9-1-1984

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Publication No. 106

September, 1984

Technical Completion Report Research Project G-829-08

Arkansas Water Resources Research Center
University of Arkansas
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AWRRC

Arkansas Water Resources Research Center

Prepared for
United States Department of the Interior

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The research on which this report is based was financed in part by the United States Department of the Interior as authorized by the Water Research and Development Act of 1978, (P.L. 95-467).

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A B S T R A C T

WETLAND FOREST COMMUNITIES AS INDICATORS OF FLOODING POTENTIAL IN BACKWATER AREAS OF RIVER BOTTOMLANDS

A phytosociological study was made of forest types that occur in backwater and river bottomlands of the Gulf Coastal Plain, Arkansas Valley, and Mississippi Delta Regions of Arkansas.

Twenty different forest types dominated principally by a single species were identified and described. Their occurrence was then correlated with flooding conditions in their habitats and the types were arranged along decreasing moisture gradients. Those forest types tolerant of flooding or saturated soils between three months to a year or more are Taxodium distichum, Nyssa aquatica, Cephalanthus occidentalis, Salix nigra, and Planera aquatica types. Those tolerant from one to three months are Forestiera acuminata, Carya aquatica, Quercus lyrata, and Fraxinus pennsylvanica. Those tolerant between one month and two weeks are Populus deltoides, Celtis laevigata, Ulmus americana, Acer negundo, Carya illinoensis, Quercus nutallii, Liquidambar styraciflua, Quercus phellos, Quercus nigra, Carya ovata and Quercus falcata var. pagodaefolia.

It is concluded that forests of the study area are similar in vegetation composition to those of wetlands in Mississippi and Louisiana and that the same types occupy comparable habitats. Principal differences are that comparable wetland types in Arkansas usually cover less area and tend to support more species characteristic of drier habitats.

Edward E. Dale, Jr.

Completion Report to the U. S. Department of the Interior, Washington, D. C. September, 1984

KEYWORDS--Bottomland Hardwoods, Flooding, Forests, Wetlands.

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ACKNOWLEDGEMENTS

The completion of this project would have been very difficult without the cooperation of many people in several state and federal agencies and the private sector. Special acknowledgement is due Harold Alexander, Richard Broach, and Craig Uyeda of the Arkansas Game and Fish Commission, Bill Pell, Arkansas Natural Heritage Commission, Kay Arnold, Arkansas Nature Conservancy, Lake Lewis, Arkansas Department of Parks and Tourism, and Calvin Guthrie and Todd Fenzel, U. S. Fish and Wildlife Service for help in locating suitable study areas or providing information on frequency and duration of flooding in various areas. Thanks are due also to Edwin B. Smith, Plant Taxonomist, Department of Botany and Microbiology for help in identification of some of the more difficult plant species.

INTRODUCTION

It is well known that annual flooding occurs in wetland areas of the Gulf Coastal Plains and the Mississippi bottomlands of Arkansas and that severe economic losses have been the result. Although stream channel improvement projects, dams, and other water manipulations have ameliorated the situation somewhat, the problem still exists in many areas of the eastern and southern parts of the state. Since natural vegetation has been shown to be a good indicator of long-term flooding patterns in Mississippi and Louisiana, the information from this study will provide basic information needed for proper land use planning in flood-prone areas of the Mississippi bottomlands and Gulf Coastal Plains areas of Arkansas.

A. Purpose and Objectives

The purpose of this investigation was to determine if the frequency of flooding in relation to occurrence of principal forest communities in Mississippi, Louisiana and southeast Arkansas applies to the Gulf Coastal Plain, the Mississippi bottomlands of eastern and northeastern Arkansas, and the lowlands of the Arkansas Valley. The objectives were to (1) identify the prinicipal forest communities present in wetland areas of Arkansas, (2) relate their occurrence to flooding frequency and duration, and (3) modify as appropriate for Arkansas the presently known information (Figure 1).

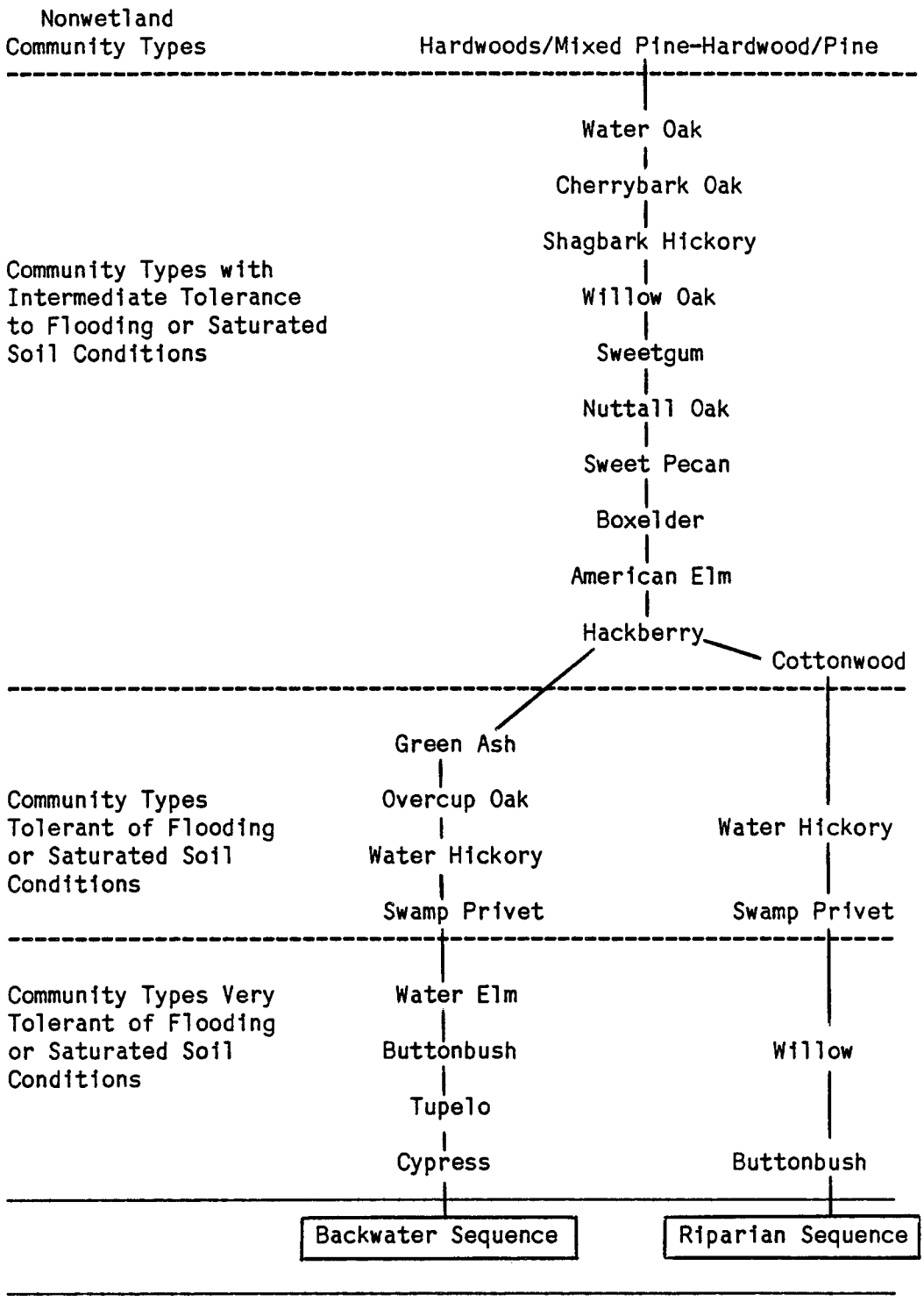

Figure 1. Summary of Relative Sequences of Wetland and Nonwetland Plant Community Types of the Mississippi River bottomlands and major tributaries in Mississippi, Louisiana and southern Arkansas. Scientific names are listed in Appendix IV.

B. Related Research or Activities

A considerable amount of information exists on the relation between the occurrence of wetland forest communities and frequency of flooding in the lower Mississippi Delta Region (Putnam and Bull 1932, Penfound 1952, Montz 1977, Rhodes 1976, Dale, Johnson and Kuroda 1981 and others) but such information for much of Arkansas is lacking. The relatively few areas in Arkansas where investigations have been made include the lower White River Valley (Bedinger 1971), the Ouachita River Basin (Huffman 1976), part of the Coastal Plain in Arkansas (Environmental Laboratory 1978), the Red River area (Marsh and Adkins 1979) and Moro Bay, Saline River, and Felsenthal areas in Southern Arkansas (Dale, Johnson and Kuroda 1981). However, these studies include quantitative information for relatively small areas and none of them consider as a whole the wetlands of the Arkansas Gulf Coastal Plain or the Mississippi bottomlands. Furthermore, much of the information is restricted to areas near stream flow gauges. While this information is useful for areas near streams, it does not always provide reliable information concerning flooding conditions behind natural levees in poorly drained backwater areas. What happens is that flood waters at first rise near streams, and then spill over natural levees into backwater areas. The flooding of the streamside areas may subside within a few days, but it may persist in the backwater areas for several weeks. The end result of this lack of quantitative information concerning

flooding in these areas, particularly during wet years, can lead to severe economic losses caused by unwise land clearing and development of marginal areas, loss of wildlife habitat, alteration of water tables, reduction in water quality downstream, and other environmental deterioration.

Attempts have been made to relate flooding frequency and duration directly to elevations, but this has not proven to be very reliable because of natural differences in topographic features in different areas or because of water manipulations such as dams and channel improvement or floodway projects that often obscure evidence of long-term past flooding.

The work of Dale, Johnson and Kuroda (1981) in Louisiana, Mississippi, and south Arkansas indicates that occurrence of natural vegetation is a good indicator of long-term flooding conditions in areas where flood gauge data are unavailable, such as in backwater areas. Also, observations by this author made in 1978 and 1979 indicate that occurrence of wetland forest communities in relation to flooding frequency is essentially similar in Arkansas as in Mississippi and Louisiana, but more definitive information is needed, particularly in wetland areas of the Gulf Coastal Plains region of Arkansas, the Arkansas Valley, and the section of the Mississippi Delta Region in the eastern and northeastern part of the state.

METHODS AND PROCEDURES

The project was initiated by a library search for literature on vegetation and flooding relationships in the areas of interest. Also, information on the location of good native forest stands in flood-prone areas was requested from state and federal agencies, private organizations, and knowledgeable individuals.

Since official records on flood frequency and duration are not available for backwater areas, it was necessary to obtain most of this information from foresters, refuge managers, landowners, and other individuals familiar with the study areas. The information was not always quantitative, but was adequate for relating the occurrence of different forest types to flooding conditions that had existed over a period of many years in the areas of concern.

