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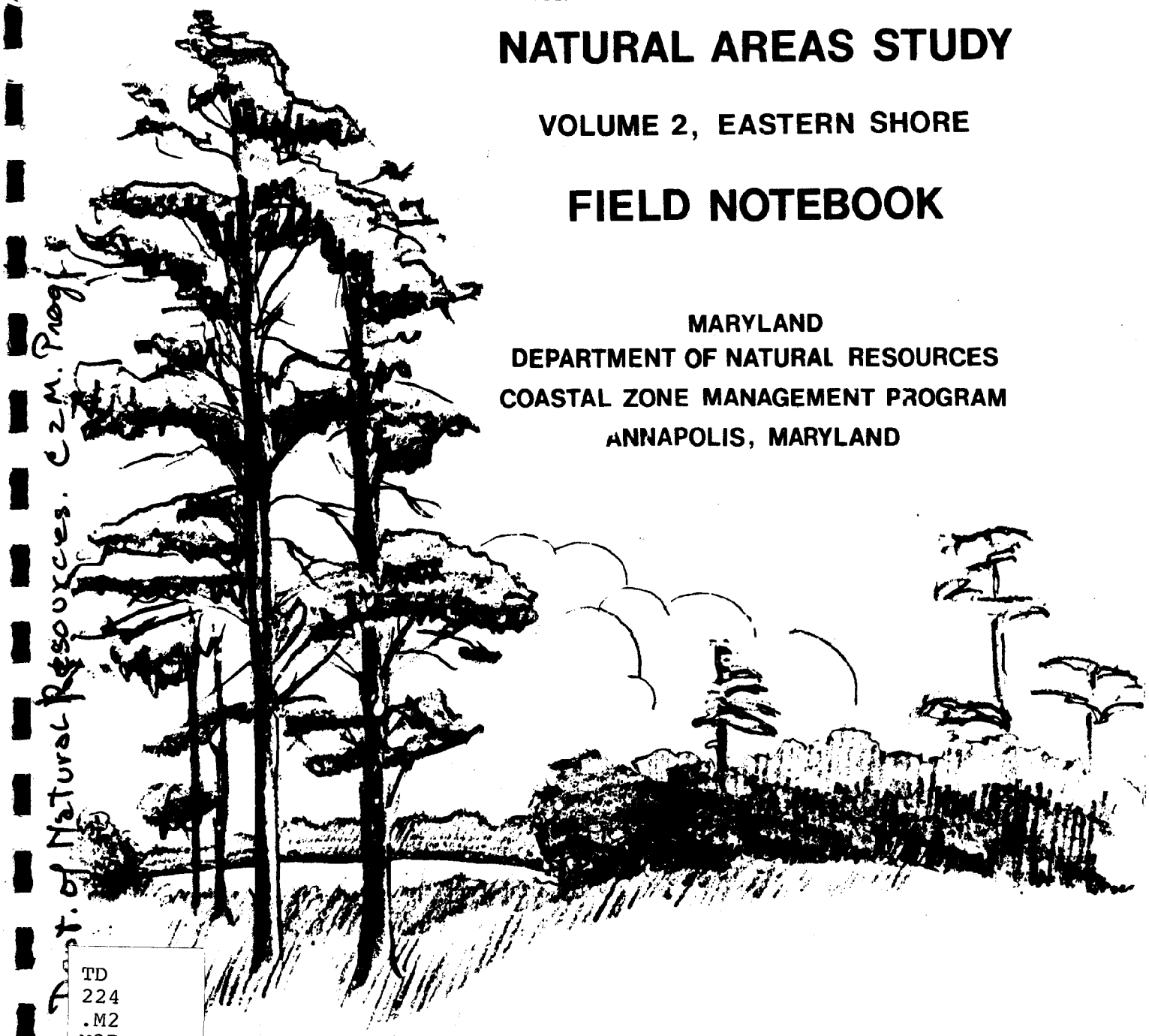
MARYLAND UPLANDS NATURAL AREAS STUDY

VOLUME 2, EASTERN SHORE

FIELD NOTEBOOK

MARYLAND
DEPARTMENT OF NATURAL RESOURCES
COASTAL ZONE MANAGEMENT PROGRAM
ANNAPOLIS, MARYLAND



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MARYLAND UPLANDS NATURAL AREAS STUDY

Volume 2 Eastern Shore
FIELD NOTEBOOK

Prepared for

Maryland Department of Natural Resources

Coastal Zone Management Program

March, 1976

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For further information contact:

Coastal Zone Management Program
Tawes State Office Building
Annapolis, Maryland 21401

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Prepared by: John Rogers, Stephan Syz and Fritts Golden

Rogers and Golden, Inc., 31 W. Allens Lane, Philadelphia, Pennsylvania 19119

(215) 242-6858

JAMES B. COULTER
SECRETARY

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
ENERGY & COASTAL ZONE ADMINISTRATION
TAWES STATE OFFICE BUILDING
ANNAPOLIS 21401

LOUIS N. PHIPPS, JR.
DEPUTY SECRETARY

CZM
MAY -3 PM 2:29
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MT

April 26, 1976

Dear Sir:

Enclosed for your information is Volume II of the Coastal Management Program's Upland Natural Areas Study. This volume details the actual methodology used in surveying potential natural areas on Maryland's Eastern Shore. It should serve both as a reference for those using the data from this study or as a field notebook for those interested in carrying out additional surveys.

Maps giving the location of sites inventoried and data on individual sites will be available shortly by request. If you wish additional information concerning this study please contact:

Maryland Department of Natural Resources
Coastal Management Program
Tawes State Office Building, B-3
Annapolis, Maryland 21401

301-267-1784

Sincerely,

Ken Perkins

Kenneth E. Perkins, Director
Coastal Management Program, E&CZA

KEP:dls

Enclosure

PREFACE

To meet the requirements of the Coastal Zone Management Act and to fulfill the Department of Natural Resources obligation to the SCS Delmarva River Basins Survey, a thorough inventory and assessment of natural areas is to be undertaken by the Maryland Coastal Zone Management Program.

The Field Notebook incorporated in this volume represents the methodology developed by the Coastal Zone Management Program for sampling upland natural areas on Maryland's Eastern Shore. The notebook contains a description of the natural history of the shore as well as a description of the methods and techniques for data collection. It is intended to serve as a manual for organizations or individuals who may be interested in carrying out field surveys of upland sites on the Eastern Shore.

The process used to develop the sampling methodology described in this report is documented in Volume 1 of this series, Maryland's Upland Natural Areas Study. A great effort was made to obtain input into the methodology from potential users of this study and from experts in the various subject areas for which sample information was to be obtained. This information was then synthesized into a sampling procedure. The sampling procedure was designed to enable field personnel to quickly obtain a concise accurate characterization of each site. The sampling is not meant to be a substitute for the detailed site assessments needed for a final project evaluation but to provide a means of screening a large number of sites for specific uses.

Approximately 400 sites have been sampled on the Eastern Shore using this methodology, the results of which will be made available in computer format for potential data users. In addition, the sites will be evaluated based on the data collected for possible designation as critical areas of state concern. As it is currently planned, the Field Notebook will be revised to make it applicable to Maryland's Western Shore and sites will be sampled there during the 1976 field season.

ACKNOWLEDGEMENT

This study was greatly aided by information and advice from many experts and professionals. Special thanks are due the following individuals:

John Antenucci, Department of State Planning; Earl Bradley, Coastal Zone Management Program; Grace Brush, Johns Hopkins University; King Burnett, Maryland Environmental Trust; James Burtis, Forestry Service; Nick Carter, Fisheries Administration; Howard Erickson, Towson College; Francis Golet, University of Rhode Island; Herbert Harris, Natural History Society of Maryland; Bernard Holla, Wildlife Administration; Lee Jaslow, Environmental Services; William Kramer, Capital Programs Administration; Randy Kerhin, Maryland Geological Survey; Steve Long, Power Plant Siting; Bruce Nichols, Soil Conservation Service; Ralph Petcher, Superintendent, Tuckahoe State Park; Chandler Robbins, Patuxent Wildlife Research Station; Kenneth Ropp, Capital Programs Administration; Lewis Rudasill, Capital Programs Administration; Craig Ten Broeck, Wildlife Administration; Tom Siccama, Yale University.

As is apparent from the variety of people with whom we have worked, the study incorporates a diversity of disciplines. In bringing the various elements together, we have relied heavily on the knowledge and labor of the professional staffs of the Department of Natural Resources, the Department of State Planning, and the Soil Conservation Service as well as members of the scientific community. In addition, we have had the good fortune to be able to visit with many knowledgeable and interested residents of the Eastern Shore. We are grateful for the courtesies, hospitality, and kindness they showed us, as well as for their valuable insights.

We are especially appreciative of the congenial working atmosphere created by Tom Chaney and Bill Jackson of the Coastal Zone Management Program, and of the advice and cooperation they have offered. The permission of Francis Golet to include his paper "Classification and Evaluation of Freshwater Wetlands as Wildlife Habitat in the Glaciated Northeast" in this report is gratefully acknowledged.

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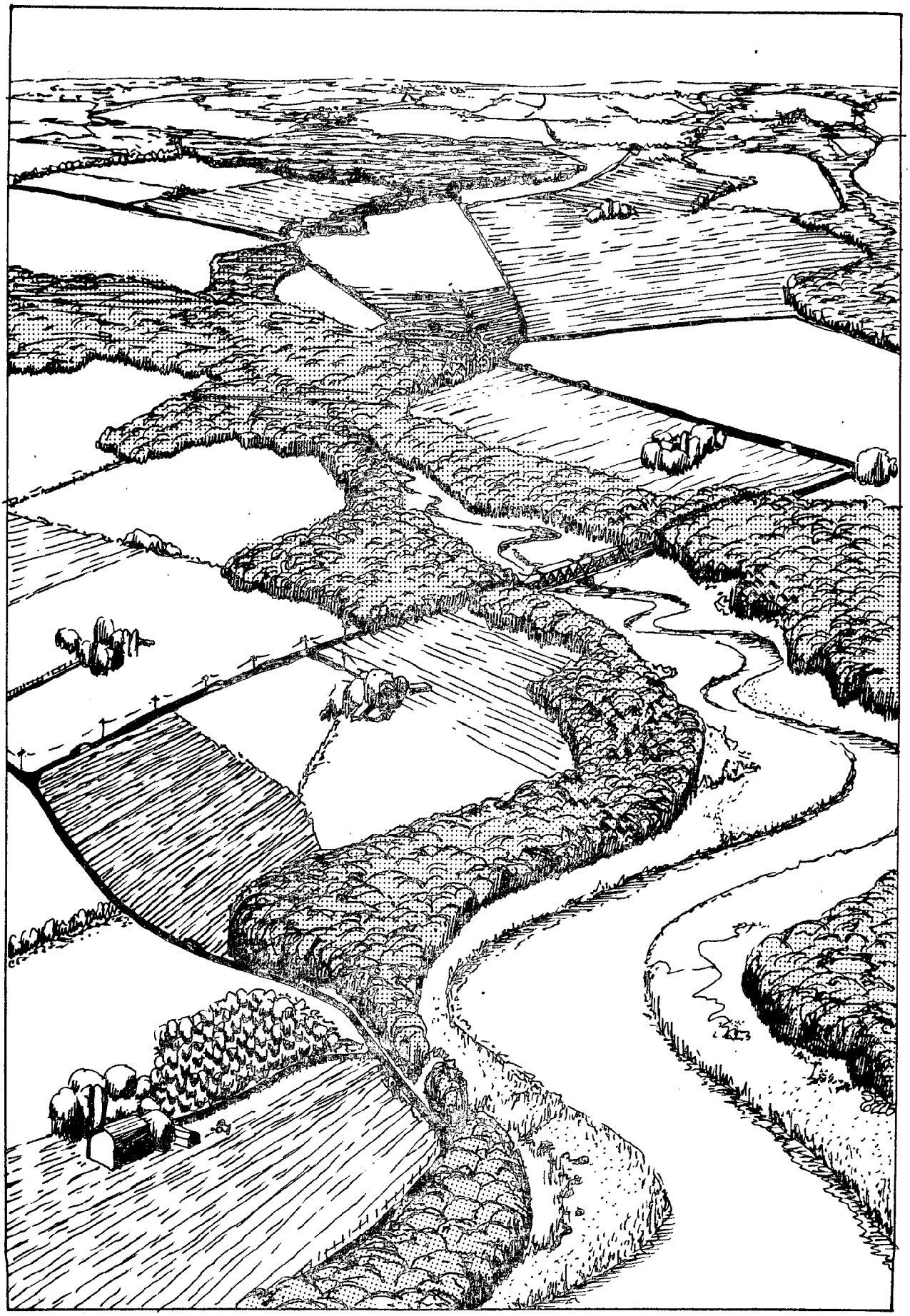


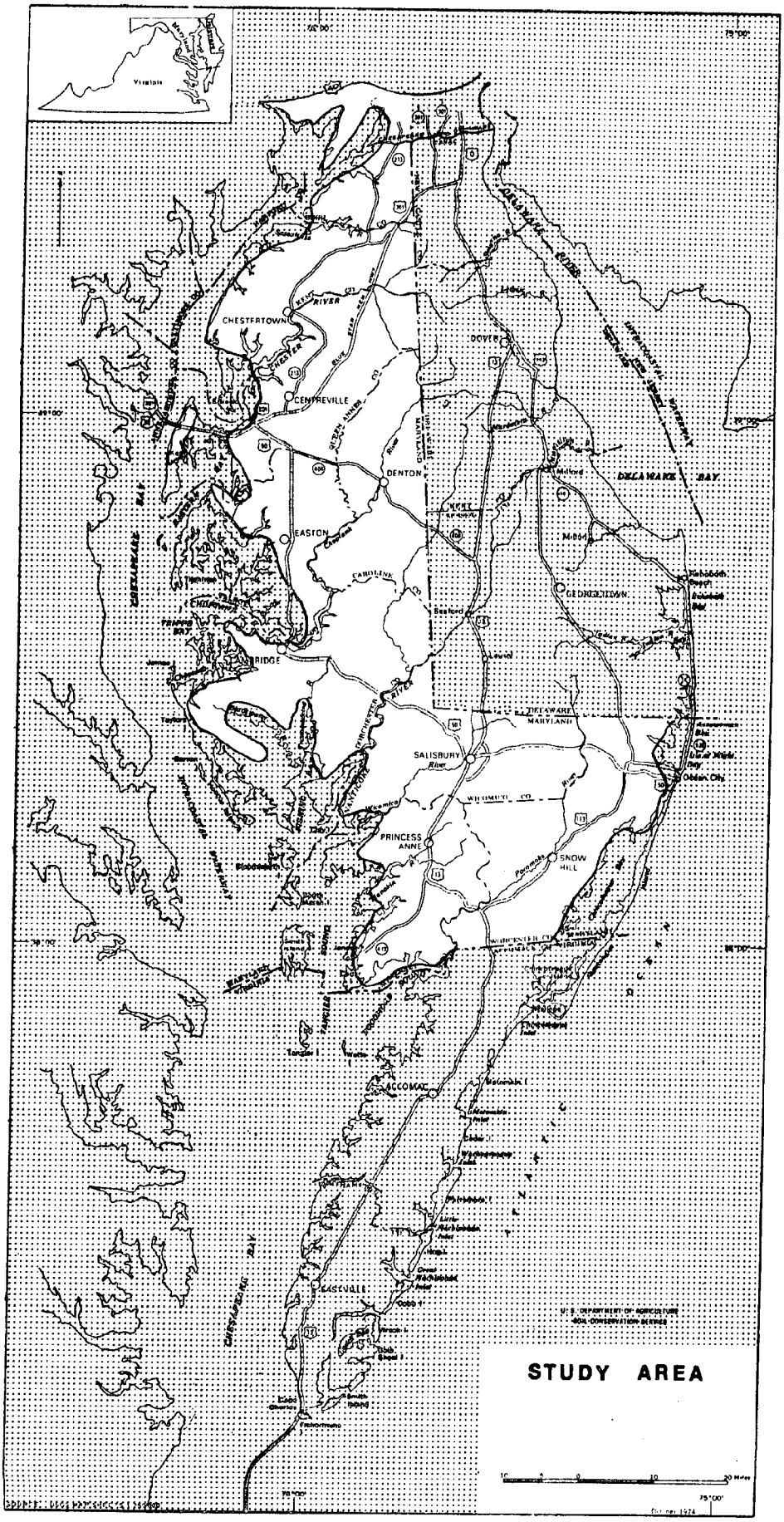
INTRODUCTION

As part of the ongoing effort by the Maryland Coastal Zone Management Program to describe and assess the resources of Maryland's coastal areas, the CZM program has undertaken a field inventory and evaluation of upland natural areas in the sixteen coastal counties. For the purposes of this study, upland natural areas in Maryland's Coastal Plain are defined as areas where, at present, natural processes predominate and are not significantly influenced by either deliberate manipulation or accidental interference by man. Tidal areas were excluded from this study and will be subjected to a separate inventory and assessment.

The purpose of the Upland Natural Areas Study is to provide both objective and descriptive data on identified natural areas. The methodology for doing this is described in this volume. This information will be used to (1) describe and evaluate the inherent value of an area as a natural ecological unit and (2) ascertain the value of specific areas for certain compatible uses. It is anticipated that this data will prove useful to a variety of federal, state and local agencies as well as private organizations and individuals as a means to evaluate the selective significances and ecological role of various coastal zone natural areas on the Eastern Shore.

The sampling procedure as developed for the Eastern Shore includes fifty parameters both objective and subjective. Subjective in this case means the field surveyor must make a decision based on his or her experience. In order to carry out the sampling, ten individuals with backgrounds in field biology, botany, forestry, and wildlife management were divided into teams of two. Each team was assigned a county in which they were responsible for inventorying all identified sites. The actual site selective process is described elsewhere in this report. At the start of the inventory, all teams went through a five day training period to familiarize them with the sampling methodology and to try to standardize their sampling techniques. In addition, one field surveyor acted as field manager floating from team to team to help maintain the consistency of the sampling techniques between field teams.

The report that follows is organized into three sections. First, the study area is described in terms of its geology, physiography, and vegetation communities. Representative cross sections of the different vegetation communities are included. This is followed by a brief overview of the site selection process, the data management system and the parameters and potential uses that were sampled for. The remaining portion of the report covers the detailed encoding instructions for filling out the field data forms. These instructions are organized by data card as shown on the sample field data form.


STUDY AREA
CHESTERTOWN
CENTREVILLE
DENTON
EASTON
DOVER
GEORGETOWN
SALISBURY
PRINCESS ANNE
SNOW HILL
ACCOMAC
DELAWARE BAY
DELAWARE
MARYLAND
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STUDY AREA

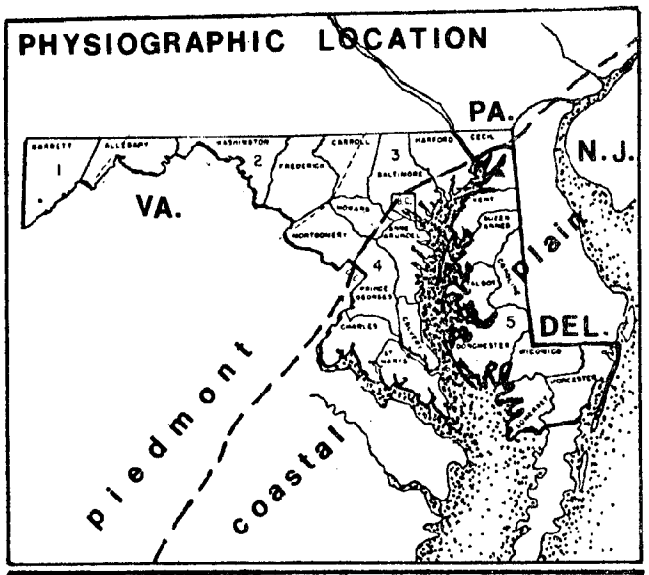
The study area is confined to upland natural areas and non-tidal freshwater wetlands on Maryland's Eastern Shore. The Eastern Shore is considered to be that part of Maryland which is on the Delmarva Penninsula south of U.S. Highway 40.

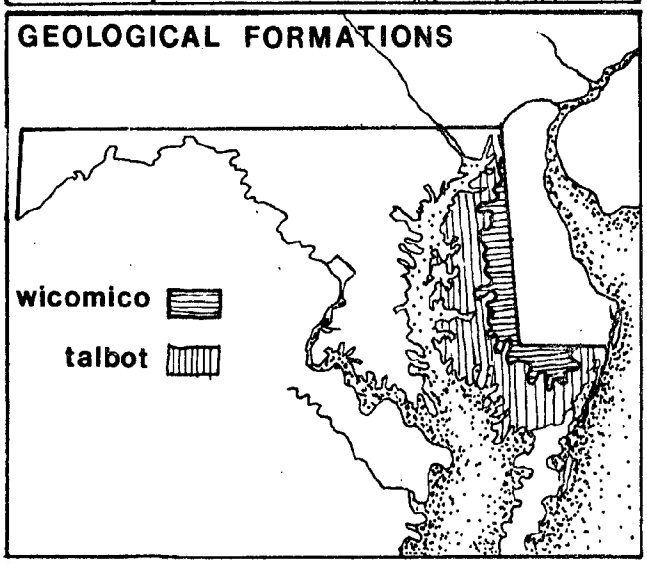
The study area lies in the southern embayed section of the Coastal Plain Province, and ranges in elevation from sea level to 253 feet at Mt. Mauldin on Elk Neck. In general, the landscape is flat, with typical elevations ranging between 20 and 60 feet. Several cliffs occur along the northern coast in Kent and Cecil Counties. Several steep, broad-faced scarps -- abrupt changes in topography carved out by the advancing and retreating ocean during the Pleistocene Age -- occur inland in Queen Anne's, Kent and Talbot Counties.

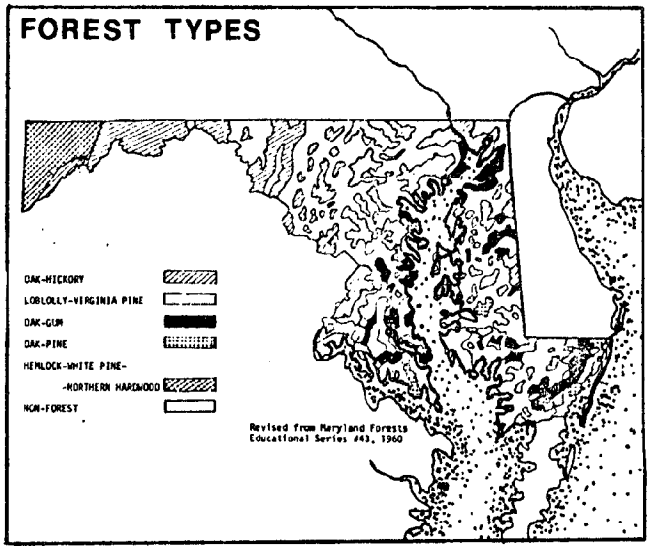
The soils of the region are generally fine textured and poorly drained along the Talbot Terrace and more medium to coarse textured and better drained on the Wicomico Terrace.

Vegetation on the Eastern Shore is more highly diversified than any other part of Maryland. (Shreve 1910). This is due, in part, to the extent and diversity of swamps, natural ponds, marshes and bogs, to the variety of soils and to the fact that several botanical species approach their northern climatic limits on the Eastern Shore.

The agricultural style of life is predominant on the Eastern Shore. A mosaic of farms and woodlands characterize the northern part of the study area. Farther south, in Kent, Queen Anne's, Talbot and Dorchester Counties, most of the land is in agriculture -- a land use pattern which has persisted for years. Talbot County hosts many estates, and is the second richest county in the State. In Talbot County, Route 50 generally







divides estates to the west from the large working farms on the east. Approximately 50% of Dorchester County is swamp or marsh. Route 50 separates agrarian lands from marshes and swamps to the south.

The land use of the southern section of the Eastern Shore is a mixture of cropland and chicken farms with large timbered areas of loblolly pine.

Much of what is now farmland on the Eastern Shore was once forested. The forests and wetlands remaining occur in areas too steep, or wet to easily cultivate or develop. Natural areas of this survey are generally directly associated with such conditions. Often these areas form sinuous streamside forests, a pattern typical of much of the central and northern Delmarva Peninsula. This pattern of narrow streamside forests is of great ecological significance, as it helps to buffer water bodies and streams from sedimentation and contamination by toxic chemicals or nutrients.

VEGETATION TYPES

A mosaic of soils and hydrologic conditions on the Eastern Shore tends to make vegetation communities complex and difficult to classify. For example, Virginia pine, commonly found on drier sites, is at times situated near swamp forests. Furthermore, many forests are selectively cut, while some are regenerating from previous clear cutting and others are plantations. Natural influences on the forest pattern include windthrow and flooding. Subtleties in topography, depth to the water table, and the degree and type of disturbance all add to the vegetation's complexity.

Ongoing research under the direction of Dr. Grace Brush, of Johns Hopkins University, is attempting to correlate the presence or absence of certain plant species with environmental conditions. It is hoped that this work will reveal the ecological potential of plants in this region. In the absence of Dr. Brush's final data, a preliminary classification scheme was developed from field reconnaissance to depict some of the typical communities of the mosaic on the Eastern Shore.

Typical vegetation communities are shown along transects of the peninsula to give an idea of edaphic and biotic conditions. These illustrations depict conditions one might expect to find in an area.

Many of the sections illustrate edge conditions such as bands of vegetation along rivers, around ponds, or conditions in marshes. Edges are important in the mosaic pattern of fields and woodlands typical of the Eastern Shore.

The four transects (Figure 1) illustrate major changes that occur from north to south within the peninsula. Vegetationally, Elk Neck (transect A) relates to the Piedmont. The other three transects show northern, central and southern peninsula characteristics. By county, these divisions are:

A. Elk Neck: Cecil County
B. Northern Shore: Kent, Queen Anne's, Talbot, and Caroline Counties
C. Middle Shore: Dorchester and Wicomico Counties
D. Southern Shore: Somerset and Worcester Counties

The Delmarva Peninsula is interesting because it contains the transitional zone where northern deciduous forests give way to southern pine forests. The approximate northern limit of the Loblolly Pine is shown on the map (Figure 1). The Wicomico and Talbot Terrace Formations, distinguished by predominantly sandy-loams and clay-loams respectively, have characteristic plant communities associated with them (Shreve, 1910).

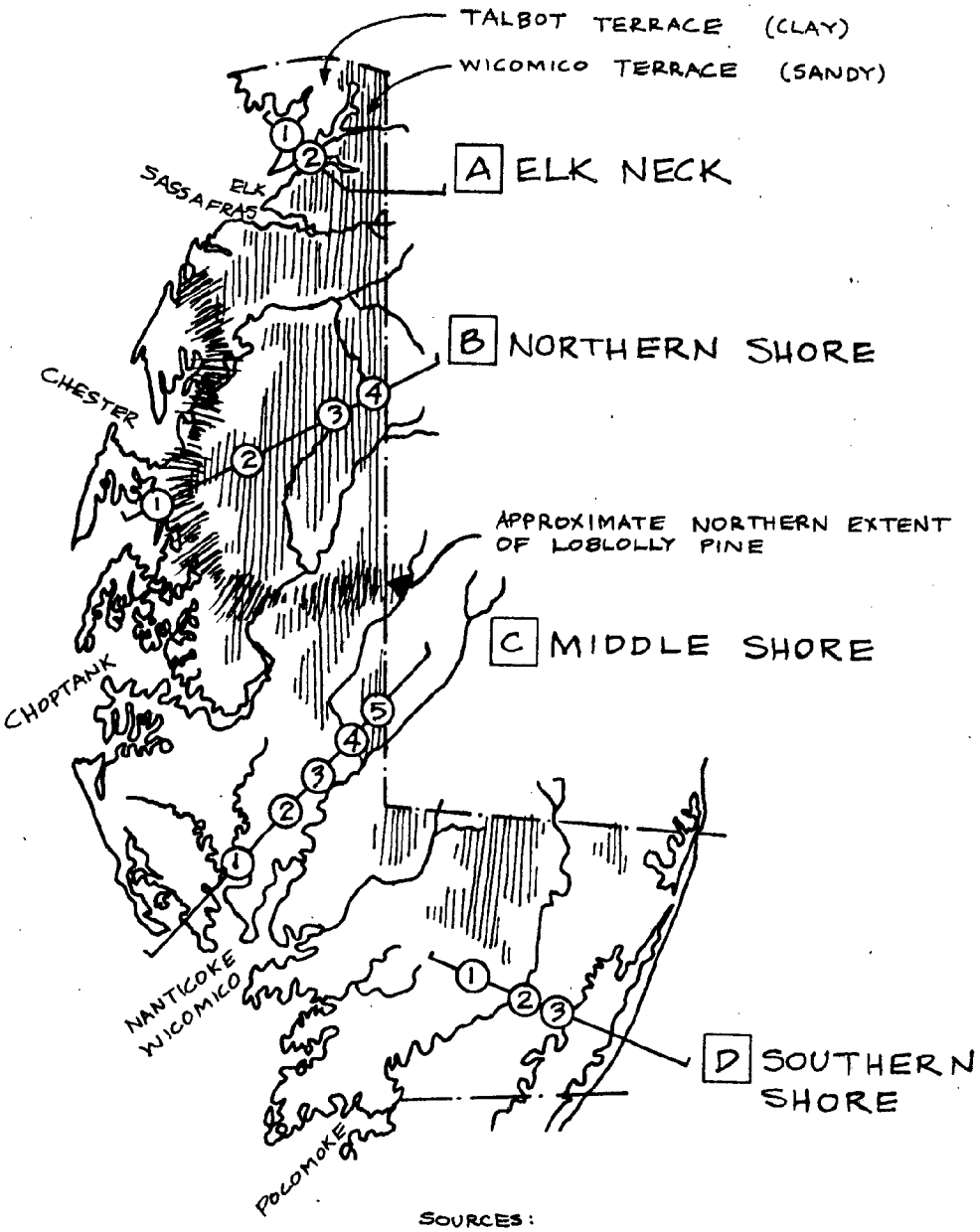
Within sections animals are distinguished in characteristic patterns. Some species are found throughout, while others are limited to specific habitats.

These observations were sketched out by the field survey staff and then correlated to information found in the following sources: Conant (1945), Hunt (1972), Natural History Society Maryland (1969), Shreve (1910), and Waggoner, (In Smithsonian, 1974a).

Typical habitat sketches accompanied by a descriptive text follow. For the location of the sites refer to Figure 1. It should be noted that the patterns described are general. The tidal marsh vegetation for example, is influenced by soil moisture, tidal frequency, salinity and a variety of local conditions. Consequently, the pattern is best described as a mosaic of which the cross-section, although generalized, illustrates only one possible arrangement in the overall vegetation pattern.

FIGURE I

LOCATION OF SECTIONS



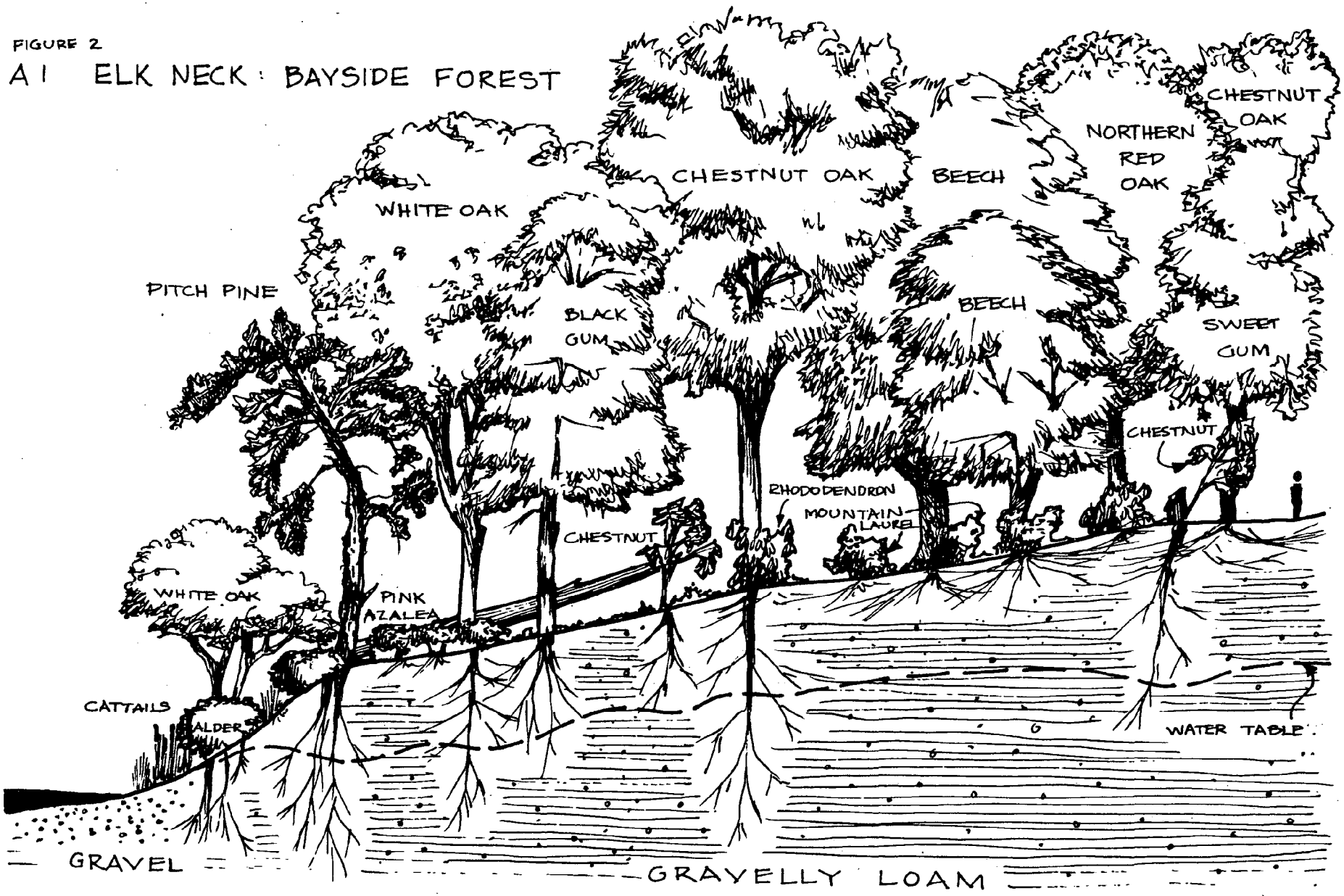
SOURCES:

SHREVE, 1910, p. 103

FIELD STAFF OBSERVATION, 1975

FIGURE 2

A I ELK NECK : BAYSIDE FOREST



A-1 ELK NECK: BAYSIDE FOREST

The forests of Elk Neck have a composition similar to the forests of the nearby Piedmont uplands. Steep slopes, nutrient-poor gravelly soil and a deep water table retard maximum growth. Repeated logging often accounts for the absence of larger diameter trees. In this context most of the Neck was known in the past as "The Barrens". (Maryland Geological Survey, 1902).

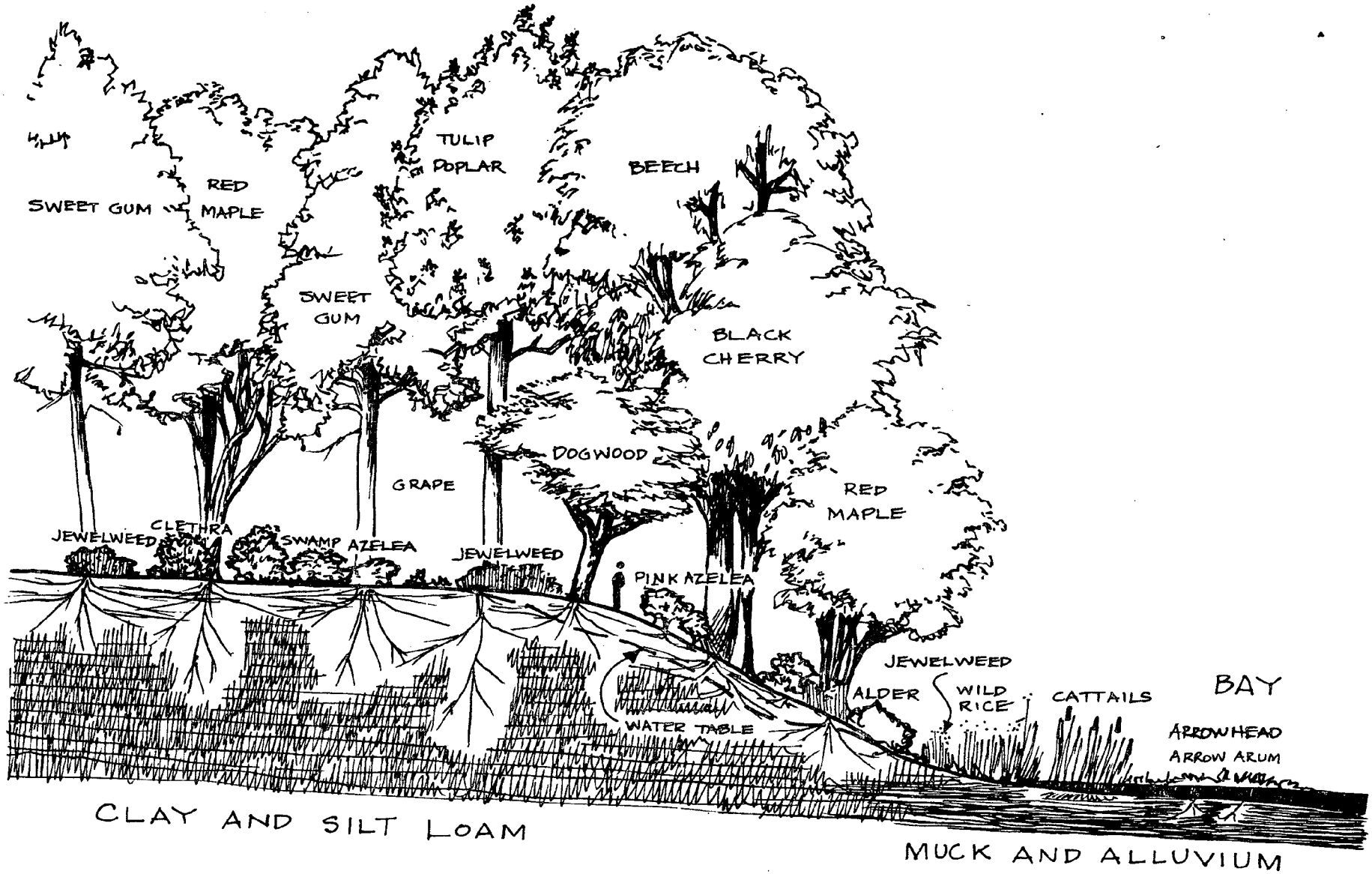
Even so, the forests of Elk Neck appear spectacular in places due to the rolling topography. In protected areas especially, such as the State Park and Forest, mountain laurel and rhododendron are well established. Beech, tulip poplar, and several of the upland oaks are the canopy dominants. Along the Bay, cattails, rushes and small red maples and white oaks create a dense edge. Much of the Neck is protected by the State. The remainder is gradually being developed with cottages.

Animal life is that of the northern deciduous forest (See Section B-2). Along the water's edge creatures such as certain snakes, frogs, and crustacea may be found. Raccoons and hawks and other predators feed here. Beaver and wild turkey have been re-introduced on state lands.

