicans	13.4	3.0	1.0	17.4
Smilax hispida	6.6	0.4	0.1	7.1
Trachelospermum difforme	3.3	1.0	0.3	4.6
Vitis palmata	3.3	0.2	0.3	3.8

Table D15 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Vitis rotundifolia	3.3	0.2	0.2	3.7
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Toxicodendron radicans	12.8	--	33.2	46.0
Vitis palmata	12.8	--	17.7	30.5
Smilax hispida	13.4	--	13.2	26.6
Hypoxis leptocarpa	8.5	--	8.9	17.4
Campsis radicans	6.3	--	4.5	10.8
Sebastiania fruticosa	4.9	--	4.7	9.6
Dichanthelium commutatum	3.5	--	4.3	7.8
Carex sp.	4.9	--	1.4	6.3
Aster simplex	4.2	--	1.2	5.4
Bignonia capreolata	4.2	--	0.7	4.9
Justicia ovata	2.1	--	1.5	3.6
Fraxinus caroliniana	2.1	--	1.5	3.6
Acer rubrum	2.8	--	0.5	3.3
Mikania scandens	2.1	--	0.9	3.0
Crataegus viridis	2.1	--	0.9	3.0
Trachelospermum difforme	1.4	--	1.4	2.8
Unknown	1.4	--	0.8	2.2
Boehmeria cylindrica	1.4	--	0.8	2.2
Vitis rotundifolia	1.4	--	0.2	1.6
Planera aquatica	1.4	--	0.2	1.6
Ilex decidua	1.4	--	0.2	1.6
Styrax americana	0.7	--	0.1	0.8
Vaccinium elliottii	0.7	--	0.1	0.8
Taxodium distichum	0.7	--	0.1	0.8
Sebatia calycina	0.7	--	0.1	0.8
Quercus nigra	0.7	--	0.1	0.8
Liquidambar styraciflua	0.7	--	0.1	0.8
Ampelopsis arborea	0.7	--	0.1	0.8
	100.0		100.0	200.0
	Zone 6			
Trees				
Quercus stellata	25.1	26.9	28.9	80.9
Quercus falcata	15.6	20.6	34.6	70.8
Carya tomentosa	18.8	25.4	14.9	59.1
Quercus nigra	9.4	7.9	8.5	25.8
Cornus florida	9.4	4.8	2.5	16.7
Quercus laurifolia	6.2	4.8	5.5	16.5
Liquidambar styraciflua	6.2	4.8	3.6	14.6

Table D15 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Pinus echinata	6.2	3.2	1.1	10.5
Vaccinium arboreum	3.1	1.6	0.4	5.1
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Carya tomentosa	13.6	24.2	29.5	67.3
Vaccinium arboreum	9.5	19.1	19.1	47.7
Viburnum rufidulum	4.0	12.5	10.8	27.3
Quercus falcata	9.6	8.2	7.3	25.1
Quercus stellata	9.6	6.9	6.8	23.3
Sassafras albidum	6.8	4.7	4.3	15.8
Cornus florida	6.8	4.3	4.6	15.7
Liquidambar styraciflua	5.4	4.3	3.8	13.5
Quercus nigra	6.8	3.4	2.6	12.8
Crataegus flava	5.4	2.2	1.5	9.1
Prunus umbellata	4.1	2.2	1.9	8.2
Chionanthus virginicus	2.7	2.2	2.5	7.4
Vaccinium elliottii	2.7	1.3	0.9	4.9
Pinus taeda	1.3	0.9	0.6	2.8
Quercus laurifolia	1.3	0.4	0.8	2.5
Morus rubra	1.3	0.4	0.5	2.2
Hamamelis virginiana	1.3	0.4	0.5	2.2
Carpinus caroliniana	1.3	0.4	0.5	2.2
Vaccinium corymbosum	1.3	0.4	0.3	2.0
Quercus marilandica	1.3	0.4	0.3	2.0
Prunus serotina	1.3	0.4	0.3	2.0
Ilex decidua	1.3	0.4	0.3	2.0
Diospyros virginiana	1.3	0.4	0.3	2.0
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	38.4	56.7	58.4	153.5
Vitis aestivalis	30.8	26.7	36.6	94.1
Gelsemium sempervirens	23.1	13.3	4.0	40.4
Lonicera sempervirens	7.7	3.3	1.0	12.0
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Toxicodendron radicans	13.9	--	25.4	39.3
Vitis rotundifolia	9.3	--	20.9	30.2
Gelsemium sempervirens	9.3	--	13.6	22.9
Quercus stellata	8.1	--	8.3	16.4
Quercus nigra	7.1	--	8.0	15.1
Aristolochia serpentaria	7.1	--	1.9	9.0
Vaccinium arboreum	4.7	--	2.9	7.6
Aristida sp.	4.7	--	1.3	6.0

Table D15 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Vaccinium elliottii	3.5	--	1.0	4.5
Carex sp.	3.5	--	1.0	4.5
Sassafras albidum	1.2	--	2.0	3.2
Liquidambar styraciflua	1.2	--	2.0	3.2
Cornus florida	1.2	--	2.0	3.2
Carya tomentosa	1.2	--	2.0	3.2
Dichanthelium commutatum	2.4	--	0.6	3.0
Lespedeza sp.	2.4	--	0.6	3.0
Stylisma humistrata	2.4	--	0.6	3.0
Acer rubrum	2.4	--	0.6	3.0
Solidago odorata	1.2	--	0.3	1.5
Solidago sp.	1.2	--	0.3	1.5
Smilax glauca	1.2	--	0.3	1.5
Rhus copallinum	1.2	--	0.3	1.5
Prunus umbellata	1.2	--	0.3	1.5
Polypodium scandens	1.2	--	0.3	1.5
Ilex opaca	1.2	--	0.3	1.5
Hamamelis virginiana	1.2	--	0.3	1.5
Diospyros virginiana	1.2	--	0.3	1.5
Cnidoscolus stimulosus	1.2	--	0.3	1.5
	100.0		100.0	200.0

(Sheet 5 of 5)

Table D16
Importance Values for Species Occurring at Site 16, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 2			
Trees				
Fraxinus caroliniana	25.8	53.6	17.4	96.8
Nyssa aquatica	22.6	9.6	53.3	85.5
Planera aquatica	29.1	28.0	21.0	78.1
Taxodium distichum	9.7	2.4	4.0	16.1
Salix nigra	6.4	4.8	2.9	14.1
Betula nigra	3.2	0.8	1.2	5.2
Quercus laurifolia	3.2	0.8	0.2	4.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Fraxinus caroliniana	37.6	55.4	56.0	149.0
Planera aquatica	25.0	22.6	21.3	68.9
Salix nigra	8.3	14.7	17.3	40.3
Cephalanthus occidentalis	8.3	3.1	2.5	13.9
Crataegus aestivalis	8.3	1.2	1.6	11.1
Gleditsia aquatica	8.3	1.2	0.7	10.2
Itea virginica	4.2	1.8	0.6	6.6
	100.0	100.0	100.0	300.0
Woody Vines				
Smilax walteri	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Planera aquatica	57.2	--	57.2	114.4
Taxodium distichum	14.3	--	14.3	28.6
Fraxinus caroliniana	14.3	--	14.3	28.6
Vitis sp.	7.1	--	7.1	14.2
Panicum rigidulum	7.1	--	7.1	14.2
	100.0		100.0	200.0
	Zone 3			
Trees				
Fraxinus caroliniana	20.7	49.9	13.4	84.0
Quercus laurifolia	24.2	18.0	41.3	83.5
Quercus lyrata	10.4	4.2	14.3	28.9
Taxodium distichum	10.4	5.6	6.5	22.5
Acer rubrum	6.9	6.9	2.5	16.3
Liquidambar styraciflua	6.9	2.8	6.0	15.7
Planera aquatica	3.4	5.6	4.3	13.3
Nyssa aquatica	3.4	1.4	8.5	13.3

(Sheet 1 of 7)

Table D16 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Betula nigra	6.9	2.8	2.3	12.0
Ilex decidua	3.4	1.4	0.6	5.4
Cephalanthus occidentalis	3.4	1.4	0.3	5.1
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Fraxinus caroliniana	25.5	59.7	60.7	145.9
Quercus laurifolia	15.4	6.6	8.6	30.6
Cephalanthus occidentalis	7.7	7.4	6.6	21.7
Crataegus aestivalis	7.7	3.7	4.7	16.1
Styrax americana	5.1	5.1	5.2	15.4
Taxodium distichum	7.7	2.9	2.3	12.9
Sebastiania fruticosa	7.7	2.9	1.4	12.0
Ilex decidua	5.1	3.7	2.9	11.7
Quercus lyrata	5.1	1.5	2.1	8.7
Acer rubrum	2.6	2.2	2.6	7.4
Hypericum galioides	2.6	2.2	1.0	5.8
Gleditsia aquatica	2.6	0.7	1.3	4.6
Planera aquatica	2.6	0.7	0.3	3.6
Liquidambar styraciflua	2.6	0.7	0.3	3.6
	100.0	100.0	100.0	300.0
Woody Vines				
Smilax walteri	50.0	89.0	94.4	233.4
Vitis riparia	16.7	4.4	1.4	22.5
Trachelospermum difforme	16.7	2.2	1.4	20.3
Vitis aestivalis	8.3	2.2	1.4	11.9
Ampelopsis arborea	8.3	2.2	1.4	11.9
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Panicum rigidulum	8.5	--	44.2	52.7
Smilax rotundifolia	12.8	--	10.5	23.3
Ampelopsis arborea	10.6	--	4.8	15.4
Erechtites hieracifolia	6.4	--	7.7	14.1
Trachelospermum difforme	6.4	--	2.9	9.3
Toxicodendron radicans	6.4	--	2.9	9.3
Quercus nigra	6.4	--	2.9	9.3
Planera aquatica	6.4	--	2.9	9.3
Carex joorii	6.4	--	2.9	9.3
Sebastiania fruticosa	2.1	--	5.9	8.0
Taxodium distichum	4.3	--	1.8	6.1
Quercus laurifolia	4.3	--	1.8	6.1
Parthenocissus quinquefolia	4.3	--	1.8	6.1
Vitis sp.	2.1	--	1.0	3.1
Quercus phellos	2.1	--	1.0	3.1
Liquidambar styraciflua	2.1	--	1.0	3.1