Quantitative phytosociological studies of forest communities in areas of known flooding frequency were made in October 1983 and in May and July 1984 by methods used by Dale, Johnson and Kuroda (1981). Briefly, these methods consisted of first locating representative stands of forest in areas of known flooding conditions. A starting point was then randomly selected within each stand on which the corner of one of a series of systematically arranged sample plots was placed. Trees were sampled in a minimum of six 72.6 x 6 ft (1/100 acre) rectangular plots (equivalent to 22 x 1.8 m, .004 ha) arranged in columns within a stand with the long axis of the plots parallel to the moisture gradient. These plots were usually

50 ft (15.23 m) apart. Data recorded for trees were species present, basal area and density. The field data were converted to relative frequency, relative density, relative basal area (dominance) and importance values (Curtis and McIntosh 1951) which give a measure of distribution, numbers, and size of tree species present. Also, density and basal area per acre (.405 ha) were determined. Data for high understory woody species such as saplings, vines and shrubs over 4.5 ft high (1.37 m) were taken from the plots and presented as density (number of stems) per acre. Cover of understory vegetation less than 4.5 ft tall was estimated using 3 x 6 ft (.92 x 1.83 m) plots placed at the ends of each rectangle.

The understory was divided into three strata: ground to 6 in (.15 m), 6 in to 2 ft (.61 m) and 2 ft to 4.5 ft (1.37 m), averaged for all plots, and assigned a percent cover value in each stratum. Forest floors were not sampled if living understory was absent or very sparse, or if the forest floor was covered by water.

Sample adequacy in the field was determined by a running mean technique (Mueller-Dombois and Ellenberg 1974) in which the variation between mean density values of the dominant trees was calculated first in 5 plots and then in 6. If the variation exceeded 15 percent, other plots were added until sample adequacy was obtained.

Transition zones between community types were noted visually, and species present were recorded along transect lines starting in the edge of one community type, then across the transition zone, and

finally into the other community on the other side of the zone.

The compiled data for vegetation types or dominant species present were then arranged in order along relative decreasing moisture gradients similar to those shown in Figure 1. The moisture gradient was estimated from local accounts provided by knowledgeable individuals familiar with the area.

In addition, the quantitative sampling was supplemented by observations of the sequence of principal species present along decreasing moisture gradients starting at edge of streams, bayous, or lakes, toward adjacent drier areas. These were recorded and used later for reference.

Twenty-five sites were quantitatively sampled and 45 sequential observations were made of changes in vegetation along moisture gradients. The counties where this was accomplished and areas where results of other studies have been reported are shown in Figure 2.

Voucher specimens of plant species present were collected, identified, and pressed. These are on file in the herbarium at the University of Arkansas, Fayetteville. Also, photographs were taken of representative sites and the location of sampling areas indicated on topographic or county road maps. All photographs, maps, field data sheets, and compiled data are available at the Department of Botany and Microbiology, University of Arkansas.

Designation of Dominants

A dominant species is a plant which is in community control

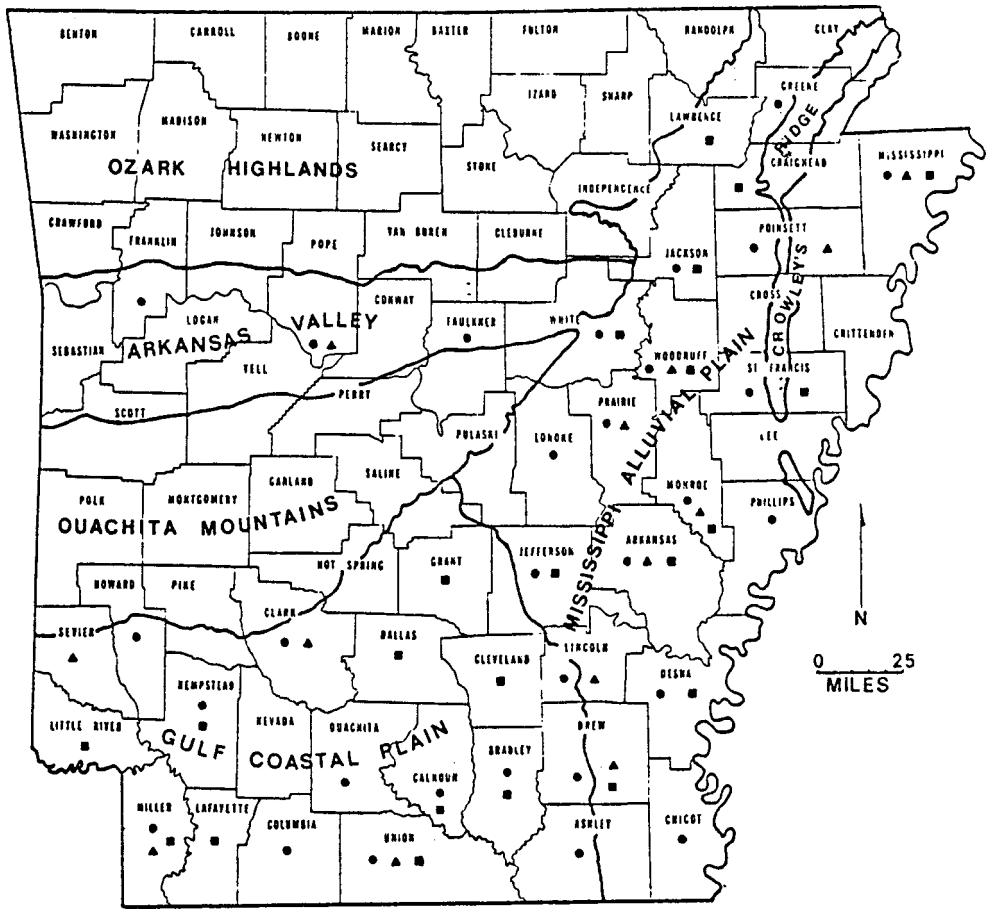

Figure 2. Counties in the Arkansas Valley, Gulf Coastal Plain and Mississippi Alluvial Plain (Mississippi Bottomlands) where field studies were made. Areas where forest types were sampled quantitatively are indicated by triangles (▲) and sites of observational sequences by circles (●). Counties where studies have been reported in the literature are shown by squares (■).

(Clements 1916; Oosting 1956). In essence this means that at least to some extent the establishment and growth of other species in the community is determined by the dominants through their influence on the habitat by competition of allelopathy. Tree species with importance values of 75 or more are considered as dominants and those with importance values between 15 and 75 are regarded as important secondary species. Other species are regarded as interstitial.

Dominance is shown by understory species also. Saplings and other woody understory species over 4.5 ft tall with densities per acre of 100 or more and low understory species below 4.5 ft with cover percentages of at least 10 percent are regarded as dominants in their strata. Field observations seem to support these values for purposes of this study.

PRINCIPAL FINDINGS AND THEIR SIGNIFICANCE

a) General

Forest community types in the study area were found to be easily recognizable entities characterized by specific populations of trees dominated by one or more species. Usually these types support characteristic shrub and herbaceous strata in the understory. Also it was determined that each of these types occur in specific kinds of habitats and in many instances the boundary areas are comparatively distinct. Where boundaries are not distinct, such areas are regarded as transition zones.

Although some authors have expressed disagreement with the vege-

tation type concept, it is used in presenting the results of this study because the vegetation units are readily discernible and also as a matter of practicality and convenience.

Twenty principal forest types can be readily identified from quantitative sampling and from observational sequences. It would be possible to delineate others, but many of these such as those dominated by cedar elm (Ulmus crassifolia) or ironwood (Ostyra virginiana) usually occur as understories of other types and those dominated by black river birch (Betula nigra) are small and infrequent.

Some of the stands are dominated by a single species but in others dominance is shared by two or more species. However, observations in Arkansas, Mississippi and Louisiana indicate that all species occurring as codominants are usually present as single dominants in other stands. For purposes of this study, the principal dominant species will be used to designate each type described.

The different forest types occur consistently under different moisture regimens associated with frequency and duration of flooding. Some of the types most frequently inundated occur near sluggish streams, edges of lakes, or in swamps of backwater areas where water levels change slowly. Others are most common along edges of streams with flowing water or where water levels change rapidly.

Transition zones between communities are generally narrow and vegetation is often composed of species common to adjacent types.

Transition zones are broadest if slopes between community type are gentle and water level changes in such areas are slow. In situations where the zones are dissected by shallow water channels, more mesic species occur in low places and less mesic ones on high areas, thus forming transition zones of highly variable vegetation composition.

Abrupt changes in elevation between adjacent communities tend to cause narrow transition zones.

b) Sequences of Types Along Moisture Gradients

On the basis of the compiled data from quantitatively sampled sites (Appendix I) and observations (Appendix II), a sequence of forest types along decreasing moisture gradients is presented in Figure 3. It should be mentioned, however, that a complete sequence as shown rarely occurs in single sites, and Figure 3 represents a composite picture of sequences over the study area as a whole. In cases where slopes from wet to dry areas are gradual, most types may be present, but on steeper slopes many types are usually absent. Thus, it is possible for any one type to be adjacent to any other type. For example, a pine (Pinus echinata) type on top of a steep ridge may be adjacent to a stand of bald cypress (Taxodium distichum) in a flooded area below it.

c) Description of Sites

Bald Cypress and Tupelo Types

Bald cypress (Taxodium distichum) and tupelo (Nyssa aquatica)