FIGURE 3

A2 ELK NECK: UPLAND WETLAND

LOWLAND WETLAND



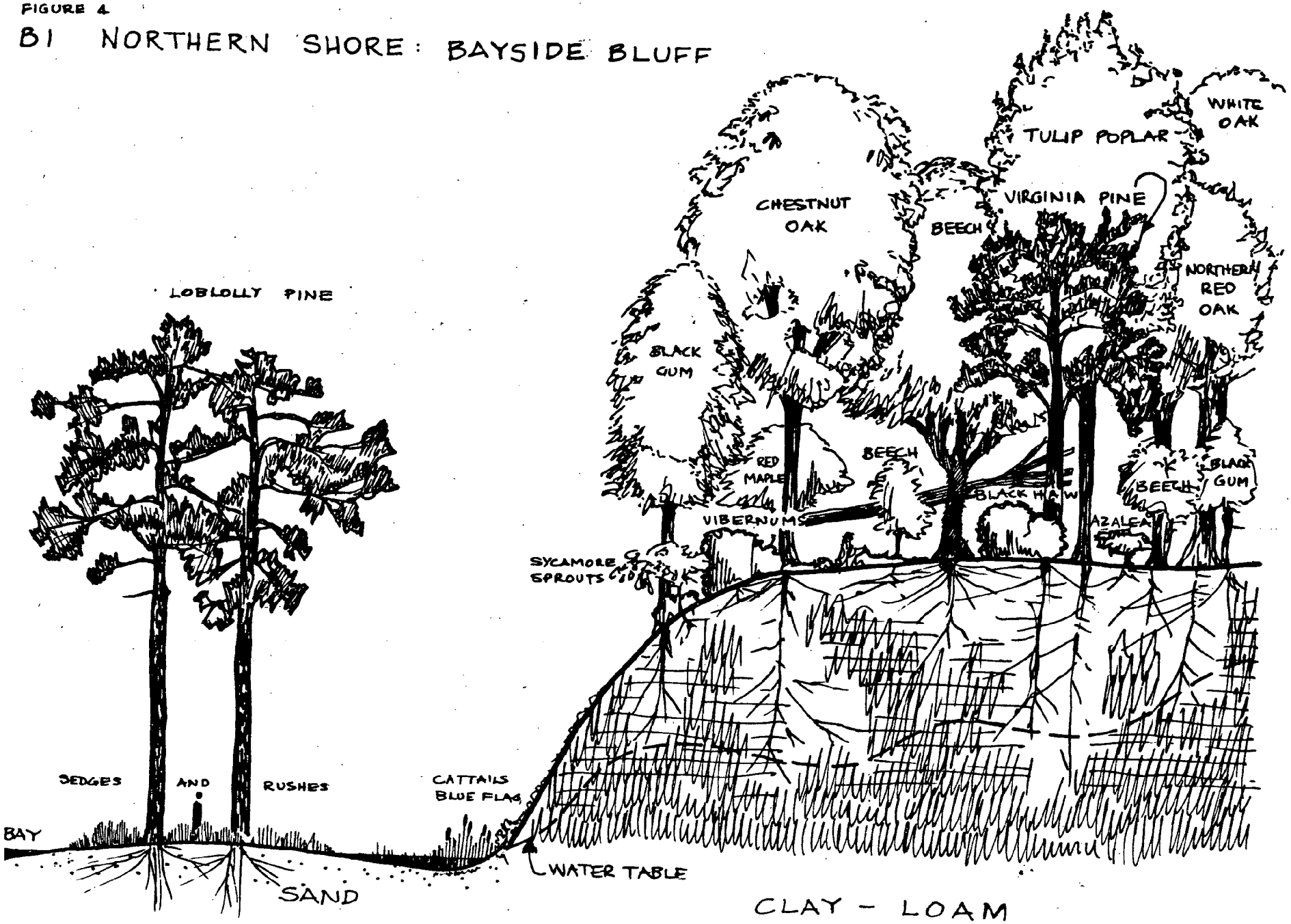
A-2 ELK NECK: UPLAND AND LOWLAND WETLANDS

There are many wetland pockets on Elk Neck. These make up two distinct wetland types. Upland wetlands are formed on clay and other impervious soils at the head of small watersheds. Typical species include blackgum, sweetgum and red maple. Tulip poplar is found on slightly higher ground. The shrub layer is dense and varied. Herbaceous plants include many ferns, jewelweed, sedges, nettles, skunk cabbage, and other moisture-lovers. Shallow-rooted trees here are particularly prone to windthrow. A variety of turtles, frogs, salamanders and woodland birds reside in these wetlands.

Small (1-10 acres) pockets of marsh and swamp dot the edge of the Neck. Most of these pockets are marshes with zones of vegetation which reflect the water's depth. Some low-lying wooded areas have become saturated. Stumps of upland trees now sitting in water apparently indicate a rise in water level relative to the land. In deeper water, cattails, rushes, and jewelweed predominate. Animal life is rich and varied because of the complexity of habitas made by adjacent wetlands and upland woodlands. Muskrat, fox, frogs and many birds are found.

FIGURE 4

B1 NORTHERN SHORE: BAYSIDE BLUFF



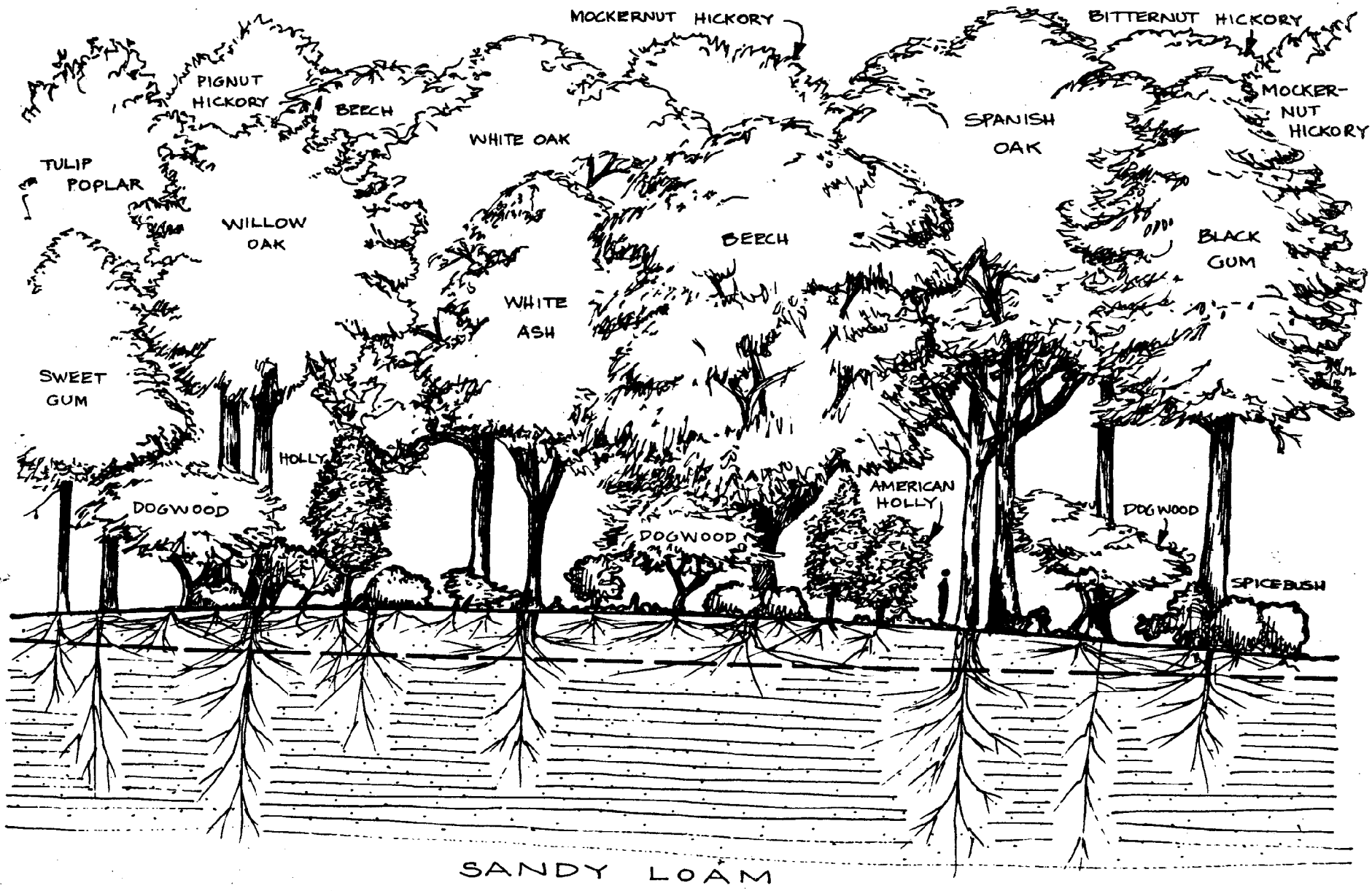
B-1 NORTHERN SHORE: BAYSIDE BLUFF

Salt-tolerant loblolly pine reaches its northern limit in Kent County along the Bay. Shore erosion is gradually cutting into the upland forest dominated by white oak, beech, sweetgum and blackgum. Dogwood and black haw are typical understory species. Near the bluff edge, where the water table drops to the bay, xeric woodland species, such as chestnut oak, are typical. As parts of the clay bank fall into the Bay, the forest edge is invaded by disturbance species such as red maple, black cherry, sycamore, sassafras, and a dense cover of shrubs and grasses. Westerly winds augment this disturbance, blowing down trees weakened by erosion. Virginia pine commonly colonizes windthrow clearings as a pioneer.

Wildlife is diverse along such an edge. On the bluff, the southern leopard frog, green frog and New Jersey chorus frog may be found. Most forest birds of the region would be present. (See Section B-2). The shallow water of the Bay provides habitat for herons, pilot black snakes, and red-winged black-birds, among others.

FIGURE 5

B2 NORTHERN SHORE: UPLAND DECIDUOUS FOREST



B-2 NORTHERN SHORE: UPLAND DECIDUOUS FOREST

To the north of the northern extent of loblolly pine, mature upland woodlands exhibit a wide variety of deciduous species. Found on both clay and sandy loams, these forests once covered most of the upper peninsula. Most farmland here has been claimed from these areas. Although no single species predominates, chestnut, white and northern red oaks, tulip poplar, and hickories are the most common. Dogwood, American holly and immature canopy trees form the understory. Shrubs include spicebush, pink azalea, several viburnums and hercules club. Herbaceous growth density depends on light intensity and soil moisture. On steep, north-facing stream banks, hemlocks are sometimes found, either as pure stands, or more often, mixed with chestnut oaks.

Many woodlots and stream-side forests of this type are being invaded along the edges by Japanese honeysuckle and poison ivy. These areas have been partially logged or entirely cut during the past 300 years. Clearcut areas can re-vegetate within 40 to 80 years to a deciduous canopy, often following a pioneering generation of pines. Species such as black cherry, red maple, and sweetgum are frequent and in some places Virginia pine forms pure or mixed stands. Older woodlands are rich in beech, oak, tulip poplar and hickory. This type of forest often grades into low-lying vegetation types since almost all non-farmed areas are adjacent to swamps or streams (See Section B-3 and B-4). Although not complete, the following species list gives an idea of the diversity of the animals which inhabit the woodlands.

Amphibians and reptiles include:

Dusky salamander	Box turtle
Red-backed salamander	Northern cricket frog
Two-lined salamander	Ground skink
Fowlers toad	Black racer
	Copperhead

Birds which are seed or insect-eaters include:

Cardinal	Crested flycatcher
Slate-colored junco	Crow
Bobwhite	Blue jay
Ruby-throated hummingbird	Tufted titmouse
	Carolina chickadee
Pileated woodpeckers	Carolina wren
Red-headed woodpecker	Wood thrush
Hairy woodpecker	Yellow-throated vireo
Downy woodpecker	Red-eyed vireo
Eastern wood pewee	Black and white warbler

Among the avian hunters are:

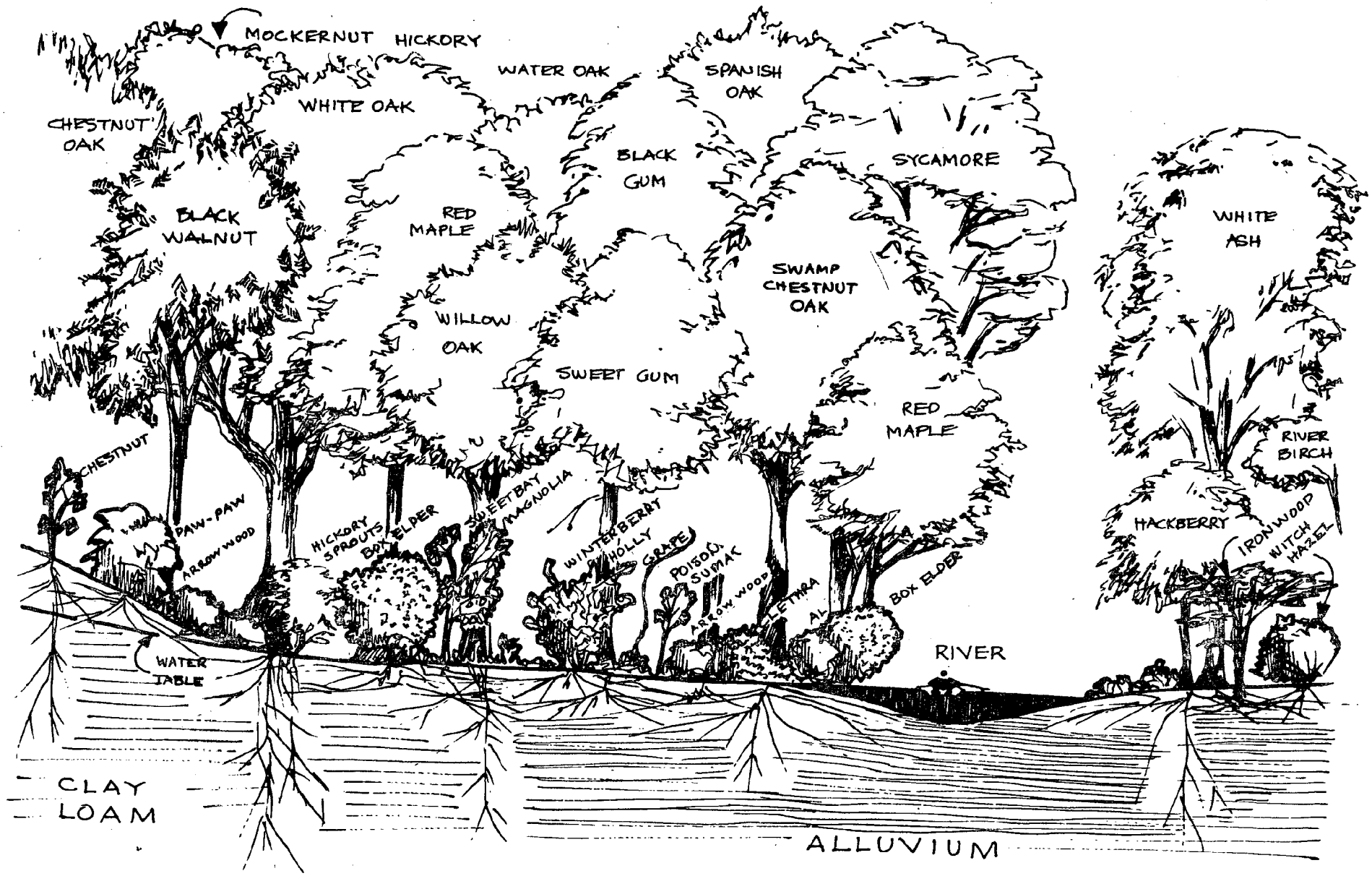
Red-shouldered hawk	Screech owl
Red-tailed hawk	Great horned owl
Broad-winged hawk	

Mammals include:

Squirrels	Raccoon
Opossum	Pine vole
Chipmunks	Gray fox
White-footed mouse	Long-tailed weasel
	Striped skunk

FIGURE 6

B3 NORTHERN SHORE: RIVER CROSS-SECTION



B-3 NORTHERN SHORE: RIVER CROSS SECTION

Streams above tidal influence have a combination of upland and moisture-loving trees along their banks. Approaching such a stream from the upland, one moves from a beech or oak-hickory woods down into the floodplain composed of the gums, red maple, elm, lowland oaks, hackberry, ashes, and river birch. Many appear stunted and the eye-level view is dominated by thin saplings in the nutrient-rich moist soil often underlain by clay loam. The shrub layer, as in most wetlands, is particularly dense. Here the principal species are winterberry holly, poison sumac, box elder, various viburnums and an abundance of woody vines such as grape and poison ivy. Along the river's edge are found trees, such as sycamore, box elder, and river birch, which tolerate periodic flooding. The vegetation of backwaters and floodplain swamps closely resembles that of the upland swamps.

These stream corridors are the areas least disturbed by man on the Eastern Shore - often impenetrable most of the year. Due to slopes or saturated soils, they were never tilled. Boating may be impossible due to fallen trees. Tuckahoe State Park is a good example of this type of corridor woodland.

Amphibians and reptiles are abundant here and include:

Water snake	Squirrel tree frog
Eastern hognose snake	Green tree frog
Common mud turtle	Bull frog
Two lined salamander	Box turtle

Birds include:

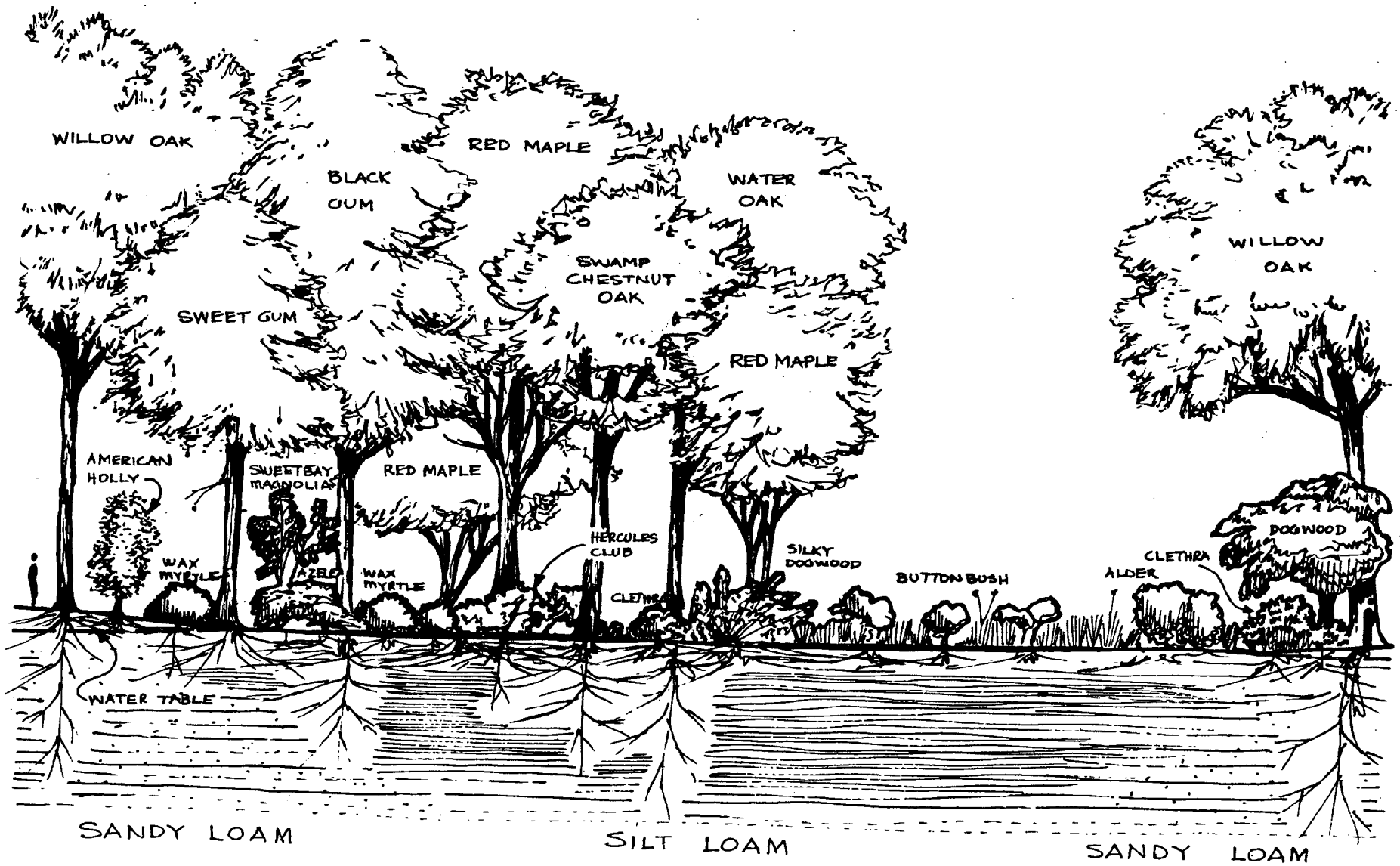
Bobwhite quail	Warblers
Woodcock	Wood duck
Red-headed woodpecker	Red-shouldered hawk
Cardinal	Barred owl

Mammals along the shore include:

Gray squirrel	Raccoon
Gray fox	Mink
Fox squirrel	River otter
Flying squirrel	

FIGURE 7

B4 NORTHERN SHORE: UPLAND SWAMP



B-4 NORTHERN SHORE: UPLAND SWAMP

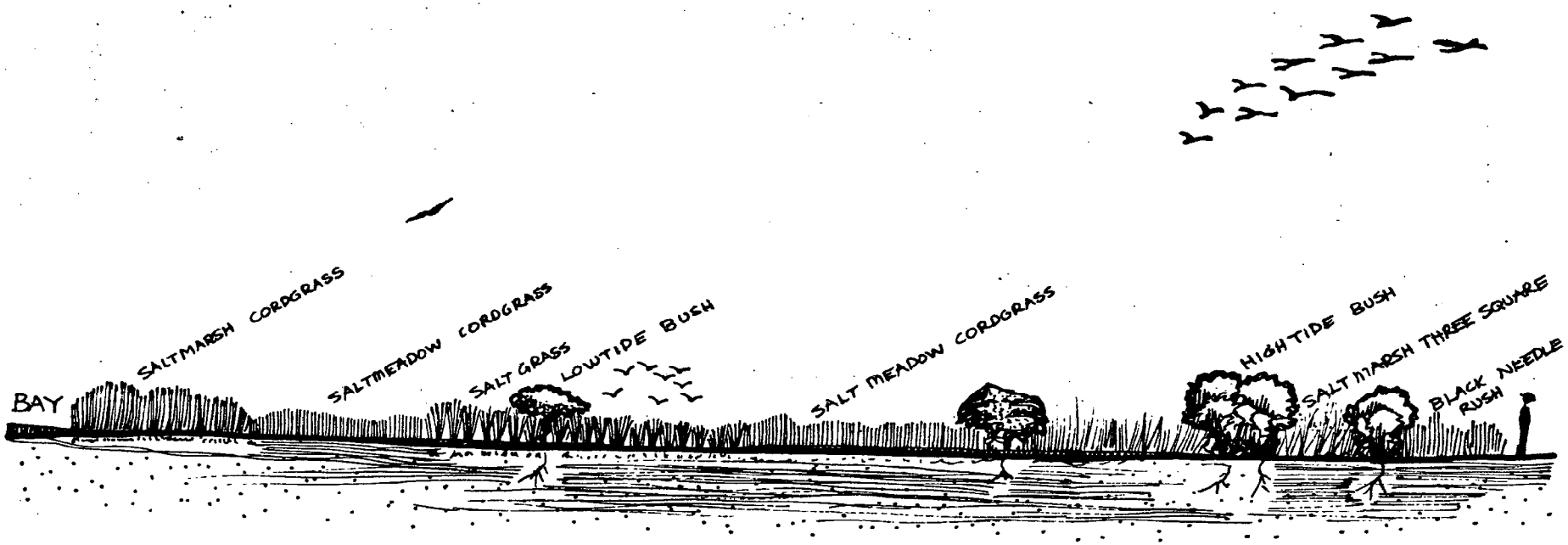
In northern Caroline and eastern Queen Anne's Counties there are extensive areas of upland swamp -- the surface being saturated part or all of the year. All trees here have root systems tolerating saturated soil conditions. Most trees are shallow-rooted and include willow, swamp chestnut and water oaks, blackgum, sweetgum, red maple, and white ash. The canopy is lower (40-50 ft.) than in deciduous upland forests. Sweetbay magnolia, American holly, and red maple form the understory.

In some places, rising water levels have apparently drowned trees, allowing a shrub swamp to develop. Typical species are: buttonbush, silky dogwood, alder, and clethra. Sedges, reeds, skunk cabbage, and ferns grow in the standing water. These areas have been logged periodically and, as a consequence, oaks of great size are rare.

Animal life is plentiful. Many species of frogs and a variety of insects are readily apparent. The four-toed salamander is found where sphagnum moss has accumulated. Birds and mammals are common. The species list is similar to that of Section B-3.

FIGURE 8

C1 MIDDLE SHORE : TIDAL MARSH



SAND AND ORGANIC MUCK

C-1 MIDDLE SHORE: TIDAL MARSH

Although not inventoried in this study, the extensive tidal marshes of Dorchester County are pictured for comparison with the adjoining freshwater swamps. Sometimes the tidal marsh boundary is determined by a road or dike. In other places changes in soil or water-level mark the boundries.

Salt marshes exhibit zonation along salinity and nutrient gradients. Salt marsh cordgrass is found closer to open water, while saltmeadow cordgrass grows in shallower water. Patches of other grasses, as well as hightide and lowtide bush add species variety.

Birds frequent these areas of high food productivity. Mussels and crabs, as well as many microscopic organisms abound. Migrating birds feeding on fish, crustaceans, molluscs, or marsh grasses include:

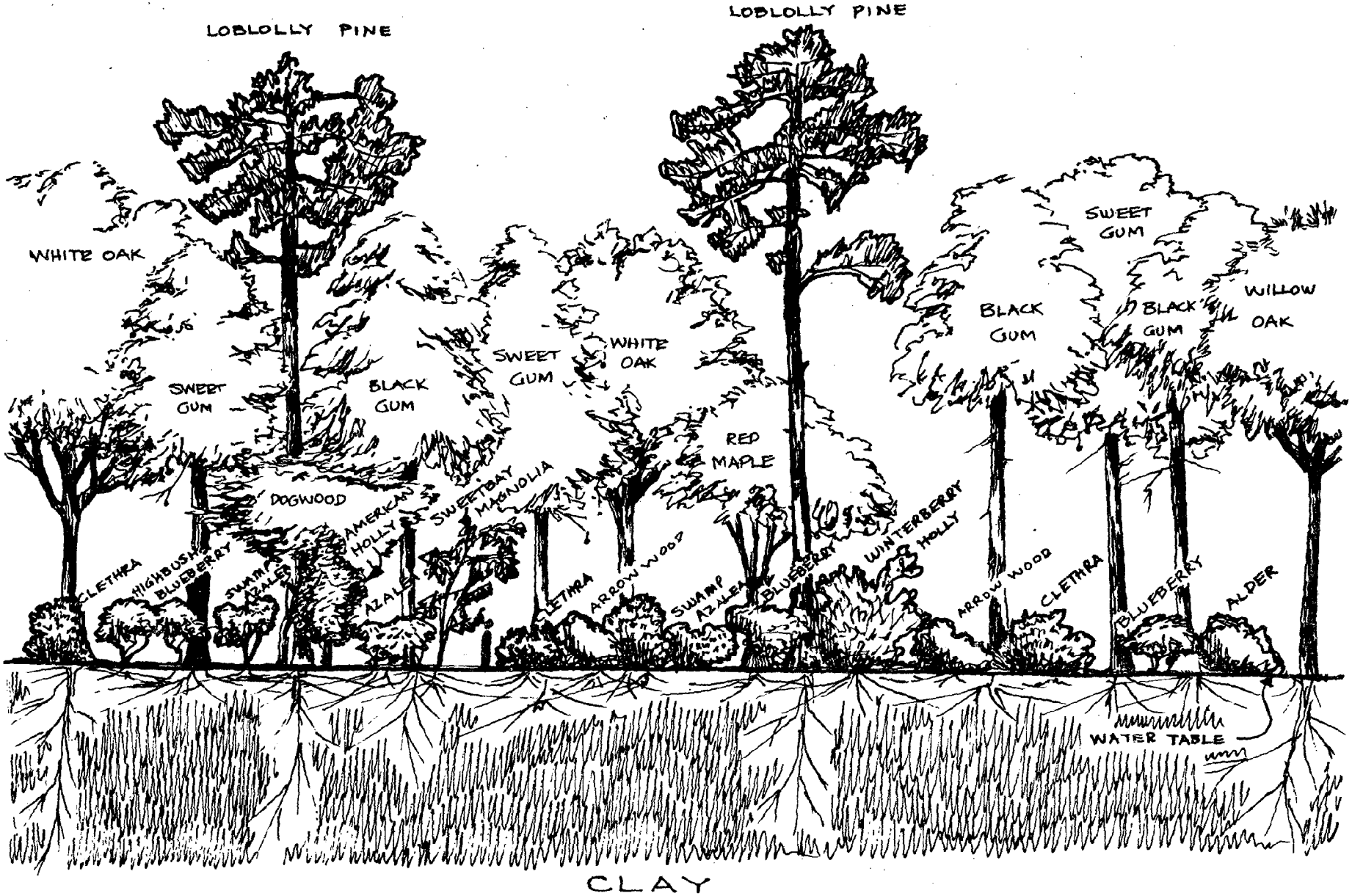
Great egret	Canada goose
Snowy egret	Mallard
Great blue heron	Black duck
Osprey	Shoveller
Red-winged blackbird	Marsh hawk
	Clapper rail

Mammals feed on insects and fish and include:

River otter	Muskrat
Mink	Nutria

FIGURE 9

C2 MIDDLE SHORE : LOWLAND SWAMP



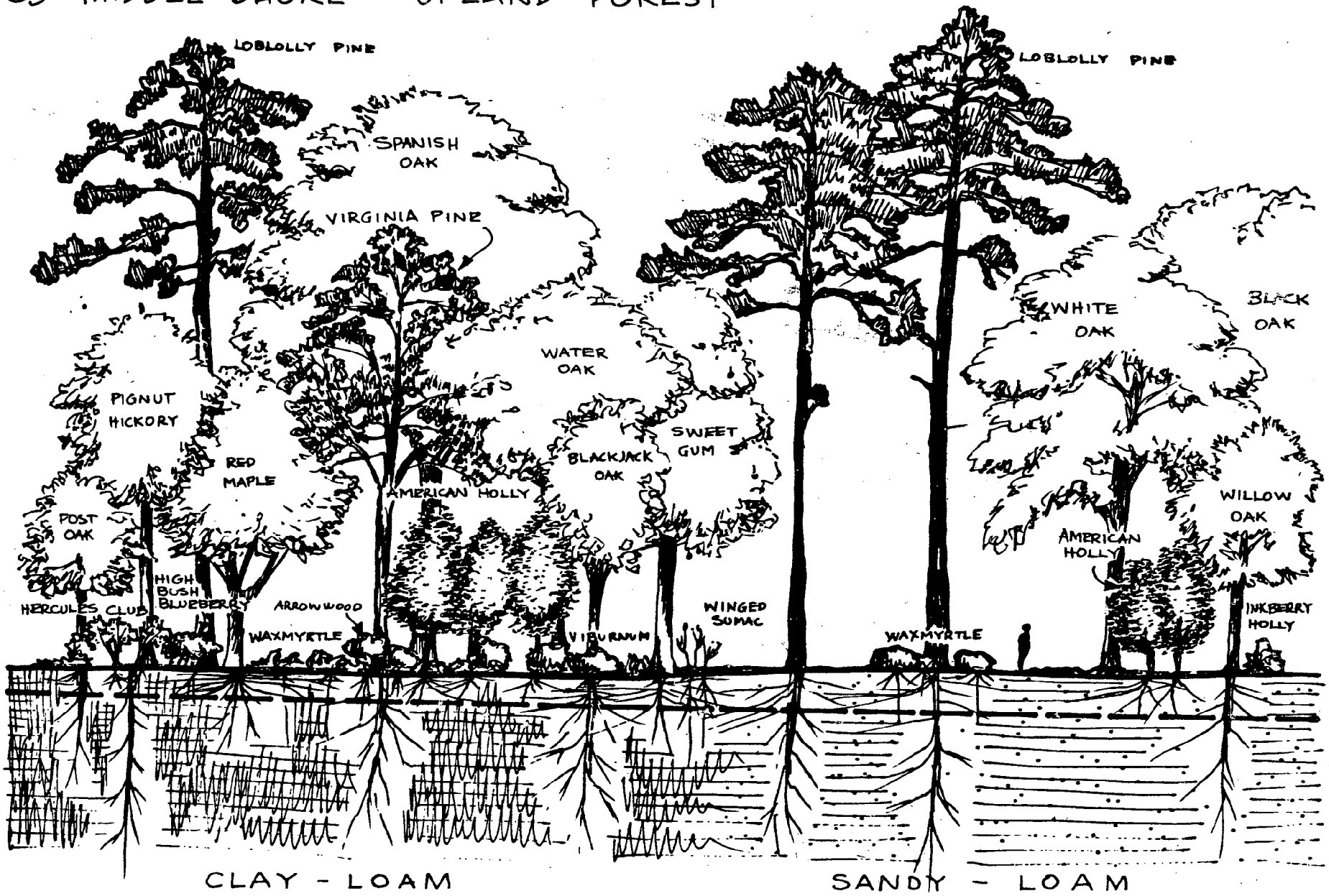
C-2 MIDDLE SHORE: LOWLAND SWAMP

Low-lying freshwater areas, generally underlain by impervious clays, form the headwaters of a series of streams draining into the tidal marshes of Dorchester County. Trees do not grow tall in the standing water. Soil conditions are anaerobic and acid, retarding nutrient availability. White and willow oaks, blackgum and sweetgum are the dominant trees. Isolated loblolly pines stand above the other trees. Their trunks are tall and narrow, rising above an extremely dense shrub layer made up of clethra, viburums, sweetbay magnolia, alder, spicebush, and winterberry holly. In clearings, ferns and sedges are found. Shrubs and herbs are particularly dense on low hummocks.

Except for the removal of large timber, these areas have hardly been disturbed by man. Farming is impossible due to the saturated soils. Deer are abundant, feeding in adjacent fields making these popular hunting areas. Birds include green heron, red shouldered hawk, woodcock and warblers. Amphibians, such as the New Jersey chorus frog, are plentiful.

FIGURE 10

C3 MIDDLE SHORE : UPLAND FOREST



C-3 MIDDLE SHORE: UPLAND FOREST

Away from streams the water table is 2 to 10 feet deep, and a tall, often sparse, canopy of loblolly pine or loblolly mixed with gums and oaks is found on predominantely sandy loam, with some clay pockets. These trees are commercially timbered. The forest is easily penetrated throughout the year. All farmland in the southern half of the Eastern Shore was cleared of this type of forest and undisturbed forests remain.

The canopy is variable in height depending on soil texture and moisture. Deciduous species may reach 80 feet and loblolly 90 or 100 feet in height. A variety of oaks are found including scrub oak, blackjack oak and, commonly, water oak. Hickory and sassafras are also found. The shrub layer is patchy and is mostly highbush blueberry, clethra, wax myrtle, inkberry holly, and other species. The herb layer is even less developed, and includes pioneer species such as goldenrods, asters, little bluestem, and bracken fern. In many places there are patches of open sand.

Forests of this upland type stretch unbroken for many miles. As towns in this region grew, they spread into nearby forest lands. Some trees are cleared, and others serve to enhance residential development. The character of the forest is lost. In parts of Wicomico and Somerset Counties shallow basins occur, forming swamps similar in vegetation to that described in Section D-1. Other areas are reverting from farmland to forest. Loblolly is an early pioneer on cleared land. Some pure pine stands indicate such a successional site, others are timber plantations.

Reptiles here include:

Eastern spadefoot toad	Green tree frog
Box turtle	Dusky salamander
Ground skink	Red-backed salamander
Corn snake	Black racer
Common king snake	Pine snake
	Copperhead

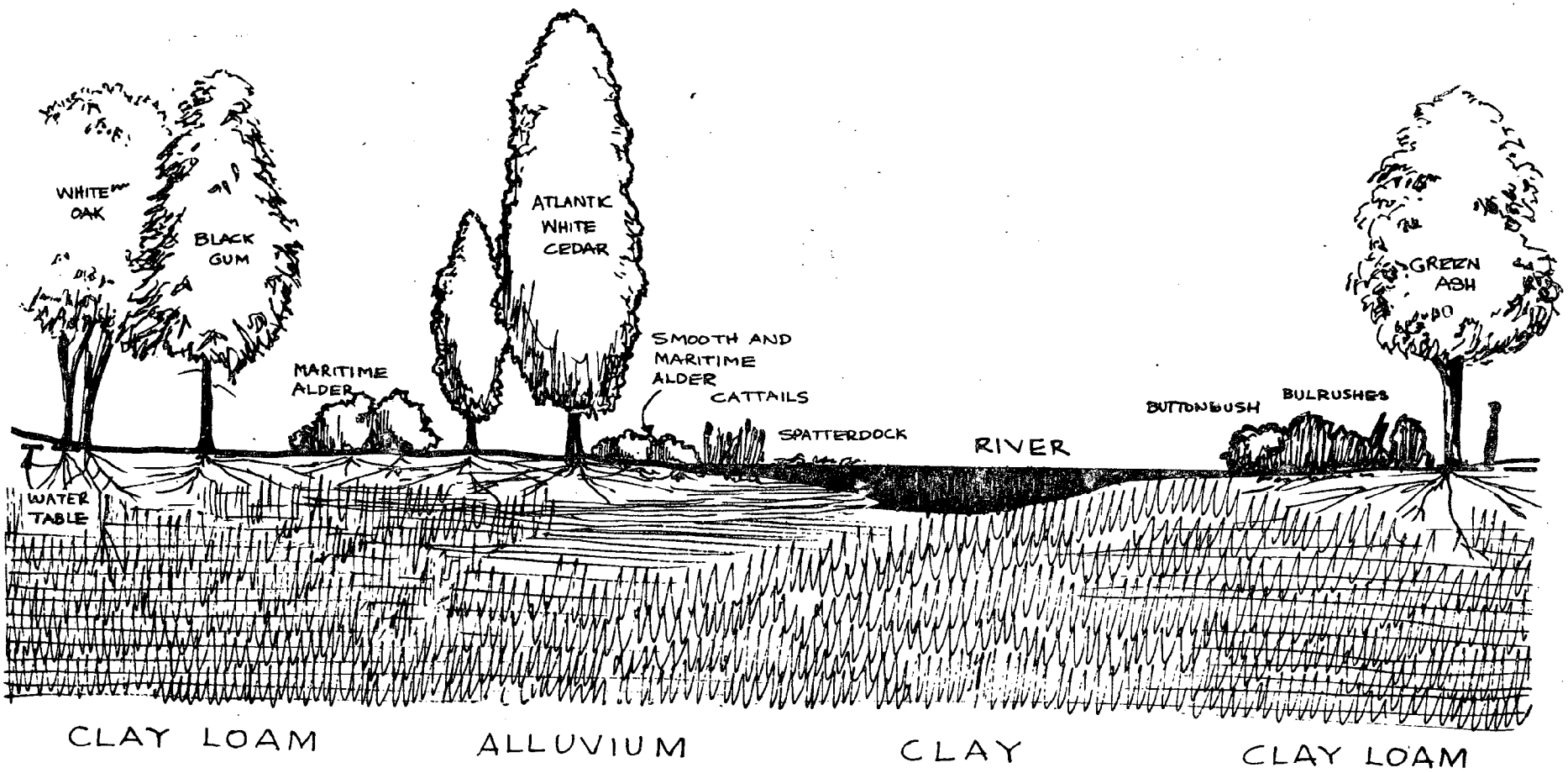
Birds include some ubiquituous species and some specially adapted to the pine woodlands:

Red-tailed hawk	Brown-headed nuthatch
Broad-winged hawk	Eastern bluebird
Bobwhite	Yellow-throated warbler
Mourning dove	Pine warbler
Great horned owl	Pine woods sparrow
Hairy woodpecker	Screech owl
Downy woodpecker	Carolina chickadee
Red-cockaded woodpecker	Cardinal

Mammals include the raccoon, deer, and foxes. The pine vole and the pine mouse are found in these drier conditions.

FIGURE 11

C4 MIDDLE SHORE : RIVER CROSS SECTION



C-4 MIDDLE SHORE: RIVER CROSS SECTION

A number of estuaries have freshwater upstream, with wide, saturated floodplains. Soils are sand and silt loams. Atlantic white cedar is a noted tree species in these areas. Once common along the flowing water's edge, this tree has been extensively timbered. It is commonly associated with maritime alder which, on the East Coast, is native only to the Delmarva Peninsula (Shreve, 1910 pp. 127-128).