Table D16 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Hypericum galioides	2.1	--	1.0	3.1
Fraxinus caroliniana	2.1	--	1.0	3.1
Cephalanthus occidentalis	2.1	--	1.0	3.1
Acer rubrum	2.1	--	1.0	3.1
	100.0		100.0	200.0
	Zone 4			
Trees				
Quercus laurifolia	30.0	38.9	47.8	116.7
Quercus nigra	16.7	13.0	12.2	41.9
Carpinus caroliniana	6.7	22.2	4.6	33.5
Liquidambar styraciflua	10.0	5.5	14.3	29.8
Acer rubrum	10.0	5.5	5.5	21.0
Quercus lyrata	10.0	5.5	4.0	19.5
Pinus taeda	3.3	1.9	9.3	14.5
Nyssa sylvatica	6.7	3.7	1.5	11.9
Betula nigra	3.3	1.9	0.6	5.8
Ilex decidua	3.3	1.9	0.2	5.4
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Quercus laurifolia	6.8	11.9	17.2	35.9
Vaccinium elliottii	7.8	11.9	8.1	27.8
Styrax americana	7.8	9.2	10.1	27.1
Fraxinus caroliniana	7.8	10.2	8.4	26.4
Ilex decidua	9.0	7.0	10.0	26.0
Cornus foemina	6.8	8.9	10.1	25.8
Hypericum galioides	1.1	13.9	7.8	22.8
Carpinus caroliniana	5.6	5.8	7.5	18.9
Acer rubrum	6.8	5.2	6.6	18.6
Nyssa sylvatica	5.6	3.1	3.3	12.0
Ilex opaca	5.6	1.8	1.9	9.3
Liquidambar styraciflua	3.4	1.2	1.3	5.9
Quercus nigra	3.4	0.9	1.6	5.9
Itea virginica	2.3	1.2	0.7	4.2
Leucothoe racemosa	1.1	1.8	1.1	4.0
Sebastiania fruticosa	2.3	0.9	0.5	3.7
Sabal minor	2.3	0.9	0.5	3.7
Ulmus americana	2.3	0.6	0.5	3.4
Amorpha fruticosa	2.3	0.6	0.3	3.2
Vaccinium corymbosum	1.1	0.6	0.4	2.1
Quercus virginiana	1.1	0.3	0.4	1.8
Viburnum dentatum	1.1	0.3	0.3	1.7
Diospyros virginiana	1.1	0.3	0.3	1.7
Cephalanthus occidentalis	1.1	0.3	0.3	1.7
Viburnum obovatum	1.1	0.3	0.2	1.6

Table D16 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Persea borbonia	1.1	0.3	0.2	1.6
Taxodium distichum	1.1	0.3	0.2	1.6
Betula nigra	1.1	0.3	0.2	1.6
	100.0	100.0	100.0	300.0
Woody Vines				
Smilax walteri	34.7	62.1	31.5	128.3
Campsis radicans	30.4	19.7	50.3	100.4
Vitis riparia	13.0	4.6	5.6	23.2
Ampelopsis arborea	8.7	7.6	6.5	22.8
Vitis palmata	3.3	1.5	4.1	8.9
Trachelospermum difforme	3.3	1.5	1.0	5.8
Parthenocissus quinquefolia	3.3	1.5	0.5	5.3
Vitus rotundifolia	3.3	1.5	0.5	5.3
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Carex louisianica	4.6	--	14.5	19.1
Sebastiania fruticosa	9.8	--	7.7	17.5
Itea virginica	8.3	--	8.0	16.3
Quercus laurifolia	6.1	--	9.7	15.8
Carex joorii	4.6	--	8.7	13.3
Vaccinium elliottii	3.8	--	7.6	11.4
Smilax rotundifolia	4.6	--	5.6	10.2
Hypericum galioides	3.8	--	5.2	9.0
Toxicodendron radicans	6.1	--	2.3	8.4
Carpinus caroliniana	5.3	--	2.1	7.4
Trachelospermum difforme	3.8	--	3.6	7.4
Rubus trivialis	3.8	--	2.7	6.5
Mitchella repens	3.8	--	2.7	6.5
Ampelopsis arborea	3.1	--	3.4	6.5
Campsis radicans	2.3	--	2.3	4.6
Liquidambar styraciflua	3.1	--	0.7	3.8
Hypoxis leptocarpa	2.3	--	1.4	3.7
Acer rubrum	2.3	--	1.4	3.7
Saururus cernuus	2.3	--	2.6	3.4
Vitis rotundifolia	0.8	--	1.3	2.8
Unknown	1.5	--	1.3	2.8
Clematis virginiana	1.5	--	1.3	2.8
Styrax americana	0.8	--	1.1	1.9
Ulmus americana	1.5	--	0.3	1.8
Sabal minor	1.5	--	0.3	1.8
Pinus glabra	1.5	--	0.3	1.8
Parthenocissus quinquefolia	1.5	--	0.3	1.8
Viola floridana	0.8	--	0.2	1.0
Chasmanthium sessiliflorum	0.8	--	0.2	1.0
Dichanthelium commutatum	0.8	--	0.2	1.0

Table D16 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Nyssa sylvatica	0.8	--	0.2	1.0
Ilex opaca	0.8	--	0.2	1.0
Crataegus aestivalis	0.8	--	0.2	1.0
Cornus foemina	0.8	--	0.2	1.0
Betula nigra	0.8	--	0.2	1.0
	100.0		100.0	200.0
	Zone 6			
Trees				
Pinus taeda	36.5	36.1	81.8	154.4
Quercus nigra	18.2	22.2	9.8	50.2
Carya glabra	13.6	13.9	2.8	30.3
Nyssa sylvatica	13.6	13.9	1.9	29.4
Quercus virginiana	9.1	8.3	2.8	20.2
Liquidambar styraciflua	4.5	2.8	0.6	7.9
Vaccinium arboreum	4.5	2.8	0.3	7.6
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Myrica cerifera	6.7	25.1	24.7	56.5
Liquidambar styraciflua	7.4	11.5	13.3	32.2
Quercus nigra	7.4	9.4	10.5	27.3
Symplocos tinctoria	8.8	9.3	8.3	26.4
Acer rubrum	6.7	6.4	7.4	20.5
Nyssa sylvatica	7.4	4.6	5.9	17.9
Vaccinium elliottii	6.7	6.1	4.9	17.7
Carya glabra	7.4	4.6	4.6	16.6
Vaccinium corymbosum	5.1	5.3	4.1	14.5
Rhododendron canescens	4.4	3.2	2.9	10.5
Ilex opaca	4.4	2.3	2.7	9.4
Clethra alnifolia	4.4	2.8	2.2	9.4
Vaccinium arboreum	2.9	2.5	2.7	8.1
Sassafras albidum	2.9	1.7	1.5	6.1
Quercus velutina	2.2	1.0	1.0	4.2
Ilex glabra	2.2	0.5	0.5	3.2
Pinus taeda	2.2	0.4	0.3	2.9
Sebastiania fruticosa	1.5	0.7	0.6	2.8
Prunus umbellata	1.5	0.5	0.8	2.8
Ascyrum hypericoides	1.5	0.3	0.2	2.0
Rhus copallinum	1.4	0.4	0.2	2.0
Viburnum dentatum	0.7	0.2	0.1	1.0
Quercus virginiana	0.7	0.2	0.1	1.0
Quercus laurifolia	0.7	0.2	0.1	1.0
Persea borbonia	0.7	0.2	0.1	1.0
Vaccinium arboreum	0.7	0.2	0.1	1.0
Leucothoe racemosa	0.7	0.2	0.1	1.0