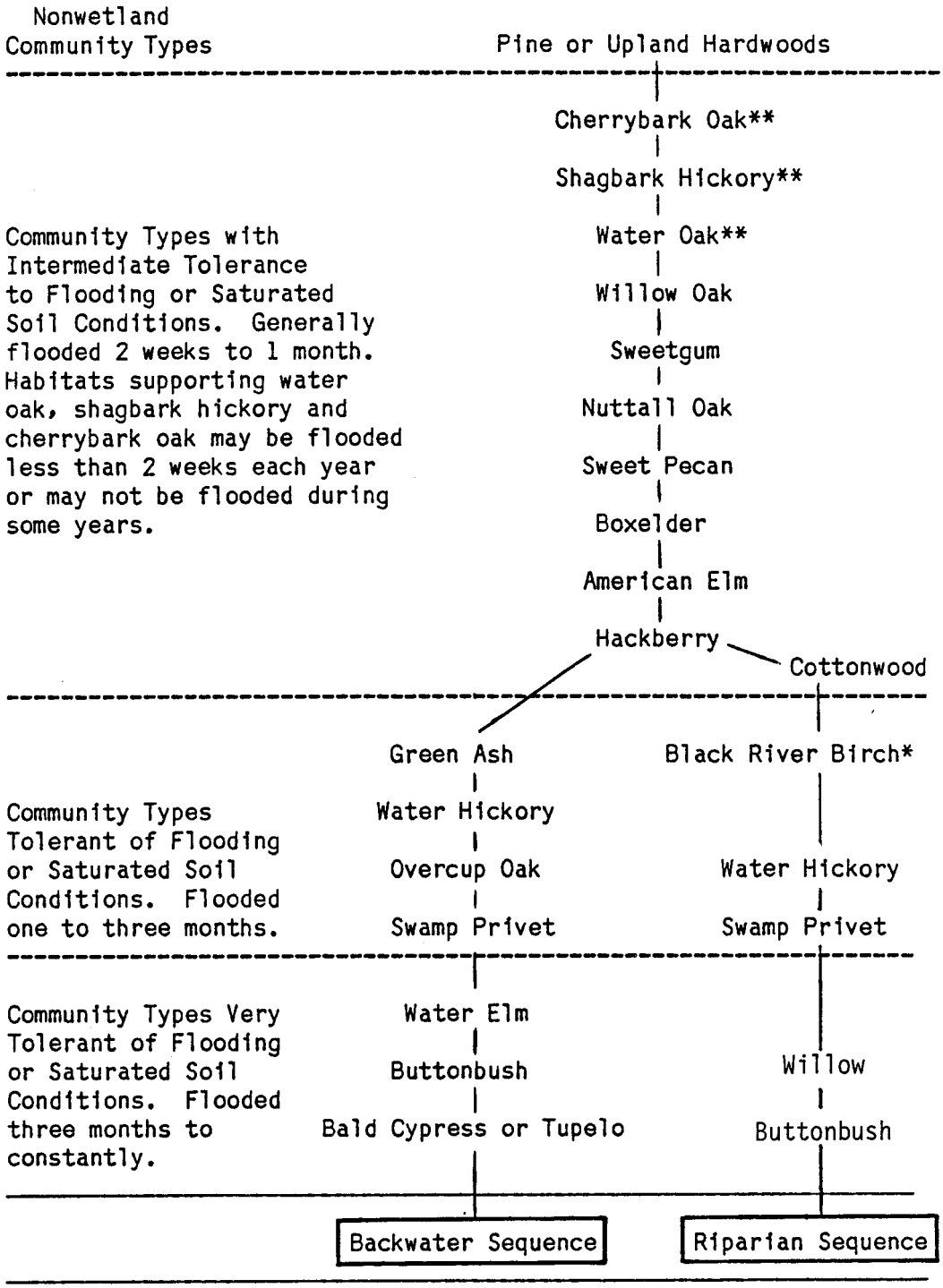

Figure 3. Summary of relative sequences of wetland forest communities in Arkansas. Some plant species may be found in either wetland or nonwetland habitats. Also, some typically riparian species may occur in backwater areas and vice-versa, but they seldom dominate under such conditions.

* A Black River Birch (Betula nigra) Type was described by Dale, Johnson and Kuroda (1981) from a site near the Saline River east of Warren in Bradley County.

** The data and observations suggest that it may be questionable as to which of these species is more xeric.

occur in backwater areas, often growing in open water on low, poorly drained flats or sloughs of first bottoms. Also, they are found along edges of sluggish streams. Some standing water is present in most habitats but parts of most stands are usually on dry ground during the last part of the growing season and in winter.

These species can occur in the same stands as codominants or as separate community types. The presence of almost pure separate stands can be attributed largely to lumbering operations. Bald cypress tends to be long lived and slower growing than tupelo. The two species when growing together are seldom of the same age or size class, thus one is usually logged separately leaving the other to grow to a merchantable size. Also, it should be mentioned that although tupelo seedlings are very tolerant of saturated soil (Hosner and Boyce 1962), full sunlight is necessary for satisfactory germination and development of seedlings (Fowells 1965). This may explain why few tupelo seedlings are present in either pure stands of tupelo or in stands mixed with bald cypress.

Overcup oak (Quercus lyrata), water locust (Gleditsia aquatica), and water hickory (C. aquatica) are the most frequently associated overstory trees, usually occurring on the edges of the stand on higher ground. Black willow (Salix nigra) sometimes occurs with bald cypress and tupelo along riversor channels in swampy areas with flowing water. It is usually found on higher elevations of the stand where the water is flowing under flooding conditions. When

the flood water subsides, the black willow is on dry land and the major portion of the bald cypress and tupelo stand is in the sluggish stream or bayou below.

The woody understory, if present, occurs on the drier edges of the stand. Trees of the overstory and buttonbush (Cephalanthus occidentalis), swamp privet (Forestiera acuminata), or water elm (Planera aquatica) and occasionally black willow seedlings are the most common associates. Woody vines are scarce, but eardrop vine (Brunnichia ovata) is one of the most common.

Forest floors are generally covered with water, are bare, or support a wide variety of herbaceous species and sometimes duckweed (Spirodela punctata).

Buttonbush Type

Buttonbush (Cephalanthus occidentalis) occurs on the drier edge of bald cypress and tupelo sites and often shares dominance with them, sometimes as a high understory. Habitat conditions and associated species are similar to those found in bald cypress and tupelo types.

Water Elm Type

Water elm (Planera aquatica) often grows with buttonbush, bald cypress, or tupelo, but is more restricted in its geographical distribution. It usually occurs on slightly drier areas than buttonbush. The only sites in the study area where large populations of nearly pure stands were noted was near the Sulphur River in Miller

County where it is an important secondary species in buttonbush-bald cypress and overcup oak (Quercus lyrata) types. However, nearly pure stands (where it occurred as a dominant) have been observed in Mississippi and Louisiana by the Principal Investigator. Overcup oak and swamp privet (Forestiera acuminata) are frequent associates, usually on the drier edge of the community.

Swamp Privet Type

Swamp privet (Forestiera acuminata) occurs principally in poorly drained backwater areas and along the banks of sluggish streams, frequently flooded abandoned river channels, or oxbow lakes. The largest stand found in the study area was associated with an overcup oak site near the Sulphur River in Miller County where it was an important secondary species.

It is present also as a high understory dominant in sites supporting a buttonbush-cypress and two overcup oak types in this same general area. Some of the more common associated woody species include bald cypress, overcup oak, water elm, and buttonbush and black willow. Vines include eardrop vine (Brunnichia ovata), rattan vine (Berchemia scandens), and climbing dogbane (Trachleospermum difforme). Forest floors are usually bare except for a few seedlings of species that occur in the overstory and various sedges and whitegrass (Leersia virginica).

Overcup Oak Type

The Overcup Oak (Quercus lyrata) Type occurs in backwater areas that are flooded during major portions of the growing season. It is common on poorly drained areas adjacent to bald cypress, tupelo, buttonbush, water elm or swamp privet sites on the more mesic side of the community. The type appears to be present in slightly wetter places than the Water Hickory Type in the study area, but this needs further study for confirmation. Also, water hickory shares dominance with overcup oak in one stand sampled quantitatively and was an important secondary species in two others.

Understories are similar to those associated with swamp privet.

Water Hickory Type

Water hickory (Carya aquatica) is common in habitats frequently inundated during the growing season. It occurs in flat backwater areas near sluggish streams or lakes, but it is common also along some faster moving streams on sloping banks. It frequently is present as almost pure stands of trees in narrow bands that reflect spring flood levels along streams. Such stands were observed at Dagmar Wildlife Management Area in Monroe County and near the Arkansas River in Jefferson County.

Common tree associates in mixed stands include overcup oak, bald cypress, and tupelo on the wetter side of the community, and green ash (Fraxinus pennsylvanica), sweetgum (Liquidambar styraciflua), persimmon (Diospyros virgininia), hackberry (Celtis laevigata) and

willow oak (Quercus phellos) on the drier side. Other woody associates are swamp privet, eardrop vine, rattan vine, and climbing dogbane. Forest floors are usually sparsely covered by vegetation, consisting mostly of seedlings of woody species, sedges, and a variety of forbs.

Green Ash Type

A Green Ash (Fraxinus pennsylvanica) Type was not sampled during this investigation, but narrow bands of this species were observed to occur consistently along the upper banks of many streams or in less-frequently flooded areas on low ridges near oxbow lakes or other backwater areas. Overcup oak or water hickory communities were often present on the lower side of green ash communities and hackberry, American elm (Ulmus americana) or box elder (Acer negundo) were common on the upper side.

Black Willow Type

Black willow (Salix nigra) is typical of habitats that are inundated by flowing water for much of the growing season. Since it cannot tolerate still waters of backwater areas, it is largely restricted to flowing stream margins, sandbars, edges of drainage ditches, lakes, or sloughs and depressions with frequently fluctuationg water levels. Evidence of this intolerance to standing water is indicated by dead willow trees in tributaries of the Arkansas River upstream from dams where raised water levels permanently

flooded such areas. This type of situation has been observed elsewhere also.

Black willow frequently occurs in pure or nearly pure stands, but it is most frequently associated with bald cypress, tupelo or buttonbush in wet areas where there is some flow of water, or with red mulberry (Morus rubra), box elder (Acer negundo), silver maple (Acer saccharinum), green ash (Fraxinus pennsylvanica) or hackberry (Celtis laevigata) on drier parts of a site. Other common woody associates are pepper vine (Ampelopsis arborea) or poison ivy (Toxicodendron radicans). Poison ivy is particularly common where the site has been extensively distributed.

Forest floors are often inundated or support a large variety of weeds during late summer or early fall after flood waters have receded.

Cottonwood Type

Cottonwood (Populus deltoides) is most common along the edges of larger rivers and streams on higher ground than black willow. It is generally present in low, sandy areas behind low ridges on natural levees on the edges of the rivers. Since cottonwood seeds require several days in standing water to germinate, they are carried by the winds to shallow, temporary ponds of standing water by the river. There they germinate and usually form nearly pure stands. Frequently, such areas support few other woody species under normal conditions, but many herbaceous weeds may be present. Cottonwood shows

poor tolerance for standing water and is seldom present on banks of sloughs, lakes, or bayous of backwater areas.

The cottonwood stand sampled was present at Holla Bend National Wildlife Refuge. The cottonwoods were old, large trees. Smaller box elder (Acer negundo) overstory trees were present in amounts great enough to make box elder a codominant at the study site. This is not a usual situation and was caused by the straightening of the channel of the Arkansas River in 1954, which resulted in less frequent and extensive flooding of the site. The box elder evidently became established among the older cottonwoods when the area became drier.

Hackberry Type

Hackberry (Celtis laevigata) is common on gently sloping or flat areas behind natural levees of rivers or edges of sloughs. It usually occurs in areas subject to periodic flooding during the growing season, but it is uncommon as a community in deep swamps.