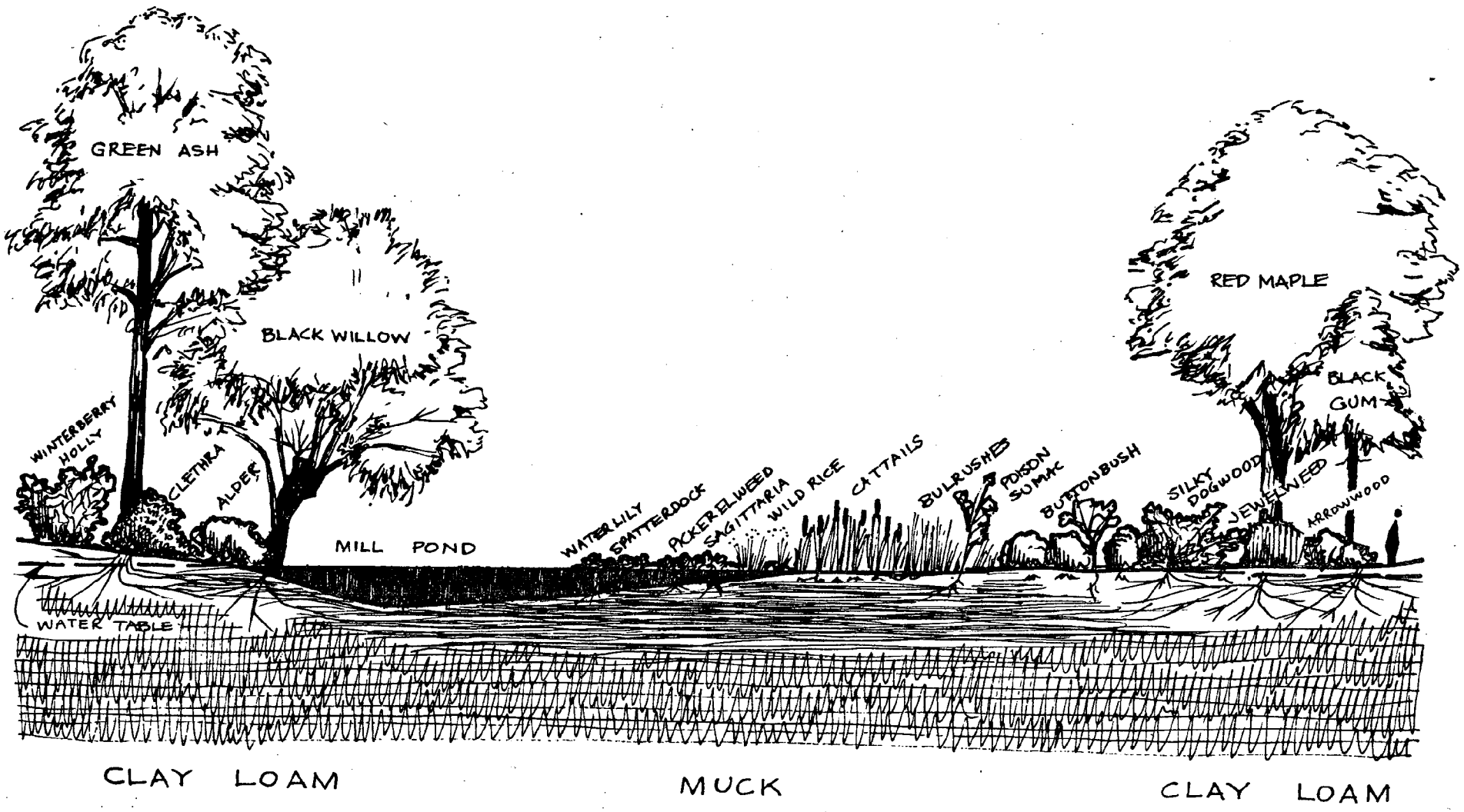
Inland from the Atlantic white cedar are found moisture-loving trees such as white and green ash, blackgum, sweetgum, and red maple. The canopy is generally low (30-40') and irregular. Farther inland are lowland oaks. The shrub layer is thick and is composed of the same species as found in the lowland swamp (Section C-2), particularly on hummocks raised above totally saturated soils.

Some of these areas are favored hunting spots, others are inaccessible because of entangling vegetation. Few have been drained or cleared, although marketable timber has been removed.

Amphibians and terrestial wildlife is abundant. There are many insects. Salamanders, frogs, snakes and turtles become food for predators such as green heron, raccoon, opossum, and red-shouldered hawk. Insect eaters include woodcock and prothonotary warbler. Wood ducks nest in the floodplain woods. Deer come from nearby fields to browse.

FIGURE 12

C5 MIDDLE SHORE : MILL POND FRESH WATER MARSH



C-5 MIDDLE SHORE: MILL POND AND FRESHWATER MARSH

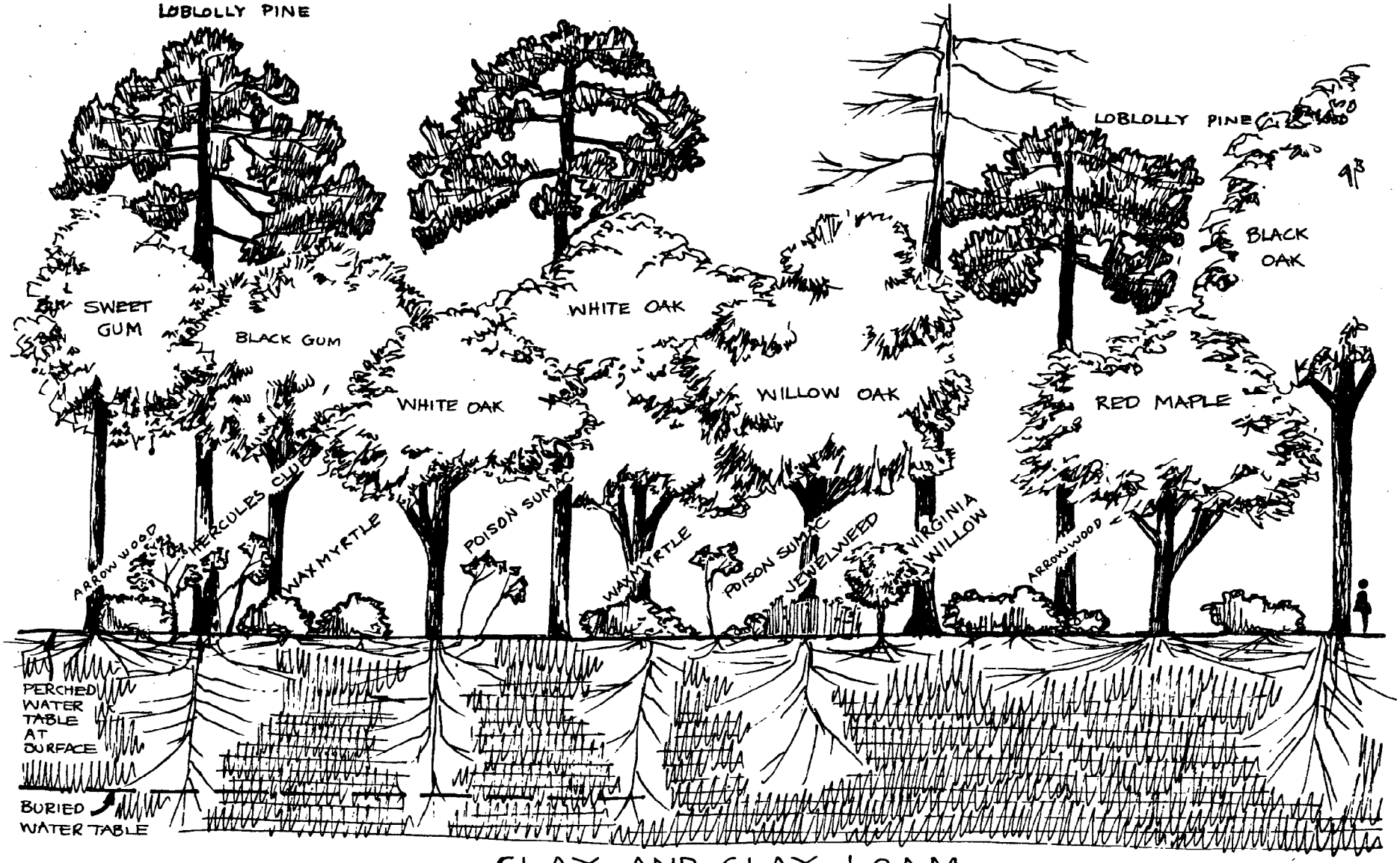
During the past 250 years many mill ponds have been created along the shallow freshwater streams of Dorchester and Wicomico Counties. Some of these have become partially or wholly filled with sediment, creating marshes. Many near towns have become the focus of residential development. These areas offer a variety of wildlife not found in uplands or wetlands alone.

The ponds are generally ringed by a band of riparian trees such as red maple, white ash, green ash, black willow, blackgum and sweetgum. Shrubs such as winterberry holly, clethra, Virginia willow, alder, poison sumac and buttonbush grow to the water. Sedges, blue flag, Carolina rose, and various ferns add interest to the edge. Silted areas exhibit zonation by water depth, with floaters (spatterdock and water lily), semi-emergents (arrowhead), emergents (cattails and bulrushes), and shoreline plants (jewelweed and smartweed).

Over time, these ponds have become a depository for a rich muck of organic material which seals their bottoms. A variety of insect, bird, and amphibious life is found. Marbled salamander, red bellied terrapin, hawks, osprey, bald eagle, muskrat, river otter, painted turtles and herons are among the frequently found species.

FIGURE 13

DI SOUTHERN SHORE: UPLAND SWAMP



CLAY AND CLAY LOAM

D-1 SOUTHERN SHORE: UPLAND SWAMP

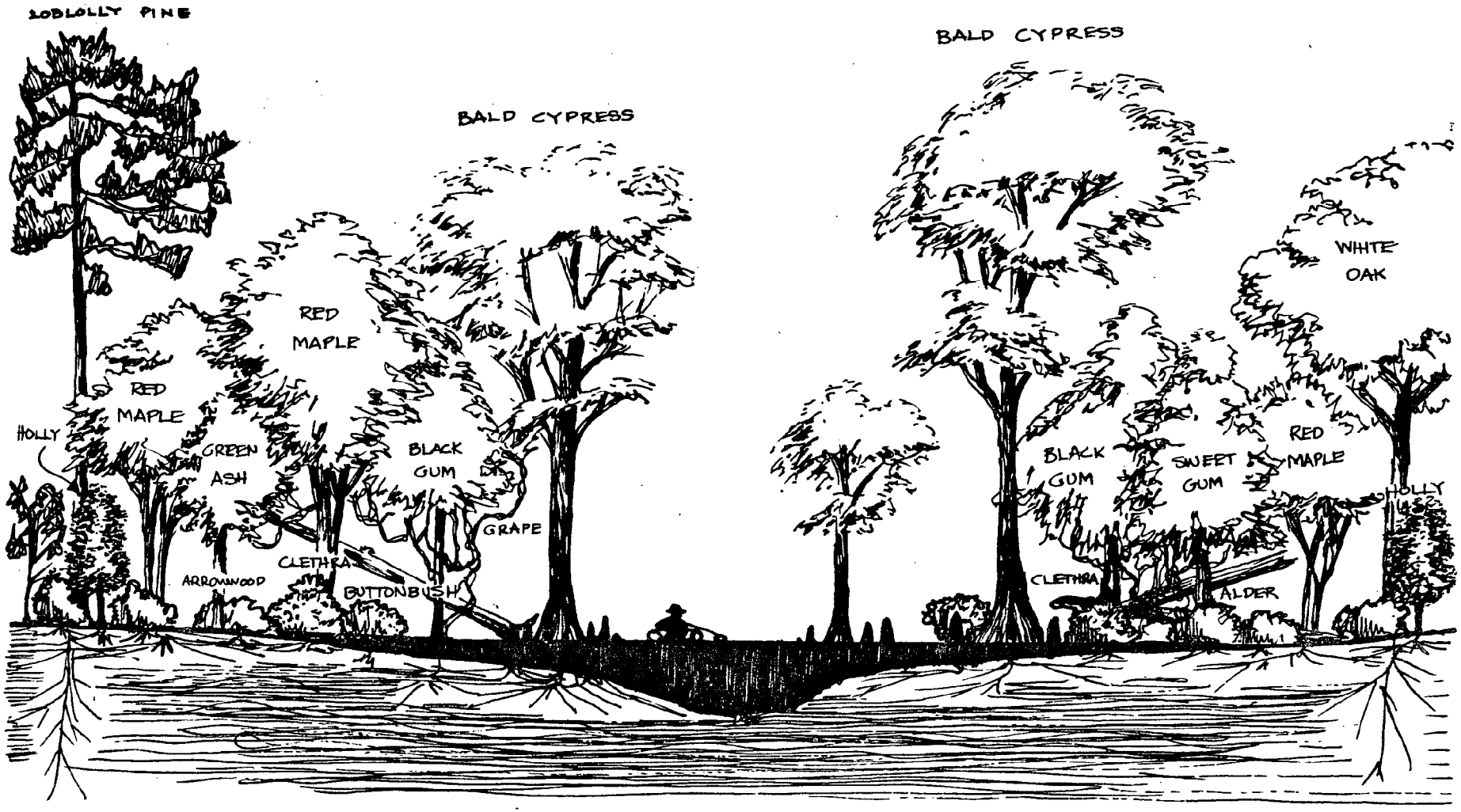
Large swamp areas occur in the headwaters of creeks in Wicomico, Somerset, and Worcester Counties as well as in poorly drained upland basins. Usually underlain by clay, these areas closely resemble the Lowland Swamps (Section C-2) of Dorchester County.

The ground surface is saturated all or most of the year. The canopy is between 50 and 70 feet high; the shrub layer is thick. Loblolly pines are ubiquitous being tolerant of the poorly drained conditions (Fowells, 1965). There are pure pine stands where the shrub layer is sparse. Red maple, blackgum and sweetgum are common associates. Sometimes the surface water is perched on impervious clay while the trees draw moisture from a water table at greater depth. Because of standing water, abundant insects, and dense undergrowth, these areas have received little clearing. A few areas have been drained by ditching and programs are under way to drain others.

The edges of these swamps which occur near farmlands are rich in wildlife and make exceptional deer hunting areas. The animal species here are similar to those in Section C-2.

FIGURE 14

D2 SOUTHERN SHORE: RIVER CROSS SECTION



MUCK AND ALLUVIUM

D-2 SOUTHERN SHORE: RIVER CROSS SECTION

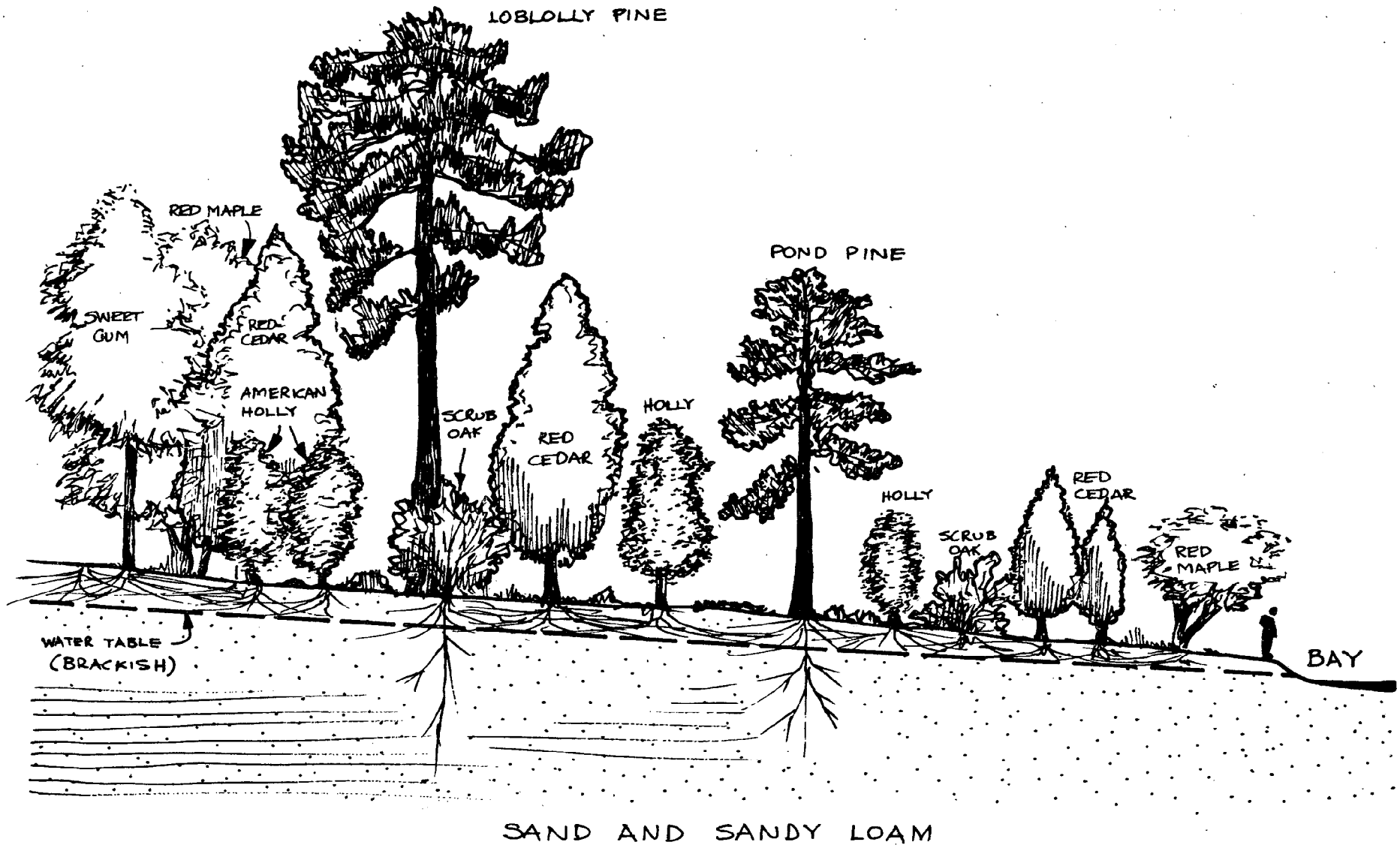
The Pocomoke River is a unique feature on the Peninsula. It drains from Delaware and flows south, parallel to the ocean shore, to Chesapeake Bay. The vegetation is similar to the river cross section of the Middle Shore (Section C-5) with the addition of bald cypress. Once occuring in great stands along the river -- in many places obliterating the channel itself -- this tree has been almost entirely removed. Centuries of organic decomposition in the acid water have built up a thick substrate of muck over the sands below (Byron, 1968).

Along much of its length, the river has no well defined bank. Trees and shrubs occur in open water. Shrubs and vines are abundant, making overland access almost impossible. Inaccessibility has preserved much of the area. The upper channel was dredged 40 years ago to drain upland farms.

In Maryland, the river is a unique habitat. Maritime alder is most likely to be found here. Beaver and wild turkey, have been re-introduced in State lands. Osprey, bald eagle, prothonotary warbler, and red-bellied water snakes are all scarce, and have been given State protection. The pileated woodpecker and carpenter frog are also endemic to this river. Seaward, on the lower part of the river, wood ducks nest. Most animals listed for the Middle Shore River Section (Section C-4) are also common here. The Pocomoke has been declared a Scenic River by the State.

FIGURE 15

D3 SOUTHERN SHORE : MARITIME "FOREST"



D-3 SOUTHERN SHORE: MARITIME "FOREST"

West of Chincoteague Bay, influenced by salt spray and offshore winds, a band of woodland several miles wide parallels the coast. Salt-tolerant loblolly pine and red cedar are the principle species. Few deciduous trees tolerate these maritime conditions. Scrub oak, pitch pine, red maple, American holly, and sweetgum are found, often in stunted forms. Shrubs are sparse and herb growth poor. Brackish ground water, few available nutrients, and salty winds near the Bay retard plant growth (Waggoner, IN Smithsonian 1974a, p. B-13).

Much of the area has been cleared for farmlands, particularly pasture. Many grasses thrive in bayside conditions.

This dry area, (due to low water table, and salt spray) exhibits certain characteristic animals.

Representative reptiles include:

Snapping turtle	Eastern hognose snake
Spotted turtle	

Representative birds include:

Red-shouldered hawk	Whip-poor-will
Red-tailed hawk	Crested flycatcher
Pine warbler	Vireos
	Cardinal

Representative mammals include:

Opossum	Gray fox
Gray squirrel	Mink
White footed mouse	White tailed deer

SITE SELECTION PROCESS

The initial group of potential upland natural areas to be sampled were identified from six existing sources. The majority of the sites were taken from two Maryland Department of State Planning publications. The Compendium of Natural Features Information (Md. DSP, 1975) updates an earlier DSP publication Catalogue of Natural Areas in Maryland (Md. DSP, 1967). This is a listing of non-field checked sites throughout Maryland which was developed as a result of an extensive interview and questionnaire survey of natural resource managers, professors, naturalists and other scientists in related fields. Non-tidal wetlands were identified from DSP's 1968 Wetlands Survey. These sites were limited to wetlands greater than 5 acres. In addition, all non-tidal sites or tidal sites containing significant upland areas as identified by the Smithsonian Center for Natural Areas (1974 a & b) were included in the survey. Other major sources of sites were The Maryland DNR Eastern Shore Study (Jackson, 1973), Dr. Grace Brush, Johns Hopkins University (personal comm., 1975) and areas identified as containing rare or endangered species (Bud Holla, personal comm.). Some additional sites were identified during the literature survey, from personnel interviews, and by field personnel during the course of the study.

The sites identified as potential upland natural areas included then all non-tidal wetlands greater than 5 acres, forested sites nominated by their inclusion in previous natural area inventories, and areas identified as rare and endangered species habitat.

DATA MANAGEMENT

In order that the site information generated by this might be easily accessed, a data management system was developed in order to store and retrieve the individual site descriptions. The data management system was designed with two main purposes: (1) to check the data for miscoding errors and (2) to print the data in an easily readable format. An example of the computer print out is shown on the following pages. As designed, the management system will also allow retrieval of individual site descriptions or retrieval by individual parameters or groups of parameters. This will allow users of the data to objectively rank areas by evaluating the different parameters in the context of their importance to potential site uses. Wherever possible, the data format has been made compatible with the Department of State Planning's MAGI system.

*JOHNSONTOWN-SHIPPEN CREEK WOODS 150793300021305

LOCATION,SITE TYPE,ECOLOGICAL UNIT	TIDAL STREAM SHORE	LOWER SLOPE	FOREST
NEAREST TOWN,COUNTY,ELECTION DISTRICT	POMONA	KENT	NUMBER 7
AREA,ELEVATION,WATERSHED	0270 ACRES	0000 FEET	CHESTER

ONE LINE DESCRIPTION- LARGE PINE-OAK FOREST ALONG THE CHESTER RIVER

PRIMARY CATEGORY- FOREST
SECONDARY CATEGORY- SIGNIFICANT AND UNUSUAL WATER-LAND INTERFACES
TERTIARY CATEGORY- HABITAT AREA OF RARE, ENDANGERED AND UNIQUE BIRD

****

OCCURRENCE	INFREQUENT	
VISUAL EXPERIENCE	MEDIUM	
DIVERSITY	MEDIUM	
ACCESS TO AREA	EASY	
NATURAL INTEGRITY	NATURALLY TRANSITORY	
CONTIGUOUS LAND USE	N-AGRICULTURE E-WATER BODY	S-WATER BODY W-AGRICULTURE
AQUATIC BUFFER ZONE	N-ADEQUATE E-NOT APPLICABLE	S-NOT APPLICABLE W-ADEQUATE
SECURITY	AREA SAFE FOR FIVE YEARS	
CURRENT USE	SEVERAL HOMES	
OWNERSHIP	PRIVATE INDIVIDUAL (MORE THAN ONE OWNER)	
ZONING	RURAL	
INVENTORY DATE	06/19/75	

LOBLOLLY PINE AND OAKS CHARACTERIZE THESE FORESTS ON THE CHESTER RIVER. IT IS ONE OF THE LARGEST FOREST IN THE VICINITY, AND HAS OVER A MILE OF SHORELINE ON THE CHESTER RIVER AND ONE OF ITS SMALL TRIBUTARIES, SHIPPEN CREEK. THIS FOREST DEMONSTRATES UPLAND SUCCESSION--IN ONE SUBSECTION COVERING 21% OF THE SITE, A DENSE UNDERSTORY OF SWEETGUMS IS COMING UP UNDER A CANOPY OF LOBLOLLY PINES. SEEDLINGS OF OAK AND OTHER TOLERANT HARDWOODS ARE COMMON ON THE FOREST FLOOR. IN THE OTHER SUBSECTION MAKING UP 79% OF THE AREA, OAKS, SWEETGUM, RED MAPLE, AND BEECH HAVE MOSTLY REPLACED THE PINES AS THE DOMINANT CANOPY TREES. WILDLIFE IS ABUNDANT, ESPECIALLY DEER AND UPLAND GAME. NO OSPREY NESTS WERE SIGHTED IN THIS SITE, BUT THOSE NESTING ALONG THE CHESTER RIVER FREQUENT THE AREA. BALD EAGLES NO LONGER NEST IN THE SITE, BUT OCCASIONALLY VISIT. SEVERAL HOMES HAVE BEEN BUILT WITHIN THE SITE AND OWNERS INTEND TO PRESERVE THE NATURAL AREA.

BIBLIOGRAPHY

MARYLAND DEPT. STATE PLANNING 1975 (UNPUBLISHED) INVENTORY OF MARYLAND CRITICAL AREAS.

PEOPLE CONTACTED

MR. AND MRS. JAMES G. HAUPT, R.D.3, CHESTERTOWN, MD. 21620.
GEORGE F. JOHNSON, R.D. 3, CHESTERTOWN, MD. 21620.

*JOHNSONTOWN-SHIPPEN CREEK WOODS 150793300021305

SUBSECTION SAMPLED & SIMILAR SS	01	02
AREA OF SUBSECTION	059 ACRES	219 ACRES
SOIL TYPE & NATURAL SOILS GROUP	SAA B1	ENA F3
RUNOFF POTENTIAL	SLIGHT (B1)	HIGH (D+)
DEPTH TO WATER TABLE	5-6 FT	1 FT +
WELL DRAINED SOILS	YES	NO
SLOPE AND SOIL ERODIBILITY	15%-,MEDIUM (.28)	15%-,HIGH (.43)
EASE OF PASSAGE	EASY	MODERATE
DISTANCE TO WATER BODY	0-10 FEET	0-10 FEET
TYPE OF WATER BODY	TIDAL STREAM	TIDAL STREAM
WATER BODY SIZE AND DEPTH	20 ACRES + 1 FOOT +	20 ACRES + 1 FOOT +
TYPE OF BOTTOM MATERIAL	SAND	SILT
BEACH LENGTH AND WIDTH		
BEACH TYPE		
PERCENT OF STREAM SHADED		
WETLAND WILDLIFE DAMS		
DISTURBANCE PRIMARY & SECONDARY	SELECT CUTTING WINDTHROW	SELECT CUTTING MOTOR VEHICLES
VEGETATION TYPE	LOBLOLLY PINE	LOBLOLLY PINE-HARDWOOD
TOTAL AVERAGE COVER BY LAYER	C=60% U=70% S=50% H=60%	C=80% U=90% S=40% H=30%

KEY TO VEGETATION
LA-LAYER
C-CANOPY
U-UNDERSTORY
S-SHRUB
H-HERB
COV-AVERAGE PERCENT COVER
I-IMPORTANCE
R-RARE OR UNIQUE
C-CHAMPION TREE CANDIDATE
E-ENDANGERED
DBH-DIAMETER AT BREAST HEIGHT

LA	VEGETATION	COV	I	DBH
C	LOBLOLLY PINE.	60		9-12
C	BLACK WALNUT.	00		6-9
C	BLACK LOCUST.	00		6-9
U	SWEET GUM.	30		
U	FLR DOGWOOD.	10		
U	RED MAPLE.	00		
S	SWEET GUM.	30		
S	WINEBERRY.	00		
H	JAP HONEYSUKL.	30		
H	TRUMPT CREEPER	10		
H	VA. CREEPER.	00		
H	JCK-N-TH-PLPIT	00		
H	WINEBERRY.	00		

LA	VEGETATION	COV	I	DBH
C	AMERICAN BEECH	10		12-18
C	WHITE OAK.	20		12-18
C	LOBLOLLY PINE.	10		12-18
C	HOCKERNUT.	00		12-18
C	SWEET GUM.	10		12-18
C	COM PERSIMMON.	00		6-9
C	PIN OAK.	00		9-12
C	WILLOW OAK.	00		12-18
U	FLR DOGWOOD.	30		
U	HOCKERNUT.	00		
U	COM PERSIMMON.	10		
U	RED MAPLE.	10		
U	AMER. HOLLY.	40		
U	BLACK OAK.	10		
S	SWEET GUM.	00		
S	WINTERBERRY.	00		
S	SYMPHORPOS	00		
H	SMILAX	00		
H	JAP HONEYSUKL.	30		
H	SENSITIVE FERN	00		
H	SWEET BAY.	00		
H	LO SWT BLUBRY	00		
H	VA. CREEPER.	00		

KEY TO ANIMALS
S-SOURCE F-FREQUENCY
O-OBSERVED A-ABUNDENT
R-REPORTED C-COMMON
D-DEN,NEST,SPOOR R-RARE
RES-RESIDENCE
BR-BREEDING
MI-MIGRATORY
WC-WINTER CONCENTRATION
YR-YEAR AROUND RESIDENT
UN-UNKNOWN
X- ANY 'X' DENOTES INPUT ERROR

*GEOLOGY LOWLAND DEP *
*MINIMUM DIMENSION 400-600 FT *
*# VEGETATION TYPES 2 *
*PERCENT 5-10 AC OPENINGS 3-5% *
*VISUAL EXPERIENCE SCORE 13 *

ANIMAL	S	F	RES
WH TAILED DEER	D	A	YR
OSPREY	R	C	BR
BALD EAGLE	R	R	UN

ANIMAL	S	F	RES
WH TAILED DEER	D	A	YR
BALD EAGLE	R	R	UN

COMPUTER PRINT-OUT (Second page)

PARAMETERS

Individuals having a knowledge of the importance and usefulness of natural area data were interviewed to determine the parameters to be sampled in this study. Contacts included personnel in Maryland's Department of Natural Resources and other qualified scientists. Through these interviews, specific parameters were identified which were included for sampling on the data forms. The rationale and criteria used in selecting these parameters are described fully in Volume 1 of this report.

USES

Data collected through the sampled parameters can be used to assess specific natural areas values for potential uses. This data can be put to practical use in the following fields:

Wildlife management in forests
Wildlife management in wetlands
Active recreation planning
Passive recreation planning
Hunting in forest
Hunting in wetland
Commercial forestry
Scientific research
Fisheries
Education
Permit Review

The manner in which specific parameters relate to these areas is described in Volume 1.

From interviews, the following list of parameters was developed:

SIZE	Size of area Minimum dimension (feet)
WATER	Type of water body Size of water body Depth of water body (feet) Van Deusen Index Bottom material Water table depth (feet) Distance to water body (feet) Beach frontage (feet) Beach width (feet) Beach type Percentage of stream shaded by trees Aquatic buffer zone
VEGETATION	Vegetation types Number of vegetation types present Total canopy cover Total understory cover Total shrub cover Total herb cover Trees with average DBH (diameter at breast height)>6" Trees>2 ft. DBH Trees older than 200 yrs. (estimate) Tree cover (average percent per species) Tree size (average DBH per species) Tree reproduction by species Shrub cover per species Herb cover per species Percent of 5-10 acre opening Site type
WILDLIFE	Species (from citations) Species sighted Seasonal concentration of wildlife Wetland class Interspersion of vegetation Cover type Dens, nests, spoors Residency Frequency
SOILS	Well drained soils Runoff potential Erodibility coefficient Soil types Natural soils groups

Table continued

PHYSICAL	Disturbance Contiguous land use Access to area (distance to road) Ease of passage through area Slope > 15% Visual experience Geological formation Unique geological features
USE	Ownership Zoning category Security Current use Previous research
STATUS	Occurrence Natural integrity Diversity Rare and endangered species

NATURAL AREAS SURVEY PROCEDURE

The following section describes the technique to be used in the field inventory. The objective of the procedure is to obtain information to characterize the dominant aspect of the vegetation of the natural area. This is for the purpose of aiding the land planning process. It is to paint a mental picture of an area through the use of words. It is not intended to generate data for any specific scientific purpose other than to identify sites of potential importance for research. Furthermore, no original work is attempted to estimate or model the potential effects of various impacts on ecological systems. For this we draw heavily on an extensive literature.

Familiarization

Review all air photos, soil surveys and topographic maps of the natural area to become familiar with the topography, soil moisture, location of water bodies and watercourses and the contiguous land uses. Review all material in the natural area folder pertaining to the site.

Preliminary Delineation

On the basis of this review make a preliminary determination as to whether the natural area delineations shown on the county map given to you are appropriate. You may find it desirable to aggregate certain categories on the county map where the character of the land is sufficiently similar. This may be especially appropriate where several areas delineated on the county map are contained within a park or wildlife refuge.

On the other hand, certain large areas with a diversity of distinct features may be more easily described if subdivided into discrete natural areas. For example, a very large tree or stand of trees may be located with an otherwise uniform forest. By designating this area separately, it can be more accurately described and assigned additional importance. Where you aggregate sites, cross out the areas on the county map which you have aggregated. Where you delineate additional natural areas, give them a natural area number and indicate them as separate natural areas on the county map and the data forms.

Vegetation Type Delineation

Using the soil survey or current aerial photos where available, carefully delineate plant communities which appear different on the aerial photograph. These are sub-sections of the natural area. Soil types give an excellent indication of the vegetation one may expect to encounter.

Natural Area Data Form

Enter all data on the Natural Area Data Form for card #1 and for card #2 through column 15.

Field Sampling

Make a field reconnaissance of the different plant communities you have delineated. Find a section of the plant community which fairly represents the character of the community as a whole. Establish a compass line which

Survey Procedure - cont.

will pass through such representative vegetation. At the beginning of the compass line, establish an imaginary circle 10 meters in radius (use a string of this length at first to aid in estimating this distance). Estimate and record cover by species in the canopy, understory, shrub and herb layers within the 10 meter radius circle. Describe the vegetation occurring in these physiognomic strata. The canopy is the highest forest layer. The understory is composed of trees of intermediate height. The shrub layer lies below the understory and is composed of species with multiple stems. The herb layer is within a few feet of the ground but may contain woody species such as Virginia creeper, poison ivy, dewberry or even grape. The latter may be found in the canopy. Determine the average DBH of trees within the circle which reach into the canopy. (Note that where, for example, tree cover is sparse and shrubs are abundant, the shrubs can be listed immediately after canopy species on the data form as long as the appropriate layer, shrub in this case, is correctly coded.)

Proceed along the compass line to the next station which must be at a sufficient distance. When data has been taken at a sufficient number of stations (no more than 5) to adequately reflect the composition of the community, enter the averages in the appropriate spaces on the data form. During sampling note animals which are distinctive and give an indication of their abundance. It should be noted that although wetlands are also to be ranked separately for wildlife value, the wetlands are to be sampled by estimating coverage as well. Note the location and number of each sampling station on the air photo.

Where wetlands are within the natural area perform the wetlands ranking as described in the accompanying paper by Francis Golet.

Where additional distinct communities are found during field reconnaisance which constitute 10 percent or more of the natural area, delineate on the map as sub-sections and sample.

Where communities located in the field are indistinct or constitute less than 10 percent of the natural area, sample them as part of the community to which they are most closely related. Small unique or unusual communities may be sampled in certain cases.

When areas delineated on the soil survey or air photo turn out on field checks to be similar to communities already sampled, it is permissible to list these communities on card #5 starting at column #5.

Sampling Station Criteria

Sampling stations are to be chosen in general according to the following criteria:

a. The vegetation shall be located on a uniform topographic site, i.e., on the exposure, slope position and geological substratum.

b. The sample area shall generally reflect the character of the mapping unit within which it is located.

Survey Procedure - cont.

Preparation of Text

Immediately upon completion of the survey, develop a paragraph from notes and data sheets and include the following considerations:

a. The unique, distinctive or characteristic features of the natural area.

b. The dominant vegetation or, if a mosaic, the type and percent coverage of the natural area by each type and describe corresponding site type(s).

c. Characteristic DBH, any lack of reproduction, obvious trends or vegetation dynamics.

d. Disturbances, historical notes.

e. Unusual animals, the importance of the natural area for wildlife, unusual geologic features.

f. Role of site in the coastal zone aquatic system.

Post-Reconnaissance Review

Following the reconnaissance, review all data sheets making certain the information accurately reflects the site's features.

Photos and Maps

Make certain all air photos are placed in the folder and are given a natural area number and that any alterations of natural areas are designated on county map. Code any personal photographs taken in the field on data sheets and label slides as soon as they are developed and returned to you.

Zoning and Land Use

On rainy days visit county seat and collect any zoning, land use planning or other site specific data possible on all natural areas.

Knowledgeable Persons

Be constantly alert for persons who may have knowledge about the natural features or history of natural areas. These may include hunters, fishermen, birders, school teachers and others. In conversation make it a point to collect names of others and set up appointments to interview the people on rainy days. Many contacts have already been made. In the folders you will find a list of people that have been interviewed.

Draw a Map

On the available air photos, delineate and label by vegetation type each of the subsections. In addition, label all roads and distinct physical features.

An example of a completed data form follows.

CARD#1

Col. No.

UPLAND NATURAL AREAS DATA FORM

JRGR Crew

1 — 1/15079330021301055 — Area Number

21 — *JOHNSTOWN-SHIPPEN CREEK WOODS — Area Name

58 — 061975 — Date

01	January	05	May	09	September
02	February	06	June	10	October
03	March	07	July	11	November
04	April	08	August	12	December

64 — 0278 — Size of Area (acres)

68 — 1 — Access to Area

1. Easy - Major highway, road or trail to the site.
2. Moderate - Road or trail a moderate distance from the site.
3. Difficult - Isolated area, not near road or surrounded by wet soils.

69 — 24 — Nearest Town

71 — 0000 — Elevation

75 — 4 — Minimum Dimension

1. Disjunct - Area is broken into segments
2. Less than 200 feet
3. 200-400 feet
4. 400-600 feet
5. 600-800 feet
6. 800-1000 feet
7. 1000-1200 feet
8. Greater than 1200 feet

76 — 2 — Zoning

1. Open Space - parks, playgrounds, stream ocrridors.
2. Rural - farms, agricultural, timber production.
3. Low Density Residential - single family.
4. High Density Residential - apartments, condominiums, PUDs.
5. Commercial - shopping centers, gas stations, professional offices.
6. Manufacturing - light industry, research.
7. Industrial - heavy industry.

77 — 08 — Current Use

1.	Recreation	5.	Wildlife Management	9.	Swimming	13.	Agriculture
2.	Vehicular Traffic (i.e. motor bikes)	6.	Timber Management	10.	Fishing	14.	Woodlots
3.	Trails	7.	Single Home	11.	Boating	15.	Dumping
4.	Hunting	8.	Several Homes	12.	Pasture	16.	Other

79 — 1* — Ownership

1. Private Individual
2. Corporation
3. Educational Institution
4. Private or Non-Profit Public Organization
5. Local Government
6. State Government
7. Federal Government
8. Unknown

CARD # 2

3 — 07 — North
5 — 07 — South
7 — 03 — East
9 — 03 — West

Contiguous Landuse

01.	Natural Area	07.	Agriculture	13.	Commercial
02.	Wetland	08.	Wildlife Management	14.	Industrial
03.	Water Body	09.	Road	15.	Recreational
04.	Park	10.	Highway	16.	Town
05.	Old Field	11.	Railroad		
06.	Managed Forest	12.	Residential		

11 — 1 — North
12 — 4 — South
13 — 4 — East
14 — 1 — West

Coastal Buffer Zone

1. Adequate - Any soil with a low to moderate runoff potential (A through C) having a cover of natural or successional vegetation 300 feet in width from the edge of a wetland (D or D* soil), watercourse of water body.
2. Questionable - Any belt of natural or successional vegetation along a wetland, watercourse or water body less than 300 feet but greater than 50 feet in width.
3. Inadequate - Any belt of natural or successional vegetation along a wetland, watercourse or water body less than 50 feet in width.
4. NOT APPLICABLE

15 — 02* — Geology

01.	Quaternary Deposits	05.	St. Mary's Formation	09.	Nanjemoy Formation	13.	Magothy Formation
02.	Lowland Deposits	06.	Choptank Formation	10.	Aquia Formation	14.	Potomac Group
03.	Upland Deposits	07.	Calvert Formation	11.	Brightseat Formation		
04.	Yorktown Formation	08.	Piney Formation	12.	Monmouth Formation		

18 — 2 — % of 5-10 Acre Openings

1 - 0-3 percent
2 - 3-5 percent
3 - 5-8 percent
4 - 8-10 percent
5 - 10-20 percent
6 - 20-30 percent
7 - Greater than 30 percent

19 — 2 — Occurrence

1. Common - Physical features or organism frequently encountered in the region.
2. Infrequent - Physical features or organism not commonly found are present; however, none are rare, endangered or unique.
3. Rare - Natural area containing an unusual physical feature or organism which is rare, endangered or at the geographic limit of its distribution.
4. Singularly Unique - Natural area containing a physical feature, organism or special habitat for an organism for which the area is the only known location in which it occurs.

20 — 2 — Diversity

1. High - Contains numerous different vegetation communities, animal habitats or physical features such as streams, bogs, scarps.
2. Medium - Contains a few different vegetation types and habitats or features.
3. Low - Contains predominantly one vegetation community or natural feature.

21 — 2 — Natural Integrity

1. Naturally Permanent - Vegetation or physical feature is relatively stable as revealed by the pattern of regeneration or the absence of physical deterioration. Disturbance is insignificant although some natural disturbance may be in evidence. Vegetation is mature or relatively stable because of its ability to resist succession.
2. Naturally Transitory - Vegetation or physical feature is changing due to plant succession either as a consequence of manmade or natural disturbance such as fire, erosion or flooding. Vegetation is relatively young and dynamic.
3. In Need of Management - Area will require management to maintain present character.
4. Uncertain - Possible source of change is not evident.