Table D16 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Gaylussacia frondosa	0.7	0.2	0.1	1.0
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	33.4	71.9	83.5	188.8
Gelsemium sempervirens	20.1	11.6	7.6	39.3
Smilax glauca	10.1	3.3	0.8	14.2
Smilax laurifolia	6,7	2.5	1.3	10.5
Campsis radicans	3.3	1.7	3.3	8.3
Vitis cinerea	3.3	2.5	1.0	6.8
Ampelopsis arborea	3.3	1.7	0.4	5.4
Vitis riparia	3.3	0.8	0.5	4.6
Trachelospermum difforme	3.3	0.8	0.4	5.4
Smilax walteri	3.3	0.8	0.5	4.6
Unknown	3.3	0.8	0.2	4.3
Smilax bona-nox	3.3	0.8	0.2	4.3
Parthenocissus quinquefolia	3.3	0.8	0.2	4.3
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Vaccinium corymbosum	7.7	--	16.7	24.4
Clethra alnifolia	8.2	--	9.7	17.9
Vitis rotundifolia	6.5	--	8.0	14.5
Myrica cerifera	5.3	--	9.2	14.5
Smilax pumila	6.5	--	7.0	13.5
Quercus nigra	6.5	--	5.0	11.5
Toxicodendron radicans	5.3	--	5.0	10.3
Liquidambar styraciflua	4.2	--	5.7	9.9
Pinus glabra	4.8	--	3.2	8.0
Vaccinium elliottii	3.6	--	4.0	7.6
Carya glabra	3.6	--	2.4	6.0
Vaccinium arboreum	2.4	--	2.6	5.0
Acer rubrum	1.8	--	3.1	4.9
Symplocos tinctoria	2.4	--	1.6	4.0
Sebastiania fruticosa	2.4	--	1.6	4.0
Parthenocissus quinquefolia	2.4	--	1.6	4.0
Nyssa sylvatica	1.8	--	1.5	3.3
Mitchella repens	1.8	--	1.5	3.3
Hypericum galioides	0.6	--	1.7	2.3
Gaylussacia frondosa	0.6	--	1.7	2.3
Smilax rotundifolia	1.8	--	0.3	2.1
Gelsemium sempervirens	1.8	--	0.3	2.1
Campsis radicans	1.8	--	0.3	2.1
Sassafras albidum	1.2	--	0.8	2.0
Rhus copallinum	1.2	--	0.8	2.0
Ilex opaca	1.2	--	0.8	2.0
Callicarpa americana	1.2	--	0.8	2.0

Table D16 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Smilax glauca	1.2	--	0.2	1.4
Quercus virginiana	1.2	--	0.2	1.4
Robinia pseudoacacia	0.6	--	0.7	1.3
Rhododendron canescens	0.6	--	0.7	1.3
Viburnum obovatum	0.6	--	0.1	0.7
Viola floridana	0.6	--	0.1	0.7
Trachelospermum difforme	0.6	--	0.1	0.7
Scleria triglomerata	0.6	--	0.1	0.7
Quercus lyrata	0.6	--	0.1	0.7
Prunus serotina	0.6	--	0.1	0.7
Ascyrum hypericoides	0.6	--	0.1	0.7
Dichondra repens	0.6	--	0.1	0.7
Cyperus sp.	0.6	--	0.1	0.7
Crataegus sp.	0.6	--	0.1	0.7
Stylisma humistrata	0.6	--	0.1	0.7
Berchemia scandens	0.6	--	0.1	0.7
Ampelopsis arborea	0.6	--	0.1	0.7
	100.0		100.0	200.0

Table D17
Importance Values for Species Occurring at Site 17, Arranged by Zone and Vegetation Layer

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
	Zone 2			
Trees				
Fraxinus caroliniana	25.0	58.8	34.3	118.1
Planera aquatica	17.5	20.6	21.2	59.3
Taxodium distichum	20.0	6.9	20.8	47.7
Nyssa biflora	12.5	3.9	16.8	33.2
Crataegus aestivalis	15.0	7.3	5.3	27.6
Cephalanthus occidentalis	5.0	1.7	0.7	7.4
Betula nigra	2.5	0.4	0.5	3.4
Acer rubrum	2.5	0.4	0.4	3.3
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Fraxinus caroliniana	18.2	71.8	73.0	163.0
Crataegus aestivalis	18.2	10.6	11.0	39.8
Planera aquatica	16.4	8.7	8.3	33.4
Cephalanthus occidentalis	9.1	3.3	3.4	15.8
Taxodium distichum	7.3	1.4	1.2	9.9
Quercus laurifolia	5.5	1.1	1.1	7.7
Leucothoe racemosa	5.5	0.87	0.3	6.6
Acer rubrum	3.6	0.6	0.6	4.8
Itea virginica	3.6	0.7	0.3	4.6
Quercus lyrata	3.6	0.3	0.3	4.2
Ilex verticillata	1.8	0.3	0.1	2.2
Lyonia lucida	1.8	0.1	0.1	2.0
Styrax americana	1.8	0.1	0.1	2.0
Cyrilla racemiflora	1.8	0.1	0.1	2.0
Betula nigra	1.8	0.1	0.1	2.0
	100.0	100.0	100.0	300.0
Woody Vines				
Smilax walteri	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Fraxinus caroliniana	37.1	--	45.5	82.6
Planera aquatica	25.9	--	28.6	54.5
Crataegus aestivalis	14.8	--	18.2	33.0
Eleocharis microcarpa	7.4	--	2.5	9.9
Taxodium distichum	3.7	--	1.3	5.0
Quercus laurifolia	3.7	--	1.3	5.0
Fraxinus pennsylvanica	3.7	--	1.3	5.0

(Sheet 1 of 6)

Table D17 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Boehmeria cylindrica	3.7		1.3	5.0
	100.0		100.0	200.0
	Zone 3			
Trees				
Nyssa biflora	23.2	37.1	63.6	123.9
Quercus laurifolia	23.2	32.3	18.8	74.3
Acer rubrum	20.9	15.0	12.0	47.9
Liquidambar styraciflua	9.3	3.1	0.8	13.2
Fraxinus caroliniana	4.7	4.7	0.8	10.2
Taxodium distichum	4.7	2.3	3.0	10.0
Ilex myrtifolia	7.0	2.3	0.5	9.8
Cyrilla racemiflora	4.7	1.6	0.2	6.5
Persea borbonia	2.3	1.6	0.3	4.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Fraxinus caroliniana	11.8	23.2	25.7	60.7
Acer rubrum	9.5	17.8	19.7	47.0
Quercus laurifolia	9.5	12.4	16.3	38.2
Nyssa biflora	6.4	9.2	8.6	24.2
Crataegus aestivalis	7.4	8.8	7.9	24.1
Cyrilla racemiflora	7.4	5.2	5.0	17.6
Styrax americana	8.5	4.4	4.0	16.9
Ilex myrtifolia	7.4	4.4	3.7	15.5
Liquidambar styraciflua	6.4	1.8	1.7	9.9
Leucothoe racemosa	6.4	2.2	1.3	9.9
Vaccinium elliottii	4.3	1.6	0.8	6.7
Clethra alnifolia	2.1	3.0	1.5	6.6
Itea virginica	3.2	2.2	1.0	6.4
Persea borbonia	3.2	1.6	1.2	6.0
Symplocos tinctoria	1.1	1.0	0.7	2.8
Myrica cerifera	2.1	0.4	0.2	2.7
Quercus lyrata	1.1	0.4	0.4	1.9
Quercus nigra	1.1	0.2	0.2	1.5
Lyonia lucida	1.1	0.2	0.1	1.4
	100.0	100.0	100.0	300.0
Woody Vines				
Smilax laurifolia	24.0	51.9	68.6	144.5
Gelsemium rankinii	28.0	17.3	5.0	50.3
Berchemia scandens	20.0	11.1	16.4	47.5
Smilax walteri	12.0	9.9	3.0	24.9
Smilax glauca	4.0	3.7	2.2	9.9

Table D17 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Smilax hispida	4.0	3.7	1.0	8.7
Toxicodendron radicans	4.0	1.2	3.0	8.2
Vitis rotundifolia	4.0	1.2	0.8	6.0
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Ascyrum hypericoides	10.3	--	26.6	36.9
Mitchella repens	6.9	--	16.7	23.6
Quercus laurifolia	13.7	--	8.6	22.3
Fraxinus caroliniana	10.3	--	8.9	19.2
Acer rubrum	9.5	--	6.5	16.0
Smilax laurifolia	11.1	--	4.3	15.4
Gelsemium rankinii	6.9	--	6.8	13.7
Berchemia scandens	6.9	--	4.3	11.2
Itea virginica	4.3	--	2.4	6.7
Carex joorii	4.3	--	2.4	6.7
Nyssa sylvatica	0.9	--	3.6	4.5
Centella erecta	1.7	--	1.7	3.4
Cyrilla racemiflora	2.6	--	0.7	3.3
Smilax hispida	0.9	--	1.5	2.4
Persea borbonia	0.9	--	1.5	2.4
Liquidambar styraciflua	0.9	--	1.5	2.4
Woodwardia virginica	1.7	--	0.5	2.2
Toxicodendron radicans	1.7	--	0.5	2.2
Smilax walteri	0.9	--	0.2	1.1
Nyssa biflora	0.9	--	0.2	1.1
Gelsemium sempervirens	0.9	--	0.2	1.1
Crataegus viridis	0.9	--	0.2	1.1
Carex sp.	0.9	--	0.2	1.1
	100.0		100.0	200.0
	Zone 4			
Trees				
Acer rubrum	18.7	33.7	29.2	81.6
Ilex opaca	16.4	14.7	3.5	34.6
Nyssa sylvatica	11.6	9.5	12.8	33.9
Gordonia lasianthus	9.3	9.5	10.9	29.7
Liquidambar styraciflua	9.3	6.8	12.4	28.5
Quercus nigra	11.6	8.1	7.3	27.0
Persea borbonia	11.6	9.5	2.1	23.2
Pinus taeda	2.3	2.7	13.5	18.5
Quercus michauxii	2.3	1.4	7.1	10.8
Symplocos tinctoria	4.6	2.7	0.7	8.0
Quercus phellos	2.3	1.4	0.5	4.2
	100.0	100.0	100.0	300.0