Many different woody species are frequently associated with hackberry. Common trees on drier parts of hackberry sites include box elder, red mulberry, sweet pecan (Carya illinoensis), roughleaf dogwood (Cornus drummondii), American elm (Ulmus americana) or green ash. In wetter areas cottonwood, black willow or water locust (Gleditsia aquatica) may be present.

Woody vines include greenbrier (Smilax bona-nox and S. rotundifolia), Virginia creeper (Parthenocissus quinquefolia),

pepper vine (Ampelopsis arborea), or rattan vine (Berchemia scandens). Poison ivy can be very common if the site has been extensively disturbed.

Forest floors are highly variable in species composition. Species noted that appear to be characteristic include stinging nettle (Urtica chamaedryoides), white avens (Geum canadensis), violet (Viola palmata), goldenrod (Solidago sp.) and aster (Aster sp.). Many grasses and sedges are present also.

Box Elder Type

Box elder (Acer negundo) occurs on flat areas of first or second bottoms that are periodically flooded during the growing season or in bands along higher banks of streams. It rarely occurs as a distinct community in deep swamps with still water.

The only site sampled was at Holla Bend National Wildlife Refuge where it shared dominance with cottonwood, thus its occurrence there is not typical of its usual habitat. However, observations of small stands elsewhere in the state indicate that common associates are essentially the same as those described for the hackberry type.

American Elm and Sweet Pecan Types

American Elm (Ulmus americana) and Sweet Pecan (Carya illinoensis) Types were not sampled because only fragmentary and greatly disturbed small stands were available. However, it was observed that small stands of these species occurred in the same community type sequences of moisture gradients as in lowlands of

Mississippi and Louisiana and supported many of the same associated tree and understory species. Based on observations in several sites, the common tree associates include hackberry, box elder, American elm, and sweetgum (Liquidambar styraciflua). High understories include overstory seedlings, deciduous holly (Ilex decidua) and vines such as wild grape (Vitis spp.), Virginia creeper, rattan vine and climbing dogbane (Trachleospermum difforme).

Forest floors in the sites examined are highly variable because of extensive disturbance. The principal species include poison ivy and Japanese honeysuckle (Lonicera japonica), both of which reflect the extensive disturbance, and a mixture of common weeds. It was noted that fewer southern species typical of Mississippi and Louisiana sites were present in the Arkansas sites.

Sweetgum Type

Sweetgum (Liquidambar styraciflua) communities are widely distributed throughout the study area, usually along first and second river bottoms that are inundated periodically by flowing water during the growing season. Also, sweetgum is most common in sites that have undergone disturbance. It rarely occurs in great numbers in deep swamps or backwater areas except on ridges.

Many different species are associated with this type, which is characteristic of sites that have been seriously disturbed. In addition to those listed for American elm, sweet pecan, and hack-

berry communities, sweetgum types support woody species such as overcup oak, ironwood (Ostyra virginia), Nuttall oak (Quercus nuttalli), cherrybark oak (Quercus falcata var. pagodaefolia), sycamore (Platanus occidentalis), persimmon (Diospyros virginiana), water oak (Quercus nigra), willow oak (Quercus phellos), American holly (Ilex opaca), and greenhaw (Crataegus viridis). A mixture of many different species occurs in understories also. At the site sampled, the most common species is poison ivy. Others present not listed for elm, sweet pecan and hackberry sites include panic grass (Panicum spp.), eardrop vine, white grass, sedges (Cyperus sp. and Carex sp.), and self-heal (Prunella vulgaris).

Nuttall Oak Type

The Nuttall Oak (Quercus nutallii) Type is most common on both low, flat areas of first and second bottoms and on fairly well-drained ridges that are inundated from two weeks up to three months during the growing season.

In the community sampled Nuttall oak shares dominance with overcup oak. Principal tree associates in addition to overcup oak include green ash, ironwood, and willow oak. Common vines are eardrop vine and poison ivy. Few herbaceous species were present when the area was sampled because the forest floor was covered by water.

Willow Oak Type

The Willow Oak (Quercus phellos) Type is widely distributed throughout the study area. It usually occurs on flat areas subject

to backwater inundations. Willow oak can tolerate inundation from two weeks to as long as several months during the growing season. Willow oak tends to be the only overstory dominant in major stands, but other trees do occur in the overstory. Principal species include sweetgum, American elm, water hickory, cedar elm (Ulmus crassifolia) and shagbark hickory. The high understory is often sparse, but ironwood, shagbark hickory, persimmon, parsley haw (Crataegus marshallii), swamp privet, trumpet vine (Campsis radicans), and overstory tree seedlings are common in the sites examined. Rattan vine, eardrop vine, pepper vine and wild grape and poison ivy are common also.

Vegetation cover of forest floors is usually sparse.

Water Oak Type

Water oak (Quercus nigra) occurs on better drained ridges and flat areas that are flooded for only a few days during the growing season. It can occur on both drier wetland sites or occasionally in some of the moister non-wetland areas. Pine (Pinus echinata) shared dominance with water oak on one site examined.

Water oak is usually the only dominant, but shagbark hickory, sweetgum, willow oak and cedar elm occur as important secondary trees in the overstory. Principal understory species include redbud (Cercis canadensis), hawthorn (Crataegus sp.), rattan vine, red maple (Acer rubrum), greenbrier, deciduous holly, Virginia creeper, and poison ivy.

The forest floor was covered by water during the time one site was visited and was not sampled. The forest floor of the site where willow oak and pine were codominants supported seedlings of ironwood and other species typical of uplands such as goldenrod, poison ivy, black gum (Nyssa sylvatica), Japanese honeysuckle and poison ivy.

Cherrybark Oak and Shagbark Hickory Types

Although small stands of cherrybark oak (Quercus falcata var. pagodaefolia), and shagbark hickory (Carya ovata) communities were observed, they are here considered together because the two species grow together in the sites sampled and occupy similar habitats.

Both are intolerant of periodic flooding for more than about one month during the growing season. Cherrybark oak tends to be more southern in distribution and does not occur as extensively on uplands as shagbark hickory. However, it is questionable as to which community is more mesic in the study area.

The most common overstory associates of cherrybark oak are water oak, sweetgum, and nuttall oak in more southern regions (Putnam and Bull 1932). These same species occur with shagbark hickory in this same area, with black oak, bitternut hickory (Carya cordiformis), cherrybark oak, chestnut oak (Quercus muhlenbergii) and black gum (Nyssa sylvatica) in addition (Dale, Johnson and Kuroda 1981).

In Arkansas at the sites sampled, the most common tree associates of both include willow oak, bitternut hickory (Carya cordiformis) and cedar elm (Ulmus crassifolia), all characteristic

of wetlands, and post oak (Quercus stellata) and mockernut hickory (Carya tomentosa), two typically upland species.

Woody understories and forest floors support species characteristic of both uplands and wetlands. Examples of common wetland species present in the sampled sites include climbing dogbane, rattan vine, eardrop vine, balsam (Impatiens capensis), smartweed (Polygonum sp.) and various sedges (Carex spp.). Typical upland species present are winged elm (Ulmus alata), service berry (Amalanchier arborea), blackberry (Rubus sp.), and yellow passion flower (Passiflora lutea).

d) Significance of the Findings

The results of this study are significant in two principal ways. The first is the basic scientific knowledge acquired about the vegetation communities of wetland areas in Arkansas and their occurrence as related to flooding. The second is that this information will be useful as baseline data for better land use planning and management.

CONCLUSIONS

It is concluded that the forest communities of wetland areas of the Mississippi bottomlands, Arkansas Valley and Gulf Coastal Plain of Arkansas are similar in vegetation composition to those found in comparable habitats in Mississippi and Louisiana. Also the occurrence of these communities along moisture gradients is similar.

A principal difference is that in Arkansas the sites supporting nearly pure stands of most forest communities tend to be smaller. This is attributed to a more dissected and higher relief in wetlands of some areas. Streams and lakes tend to have steeper banks, thus habitats suitable for some communities are narrower. Another difference is that on the Gulf Coastal Plains and upper part of the Mississippi bottomland area, wetland forest communities tend to support a greater percentage of species more characteristic of drier habitats.

APPENDIX I. Compiled data from sampling sites.

Table I. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Bald Cypress Forest Type located at Bayou Bartholomew.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Taxodium distichum	182.6	237.4	300.0	
Cephalanthus occidentalis				66.4
Totals	182.6	237.4	300.0	66.4

Table II. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Water Tupelo Forest Type located at Bayou Deview east of Becton, Arkansas.

Species	Overstory D	BA	I.V.	High Understory (density per acre)
Nyssa aquatica	182.6	61.5	146.6	49.8
Carya aquatica	66.4	6.6	36.5	49.8
Diospyros virginiana	33.2	10.9	26.0	16.6
Quercus lytrata	33.2	3.3	25.3	16.6
Taxodium distichum	33.2	3.3	27.3	16.6
Fraxinus pennsylvanica	16.6	1.7	12.8	16.6
Ulmus americana	16.6	1.6	12.7	
Acer saccharinum	16.6	1.7	12.8	16.6
Cepalanthus occidentalis				49.8
Totals	398.4	90.8	300.0	215.8

Table III. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Water Tupelo Forest Type located at Bayou Meto Wildlife Management Area.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Nyssa aquatica	132.8	62.0	144.5	66.4
Acer rubrum	66.4	30.4	56.9	83.0
Taxodium distichum	16.6	29.9	37.8	
Quercus falcata var. pagodaefolia	16.6	13.3	25.9	
Liquidambar styraciflua	16.6	1.7	17.5	
Ulmus americana	16.6	1.7	17.4	33.2
Quercus lyrata				16.6
Diospyros virginiana				16.6
Ilex decidua				16.6
Berchemia scandens				49.8
Fraxinus pennsylvanica				16.6
	265.6	139.0	300.0	298.8

Table IV. Percent cover of the forest floor species in the low understory of the Water Tupelo Forest Type located at Bayou Meto Wildlife Management Area. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Berchemia scandens			*	
Spirodela punctata		*		
Brunnichia ovata		1.7		
Toxicodendron radicans		1.1	*	
Cornus drummondii				*
Ulmus crassifolia			*	
Ampelopsis arborea			*	
Carya ovata			*	
Forestiera acuminata				
Moss	8.0			
Litter	64.6			
Bare ground	27.4			

Table V. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Black Willow Forest Type located at Holla Bend National Wildlife Refuge.