Col. No. CARD#2

22 [2] Security

1. Threatened with destruction within five years.
   a. areas currently being disturbed by man (i.e. channalization, siltation, logging, construction)
   b. areas currently under plan to be altered (i.e. sewer lines, homes)
   c. areas contiguous with new development, highway interchanges
   d. areas zoned commercial, residential, industrial
2. Areas safe for five years.
   a. areas not currently threatened with destruction, but not currently protected
3. Areas safe indefinitely
   a. areas owned by conservation organizations, designated as wildlife management areas or parks.
4. Unknown

23 [0 2] # Of Vegetation Types

25 [1 3] Visual Experience Score

27 [0 2] Visual Experience Term

29 [4 0 0 8] Primary Category

33 [3 0 9 1] Secondary Category

37 [6 0 0 1] Tertiary Category

41 [L A R G E P I N E - O A K F O R E S T A L O N G T H E C H E]

76 [S T E R] One Line Description (continue one line description onto Card#3 when necessary)

CARD#3

3 [R I V E R]

38

61 [0 5] Location

01 interior	05 tidal stream bank	09 ocean shore
02 island	06 non-tidal stream bank	10 water body
03 natural pond shore	07 bay shore	
04 impoundment shore	08 river bank	

63 [0 4] Site-Type

Upland:	Wetland:	
01 ridge	06 upland isolated	11 bottomland deltaic
02 upper slope	07 upland pondside	
03 mid-slope	08 bottomland isolated	
04 lower slope	09 bottomland pondside	
05 Floodplain	10 bottomland streamside	

65 [0 9] Ecological Unit

01 pond	05 marsh	09 forest	
02 river	06 bog	10 early forest	
03 tidal stream	07 wooded swamp	11 thicket	
04 non-tidal stream	08 shrub swamp	12 old field	
		13 Unusually Large Tree	

CARD#4

1 [2 / 1 5 4] Bibliography

6 "

9 "

12 "

15 "

18 "

21 "

24 "

27 "

30 "

Indicate The Identification Number Of Any Bibliographic Citations Which Relate To The Natural Area. This information is initially available in the site file folders. If you become aware of other studies not listed in the folder, record the citation as shown in the enclosed sample and give it a number as follows:

	County
701-730	Caroline
731-760	Cecil
761-790	Dorchester
791-820	Kent
821-850	Queen Anne
851-880	Somerset
881-910	Talbot
911-940	Wicomico
941-970	Worchester

These additional natural area references are given discrete identification numbers by field personnel according to the county in which they are located.

NAME(S)

Col. No.	CARD	coun.	elect. dist.		coun. site		field site		
1	7	1	5	0	7	9	3	3	0	0

CARD

3	M	R	.		A	N	D		M	R	S	.		J	A	M	E	S		G	.		H	A	U	P	T	,		R
33	.	D	.	3	,		C	H	E	S	T	E	R	T	O	W	N	,		M	D	.		2	1	6	2	0	.		

CARD

3	G	E	O	R	G	E		F.	.		J	O	H	N	S	O	N	,		R	.	D	.		3	,		C	H	E
33	S	T	E	R	T	O	W	N	,		M	D	.		2	1	6	2	0	.											

CARD

3																															
33																															

CARD

3																															
33																															

AUDITORY & VISUAL EXPERIENCE

Indicate The Experience Characteristics Of The Entire Area. Circle the appropriate word on the data sheet for each evaluation. Where indicated, enter the code in the blank preceding selected evaluations. Add the numerical codes for a Total Score, and select the appropriate term for that score. In the margin, make note of factors to include in the write-up of the area.

Auditory

Noise from offsite	(little/none)	audible	loud
Nature of offsite noise	(infrequent)	intermittent	constant

Visual

Typical length of views	long	intermediate	short	(mixed)
Typical nature of views	panoramas	enclosed	(mixed)	
Scale of landscape elements	large	(moderate)	small	mixed

		CODE: 3	2	1
2	Size of site	large	moderate	small
2	Variety (diversity) of visual elements	great	moderate	little
3	Views of water	frequent	occasional	rare/none
2	Rate of landscape change over distance	rapid	moderate	slow
2	Complexity of topography	complex	intermediate	simple
2	Personal impression of site	impressive	pleasant	unnoteworthy

13 Experience Total Score (enter in boxes)

Experience Term (enter in box)

	Score	
1.	6-9	low
(2.)	10-14	medium
3.	15-18	high

TEXT (p.1)

CARD

```
LOBLOLLY PINE AND OAKS CHARACT
ERIZE THESE FORESTS ON THE
```

CARD

```
CHESTER RIVER. IT IS ONE OF TH
E LARGEST FORESTS IN THE VI-
```

CARD

```
CINITY, AND HAS OVER A MILE OF
SHORELINE ON THE CHESTER RI-
```

CARD

```
VER AND ONE OF ITS SMALL TRIBU
TARIES, SHIRPEN CREEK. THIS
```

CARD

```
FOREST DEMONSTRATES FOREST SUC
CESSION--IN ONE SUBSECTION
```

CARD

```
COVERING 21% OF THE SITE, A DE
NSE UNDERSTORY OF SWEETGUMS IS
```

CARD

```
COMING UP UNDER A CANOPY OF LO
BLOLLY PINES. SEEDLINGS OF OAK
```

CARD

```
AND OTHER TOLERANT HARDWOODS A
RE COMMON ON THE FOREST FLOOR.
```

CARD

```
IN THE OTHER SUBSECTION MAKING
UP 79% OF THE AREA, OAKS,
```

CARD

```
SWEETGUM, RED MAPLE, AND BEECH
HAVE MOSTLY REPLACED THE
```

TEXT (p.2)

Col. No.

CARD

3 PINES AS THE DOMINANT CANOPY T
33 REES. WILDLIFE IS ABUNDANT,

CARD

3 ESPECIALLY DEER AND UPLAND GAM
33 E. NO OSPREY NESTS WERE

CARD

3 SIGHTED IN THIS SITE, BUT THOS
33 E NESTING ALONG THE CHESTER

CARD

3 RIVER FREQUENT THE AREA. BALD
33 EAGLES NO LONGER NEST IN THE

CARD

3 SITE, BUT OCCASIONALLY VISIT.
33 SEVERAL HOMES HAVE BEEN BUILT

CARD

3 WITHIN THE SITE AND OWNERS INT
33 END TO PRESERVE THE NATURAL

CARD

3 AREA.
33

CARD

3
33

CARD

3
33

CARD

3
33

Col. No. CARD#5

1 [3 / 0 1] Subsection Sampled

5 [ ] Similar Subsections

15 [0 5 9] Area of Subsection(s) (acres)

18 [S A A] Soil Type

22 [B 1] Natural Soils Group

25 [6] Runoff Potential

1. D+ High
2. D High
3. C+ Moderate
4. C Moderate
5. B+ Slight
6. B Slight
7. A Low

26 [6] High Water Table (depth)

1. Less than 1 ft.
2. 1-2 ft.
3. 2-3 ft.
4. 3-4 ft.
5. 4-5 ft.
6. 5-6 ft.
7. 6-7 ft.
8. 7-8 ft.
9. Greater than 8 ft.

27 [1] Soil Drainage

1. Yes Well drained soils occur in the subsection
2. No Well drained soils do not occur in the subsection

28 [1] Slope

1. Less than 15% slope
2. Greater than 15% slope

29 [4] Soil Erodibility

1. .17 Low
2. .20 Low
3. .24 Low
4. .28 Medium
5. .32 Medium
6. .37 Medium
7. .43 High
8. .49 High

30 [1] Water Body Distance

1. 0-10 feet
2. 10-50 feet
3. 50-100 feet
4. 100-200 feet
5. 200-300 feet
6. 300-500 feet
7. Greater than 500 feet
8. Contained within some subsection

31 [1 1] Water Body Type

01 Dace Trickle Stream
02 Trout Feeder
03 Trout Stream
04 Sucker Stream
05 Bass Feeder
06 Bass Stream
07 Pickerel Stream
08 Bullhead Stream
09 Catfish Stream
10 Carp Stream
11 Tidal Stream
12 Ocean - Atlantic Ocean
13 Bay - Bays indicated on County Topographic Maps.
14 Pond - small enclosed body of freshwater, often artificially formed.
15 Bog - waterlogged spongy accumulation of sphagnum moss which may support herbs such as sedges, rushes or scattered shrubs that cover less than 50 percent of the area.
16 Shallow Freshwater Marsh - low lying waterlogged soils covered with an average depth less than 6 inches during the growing season. Surface water may be absent during the late summer and abnormally dry periods. Vegetation is usually dominated by robust or marsh emergents.
17 Deep Freshwater Marsh - soil is covered with an average water depth between 6 inches and 3 feet during the growing season. Vegetation includes cattails, reeds, bulrushes, spikerushes, and wild rice.
18 Shrub Swamp - soil is usually waterlogged during the growing season and often covered by standing water. Vegetation is dominated by shrubs and includes alders, willows, buttonbush, dogwoods and swamp privet.
19 Wooded Swamp - soil is usually waterlogged during the growing season and seasonally covered with up to one foot of standing water. Trees include water oak, overcup oak, red maple, bald cypress and black gum.
20 Tidal Wetlands - marshes and swamps which are influenced by the tide.

33 [6] Water Body Size

1. Less than 1 acre
2. 1-5 acres
3. 5-10 acres
4. 10-20 acres
5. 20-30 acres
6. Greater than 30 acres

34 [2] Water Body Depth

1. Less than 1 foot
2. Greater than 1 foot

35 [4] Water Body Bottom Material

1. Peat - fibrous organic material with recognizable plant parts.
2. Muck - black ooze composed of silt and decomposed organic matter.
3. Silt - fine sediment with little organic material.
4. Sand - granular sediment.
5. Gravel - granular sediment with particles larger than 2 mm (approximately 1/8 in.).
6. Cobble - round or sub-round, water-worn rock 2 1/2-10 inches in diameter.
7. Rock - solid aggregate of minerals larger than a cobble.

36 [ ] Beach Length

1. Less than 500 feet
2. 500-1000 feet
3. 1000-1500 feet
4. Greater than 1500 feet

37 [ ] Beach Width

1. Less than 1 foot
2. 1-10 feet
3. 10-20 feet
4. Greater than 20 feet

38 [ ] Beach Type

1. Bank or Bluff - steep slope or abrupt embankment along water's edge.
2. Low, sloping sandy beach without dunes.
3. Low, sloping sandy beach with dunes.

CARD#5(con't)

39 [ ] % Stream Shaded

0 - less than 10% 1 - 10-20% 2 - 20-30% 3 - 30-40% 4 - 40-50% 5 - 50-60% 6 - 60-70% 7 - 70-80% 8 - 80-90% 9 - 90-100%

40 [ ] Wetland Wildlife Rank

43 [0 8 1] Vegetation Type

46 [1 7] Primary Disturbance

48 [2 0] Secondary Disturbance

1. Channalization (Channalizat)
2. Dredging
3. Sewer Outlet
4. Culverts
5. Bulkheading
6. Dikes
7. Dams
8. Change in Watertable (Chng watrtbl)
9. Logs and Debris (Log + Debris)
10. Beaver Dams
11. Algal Blooms
12. Fedid Odor
13. Siltation
14. Erosion
15. Noise
16. Air Pollution (Air Pollutn)
17. Selective Cutting (Selct Cutng)
18. Clear Cutting (Clear Cutng)
19. Fire
20. Windthrow
21. Disease
22. Litter Accumulation, leaf (Leaf Litter)
23. Dumping
24. Littering, paper (Paper Litter)
25. Vandalism
26. Trampling
27. Motor Vehicles (Motr Vehicl)
28. Postagricultural (Post Ag)
29. Other
30 none
31. Flooding
32. Grazing

50 [3] Ease of Passage

1. Difficult - Thick understory or wet mucky soil
2. Moderate - Interspersed understory or wet soils
3. Easy - Open understory, dry soils

51 [5 0 1 5] Animal

55 [7] Source and Frequency

56 [4] Residency

57 [6 3 6 4] Animal

61 [5] Source and Frequency

62 [1] Residency

63 [6 8 0 0] Animal

67 [6] Source and Frequency

68 [5] Residency

69 [ ] Animal

73 [ ] Source and Frequency

74 [ ] Residency

75 [ ] Animal

79 [ ] Source and Frequency

80 [ ] Residency

PHOTOGRAPH#(S)

SOURCE - FREQUENCY

1. Observed-abundant
2. Observed - common
3. Observed- rare
4. Reported- abundant
5. Reported-common
6. Reported-rare
7. Den or Nest-abundant
8. Den or Nest-common
9. Den or Neast-rare

RESIDENCY

1. Breeding
2. Migratory
3. Winter Concentration
4. Year-round Resident
5. Unknown

VEGETATION SAMPLING

Data Form — Worksheet

CARD #6

Col No.	coun.	elect. dist.	coun. site	field site	sub sec
1	5 / 1	5 0 7 9	3 3	0 0	0 1

	Species	LAYER	IMPORT	Avpct cov	DBH	SPECIES NAME	REPROD	1 cov	1 DBH	2 cov	2 DBH	3 cov	3 DBH	4 cov	4 DBH	5 cov	5 DBH
14	0 4 4 5	1		6	4	LOBLOLLY PINE		6	4								
22	0 3 1 3	1		0	3	BLACK WALNUT		0	3								
30	0 5 4 8	1		0	3	BLACK LOCUST		0	3								
38	0 3 4 6	2		5		SWEETGUM		5									
46	0 1 8 7	2		1		FLOWERING DOGWOOD		1									
54	0 0 3 3	2		0		RED MAPLE		0									
62	0 3 4 6	3		3		SWEETGUM		3									
70	0 5 7 1	3		0		WINEBERRY		0									
	CARD #7																
3	0 3 5 5	4		3		JAPANESE HONEYSUCKLE		3									
11	0 1 1 6	4		1		TRUMPET CREEPER		1									
19	0 4 0 9	4		0		VIRGINIA CREEPER		0									
27	0 7 3 9	4		0		JACK-IN-THE-PULPIT		0									
35	0 5 7 1	4		0		WINEBERRY		0									
43																	
51																	
59																	
67																	
	CARD #8																
3																	
11																	
19																	
27																	
35																	
43																	
51																	
59	6 7 4 6					Canopy, Understory, Shrub, Herb- Total Average Cover											

Layer	Avg. % Cover		Reproduction	Average DBH	
1. canopy 3. shrub	0-<5	5-50	X-yes	1=1-4"	6=18-24"
2. understory 4. herb	1-10	6-60	O-no	2=4-6"	7=24-30"
Importance	2-20	7-70		3=6-9"	8=30-36"
1. unique or rare	3-30	8-80		4=9-12"	9= > 36"
2. champion tree(>2ft.)	4-40	9-90		5=12-18"	
3. endangered					

Col. No. CARD #5

1 [3][/][0][2] Subsection Sampled

5 [ ] Similar Subsections

15 [2][1][9] Area of Subsection(s) (acres)

18 [E][N][A][ ] Soil Type

22 [F][3][ ] Natural Soils Group

25 [1] Runoff Potential

1. D+ High
2. D High
3. C+ Moderate
4. C Moderate
5. B+ Slight
6. B Slight
7. A Low

26 [1] High Water Table (depth)

1. Less than 1 ft.
2. 1-2 ft.
3. 2-3 ft.
4. 3-4 ft.
5. 4-5 ft.
6. 5-6 ft.
7. 6-7 ft.
8. 7-8 ft.
9. Greater than 8 ft.

27 [2] Soil Drainage

1. Yes Well drained soils occur in the subsection
2. No Well drained soils do not occur in the subsection

28 [1] Slope

1. Less than 15% slope
2. Greater than 15% slope

29 [7] Soil Erodibility

1. .17 Low
2. .20 Low
3. .24 Low
4. .28 Medium
5. .32 Medium
6. .37 Medium
7. .43 High
8. .49 High

30 [1] Water Body Distance

1. 0-10 feet
2. 10-50 feet
3. 50-100 feet
4. 100-200 feet
5. 200-300 feet
6. 300-500 feet
7. Greater than 500 feet
8. Contained within some subsection

31 [1][1] Water Body Type

01 Dace Trickle Stream
02 Trout Feeder
03 Trout Stream
04 Sucker Stream
05 Bass Feeder
06 Bass Stream
07 Pickerel Stream
08 Bullhead Stream
09 Catfish Stream
10 Carp Stream
11 Tidal Stream
12 Ocean - Atlantic Ocean
13 Bay - Bays indicated on County Topographic Maps.
14 Pond - small enclosed body of freshwater, often artificially formed.
15 Bog - waterlogged spongy accumulation of sphagnum moss which may support herbs such as sedges, rushes or scattered shrubs that cover less than 50 percent of the area.
16 Shallow Freshwater Marsh - low lying waterlogged soils covered with an average depth less than 6 inches during the growing season. Surface water may be absent during the late summer and abnormally dry periods. Vegetation is usually dominated by robust or marsh emergents.
17 Deep Freshwater Marsh - soil is covered with an average water depth between 6 inches and 3 feet during the growing season. Vegetation includes cattails, reeds, bulrushes, spikerushes, and wild rice.
18 Shrub Swamp - soil is usually waterlogged during the growing season and often covered by standing water. Vegetation is dominated by shrubs and includes alders, willows, buttonbush, dogwoods and swamp privet.
19 Wooded Swamp - soil is usually waterlogged during the growing season and seasonally covered with up to one foot of standing water. Trees include water oak, overcup oak, red maple, bald cypress and black gum.
20 Tidal Wetlands - marshes and swamps which are influenced by the tide.

33 [6] Water Body Size

1. Less than 1 acre
2. 1-5 acres
3. 5-10 acres
4. 10-20 acres
5. 20-30 acres
6. Greater than 30 acres

34 [2] Water Body Depth

1. Less than 1 foot
2. Greater than 1 foot

35 [3] Water Body Bottom Material

1. Peat - fibrous organic material with recognizable plant parts.
2. Muck - black ooze composed of silt and decomposed organic matter.
3. Silt - fine sediment with little organic material.
4. Sand - granular sediment.
5. Gravel - granular sediment with particles larger than 2 mm (approximately 1/8 in.).
6. Cobble - round or sub-round, water-worn rock 2 1/2-10 inches in diameter.
7. Rock - solid aggregate of minerals larger than a cobble.

36 [ ] Beach Length

1. Less than 500 feet
2. 500-1000 feet
3. 1000-1500 feet
4. Greater than 1500 feet

37 [ ] Beach Width

1. Less than 1 foot
2. 1-10 feet
3. 10-20 feet
4. Greater than 20 feet

38 [ ] Beach Type

1. Bank or Bluff - steep slope or abrupt embankment along water's edge.
2. Low, sloping sandy beach without dunes.
3. Low, sloping sandy beach with dunes.

CARD#5(con't)

39 [ ] % Stream Shaded

0 - less than 10% 1 - 10-20% 2 - 20-30% 3 - 30-40% 4 - 40-50% 5 - 50-60% 6 - 60-70% 7 - 70-80% 8 - 80-90% 9 - 90-100%

40 [ ] Wetland Wildlife Rank

43 [0 8 2] Vegetation Type

46 [1 7] Primary Disturbance

48 [2 7] Secondary Disturbance

1. Channalization (Channalizat)
2. Dredging
3. Sewer Outlet
4. Culverts
5. Bulkheading
6. Dikes
7. Dams
8. Change in Waterlable (Chng watrtbl)
9. Logs and Debris (Log + Debris)
10. Beaver Dams
11. Algal Blooms
12. Fedid Odor
13. Siltation
14. Erosion
15. Noise
16. Air Pollution (Air Pollutn)
17. Selective Cutting (Select Cutng)
18. Clear Cutting (Clear Cutng)
19. Fire
20. Windthrow
21. Disease
22. Litter Accumulation, leaf (Leaf Litter)
23. Dumping
24. Littering, paper (Paper Litter)
25. Vandalism
26. Trampling
27. Motor Vehicles (Motr Vehicl)
28. Postagricultural (Post Ag)
29. Other
30 none
31. Flooding
32. Grazing

50 [2] Ease of Passage

1. Difficult - Thick understory or wet mucky soil
2. Moderate - Interspersed understory or wet soils
3. Easy - Open understory, dry soils

51 [5 0 1 5] Animal

55 [7] Source and Frequency

56 [4] Residency

57 [6 8 0 0] Animal

61 [6] Source and Frequency

62 [5] Residency

63 [ ] Animal

67 [ ] Source and Frequency

68 [ ] Residency

69 [ ] Animal

73 [ ] Source and Frequency

74 [ ] Residency

75 [ ] Animal

79 [ ] Source and Frequency

80 [ ] Residency

PHOTOGRAPH#(S)

SOURCE - FREQUENCY

1. Observed-abundant
2. Observed - common
3. Observed- rare
4. Reported- abundant
5. Reported-common
6. Reported-rare
7. Den or Nest-abundant
8. Den or Nest-common
9. Den or Neast-rare

RESIDENCY

1. Breeding
2. Migratory
3. Winter Concentration
4. Year-round Resident
5. Unknown

VEGETATION SAMPLING

Data Form — Worksheet

CARD #6

Col No.	coun.	elect. dist.	coun. site	field site	sub sec
1	5 / 1 5	0 7 9	3 3	0 0	0 2

Col No.	Species	LAYER	IMPORT	Avpctcov	DBH	SPECIES NAME	REPROD	1 COV	1 DBH	2 COV	2 DBH	3 COV	3 DBH	4 COV	4 DBH	5 COV	5 DBH
14	0 2 4 6	1		1	5	AMERICAN BEECH		1	5								
22	0 4 9 2	1		2	5	WHITE OAK		2	5								
30	0 4 4 5	1		1	5	LOBLOLLY PINE		1	5								
38	0 1 2 8	1		0	5	MOCKERNUT		0	5								
46	0 3 4 6	1		1	5	SWEETGUM		1	5								
54	0 2 2 0	1		0	3	COMMON PERSIMMON		0	3								
62	0 5 0 4	1		0	4	PIN OAK		0	4								
70	0 5 0 5	1		0	5	WILLOW OAK		0	5								
	CARD #7																
3	0 1 8 7	2		3		FLOWERING DOGWOOD		3									
11	0 1 2 8	2		0		MOCKERNUT		0									
19	0 2 2 0	2		1		COMMON PERSIMMON		1									
27	0 0 3 3	2		1		RED MAPLE		1									
35	0 3 0 1	2		4		AMERICAN HOLLY		4									
43	0 5 1 1	2		1		BLACK OAK		1									
51	0 3 4 6	3		0		SWEET GUM		0									
59	0 2 9 9	3		0		WINTER BERRY		0									
67	0 6 2 3	3		0		SYMPHORICARPOS		0									
	CARD #8																
3	0 6 0 2	4		0		SMILAX		0									
11	0 3 5 5	4		0		JAPANESE HONEYSUCKLE		0									
19	0 9 3 1	4		0		SENSITIVE FERN		0									
27	0 3 7 5	4		0		SWEETBAY		0									
35	0 6 5 9	4		0		LOW SWEET BLUEBERRY		0									
43	0 4 0 9	4		0		VIRGINIA CREEPER		0									
51																	
59	8 5 4 3	Canopy, Understory, Shrub, Herb- Total Average Cover															

Layer	Avg. % Cover		Reproduction	Average DBH	
1. canopy 3. shrub	0-<5	5-50	X-yes	1=1-4"	6=18-24"
2. understory 4. herb	1-10	6-60	O-no	2=4-6"	7=24-30"
Importance	2-20	7-70		3=6-9"	8=30-36"
1. unique or rare	3-30	8-80		4=9-12"	9= > 36"
2. champion tree(>2ft.)	4-40	9-90		5=12-18"	
3. endangered					

WETLAND FIELD SAMPLING

Wetlands shall be sampled according to the procedure outlined in the enclosed paper by Francis C. Golet. The categories used in this procedure along with their significance coefficients and rank are summarized in the appendix "Wetlands". The Wetland Wildlife Rating Worksheet and Data Form is to be used to rank wetlands.

All wetland classes found are listed in the spaces under Class Richness starting at the right. The rank is determined by the number of classes and multiplied by the significance coefficient to give the sub-score. Surrounding habitats are listed as percent of the shoreline. Percentages are entered in boxes. Rank is determined from appendix "Wetland".

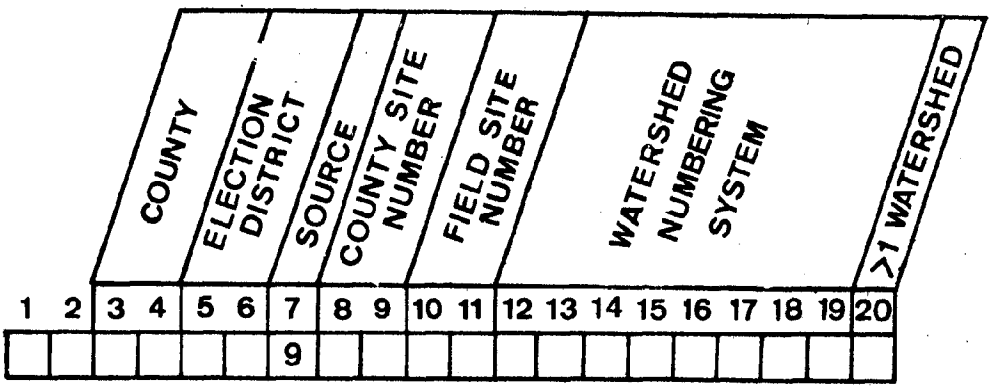
CODING

The nucleus of the study is the field evaluation and the data sheets which are generated for each natural area. These data sheets will be digitized on computer cards which will become the data bank for the study. Computer programs are being devised to permit the printing-out of selected combinations of data for easier handling and for comparison or ranking of areas.

As in any computerized data system, observed or ranked information will have to be translated into coding. This is a relatively easy process. A range of possible phenomena are listed in the encoding instructions with a specific number or symbol assigned to each. These numbers simply stand for the entire descriptive phrase or number associated with the actual field observation. Unlike typographical errors, where mistakes are readily observable, errors in encoding will be extremely difficult to detect. Therefore, it is essential that care be exercised in entering the code numbers into the appropriate spaces. The following sheets are instructions for filling out data forms by parameter. They are organized in the sequence which they occur on the data sheets. The transparent **index dividers labeled** - CARD #1, CARD #2.....correspond to the computer card numbers on the data sheets.

ENCODING INSTRUCTIONS

NATURAL AREA NUMBER



County Numbers

Indicate the county which contains the major portion of the natural area.

06	Caroline
08	Cecil
10	Dorchester
15	Kent
18	Queen Anne's
20	Somerset
21	Talbot
23	Wicomico
24	Worcester

County Site Number

Sites have been delineated and numbered on each County Topographic Map. Record the number indicated on the map.

Field Site Number

Natural Areas are given a 4-digit number. The first two digits refer to the County site number. The second 2-digits refer to the Field Site number or other natural areas contained in a larger natural area. Thus number 1200 refers to a larger natural area while number 1201 refers to a smaller natural area within natural area 1200. Where field personnel determine a site to be a separate natural area within a larger natural area, the Field Site Number will be given the next number in the sequence of field sites.

Election District

Election Districts vary by county. This information is available on County Topographic Maps. Indicate the district which contains the major portion of the natural area.

Source

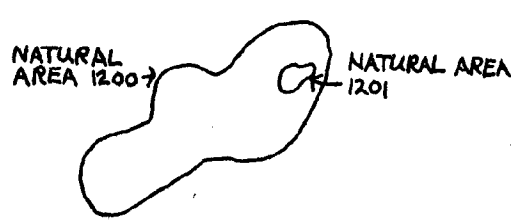
We are considered by State Planning MAGI Computer System to be information source #9.

Watershed Number

Each watershed and sub-watershed has been numbered by the Water Resources Administration. See the attached list and record the watershed number for each natural area.

More Than One Watershed

Where a site occurs in more than one watershed, mark an (*) in column 20.



AREA NAME

Sites Already Named

Where the site already has a name it should be recorded as given on the County Topographic Maps or in secondary sources of information contained in the file folders provided for the site.

Sites Without Names

Sites with no names should be given a name which reflects the salient characteristics of the site. Where a site is assigned a name in the field it should be indicated as such with an asterisk before the name.

For Example:

1. *MIXED FOREST WITH RHODODENDRONS
2. *WICOMICO CREEK FRESHWATER MARSH
3. *TALBOT SCARP
4. *PLAINFIELD NATURAL SPRINGS
5. *NATURAL UNDISTURBED LOBLOLLY PINE STAND
6. *REGENERATING BALD CYPRESS FOREST
7. *NORTHERN LIMIT OVERCUP OAK STAND
8. *ELK NECK CLIFFS

21 57

Leave a space between words

DATE

Indicate the month, day and year.

	Month		Month
01	January	07	July
02	February	08	August
03	March	09	September
04	April	10	October
05	May	11	November
06	June	12	December

AREA SIZE

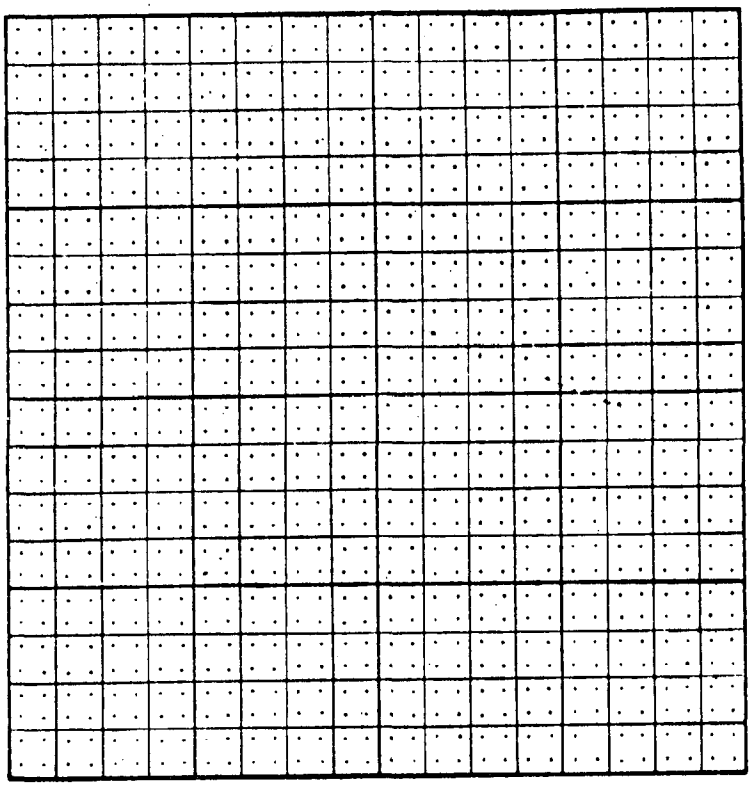
Count the number of acres of each natural area

Use of a dot grid is the preferred method for determining the number of acres on aerial photographs. A dot grid (provided in the notebook) is a transparent overlay with dots systematically arranged on a grid pattern. In use, the grid is aligned with a straight-line feature to avoid positioning bias, and then dots or squares are tallied for the area. Follow the instructions on the transparent overlay.

Example Conversion for Grid Squares:

Scale -- 1:15,840 - 2.5 acres/grid square
1:20,000 - 4 acres/grid square

Source: USDA Forest Service, Articultural Handbook 308.



MODIFIED ACREAGE GRID

(64 dots per square inch)

To be used for acreage determinations on maps of any scale.

Place grid over area to be measured; count dots, multiply by converting factor to compute total acreage. When dots fall on area boundary count alternate dots.

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Item #45010, Forestry Suppliers, Inc., Jackson, Miss.

MAP SCALES AND EQUIVALENTS

Fractional Scale	Inches Per Mile	Acres Per Square Inch	Converting Factor Each dot equals:
1" = 7,920"	8.00	10.000	0.156 Acres
1" = 9,600"	6.60	14.692	0.230 Acres
1" = 15,840"	4.00	40.000	0.625 Acres
1" = 20,000"	3.168	63.769	0.996 Acres
1" = 31,680"	2.00	160.000	2.500 Acres
1" = 63,360"	1.00	640.000	10.000 Acres
1" = 125,000"	0.507	2,490.980	38.922 Acres
1" = 250,000"	0.253	9,963.906	155.686 Acres
1" = 500,000"	0.127	39,855.627	622.744 Acres

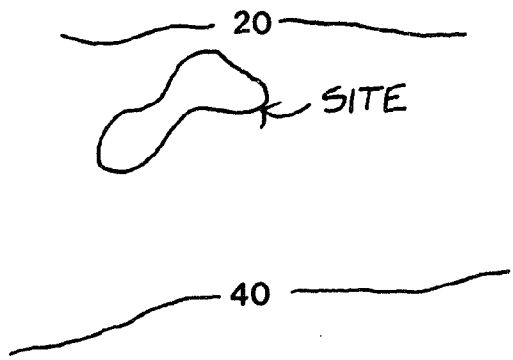
ELEVATION

Indicate the nearest contour interval

Using the County Topographic Maps, indicate the elevation by recording the elevation of the nearest contour interval.

For Example:

		2	0

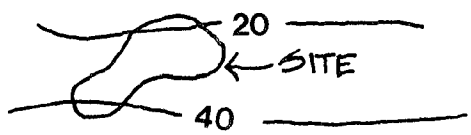


Where more than one contour interval exists

Indicate the average elevation.

For Example:

		3	0



All numbers should be right justified, leaving blanks before number.

ACCESS TO AREA

Indicate the ease of approach to a natural area

1. Easy - Major highway, road or trail to the site.

2. Moderate - Road or trail a moderate distance from the site.

3. Difficult - Isolated area, not near road or area surrounded by wet soils.

NEAREST TOWN

Choosing the nearest town

Using the County Topographic Maps, indicate the nearest town by straight line distance. Record the town number taken from the list of nearest towns.

MINIMUM DIMENSION

Indicate the width of the most constricted segment of the natural area

1. Disjunct - Area is broken into segments
2. Less than 200 feet
3. 200-400 feet
4. 400-600 feet
5. 600-800 feet
6. 800-1000 feet
7. 1000-1200 feet
8. Greater than 1200 feet

ZONING

Indicate the current zoning status of the natural area

1. Open Space - parks, playground, stream corridors.
2. Rural - farms, agricultural, timber production.
3. Low Density Residential - single family.
4. High Density Residential - apartments, condominiums, PUDs.
5. Commercial - shopping centers, gas stations, professional offices.
6. Manufacturing - light industry, research.
7. Industrial - heavy industry.

CURRENT USE

Indicate the current major use of the natural area

01. Recreation
02. Vehicular Traffic (i.e.,motor bikes)
03. Trails
04. Hunting
05. Wildlife Management
06. Timber Management
07. Single Home
08. Several Homes
09. Swimming
10. Fishing
11. Boating
12. Pasture
13. Agriculture
14. Woodlots
15. Dumping
16. Other or none

OWNERSHIP

Indicate who is principal owner of the natural area

1. Private Individual
2. Corporation
3. Educational Institution
4. Private or Non-Profit Public Organization
5. Local Government
6. State Government
7. Federal Government
8. Unknown

If the area is owned by more than one party, indicate this by placing an asterisk (*) in the second square on the right.

CANADA 2

CONTIGUOUS LAND USE

Indicate contiguous land uses for each compass direction of a natural area

01. Natural Area
02. Wetland
03. Water Body
04. Park
05. Old Field
06. Managed Forest
07. Agriculture
08. Wildlife Management
09. Road
10. Highway
11. Railroad
12. Residential
13. Commercial
14. Industrial
15. Recreational
16. Town
17. Channelized Stream

GEOLOGICAL FORMATION

Indicate the geological formation which underlies the natural area using the geologic map of Maryland 1968

01. Quaternary Deposits
02. Lowland Deposits
03. Upland Deposits
04. Yorktown Formation
05. St. Mary's Formation
06. Choptank Formation
07. Calvert Formation
08. Piney Formation
09. Nanjemoy Formation
10. Aquia Formation
11. Brightseat Formation
12. Monmouth Formation
13. Magothy Formation
14. Potomac Group
15. Matawan

If more than one formation occurs in the area, indicate this by placing an asterisk (*) in the third square.

AQUATIC BUFFER ZONE

Indicate the category which applies only to areas acting as buffers to aquatic systems by compass direction

For the purposes of this study, a buffer zone is a band of vegetation contiguous with wetlands or watercourses which protects them from erosion and from contamination by non-point source pollutants such as sediment, fertilizer and pesticides. Always determine the buffer direction with respect to the water body. Where a stream flows through the natural area, indicate buffers' direction from the stream. Where a natural area is on a point surrounded by a bay or broad river embayment, indicate the buffer direction from the river or bay. Where a site both contains a stream and is flanked by an embayment, describe the buffer to the water body having the greatest frontage on or in the natural area. For the smaller of the two water bodies, describe the adequacy of the buffer in the text.

1. Adequate. Any soil area with a low to moderate runoff potential (A through C) having a cover of natural or successional vegetation and which is 300 feet in width from the edge of a wetland (D or D^+ soil), watercourse or water body.

2. Questionable. Any belt of natural or successional vegetation along a wetland, watercourse or water body less than 300 feet but greater than 50 feet in width.

3. Inadequate. Any belt of natural or successional vegetation along a wetland, watercourse or water body less than 50 feet in width.

% OF 5-10 ACRE OPENINGS

Using an aerial photograph determine the percentage of 5-10 acre openings in forests

Small openings scattered throughout a forest add substantially to the quality of width habitat because of the favorable "edge effect" created for certain wildlife species. The major forest game species prefer the more open conditions of forest edges to those of the forest interior. A landscape with 3 to 5 percent of the area in openings 5 to 10 acres in size is considered to be of highest quality for such forest wildlife. Forested regions with no openings or with more than 5 percent of the area in openings are considered to provide a lower quality habitat for game species.

1 - 0-3 percent
2 - 3-5 percent
3 - 5-8 percent
4 - 8-10 percent
5 - 10-20 percent
6 - 20-30 percent
7 - Greater than 30 percent

OCCURRENCE

Indicate the relative frequency of the vegetation type(s) or other significant natural features of the natural area in the context of its frequency of occurrence on the Eastern Shore

Where an unusual natural feature occurs within the natural area or where the natural area provides the habitat for a particular plant or animal which is in some way rare, unique or unusual, then "occurrence" shall be defined in terms of this feature, plant or animal.

1. Common - Vegetation, physical features or organism of the natural area frequently encountered in the region.

2. Infrequent - Vegetation, physical features or organism of the natural area not commonly found are present; however, none are rare, endangered or unique.

3. Rare - Natural area containing an unusual physical feature or organism which is rare, endangered or at the geographic limit of its distribution.

4. Singularly Unique - Natural area containing a physical feature, organism or special habitat for an organism for which the area is the only known location in which it occurs.

DIVERSITY

Indicate the number of different vegetation communities or other natural features which the site contains

1. High - Contains numerous different vegetation communities, animal habitats or physical features such as streams, bogs, scarps.

2. Medium - Contains a few different vegetation types and habitats or features.

3. Low - Contains predominantly one vegetation community or natural feature.

NATURAL INTEGRITY

Indicate the present natural integrity of the natural area on the basis of natural regeneration, age, and the absence of man-induced disturbance

1. Naturally Permanent - Vegetation or physical feature is relatively stable as revealed by the pattern or regeneration or the absence of physical deterioration. Disturbance is insignificant although some natural disturbance may be in evidence. Vegetation is mature or may be relatively stable because of its ability to resist succession.

2. Naturally Transitory - Vegetation or physical feature is changing due to plant succession either as a consequence or man-made or natural disturbance such as fire, erosion or flooding. Vegetation is relatively young and dynamic.

3. In Need of Management - Area will require management to maintain present character.

4. Uncertain - Possible source of change is not evident.

SECURITY

Indicate the probable time frame within which physical alterations by man's activities may occur

Assess all influences operating in a locality which may contribute to encroachment upon or destruction of the natural area.

1. Threatened with destruction within five years

    a. area currently being disturbed by man (i.e., channelization, siltation, logging, construction)

    b. areas currently under plan to be altered (i.e., sewer lines, homes)

    c. areas contiguous with new development, highway interchanges

    d. areas zoned commercial, residential, industrial

    e. for sale signs

2. Areas safe for five years

    a. areas not currently threatened with destruction, but not currently protected

3. Areas safe indefinitely

    a. areas owned by conservation organization, designated as wildlife management areas or parks.

4. Unknown

TOTAL NUMBER OF VEGETATION TYPES

Indicate the total number of vegetation types present in each natural area

AUDITORY & VISUAL EXPERIENCE

Describe the experiential characteristics of the entire area

Circle the appropriate word on the data sheet for each evaluation. Where indicated, enter the code in the blank preceding selected evaluations. Add the numerical codes for a Total Score. In the margin, make note of factors you want to remember to include in the write-up of the area. In addition, select the term which best summarizes your visual impression or visual experience and enter the number on the data sheet under Visual Term.

Auditory

Noise from offsite	little/none	audible	loud
Nature of offsite noise	infrequent	intermittent	constant

Visual

Typical length of views	long	intermediate	short	mixed
Typical nature of views	panoramas	enclosed	mixed	
Scale of landscape elements	large	moderate	small	mixed

	CODE:	3	2	1
____	Size of site	large	moderate	small
____	Variety (diversity) of visual elements	great	moderate	little
____	Views of water	frequent	occasional	rare/none
____	Rate of landscape change over distance	rapid	moderate	slow
____	Complexity of topography	complex	intermediate	simple
____	Personal impression of site	impressive	pleasant	unnoteworthy

____ Experience Total Score (enter in boxes)

Experience Term (enter in box)

1. low
2. medium
3. high

CATEGORIES

Indicate the three most interesting, unusual or most descriptive characteristics of the natural area

The priority for choosing a category should follow the general rule of ....rare, endangered, unusual, interesting, descriptive. All three categories need not be filled out; however, the Primary and Secondary Categories should be filled out whenever possible. Record the number listed on the Category Code Sheets which follow.