Table D17 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Saplings and Shrubs				
Ilex opaca	12.6	35.3	41.4	89.3
Ilex coriacea	8.8	15.0	11.6	35.4
Vaccinium fuscatum	12.6	10.7	10.9	34.2
Persea borbonia	12.6	11.6	9.2	33.4
Gordonia lasianthus	5.1	67.5	6.6	18.2
Acer rubrum	7.6	3.7	4.1	15.4
Symplocos tinctoria	7,6	3.1	3.9	14.6
Clethra alnifolia	6.4	4.3	2.8	13.5
Quercus nigra	5.1	4.0	3.1	12.2
Cyrilla racemiflora	5.1	1.6	1.4	8.1
Magnolia virginiana	3.8	1.2	1.7	6.7
Quercus michauxii	3.8	0.9	1.6	6.3
Prunus serotina	2.5	0.6	0.5	3.6
Lyonia lucida	2.5	0.6	0.4	3.5
Sebastiania fruticosa	1.3	0.3	0.4	2.0
Myrica cerifera	1.3	0.3	0.2	1.8
Leucothoe racemosa	1.3	0.3	0.2	1.8
	100.0	100.0	100.0	300.0
Woody Vines				
Smilax laurifolia	33.2	44.4	65.5	143.1
Smilax walteri	42.6	43.4	21.3	107.3
Vitis rotundifolia	19.5	6.6	11.1	37.2
Smilax glauca	4.7	5.6	2.1	12.4
	100.0	100.0	100.0	300.0
Herbs and Woody Seedlings				
Ilex coriacea	8.7	--	16.4	25.1
Woodwardia areolata	10.9	--	13.1	24.0
Persea borbonia	13.0	--	10.1	23.1
Leucothoe axillaris	4.3	--	18.5	22.8
Mitchella repens	13.0	--	9.3	22.3
Clethra alnifolia	7.6	--	7.9	15.5
Symplocos tinctoria	6.5	--	5.5	12.0
Quercus nigra	6.5	--	2.4	8.9
Asarum arifolium	5.4	--	2.2	7.6
Ilex opaca	4.3	--	2.0	6.3
Osmunda cinnamomea	3.3	--	1.8	5.1
Smilax rotundifolia	1.1	--	3.3	4.4
Smilax glauca	3.3	--	0.6	3.9
Smilax walteri	2.2	--	1.6	3.8
Quercus michauxii	2.2	--	1.6	3.8
Vaccinium sp.	1.1	--	1.4	2.5
Woodwardia virginica	1.1	--	1.3	2.4
Vitis rotundifolia	1.1	--	0.2	1.3

Table D17 (Continued)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Vaccinium corymbosum	1.1	--	0.2	1.3
Nyssa sylvatica	1.1	--	0.2	1.3
Cyrilla racemiflora	1.1	--	0.2	1.3
Carex sp.	1.1	--	0.2	1.3
	100.0		100.0	200.0
	Zone 6			
Trees				
Quercus nigra	43.6	59.3	37.1	140.0
Pinus taeda	26.2	18.7	44.6	89.5
Liquidambar styraciflua	13.0	9.4	9.7	32.1
Quercus virginiana	4.3	6.3	6.6	17.2
Symplocos tinctoria	4.3	3.1	1.4	8.8
Sassafras albidum	4.3	1.6	0.3	6.2
Ilex opaca	4.3	1.6	0.3	6.2
	100.0	100.0	100.0	300.0
Saplings and Shrubs				
Symplocos tinctoria	11.5	51.6	46.0	109.1
Quercus nigra	10.5	12.3	16.2	39.0
Sassafras albidum	9.3	7.1	8.0	24.4
Liquidambar styraciflua	10.4	6.1	7.2	23.7
Ilex opaca	8.2	3.9	4.8	16.9
Myrica cerifera	5.8	4.7	4.1	14.6
Vaccinium elliottii	7.0	3.0	2.4	12.4
Acer rubrum	5.8	3.0	3.4	12.2
Persea borbonia	5.8	1.8	1.4	9.0
Castanea pumila	4.6	1.8	1.5	7.9
Nyssa sylvatica	3.5	0.9	1.8	6.2
Quercus falcata	3.5	0.7	0.4	4.6
Prunus serotina	2.3	0.9	0.8	4.0
Quercus virginiana	2.3	0.4	0.5	3.2
Cornus florida	2.3	0.4	0.4	3.1
Vaccinium arboreum	1.2	0.4	0.4	2.0
Vaccinium fuscatum	1.2	0.2	0.2	1.6
Quercus stellata	1.2	0.2	0.2	1.6
Quercus michauxii	1.2	0.2	0.1	1.5
Ilex coriacea	1.2	0.2	0.1	1.5
Diospyros virginiana	1.2	0.2	0.1	1.5
	100.0	100.0	100.0	300.0
Woody Vines				
Vitis rotundifolia	46.1	50.0	55.0	151.1
Gelsemium sempervirens	53.9	50.0	45.0	148.9
	100.0	100.0	100.0	300.0

Table D17 (Concluded)

Species	Percent Relative Frequency	Percent Relative Density	Percent Relative Dominance	Importance Value
Herbs and Woody Seedlings				
Quercus nigra	17.7	--	20.7	38.4
Symplocos tinctoria	8.8	--	12.7	27.4
Sassafras albidum	14.7	--	12.7	27.4
Nyssa sylvatica	7.8	--	12.8	20.6
Persea borbonia	8.8	--	10.8	19.6
Chimaphila maculata	4.9	--	3.8	8.7
Vitis rotundifolia	3.9	--	2.3	6.2
Tragia urens	3.9	--	2.3	6.2
Liquidambar styraciflua	3.9	--	2.3	6.2
Gelsemium sempervirens	2.0	--	1.8	3.8
Smilax glauca	2.9	--	0.7	3.6
Pinus taeda	2.9	--	0.7	3.6
Ilex opaca	2.9	--	0.7	3.6
Cnidoscolus stimulosus	2.9	--	0.7	3.6
Dichanthelium commutatum	2.0	--	0.5	2.5
Vaccinium elliottii	1.0	--	1.5	2.5
Quercus velutina	1.0	--	1.5	2.5
Lonicera sempervirens	1.0	--	1.5	2.5
Smilax hispida	1.0	--	0.2	1.2
Sebastiania fruticosa	1.0	--	0.2	1.2
Rhus copallinum	1.0	--	0.2	1.2
Unknown	1.0	--	0.2	1.2
Mitchella repens	1.0	--	0.2	1.2
Carex sp.	1.0	--	0.2	1.2
Andropogon virginicus	1.0	--	0.2	1.2
	100.0		100.0	200.0

Appendix E
FTI Plant List and Comparison with Two Other Water-Tolerance Rating Systems

Table E1
FTI Plant List

Species	Species Code	FTI[1] - SD	NWI[2] Status Region 2	Water Logging Tolerance Ratings[3] (WLT)
		Trees		
Acer drummondii	ACDR	3.48 ± 0.12	OBL	
Acer negundo	ACNE	4.83 ± 0.47	FACW	Moderately tolerant
Acer rubrum	ACRU	4.21 ± 0.68	FAC	Moderately tolerant
Acer saccharinum	ACSA	3.75 ± 0.36	FACW	Moderately tolerant
Betula nigra	BENI	4.01 ± 1.73	OBL	Moderately tolerant
Bumelia lanuginosa	BULA	6.50 ± 0.00	FACU	
Bumelia lycoides	BULY	4.50 ± 0.00	FACW	
Carpinus caroliniana	CACA	4.84 ± 0.61	FAC	Weakly tolerant
Carya aquatica	CAAQ	3.54 ± 0.34	OBL	Highly tolerant
Carya glabra	CAGL	6.50 ± 0.00	FACU	
Carya illinoensis	CAIL	5.57 ± 1.01	FAC	Weakly tolerant
Carya tomentosa	CATO	6.50 ± 0.00	UPL	
Celtis laevigata	CELA	4.84 ± 0.56	FACW	Weakly tolerant
Cephalanthus occidentalis	CEOC	2.83 ± 0.52	OBL	Most tolerant
Cercis canadensis	CECA	5.50 ± 1.40	FACU	
Cornus drummondii	CODR	4.50 ± 0.00	FAC	
Cornus florida	COFL	6.50 ± 0.00	FACU	Least tolerant

[1] Mean for all study sites.
[2] Taken from Reed (1988); definitions are at the end of the appendix.
[3] Taken from Hook (1984); definitions are at the end of the appendix.

Table E1 (Continued)

Species	Species Code	FTI - SD	NWI Status Region 2	Water Logging Tolerance Ratings (WLT)
Cornus foemina	COFO	5.50 ± 0.00	FACW-	
Crataegus aestivilis	CRAE	3.00 ± 0.70	OBL	Moderately tolerant
Crataegus viridis	CRVI	4.52 ± 0.58	FACW	Moderately tolerant
Cyrilla racemiflora	CYRA	3.50 ± 0.00	FACW	
Diospyros virginiana	DIVI	4.13 ± 0.82	FAC	Moderately tolerant
Fagus grandifolia	FAGR	6.50 ± 0.00	FACU	Least tolerant
Forestiera acuminata	FOAC	3.48 ± 0.50	OBL	Most tolerant
Fraxinus americana	FRAM	6.50 ± 0.00	FACU	
Fraxinus caroliniana	FRCA	2.87 ± 0.41	OBL	Most tolerant
Fraxinus pennsylvanica	FRPE	4.44 ± 0.67	FACW	Moderately tolerant
Gleditsia aquatica	GLAQ	3.50 ± 0.00	OBL	Highly tolerant
Gordonia lasianthus	GOLA	4.50 ± 0.00	FACW	Moderately tolerant
Halesia carolina	HACA	6.50 ± 0.00	FACU+	
Halesia diptera	HADI	6.19 ± 0.43	FAC	
Ilex decidua	ILDE	4.35 ± 0.83	FACW	Moderately tolerant
Ilex myrtifolia	ILMY	3.50 ± 0.00	FACW	
Ilex opaca	ILOP	5.79 ± 0.72	FACU+	Weakly tolerant
Juglans nigra	JUNI	6.50 ± 0.00	FACU	Weakly tolerant
Juniperus virginiana	JUVI	6.50 ± 0.00	FACU	Least tolerant
Liquidambar styraciflua	LIST	5.03 ± 0.65	FAC+	Moderately tolerant