Species	Overstory D	BA	I.V.	High Understory (density per acre)
Salix nigra	199.2	66.4	235.5	
Morus rubra	16.6	13.3	37.1	
Acer negundo	16.6	5.0	27.3	
Toxicodendron radicans				33.2
Totals	232.4	84.7	299.9	33.2

Table VI. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Black Willow Forest Type located at Holla Bend National Wildlife Refuge.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Salix nigra	204.4	41.9	156.4	16.6
Celtis laevigata	49.8	5.0	45.6	49.8
Acer saccharinum	16.6	20.0	32.6	
Toxicodendron radicans	16.6	20.0	32.6	132.8
Fraxinus pennsylvanica	16.6	20.0	32.6	
Ampelopsis arborea				132.8
Totals	304.0	107.9	299.8	332.0

Table VII. Percent cover of the forest floor species in the low understory of the Black Willow Forest Type located at Holla Bend National Wildlife Refuge. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Ampelopsis arborea		3.3	2.5	
Rubus L. sp.		1.7		
Celtis laevigata			*	
Ilex decidua		*		
Toxicodendron radicans		*		
Moss	*			
Litter	72.3			
Bare ground	27.1			

Table VIII. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Overcup Oak Site Forest Type located at Sulphur River Wildlife Management Area.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Quercus lyrata	114.4	28.54	108.4	100.1
Gleditsia aquatica	42.9	23.18	68.25	14.3
Forestiera acuminata	42.9	4.29	47.0	500.5
Planera aquatica	28.6	2.86	27.2	243.1
Taxodium distichum	14.3	4.29	17.75	
Ulmus americana	14.3	4.29	17.75	14.3
Quercus phellos	14.3	1.43	13.65	
Ulmus crassifolia				14.3
Vitis L. sp.				14.3
Carya aquatica				14.3
Fraxinus pennsylvanica				42.9
Berchemia scandens				42.9
Brunnichia ovata				100.1
Totals	271.7	68.88	300.0	1101.1

Table IX. Percent cover of the forest floor species in the low understory of the Overcup Oak Forest Type located at Sulphur River Wildlife Management Area. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Polygonum L. sp.		0.1	0.1	
Brunnichia ovata		2.2	0.1	
Planera aquatica				
Forestiera acuminata	0.2			
Quercus lyrata	0.3			
Taxodium distichum	0.1			
Trachelospernum difforme	3.6			
Cephalanthus occidentalis	1.1			
Moss	1.2			
Litter	87.5			
Bare ground	11.3			

Table X. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Overcup Oak Forest Type located at Terre Noire Creek.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Quercus lyrata	60.0	32.1	75.8	200.0
Liquidambar styraciflua	100.0	16.9	74.4	
Quercus nigra	80.0	16.5	68.6	100.0
Arundinaria gigantea	40.0	4.0	32.5	
Carya aquatica	40.0	4.0	32.5	20.0
Quercus phellos	20.0	2.0	16.3	20.0
Forestiera acuminata				20.0
Similax bona-nox				20.0
Ilex decidua				180.0
Toxicodendron radicans				20.0
Cephalanthus occidentalis				20.0
Crataegus marshallii				20.0
Morus rubra				20.0
Berchemia scandens				60.0
Totals	340.0	75.0	300.1	900.0

Table XI. Percent cover of the forest floor species in the low understory of the Overcup Oak Forest Type located at Terre Noire Creek. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Carex L. sp.		4.1		
Toxicodendron radicans		3.1	2.0	
Aster pilosus		2.1		
Arundinaria gigantea		*	2.0	*
Quercus nigra			*	2.0
Smilax bona-nox		*	*	*
Ilex decidua		*		
Chasmanthium sessiliflorum		*		
Liquidambar styraciflua		*		
Berchemia scandens		*		
Ampelopsis arborea			*	
Panicum L. sp.		1.1		
Hypericum L. sp.		1.1		
Moss	6.0			
Litter	65.0			
Bare ground	29.0			

Table XII. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Hackberry Forest Type located at Big Lake National Wildlife Refuge.

Species	Overstory D	BA	I.V.	High Understory (density per acre)
Celtis laevigata	83.0	26.8	83.1	
Populus deltoides	16.6	29.9	49.8	
Taxodium distichum	33.2	13.6	42.4	
Cephalanthus occidentalis	33.2	3.3	31.4	
Acer negundo	33.2	3.4	23.7	
Fraxinus pennsylvanica	16.6	5.0	19.3	20.0
Nyssa aquatica	16.6	4.9	19.3	
Gleditsia aquatica	16.6	5.0	19.2	
Ulmus americana	16.6	1.6	15.8	
Brunnichia ovata				33.2
Totals	265.6	93.56	299.9	53.2

Table XIII. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Hackberry Forest Type located at Holla Bend National Wildlife Refuge.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Celtis laevigata	150.0	23.2	158.0	
Acer negundo	50.0	8.8	67.0	16.6
Morus rubra	33.3	10.3	54.0	
Cornus drummondii				66.6
Parthenocissus quinquelfolia				133.0
Ulmus americana	16.7	1.8	21.0	
Toxicodendron radicans				16.7
Vitis L. sp.				50.0
Totals	250.0	44.1	300.0	283.0

Table XIV. Percent cover of the forest floor species in the low understory of the Hackberry Forest Type located at Holla Bend National Wildlife Refuge. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Geum canadense		3.3		
Acer negundo		*	3.8	
Geum canadense		2.5		
Impatiens capensis		2.6		
Viola palmata		1.8		
Solidago L. sp.		1.8	*	
Rubus L. sp.		*	*	
Toxicodendron radicans			*	
Myosotis virginica		*	*	
Urtica chamedryoides		*	*	
Cornus drummondii		*		
Parthenocissus quinquefolia		*		
Moss	1.5			
Litter	97.0			
Bare ground	1.5			

Table XV. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Sweetgum Forest Type located at Saline River Area, Sevier County.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Liquidambar styraciflua	199.2	25.6	226.4	99.6
Quercus lyrata	33.2	13.4	13.6	
Ulmus alata				199.1
Diospyros virginiana				132.8
Toxicodendron radicans				116.2
Berchemia scandens				99.6
Acer rubrum				83.0
Ilex opaca				66.4
Quercus nigra				66.4
Ulmus americana				66.4
Fraxinus pennsylvanica				49.8
Crataegus L. sp.				33.2
Lonicera japonica				16.6
Ostyra virginiana				16.6
Parthenocissus quinquefolia				16.6
Quercus nuttallii				16.6
Quercus phellos				16.6
Vitis L. sp.				16.6
Totals	232.4	39.0	300.0	1112.1

Table XVI. Percent cover of the forest floor species in the low understory of the Sweetgum Forest Type located at Saline River area, Sevier County. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Toxicodendron radicans		8.5		*
Ostyra virginiana				*
Quercus phellos		*	*	*
Quercus nigra			*	
Trachleospermum difforme		*	*	
Vernonia altissima		*	*	
Diospyros virginiana		*	*	
Cephalanthus occidentalis			*	
Solidago L. sp.		*	*	
Crataegus marshallii		*	*	
Viola palmata		1.75		
Cyperus L. sp.		3.6		
Prunella vulgaris		*		
Leersia virginica		*		
Sanicula canadensis		*		
Geum canadensis		*		
Panicum lanuginosum		2.75		
Ulmus alata		*		
Quercus lyrata		*		
Brunnichia ovata		*		
Parthenocissus quinquefolia		*		
Berchemia scandens		*		
Moss	43.0			
Litter	29.3			
Bare ground	27.7			

Table XVII. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Willow Oak Forest Type located at Dagmar Wildlife Management Area.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Quercus phellos	100.1	129.8	223.9	
Liquidambar styraciflua	28.6	2.9	50.7	128.7
Ulmus americana	14.3	1.4	25.4	14.3
Ulmus crassifolia				28.6
Campsis radicans				14.3
Crataegus viridis				14.3
Diospyros virginiana				14.3
Ostyra virginiana				57.2
Carya ovata				28.6
Berchemia scandens				28.6
Vitis L. sp.				14.3
Morus rubra				14.3
Forestiera acuminata				14.3
Quercus nigra				14.3
Toxicodendron radicans				14.3
Totals	143.0	134.1	300.0	400.4

Table XVIII. Percent cover of the forest floor species in the low understory of the Willow Oak Forest Type located at Dagmar Wildlife Management Area. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Toxicodendrom radicans		6.9	1.6	
Carex L. sp.		3.2	*	
Quercus phellos			*	
Liquidambar styraciflua		*	*	
Rubus L. sp.		*	*	
Cornus drummondii		*	*	
Berchemia scandens		*		
Vitis L. sp.		*		
Smilax L. sp.		*		
Brunnichia ovata		*		
Galactia mohlenbrockii		*	*	
Ostyra virginiana		*		
Crataegus viridis		*		
Trachelospermum difforme		*		
Impatiens capensis			*	
Ulmus crassifolia			*	
Moss	2.3			
Litter	95.3			
Bare ground	2.4			

Table XIX. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Willow Oak Forest Type located at Sulphur River Wildlife Management Area.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Quercus phellos	140.0	46.0	177.4	40.0
Carya aquatica	40.0	8.0	54.3	20.0
Liquidambar styraciflua	20.0	16.0	43.8	
Fraxinus pennsylvanica	20.0	2.7	24.3	
Toxicodendron radicans				60.0
Acer rubrum				20.0
Lonicera japonica				20.0
Rubus sp.				20.0
Ampelopsis arborea				20.0
Quercus lyrata				20.0
Berchemia scandens				20.0
Totals	220.0	72.0	299.8	260.0

Table XX. Percent cover of the forest floor species in the low understory of the Willow Oak Forest Type located at Sulphur River Wildlife Management Area. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Lonicera japonica		*	*	
Pinus echinata			*	
Ulmus americana			*	
Vitis L. sp.			*	
Toxicodendron radicans		1.1	*	
Liquidambar styraciflua			*	
Hypericum L. sp.			*	
Ampelopsis arborea		*	1.2	
Berchemia scandens		*	*	
Lycopus rubellus			*	
Carex L. sp.			*	
Trachelospermum difforme		*		
Ostyra virginiana		*		
Moss	2.5			
Litter	95.0			
Bare ground	2.5			

Table XXI. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Willow Oak Forest Type located at Bayou Deview west of Weiner, Arkansas.

Species	Overstory D	BA	I.V.	High Understory (density per acre)
Quercus phellos	149.4	14.9	156.9	16.6
Ulmus crassifolia	49.8	5.2	60.5	182.6
Quercus nuttallii	16.6	5.0	35.4	
Fraxinus pennsylvanica	16.6	1.7	23.7	
Carya ovata	16.6	1.7	23.7	66.4
Crataegus marshallii				49.8
Forestiera acuminata				16.6
Toxicodendron radicans				16.6
Brunnichia ovata				16.6
Campsis radicans				16.6
Totals	249.0	28.5	300.2	381.8

Table XXII. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Shagbark Hickory Forest Type located at Bayou Meto Wildlife Management Area.