PRIMARY CATEGORY

SECONDARY CATEGORY

TERTIARY CATEGORY

ONE LINE DESCRIPTION

Write a brief sentence or phrase describing the salient characteristic of the Natural area

You are limited to 100 spaces.

For Example:

1. Large and active natural spring
2. Small bog with nearby hiking trails
3. Natural pond, excellent wildlife area
4. Large stand of mixed hardwoods with beech predominating
5. Large bog and pond, unusual vegetation on both
6. Very remote white cedar swamp with rhododendron

CARD 3

LOCATION

Indicate the general geographic location of each natural area

01	Interior - upland site.
02	Island - upland surrounded by water.
03	Natural Pond Shore - adjacent to small, enclosed body of water.
04	Water Impoundment Shore - adjacent to waterbody held back by a dam.
05	Tidal Stream Shore - adjacent to tidal stream.
06	Non-Tidal Stream Shore - adjacent to non-tidal stream.
07	Bay Shore - area bayside of an imaginary line connecting the two outer-most land peninsulas gutting out from the edge of the mouth of the stream.
08	River Shore - area interior and labeled "River" on County Topographic Maps.
09	Ocean Shore - area adjacent to ocean.
10	Waterbody - a waterbody itself.

SITE - TYPE

Indicate a vegetation descriptor based upon topographic and hydrologic location

The site-type refers to the general or dominant characteristic of the natural area.

UPLAND

01	Ridge - hill crest with dry, thin or no soil. A ridge typically contains rock outcrops with scattered pockets of soil.
02	Upper Slope - thin soils on hilltops drying early in summer and supporting species characteristic of drier sites.
03	Midslope - site displaying characteristic regional vegetation. Soils are neither excessively droughty nor excessively saturated.
04	Lower Slope - sites with a seasonal high water table (about 1 foot from surface) with characteristic vegetation between streams, ponds and wetlands and the midslope.
05	Floodplain - seasonally flooded sites supporting a lower slope vegetation.

WETLANDS

06	Upland-isolated - wetland sites above alluvial soils and not contiguous with open bodies of water.
07	Upland-pondside - wetland sites above alluvial soils and contiguous with ponds and impoundments.
08	Bottomland-isolated - wetland sites in floodplains and/or wet soils and not contiguous with other open bodies of water.
09	Bottomland-pondside - wetland sites in floodplains and/or wet soils countiguous with ponds or impoundments.
10	Bottomland-streamside - wetland sites in floodplains and/or wet soils and contiguous with streams.
11	Bottomland-deltaic - wetland sites in floodplains and/or wet soils at the point where a stream enters a pond or impoundment.

ECOLOGICAL UNIT

Indicate the generalized descriptive term for the ecological system which predominates in the natural area

01	Pond - small enclosed body of freshwater often artificially formed.
02	River - a flowing body of water designated as a river on the County Topographic Maps and interior to the first bridge.
03	Tidal Stream - a stream whose water level fluctuates due to tidal influence.
04	Non-Tidal Stream - a stream which is above tidal influence.
05	Marsh - the soil is usually covered with water during the growing season. Vegetation includes grasses and forbs such as bulrush, cattails, arrowheads and smartweeds.
06	Bog - waterlogged soils supported by a spongy covering of mosses. Typical vegetation includes heath shrubs, moss and sedges.
07	Wooded Swamp - soil is usually waterlogged during the growing season and often covered by standing water. Trees are the dominant vegetation. Trees include water oak, overcup oak, red maple, cypress and black gum.
08	Shrub Swamp - soil is usually waterlogged during the growing season and is often covered with standing water. Vegetation includes alders, willows, buttonbush, dogwoods, and swamp privet.
09	Forest - upland site which is not less than 20 acres in area and contains at least 60% canopy cover with trees not less than 6 inches diameter at breast height.
10	Early Forest - upland site which is not less than 20 acres and contains trees with average diameter at breast height less than 6 inches with at least 60% canopy cover.
11	Thicket - upland site which is not less than 40 acres and contains shrubs, and herbaceous plants with occasional tree seedlings or saplings.
12	Old Field - area not less than 40 acres which contains predominantly herbaceous plants such as goldenrod, asters and various grasses.

BIBLIOGRAPHY

Indicate the identification number of any bibliographic citations which relate to the natural area

Some citations are in the site file folders. If you become aware of other studies record the citation as shown in the enclosed sample and give it a number as follows:

	County
701-730	Caroline
731-760	Cecil
761-790	Dorchester
791-820	Kent
821-850	Queen Anne
851-880	Somerset
881-910	Talbot
911-940	Wicomico
941-970	Worcester

These additional natural area references are given discrete identification numbers of field personnel according to the county in which they are located.

IBM MASTER SHEET (Fill out in PENCIL) FORTRAN Coding Form

GX28-7327-6 U/M 050** Printed in U.S.A.

PROGRAMMER DATE

Maryland Upland Natural Areas Study

(LEAVE [1] & [2] BLANK)

(BOOK) (PUBLICATION DATE) FORTRAN STATEMENT (LIMIT) IDENTIFICATION SEQUENCE

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H 803BELLWETHER J AND PUGH W R 1936  EASTERN SHORE EXCURSIONS          1 of 2
H 803BALTO: JOHNS HOPKINS PRESS 325PP WITH MAPS.                        2 of 2
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(IDENTIFICATION NUMBER - ANY ORDER, BUT DO NOT DUPLICATE - NUMBER EVERY LINE)

(PLACE AND PUBLISHER)

(TITLE - SEPARATE 2 SPACES BEFORE AND AFTER)

(LABEL EACH LINE AS 1 OF TOTAL NUMBER OF LINES)

(ARTICLE) (AUTHOR, LAST NAME FIRST) (ARTICLE TITLE + "IN")

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729ANTHONY JAMES T 1972  BOTANICAL RARITIES OF MARYLANDS               1 of 3
729EASTERN SHORE, IN: PRCDGS ACAD NAT SCIENCES, PHILA. VOL7            2 of 3
729PP 63-79. MAPS AND BIBLIO.  UP TO DATE ON RARE SPECIES.             3 of 3
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(PUBLICATION TITLE)

(ANNOTATION SHOULD BE WELL INDENTED. IF IT STARTS ON A NEW LINE, START IN COLUMN [9].)

**Number of forms per pad may vary slightly

SUBSECTION

Indicate the Sub-section to which the data sampled corresponds

SIMILAR SUBSECTIONS

List any similar sub-sections by number in the boxes labeled "Similar Sub-sections" starting in the left pair of squares

Where the number consists of only one digit, place a zero in the ten's place.

SUBSECTION AREA

Enter the area of the sub-section in acres

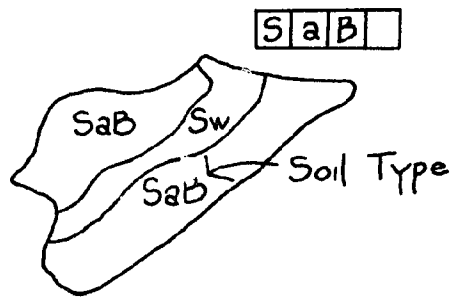
Keep all numbers to the right when less than three digits.

SOIL TYPE

Indicate the symbol for the Dominant soil type which occurs within the boundaries of each subsection of a natural area

The symbols within the soil boundaries on the soils map are the soil type. Soils maps can be found at the back of each Soil Survey Manual. Left register all soil type symbols on the data sheet.

For example:



NATURAL SOIL GROUP

Indicate the dominant natural soils group which occurs in the natural area

The Soils Data Sheet shows Natural Soils Groups by Soil Series. Left register all Natural Soil Group symbols on data sheets.

RUNOFF POTENTIAL

Indicate the dominant runoff potential category for each subsection in the natural area

The Soils Data Sheet shows Runoff Potential Categories by Soil Series.

1. D^+ High
2. D High
3. C^+ Moderate
4. C Moderate
5. B^+ Slight
6. B Slight
7. A Low

Source: (Chiang, 1971)

HIGH WATERTABLE

Indicate the depth to seasonal high watertable for each sub-section in the natural area

The Soils Data Sheet shows watertable depth by soil series. Indicate the minimum depth. Where more than one soil type is present, indicate the water table depth of the dominant soil.

1. Less than 1 ft.
2. 1-2 ft.
3. 2-3 ft.
4. 3-4 ft.
5. 4-5 ft.
6. 5-6 ft.
7. 6-7 ft.
8. 7-8 ft.
9. Greater than 8 ft.

SOIL DRAINAGE

Indicate whether or not well drained soils occur within each sub-section of the natural area

1. Yes Well drained soils occur in the sub-section
2. No Well drained soils do not occur in the sub-section

SLOPE

Indicate the dominate range of slope for each sub-section of the natural area

1. Less than 15% slope
2. Greater than 15% slope

SOIL ERODIBILITY

Indicate the dominant erodibility coefficient (K Factor) for each sub-section in the natural area

1. .17 Low
2. .20 Low
3. .24 Low
4. .28 Medium
5. .32 Medium
6. .37 Medium
7. .43 High
8. .49 High

Source: USDA Soil Conservation Service

WATERBODY DISTANCE

Indicate the linear distance from the edge of a waterbody to the close edge of each sub-section within the natural area

1. 0-10 feet
2. 10-50 feet
3. 50-100 feet
4. 100-200 feet
5. 200-300 feet
6. 300-500 feet
7. Greater than 500 feet
8. Contained within some sub-section

WATERBODY TYPE

Indicate the type of waterbody present in each sub-section

	Van Deusen Index (see Maryland Stream Classification List).
01	Dace Trickle Stream
02	Trout Feeder
03	Trout Stream
04	Sucker Stream
05	Bass Feeder
06	Bass Stream
07	Pickerel Stream
08	Bullhead Stream
09	Catfish Stream
10	Carp Stream
11	Tidal Stream
12	Ocean - Atlantic Ocean.
13	Bay - Bays indicated on County Topographic Maps.
14	Pond - small enclosed body of freshwater, often artificially formed.
15	Bog - waterlogged spongy accumulation of sphagnum moss which may support herbs such as sedges, rushes or scattered shrubs that cover less than 50 percent of the area.
16	Shallow Freshwater Marsh - low lying waterlogged soils covered with an average depth less than 6 inches during the growing season. Surface water may be absent during the late summer and abnormally dry periods. Vegetation is usually dominated by robust or marsh emergents.
17	Deep Freshwater Marsh - soil is covered with an average water depth between 6 inches and 3 feet during the growing season. Vegetation includes cattails, reeds, bulrushes, spikerushes, and wild rice.
18	Shrub Swamp - soil is usually waterlogged during the growing season and often covered by standing water. Vegetation is dominated by shrubs and includes alders, willows, buttonbush, dogwoods and swamp privet.
19	Wooded Swamp - soil is usually waterlogged during the growing season and seasonally covered with up to one foot of standing water. Trees include water oak, overcup oak, red maple, bald cypress and black gum.
20	Tidal Wetlands - marshes and swamps which are influenced by the tide.

WATERBODY SIZE

Indicate the size of each pond or impoundment within or adjacent to each sub-section of a natural area

1. Less than 1 acre
2. 1-5 acres
3. 5-10 acres
4. 10-20 acres
5. 20-30 acres
6. Greater than 30 acres

WATERBODY DEPTH

Indicate the depth of impoundments, ponds and streams within each sub-section of a natural area

1. Less than 1 foot
2. Greater than 1 foot

WATERBODY BOTTOM MATERIAL

Indicate the type of bottom material which occurs in water bodies or watercourses within each sub-section of a natural area

1. Peat - fibrous organic material with recognizable plant parts.
2. Muck - black ooze composed of silt and decomposed organic matter.
3. Silt - fine sediment with little organic material.
4. Sand - granular sediment.
5. Gravel -granular sediment with particles larger than 2mm (approximately 1/8 inches).
6. Cobble -round or sub-round, water-worn rock 2 1/2-10 inches in diameter.
7. Rock - solid aggregate of minerals larger than a cobble.

BEACH LENGTH

Indicate the length of sandy beach along the water's edge within each sub-section of a natural area

1. Less than 500 feet
2. 500-1000 feet
3. 1000-1500 feet
4. Greater than 1500 feet

BEACH WIDTH

Indicate the width of sandy beach in each sub-section

1. Less than 1 foot
2. 1-10 feet
3. 10-20 feet
4. Greater than 20 feet

BEACH TYPE

Indicate the type of beach in each sub-section of a natural area

1. Bank or Bluff - steep slope or abrupt embankment along water's edge.

2. Low, sloping sandy beach without dunes.

3. Low, sloping sandy beach with dunes.

% OF STREAM SHADED

Indicate the percentage of the stream(s) shaded by tree cover in each sub-section of a natural area

0 - less than 10%
1 - 10-20%
2 - 20-30%
3 - 30-40%
4 - 40-50%
5 - 50-60%
6 - 60-70%
7 - 70-80%
8 - 80-90%
9 - 90-100%

WETLAND WILDLIFE RANK

See the Appendix "Wetlands"

VEGETATION TYPES

Indicate the forest cover type of each section sampled.

16	Aspen
17	Pin cherry
20	White pine-northern red oak-white ash
21	White pine
22	White pine-hemlock
23	Hemlock
24	Hemlock-yellow birch
25	Sugar maple-beech-yellow birch
26	Sugar maple-basswood
27	Sugar maple
28	Black cherry-sugar maple
29	Black cherry
39	Black ash-American elm-red maple
40	Post oak-black oak
41	Scarlet oak
42	Bur oak
43	Bear oak
44	Chestnut oak
45	Pitch pine
46	Eastern red cedar
47	Eastern red cedar-pine
48	Eastern red cedar-hardwoods
49	Eastern red cedar-pine-hardwoods
50	Black locust
51	White pine-chestnut oak
52	White oak-red oak-hickory
53	White oak
54	Northern red oak-basswood-white ash
55	Northern red oak
56	Northern red oak-mockernut hickory-sweetgum
57	Yellow poplar
58	Yellow poplar-hemlock
59	Yellow poplar-white oak-northern red oak
60	Beech-sugar maple
61	River birch-sycamore
62	Silver maple-American elm
63	Cottonwood
64	Sassafras-persimmon
65	Pin oak-sweetgum
75	Shortleaf pine
76	Shortleaf pine-oak
77	Shortleaf pine-Virginia pine
78	Virginia pine-southern red oak
79	Virginia pine

Vegetation types - continued

80	Loblolly pine-shortleaf pine
81	Loblolly pine
82	Loblolly pine-hardwood
84	Slash pine
85	Slash pine-hardwoods
87	Sweetgum-yellow poplar
88	Laurel oak-willow oak
90	Beech-southern magnolia
91	Swamp chestnut oak-cherrybark oak
63	Cottonwood
92	Sweetgum-Nuttall oak-willow oak
93	Sugarberry-American elm-green ash
94	Sycamore-pecan-American elm
95	Black willow
96	Overcup oak-water hickory
97	Atlantic white cedar
98	Pond pine
99	Slash pine-swamp tupelo
100	Pondcypress
101	Baldcypress
102	Baldcypress-water tupelo
103	Water tupelo
104	Sweetbay-swamp tupelo-red maple
107	Typha spp. (etc.)
108	Shrub swamp
109	Grasses, sedges, rushes

Source: Society of American Foresters, 1975.

DISTURBANCE

Indicate the two dominant types of physical disturbance (where present) in each subsection of a natural area

The dominant disturbance should be listed first and the less severe type second.

In the following list the computerized abbreviations for long terms are given in parentheses.

1. Channelization (Channelizat)
2. Dredging
3. Sewer Outlet
4. Culverts
5. Bulkheading
6. Dikes
7. Dams
8. Change in Water table (Chng watrtbl)
9. Logs and Debris (Log+Debris)
10. Beaver Dams
11. Algal Blooms
12. Fedid Odor
13. Siltation
14. Erosion
15. Noise
16. Air Pollution (Air Pollutn)
17. Selective Cutting (Selct Cutng)
18. Clear Cutting (Clear Cutng)
19. Fire
20. Windthrow
21. Disease
22. Litter Accumulation, leaf (Leaf Litter)
23. Dumping
24. Littering, paper (Paper Litter)
25. Vandalism
26. Trampling
27. Motor Vehicles (Motr Vehicl)
28. Postagricultural (Post Ag)
29. Other
30. None
31. Flooding
32. Grazing

EASE OF PASSAGE

Indicate the degree of difficulty a hiker would encounter when walking through each subsection of the natural area

1. Difficult - Thick understory or wet mucky soil
2. Moderate - Interspersed understory or wet soils
3. Easy - Open understory, dry soils

ANIMALS

Indicate the source, frequency and residency or each rare, common, or abundant bird, mammal, amphibian or reptile for each subsection

Where they are common to the entire natural area list them for each subsection.

SOURCE	FREQUENCY	RESIDENCY
1 Observed	1 Abundant	1 Breeding
2 Observed	2 Common	2 Migratory
3 Observed	3 Rare	3 Winter Concentration
4 Reported	4 Abundant	4 Year-round Resident
5 Reported	5 Common	5 Unknown
6 Reported	6 Rare	
7 Den of Nest	7 Abundant	
8 Den or Nest	8 Common	
9 Den or Nest	9 Rare	

PHOTOGRAPHS

Any photographs which you take of the site should be numbered and notes should be made as to the compass direction of the shot within each subsection. Record this information at the bottom of your data sheets under "PHOTOGRAPH". Aerial photograph numbers should be put at the top of the first page of the data form just above the squares which are designated "CREW".

CHAMPION TREE

A candidate for the champion tree program is a tree which is estimated to be over 200 years old.

For our purposes any tree with a DBH greater than 2 feet is a candidate. Candidate trees are checked by the Forest Service. Trees which are designated "Champions" will be actively protected by the Forest Service.

SEIMAN

NAMES

Record the names of any people either listed in the folders or whom you have spoken with who have information on the natural area. See the Data Form entitled "Names". Number each card you use in sequence. Each line of information will be entered on a separate computer card.

NAME(S)

Col. No.	CARD	coun.	elect. dist.		coun. site		field site	
1	7				9			

CARD

3
33

CARD

3
33

CARD

3
33

CARD

3
33

TEXT

TEXT

Immediately upon completion of the survey, develop a paragraph from notes and data sheets and include the following considerations

a. The unique, distinctive or characteristic features of the natural area.

b. The dominant vegetation or, if a mosaic, the types and percent coverage of the natural area by each type and describe corresponding site type(s).

c. Characteristic DBH, any lack of reproduction, obvious trends or vegetation dynamics.

d. Disturbances, historical notes.

e. Unusual animals, importance of the natural area for wildlife, geologic features.

f. Role of site in the coastal zone aquatic system (i.e., buffer, natural spring, high erosion).

See the data sheet entitled"TEXT". Each line of text will be entered on a separate computer data card. Number each Card you use in sequence.

TEXT (p.1)

Col. No.	CARD	coun.	elect. dist.				coun. site			field site	
1	8	/					9				

CARD

3
33

CARD

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CARD

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CARD

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CARD

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CARD

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CARD

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33

CARD

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33

WATERSHED

WATERSHED DESIGNATIONS

Major Basin
Minor Basin
Sub-Basin
Segment

02-13-99 Chesapeake Bay (Proper)

-98 Lower Chesapeake Bay (below north side original Bay Bridge)
-99 Upper Chesapeake Bay (above north side original Bay Bridge)

02-12-02 Lower Susquehanna River Area

-01 Susquehanna River (below Conowingo Dam)
-02 Deer Creek Drainage
-03 Octoraro Creek drainage
-05 Susquehanna River (above Dam)
-06 Broad Creek drainage
-07 Castleton area drainage
-08 Oakwood area drainage
-09 Pennsylvania line area drainage
-10 Havre De Grace area drainage
-11 Bainbridge area drainage
-12 Camp Ramblewood area drainage
-15 Susquehanna River (Pennsylvania area) drainage

02-13-01 Coastal Area

-01 Atlantic Ocean
-02 Assawoman Bay drainage
-03 Isle of Wight Bay
-04 Sinepuxent Bay bridge
-05 Newport Bay drainage
-06 Chincoteaque Bay drainage

02-13-02 Pocomoke River Area

-01 Pocomoke Sound
-02 Pocomoke River, mainstem
-03 Dividing Creek drainage
-04 Nassawango Creek drainage
-05 Pocomoke City-Snow Hill area drainage
-06 Tangier Sound
-07 Little Annemessex River area drainage
-08 Big Annemessex River drainage
-09 Manokin River drainage
-10 Pocomoke River East area drainage
-11 Pocomoke River West area drainage
-12 Corbin area drainage
-13 Other Pocomoke River drainage
-14 Deal Island area drainage
-15 North Pocomoke Sound drainage

Source: Maryland Water Resources Administration

02-13-03 Nanticoke River Area

-01	Wicomico River, mainstem
-02	Wicomico Creek drainage
-03	Ferry Point area drainage
-04	Nanticoke River, mainstem
-05	Marshyhope Creek drainage
-06	Nanticoke River West area drainage
-07	Fishing Bay drainage
-08	Transquaking River drainage
-09	Chicamacomico River drainage
-10	Blackwater River drainage
-11	Monie Bay drainage
-12	Wicomico River West area drainage
-13	Wicomico River headwaters area drainage
-15	Nanticoke River East area drainage
-16	Nanticoke River North area drainage

02-13-04 Choptank River Area

-01	Honga River drainage
-02	Little Choptank River drainage
-03	Choptank River, mainstem
-04	Harris Creek-Blackwater Cover drainage
-05	Broad Creek drainage
-06	Tred Avon River drainage
-07	Hunting Creek drainage
-08	Tuckahoe Creek drainage
-09	Trippe Bay area drainage
-10	Choptank River area bay drainage
-11	Cambridge area drainage
-12	Choptank River Northwest area drainage
-13	Choptank River East area drainage
-14	Choptank River headwaters area drainage

02-13-05 Chester River Area-

-01	Eastern Bay
-02	Miles River drainage
-03	Wye River drainage
-04	Eastern Bay north area drainage
-05	Kent Island narrows
-06	Chester River, mainstem
-07	Langford Creek drainage
-08	Corsica River drainage
-09	Southeast Creek drainage
-10	Eastern Bay South area drainage
-11	Kent Island Bay area drainage
-15	Cloverfields area drainage
-16	Queenstown area drainage
-17	Eastern Neck (Chester River) area drainage
-18	Indiantown - Riverview area drainage
-19	Old Town area drainage
-20	Chester River headwaters area
-30	Rock Hall area drainage

02-13-06 Elk River Area

-01	Sassafras River drainage
-02	Elk River, mainstem
-03	Bohemia River drainage
-04	Back Creek drainage
-06	Northeast River drainage
-07	Furnace Bay area drainage
-08	Stillpond - Fairlee area drainage
-09	Christina River drainage (Delaware)
-10	Crystal Beach area drainage
-11	Elk Neck (Elk River) area drainage
-12	Port Herman area drainage
-13	Elk River headwater area drainage
-14	Elk Neck (Bay) area drainage

NEAREST TOWN

NEAREST TOWNS

Caroline County

01 American Corner
02 Andersontown
03 Baltimore Corner
04 Choptank
05 Boonsboro
06 Bethlehem
07 Bridgetown
08 Burrsville
09 Concord
10 Denton
11 Federalsburg
12 Goldsboro
13 Greensboro
14 Harmony
15 Henderson
16 Hillsboro
17 Hobbs
18 Marydel
19 Oakland
20 Potters Landing
21 Preston
22 Ridgely
23 Smithville
24 Tanyard
25 Whiteleysburg

Cecil County

01 Cayots
02 Ceciltown
03 Chesapeake City
04 Crystal Bch.
05 Earlville
06 Elkton
07 Fredericktown
08 Port Herman
09 St. Augustine
10 Warwick

Dorchester County

01 Airey
02 Andrews
03 Bestpitch
04 Bishops Head
05 Brookview
06 Bucktown
07 Cambridge
08 Church Creek
09 Cornersville
10 Crapo
11 Crocheron
12 Drawbridge
13 East New Market
14 Eldorado
15 Elliot
16 Ellwood
17 Finchville
18 Fishing Creek
19 Galestown
20 Henrys Grossroads
21 Honga
22 Hoopersville
23 Hudson
24 Hurlock
25 James
26 Lakesville
27 Linkwood
28 Lloyds
29 Madison
30 Reids Grove
31 Reliance
32 Rhodesdale
33 Salem
34 Secretary
35 Seward
36 Taylors Is.
37 Thomas
38 Toddville
39 Vienna
40 Williamsburg
41 Wingate
42 Woolford

Source: County Topographic Maps.

Nearest Towns - cont.

Kent County

01 Betterton
02 Chestertown
03 Chesterville
04 Cliffs City
05 Coleman
06 Crosby
07 Edesville
08 Fairlee
09 Galena
10 Georgetown
11 Golts
12 Gratitude
13 Hanesville
14 Kennedyville
15 Kentmore Park
16 Lankford
17 Locust Grove
18 Lynch
19 Massey
20 Melitota
21 Millington
22 Morgnec
23 Newtown
24 Pomona
25 Quaker Neck Landing
26 Rock Hall
27 Sandy Bottom
28 Sassafras
29 Still Pond
30 Tolchester Bch.
31 Worton

Queen Anne's County

01 Barclay
02 Carmichael
03 Carville Station
04 Centreville
05 Chester
06 Church Hill
07 Crumpton

Queen Anne's County (cont.)

08 Dominion
09 Dudley Corner
10 Grasonville
11 Guys
12 Hope
13 Ingleside
14 Kings Town
15 Love Point
16 Matapeake
17 Mattapex
18 McGinnes
19 Normans
20 Peters Corner
21 Pondtown
22 Queenstown
23 Roberts
24 Roe
25 Romancoke
26 Ruthsburg
27 Starkley Corner
28 Starr
29 Sudlersville
30 Templeville
31 Unicorn
32 Wye Mills

Somerset County

01 Bedsworth
02 Birdtown
03 Champ
04 Chance
05 Cokesbury
06 Crisfield
07 Dames Quarter
08 Deal Is.
09 Eden
10 Ewell
11 Fairmont
12 Hopewell
13 Hudsons Corner

Nearest Towns - cont.

Somerset County (cont.)

14 Jason
15 Kingston
16 Manokin
17 Marion
18 Monie
19 Mount Vernon
20 Oriole
21 Princess Anne
22 Rehobeth
23 Rhodes Pt.
24 Rumbley
25 Shelltown
26 Tylerton
27 Upper Fairmont
28 Upper Hill
29 Wellington
30 Wenoma
31 Westover
32 Widgeon

Talbot County

01 Bellevue
02 Bozman
03 Claiborne
04 Cordova
05 Easton
06 Fairbank
07 Longwoods
08 Matthews
09 McDaniel
10 Neavitt
11 Newcomb
12 Oxford
13 Queen Anne
14 Royal Oak
15 Sherwood
16 St. Michaels
17 Tilghman
18 Trappe
19 Tunis Mills

Talbot County (cont.)

20 Windyhill
21 Wittman

Wicomico County

01 Athel
02 Bivalve
03 Coxs Corner
04 Delmar
05 Fruitland
06 Hebron
07 Mardela Springs
08 Nanticote
09 Parsonburg
10 Pittsville
11 Powellville
12 Quantico
13 Royal Oak
14 Salisbury
15 Sharptown
16 Tyaskin
17 Walston
18 Wango
19 Waste Gate
20 Waterview
21 Whitehaven
22 Willards

Worcester County

01 Basket Switch
02 Bayview
03 Beaverdam
04 Berlin
05 Bishop
06 Bishopville
07 Colbourne
08 George Is. Landing
09 Girdletree
10 Goodwill

Nearest Towns - cont.

Worchester County (cont.)

11 Ironshire
12 Jones
13 Libertytown
14 Longridge
15 Newark
16 Ocean City
17 Pocomoke City
18 Public Landing
19 Showell
20 Snow Hill
21 Spence
22 St. Martin
23 Stockton
24 Taylorville
25 Wesley
26 Whaleysville
27 Whiton
28 Whiteburg

VEGETATION

WOODY PLANTS

20 Abies balsamea. Balsam fir.
23 Aesculus spp. Aesculus.
24 Aesculus Hippocastanum. Horsechestnut.
25 Aesculus octandra. Sweet Buckeye.
28 Acer spp. Maple
29 Acer negundo. Box Edler.
30 Acer nigrum. Black maple.
31 Acer pensylvanicum. Striped maple.
32 Acer platanoides. Norway maple.
33 Acer rubrum. Red maple.
34 Acer saccharinum. Silver maple.
35 Acer saccharum. Sugar maple.
36 Acer spicatum. Mountain maple (Mtn. maple).
39 Ailanthus altissima. Ailanthus.
42 Akebia quinata. Akebia.
45 Albizzia Julibrissin. Mimosa.
48 Alnus spp. Alder.
49 Alnus maritima. Seaside alder.
50 Alnus rugosa. Speckled alder.
51 Alnus serrulata. Smooth alder.
54 Amelanchier spp. Service Berry.
55 Amelanchier arborea. Common Service Berry (Com. svcberry).
56 Amelanchier canadensis. Canadian Service Berry (Can svcberry).
57 Amelanchier humilis. Low Service Berry (Lo svcberry).
58 Amelanchier intermedia spach. Intermediate Service Berry (Int svcberry).
59 Amelanchier laevis. Smooth Service Berry (Smith svcberry).
60 Amelanchier obovalis. Obovate Service Berry (Obvt svcberry).
61 Amelancier sanguinea. Roundleaf Service Berry (Rd lf svcberry).
62 Amelanchier stolonifera. Stoloniferous Service Berry (Stol svcberry).
65 Amorpha fruitcosa.Falso indigo.
68 Ampelopsis arborea. Pepper-vine.
69 Aralia sp. L. Ginseng.
71 Aralia spinosa. Hercules Club.
74 Aristolochia durior. Pipe-vine.
77 Arundinaria gigantea. Brake cane.
80 Ascyrum spp. Ascyrum.
81 Ascyrum stans. St. Peter's wort. (St Pete wort).
82 Ascyrum Hypericoides. St. Andrew's Cross. (St Andy Cross).
85 Asimina triloba. Pawpaw.
86 Same as Rhododendron Viscosa
88 Baccharis halimifolia. High-tide bush.
91 Berberis spp. Barberry
92 Berberis canadensis. American Barberry (Amer Barberry).
93 Berberis Thunbergii. Japanese Barberry (Jap Barberry).
94 Berberis vulgaris. Common Barberry (Com Barberry).
97 Betula spp. Birch.
98 Betula alba. European white birch (Eur. white birch).
99 Betula lenta. Black birch.
100. Betula lutea. Yellow birch.

Source: Brown and Brown, 1972.

Woody Plants - cont.

101 Betula nigra. River birch.
104 Bignonia capreolata. Crossvine.
107 Broussonetia papyrifera. Paper Mulberry.
110 Callicarpa americana. Beauty berry.
113 Calycanthus floridus. Carolina allspice (Carol allspice).
116 Campsis radicans. Trumpet creeper (Trumpt creepr)
119 Carpinus caroliniana. American hornbeam (Amer hornbeam).
122 Carya spp. Hickory.
123 Carya cordiformis. Swamp hickory.
124 Carya glabra. Pignut.
125 Carya ovalis. Sweet pignut.
126 Carya ovata. Shagbark Hickory (Shagbark).
127 Carya pallida. Pale hickory.
128 Carya tomentosa. Mockernut.
131 Castanea spp. Castanea.
132 Castanea dentata. American Chestnut (Amer Chestnut).
133 Castanea pumila. Chinquapin.
136 Catalpa spp. Catalpa.
137 Catalpa bignioides. Southern catalpa (S. Catalpa).
138 Catalpa ovata. Chinese Catalpa (Chinese Cat.).
139 Catalpa speciosa.Northern Catalpa (N. Catalpa).
142 Ceanothus americanus. New Jersey Tea (Jersey Tea).
145 Celtis spp. Celtis
146 Celtis occidentalis. Hackberry.
147 Celtis tenuifolia. Dwarf Hackberry (Dwf. Hackberry).
150 Cephalanthus occidentalis. Buttonbush.
153 Celastrus scandens. Bittersweet.
156 Cercis canadensis. Redbud.
159 Chamaecyparis thyoides. Southern White Cedar (S. White Cedar).
162 Chimaphila spp. Chimaphila.
163 Chimaphila maculata. Spotted Wintergreen (Spot wintergrn).
164 Chimaphila umbellata. Pipsissewa.
167 Chionanthus virginicus. Fringe-tree.
170 Clematis spp. Clematis
171 Clematis dioscoreifolia. Clematis.
172 Clematis verticillaris. Mountain clematis (Mtn clematis).
173 Clematis Viorna. Leather flower.
174 Clematis virginiana. Virgin's bower.
177 Clethra alnifolia. Sweet Pepperbush (Swt. Pepperbush).
180 Comptonia peregrina. Sweet fern.
183 Cornus alternifolia. Green Osier.
184 Cornus spp. Dogwood
185 Cornus Amomum. Red Willow.
186 Cornus canadensis. Bunchberry.
187 Cornus florida. Flowering dogwood (Flr dogwood).
188 Cornus obliqua. Silky dogwood.
189 Cornus racemosa. Gray-stem dogwood (Gry-stem dogwd).
190 Cornus stolonifera. Red Osier.
191 Cornus rugosa. Roundleaf dogwood. (Rndleg dogwood)
193 Corylus spp. Hazel
194 Corylus americana. American hazelnut (Amer hazelnut).
195 Corylus cornuta. Beaked hazelnut (Beak hazelnut).
198 Crataegus spp. Hawthorn.

Woody Plants - cont.

199 Crataegus basilica. Hawthorn #1.
200 Crataegus biltmoreana. Biltmore Hawthorn (Biltmore Hthn).
201 Crataegus Calpodendron. Pear Hawthorn.
202 Crataegus Canbyi. Canby's Hawthorn (Canby's Hthn).
203 Crataegus crus-galli. Cockspur-Thorn.
204 Crataegus Dodgei. Dodge Hawthorn (Dodge Hthn).
205 Crataegus intricata. Hawthorn #2.
206 Crataegus macrosperma. Variable Hawthorn (Var. Hawthorn).
207 Crataegus Margaretta. Margaret Hawthorn (Margaret Hthn).
208 Crataegus mercerensis. Hawthorn #3.
209 Crataegus pedicellata, Scarlet Hawthorn (Scarlet Hthn).
210 Crataegus pensylvanica. Hawthorn #4.
211 Crataegus Phaenopyrum. Washington Hawthorn (Wash Hawthorn).
212 Crataegus populnea. Hawthorn #5.
213 Crataegus pruinosa. Wax-fruit Hawthorn (Wax-fruit Hthn).
214 Crataegus punctata. Dotted Hawthorn (Dotted Hthn).
215 Crataegus rugosa. Hawthorn #6
216 Crataegus sicca. Hawthorn #7
217 Crataegus stolonifera. Hawthorn #8
218 Crataegus uniflora. Dwarf Hawthorn (Dwf Hawthorn).
219 Crataegus viridis. Southern Thorn (S. Thorn).
222 Cytisus scoparius. Scoth Broom.
224 Decadon verticillatus.Swamp loosestrife.
225 Diervilla Lonicera. Bush Honeysuckle (Bsh Honeysukle).
228 Diospyros virginiana. Common Persimmon (Com Persimmon).
231 Dirca Palustris. Leatherwood.
234 Elaeagus angustifolia. Russian olive.
237 Epigaea repens. Ground laurel.
240 Euonymus spp. Euonymus
241 Euonymus alatus. Winged Euonymus (Wing Euonymus).
242 Euonymus americanus. Strawberry Bush.
243 Euonymus atropurpureus. Burning Bush
246 Fagus grandifolia. American Beech.
247 Fagus sylvatica. European Beech.
249 Forsythia spp. Forsythia.
250 Forsythia suspensa. Forsythia.
251 Forsythia viridissima. Forsythia.
254 Fraxinus spp. Ash.
255 Fraxinus americana. White Ash.
256 Fraxinus pennsylvanica. Green Ash.
257 Fraxinus nigra. Black Ash.
260 Gaultheria procumbens. Wintergreen.
263 Gaylussacia spp. Huckleberry.
264 Gaylussacia baccata. Black huckleberry (Blk hucklebry).
265 Gaylussacia brachycera. Juniper Berry.
266 Gaylussacia dumosa. Dwarf huckleberry (Dwf Hucklebry).
267 Gaulussacia frondosa. Dangleberry.
270 Gleditsia triacanthos. Honey Locust.
273 Gymnocladus dioica. Kentucky Coffeetree (Ky Coffeetree).
276 Hamamelis virginiana. Witch-hazel.
279 Hedera Helix. English Ivy.

WOODY Plants - cont.

281 Hibiscus spp. Marsh Mallow.
282 Hibiscus syriacus. Rose-of-Sharon.
285 Hudsonia tomentosa. Beach heath.
288 Hydrangea arborsecens. Wild hydrangea.
291 Hypericum spp. St. John's-wort.
292 Hypericum densifolorum. St. John's-wort. (St John-wort).
293 Hypericum spathulatum. St. John's-wort. (St John-wort).
296 Ilex spp. Holly.
297 Ilex decidua. Possum Haw.
298 Ilex glabra. Inkberry.
299 Ilex laevigata. Winterberry.
300 Ilex montana. Mountain holly (Mtn Holly).
301 Ilex opaca. American Holly (Amer Holly).
302 Ilex verticillata. Black Alder.
305 Itea virginica. Tassel-white.
308 Iva frutescens. Low-tide bush.
311 Juglans spp. Juglans.
312 Juglans cinera. Butternut.
313 Juglans nigra. Black walnut.
316 Juglans communis. Common juniper.
317 Juniperus virginiana. Red cedar.
320 Kalmia spp. Laurel.
321 Kalmia angustifolia. Sheep-laurel.
322 Kalmia latifolia. Mountain laurel (Mtn laurel).
323 Leiophyllum buxifolum. Sand myrtle
325 Koelrenteria paniculata. Goldenrain-Tree (Goldenrn-Tree).
328 Larix laricina. American larch.
331 Leucothoe racemosa.Fetterbush.
334 Ligustrum spp. Privet.
335 Ligustrum obtusifolium. Privet.
336 Ligustrum ovalifolium.California Privet (Cal Privet).
337 Ligustrum vulgare. Common privet.
340 Lindera Benzoin. Blume Spicebush. (Blume Spicebsh)
343 Linnaea borealis. Twinflower.
346 Liquidambar styraciflua. Sweet gum.
349 Liriodendron tulipifera. Tulip tree.
352 Lonicera spp. Honeysuckle.
353 Lonicera canadensis. Fly-honeysuckle (Fly-honeysukl).
354 Lonicera dioica. Mountain honeysuckle (Mtn honysukl).
355 Lonicera japonica. Japanese honeysuckle (Jap honeysukl).
356 Lonicera Morrowi. Honeysuckle #1.
357 Lonicera sempervirens. Trumpet honeysuckle (Trump hnysukl).
358 Lonicera tatarica. Tartarian honeysuckle (Tarta hnysukl).
361 Lycium halimifolium. Matrimony vine.
364 Lyonia spp. Lyonia.
365 Lyonia ligustrina. Male-berry.
366 Lyonia mariana. Stagger bush.
369 Maclura pomifera. Osage orange.
372 Magnolia spp. Magnolia.

Woody Plants - cont.

373 Magnolia acuminata. Cucumber tree.
374 Magnolia tripetala. Umbrella Magnolia (Umbrella Mag).
375 Magnolia virginiana. Sweet Bay.
378 Menisperum canadense. Canadian Moonseed (Can Moonseed).
381 Menziesia pilosa. Minnie-bush.
384 Mitchella repens. Partridge berry (Partridge bry).
387 Morus spp. Mulberry.
388 Morus alba. White Mulberry.
389 Morus rubra. Red Mulberry.
392 Myrica spp. Myrica.
393 Myrica cerifera. Wax-myrtle.
394 Myrica pensylvanica. Bayberry.
397 Nemopanthus mucronata. Catberry.
400 Nyssa sylvatica. Black gum.
401 Opuntia humifusa.Prickly pear.
403 Ostrya virginiana. Hop Hornbeam.
406 Oxydendrum arboreum. Sorrel Tree.
409 Parthenocissus quinquefolia. Virginia Creeper (Va Creeper).
412 Paulownia tomentosa. Empress tree.
415 Persea Borbonia. Red Bay.
418 Philadelphus spp.Mock Orange.
419 Philadephus coronarius. Garden Mock-orange (Gdn Mock-orng).
420 Philadelphus hirsutus. Hairy Mock-orange (Hry Mock-orng).
421 Philadelphus inodorus. Common Mock-orange (Com Mock-orng).
422 Philadelphus pubescens. Gray Mock-orange (Gry Mock-orng).
425 Phoradendon flavescens. Mistletoe.
428 Physocarpus opulifolius. Ninebark.
431 Picea spp. Spruce.
432 Picea Abies. Norway Spruce.
433 Picea glauca. White Spruce.
434 Picea pungens. Blue Spruce.
435 Picea rubens. Red Spruce.
438 Pinus spp. Pine.
439 Pinus echinata. Yellow Pine.
440 Pinus resinosa. Red Pine.
441 Pinus rigida. Pitch Pine.
442 Pinus serotina. Marsh Pine.
443 Pinus strobus. White Pine.
444 Pinus sylvestris. Scotch Pine.
445 Pinus taeda. Loblolly Pine.
446 Pinus virginiana. Virginia Pine.
449 Platanus occidentalis. Sycamore.
452 Populus spp. Populus.
453 Populus alba. White poplar.
454 Populus canescens. Gray poplar.
455 Populus deltoides. Eastern cottonwood (E.cottonwood).
456 Populus gileadensis. Balm of Gilead (Gilead Balm).
457 Populus grandidentata. Large-toothed aspen (lg tooth aspen).
458 Populus heterophylla. Downy poplar.
459 Populus nigra. Black poplar.
460 Populus tremuloides. Trembling aspen.