Table E1 (Continued)

Species	Species Code	FTI - SD	NWI Status Region 2	Water Logging Tolerance Ratings (WLT)
Malus angustifolia	MAAN	6.50 ± 0.00	UPL	
Melia azedarach	MEAZ	5.54 ± 0.00	UPL	
Morus rubra	MORU	5.75 ± 0.96	FAC	Weakly tolerant
Nyssa aquatica	NYAQ	2.62 ± 0.20	OBL	Most tolerant
Nyssa biflora	NYBI	3.04 ± 0.47	OBL	Most tolerant
Nyssa ogeche	NYOG	2.64 ± 0.00	OBL	
Nyssa sylvatica	NYSY	5.27 ± 0.65	FAC	Weakly tolerant
Ostrya virginiana	OSVI	6.50 ± 0.00	FACU-	Least tolerant
Persea borbonia	PEBO	4.35 ± 0.00	FACW	Moderately tolerant
Pinus echinata	PIEC	6.50 ± 0.00	UPL	Least tolerant
Pinus elliottii	PIEL	5.50 ± 0.00	FACW	
Pinus glabra	PIGL	6.24 ± 0.37	FACW	Weakly tolerant
Pinus taeda	PITA	6.41 ± 0.14	FAC	Moderately tolerant
Planera aquatica	PLAQ	3.12 ± 0.68	OBL	Most tolerant
Platanus occidentalis	PLOC	5.18 ± 0.00	FACW-	Moderately tolerant
Quercus alba	QUAL	6.50 ± 0.00	FACU	Least tolerant
Quercus falcata	QUFA	6.50 ± 0.00	FACU-	
Quercus falcata var. pagodifolia	QUPA	6.39 ± 0.31	FAC+	Weakly tolerant
Quercus laurifolia	QULA	3.89 ± 0.38	FACW	Weakly tolerant
Quercus lyrata	QULY	3.73 ± 0.68	OBL	Highly tolerant

Table E1 (Continued)

Species	Species Code	FTI - SD	NWI Status Region 2	Water Logging Tolerance Ratings (WLT)
Quercus michauxii	QUMI	4.81 ± 0.61	FACW	Weakly tolerant
Quercus nigra	QUNI	5.73 ± 0.69	FAC	
Quercus nuttallii	QUNU	4.50 ± 0.00	OBL	Moderately tolerant
Quercus palustris	QUPA	4.00 ± 0.00	FACW	Moderately tolerant
Quercus phellos	QUPH	4.81 ± 1.07	FACW	Moderately tolerant
Quercus shumardii	QUSH	5.50 ± 0.00	FACW	Weakly tolerant
Ouercus stellata	QUST	6.50 ± 0.00	FACU	
Quercus virginiana	QUVI	6.50 ± 0.00	FACU+	Weakly tolerant
Quercus velutina	QUVE	6.50 ± 0.00		
Salix nigra	SANI	2.83 ± 0.58	OBL	Most tolerant
Sassafras albidum	SAAL	6.50 ± 0.00	FACU	Least tolerant
Symplocos tinctoria	SYTI	5.54 ± 0.00	FAC	
Taxodium distichum	TADI	2.97 ± 0.61	OBL	Most tolerant
Ulmus alata	ULAL	6.43 ± 0.13	FACU+	Weakly tolerant
Ulmus americana	ULAM	4.46 ± 0.62	FACW	Moderately tolerant
Ulmus rubra	ULRU	5.50 ± 0.00	FAC	Least tolerant
Vaccinium arboreum	VAAR	6.50 ± 0.00	FACU	

Table E1 (Continued)

Species	Species Code	FTI SD	NWI Status
	Saplings and Shrubs		
Acer drummondii	ACDR	3.68 ± 0.57	OBL
Acer negundo	ACNE	5.20 ± 0.99	FACW
Acer rubrum	ACRU	4.96 ± 0.94	FAC
Acer saccharinum	ACSA	3.50 ± 0.00	FACW
Amelanchier arborea	AMAB	6.50 ± 0.00	FACU
Amorpha fruiticosa	AMFR	4.08 ± 0.59	FACW
Aralia spinosa	ARSP	6.50 ± 0.00	FAC
Arundinaria gigantea	ARGI	5.41 ± 1.66	FACW
Ascyrum hypercoides	ASHY	6.50 ± 0.00	
Asimina parviflora	ASPA	6.50 ± 0.00	FACU
Asimina triloba	ASTR	6.50 ± 0.00	FAC
Betula nigra	BENI	4.50 ± 2.00	OBL
Bumelia lanuginosa	BULA	5.91 ± 0.00	FACU
Callicarpa americana	CAAM	6.39 ± 0.20	FACU-
Carpinus caroliniana	CACA	5.07 ± 0.43	FAC
Carya aquatica	CAAQ	3.70 ± 0.38	OBL
Carya glabra	CAGL	6.50 ± 0.00	FACU
Carya illinoensis	CAIL	5.00 ± 0.71	FAC+
Carya tomentosa	CATO	6.50 ± 0.00	UPL
Castanea pumila	CAPU	6.50 ± 0.00	UPL
Celtis laevigata	CELA	4.37 ± 0.38	FACW
Cephalanthus occidentalis	CEOC	3.13 ± 0.44	OBL
Cercis canadensis	CECA	6.37 ± 0.22	FACU
Chionanthus virginicus	CHVI	6.50 ± 0.00	FACU
Clethera alnifolia	CLAL	5.32 ± 1.67	FACW
Cornus drummondii	CODR	5.69 ± 0.90	FAC
Cornus florida	COFL	6.50 ± 0.00	FACU
Cornus foemina	COFO	4.70 ± 0.90	FACW-
Crataegus aestivalis	CRAE	2.98 ± 0.15	OBL
Crataegus flava	CRFL	6.50 ± 0.00	UPL
Crataegus marshallii	CRMA	5.37 ± 1.63	FAC
Crataegus viridis	CRVI	4.46 ± 0.65	FACW
Cyrilla racemiflora	CYRA	3.72 ± 0.00	FACW
Diospyos virginiana	DIVI	5.08 ± 1.18	FAC
Fagus grandifolia	FAGR	6.50 ± 0.00	FACU
Forestiera acuminata	FOAC	3.57 ± 0.54	OBL
Fraxinus americana	FRAM	6.50 ± 0.00	FACU
Fraxinus caroliniana	FRCA	2.91 ± 0.33	OBL
Fraxinus pennsylvanica	FRPE	4.27 ± 0.70	FACW
Gaylussacia frondosa	GAFR	6.50 ± 0.00	FAC
Gleditsia aquatica	GLAQ	3.15 ± 0.49	OBL
Gleditsia triacanthos	GLTR	6.50 ± 0.00	FAC-
Gordonia lasianthus	GOLA	4.50 ± 0.00	FACW
Halesia carolina	HACA	6.50 ± 0.00	FACU+
Halesia diptera	HADI	6.09 ± 0.57	FAC
Hamamelis virginiana	HAVI	6.50 ± 0.00	FACU
Hypericum galioides	HYGA	4.30 ± 0.00	OBL

Table E1 (Continued)

Species	Species Code	FTI SD	NWI Status
Ilex amelanchier	ILAM	2.50 ± 0.00	OBL
Ilex coriacea	ILCO	4.58 ± 0.00	FACW
Ilex decidua	ILDE	4.57 ± 0.73	FACW-
Ilex glabra	ILGL	6.50 ± 0.00	FACW
Ilex myrtifolia	ILMY	3.50 ± 0.00	FACW
Ilex opaca	ILOP	5.96 ± 0.61	FACU+
Ilex verticillata	ILVE	2.50 ± 0.00	FACW
Ilex vomitoria	ILVO	6.50 ± 0.00	FAC
Itea virginica	ITVI	2.83 ± 0.35	FACW+
Juglans nigra	JUNI	6.50 ± 0.00	FACU
Juniperus virginiana	JUVI	6.50 ± 0.00	FACU-
Leucothoe racemosa	LERA	4.06 ± 1.17	FACW
Lindera benzoin	LIBE	5.82 ± 0.00	FACW
Liquidambar styraciflua	LIST	5.52 ± 0.76	FAC+
Lyonia lucida	LYLU	3.71 ± 0.00	FACW
Magnolia grandiflora	MAGR	5.43 ± 0.09	FAC+
Magnolia virginiana	MAVI	5.50 ± 1.41	FACW+
Malus angustifolia	MAAN	6.50 ± 0.00	UPL
Malus coronaria	MACO	6.50 ± 0.00	UPL
Melia azedarach	MEAZ	6.21 ± 0.00	UPL
Morus rubra	MORU	6.25 ± 0.50	FAC
Myrica cerifera	MYCE	6.19 ± 0.43	FAC+
Nyssa aquatica	NYAQ	3.25 ± 0.50	OBL
Nyssa biflora	NYBI	3.50 ± 0.00	OBL
Nyssa ogeche	NYOG	3.50 ± 0.00	OBL
Nyssa sylvatica	NYSY	5.80 ± 0.69	FAC
Ostrya virginiana	OSVI	6.50 ± 0.00	FACU-
Persea borbonia	PEBO	4.78 ± 1.23	FACW
Pinus taeda	PITA	6.50 ± 0.00	FAC
Planera aquatica	PLAQ	3.01 ± 0.64	OBL
Platanus occidentalis	PLOC	5.05 ± 0.00	FACW-
Poncirus trifoliata	POTR	6.50 ± 0.00	UPL
Prunus serotina	PRSE	6.26 ± 0.47	FACU
Prunus umbellata	PRUM	6.50 ± 0.00	UPL
Quercus alba	QUAL	6.50 ± 0.00	FACU
Quercus falcata	QUFA	6.50 ± 0.00	FACU-
Quercus falcata var. pagodifolia	QUPA	6.50 ± 0.00	FAC+
Quercus laurifolia	QULA	4.39 ± 0.00	FACW
Quercus lyrata	QULY	3.99 ± 1.00	OBL
Quercus marilandica	QUMA	6.50 ± 0.00	UPL
Quercus michauxii	QUMI	5.34 ± 0.33	FACW
Quercus nigra	QUNI	5.92 ± 0.49	FAC
Quercus nuttallii	QUNU	4.50 ± 0.00	OBL
Quercus phellos	QUPH	5.29 ± 1.18	FACW-
Quercus shumardii	QUSH	5.50 ± 0.00	FACW
Quercus stellata	QUST	6.50 ± 0.00	FACU
Quercus velutina	QUVE	6.50 ± 0.00	UPL
Quercus virginiana	QUVI	5.85 ± 0.92	FACU+