Species	Overstory D	BA	I.V.	High Understory (density per acre)
Carya ovata	83.0	13.9	76.6	99.6
Quercus phellos	83.0	13.6	63.1	49.8
Quercus falcata var. pagodaefolia	16.6	29.8	47.9	16.6
Ulmus crassifolia	49.8	13.7	45.3	282.2
Carya tomentosa	49.8	13.5	51.7	66.4
Quercus stellata	16.6	4.9	15.9	49.8
Trachelospermum difforme				16.6
Ulmus americana				16.6
Forestiera acuminata				116.2
Toxicodendron radicans				149.4
Berchemia scandens				116.2
Ulmus alata				49.8
Dioscorea villosa				16.6
Diospyros virginiana				16.6
Fraxinus americana				66.4
Brunnichia ovata				16.6
Cornus drummondii				83.0
Totals	298.8	89.4	300.5	1228.4

Table XXIII. Percent cover of the forest floor species in the low understory of the Shagbark Hickory Forest Type located at Bayou Meto Wildlife Management Area. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Impatiens capensis		4.8	11.6	
Brunnichia ovata		*	*	
Galium obtusum subsp. obtusum		2.4		1.9
Polygonum sp.		1.5		
Toxicodendron radicans		*		
Carex lupulina		*	*	
Ulmus crassifolia		*		*
Carex L. sp.		*		
Fraxinus americana			*	
Carex L. sp.			*	
Dioscorea villosa		*		*
Carya ovata			*	
Rubus L. sp.			*	
Moss	5.9			
Litter	85.6			
Bare ground	8.5			

Table XXIV. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Water Oak Forest Type located at Dagmar Wildlife Management Area.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Quercus nigra	99.6	53.1	115.7	
Carya ovata	83.0	14.9	69.3	
Liquidambar styraciflua	49.8	8.3	45.0	16.6
Quercus phellos	16.6	29.8	39.1	
Ulmus crassifolia	33.2	6.6	31.0	
Quercus muehlenbergii				33.2
Vitis L. sp.				33.2
Toxicodendron radicans				83.0
Ulmus americana				33.2
Cercis canadensis				49.8
Crataegus L. sp.				49.8
Totals	332.0	112.7	300.1	298.8

Table XXV. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Black Willow-Cottonwood Forest Type located at Holla Bend National Wildlife Refuge.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Acer negundo	166.0	31.5	154.7	33.2
Populus deltoides	66.4	63.1	145.3	
Fraxinus pennsylvanica				16.6
Parthenocissus quinquefolia				99.6
Toxicodendron radicans				199.2
Cornus amomum				16.6
Totals	232.4	94.6	300.0	365.2

Table XXVI. Percent cover of the forest floor species in the low understory of the Black Willow-Cottonwood Forest Type located at Holla Bend National Wildlife Refuge. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Viola palmata		1.7		
Geum canadense		*	*	
Phytolacca americana			*	
Urtica chamaedryoides		*	*	
Toxicodendron radicans		*		
Parthenocissus quinquefolia		*		
Solidago L. sp.		*		
Scycios angulatus		*		
Acer negundo		*		
Rubus L. sp.		*		
Moss	*			
Litter	98.4			
Bare ground	*			

Table XXVII. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Button-Bush-Cypress Forest Type located at Sulphur River Wildlife Management Area.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Taxodium distichum	100.0	11.0	102.0	20.0
Celphalantus occidentalis	60.0	3.6	75.0	1380.0
Planera aquatica	60.0	20.0	68.0	440.0
Salix nigra	60.0	3.6	55.0	180.0
Forestiera acuminata				140.0
Quercus lyrata Walt.				20.0
Totals	280.0	38.2	300.0	2180.0

Table XXVIII. Percent cover of the forest floor species in the low understory of the Buttonbush-Cypress Forest Type located at Sulphur River Wildlife Management Area. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Carex L. sp.		2.2		
Cephalanthus occidentalis			*	
Echinodorus cordifolius		*	*	
Quercus lyrata		*		
Toxodium distichum		*		
Ampelopsis arborea		*		
Planera aquatica		*		
Brunnichia ovata				
Moss	5.5			
Litter	24.1			
Bare ground	70.4			

Table XXIX. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Bald Cypress-Overcup Oak Forest Type located at L'Anguille River west of Colt, Arkansas.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Toxidium distichum	60.0	12.1	106.4	
Quercus lyrata	60.0	6.2	87.0	
Carya aquatica	40.0	6.1	64.5	
Quercus phellos	20.0	6.0	41.9	
Crataegus viridis				100.0
Brunnichia ovata				20.0
Cephalanthus occidentalis				60.0
Campsis radicans				80.0
Ilex decidua				80.0
Ostyra virginiana				20.0
Totals	180.0	30.4	299.8	360.0

Table XXX. Percent cover of the forest floor species in the low understory of the Overcup Oak-Bald Cyrpress Forest Type located at L'Anguille River west of Colt, Arkansas. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Campsis radicans		5.0		
Brunnichia ovata		3.1		
Cephalanthus occidentalis		*		
Aster L. sp.		*		
Moss	2.2			
Litter	35.2			
Bare ground	62.6			

Table XXXI. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Overcup Oak-Water Hickory Forest Type located at Dagmar Wildlife Management Area.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Quercus lyrata	71.9	26.5	140.3	
Carya aquatica	42.9	23.9	97.3	42.9
Liquidambar styraciflua	14.3	1.4	20.9	14.3
Fraxinus pennsylvanica	14.3	1.4	20.9	28.6
Sassafras albidum	14.3	1.4	20.9	
Crataegus L. sp.				42.9
Quercus phellos				14.3
Carya ovata				14.3
Ilex decidua				100.1
Ulmus americana				28.6
Toxicodenderon radicans				14.3
Berchemia scandens				85.8
Totals	157.3	54.6	300.3	386.1

Table XXXII. Percent cover of the forest floor species in the low understory of the Overcup Oak-Water Hickory Forest Type located at Dagmar Wildlife Management Area. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Spirodela punctata		2.9		
Toxicodendron radicans		*		
Ulmus crassifolia		*	*	
Forestiera acuminata		*		
Campsis radicans		*		
Carex L. sp.			*	
Ilex decidua			*	
Berchemia scandens		*	*	
Acer rubrum		*		
Ampelopsis arborea		*		
Viola palmata		*		
Moss	1.3			
Litter	96.7			
Bare ground	2.0			

Table XXXIII. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Overcup Oak-Ironwood Forest Type located at Sulphur River Wildlife Management Area.

Species	Overstory D	BA	I.V.	High Understory (density per acre)
Quercus lyrata	60.0	40.2	106.9	
Ostyra virginiana	320.0	40.0	89.4	20.0
Taxodium distichum	80.0	40.0	54.5	
Celphalanthus occidentalis	180.0	18.0	49.2	320.0
Planera aquatica				80.0
Cornus drummondii				100.0
Berchemia scandens				20.0
Totals	640.0	50.0	300.0	560.0

Table XXXIV. Percent cover of the forest floor species in the low understory of the Overcup Oak-Ironwood Forest Type located at Sulphur River Wildlife Management Area. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Quercus lyrata		10.1	*	
Vitis rotundifolia			*	
Carya aquatica		*	*	
Brunnichia ovata		3.0		
Taxodium distichum		*		
Echinodorus cordifolius		2.0		
Ostyra virginiana		1.3		
Moss	8.7			
Litter	67.1			
Bare ground	24.2			

Table XXXV. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Overcup Oak-Hackberry Forest Type located at Sulphur River Wildlife Management Area.

Species	Overstory D	BA	I.V.	High Understory (density per acre)
Quercus lyrata	140.0	17.0	188.9	80.0
Celtis laevigata	40.0	16.3	111.1	
Planera aquatica				40.0
Ilex decidua				20.0
Berchemia scandens				20.0
Totals	180.0	33.3	300.0	160.0

Table XXXVI. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Overcup Oak-Nuttall Forest Type located at Bayou Deview west of Weiner, Arkansas.

Species	Overstory D	BA	I.V.	High Understory (density per acre)
Quercus lyrata	99.6	30.6	116.4	20.0
Quercus nuttallii	99.6	14.4	81.7	60.0
Fraxinus pennsylvanica	33.2	9.9	43.9	
Ostyra virginiana	49.8	4.9	41.5	40.0
Quercus phellos	16.6	1.7	16.7	
Brunnichia ovata				66.4
Cephalanthus occidentalis				16.6
Ulmus americana				16.6
Totals	298.8	61.5	300.2	249.6

Table XXXVII. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Cherrybark Oak-Shagbark Hickory Forest Type located at Wattensaw Wildlife Management Area.

Species	Overstory D	BA	I.V.	High Understory (density per acre)
Quercus falcata var. pagodaefolia	66.4	51.4	134.4	
Carya ovata	49.8	13.5	76.7	
Quercus stellata	16.6	19.9	44.4	16.6
Quercus phellos	16.6	19.9	44.4	
Ulmus americana				234.4
Rubus L. sp.				16.6
Quercus nigra				49.8
Fraxinus pennsylvanica				16.6
Diospyros virginiana				16.6
Toxicodendron radicans				66.4
Totals	149.4	104.7	299.9	415.0

Table XXXVIII. Percent cover of the forest floor species in the low understory of the Cherrybark Oak-Shagbark Hickory Forest Type located at Wattensaw Wildlife Management Area. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Toxicodendron radicans		*		
Diospyros virginiana		*		
Carya ovata		*		
Forestiera acuminata		*		*
Amelanchier arborea			*	
Ulmus alata			*	
Quercus falcata var. pagodaefolia		*		
Trachleospermum difforme		*		
Vitis L. sp.		*		
Carex L. sp.		*		
Passiflora lutea		*		
Moss	1.1			
Litter	93.0			
Bare ground	5.9			

Table XXXIX. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Water Oak-Sweetgum Forest Type located at Dagmar Wildlife Management Area.