Woody Plants - cont.

463 Prunus spp. Prunus.
464 Prunus alleghaniensis. Allegheny Plum (Allgny Plum).
465 Prunus americana. American Wild Plum (A Wild Plum).
466 Prunus angustifolia. Chickasaw Plum.
467 Prunus avium.Bird Cherry.
468 Prunus Cerasus. Sour Cherry.
469 Prunus Mahaleb. Mahaleb Cherry.
470 Prunus maritima. Beach Plum.
471 Prunus pensylvanica. Pin Cherry.
472 Prunus Persica. Peach.
473 Prunus serotina. Black Cherry.
474 Prunus virginiana. Choke Cherry.
477 Ptelea trifoliata. Water-ash.
480 Pyrus spp. Pyrus.
481 Pyrus americana. American mountain ash (Am mtn ash).
482 Pyrus angustifolia Ait. Wild crab.
483 Pyrus arbutifolia. Red chokeberry.
484 Pyrus communis. Common pear.
485 Pyrus coronaria. Wild crab.
486 Pyrus floribunda. Purple chokeberry (Pur chokeberry)
487 Pyrus Malus. Apple.
488 Pyrus melanocarpa. Black chokeberry (Blk chokeberry).
491 Quercus spp. Oak.
492 Quercus alba. White oak.
493 Quercus bicolar. Swamp white oak.
494 Quercus coccinea. Scarlet oak.
495 Quercus falcata. Southern red oak (S red oak).
496 Quercus ilicifolia. Scrub oak.
497 Quercus imbricaria. Shingle oak.
498 Quercus lyrata. Swamp post oak.
499 Quercus macrocarpa. Bur oak.
500 Quercus marilandica. Black Jack oak.
501 Quercus Michauxii. Basket oak.
502 Quercus Muchlenbergii. Yellow oak.
503 Quercus nigra. Water oak.
504 Quercus palustris. Pin Oak.
505 Quercus Phellos. Willow oak.
506 Quercus prinoides. Chinquapin oak.
507 Quercus Prinus. Chestnut oak.
508 Quercus rubra. Red oak.
509 Quercus Shumardii. Shumard's oak.
510 Quercus stellata. Post oak.
511 Quercus velutina. Black oak.
512 Quercus laurifolia. Laurel-leaved oak.
514 Rhamnus spp. Buckthorn.
515 Rhamnus cathartica. Common Buckthorn (Com Buckthorn).
516 Rhamnus frangula. European Buckthorn (Eur Buckthorn).
519 Rhododendron spp. Rhododendron.

Woody Plants - cont.

520 Rhododendron arborescens. Smooth azalea.
521 Rhododendron atlanticum. Dwarf azalea.
522 Rododendron calendulaceum. Flame azalea.
523 Rhododendron canescens. Sweet azalea.
524 Rhododendron maximum. Rosebay.
525 Rhododendron nudiflorum. Pink azalea.
526 Rhododendron roseum. Mountain azalea (Mtn azalea).
527 Rhododendron vicosum. Swamp azalea.
529 Rhus spp. Rhus.
530 Rhus aromatica. Fragrant sumac.
531 Rhus copallina. Shining sumac.
532 Rhus glabra. Smooth sumac.
533 Rhus radicans. Poison Ivy.
534 Rhus toxicodendron. Poison Oak.
535 Rhus typhina. Staghorn sumac.
536 Rhus vernix. Poison sumac.
539 Ribes spp. Ribes
540 Ribes americanum. Black currant.
541 Ribes cynosbati. Dogberry.
542 Ribes glandulosum. Skunk currant.
543 Ribes rotundifolium. Eastern wild gooseberry (E. gooseberry).
546 Robinia spp. Locust.
547 Robinia hispida. Bristly Locust.
548 Robinia Pseudo-Acacia. Black Locust.
551 Rosa spp. Rose
552 Rosa canina. Dog Rose.
553 Rosa carolina. Low Pasture Rose (L Pasture Rose).
554 Rosa eglanteria. Sweet Brier.
555 Rosa multiflora. Multiflora Rose (Multiflr Rose).
556 Rosa palustirs. Swamp Rose.
557 Rosa virginiana. Pasture Rose.
560 Rubus spp. Raspberry
561 Rubus argutus. Tall blackberry (Tall bkberry).
562 Rubus allegheniensis. Allegheny blackberry (Allgny bkberry).
563 Rubus cuneifolius. Sand blackberry (Sand bkberry).
564 Rubus Eusleuii. Southern dewberry (S. dewberry).
565 Rubus flagellaris. Northern dewberry (N. dewberry).
566 Rubus hispidus. Swamp dewberry.
567 Rubus occidentalis. Wild Black raspberry (Blk raspberry).
568 Rubus odoratus. Purple-flowering raspberry.
569 Rubus ostryifolius. Dewberry.
570 Rubus pensilvanicus. Blackberry #1.
571 Rubus phoenicolasius. Wineberry.
572 Rubus ideas strigosus. Maximum Red raspberry (Max red rsberry).
575 Salix spp. Willow.
576 Salix alba. White willow.
577 Salix babylonica. Weeping willow.
578 Salix Bebbiana. Bebb's willow.
579 Salix capra. Goat willow.
580 Salix caroliniana. Ward's willow.
581 Salix discolor. Pussy willow.
582 Salix fragilis. Crack willow.
583 Salix hispida. Bristly crier.
584 Salix humilis. Upland willow.

Woody Plants - cont.

585 Salix interior. Sandbar willow.
586 Salix lucida. Shining willow.
587 Salix nigra. Black willow.
588 Salix pentandra. Bay-leaf willow (Bay-lf willow).
589 Salix purpurea. Purple willow.
590 Salix rigida. Heart-leaf willow (Heart-lf willow).
591 Salix sericea. Silky willow.
594 Sambucus spp. Elder.
595 Sambucus canadensis. Common elder.
596 Sambucus pubens. Red-berry Elder (Red-bry Elder).
599 Sassafras albidum. White Sassafras (Wt Sassafras).
602 Smilax spp. Smilax.
603 Smilax Bona-nox. Bullbrier.
604 Smilax glauca. Sawbrier.
605 Smilax laurifolia. Laurel-leaf brier (Laurl lf brier).
606 Smilax rotunfifolia. Common greenbrier (Com greenbrier).
609 Solanum Dulcamara. Bittersweet.
612 Spiraea spp. Spiraea.
613 Spiraea alba. Narrow-leaved Meadow Sweet (Nr-lv Md-Sweet).
614 Spiraea corymbosa. Corymed Spiraea.
615 Spiraea japonica. Japanese spirea (Jap spirea).
616 Spiraea latifolia. American Meadow Sweet (Am Md-Sweet).
617 Spiraea tomentosa. Steeple-bush.
620 Staphylea trifolia. American bladderunut (A. bladdernut).
621 Styrax grandifolia. Storax.
623 Symphoricarpos spp. Symphoricarpos
624 Symphoricarpos alba. Snowberry.
625 Symphoricarpos orbiculatus. Coralberry.
628 Symplocos tinctoria. Horse-sugar.
631 Syringa spp. Lilac.
632 Syringa Persica. Persian lilac.
633 Syringa vulgaris. Lilac.
636 Taxodium distichum. Baldcypress.
639 Thuja occidentalis. N. white cedar.
642 Tilia spp.
643 Tilia americana. Basswood.
644 Tilia heterophylla. White Basswood.
647 Tsuga canadensis. Hemlock.
650 Ulmus spp. Elm.
651 Ulmus americana. American elm.
652 Ulmus parvifolia. Chinese elm.
653 Ulmus procera. English elm.
654 Ulmus pumila. Siberian elm.
655 Ulmus rubra. Red elm.
658 Vaccinium spp. Vaccinium.
659 Vaccinium angustifolium. Low sweet blueberry (Lo swt blubry).
660 Vaccinium atrococcum. Black High-bush blueberry (Bk hi-bsh bbry).
661 Vaccinium caesariense. Jersey blueberry (Jsy blubry).
662 Vaccinium corymbosum. High-bush blueberry (hi-bsh-blubry).
663 Vaccinium macrocarpon. American cranberry (A. cranberry).

Woody Plants - cont.

664 Vaccinium myrtilloides. Canadian Blueberry (Can blueberry)
665 Vaccinium Oxycoccos. Small cranberry (Sml cranberry).
666 Vaccinium stamineum. Deerberry.
667 Vaccinium vacillans. Low blueberry.
670 Viburnum spp. Viburnum.
671 Viburnum acerifolium. Maple-leved viburnum (Maple-lv vib)
672 Viburnum alnifolium. Hobblebush.
673 Viburnum cassinoides. Witherod.
674 Viburnum dentatum. Southern Arrow-wood (S. Arrow-wood).
675 Viburnum Lentago. Nannyberry.
676 Viburnum nudum. Possum-haw.
677 Viburnum prunifolium. Black haw.
678 Viburnum Rafinesquianum. Downy Arrow-wood (Downy Arrow-wd).
679 Viburnum recognitum. Smooth Arrow-wood (Smth Arrow-wd).
682 Vitex Agnus-castus. Chaste tree.
685 Vitis spp. Grape.
686 Vitis aestivalis. Summer grape.
687 Vitis Labrusca. Fox grape.
688 Vitis riparia. Frost grape.
689 Vitis rotundifolia. Muscadine grape (Muscadine grp).
690 Vitis rupestris. Sugar grape.
691 Vitis vulpina. Winter grape.
694 Wisteria spp. Wisteria.
695 Wisteria floribunda. Wisteria #1.
696 Wisteria frutescens. Wisteria #2.
697 Wisteria sinesis. Sweet Wisteria.

HERBACEOUS PLANTS

705 Acorus calamus. Sweet Flag.
708 Agropyron spp. Couch Grass #1.
709 Agropyron repens. Couch grass #2.
712 Agrostis spp. Agrostis.
713 Agrostis hyemalis. Rough Hair grass (Rg Hair grass).
716 Alisma spp. Water Plantain #1 (Watr Plantan 1).
717 Alisma plantago-aquatica. Water Plantain #2 (Watr Plantan 2).
720 Allium spp. Garlic.
721 Ambrosia spp. Ragweed.
723 Ammophila arenaria. Sand reed.
725 Andropogon spp. Beard Grass.
726 Andropogon Blue Stem grass (Blue Stem grass).
727 Andropogon furcatus. Forked Beard-grass (Frk Berd grass).
728 Andropogon glomeratus. Bushy Beard-grass (Bsy Berd grass).
729 Andropogon scoparius. Little blue-stem (Ltl blue stem).
730 Andropogon ternarius. Silvery Beard-grass (Slv Berd grass).
731 Andropogon virginicus. Virginia Beard Grass (Va Beard Grass).
734 Anthoxanthm spp. Vernal grass #1.
735 Anthoxanthum odoratum. Vernal grass #2.
738 Arisaema sp. Jack-in-the-pulpit (Jk-n-th-plpit).
739 Arisaema triphyllum. Jack-in-the-pulpit (Jck-n-th-plpit).
742 Aristida spp. Three-awn.
743 Aristida odoratum. Poverty Grass.
744 Asclepias spp. Milkweed.
747 Asparagus officinalis. Asparagus.
750 Asplenium felix-femina. Lady Fern.
751 Asplenium platyneuron. Ebony Spleenwort (Ebony Splnwort).
752 Aster spp. Wild aster.
754 Botrychium ternatum. Grape fern.
755 Botrychium virginianum. Virginia Grape fern (Va Grape fern).
758 Bromus spp. Brome-grass.
761 Carex spp. Carex.
764 Cenchrus tribuloides. Bur-grass.
765 Ceratophyllum spp. Coontail.
767 Chaetochloa spp. Foxtail grass.
770 Chamaelirium spp.Blazing star #1.
771 Chamaelirium luteum. Blazing star #2.
772 Chimaphila maculata. Spotted wintergreen. (Spottd wintrgrn).
774 Chrosperma spp. Fly poison #1.
775 Chrosperma muscaetoxicum. Fly poison #2.
776 Ciraea quadrisulcata. Enchanters nightshade. (Ench nitshade).
778 Commelina spp. Day flower.
781 Corallorhiza spp. Coral-foot.
782 Corallorhiza multiflora. Large Coral-foot (Lg Coral ft).
785 Crypripedium spp. Ladies Slipper.
788 Cyperus spp. Cyperus.
791 Cypripedium acaule. Moccasin Flower (Mocasin Flwr).
794 Danthonia spp. Wild Oat-grass.
795 Daucus carota. Wild carrot.

Source: Shreve, 1910 and Britton and Brown, 1963

Herbaceous Plants - cont.

796 Datura spp. Jimson weed.
797 Dioscorea Villosa. Yam root.
800 Distichlis spicata. Marsh Spike grass (Mrsh spk grass).
803 Dryopteris acrostichoides. Christmas Fern.
804 Dryopteris marginalis. Marginal Shield Fern (Margn Sld Fern).
805 Cryopteris noveboracensis. New York Fern.
806 Dryopteris intermedia. American Shield-fern (Am Shield fern).
809 Dulichium arundinaceum. Dulichium.
812 Eleocharis spp. Spike Rush.
815 Elymus spp. Wild Rye.
818 Equisetumarvense. Field Horsetail (Field Horsetl).
819 Equisetum hyemale. Scouring-rush.
822 Ergrostis spp. Love Grass.
825 Erianthus spp. Plume Grass #1.
826 Erianthus saccharoides. Plume Grass #2.
829 Eriocaulon spp. Pipewort #1.
830 Eriocaulon septangulare. Pipewort #2.
833 Eriophorum spp. Cotton-grass.
834 Eriophorum virginicum. Virginia Cotton-grass (Va Coton grass).
837 Erythronium spp. Adder's Tongue.
840 Festuca spp. Fescue.
843 Fimbristylis spp. Fimbristylis.
844 Fragaria spp. Strawberry.
846 Fuirena spp. Fuirena
847 Galium spp. Bedstraw.
848 Glyceria spp. Manna Grass.
849 Gyrostuchys spp.Ladies Tresses.
852 Habenaria spp. Orchis.
855 Hemerocallis fulva. Day Lily.
858 Heteranthera spp. Mud Plantain.
859 Heteranthera dubia. Water Star grass (Watr Star gras).
862 Homalocenchrus spp. White grass.
865 Hordeum spp. Barley.
868 Hypoxis hirsuta. Star grass.
871 Hystrix hystrix. Bottle-brush grass (Botle-brsh Grs).
872 Impatiens spp. Jewel-weed.
874 Iris spp. Iris.
875 Iris versicolor. Large Blue-flag (Lg Blue-flag).
878 Isoetes saccharata. Quillwort.
881 Juncus spp. Bulrush.
884 Lemna minor. Duckweed.
885 Lepedeza spp. Bush Clover.
887 Lilium spp. Red lily.
888 Lilium canadense. Wild Yellow Lily (Wld Yelow Lily).
891 Limodorum tuberosum. Grass-pink.
894 Liparis liliifolia. Large Tway blade (Lg Tway blade).
897 Lolium spp. Lolium.
900 Lorinseria areolata. Net-veined Chair-fern (Nt-vnd-Chn-fern).
903 Lycopodium complanatum. Crow-foot.
904 Lycopodium inundatum. Bog Club-moss.
905 Lycopodium obscurum. Ground Pine #1.

Herbaceous Plants - cont.

906 Lycopodium tristachyum. Ground Pine #2.
909 Malaxis uniflora. Green Adders mouth (Grn Aders moth).
912 Mariscus mariscoides. Twig Rush.
915 Medeola virginiana. Indian Cucumber-root (Idn Cucumbr rt).
918 Melanthium spp. Bunch flower #1.
919 Melanthium latifolium. Crisped Bunch flower (Crsp Bnch flwr).
920 Melanthium virginicum. Bunch flower #2 (Bunch flowr #2).
921 Monotropa spp. Pine sap.
922 Mentha spp. Spearmint.
923 Muhlenbergia spp. Dropseed grass.
926 Najas spp. Naiad.
927 Najas flexilis. Pondweed.
928 Najas gracillima. Thread-like Najas (Thrd-lke-Najas).
929 Nuphar spp. Water lilly (yellow) (Ywl wt lilly).
930 Nyphaea spp. Fragrant water lilly (Frgnt wt lilly).
931 Onoclea sensibilis. Sensitive Fern.
934 Ophioglossum spp. Adders Tongue #1 (Aders Tongue 1).
935 Ophioglossum vulgatum. Adders Tongue #2 (Aders Tongue 2).
936 Opuntia humifusa. Prickly pear.
938 Orchis spectabilis. Showy Orchis.
941 Orontium aquaticum. Golden club.
944 Osmunda cinnamomea. Cinnamon Fern.
945 Osmunda claytoniana. Interrupted Fern (Interupt Fern).
946 Osmunda regalis. Royal Fern.
952 Panicum spp. Panic Grass.
953 Panicum agrostidiforme. Narrow-leaved Panic Grass (Nw-lv Panic Gs).
954 Panicum capillare. Witch grass.
955 Panicum crus-galli. Cockspur Grass.
956 Panicum dichotomum. Narrow Panicum (Nrw Panic).
957 Panicum microcarpon. Barbed Panic-grass (Barb Panic gs).
960 Paspalum spp. Paspalum.
961 Paspalum floridanum. Florida Paspalum (Flord Paspalum).
962 Paspalum laeve. Field Paspalum.
965 Peltandra virginica. Arrow-arum.
968 Peramium pubescens. Rattlesnake Plantain (Rtlesnk Platan).
971 Phalaris spp. Phalaris.
972 Phalaris arundinacea. Reed Canary Grass (Rd. Cnry Grass).
973 Phalaris canariensis. Canary Grass.
976 Phegopteris phegopteris. Long Beech Fern (Lng Beech Fern).
979 Philotria spp. Water-weed #1.
980 Philotria canadensis. Water-weed #2.
983 Phleum prantense. Timothy.
986 Phragmites australis. Reed grass.
988 Phytolacca americana. Pokeweed
989 Poa spp. Poa.
990 Padophyllum peltatum. May Apple.
992 Pogonia spp. Pogonia.
995 Polygonatum biflorum. Solomons Seal.
996 Polygonum spp. Smartweed.
998 Polypogon spp. Polypogon.
999 Polypogon monspeliensis. Beard-grass.
1000 Polystichum acrostichoides. Christmas Fern.

Herbaceous Plants - cont.

1002 Pontederia cordata. Pickerel-weed.
1005 Potamogeton spp. Pondweed #1.
1006 Potamogeton crispus. Pondweed #2.
1007 Potamogeton diversifolius. Pondweed #3.
1008 Potamogeton lonchites. Pondweed #4.
1009 Potamogeton mysticus. Pondweed #5.
1010 Potamogeton natans. Pondweed #6.
1011 Potamogeton nuttallii. Pondweed #7.
1012 Potamogeton pectinatus. Pondweed #8.
1013 Potamogeton perfoliatus. Pondweed #9.
1014 Potamogeton pulcher. Pondweed #10.
1017 Pteridum aquilinum. Bracken Fern.
1020 Ruppia maritima. Tassel Pondweed (Tasel Pondweed).
1023 Rynchospora spp. Beaked-rush.
1024 Rynchospora alba. White Beaked-rush (Wt Beakd-rush).
1025 Rynchospora corniculata. Horned Rush.
1028 Sagittaria spp. Arrow-head #1.
1029 Sagittaria engelmanniana. Arrow-head #2.
1030 Sagittaria graminea. Arrow-head #3.
1031 Sagittaria lancifolia. Lance-leaved Arrow-head (Lance lv Ar hd).
1032 Sagittaria latifolia. Arrow-head #4.
1033 Sagittaria subulata. Arrow-head #5.
1034 Saururus cernuus. Lizard tail.
1036 Scirpus spp. Club-rush.
1039 Scleria spp. Nut Rush.
1042 Selaginella apus. Creeping Selaginella (Creep Sela).
1045 Sisyrinchium spp. Blue-eyed grass (Blu-eyed grass).
1046 Sisyrinchium graminoides. Stout Blue-eyed grass (St Blu-eyd gras).
1047 Smilacina racemosa. False Solomon Seal (Fls Solmn Seal).
1048 Solidago spp. Goldenrod.
1052 Spathyema foetida. Skunk cabbage.
1054 Sphagnum spp. Sphagnum.
1055 Sphenopholis spp. Eatons grass.
1058 Spirodela polyrhiza. Greater Duckweed (Grt Duckweed).
1061 Stenophyllus capillaris. Hair-like Stenophyllus (Hr-like Stenop).
1064 Syntherisma spp. Finger grass #1 (Finger gras 1).
1065 Syntherisma Ischaemum. Small Crab-grass (Sm Crab-grass).
1066 Syntherisma sanguinale. Finger-grass #2 (Finger gras 2).
1068 Thalictrum spp. Meadow Rue.
1069 Tipularia unifolia. Crane-fly Orchis (Crn-fly orchis).
1072 Tradescantia virginiana. Spiderwort.
1075 Trillium spp. Wake-robin.
1078 Tripsacum dactyloides. Gama Grass.
1081 Typha angustifolia. Cat-tail #1.
1082 Typha latifolia. Cat-tail #2.
1083 Urtica spp. Stinging Nettle. (Stinging Nettl).
1085 Uniola spp. Uniola.
1086 Uniola latifolia. Broad-leaved Spike grass (Bd-lvd Spk grs).
1087 Uniola laxa. Slender Spike grass (Sl Spike grass).
1089 Utricularia spp. Bladderwort.
1090 Uvularia spp. Bellwort.
1093 Vallisneria americana. Tape grass.
1094 Vallisneria spiralis. Tape grass #2.

Herbaceous Plants - cont.

1096 Veratrum viride. American White Hellebore (Am Wt Helebore).
1097 Viola spp. Violet.
1098 Woodwardia areolata. Netted Chain Fern. (Nettd Chan Frn).
1099 Xyris spp. Yellow-eyed Grass.
1102 Zizania aquatica. Wild Rice.

Addenda

295 Ilex coreacea. Large Gallberry (Large Balberry).
607 Smilax walterec. Redberried Greenbrier.
680 Viburnum rufidulum. Rusty blackhaw.
757 Bidens spp. Beggars Tick.
816 Epifagus virginiana. Beechdrops.
839 Eupetorium spp. Joe Pyeweed.
848 Glyceria spp. Manna-grass.
850 Goodyera pubescens. Rattlesnake plaintain (Ratlsnk plantn).
867 Hypericum spp. St. John's Wort.
896 Lobelia cardinalis. Cardinal Flower.
907 Lycopsis spp. Water horehound.
908 Lycopodium lucidulum. Shining club moss.
916 Mikania Scandens. Climbing Lemp.
924 Myriophyllum spp. Water Mill foil.
1001 Polymnia uvedalia. Large flowered leaf-cup.
1035 Sarracenia spp. Pitcher plant.
1043 Sium spp. Water parsnip.
1044 Setaria spp. Foxtail grass.
1067 Thalypterus palustris. Marsh fern.
1071 Tracaulon spp. Tear-Thumb.
1201 Unknown fern.
1202 Unknown grass.
1203 Unknown sedge.
1204 Unknown herb.

MANUALS

MAMMALS

Mammal identification numbers are always preceeded by the number 5

MAMMALS

001 Blarina brevicauda. Short tail shrew.
002 Castor canadensis. Beaver.
003 Clethrionomys gapperi. Red-backed vole.
004 Condylura cristata. Star nosed mole.
005 Cryptotis parva. Least shrew.
006 Didelphis marsupialis. Opossum.
007 Glaucomys volans. Flying squirrel.
008 Lutra canadensis. River otter.
009 Lynx rufus. Bobcat.
010 Mephitis mephitis. Striped skunk.
011 Microtus pennsylvanicus. Meadow vole.
012 Mus musculus. House mouse.
013 Mustela frenata. Long tail weasel.
014 Mustela vison. Mink.
015 Odocoileus virginianus. White tailed deer (wh tailed deer).
016 Ondatra zibethicus. Muskrat.
017 Oryzomys palustris. Rice rat.
018 Peromyscus leucopus. White footed mouse (wh footed mouse).
019 Pitymys pinetorum. Pine mouse.
020 Procyon lotor. Raccoon.
021 Scalopus aquaticus. Common mole.
022 Sciurus carolinensis. Gray squirrel.
023 Sciurus niger. Fox squirrel.
024 Sorex cinereus. Masked shrew.
025 Sylvilagus floridanus. Eastern Cottontail (E. Cottontail).
026 Tamias striatus. Eastern chipmunk
027 Tamiasciurus hudsonicus. Red squirrel.
028 Urocyon cinereoargenteus. Gray fox.
029 Ursus americanus. Black bear.
030 Vulpes fulva. Red fox.
031 Zapus hussonius. Meadow jump mouse (Meadw jump mouse).
032 Marmota monax. Woodchuck.
999 Unknown.

Source: Smithsonian Institute, 1974

BIRDS

BIRDS

Bird identification numbers are always preceeded by the number 6*

Green Heron	201	Purple Martin	611	Hooded Warbler	684
Mallard	132	Blue Jay	477	House Sparrow	688
Wood Duck	144	Common Crow	488	E. Meadowlark	501
Turkey Vulture	325	Car. Chickadee	736	R-w. Blackbird	498
Red-shd. Hawk	339	House Wren	721	North. Oriole	507
Sparrow Hawk	360	Tuft. Titmouse	731	Orchard Oriole	506
Bob White	280	Carolina Wren	718	Cmmn. Grackle	511
Killdeer	273	Mockingbird	703	Br.-h. Cowbird	495
Rock Dove	313	Catbird	704	Scarlet Tanager	608
Mourning Dove	316	Brown Thrasher	705	Cardinal	593
Yell-Bill Cuckoo	387	Robin	761	Blue Grosbeak	597
Screech Owl	373	Wood Thrush	755	Indigo Bunting	.598
Whip-poor-will	417	E. Bluebird(Box)	766	Am. Goldfinch	529
Chimney Swift	423	Bluebird(Cavity)	766	Ruf.-S. Towhee	587
R.-thr. Hummer	428	B-grGnatcatcher	751	Chipping Sparrow	560
B. Kingfisher	390	Starling	493	Field Sparrow	563
Y.-Sh. Flicker	412	W. -eye Vireo	631	Song Sparrow	581
Pileated Wdpkr.	405	R.-eye Vireo	624	B & W Warbler	636
Hairy Woodpkr.	393	Parula Warbler	648	Pine Warbler	671
Downy Woodpkr.	394	Prairie Warbler	673	Ovenbird	674
E. Kingbird	444	La. Waterthrush	676	Kent. Warbler	677
Gr.-cr. Flycat	452	Yellowthroat	681	Y. Br. Chat	683
E. Phoebe	456	Woodcock	228	Cedar Waxwing	619
Acadian Flycat.	465	Spot. Sandpiper	263	Yel. Thr. Vireo	628
Wood Pewee	461	Bl.-B. Cuckoo	388	Warbling Vireo	627
Barn Swallow	613	Barn Owl	365	Prothonotary W.	637
Pied.-b. Grebe	006	Gr.Horned Owl	375	Worm-eating W.	639
Gr. Blue Heron	194	Barred Owl	368	Yellow Warbler	652
Least Bittern	191	Chuck-will-wdow	416	Cerulean Warb.	658
Canada Goose	172	Rd.Hded.Woodpkr	406	Yel.-thr. Warbler	663
Black Duck	133	Alder Flycatchr	801	Am. Redstart	687
Blue-wing Teal	140	WillowFlycatchr	466	Summer Tanager	610
Hded. Merganser	131	Least Flycatchr	467	Grasshopper Sp.	546
Black Vulture	326	Horned Lark	474	Vesper Sparrow	540
Cooper's Hawk	333	Tree Swallow	614	Savannah Sp.	542
Red-tailed Hawk	337	Bank Swallow	616	Henslow Sparrow	547
Brd.-wing Hawk	343	Rgh-w. Swallow	617	Swamp Sparrow	584
Osprey	364	Cliff Swallow	612	House Finch	519
W.-Br. Nuthatch	727	Fish Crow	490	R. neck Pheas't	309
Veery	756	King Rail	208	Brown Creeper	726
Great Egret	196	Virginia Rail	212	Bald Eagle	800
Snowy Egret	197	Rd-bellied Wdpkr	409	Blck.Crn.Nt. Heron	202
La. Heron	199	Ltle. Blue Heron	200	Am. Bittern	190
Cattle Egret	198				

Source: Chandler Robbins, Patuxent Wildlife Research Station

*Additional species sighted were assigned numbers according to the A.O.U. List of Species Numbers and Recommended Band Sizes.

REPTILES AND AMPHIBIANS

Herptofauna identification numbers are always preceeded by the number 7

TURTLES

080 Sternotherus odoratus (Latreille). Common Musk Turtle (Musk Turtle)
081 Kinosternon subrubrum subrubrum (Lacepede). Common Mud Turtle (Mud Turtle).
082 Chelydra serpentina serpentina (Linne). Snapping Turtle.
083 Clemmys guttata (Schneider). Spotted Turtle.
084 Clemmys muhlenbergii (Schopf). Muhlenberg's Turtle (Muhlenberg Turtl).
085 Terrapene carolina carolina (Linne). Common Box Turtle (Box Turtle).
086 Malaclemys terrapin terrapin (Schopf). Northern Diamond-backed Terrapin (N Di-bk Terrapin).
087 Graptemys geographica (Le Sueur). Common Map Turtle (Map Turtle.
088 Chrysemys picta picta (Schneider). Eastern Painted Turtle (E Painted Turtle).
089 Pseudemys rubriventris rubriventris (Le Conte). Red-bellied Terrapin (Rd-bely Terrapin).

SALAMANDERS

001 Cryptobranchus alleganiensis (Daudin). Hellbender.
002 Triturus viridescens viridescens Rafinesque. Common Newt.
003 Ambystoma maculatum (Shaw). Spotted Salamander (Spot Salamander).
004 Ambystoma opacum (Gravenhorst). Marbled Salamander (Marbl Salamander).
005 Ambystoma tigrinum tigrinum (Green). Eastern Tiger Salamander (E Tiger Salamand).
006 Desmognathus fuscus fuscus (Rafinesque). Northern Dusky Salamander (N Dusky Salamand).
007 Plethodon cinereus cinereus (Green). Red-backed Salamander (Rd-back Salamand).
008 Plethoden glutinosus glutinosus (Green). Slimy Salamander.
009 Hemidactylium scutatum (Schlegel). Four-toed Salamander (4-toed Salamand),
010 Pseudotriton montanus montanus Baird. Baird's Red Salamander (Baird Rd Salamand).
011 Pseudotriton ruber ruber (Sonnini). Red Salamander.
012 Eurycea bislineata (Green). Northern Two-lined Salamander (N 2-line Salamand).
013 Eurycea longicauda longicauda (Green). Long-tailed Salamander (Long-tail Salamand).

Source: Conant, 1945

FROGS AND TOADS

020 Scaphiopus holbrookii holbrookii (Harlan). Spadefoot Toad.
021 Bufo terrestris americanus Holbrook. American Toad.
022 Bufo woodhousii fowleri Hinckley. Fowler's Toad.
023 Acris crepitans Baird. Cricket Frog.
024 Pseudacris nigrita triseriata (Wied). Chorus Frog.
025 Hyla cinerea (Schneider). Green Tree Frog.
026 Hyla crucifer crucifer Wied. Northern Spring Peeper (N Spring Peeper).
027 Hyla versicolor versicolor Le Conte. Common Tree Frog.
028 Rana catesbeiana Shaw. Bull Frog.
029 Rana clamitans Latreille. Green Frog.
030 Rana palustris Le Conte. Pickerel Frog.
031 Rana pipiens Schreber. Leopard Frog.
032 Rana sylvatica sylvatica Le Conte. Wood Frog.
033 Rana virgatipes Cope. Carpenter Frog.

SNAKES

040 Carphophis amoena amoena (Say). Eastern Worm Snake (E Worm Snake).
041 Diadophis punctatus (Linne). Ring-necked Snake (Ring-neck Snake).
042 Heterodon contortrix contortrix (Linne). Common Hog-nosed Snake (Hog-nosed Snake).
043 Opheodrys aestivus (Linne). Keeled Green Snake (Keel Green Snake).
044 Coluber constrictor constrictor(Linne). Black Snake.
045 Elaphe guttata (Linne). Corn Snake.
046 Elaphe obsoleta obsoleta (Say). Pilot Black Snake (Pilot Bl Snake).
047 Lampropeltis getulus getulus (Linne). Common King Snake (King Snake).
048 Lampropeltis triangulum triangulum (Lacepede). Common Milk Snake (Milk Snake).
049 Lampropeltis triangulum temporalis (Cope). Coastal Plain Milk Snake. (Cstl Pl Milk Snk).
050 Cemophora coccinea (Blumenbach). Scarlet Snake.
051 Natrix erythrogaster erythrogaster (Forster). Red-bellied Water Snake. (Rd-bely Water Snk).
052 Natrix septemvittata (Say). Queen Snake.
053 Natrix sipedon (Linne). Common Water Snake (Water Snake).
054 Storeria dekayi dekayi (Holbrook). Dekay's Snake.
055 Storeria occipitomaculata occipitomaculata (Storer). Red-bellied Snake (Red-bellied Snk).
056 Haldea valeriae (Baird and Girard). Eastern Ground Snake (E Ground Snake).
057 Thamnophis sauritus sauritus (Linne). Eastern Ribbon Snake (Ribbon Snake).
058 Thamnophis sirtalis sirtalis (Linne). Common Garter Snake (Garter Snake).
059 Agkistrodon mokeson mokeson (Daudin). Northern Cooperhead (N Copperhead).

LIZARDS

070 Sceloporus undulatus hyacinthinus (Green). Common Swift.
071 Lygosoma laterale (Say). Brown-backed Skink (Br-backed Skink).
072 Eumeces fasciatus (Linne). Blue-tailed Skink (Blu-tailed Skink).
073 Eumeces laticeps (Schneider). Large-headed Skink (Large-head Skink).

VAN DEUSEN

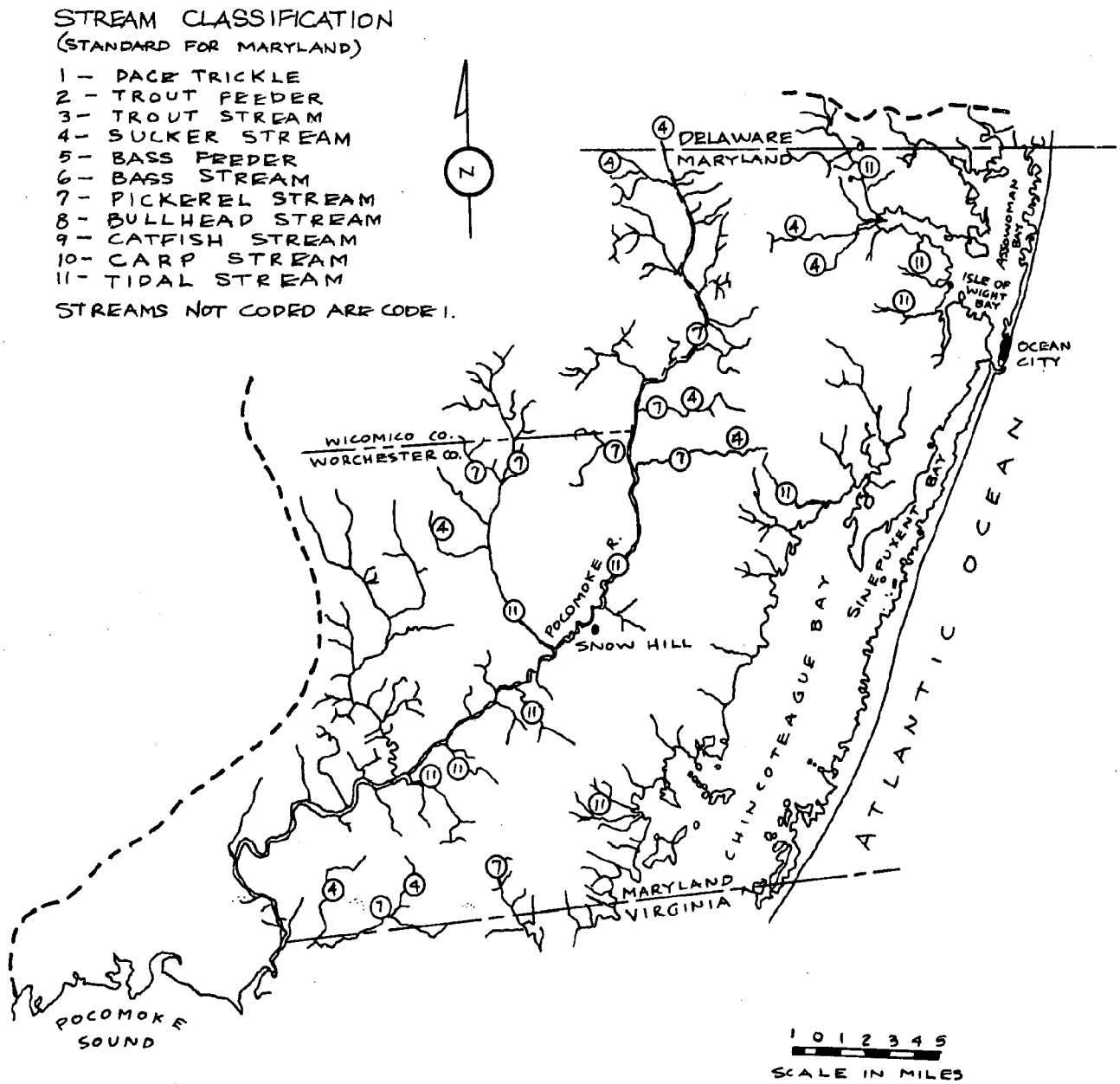
MARYLAND STREAM CLASSIFICATION

Natural Resources Inventory, Department of Research and Education, Solomons, Md.