Table E1 (Continued)

Species	Species Code	FTI SD	NWI Status
Rhododendron canescens	RHCN	6.50 ± 0.00	UPL
Rhus glabra	RHGL	6.50 ± 0.00	UPL
Rhus copallinum	RHCO	6.50 ± 0.00	UPL
Sabal minor	SAMI	4.50 ± 0.00	FACW
Salix nigra	SANI	2.83 ± 0.58	OBL
Sambucus canadensis	SACA	5.95 ± 0.77	FACW-
Sapium sebiferum	SASE	3.50 ± 0.00	FAC
Sassafras albidum	SAAL	6.50 ± 0.00	FACU
Sebastiania fruticosa	SEFR	4.45 ± 0.67	UPL
Styrax americana	STAM	3.41 ± 0.64	FACW
Symplocos tinctoria	SYTI	6.40 ± 0.17	FAC
Taxodium distichum	TADI	3.33 ± 0.71	OBL
Ulmus alata	ULAL	6.24 ± 0.34	FACU+
Ulmus americana	ULAM	4.81 ± 0.74	FACW
Ulmus crassifolia	ULCR	6.50 ± 0.00	FAC
Ulmus rubra	ULRU	5.75 ± 0.50	FAC
Vaccinium arboreum	VAAR	6.45 ± 0.13	FACU
Vaccinium corymbosum	VACO	6.50 ± 0.00	
Vaccinium elliottii	VAEL	5.82 ± 0.96	FAC+
Vaccinium fuscatum	VAFU	4.50 ± 0.00	FAC+
Viburnum dentatum	VIDE	4.87 ± 1.24	FAC
Viburnum obovatum	VIOB	4.50 ± 0.00	FACW+
Viburnum rufidulum	VIRU	6.50 ± 0.00	FACU
	Woody Vines		
Ampelopsis arborea	AMAR	3.94 ± 1.04	FAC+
Ampelopsis cordata	AMCO	4.50 ± 1.41	FAC+
Aristolochia tomentosa	ARTO	6.50 ± 0.00	FAC+
Berchemia scandens	BESC	4.55 ± 0.96	FACW
Bignonia capreolata	BICA	5.70 ± 1.05	FAC
Brunnichia cirrhosa	BRCI	3.58 ± 0.52	FACW
Campsis radicans	CARA	4.05 ± 0.97	FAC
Cardiospermum halicacabum	CAHA	2.50 ± 0.00	FAC
Clematis ligusticifolia	CLLI	6.50 ± 0.00	FACW
Cocculus carolinus	COCA	4.37 ± 1.01	FAC
Gelsemium rankinii	GERA	3.50 ± 0.00	FACW+
Gelsemium sempervirens	GESE	6.50 ± 0.00	FAC
Ipomea lacunosa	IPLA	2.50 ± 0.00	FAC+
Ipomea wrightii	IPWR	2.50 ± 0.00	FACW-
Lonicera japonica	LOJA	6.50 ± 0.00	FAC-
Lonicera sempervirens	LOSE	6.50 ± 0.00	FAC
Parthenocissus quinquefolia	PAQU	5.93 ± 0.79	FAC
Smilax bona-nox	SMBO	4.75 ± 1.30	FAC
Smilax glauca	SMGL	5.61 ± 1.23	FAC
Smilax hispida	SMHI	3.80 ± 0.87	FAC+
Smilax laurifolia	SMLA	4.33 ± 2.02	FACW+
Smilax rotundifolia	SMRO	5.18 ± 0.98	FAC
Smilax walteri	SMWA	3.05 ± 0.21	OBL

Table E1 (Continued)

Species	Species Code	FTI SD	NWI Status
Toxicodendron radicans	TORA	4.82 ± 0.91	FAC
Trachelospermum difforme	TRDI	4.18 ± 1.14	FAC
Vitis aestivalis	VIAE	6.50 ± 0.00	FAC-
Vitis cinerea	VICI	5.50 ± 1.41	FAC+
Vitis palmata	VIPA	4.07 ± 0.38	FACW-
Vitis riparia	VIRI	4.27 ± 0.57	FACW
Vitis rotundifolia	VIRO	5.71 ± 0.80	FAC
Wisteria frutescens	WIFR	3.65 ± 0.00	FACW
	Herbs and Woody Seedlings		
Acalypha gracilems	ACGR	3.77 ± 0.00	UPL
Acalypha rhomboidea	ACRH	3.85 ± 0.47	FAC-
Acer drummondii	ACDR	3.64 ± 0.19	OBL
Acer negundo	ACNE	5.58 ± 0.96	FACW
Acer rubrum	ACRU	4.63 ± 1.10	FAC
Ageratina altissima	AGAL	4.71 ± 1.53	FACU-
Agrimonia pubescens	AGPU	6.50 ± 0.00	UPL
Agrostis hiemalis	AGHI	6.50 ± 0.00	FAC
Amaranthus rudis	AMRU	3.50 ± 0.00	FAC
Ameranthus tuberculatus	AMTU	6.50 ± 0.00	FACW+
Ammania coccinea	AMCC	3.50 ± 0.00	FACW+
Amorpha fruiticosa	AMFR	3.78 ± 0.00	FACW
Ampelamus albidus	AMAL	6.50 ± 0.00	FAC
Ampelopsis arborea	AMAR	3.76 ± 0.00	FAC+
Ampelopsis brevipedunculata	AMBR	6.50 ± 0.00	UPL
Andropogon virginicus	ANVI	6.50 ± 0.00	FAC-
Aralia spinosa	ARSP	6.50 ± 0.00	FAC
Aristolochia serpentaria	ARSE	5.07 ± 1.13	
Arundinaria gigantea	ARGI	5.34 ± 1.42	FACW
Asarum arifolium	ASAR	5.50 ± 0.00	FAC-
Asclepias perennis	ASPE	3.24 ± 0.37	OBL
Ascyrum hypericoides	ASHY	6.50 ± 0.00	FAC
Aster lateriflorus	ASLA	4.50 ± 0.00	FAC
Aster simplex	ASSI	3.04 ± 0.40	FACW
Berchemia scandens	BESC	4.72 ± 1.14	FACW
Betula nigra	BENI	4.50 ± 0.00	OBL
Bidens cernua	BICE	3.50 ± 0.00	OBL
Bidens discoidea	BIDI	3.50 ± 0.00	FACW
Bidens frondosa	BIFR	4.17 ± 0.00	FACW
Bignonia capreolata	BICA	5.47 ± 0.92	FAC
Boehmeria cylindrica	BOCY	3.34 ± 0.62	FACW+
Botrychium biternatum	BOBI	5.00 ± 0.71	FAC
Botrychium virginianum	BOVI	6.50 ± 0.00	FACU
Brunnichia cirrhosa	BRCI	3.74 ± 0.62	FACW
Bumelia lanuginosa	BULA	6.50 ± 0.00	FACU
Callicarpa americana	CAAM	6.39 ± 0.22	FACU-
Campsis radicans	CARA	4.34 ± 0.86	FAC
Cardiospermum halicacabum	CAHA	3.50 ± 1.41	FAC

Table E1 (Continued)