Species	Overstory D	Overstory BA	Overstory I.V.	High Understory (density per acre)
Quercus nigra	99.6	40.4	167.3	49.8
Liquidambar styraciflua	149.4	5.8	113.8	83.0
Ostyra virginiana	16.6	1.7	18.9	49.8
Berchemia scandens				83.0
Smilax L. sp.				16.6
Toxicodendron radicans				199.2
Forestiera acuminata				215.8
Diospyros virginiana				16.6
Ulmus crassifolia				132.8
Vitis L. sp.				33.2
Ulmus americana				33.2
Carya ovata				16.6
Cornus drummondii				16.6
Campsis radicans				16.6
Totals	265.6	47.9	300.0	962.8

Table XL. Percent cover of the forest floor species in the low understory of the Water Oak-Sweetgum Forest Type located at Dagmar Wildlife Management Area. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Toxicodendron radicans		21.3	3.0	
Carex L. sp.		3.0	*	
Rubus L. sp.		*	2.3	
Ilex decidua			*	
Liquidambar styraciflua		*	*	
Ulmus crassifolia		*	*	
Ampelopsis arborea			*	
Desmodium glutinosum			*	
Berchemia scandens		*	*	
Carya aquatica		*		
Viola palmata		*		
Crataegus L. sp.		*		
Quercus phellos		*		
Smilax L. sp.		*		
Campsis radicans		*		
Impatiens capensis		*		
Moss	1.4			
Litter	97.1			
Bare ground	1.5			

Table XLI. Density (D) and basal area (BA) per acre, and importance value (I.V.) of overstory trees and density per acre of saplings, shrubs, and woody vines in the high understory of the Water Oak-Pine Forest Type located at Bodcau Creek.

Species	Overstory D	BA	I.V.	High Understory (density per acre)
Quercus nigra	132.8	10.6	112.6	83.0
Pinus echinata	66.4	10.2	79.4	
Liquidambar styracifua	49.8	5.0	49.7	33.2
Betula nigra	18.6	1.6	19.4	16.6
Acer rubrum	16.6	1.7	19.4	33.2
Quercus phellos	16.6	1.6	19.4	49.8
Smilax rotundifolia				348.6
Berchemia scandens				232.4
Ostyra virginiana				166.0
Lonicera japonica				132.8
Toxicodendron radicans				83.0
Ilex decidua				16.6
Quercus lyrata				16.6
Totals	298.8	30.7	299.9	1211.8

Table XLII. Percent cover of the forest floor species in the low understory of the Water Oak-Pine Forest Type located at Bodcau Creek. Asterisk (*) indicates a percent cover of 1 or less.

Species	Ground	Ground to 6"	6" to 2'	2' to 4.5'
Ostyra virginiana			2.0	
Solidago L. sp.			*	
Acer rubrum			*	
Toxicodendron radicans		32.6	*	
Lonicera japonica		4.8	*	
Ilex decidua		*	*	
Nyssa sylvatica		*		
Quercus nigra		*		
Moss	*			
Litter	98.7			
Bare ground	*			

APPENDIX II. County, location of sites, and sequences of forest types observed along decreasing moisture gradients in the study area.

County	Location	Sequence of types	Remarks
Arkansas	Bayou Meto west of Lodge Corner	Bald cypress-tupelo-buttonbush-disturbed area	Mixed stand at bald cypress and tupelo with buttonbush on drier area of the stand
Arkansas	Bayou Meto near upper Vallier School access	Tupelo-willow oak-shagbark hickory-road	Tupelo in low area - other species on drier banks
Ashley	Felsenthal National Wildlife Refuge on east bank of Ouachita River	Black willow-overcup oak-Nuttall oak-disturbed area	—
Bradley	Bank of Saline River east of Warren	Black river birch-pine-cultivated field	Steep bank
Bradley	Ouachita River area near Moro Bay State Park	Black willow-water hickory-disturbed area	Steep bank above river
Calhoun	Ouachita River near Camden	Green ash-hackberry-willow oak-field	Disturbed area
Chicot	Lake Chicot State Park	Bald cypress-buttonbush-oakcup oak-willow oak	Gentle slope

County	Location	Sequence of types	Remarks
Clark	Terre Noire Creek area between Arkadelphia and Gurdon	Overcup oak-sweetgum-water oak-road	Flat, dissected area on each site of creek
Columbia	Bayou west of Waldo near Highway 98	Black willow-buttonbush-bush-willow oak-field	Stream channel with steep bank, then flat area. Extensively disturbed
Desha	White River National Wildlife Refuge near Arkansas Post Canal	Water elm-water locust-swamp privet-overcup oak-hackberry-field	Low gently sloping area
Desha	River bank near Lock and Dam 2 on Arkansas River	Black willow-buttonbush-levee-field	Streamside site
Drew	Bayou Bartholomew near Tillar	Buttonbush-overcup oak-hackberry-field	Flat area near creek, then steep bank away from bayou
Faulkner	Lake Conway, Bell Slough	Bald cypress-buttonbush-overcup oak-disturbed area	Site located in wetland area of Fourche section of Quachita Mts.
Franklin	Arkansas River south of Ozark	Black willow-cottonwood-natural levee-cultivated area	—

County	Location	Sequence of types	Remarks
Greene	Johnson Creek near Highway 1 east of Paragould	Black willow-box elder-green ash-field	Channelized stream bank
Greene	Big ditch slough east of Marmaduke at Highway 34	Black willow-river locust-cottonwood-upland grassy area	Channelized stream
Hempstead	Beard Lake near Milwood Dam	Black willow-buttonbush-water elm-cedar elm-willow oak-water oak-deciduous holly-mowed area	Gradually sloping area from Oxbow Lake
Howard	Saline River east of Lockesburg	Bald cypress-silver maple-Nuttall oak-winged elm-willow oak-water oak-upland forest	Sluggish stream with cypress in water, steep bank with typical stream-site species, then flat poorly drained area. Understory a mixture of wetland and non-wetland species

County	Location	Sequence of types	Remarks
Jackson	Village Creek northeast of Tuckerman	Bald cypress-tupelo-buttonbush, black willow-cottonwood-black river birch-green ash-American elm-willow oak-water oak-field	Stream channelized approx. 50 years previously, cypress-tupelo-buttonbush along edge of channel, other species on adjacent gently-sloping bottomland
Jefferson	Trulock Park	Black willow-cottonwood-water hickory-upland forest	Typical bank habitat of Arkansas River
Lincoln	Bayou Bartholomew east of Star City	Black willow-cottonwood-sycamore-green ash-sweetgum-cherrybark oak-meadow	Water flowing in from small creek nearby, local riparian conditions with flowing water
Lincoln	Bayou Bartholomew near Highway 293	Bald cypress-swamp privet-water hickory-water locust-meadow	—
Lincoln	Bayou Bartholomew Highway 293 near Fresno	Bald cypress-buttonbush-ironwood-water locust-sweet pecan-water oak-American elm-field	Backwater area. Moderate slope from water to upper bank then flat

County	Location	Sequence of types	Remarks
Lonoke	Lake in Toltec Mound State Park Area	Bald cypress-buttonbush-overcup oak-water oak-cherrybark oak-meadow	Edge of Oxbow Lake
Miller	Bodcau Creek	Bald cypress-tupelo-buttonbush-swamp privet-overcup oak-sweetgum-water oak-pine-field	Slow flowing creek, wide area, then steep bank, flat area, and mixed pine-water oak forest
Miller	Bodcau Creek	Bald cypress-tupelo-black river birch-ironwood-deciduous holly-water oak-field	Slow flowing creek, steep bank and flat, dissected first bottom
Miller	Bodcau Creek	Tupelo-overcup oak-ironwood-black river birch-water oak-field	---
Miller	Red River east of Garland	Black willow-cottonwood-cultivated fields	---
Miller	Sulphur River Wildlife Management Area near boat launch area on east side	Bald cypress-buttonbush-water elm-swamp privet-overcup oak-willow oak-water oak-upland forest	Gradual slope away from backwater area

County	Location	Sequence of types	Remarks
Mississippi	Big Lake National Wildlife Refuge	Bald cypress-ironwood-hackberry-road	Steep, disturbed slope, backwater area
Mississippi	Near Osceola	Black willow-cottonwood-top of levee	Bank of Mississippi River
Mississippi	Big Lake National Refuge	Bald cypress-silver maple-box elder-road	Along channel cut into area, northern part of refuge
Monroe	Dagmar Wildlife Management Area	American elm-sweetgum-willow oak-road	Gentle slope dissected by shallow channels
Monroe	Bank of White River where Arkansas highway No. 1 crosses the river	Swamp privet-overcup oak-hackberry-nuttall oak-green ash	Flat area near river, then sloping upward
Ouachita	Ouachita River east of Camden	Bald cypress-buttonbush-overcup oak-disturbed area	Forest extensively disturbed
Phillips	Edge of Old Town Lake	Bald cypress-overcup oak-disturbed area	---

County	Location	Sequence of types	Remarks
Phillips	East side of White River in National Wildlife Refuge near White River-Sugarberry Research Natural Area	Overcup oak-Nuttall oak-hackberry-American elm-willow oak-sweetgum-levee	Low, nearly flat area dissected by channels
Poinsett	Bayou Deview near Weiner	Black willow-cottonwood-silver maple-green ash-persimmon-cedar-elm-meadow	Black willow-cottonwood near stream, other species on adjacent uplands
Pope	Arkansas River near Dardanelle	Black willow-cottonwood-cultivated area	---
Pope	Holla Bend National Wildlife Refuge	Black willow-cottonwood-box elder-field	Gently sloping area toward water box elder forms high understory beneath old cottonwoods
Prairie	Wattensaw Wildlife Management Area	Willow oak-cherrybark oak-shagbark hickory-post oak	Gentle slope from infrequently flooded area to upland
St. Francis	L'Anguille River west of Colt	Bald cypress-overcup oak-water hickory-willow oak-road	Stream channel with cypress, then flat area and steep bank with gently sloping willow oak stand

County	Location	Sequence of types	Remarks
Union	Edge of Calion Lake	Bald cypress-buttonbush-overcup oak-road	---
Woodruff	Black Swamp Wildlife Management Area	Bald cypress-tupelo-overcup oak-willow oak-pine	Site gently sloping
White	Hurricane Lake Wildlife Management Area	Green ash-American elm-mockernut hickory-shagbark hickory-cherrybark oak-white oak	Infrequently flooded area