Code No.	Stream Class	Width	Depth	Temp.	Water Quality	Bottom	Flow	Volume	Characteristic Forms	Shade and Cover	Misc. Characters
1	DACE TRICKLE	0 to 3'	Very Shallow	Cool	Usually clear clean water except in spring	Boulders Gravel Sand	Little	Little	Blacknose Dace	Usually has some forest cover but may have none	Extreme upper reaches of most streams.
2	TROUT FEEDER	3' to 7'	Shallow	Cold	Clear, clean water	Rubble to gravel	Medium	Little to Medium	Trout, Muddlers & Creek Chubs	Moderate shades, insufficient stream cover for large fish	Water volume not great enough to support legal sized trout popu.
3	TROUT STREAM	5' and over	Shallow with pools	Cold	Clear, clean water	Rubble to gravel	Medium to Mod.	Medium to Mod.	Trout, Muddlers, River & Creek Chubs	Moderate am't of shade, & cover for fish	With trout feeder streams flowing into main axis
4	SUCKER STREAM	3' to 20'	Medium	Cool	Intermediate may carry silt at times	Sand and gravel	Medium	Medium	Common Sucker & Common Shiner	Lack shade and cover	Has characteristics of trout stream and may fall below
5	BASS FEEDER	10' and over	Shallow with pools	Cool	Clear to slightly turbid water	Sand and gravel	Medium	Medium	Smallmouth Bass, Crayfish & Mussels	Medium amount of shade and cover	Insufficient volume of water to support legal popu. of bass
6	BASS STREAM	20' and over	Medium with pools	Cool	Clear to slightly turbid water	Sand	Mod.	Mod.	Smallmouth Bass, Chubs, & Crayfish	Medium amount shade & mod. am't of cover	Sufficient volume and deep pools
7	PICKEREL STREAM	20' and over	Mod. with pools	Cool to Warm	Dark turbid waters	Muck, sand	Medium to slow	Medium	Chain Pickerel Sunfish, Crappie, & Golden Shiner	Moderate shade and cover	Aquatic vegetation, serves as stream cover
8	BULL-HEAD STREAM	20' to 50'	Medium	Warm to Cool	Turbid Water	Mud and muck	Little to Medium	Medium to Little	Bullheads and variety of Sunfishes	Medium shade and cover	Only occasional pools
9	CATFISH STREAM	70' and over	Mod.	Cool to Warm	Turbid Water	Mud Sand Gravel	Medium	Medium and Mod.	Catfish, Bullheads & variety of panfishes	Medium shade and cover	Frequent deep pools
10	CARP STREAM	70' and over	Medium to Mod.	Warm	Muddy sometimes highly turbid water	Mud and muck	Medium	Little to Medium	Carp, Sunfishes & Catfish in marginal areas	Little shade and cover	Characterized by only a few species of fish present
11	TIDAL STREAM	5' and over	Medium	Warm	Seasonally clear and muddy, more or less brackish	Sand Muck Peat	Slow to Medium	Medium	Variety of fresh and saltwater forms	Sparse shade and little stream cover	Shallow to deep channels with bars

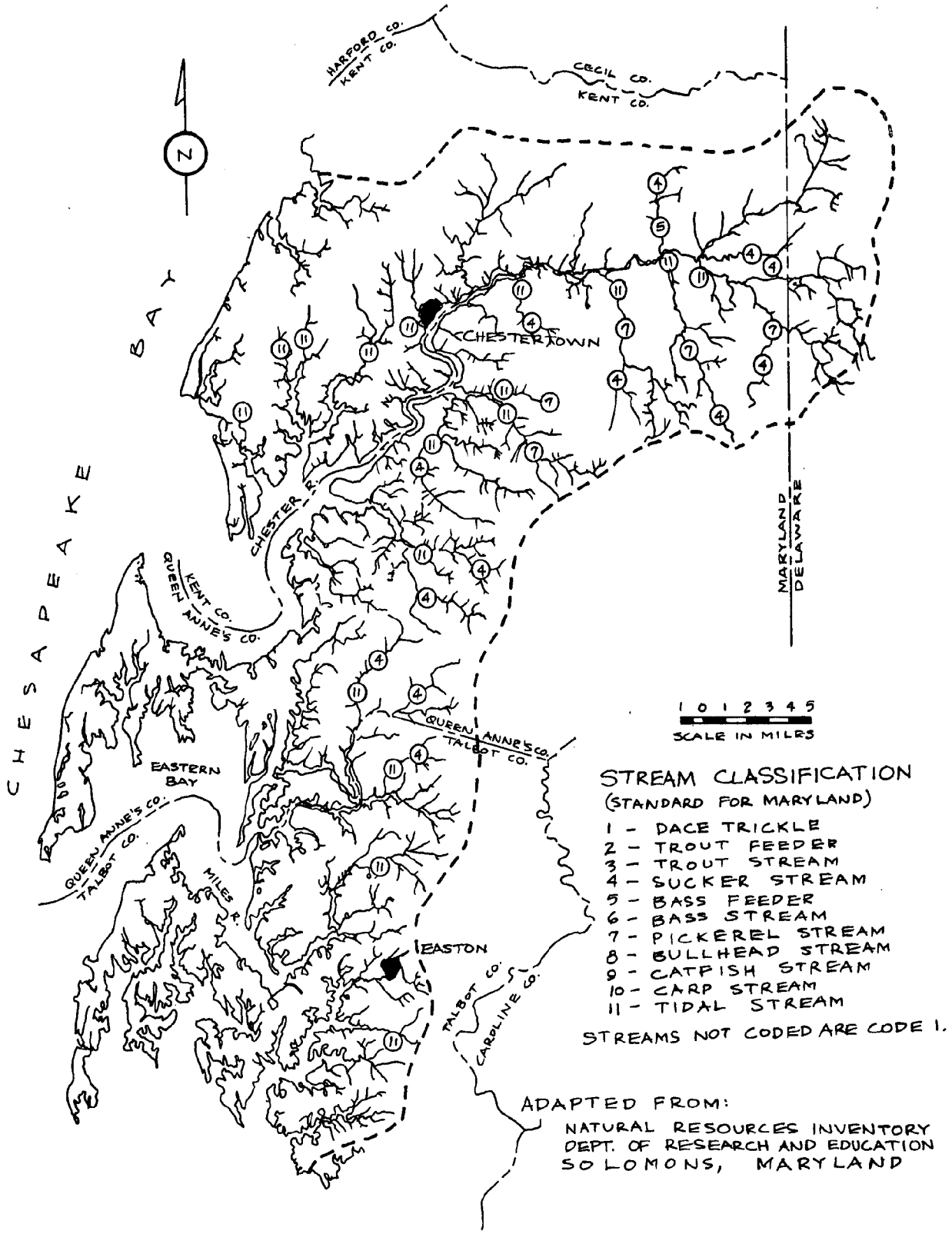
VAN DUESEN INDEX

ATLANTIC OCEAN DRAINAGE AND POCOMOKE RIVER WATERSHED

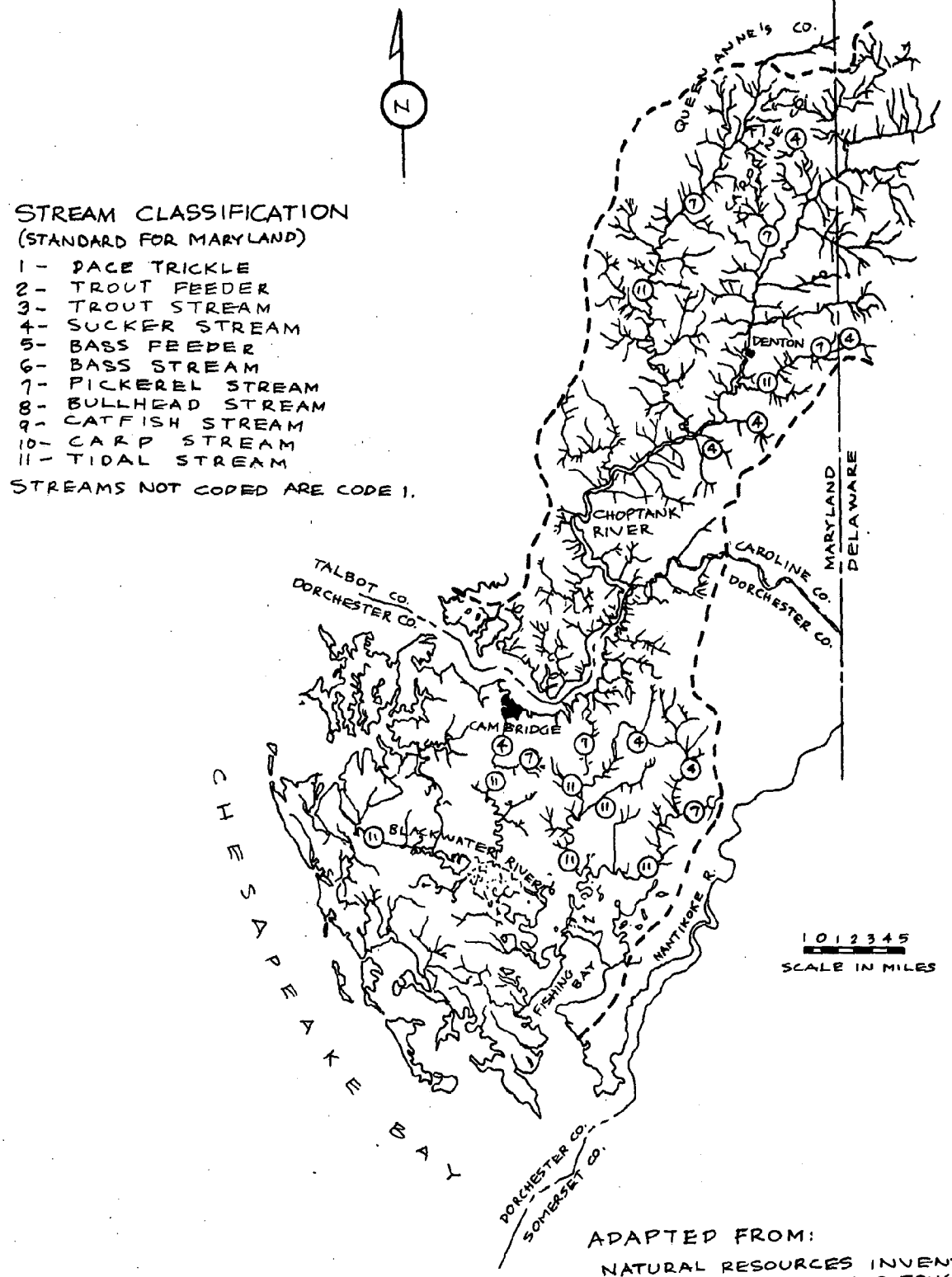


ADAPTED FROM:
NATURAL RESOURCES INVENTORY
DEPARTMENT OF RESEARCH AND EDUCATION
SOLOMONS, MARYLAND

EASTERN BAY AREA AND CHESTER RIVER WATERSHED



CHOPTANK AND BLACKWATER RIVERS WATERSHEDS



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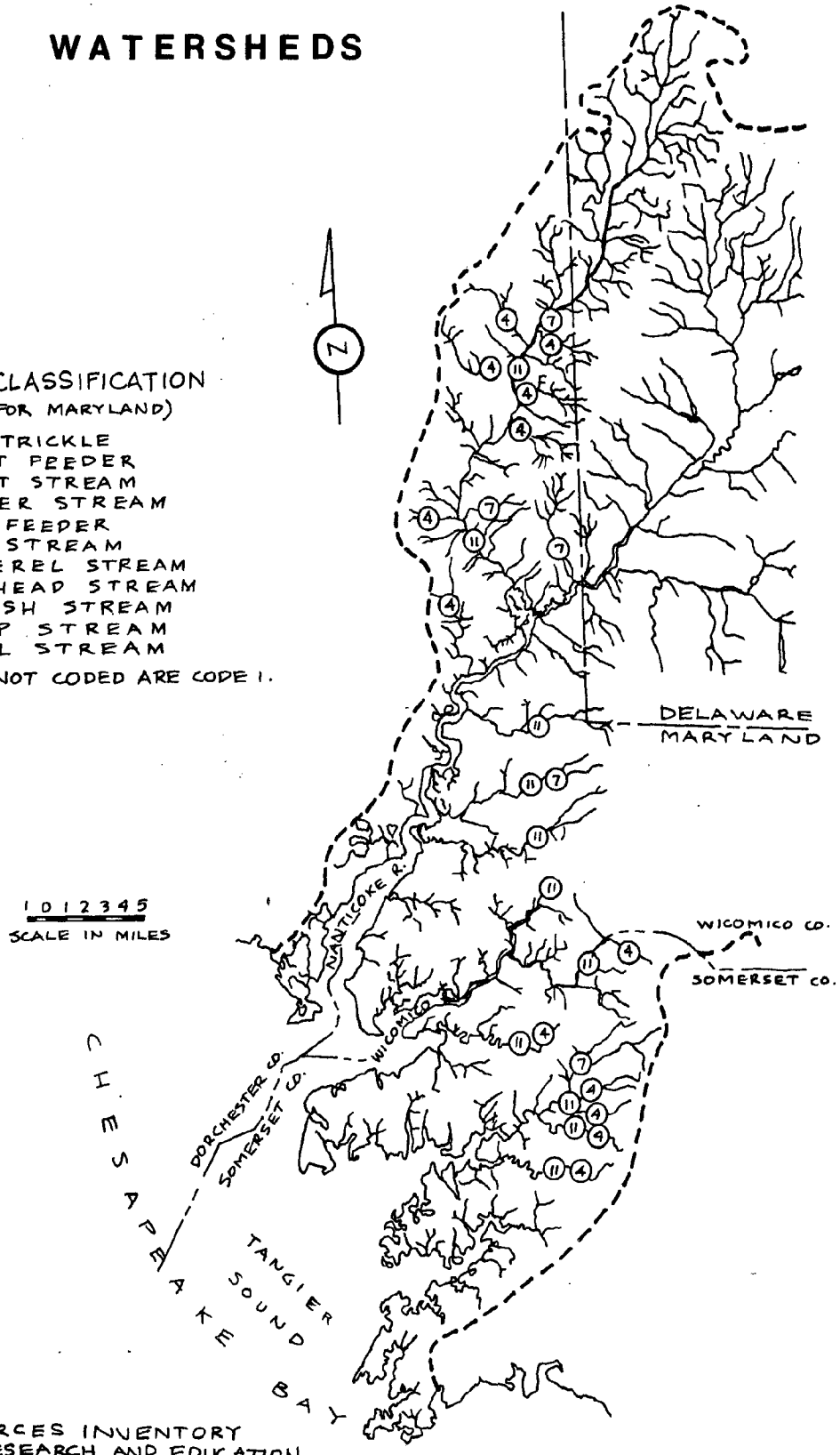
WATERSHEDS



STREAM CLASSIFICATION
(STANDARD FOR MARYLAND)

1 - DACE TRICKLE
2 - TROUT FEEDER
3 - TROUT STREAM
4 - SUCKER STREAM
5 - BASS FEEDER
6 - BASS STREAM
7 - PICKEREL STREAM
8 - BULLHEAD STREAM
9 - CATFISH STREAM
10 - CARP STREAM
11 - TIDAL STREAM

STREAMS NOT CODED ARE CODE 1.

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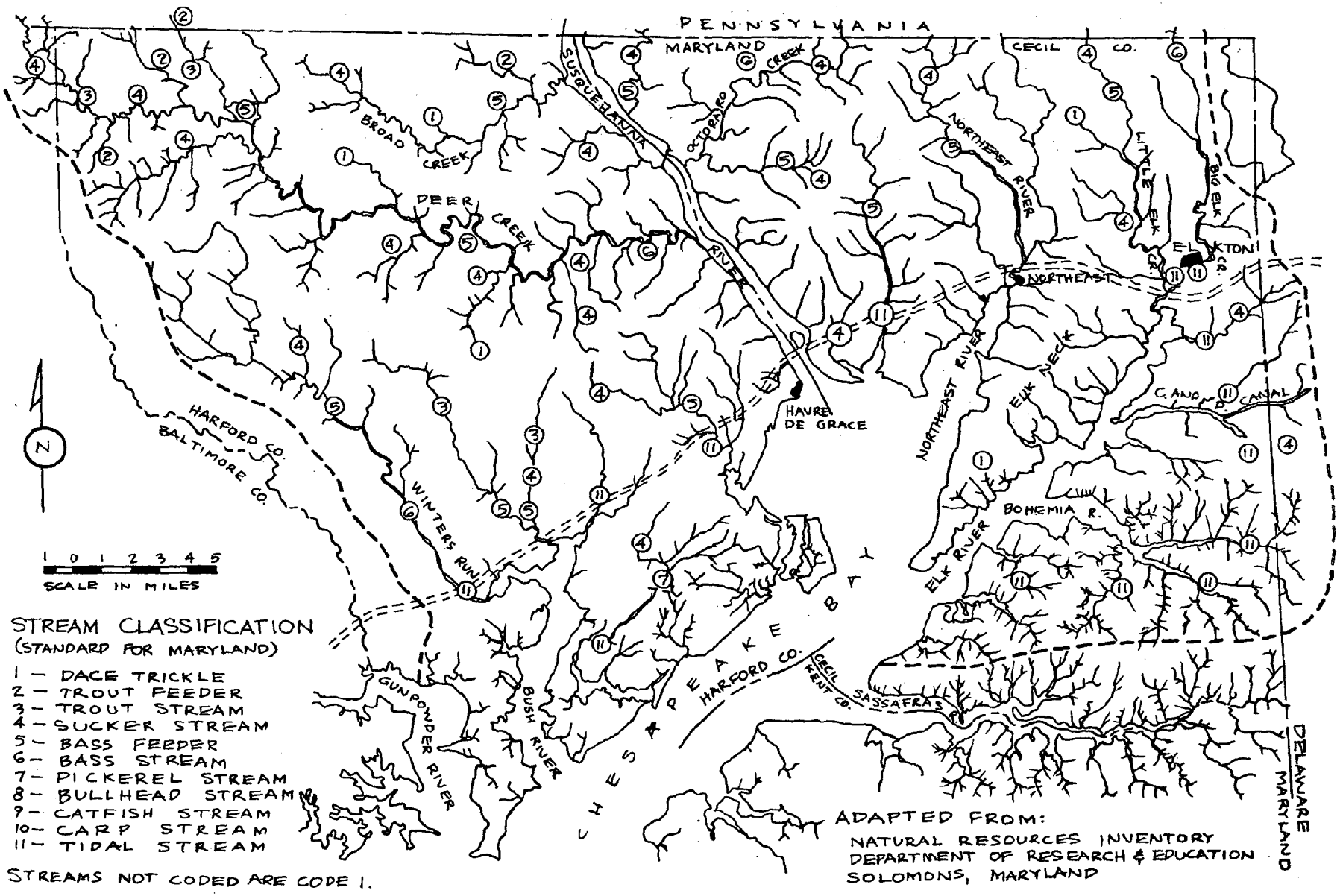
SUSQUEHANNA RIVER WATERSHED



SOILS

SOILS DATA

Soil Series	Runoff Potential Rating	Depth to Seasonal High Water Table	Well Drained Soils	Erodibility Coefficient	Natural Soil Group
Aura	B+	20 ft.	*	.43	B_2
Barclay	C	1		.24	F_2
Bayboro	D	0		.43	F_3
Beaches				.17	A_2
Bettsville	C+	1.5		.43	E_2
Bertie	C	0-1.5		.37	F_3
Bibb	D+	0-1		.24	G_2
Bladen	D	0-1		.43	F_3
Borrow pits	D			--	Bp
Buttertown	C+	1-2		.43	B_2
Chillum	C+	5	*	.32	B_2
Christiana	B	5	*	.37	B_3
Clay pits	D			--	Bp
Coastal beach				--	A_2
Collington	B	5	*	.28	B_1
Downer	B+	10	*	.28	A_1
Dragston	C			.28	F_2

Soils Data - Table Continued

Soil Series	Runoff Potential Rating	Depth to Seasonal High Water Table	Well Drained Soils	Erodibility Coefficient	Natural Soil Group
Elkton	D+	0-1		.43	F_3
Evesboro	B+	10	*	.17	A_1
Fallsington	D+	0-1		.28	F_1
Fort Mott	B+	5	*	.20	A_1
Galestown	B+	5	*	.17	A_1
Gravel pits	D			--	B_p
Johnston	D	0		.43	G_2
Keyport	C	2		.43	E_2
Klej	B	2		.17	E_1
Lakeland	B+	5	*	.17	A_1
Leon	C	1		.17	F_1
Leonardtown	D+	0		.43	F_3
Loamy & clay land	D			.49	B_3
Made land				--	Ma
Matapeake	B	5	*	.32	B_1
Matawan	C+	2		.32	E_2
Mattapex	C+	2		.37	E_3
Mixed Alluvial land	D+	0-1		.28	G_2
Muck	D	0		--	G_2

Soils Data - Table Continued

Soil Series	Runoff Potential Rating	Depth to Seasonal High Water Table	Well Drained Soils	Erodibility Coefficient	Natural Soil Group
Norfolk	B	10	*	.28	B_2
Othello	D+	0-1		.37	F_3
Plummer	D+	0-1		.17	F_1
Pocomoke	D	0		.28	F_2
Portsmouth	D	0		.28	F_3
Rumford	B	5	*	.24	A_1
Rutledge	D	0		.17	F_1
Sandy land, steep	D			.49	A_{1c}
Sassafras	B	5	*	.28	B_1
St. Johns	D	0		.17	F_1
Stony land	D			--	H_{1c}
Swamp	D	0		--	G_3
Tidal marsh	D	0		--	G_3
Woodstown	C +	2		.28	E_1

Source: USDA. Soil Conservation Service (Chiang 1971), Maryland Dept of State Planning 1973 Natural Soils Groups of Maryland.

WETLANDS

WETLAND WILDLIFE RATING

Wetland Classes

5 acre minimum	Dominance Class	Richness Class	Rank
1. Open water	4,2	5 or more	3.0
2. Deep marsh	3	4	2.5
3. Shallow marsh	7,6	3	2.0
4. Seasonally flooded flats	1,8	2	1.5
5. Meadow	5	1	1.0
6. Shrub swamp			
7. Wooded swamp			
8. Bog			

Size

	Rank
9. Very small - less than 10 acres	1.0
10. Small - 10-50 acres	1.5
11. Medium-sized - 51-100 acres	2.0
12. Large - 101-500 acres	2.5
13. Very large - greater than 500 acres	3.0

Site Types

	Cover Types	Site Types	Rank
14. Upland-isolated	24	17,18,19	3.0
15. Upland-lakeside	23		2.5
16. Bottomland-isoladed	22,26	15,16	2.0
17. Bottomland-lakeside	20,21,25		1.5
18. Bottomland-streamside	27	14	1.0
19. Bottomland-deltaic			

Cover Types

20. Cover occupies more than 95 percent of the wetland area.
21. Cover occupies 76-95 percent of the wetland area, occurring in a peripheral band.
22. Cover occupies 76-95 percent of the wetland area, occurring in dense patches or diffuse open stands.
23. Cover occupies 26-75 percent of the wetland area, occurring in a peripheral band.
24. Cover occupies 26-75 percent of the wetland area, occurring in dense patches or diffuse open stands.
25. Cover occupies 5-25 percent of the wetland area, occurring in a peripheral band.
26. Cover occupies 5-25 percent of the wetland area, occurring in patches or diffuse open stands.
27. Coveroccupies less than 5 percent of wetland area.

Wetland Wildlife Categories - cont.

Surrounding Habitat Types

		Habitats	Rank
28.	Agricultural or open land	2 or more of	
29.	Forest land	28,29,30 making	3.0
30.	Salt marshes	up more than 90%	
31.	Mining or waste disposal area	1 or more of	
32.	Urban land	28,29,30 making	2.0
33.	Outdoor recreation facilities	up 50-90%	
		1 or more of	
		28,29,30 making	1.0
		up less than 50%	

Vegetative Interspersion

		Rank
34.	Type 1	1.0
35.	Type 2	2.0
36.	Type 3	3.0

Wetland Juxtaposition

37. Hydrologically connected to other wetlands (different dom. class) or open water bodies within one mile.
(or)
Hydrologically connected to other wetlands (same dom. class) within 1/4 mile
(or)
Wetland greater than 500 acres, with three or more wetland classes (including deep marsh or shallow marsh).

38. Hydrologically connected to other wetlands (different dom. class) or open water bodies from 1-3 miles away.
(or)
Within 1/2 mile of other wetlands (different dom. class) or open water bodies, but not hydrologically connected).

39. All other possibilities

	Rank
37	3.0
38	2.0
39	1.0

WETLAND WILDLIFE RATING

Col. No.		Sig. Coeff.		Rank		Sub-score
1	**Class Richness** [6 /]	5	×	_____	:	_____
13	**Dominant Class** [ ]	5	×	_____	:	_____
14	**Size** [ ][ ]	5	×	_____	:	_____
16	**Site Type** [ ][ ]	4	×	_____	:	_____
18	**Cover Type** [ ][ ]	3	×	_____	:	_____
	Surrounding Habitat	4	×	_____	:	_____
20	[ ][ ] Agricultural or open					
22	[ ][ ] Forest					
24	[ ][ ] Salt Marsh					
26	[ ][ ] Mining, Waste disposal					
28	[ ][ ] Urban					
30	[ ][ ] Outdoor Recreation					
32	**Vegetative Interspersion** [ ][ ]	3	×	_____	:	_____
34	**Juxtapostion** [ ][ ]	2	×	_____	:	_____
36	**TOTAL SCORE** [ ][ ][ ]					**TOTAL SCORE** _____

CLASSIFICATION AND EVALUATION OF FRESHWATER WETLANDS AS WILDLIFE HABITAT IN THE GLACIATED NORTHEAST[1,2]

Francis C. Golet, Assistant Professor, Department of Forest and Wildlife Management, University Rhode Island.

Abstract

A detailed classification system for freshwater wetlands is presented along with ten criteria for the evaluation of wetlands as wildlife habitat. The results are based on a two-year field study of over 150 wetlands located throughout the state of Massachusetts. The major components of the classification system include wetland classes and subclasses, based on the dominant life form of vegetation and surface water depth and permanence; size categories; topographic and hydrologic location; surrounding habitat types; proportions and interspersion of cover and water; and vegetative interspersion. These components are combined with wetland juxtaposition and water chemistry to produce criteria for wetland evaluation. Using a system of specifications and ranks, wetlands can be arrayed according to their wildlife value for decision-making.

Wetlands traditionally have been regarded as waste areas. More than one-third of the nation's total original wetland acreage has been obliterated, and the remaining acres are fast disappearing (Shaw and Fredine, 1956). In the prairies and in the south, man has drained wetlands primarily for agricultural purposes. In the northeast, expansion of urban areas has created a growing need for land suitable for highway construction and commercial, industrial and housing development, often at the expense of wetlands.

During the last 10 years, several northeastern states, realizing the natural values of freshwater wetlands, enacted laws to control their alteration. Implementation of these laws has been generally unsuccessful because decision-makers lack appropriate criteria for wetland evaluation. In 1969 a research team of wildlife biologists, hydrogeologists, landscape planners and resource economists organized at the University of Massachusetts to develop a decision-making model for public management of freshwater wetlands (Larson, 1971).

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[1] This paper is a contribution of the Massachusetts Cooperative Wildlife Research Unit. The work was supported by the U.S. Department of the Interior, Office of Water Resources Research, as authorized under the Water Resources Research Act of 1964 (P.L. 88-379), Dr. Joseph S. Larson, Principal Investigator.

[2] Reference: 1973. Trans. Northeast Fish & Wildlife Conf. 30:257-279.

This paper is a contribution of the wildlife sub-project toward evaluation of wetlands as wildlife habitat.

Early in this study, it became clear that a detailed wetland classification system was prerequisite to development of criteria for evaluation. The national classification system devised by Martin et al. (1953) has been used widely, but it is too generalized for wetlands research and management on a regional or statewide scale. Stewart and Kantrud (1971) produced a detailed system for the Prairie Pothole Region, but similar refinements are notably lacking in other parts of North America. Golet (1972) and Golet and Larson (1974) have described several of the more prominent systems being used throughout the United States and Canada.

Nearly all of these classification systems were developed to facilitate description and evaluation of waterfowl habitat. Because of the greatly expanded use of northeastern freshwater wetlands by educational groups, bird watchers, hikers, nature photographers, as well as sportsmen, the standard for evaluation in this study is maximum wildlife production and diversity. The classification system presented here identifies wetland features that determine the presence and abundance of a great variety of wildlife species. Criteria for wetland evaluation are developed from this system.

Acknowledgments

Special appreciation is extended to my major advisor, Dr. Joseph S. Larson, Department of Forestry and Wildlife Management, University of Massachusetts, for his advice and criticism throughout this study. I am grateful to Warren Blandin, Chief of Research; Richard Cronin, Chief of Information and Education; Harry Heusmann, Chief Waterfowl Biologist; and all district biologists of the Massachusetts Division of Fisheries and Game who helped in various phases of this work. Massachusetts Audubon Society personnel identified many wetlands valuable for wildlife. Harry Ahles, Department of Botany, University of Massachusetts, reviewed the section on plant classification.

Materials and Methods

During 1970 a reconnaissance study provided a broad range of qualitative data on the nature and diversity of 131 freshwater wetlands in Massachusetts. After refining earlier physiographic maps of the state (Office of River Basin Studies, 1954; Beaumont, 1956), I selected usually four or more U.S.G.S. map quadrangles as study areas within each physiographic region (Figure 1). These quadrangles were selected so as to include a maximum number of wetlands, a maximum diversity of surficial geologic substrates, both alkaline and acidic hydrochemical ground-water facies (Motts and Saines, 1969), and several wetlands deemed valuable as wildlife habitat by state or federal wildlife agencies.

Within each study area, I selected specific wetlands so as to achieve diversity with respect to the following criteria: hydrologic location, surficial

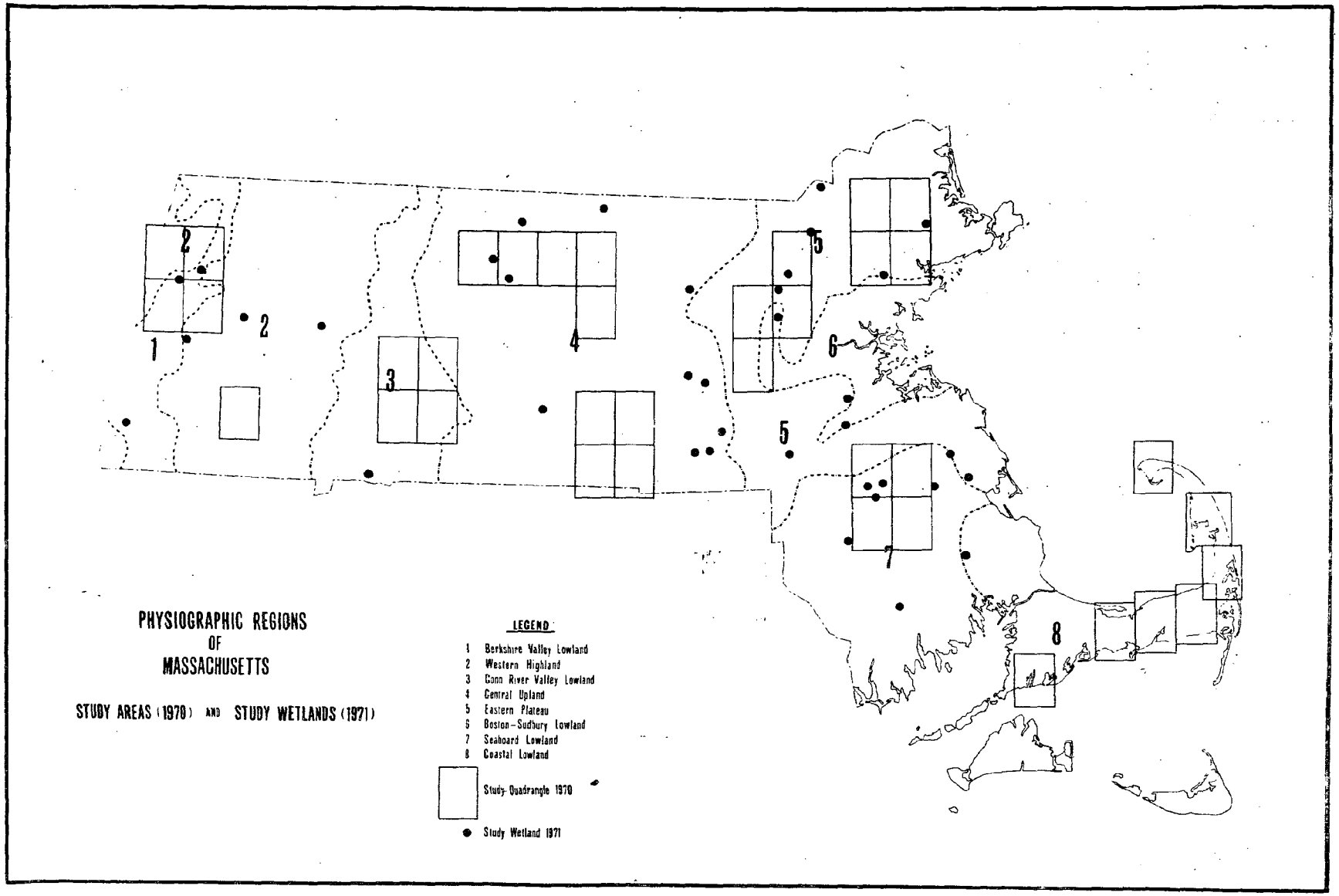


Figure 1. Physiographic regions of Massachusetts, study areas for wetland reconnaissance (1970) and high value study wetlands (1971).

geologic substrate, wetland class as outlined by Martin et al. (1953), size, and urban-rural context. Land-use maps (MacConnell and Garvin, 1956) were used in the selection and field study of wetlands. I obtained additional data from topographic maps, surficial geologic maps and 1:20,000 aerial photographs.

During 1971 I asked biologists from the Massachusetts Division of fisheries and Game and the Massachusetts Audubon Society to identify wetlands of high value to wildlife in the various physiographic regions. After adding several wetlands designated "high value" for waterfowl by the federal inventory (Office of River Basin Studies, 1954), I selected 38 high value wetlands and gathered detailed qualitative data on them in the field. The locations of these wetlands are designated by dots in Figure 1. Extensive literature review on the habitat requirements of wetland wildlife species supplemented field work (Golet, 1972). In addition, I reviewed and summarized nine years of unpublished water chemistry data collected by the Massachusetts Division of Fisheries and Game in 95 lakes and ponds located throughout the state.

Results

Classification of Freshwater Wetlands

Life forms and sub-forms of wetland vegetation. The classification of plant life forms was the first step toward wetland classification. Five life forms and 18 sub-forms are recognized (Figures 2 and 3). The forms represent obvious divisions of vegetation: trees, shrubs, emergents, surface plants and submergents. Because differences in wildlife value often exist between plants belonging to the same life form, I have divided each form into sub-forms which reflect not only differences in structure, but differences in ecology and stand density as well.

Below is a description of each life form and sub-form. Height classes given are average. Latin names are taken from the eighth edition of Gray's Manual (Fernald, 1950).

TREES (3 sub-forms). Woody plants greater than 20 ft tall.

1. Live deciduous trees. Living trees that lack leaves or needles during late fall, winter and early spring (e.g., *Acer rubrum*).
2. Live evergreen trees. Living trees that retain their leaves or needles throughout the year (e.g., *Picea mariana*).
3. Dead trees. Standing dead trees and tree stumps 5 ft or more in height.

SHRUBS (6 sub-forms). Woody plants less than 20 ft tall. Woody plants taller than 20 ft at maturity (and commonly called trees) are considered shrubs when less than 20 ft tall.

4. Tall slender shrubs. Shrubs 10 to 20 ft tall, having usually one distinct trunk, and unbranched for 3 ft or more above the ground (e.g., *Alnus rugosa*).
5. Bushy shrubs. Non-aquatic shrubs 4 to 7 ft tall, having usually several stems, a bushy appearance and often branched from within 1 ft of the ground (e.g., *Vaccinium corymbosum*).

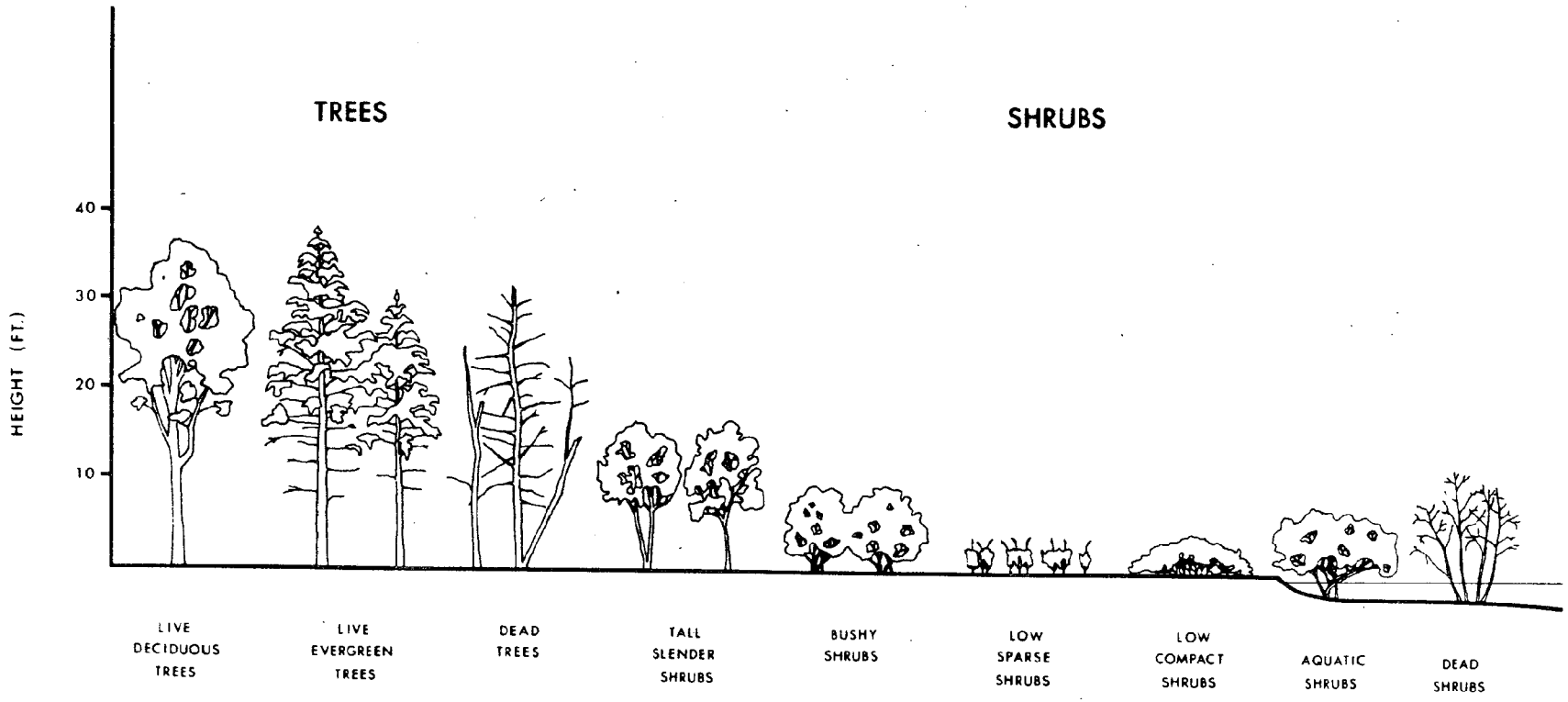


Figure 2. Sub-forms of wetland trees and shrubs.

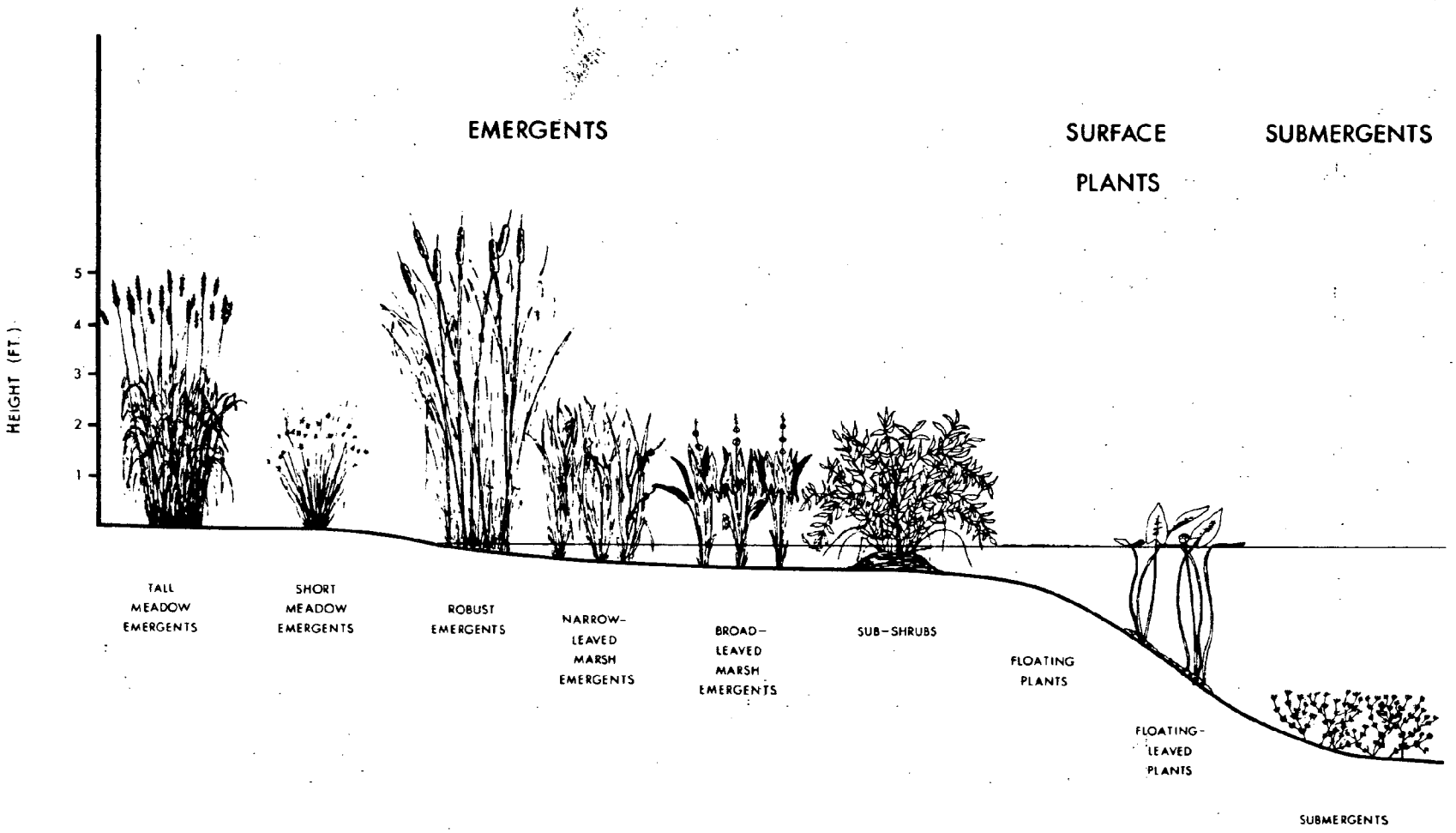


Figure 3. Sub-forms of wetland emergents, surface plants and submergents.

6. Low compact shrubs. Non-aquatic shrubs less than 4 ft tall, having usually several stems, very dense foliage, and often branched from within 6 in of the ground (e.g., Myrica gale).
7. Low sparse shrubs. Non-aquatic, simple or sparsely branched shrubs up to 3 ft tall (e.g., Spiraea tomentosa).
8. Aquatic shrubs. Shrubs up to 7 ft tall, growing in standing water 6 in or more deep (e.g., Cephalanthus occidentalis).
9. Dead shrubs. Standing dead shrubs and tree stumps less than 5 ft tall.