Species	Species Code	FTI SD	NWI Status
Carex albolutecens	CAAL	6.50 ± 0.00	FAC+
Carex blanda	CABL	6.50 ± 0.00	FAC-
Carex cephalophora	CACE	6.50 ± 0.00	FAC
Carex flaccidula	CAFL	6.50 ± 0.00	
Carex intumescens	CAIN	4.50 ± 0.00	FACW
Carex joorii	CAJO	4.01 ± 0.00	OBL
Carex louisianica	CALO	4.50 ± 0.00	OBL
Carex squarrosa	CASQ	4.50 ± 0.00	FACW
Carex torta	CATR	5.83 ± 0.86	OBL
Carpinus caroliniana	CACA	4.84 ± 0.35	FAC
Carya aquatica	CAAQ	3.69 ± 0.52	OBL
Carya glabra	CAGL	6.50 ± 0.00	FACU
Carya tomentosa	CATO	6.50 ± 0.00	UPL
Carya illinoensis	CAIL	6.50 ± 0.00	FAC+
Castanea pumila	CAPU	6.50 ± 0.00	UPL
Celtis laevigata	CELA	4.77 ± 0.81	FACW
Centella erecta	CEER	3.50 ± 0.00	FACW
Cephalanthus occidentalis	CEOC	3.18 ± 0.49	OBL
Cercis canadensis	CECA	6.50 ± 0.00	FACU
Chasmanthium laxum	CHLA	6.50 ± 0.00	FACW-
Chasmanthium sessiliflorum	CHSE	6.17 ± 0.82	FAC+
Chimaphila maculata	CHMA	6.50 ± 0.00	UPL
Chionanthus virginicus	CHVI	6.50 ± 0.00	FACU
Clematis crispa	CLCR	4.13 ± 0.48	FACW+
Clematis ligusticifolia	CLLI	6.50 ± 0.00	FACW
Clematis viorna	CLVO	5.50 ± 0.00	UPL
Clematis virginiana	CLVI	4.57 ± 0.10	FAC+
Clethra alnifolia	CLAL	5.50 ± 1.41	FACW
Cnisdoscolus stimulosus	CNST	6.50 ± 0.00	UPL
Cocculus carolinus	COCA	4.78 ± 0.90	FAC
Commelina communis	COCO	2.50 ± 0.00	FAC
Commelina diffusa	CODI	3.83 ± 1.53	FACW
Commelina virginica	COVI	4.02 ± 0.06	FACW
Conoclinium coelestinum	COCE	6.50 ± 0.00	FAC
Cornus drummondii	CODR	5.73 ± 0.00	FAC
Cornus florida	COFL	6.50 ± 0.00	FACU
Cornus foemina	COFO	5.25 ± 0.98	FACW-
Crataegus aestivalis	CRAE	3.50 ± 1.41	OBL
Crataegus marshallii	CRMA	6.50 ± 0.00	FAC
Crataegus viridis	CRVI	4.09 ± 0.77	FACW
Cynoctonum mitriola	CYMI	2.56 ± 0.00	FACW-
Cyperus erythrorhizos	CYER	2.50 ± 0.00	OBL
Cyrilla racemiflora	CYRA	3.79 ± 0.00	FACW
Decumaria barbara	DEBA	5.50 ± 0.00	FACW
Desmodium glabellum	DEGL	6.50 ± 0.00	UPL
Desmodium paniculatum	DEPA	6.50 ± 0.00	FACU
Desmodium passiflorum	DEPS	6.50 ± 0.00	UPL
Dichanthelium commutatum	DICO	4.17 ± 1.36	FAC
Dichondra carolinensis	DICA	6.50 ± 0.00	FACW-

Table E1 (Continued)

Species	Species Code	FTI SD	NWI Status
Dichondra repens	DIRE	6.50 ± 0.00	FACU
Dicliptera brachiata	DIBR	5.80 ± 0.00	FACW
Dioclea multiflora	DIMU	5.50 ± 1.41	FAC+
Diodia virginiana	DIVR	3.60 ± 0.98	FACW
Dioscorea quaternata	DIQU	5.50 ± 1.41	FAC
Diospyros virginiana	DIVI	4.59 ± 0.94	FAC
Duchesnea indica	DUIN	5.50 ± 0.00	UPL
Echinodorus cordifolius	ECCO	3.00 ± 0.70	EL
Eleocharis microcarpa	ELMI	2.50 ± 0.00	OBL
Elytraria carolinensis	ELCA	5.00 ± 0.70	FACW
Erechtites hieracifolia	ERHI	3.50 ± 0.00	FAC
Erigeron philadelphicus	ERPH	6.50 ± 0.00	FAC
Eragrostis hypnoides	ERHY	2.50 ± 0.00	OBL
Eupatorium serotinum	EUSE	4.17 ± 1.15	FAC
Fagus grandifolia	FAGR	6.50 ± 0.00	FACU
Forestiera acuminata	FOAC	3.32 ± 0.36	FACW+
Fraxinus caroliniana	FRCA	3.00 ± 0.45	OBL
Fraxinus pennyslvanica	FRPE	4.00 ± 1.29	FACW
Galium aparine	GAAP	6.50 ± 0.00	FACU
Galium circaezans	GACI	6.50 ± 0.00	FACU-
Galium trifidum	GATR	6.50 ± 0.00	UPL
Galium uniflorum	GAUN	6.50 ± 0.00	UPL
Gaylussacia frondosa	GAFR	6.50 ± 0.00	FAC
Gelsemium rankinii	GERA	3.50 ± 0.00	FACW+
Gelsemium sempervirens	GESE	6.31 ± 0.38	FAC
Geum canadense	GECA	5.32 ± 0.96	FAC
Gleditsia aquatica	GLAQ	3.27 ± 0.00	OBL
Gratiola virginiana	GRVI	2.50 ± 0.00	OBL
Hamamelis virginiana	HAVI	6.50 ± 0.00	FAC
Halesia diptera	HADI	6.50 ± 0.00	FAC
Heliotropium indicum	HEIN	2.50 ± 0.00	FAC+
Hibiscus laevis	HILA	3.50 ± 0.00	OBL
Hypericum galioides	HYGA	4.53 ± 0.00	OBL
Hypericum hypericoides	HYHY	5.25 ± 1.50	UPL
Hypoxis leptocarpa	HYLE	3.80 ± 0.99	FACW
Hyptis mutabilis	HYMU	6.50 ± 0.00	FAC
Ilex coriacea	ILCO	5.50 ± 1.41	FACW
Ilex decidua	ILDE	4.46 ± 0.89	FACW-
Ilex opaca	ILOP	6.09 ± 0.51	FACU+
Ilex vomitoria	ILVO	6.50 ± 0.00	FAC
Ipomoea lacunosa	IPLA	3.03 ± 0.00	FAC+
Ipomoea wrightii	IPWR	2.50 ± 0.00	FACW-
Itea virginica	ITVI	4.03 ± 0.50	FACW+
Iva annua	IVAN	4.50 ± 0.00	FAC
Juniperus virginiana	JUVI	6.50 ± 0.00	FACU-
Justicia americana	JUAM	3.83 ± 0.67	OBL
Justicia ovata	JUOV	6.50 ± 0.00	OBL
Lactuca floridana	LAFL	3.67 ± 0.76	FACU
Lactuca serriola	LASE	6.50 ± 0.00	FAC

Table E1 (Continued)

Species	Species Code	FTI SD	NWI Status
Leersia lenticularis	LELE	3.65 ± 0.72	OBL
Leersia oryzoides	LEOR	3.50 ± 0.00	OBL
Leersia virginica	LEVI		FACW
Leucothoe axillaris	LEAX	4.50 ± 0.00	FACW
Lindera benzoin	LIBE	6.23 ± 0.00	FACW
Lindernia dubia	LIDU	3.50 ± 0.00	OBL
Liquidambar styraciflua	LIST	4.87 ± 0.75	FAC+
Lonicera japonica	LOJA	6.50 ± 0.00	FAC-
Lonicera sempervirens	LOSE	6.50 ± 0.00	FAC
Ludwigia decurrens	LUDE	2.50 ± 0.00	OBL
Lygodium japonicum	LYJA	5.17 ± 0.14	FAC
Lysimachia radicans	LYRA	3.86 ± 0.44	OBL
Malus coronaria	MACO	6.50 ± 0.00	UPL
Matelea gonocarpa	MAGO	4.50 ± 0.00	UPL
Melia azedarach	MEAZ	4.50 ± 0.00	UPL
Melothria pendula	MEPE	3.50 ± 1.41	FACW-
Mikania scandens	MISC	4.30 ± 0.84	FACW+
Mimosa strigillosa	MIST	3.50 ± 0.00	FAC
Mitchella repens	MIRE	5.32 ± 0.83	FACU+
Morus rubra	MORU	5.70 ± 0.84	FAC
Myrica cerifera	MYCE	6.50 ± 0.00	FAC+
Nyssa aquatica	NYAQ	2.93 ± 0.79	OBL
Nyssa biflora	NYBI	3.42 ± 0.12	OBL
Nyssa ogeche	NYOG	2.50 ± 0.00	OBL
Nyssa sylvatica	NYSY	4.99 ± 1.47	FAC
Onoclea sensibilis	ONSE	4.62 ± 1.82	FACW
Oplismenus hintellus	OPHI	5.74 ± 1.00	FACU+
Osmunda cinnamomea	OSCI	4.50 ± 0.00	FACW+
Ostrya virginiana	OSVI	6.50 ± 0.00	FACU-
Oxalis debilis	OXDI	6.50 ± 0.00	UPL
Oxalis stricta	OXST	5.66 ± 1.04	UPL
Panicum rigidulum	PARI	3.83 ± 0.45	FACW
Parietaria pensylvanica	PAPE	6.50 ± 0.00	FAC-
Parthenocissus quinquefolia	PAQU	5.51 ± 0.93	FAC
Paspalum fluitans	PAFL	2.50 ± 0.00	OBL
Paspalum urvillei	PAUR	2.50 ± 0.00	OBL
Passiflora lutea	PALU	4.50 ± 0.00	UPL
Persea borbonia	PEBO	5.29 ± 0.00	FACW
Phanopyrum gymnocarpon	PHGY	3.00 ± 0.71	OBL
Phytolacca americana	PHAM	6.50 ± 0.00	FACU+
Pilea pumila	PIPU	3.50 ± 1.41	FACW
Pinus glabra	PIGL	6.29 ± 0.30	FACW
Pinus taeda	PITA	6.50 ± 0.00	FAC
Planera aquatica	PLAQ	3.07 ± 0.56	OBL
Platanthera flava	PLFL	6.00 ± 0.71	FACW
Pluchea camphorata	PLCA	3.41 ± 0.13	FACW
Polygonum hydropiperoides	POHY	3.50 ± 1.41	OBL
Polygonum virginianum	POVI	5.87 ± 0.52	FAC
Polypodium scandens	POSC	6.50 ± 0.00	UPL