APPENDIX III. Index of scientific names

Scientific names	Common names
Acer negundo L.	Box Elder
Acer rubrum L.	Red Maple
Acer saccharinum L.	Silver Maple
Acer saccharum Marsh.	Sugar Maple
Amelanchier arborea (Michx. f.)Fern	Service Berry
Amorpha fruticosa L.	River Locust
Ampelopsis arborea (L.) Koehne	Pepper Vine
Arundinaria gigantea (Walt.) Muhl.	Cane
Aster L. sp.	Aster
Aster pilosus Willd.	Heath Aster
Berchemia scandens (Hill) K. Koch	Rattan Vine
Betula nigra L.	River Birch
Brunnichia ovata (Walt.) Shinners	Eardrop Vine
Campsis radicans (L.) Seem.	Trumpet Vine
Carex lupulina Muhl. ex Schkuhr	Sedge
Carex L. sp.	Sedge
Carya aquatica (Michx. f.)Nutt.	Water Hickory
Carya cordiformis (Wang.) K. Koch	Bitternut Hickory
Carya illinoensis (Wang.) K. Koch	Sweet Pecan
Carya ovata (Mill.) K. Koch	Shagbark Hickory
Carya tomentosa (Poir.) Nutt.	Mockernut Hickory
Celtis laevigata Willd.	Hackberry
Cephalanthus occidentalis L.	Buttonbush
Cercis canadensis L.	Redbud
Chasmanthium latifolium (Michx.) Yates	Bangle Grass
Chasmanthium sessiliflorum (Poir.) Yates	Chasmanthium
Commelina virginica L.	Day Flower
Cornus amomum Mill.	Swamp Dogwood
Cornus drummondii Meyer	Roughleaf Dogwood
Crataegus marshallii Egglest	Pursley Haw
Crataegus viridis L.	Green Haw
Crataegus L. sp.	Hawthorn
Cyperus L. sp.	Flatsedge
Desmodium glutinosum (Muhl.) Wood.	Beggar's Lice
Dioscoria villosa L.	Wild Yam
Diospyros virginiana L.	Persimmon
Echinodorus cordifolius (L.) Griseb.	Creeping Burhead

Forestiera acuminata (Michx.) Poir.	Swamp Privet
Fraxinus americana L.	White Ash
Fraxinus pennsylvanica Marsh.	Green Ash
Galactia mohlenbrockii Maxwell	Galactia
Galium L. sp.	Bedstraw
Galium obtusum Bigel. subsp. obtusum	Bedstraw
Geum canadense Jacq.	White Avens
Gleditsia aquatica Marsh.	Water Locust
Hypericum L. sp.	St. John's Wort
Ilex decidua Walt.	Deciduous Holly
Ilex opaca Ait.	American Holly
Impatiens capensis Merrb.	Balsam
Leersia virginica Willd.	White Grass
Liquidambar styraciflua L.	Sweet Gum
Lonicera japonica Thunb.	Japanese Honeysuckle
Lycopus rubellus Moench.	Bugle Weed
Morus rubra L.	Mulberry
Myosotis virginica (L.) BSP.	Scorpion Grass
Nyssa aquatica L.	Water Tupelo
Nyssa sylvatica Marsh.	Black Gum
Ostyra virginiana (Mill.) K. Koch	Ironwood
Panicum lanuginosum Ell.	Panic Grass
Panicum L. sp.	Panic Grass
Parietaria pennsylvanica Muhl.	Pellitory
Parthenocissus quinquefolia (L.) Planch.	Virginia Creeper
Passiflora lutea L.	Yellow Passion Flower
Penstemon digitalis Nutt.	Beard Tongue
Phytolacca americana L.	Pokeweed
Pinus echinata Mill.	Shortleaf Pine
Planera aquatica Walt. ex Gmelin	Water Elm
Platanus occidentalis L.	Sycamore
Polygonum L. sp.	Smartweed
Polygonum virginicum L.	Smartweed
Populus deltoides Marsh.	Cottonwood
Prunus mexicana S. Wats.	Big Tree Plum
Prunus serotina Ehrh.	Black Cherry
Quercus alba L.	White Oak
Quercus falcata Michx. var. pagodaefolia Ell.	Cherrybark Oak
Quercus lyrata Walt.	Overcup Oak
Quercus marilandica Muenchh.	Blackjack Oak
Quercus muehlenbergii Engelm.	Chestnut Oak
Quercus nigra L.	Water Oak
Quercus nuttallii Palmer	Nuttall Oak
Quercus phellos L.	Willow Oak
Quercus stellata Wang.	Post Oak

Quercus velutina Lam.	Black Oak
Robinia pseudo-acacia L.	Black Locust
Rubus L. sp.	Blackberry
Salix nigra Marsh.	Black Willow
Sambucus canadense L.	Common Elderberry
Sanicula canadensis L.	Black Snakeroot
Sassafras albidum (Nutt.) Nees	Sassafras
Smilax bona-nox L.	Greenbrier
Smilax rotundifolia L.	Greenbrier
Smilax L. sp.	Greenbrier
Solidago L. sp.	Goldenrod
Spigelia marilandica L.	Indian Pink
Spirodela punctata (Meyer) Thompson	Big Duckweed
Scycyos angulatus L.	Bur Cucumber
Taxodium distichum (L.) Rich.	Bald Cypress
Toxicodendron radicans (L.) Kuntze	Poison Ivy
Trachelospermum difforme (Walt.) Gray	Climbing Dogbane
Ulmus alata Michx.	Winged Elm
Ulmus americana L.	American Elm
Ulmus crassifolia Nutt.	Cedar Elm
Urtica chamaedryoides Pursh	Stinging Nettle
Vernonia altissima Nutt.	Ironweed
Viola palmata L.	Violet
Vitis L. sp.	Wild Grape
Vitis rotundifolia Michx.	Muscadine
Zanthoxylum clava-herculis L.	Hercules Club

APPENDIX IV. Index of common names.

Common names	Scientific names
American Elm	Ulmus americana L.
American Holly	Ilex opaca Ait.
Aster	Aster L. sp.
Bald Cypress	Taxodium distichum (L.) Rich.
Balsam	Impatiens capensis Meerb.
Bangle Grass	Chasmanthium latifolium (Michx.) Yates
Beard Tongue	Penstemon digitalis Nutt.
Bedstraw	Galium obtusum Bigel. subsp. obtusum
Beggars Lice	Desmodium glutinosum (Muhl.) Wood.
Big Duckweed	Spirodela punctata (Meyer) Thompson
Big Tree Plum	Prunus mexicana S. Wats
Bitternut Hickory	Carya cordiformis (Wang.) K. Koch.
Blackberry	Rubus L. sp.
Black Cherry	Prunus serotina Ehrh.
Black Gum	Nyssa sylvatica Marsh.
Blackjack Oak	Quercus marilandica Muenchh.
Black Locust	Robinia pseudo-acacia L.
Black Oak	Quercus velutina Lam.
Black Snakeroot	Sanicula canadensis L.
Black Willow	Salix nigra Marsh.
Box Elder	Acer negundo L.
Bugle Weed	Lycopus rubellus Moench.
Bur Cucumber	Scycyos angulatus L.
Button Bush	Cephalanthus occidentalis L.
Cane	Arundinaria gigantea (Walt.) Muhl.
Cedar Elm	Ulmus crassifolia Nutt.
Chasmanthium	Chasmanthium sessiliflorum (Poir.) Yates
Cherry Bark Oak	Quercus falacata Michx. var. pagodaefolia Ell.
Chestnut Oak	Quercus muehlenbergii Engelm.
Climbing Dogbane	Trachelospermum difforme (Walt.) Grey
Common Elder Berry	Sambucus canadense L.
Cottonwood	Populus deltoides Marsh
Creeping Burhead	Echinodorus cordifolius (L.) Griseb.
Day Flower	Commelina virginica L.
Deciduous Holly	Ilex decidua Walt.
Eardrop Vine	Brunnichia ovata (Walt.) Shinners

Flatsedge	Cyperus L. sp.
Galactia	Galactia mohlenbrockii Maxwell
Goldenrod	Solidago L. sp.
Green Ash	Fraxinus pennsylvanica Marsh.
Green Brier	Smilax L. sp.
Green Brier	Smilax bona-nox L.
Green Briar	Smilax rotundifolia L.
Green Haw	Crataegus viridis L.
Hackberry	Celtis laevigata Willd.
Hawthorn	Crataegus L. sp.
Heath Aster	Aster pilosus Willd.
Hercules Club	Zanthoxylum clava-herculis L.
Indian Pink	Spigelia marilandica L.
Ironweed	Vernonia altissima Nutt.
Ironwood	Ostyra virginiana (Mill.) K. Koch
Japanese Honeysuckle	Lonicera japonica Thunb.
Mockernut Hickory	Carya tomentosa (Poir.) Nutt.
Mulberry	Morus rubra L.
Muscadine	Vitis rotundifolia Michx.
Nuttall Oak	Quercus nuttallii Palmer
Overcup Oak	Quercus lyrata Walt.
Panic Grass	Panicum lanuginosom Ell.
Parsley Haw	Crataegus marshallii Egg Lest
Pellitory	Parietaria pennsylvanica Muhl.
Pepper Vine	Ampelopsis arborea (L.) Koehne
Persimmon	Diospyros virginiana L.
Poison Ivy	Toxicodendron radicans (L.) Kuntze
Pokeweed	Phytolacca americana L.
Post Oak	Quercus stellata Wang.
Rattan Vine	Berchemia scandens (Hill) K. Koch
Red Bud	Cercis canadensis L.
Red Maple	Acer rubrum L.
River Birch	Betula nigra L.
River Locust	Amorpha fruticosa L.
Rough-leaf Dogwood	Cornus drummondii Meyer
St. John's Wort	Hypericum L. sp.
Sassafras	Sassafras albidum (Nutt.) Nees.
Scorpion Grass	Myosotis virginica (L.) BSP.
Sedge	Carex L. sp.
Sedge	Carex lupulina Muhl. ex Schkuhr.
Service Berry	Amelanchier arborea (Michx. F.) Fern
Shagbark Hickory	Carya ovata (Mill.) K. Koch
Shortleaf Pine	Pinus echinata Mill.
Smartweed	Polygonum L. sp.
Smartweed	Polygonum virginicum L.

Stinging Nettle	Urtica chamaedryoides Pursh.
Sugar Maple	Acer saccharum Marsh.
Swamp Dogwood	Cornus amomum Mill.
Swamp Privet	Forestiera acuminata (Michx.) Poir.
Sweet Gum	Liquidambar styraciflua L.
Sweet Pecan	Carya illinoensis (Wang.) K. Koch
Sycamore	Platanus occidentalis L.
Trumpet Vine	Campsis radicans (L.) Seem
Violet	Viola palmata L.
Virginia Creeper	Parthenocissus quinquefolia (L.) Planch
Water Elm	Planera aquatica Walt. ex Gmelin
Water Hickory	Carya aquatica (Michx. F.) Nutt.
Water Locust	Gleditsia aquatica Marsh
Water Oak	Quercus nigra L.
Water Tupelo	Nyssa aquatica L.
Western Mayhaw	Crataegus opaca Hook
White Ash	Fraxinus americana L.
White Avens	Geum canadense Jacq.
White Grass	Leersia virginica Willd.
White Oak	Quercus alba L.
Wild Grape	Vitis L. sp.
Wild Yam	Dioscorea villosa L.
Willow Oak	Quercus phellos L.
Winged Elm	Ulmus alata Michx.
Yellow Passion Flower	Passiflora lutea L.

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