EMERGENTS (6 sub-forms). Rooted herbaceous or semi-woody plants that have the majority of their vegetative portion above the water surface. This includes herbaceous plants growing on moist, but exposed soil.

10. Sub-shrubs. Emergents up to 5 ft tall with herbaceous, arching stems; a persistent semi-woody base; and growing in water up to 18 in deep (e.g., Decodon verticillatus).
11. Robust emergents. Stout, erect emergents 5 to 10 ft tall which persist upright during the winter and into the second spring (e.g., Typha latifolia).
12. Tall meadow emergents. Grass-like emergents up to 6 ft tall, often forming dense stands; found on moist or seasonally flooded soil (e.g., Phalaris arundinacea).
13. Short meadow emergents. Sedge-like emergents less than 4 ft tall, some species forming tussocks; found on moist or seasonally flooded soil (e.g., Juncus effusus).
14. Narrow-leaved marsh emergents. Narrow-leaved emergents less than 5 ft tall, growing in water up to 18 in deep (e.g., Sparganium eurycarpum).
15. Broad-leaved marsh emergents. Broad-leaved emergents less than 3 ft tall, growing in water up to 18 in deep (e.g., Pontederia cordata).

SURFACE VEGETATION (2 sub-forms). Plants with vegetative parts principally on the water surface.

16. Floating-leaved vegetation. Rooted plants with leaves floating on the water surface (e.g., Nymphaea odorata).
17. Floating vegetation. Non-rooted plants that float freely on the water surface (e.g., Lemna minor).

SUBMERGENTS (1 sub-form). Plants that lie beneath the water surface, except for flowering parts in some species.

18. Submergents. (e.g., Ceratophyllum demersum).

Wetland classes and subclasses. Wetland classes are synonymous with the following freshwater wetland types outlined by Martin et al (1953): open fresh water, deep fresh marsh, shallow fresh marsh, fresh meadow, seasonally flooded basins and flats, shrub swamp, wooded swamp and bog. Seasonally flooded flats are restricted to river floodplains, whereas they also include upland basins in the Martin et al. (1953) system. A wetland subclass is one of two or more types of wetlands of the same class that differ significantly in their wildlife value, chiefly because of differences in dominant sub-forms of vegetation. The subclasses below are those most common in Massachusetts. Additional subclasses can be named simply by using a sub-form name to modify a class name; e.g., sub-shrub shallow marsh.

OPEN WATER (OW). This class applies to water 3 to 10 ft deep, associated with any of the other wetland classes, but usually with deep or shallow marshes. Submergent and surface vegetation are dominant.
Vegetated open water (OW-1). Surface vegetation is present. Submergents that reach to within 6 in of the surface may be present.
Non-vegetated open water (OW-2). Surface vegetation and near-surface submergents are absent.

DEEP MARSH (DM). This class applies to wetlands with an average water depth between 6 in and 3 ft during the growing season. Emergent marsh vegetation is usually dominant, with surface and submergent plants present in open areas.
Dead woody deep marsh (DM-1). Standing dead trees (sub-form #3), dead shrubs or stumps (#9) are the most abundant form of cover.
Shrub deep marsh (DM-2). Aquatic shrubs (#8) are the dominant form of cover. If shrubs cover less than 50 percent of the area, the wetland is classified shrub deep marsh. It is classified shrub swamp (see below) if the shrub cover is 50 percent or greater.
Sub-shrub deep marsh (DM-3). *Decodon verticillatus* (sub-form #10) is the dominant cover plant.
Robust deep marsh (DM-4). Robust emergents (#11) are dominant. This is the classic deep marsh described as Type 4 by Martin et al.(1953).
Narrow-leaved deep marsh (DM-5). Narrow-leaved marsh emergents (#14) are dominant.
Broad-leaved deep marsh (DM-6). Broad-leaved marsh emergents (#15) are dominant.

SHALLOW MARSH (SM). This class applies to wetlands dominated usually by robust or marsh emergents, with an average water depth less than 6 in during the growing season. Surface water may be absent during the late summer and abnormally dry periods. Floating-leaved plants (#16) and submergents (#18) are often present in open areas.
Robust shallow marsh (SM-1). Robust emergents (#11) are dominant.
Narrow-leaved shallow marsh (SM-2). Narrow-leaved marsh emergents (#14) are dominant.
Broad-leaved shallow marsh (SM-3). Broad-leaved marsh emergents (#15) are dominant.
Floating-leaved shallow marsh (SM-4). Floating-leaved vegetation (#16) dominates. This is an unusual wetland type which occurs primarily on Cape Cod. It is classified shallow marsh since the average water depth is less than 6 in. Most of the surface water is gone by late summer, leaving water lilies lying on exposed mud. Emergent plants occur only in sparse stands on the periphery.

SEASONALLY FLOODED FLATS (SF). This class applies to extensive river floodplains where flooding to a depth of 12 or more inches occurs annually during late fall, winter and spring. During the summer, the soil is saturated, with a few inches of surface water occurring locally. Dominant vegetation usually is emergent, but shrubs and scattered trees may be present.
Seasonally flooded emergent flats (SF-1). Meadow emergents (#12, 13) dominate, with robust (#11) and marsh emergents (#14, 15) occurring in wetter places, particularly along the stream. Bushy (#5) and aquatic shrubs (#8) are often found near the stream ar scattered across the

floodplain. This subclass resembles an ungrazed meadow (M-1, below) except for its greater size, its floodplain location and its generally deeper surface water during the spring.

Seasonally flooded shrub flats (SF-2). Aquatic (#8) and bushy (#5) shrubs are dominant. Low sparse shrubs (#7) are sometimes abundant. Ground cover is largely sedges and grasses like those that dominate the previous subclass. Shrub flats are similar in appearance to bushy shrub swamps (SS-2) and aquatic shrub swamps (SS-4) except for their floodplain location and their generally deeper surface water during the spring.

MEADOW (M). This class applies to wetlands dominated by meadow emergents (#12, 13), with up to 6 in of surface water during the late fall, winter and early spring. During the growing season the soil is saturated and the surface exposed, except in shallow depressions and drainage ditches. Meadows occur most commonly on agricultural land where periodic grazing or mowing keeps shrubs from becoming established. The structural differences in meadow vegetation often result from grazing; therefore, meadows have been divided into grazed and ungrazed subclasses.

Ungrazed meadow (M-1). The effects of grazing are absent. By early summer, most ungrazed meadows support dense, unbroken stands of tall meadow emergents (#12); short meadow emergents (#13) and broad-leaved herbs are often present, but rarely dominant. This subclass occurs in two major locations: on agricultural land and on the floodplains of small streams. In the latter site, the meadows resemble miniature seasonally flooded flats.

Grazed meadow (M-2). Cover plants are greatly modified as a result of grazing. Certain plants such as *Juncus effusus* and *Spiraea tomentosa* persist while most of the grasses and sedges are selectively removed.

SHRUB SWAMP (SS). This class applies to wetlands dominated by shrubs where the soil surface is seasonally or permanently flooded with as much as 12 in of water. *Carex stricta* is the characteristic ground cover beneath shrubs. Meadow (#12, 13) or marsh emergents (#14, 15) occupy open areas.

Sapling shrub swamp (SS-1). Tall slender shrubs (#4) are dominant. The term "sapling" is used because the most common woody species in this subclass is *Acer rubrum*. Large *Alnus rugosa*, although technically not a sapling, is the second most common species.

Bushy shrub swamp (SS-2). Bushy shrubs (#5) are dominant.

Compact shrub swamp (SS-3). Compact shrubs (#6) are dominant. Stands of *Chamaedaphne calyculata* are excluded because this species typically grows on peat, in bogs, rather than on mineral soil or muck, the characteristic substrate of swamps.

Aquatic shrub swamp (SS-4). Aquatic shrubs (#8) are dominant. They cover more than 50 percent of the wetland area (cf. DM-2). Aquatic shrub swamps contain surface water longer and of greater depth than other shrub swamp subclasses.

WOODED SWAMP (WS). This class applies to wetlands dominated by trees. The soil surface is seasonally flooded with up to 1 ft of water. Several levels of vegetation are usually present, including trees, shrubs and herbaceous plants. In mature wooded swamps, microtopography is very pronounced. Trees and many shrubs grow on well developed windthrow mounds while marsh emergents and ferns occupy the vernal pools.

Deciduous wooded swamp (WS-1). Deciduous trees (#1) are dominant.
Evergreen wooded swamp (WS-2). Evergreen trees (#2) are dominant. Sphagnum often covers the ground in wetter areas, but the soil is muck rather than peat.

BOG(BG). This class applies to wetlands where the accumulation of Sphagnum moss, as peat, determines the nature of the plant community. Young bogs commonly have floating peat mats which creep outward from shore over the surface of open water. Northern New England bogs resemble those of the Boreal Forest region. Picea mariana and Larix laricina are characteristic tree species. In southern New England bogs especially those in the coastal zone, Chamaecyparis thyoides is dominant. Chamaedaphne calyculata, Kalmia angustifolia, Sarracenia purpurea, and Eriophorum spp. are characteristic plants found in bogs throughout the northeast. A bog often can be divided into at least five zones (Moizuk and Livingston, 1966): open water, bog mat (Sphagnum and sedges), low shrubs, high shrubs and trees. In Massachusetts, bogs dominated by low shrubs or by trees are most common.
Shrub bog (BG-1). Low, compact shrubs (#16) are dominant.
Wooded bog (BG-2). Evergreen trees (#2) are dominant. Acer rubrum is usually present, but seldom does it reach maximum size on the peat mat.

Size categories. Wetlands in the glaciated northeast range from less than 1 acre to several thousand acres in size. The size categories devised apply to individual wetlands as typed on aerial photographs. In interpreting the influence of size on a wetland's wildlife value, both the size and the juxtaposition of the wetland with others in a complex must be considered. The following size categories were devised for use in statewide or regional planning. In a more localized area, a 50-acre wetland might be considered "large."

Size categories:
1. Very Small -- less than 10 acres
2. Small -- 10-50 acres
3. Medium-sized -- 51-100 acres
4. Large -- 101-500 acres
5. Very Large -- greater than 500 acres

Site types. Site type is a wetland descriptor based upon topographic and hydrologic location. Topographic location can be broadly categorized as either upland or bottomland. Upland sites lie above alluvial or outwash plains, above stream valleys and floodplains. Most upland wetlands occur on bedrock, on till or on small pockets of outwash overlying till; the water table is usually perched. Bottomland sites lie chiefly on the alluvium of stream floodplains, on outwash plains or on glacial lake deposits. Perched water tables may occur, but regional water tables are the rule.

A wetland's hydrologic location may be lakeside, streamside, deltaic or isolated. To be isolated, the wetland must not border any larger body of open water. Small streams may course through it, but the wetland is obviously not subordinate to the streams. Isolated wetlands usually owe their wetness as much to groundwater seepage and surface runoff as to stream-flow. Streamside wetlands occur along a large stream and occupy part of all of its floodplain. A lakeside wetland occurs on the margin of a lake. A deltaic wetland lies at the point where a stream enters a lake.

Site types:

1. Upland -- isolated
2. Upland -- lakeside
3. Bottomland -- isolated
4. Bottomland -- lakeside
5. Bottomland -- streamside
6. Bottomland -- deltaic

Cover types. The relative proportions of cover and open water and their degree of interspersion are two of the most vital features affecting wildlife value (Williams and Marshall, 1938; Mendall, 1958; Weller, 1964; Weller and Spatcher, 1965; McGilvrey, 1968). Collectively these features constitute the cover type, a term coined by Stewart and Kantrud (1971). In their system, where each wetland usually consists of one wetland class, "cover" refers to stands of plants on the periphery of, or interspersed with, areas of open water. I have expanded their concept considerably to fit the northeastern wetland which often consists of several wetland classes. In this system cover type is determined from aerial photographs with field checking. "Cover" can include entire wetland classes (e.g., wooded swamp, shrub swamp) as well as stands of individual plants. "Open water" consists of the class open water (OW) and the smaller open portions of marshes and bogs. Stewart and Kantrud (1971) recognized four cover types; I have outlined eight. They are diagrammed in Figure 4 and described below.

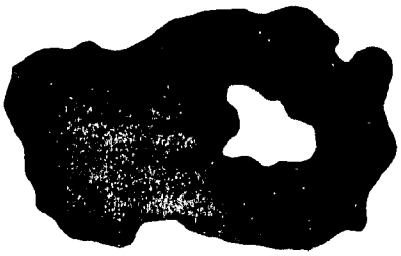
Cover types:

1. Cover occupies more than 95 percent of the wetland area.
2. Cover occupies 76-95 percent of the wetland area, occurring in a peripheral band.
3. Cover occupies 76-95 percent of the wetland area, occurring in dense patches or diffuse, open stands.
4. Cover occupies 26-75 percent of the wetland area, occurring in a peripheral band.
5. Cover occupies 26-75 percent of the wetland area, occurring in dense patches or diffuse, open stands.
6. Cover occupies 5-25 percent of the wetland area, occurring in a peripheral band.
7. Cover occupies 5-25 percent of the wetland area, occurring in patches or diffuse, open stands.
8. Cover occupies less than 5 percent of the wetland area.

Vegetative interspersion types. Since most wildlife species require more than one structural type of vegetation, their population density depends partly on the presence and length of certain kinds of edge. In this context, edge refers to the line of contact between two different sub-forms of vegetation. Whereas wildlife numbers are closely related to the total length of edge, wildlife diversity is a function of the number of kinds of edge. Small sub-form stands have more edge per unit of area than larger stands. For wetland evaluation, I recommend a minimum size of 1 acre for recognition of a sub-form stand. Since long, narrow strips of vegetation, like those that flank streams, are extremely significant to wildlife, these should be considered during evaluation, even though the total area of such a strip might be far less than 1 acre.

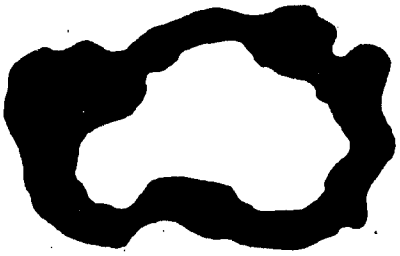
Figure 4. Wetland cover types. White areas indicate water (with or without surface plants); black areas indicate emergents, shrubs or trees.

COVER TYPE 1

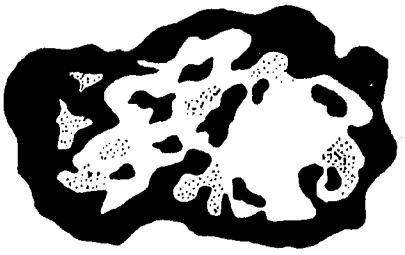


COVER TYPE 2

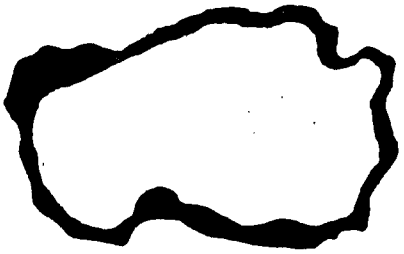
COVER TYPE 3



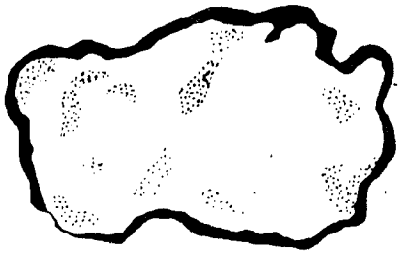
COVER TYPE 4



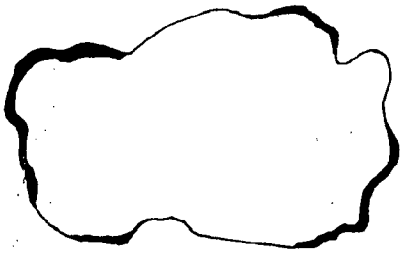
COVER TYPE 5



COVER TYPE 6



COVER TYPE 7



COVER TYPE 8

Figure 5 illustrates three wetlands which contain the same number of life forms (three) and sub-forms (six), but which represent different vegetative interspersion types. The number of kinds of edge associated with each type is just an example; it is not the characteristic number for that type.

Vegetative interspersion types:

1. Low Interspersion -- Length and types of edge are at a minimum. The wetland consists of concentric life form and sub-form zones or a single sub-form. Sub-form stands are large and unbroken.
2. Moderate Interspersion -- Edge is moderate in length and diversity. There is some irregularity in the distribution of sub-form stands, but life form zones remain largely intact.
3. High Interspersion -- Edge is abundant and consists of many kinds. Life form zones are broken into segments of variable size and shape. Sub-form stands are small and scattered.

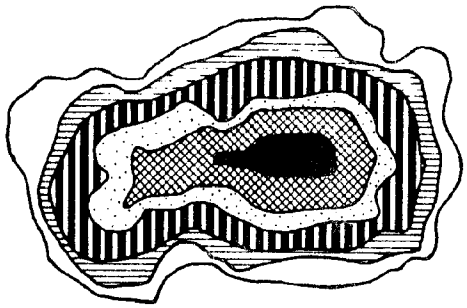
Surrounding habitat types. The nature of the surrounding habitat is a key feature determining a wetland's wildlife value. Waterfowl and most other wetland wildlife depend upon suitable surroundings for food and nest sites. The surrounding habitat types also determine what upland species are likely to use the wetland. Furthermore, intense human activity adjacent to a wetland can deter many species from utilizing the wetland. Surrounding "natural" habitat may serve as a buffer, reducing disturbance of wildlife and satisfying some of their requirements. The broad surrounding habitat types below were adopted from a land use cover-typing system developed by MacConnell and Pywell (1969):

1. Agricultural or Open Land
2. Forest Land
3. Salt Marshes
4. Mining or Waste Disposal Areas
5. Urban Land
6. Outdoor Recreation Facilities

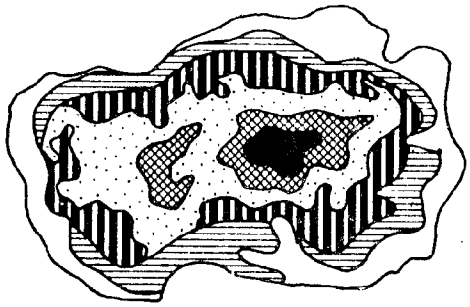
Additional descriptive components. The components described so far represent the most important ecological features determining a wetland's wildlife value. Two other components, wetland juxtaposition and water chemistry, are useful in wetland evaluation (see next section) but are not employed in classification.

Criteria for Wetland Evaluation

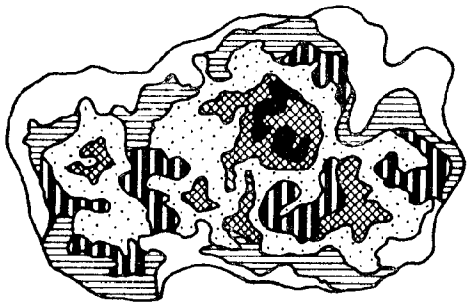
Once a wetland has been classified, evaluation is straightforward. Table 1 contains ten criteria and a relatively simple rating system. Each criterion has specifications describing three or more possible categories into which a given wetland might be placed. Specifications have been assigned ranks, ranging from 3 (highest value) to 1 (lowest value). During evaluation a wetland receives a rank for each of the ten criteria. If, for any criterion, more than one specification seems to fit the wetland, the ranks for those specifications are averaged. Since some criteria are more important than others, each has been given a fixed numerical value, called a significance coefficient, ranging from 5 (most important criteria) to 1 (least important



INTERSPERSION TYPE 1



INTERSPERSION TYPE 2



INTERSPERSION TYPE 3

Figure 5. Examples of the three wetland vegetative interspersion types. Type 1 -- minimum length of edge, large units and few types of edge (five in this example). Type 2 -- moderate length of edge, medium-large units and moderate number of types of edge (seven in this example). Type 3 -- great length of edge, small units and many types of edge (eleven in this example).

Table 1. Wildlife criteria, significance coefficients, specifications and ranks.

Rank	(3.0)	(2.5)	(2.0)	(1.5)	(1.0)
Criteria		Specifications			
Wetland Class Richness (5)[1]	5 or more classes	4 classes	3 classes	2 classes	1 class
Lominant Wetland Class (5)	SF, DM	SM	WS, SS	OW, BG	M
Size Category (5)	over 500 acres	101-500 acres	51-100 acres	10-50 acres	under 10 acres
Subclass Richness (4)	10 or more subclasses	6-9 subclasses	4-5 subclasses	2-3 subclasses	1 subclass
Site Type (4)	bottomland - lakeside bottomland - deltaic bottomland - streamside		bottomland - isolated upland - ~~bottomland~~ - lakeside		upland - isolated

[1]Number in parentheses after each criterion is its significance coefficient.

Table 1. (Continued)

Rank	(3.0)	(2.5)	(2.0)	(1.5)	(1.0)
Criteria		Specifications			
Wetland Juxta-position (2)	Hydrologically connected to other wetlands (different dom. class) or open water bodies within 1 mile. (or) Hydrologically connected to other wetlands (same dom. class) within 1/4 mile. (or) Wetland greater than 500 acres, with three or more wetland classes (including DM or SM).		Hydrologically connected to other wetlands (different dom. class) or open water bodies from 1-3 miles away. (or) Hydrologically connected to other wetlands (same dom. class) from 1/4-1 mile away. (or) Within 1/2 mile of other wetlands (different dom. class) or open water bodies, but not hydrologically connected.		All other possibilities

Table 1. (Continued)

Rank	(3.0)	(2.5)	(2.0)	(1.5)	(1.0)
Criteria			Specifications		
Surrounding Habitat Types (4)	2 or more of following constitute more than 90% of surrounding habitat: 1. forestland 2. agricultural or open land 3. salt marsh		1 or more of following constitute 50-90% of surrounding habitat: 1. forestland 2. agricultural or open land 3. salt marsh (or) 1 of preceding constitutes more than 90% of surrounding habitat.		1 or more of following constitute less than 50% of surrounding habitat: 1. forestland 2. agricultural or open land 3. salt marsh
Cover Type (3)	Type 5	Type 4	Type 3 Type 7	Type 1 Type 2 Type 6	Type 8
Vegetative Interspersion Type (3)	Type 3		Type 2		Type 1

Table 1. (Continued)

Rank	(3.0)	(2.5)	(2.0)	(1.5)	(1.0)
Criteria			Specifications		
Water Chemistry (1)	Total Alkalinity greater than 69 ppm $CaCO_3$.		Total Alkalinity 23-69 ppm $CaCO_3$.		Total Alkalinity less than 23 ppm $CaCO_3$.
	pH greater than 7.5		pH 6.5-7.5		pH less than 6.5

criterion). A sub-score is calculated for each criterion by multiplying the significance coefficient for that criterion by the rank given. Scores for all criteria are summed and a total wetland score is obtained. This final score represents, in simple quantitative fashion, the wetland's relative wildlife value. Table 2 illustrates the scoring procedure for an imaginary wetland.

Table 2. Wetland scoring (ranks are based on fictitious data).

Criterion	Significance Coefficient	Rank	Subscore
1. Class Richness	5	2.0	10.0
2. Dominant Class	5	3.0	15.0
3. Size	5	2.5	12.5
4. Subclass Richness	4	2.5	10.0
5. Site Type	4	2.0	8.0
6. Surrounding Habitat	4	3.0	12.0
7. Cover Type	3	2.0	6.0
8. Veg. Interspersion	3	1.0	3.0
9. Juxtaposition	2	2.0	4.0
10. Water Chemistry	1	3.0	3.0
Total Wetland Score			83.5

The lowest possible total score is 36 and the highest is 108. This implies, and rightly so, that even the least valuable wetland has some wildlife value. For some criteria there are five categories of specifications and five corresponding ranks (3.0, 2.5, 2.0, 1.5 and 1.0). For other criteria, where our knowledge or measurement ability is less refined, only three categories of specifications and ranks (3.0, 2.0, 1.0) are recognized. A brief description of each of the criteria follows.

1. Wetland class richness. This criterion describes the number of wetland classes present in a wetland, where 5 acres is the minimum area recognizable as a separate class. As class richness increases, so does the likelihood for greater wildlife species richness. Wetland class richness is the broadest and single most important criterion for evaluation.

2. Dominant wetland class. Some wetland classes have greater value than others for wildlife diversity and production, and certain classes provide the only suitable habitat for some species highly valued by man (e.g., waterfowl). Dominant life form of vegetation, water depth and permanence of surface water are the major characteristics considered in ranking classes (see Table 1). The dominant class is the one that clearly occupies the greatest area. If two or more classes are co-dominant, the ranks are averaged.

3. Size categories. Wetlands are ranked from largest to smallest, according to the general principle that as size increases, so does wildlife value. Greater size usually results in greater insulation from human disturbance, greater habitat diversity and greater wetland longevity. In addition, wetlands larger than 100 acres are of great value to flocks of migrating waterfowl.

4. Subclass richness. This variable goes one step further than wetland class richness in assessing habitat diversity. Just as particular life forms characterize classes, particular sub-forms characterize subclasses. A wetland's broad wildlife value increases as the number of subclasses increases. As noted above, a wetland segment must be at least 1 acre in size to be recognized as a separate subclass.

5. Site type. Bottomland wetlands are generally more valuable than upland wetlands because of greater soil fertility, more sustained surface water levels and greater life expectancy. Similarly, wetlands associated with open water bodies are usually more valuable than isolated ones. Using this rationale I grouped site types into three categories for evaluation (see Table 1).

6. Surrounding habitat types. Freshwater wetlands bordered by forest, agricultural or open land, or salt marsh are more valuable to wildlife than those adjacent to land more intensively developed by man. Furthermore, diversity in the surrounding habitat increases the possibility of wildlife diversity within the wetland. The percentage of the surrounding habitat types present determine the rank given for this criterion.

7. Cover type. This variable can be assessed in wetlands consisting of one or many wetland classes, although its value is most evident in evaluating deep and shallow marshes. Studies (Weller and Spatcher, 1965; McGilvrey, 1968) suggest that a cover-water ratio of approximately 50:50 is optimal for waterfowl and marsh birds in general. Highest ranks are thus given to wetlands with nearly equal proportions of cover and water. Areas with nearly total cover or total open water receive low ranks. In addition, cover interspersed with water is deemed more valuable than a band of cover surrounding open water.

8. Vegetative interspersion. A wetland receives a rank for this criterion according to which interspersion type (Figure 5) it approximates. High ranks are associated with an abundance of edge between sub-form stands, small size of such stands and a large number of different kinds of edge.

9. Wetland juxtaposition. A wetland's value is generally higher if it is located near other wetlands, expecially if the adjacent wetlands contain classes or subclasses different from those of the wetland being evaluated. Moreover, the value increases if these wetlands are interconnected by streams. In such cases, wildlife (especially waterfowl) can move safely between wetlands to best meet their habitat requirements. The ranking of specifications listed in Table 1 reflects these considerations.

10. Water chemistry. Water chemistry influences the presence, abundance and distribution of aquatic plants and invertebrates (Juday, 1942; Moyle, 1945, 1946; Jahn and Hunt, 1964). Decision-makers have no time to adequately sample and describe wildlife food plants and animals, but water chemistry determinations can serve as indices of potential productivity. Brooks and Deevey (1963) pointed out that New England surface waters are very dilute and extremely soft for the most part. Analysis of water chemistry data provided by the Massachusetts Division of Fisheries and Game produced support for this generalization. These data suggest that average total alkalinity in excess of 70 ppm $CaCO_3$ and pH values above 7.5 can be considered high. Specifications for pH (Table 1) are based upon clear-cut groupings of the graphed data for 95 ponds and lakes. Alkalinity specifications derive from classes of Brooks and Deevey (1963). Total alkalinity is the better index of productivity; pH is less reliable, and should only be used if alkalinity data are not obtainable.

Discussion

This system of wetland classification and evaluation allows one to objectively group wetlands according to their wildlife value and to identify key areas for preservation and acquisition. Use of the system assumes, however, acceptance of the stated standard for evaluation: maximum wildlife production and diversity. The above criteria would not be suitable for use by a state fish and game agency attempting to identify valuable wood duck (*Aix sponsa*) production areas. For that case, more specialized criteria would be required.

Two major constraints guided the development of this system. First, it was designed for use by decision-makers. A special effort was made to produce criteria that are as uncomplicated and objective, and yet as sensitive, as possible. The necessary data for most of the evaluation can be obtained from recent aerial photographs, topographic maps and surficial geology maps. Wetland subclass, vegetative interspersion and water chemistry are key descriptors which require unavoidable, but limited, field work. Shortage of time and expertise would render a more sophisticated system useless to the decision-maker.

The choice to consider virtually all wildlife species during evaluation imposed another major constraint. Although wildlife production and diversity are both reasonable goals, they are not strictly compatible. It is impossible to maximize the production of all species at once, since each has a different set of habitat requirements. The broadness of the criteria reflect the overriding influence of compromise.

Certain wetlands possess characteristics that render them unique or of outstanding value. For example, a wetland might support the only nesting colony of black-crowned night herons (*Nycticorax nycticorax*) in an entire state. Such a wetland merits preservation, even though it might not score highly by this system. Clearly, some subjective decisions must be made.

Similarly, after a wetland has been scored by this system, other subjective considerations are in order. What human impacts are operating on the wetland, and to what extent do these depress the total score? In some cases, proper control of land use practices can raise significantly a wetland's wildlife value. Secondly, what is the wetland's potential for enhancement via habitat manipulation? Two wetlands with identical scores might be differentiated according to their potential for enhancement. This potential depends on such factors as topographic and hydrologic location.

Above all, the value of any wetland must be viewed in its proper context. The absolute value of a score is meaningless; the score has meaning only in relation to the scores of other wetlands. All wetlands in Amherst, Massachusetts might be evaluated and their scores compared. The "average" score would undoubtedly vary from the "average" score in Worcester or Provincetown since wetland characteristics are greatly influenced by physiography and land use. Any attempt at the use of cut-off scores in decision-making must be sensitive to the importance of the scale of reference.

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CATEGORY CODE SHEET

CATEGORY CODE SHEET

1 GEOLOGIC (Landform)

001	Gorges
002	Distinctive mountain features
003	Cliffs, bluffs
004	Natural rock outcrops of geologic significance
005	Manmade rock outcrops of geologic significance (road cuts and quarries)
006	Natural sand, beach, dune features
007	Fossil evidence
008	Scarp
009	Other unusual geologic features

2 SOILS

101	Unusual soil groups undisturbed by human activity

3 HYDROLOGIC

091	Significant and unusual water-land interfaces (e.g., islands; scenic stretches of coast, rivers, streams, lakes or ponds)
092	White water stretches
093	Waterfalls
094	Natural Springs
095	Marshes, bogs, swamps, flats (coastline)
096	Marshes, bogs, swamps, flats (inland)
097	Aquifer recharge areas
098	Water areas supporting unusual or significant freshwater aquatic life
099	Lakes or ponds of unusually low productivity
100	Lakes or ponds of unusually high productivity
101	Unusual natural river, lake or pond
102	Stream and wetland margin habitat
103	Floodplain
104	Lake or pond
105	Other unusual hydrologic feature

4 BIOLOGICAL-FLORAL

001	Rare, remnant or unique species of plants
002	Unique plant community
003	Plant community unique to a geographic area
004	Individual plant specimen(s) or unusual significance (e.g., large trees)
005	Plant communities of unusual age or maturity
006	Plant communities of unusual diversity and productivity
007	Areas exhibiting outstanding seasonal color
008	Forest
009	Managed Forest
010	Field or shrub swamp

Category Code Sheet - cont.

5 BIOLOGICAL - FAUNAL (terrestial animals)

091	Habitat areas of rare, endangered and unique species
092	Habitat areas of unusual significance to a faunal community (e.g., feeding, breeding, wintering, resting)
093	Faunal communities unusual to a geographic area
094	Habitat areas supporting faunal communities of unusual diversity and productivity
095	Habitat areas exhibiting other interesting features

6 BIOLOGICAL - FAUNAL (birds)

001	Habitat areas of rare, endangered and unique species
002	Habitat areas of unusual significance to a faunal community (e.g., feeding, breeding, wintering, resting)
003	Faunal community unusual to a geographic area
004	Habitat areas supporting faunal communities of unusual diversity and productivity

7 BIOLOGICAL - FAUNAL (aquatic life)

091	Habitat areas of rare, endangered and unique species
092	Habitat areas of unusual significance to a faunal community
093	Faunal communities unusual to a geographic area
094	Habitat areas supporting faunal communities of unusual diversity and productivity.

8 CULTURAL-AESTHETIC-VISUAL

001	Manmade features having unusual aesthetic features of aesthetic significance due to natural setting (e.g., old mill along creek)
002	Scenic gravel or unimproved roads
003	Vista points
004	Trail systems
005	Unusual juxtaposition of manmade and natural features
006	Unusually scenic area
007	Archaeological site

DEFINITIONS

GLOSSARY

Aquatic Buffer Zone - a band of vegetation contiguous with wetlands and watercourses which protects an aquatic system from excess runoff, erosion and contamination from non-point sources of pollution such as fertilizers and pesticides. The width of vegetated land necessary to adequately buffer the aquatic system varies, depending on the soil's ability to store water and the type and extent of the vegetation in the buffer.

Aquatic System - a wetland, watercourse, or water body and contiguous areas with D or D+ soils.

Bacterial Danger Zone - soil between the highest water table level and one foot below the lowest water table level; where conditions are ideal for bacterial growth.

Basal Area - the area, usually measured in square feet, of the cross-section at breast height of a single tree or of all trees in a stand.

Baseflow - stream flow derived from deep percolation of infiltrated water that enters the permanently saturated ground water system and discharges into the stream channel.

Buffer - a limited use area between a developed area and a protected area.

Categories - a division within a parameter used for the purpose of scaling.

Class - a group of areas considered as a unit (e.g., wetlands, forests, fields).

Community - any assemblage of populations living in a prescribed area or physical habitat.

Contamination - befoulment through contact with a pollutant (e.g., pesticide, herbicide, toxic chemical, oil residue, bacteria, sediment).

Contiguous Land Use - the type of use being made of land adjacent to and bordering a natural area.

Critical Area - areas where man's activities can have a relatively severe impact on natural systems. Critical areas may also be habitats which are infrequently found in a state or in the nation as a whole.

DBH - tree diameter at breast height (4.5 feet above the ground).

Detritus - particles of plant matter in varying stages of decomposition.

Disturbance - a disruption, or perturbation, of an ecosystem resulting from human activity.

Diversity - the number of different vegetation types, animal species or physical features (e.g., streams, scarps, bogs) which the natural area contains.

Drainageway - a pathway for watershed drainage, characterized by wet soil vegetation; often intermittent in flow.

Edaphic Climax - where topography, soil, water, fire and other disturbances are such that the climatic climax cannot develop.

Endemic - a species of limited geographic extent.

Erodibility Coefficient - (K factor) - the erosion rate per unit of erosion index for a specific soil in continuously cultivated fallow ground on a 9% slope, 72.6 feet long. This factor is used by the Soil Conservation Service to calculate the erosion from a particular soil.

Exotic species - any plant or animal species not naturally a member of the plant community in which it is found.

Fauna - a collective term for the animal species present in an ecosystem.

Floodplain - a flat, low-lying area bordering a river or stream which is flooded only at times of high water.

Flora - a collective term for the plant species present in an ecosystem.

Floristics - plant species composition of an area.

Ground flow - the movement of water within the ground.

Ground water - that part of the subsurface water which is in the zone of saturation.

Habitat - the area of residence for an animal species or a community of species.

Home range - the area to which individuals, pairs, or family groups of vertebrates and the higher invertebrates restrict their activity.

Infiltration - the flow or movement of water through the soil surface into the ground.

Mottling - colored spots in soil horizons which indicate the existence of fluctuations in the ground water level.

Natural area - areas where at present natural processes predominate and are not significantly influenced by either deliberate manipulation or accidental interference by man.

Natural integrity - the degree to which a natural area is characterized by the natural regeneration of vegetation, mature or stable vegetation and the absence of man-induced disturbances.

Natural soils group - a new classification system of the State of Maryland's Department of State Planning which groups soils into similar major properties and features. The soil typologies of each county are regrouped around six categories of interest: agriculture, productivity, erosion susceptability, permeability, depth of bedrock, depth of water table, and stability. In general, the natural soil groups are arranged in order of increasing limitation for most uses.

Occurrence - the relative frequency of the vegetation type(s) or natural features in a natural area within the context of its frequency of occurrence on the Delmarva Peninsula.

Overland flow - water flowing over the ground surface.

Parameter - a topic whose information is amenable to collection and analysis.

Partial area - dynamic, saturated, often shallow, stony or compacted areas near streams which contribute large volumes of runoff during a storm.

Perched water table - water table above an impermeable bed underlain by unsaturated rocks of sufficient permeability to allow movement of ground water.

Percolation - movement under hydrostatic pressure of water through the interstices of the ground.

Primary productivity - the amount of organic matter produced by photosynthesis.

Quadrat - a sampling area, usually square, of relatively small but consistent size.

Return flow - subsurface flow which intersects the ground surface and emerges as a spring or seep.

Runoff - the discharge of water through surface streams, expressed usually in units of volume such as gallons, cubic feet or acre-feet.

Runoff potential - the potential of the soil to shed rainwater. The runoff potential rating is based on soil catenas. Soils are grouped into seven runoff potential rating categories according to internal drainage, depth and texture of the soil as well as subsurface soil conditions. The rating system enables hydrologists or land management personnel to classify the soils hydrologically. D and D^+soils have the highest runoff potential while A soils have the lowest. This system not only expands S.C.S. hydrologic soil groups but also includes relevant soils information to reclassify certain soils based on recent research.

Saturated overland flow - surface water flowing over saturated soils near streams and drainage ways.

Security - the probable period of time during which no significant man-induced, direct or indirect alteration of a natural area is foreseen.

Sedimentation - the process of gravitational deposition of soil and other particles transported by water.

Soil series - a group of soils developed by the same combination of genetic processes. Its horizons have similar differentiating characteristics and arrangement in the soil profile and soils have developed from the same kind of parent material. Except for the "A" horizon texture (which is used to classify soil series into types) all soils having similar physical, chemical and morphological characteristics such as structure, texture, pH, base saturation, organic matter content, topographic position, drainage, depth, color, parent material and horizon thickness, type and arrangement belong to the same series.

Soil series are named for the geographic location where they were first described. Hence names such as Pocomoke, Sassafras, etc.

Soil type - a subdivision of the soil series based on the texture of the "A" horizon. Soil individuals belonging to the same type have similar characteristics as required by the soil series as well as the same surface texture. Soil types derive their name by adding the surface texture to the series name.

Subsection- a division of a natural area which reflects a discrete vegetation type, site-type or natural feature.

Substrate - layer beneath the soil surface.

Subsurface flow - water flowing through substrate, often along impeding layers (fragipan) in the soil.

Succession - a systematic series of species replacement in a biological system.

Transpiration - giving off of moisture and gases through the surface of leaves and other parts of a plant.

Trophic level -a step in the food chain.

Type - a subdivision of a class, a group having distinguishing characteristics, (e.g., pond, marsh, swamp; oak-beech, mixed oak, oak-pine).

Uplands - sites where the soil is dry or moist most of the year including ridges, upperslopes, midslopes, lowerslopes and well drained stream terraces.

Vegetation - the mosaic of plant communities in the landscape.

Vegetation structure - the density and distribution of leaf surfaces vertically and horizontally. Canopy, understory, shrub and herb layers are common descriptions of vegetation structure.

Vegetation types - an assemblage of plants consisting of particular species composition. The vegetation type is named for the dominant or co-dominant species. Vegetation types such as "Oak-Hickory" or "Bald cypress", may include as many as 20 different species of trees, as well as numerous shrubs and herbs. In some cases the transition between adjacent types are gradual; therefore the description given the vegetation type is more typical of the center of the type than its edge.

Water table - the highest level at which the soil or underlying rock material is wholly saturated with water. In certain places a perched water table may be separated from a lower water table by a dry zone.

Well drained soil - soils nearly free of mottling and commonly of an intermediate texture.

Wetland - any area where the water table stands at or above the land surface for at least part of the year. Wetlands are described according to the degree of wetness and the type of vegetation which the site supports.

PERSONNEL

The following personnel were responsible for the completion of this report:

Project Director, Interviews, Parameter Determination and Sampling Methodology	John Rogers
Sampling Methodology, Computer Format, Interviews, Editor	Stephan Syz
Visual Analysis Method, Research, Business Manager, Editor	Eritts Golden
Literature Search, Local Public Relations, Graphics	Steve Elkinton
Field Survey Supervisor, Site Cataloguing	Sam Poole
Site Cataloguing	Kay Fairs George MacPherson
Computer Programming	Andrew Schwartz
Typists	Vera Dutton Linn Syz Ann Rogers
Office Personnel	Debbie Golden Ted Wall
Consultants	Tom Siccama Grace Brush
Field Survey Staff	Carl Bailey Steve Dawson John Hutson Wayne Klockner Chris Merker Tim O'Meara George Robbins Eric See Arthur Tai

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