Table E1 (Continued)

Species	Species Code	FTI SD	NWI Status
Poncirus trifoliata	POTR	6.50 ± 0.00	UPL
Prunus serotina	PRSE	6.50 ± 0.00	FACU
Prunus umbellata	PRUM	6.50 ± 0.00	UPL
Quercus alba	QUAL	6.50 ± 0.00	FACU
Quercus falcata var. pagodifolia	QUPA	6.50 ± 0.00	FAC+
Quercus laurifolia	QULA	3.81 ± 0.45	FACW
Quercus lyrata	QULY	3.80 ± 1.01	OBL
Quercus michauxii	QUMI	5.00 ± 1.00	FACW-
Quercus nigra	QUNI	5.85 ± 0.70	FAC
Quercus nuttallii	QUNU	4.50 ± 0.00	OBL
Quercus phellos	QUPH	5.43 ± 1.07	FACW-
Quercus shumardii	QUSH	5.77 ± 0.00	FACW
Quercus stellata	QUST	6.50 ± 0.00	FACU
Quercus velutina	QUVE	6.50 ± 0.00	UPL
Quercus virginiana	QUVI	6.50 ± 0.00	FACU+
Rhododendron canescens	RHCN	6.50 ± 0.00	FACW
Rhus copallinum	RHCO	6.50 ± 0.00	
Ricciocarpus natans	RINA	2.50 ± 0.00	OBL
Robinia nana	RONA	6.50 ± 0.00	UPL
Robinia psuedoacacia	ROPS	6.50 ± 0.00	UPL
Rorippa islandica	ROIS	2.50 ± 0.00	OBL
Rubus argutus	RUAR	6.17 ± 0.58	FACU+
Rubus occidentalis	RUOC	6.50 ± 0.00	UPL
Rubus trivialis	RUTR	5.20 ± 0.80	FACU+
Sabatia calycina	SACA	5.00 ± 2.12	OBL
Sabal minor	SAMI	5.01 ± 0.77	FACW
Salix nigra	SANI	2.50 ± 0.00	OBL
Sambucus canadensis	SACA	5.85 ± 0.94	FACW-
Sanicula canadensis	SACN	6.39 ± 0.00	FACU
Sassafras albidum	SAAL	6.07 ± 1.13	FACU
Saururus cernuus	SACE	3.65 ± 0.45	OBL
Scleria triglomerata	SCTR	6.50 ± 0.00	FACU+
Sebatia calycina	SECA	5.50 ± 0.00	
Sebastinania fruticosa	SEFR	5.26 ± 1.16	FACW
Senecio glabellus	SEGL	4.36 ± 0.00	FACW+
Sesbania exaltata	SEEX	2.50 ± 0.00	FACW-
Smallanthus uvedalia	SMUV	6.50 ± 0.00	
Smilax bona-nox	SMBO	5.32 ± 0.94	FAC
Smilax glauca	SMGL	5.62 ± 0.95	UPL
Smilax hispida	SMHI	3.95 ± 0.95	FAC+
Smilax laurifolia	SMLA	3.50 ± 0.00	FACW+
Smilax pumila	SMPU	6.50 ± 0.00	UPL
Smilax rotundifolia	SMRO	5.06 ± 0.89	FAC
Smilax walteri	SMWA	4.11 ± 0.13	OBL
Solanum carolinense	SOCA	5.50 ± 1.41	FACU
Solidago altissima	SOAL	5.50 ± 0.00	FACU+
Solidago odorata	SOOD	6.50 ± 0.00	UPL
Spermacoce glabra	SPGL	3.50 ± 1.00	FACWD

Table E1 (Concluded)

Species	Species Code	FTI SD	NWI Status
Spilanthes americana	SPAM	3.00 ± 0.71	FACW
Stylisma humistrata	STHU	6.50 ± 0.00	UPL
Styrax americana	STAM	3.29 ± 0.86	FACW
Symplocos tinctoria	SYTI	6.18 ± 0.46	FAC
Taxodium distichum	TADI	3.09 ± 0.66	OBL
Thelypterus kunthii	THKU	5.50 ± 0.00	FACW
Toxicodendron radicans	TORA	4.94 ± 0.71	
Trachelospermum difforme	TRDI	4.26 ± 0.85	FAC
Triadinum walteri	TRWA	3.50 ± 1.41	OBL
Tragia urens	TRUR	6.50 ± 0.00	
Trepocarpus aethusae	TRAE	6.50 ± 0.00	FACW
Ulmus alata	ULAL	5.66 ± 0.84	FACU+
Ulmus americana	ULAM	4.35 ± 0.59	FACW
Ulmus rubra	ULRU	6.50 ± 0.00	FAC
Urtica chamaedryoides	URCH	4.42 ± 0.00	FAC
Vaccinium arboreum	VAAR	6.50 ± 0.00	FACU
Vaccinium corymbosum	VACO	4.50 ± 0.00	FACW
Vaccinium elliottii	VAEL	6.06 ± 0.53	FAC+
Vernonia gigantea	VEGI	4.75 ± 0.00	FAC+
Viburnum dentatum	VIDE	6.05 ± 0.78	FAC
Viburnum cassinoides	VICA	6.50 ± 0.00	FACW
Viburnum obovatum	VIOB	6.50 ± 0.00	FACW+
Viburnum rufidulum	VIRU	6.50 ± 0.00	FACU
Viola floridana	VIFL	5.69 ± 0.45	FACW-
Viola missouriensis	VIMI	4.83 ± 0.58	FAC+
Viola papilionacea	VIPA	3.58 ± 0.75	FAC
Viola triloba	VITR	6.50 ± 0.00	UPL
Vitis aestivalis	VIAE	6.50 ± 0.00	FAC-
Vitis cinerea	VICI	3.50 ± 0.00	FAC+
Vitis palmata	VIPA	3.58 ± 0.75	FACW
Vitis riparia	VIRI	4.37 ± 1.06	FACW
Vitis rotundifolia	VIRO	5.89 ± 0.68	FAC
Vitis vulpina	VIVU	3.53 ± 0.00	FAC+
Woodwardia areolata	WOAR	4.50 ± 0.00	OBL
Woodwardia virginica	WOVI	3.97 ± 0.00	OBL

Definitions for Waterlogging Tolerance Rating

Most tolerant

Those species capable of living from seedling to maturity in soils that are waterlogged almost continually year after year except for short durations during droughts. The soils are typically anaerobic in character but are less so where the water is moving. Some species in this group adapt by producing soil water roots that oxidize their rhizosphere, accelerate anaerobic metabolism but at a controlled rate, and tolerate the toxic compounds typical of highly reduced waterlogging soils.

Highly tolerant

Those species capable of living from seedling to maturity in soils that are waterlogged for 50 to 75 percent of the year. Waterlogging typically occurs during the winter, spring, and 1-3 months of summer.

Moderately tolerant

Those species capable of living from seedling to maturity in soils that are waterlogged about 50 percent of the time. Waterlogging typically occurs in portions of the winter, spring, and early summer.

Weakly tolerant

Those species capable of living from seedling through maturity in soils that are temporarily waterlogged for durations of 1-4 weeks, usually accounting for 10 percent of the growing season.

Least tolerant

Those species that are capable of living from seedling through maturity in soils that are occasionally waterlogged for durations of a few days only, usually accounting for less than 2 percent of the growing season.

Definitions for NWI Status Descriptions

Obligate wetland (OBL)

Occur almost always (estimated probability >99 percent) under natural conditions in wetlands.

Facultative wetland (FACW)

Usually occur in wetlands (estimated probability 67 to 99 percent), but occasionally found in nonwetlands.

Facultative (FAC)

Equally likely to occur in wetlands or nonwetlands (estimated probability 34 to 66 percent).

Facultative upland (FACU)

Usually occur in nonwetlands (estimated probability 67 to 99 percent), but occasionally found in wetlands (estimated probability 1 to 33 percent).

Obligate upland (UPL)

Occur in wetlands in another region, but almost always (estimated probability >99 percent) found under natural conditions in nonwetlands in the region specified. If a species does not occur in wetlands in any region, it is not on the *National List.*

A positive (+) or negative (-) symbol was used with the Facultative Indicator categories to define more specifically the regional frequency of occurrence in wetlands. The positive sign indicates a frequency toward the higher end of the category (more frequently found in wetlands), and a negative sign indicates a frequency toward the lower end of the category (less frequently found in wetlands).

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13. ABSTRACT *(Maximum 200 words)*

Vegetation data on species composition along a hydrologic gradient were collected at 17 bottomland forest sites throughout the southeastern United States. Weighted averages based on importance values calculated from 55 stands resulted in flood tolerance index (FTI) numbers, the optimum position for each species along the defined hydrologic gradient, for 312 identified species.

Commonly occurring species were evaluated using cluster analyses and discriminant function analyses. Data on tree, sapling, and vine species clustered into distinct groups, with tree species being the most reliable; however, shrubs and herbaceous species did not cluster distinctly. Discriminant function analysis using FTI numbers for tree species proved to be 82 percent reliable in predicting zones.

The accuracy of the Flood Tolerance Index (FTI) numbers did not vary regionally in the southeastern United States. Therefore, a single FTI number calculated for each species can be used to predict hydrologic zones for the entire study area.

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