

Coastal Zone
Information
Center

W.P.

009710

MARYLAND UPLANDS NATURAL AREAS STUDY

VOLUME 2, EASTERN SHORE

FIELD NOTEBOOK

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

Maryland Dept. of Natural Resources. C.Z.M. Project

TD
224
.M2
M37
1989
V. 2

ROGERS AND GOLDEN, INC., 31 W. Allens Lane, Philadelphia, PA 19119

Preparation of this report
was partially funded by the
office of Coastal Zone Management,
National Oceanic and Atmospheric Administration

This report is printed on recycled paper.

MARYLAND UPLANDS NATURAL AREAS STUDY

**Volume 2 Eastern Shore
FIELD NOTEBOOK**

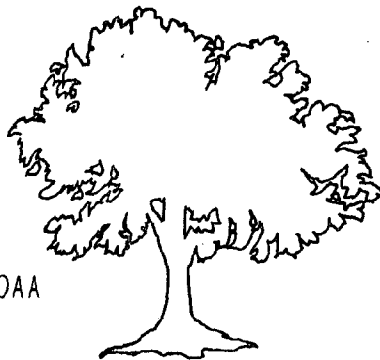
Prepared for
Maryland Department of Natural Resources

Coastal Zone Management Program

March, 1976

Property of CSC Library

U. S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413



For further information contact:

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

Prepared by: John Rogers, Stephan Syz and Fritts Golden

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

(215) 242-6858

QH 76.5 .M3 R6 1976 v.2
9373505

DEC 27 1996

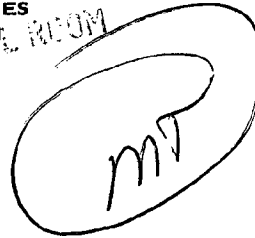


JAMES B. COULTER
SECRETARY

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

LOUIS N. PHIPPS, JR.
DEPUTY SECRETARY

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,

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.

TABLE OF CONTENTS

	Page
Preface	i
Acknowledgements	ii
Table of Contents	iii
List of Figures	vii
Introduction	1
Study Area	2
Vegetation Types	4
Site Selection Process	36
Data Management	36
Computer Printout	37
Parameters	39
Uses	39
List of Parameters	40
Natural Areas Survey Procedure	42
Completed Data Form	45
Wetland Field Sampling	57
Coding	57
Encoding Instructions	59
Card 1	61
Natural Area Number	63
Area Name	64
Date	65
Area Size	65
Elevation	67
Access to Area	68
Nearest Town	68
Minimum Dimension	69
Zoning	69
Current Use	70
Ownership	70
Card 2	71
Contiguous Land Use	73
Geological Formation	73
Aquatic Buffer Zone	74
% of 5-10 Acre Openings	75
Occurrence	75
Diversity	76
Natural Integrity	76
Security	77
Total Number of Vegetation Types	77

	Page
Auditory and Visual Experience	78
Categories	79
One Line Description	79
Card 3	81
Location	83
Site Type	84
Ecological Unit	85
Card 4	87
Bibliography	89
Card 5	91
Subsection	93
Similar Subsections	93
Subsection Area	93
Soil Type	94
Natural Soil Group	94
Runoff Potential	94
High Water Table	95
Soil Drainage	95
Slope	95
Soil Erodibility	96
Water Body Distance	96
Water Body Type	97
Water Body Size	98
Water Body Depth	98
Water Body Bottom Material	98
Beach Length	99
Beach Width	99
Beach Type	99
% of Stream Shaded	100
Wetland Wildlife Rank	100
Vegetation Types	101
Disturbance	103
Ease of Passage	104
Animals	104
Photographs	105
Champion Tree	105
Names	107
Text	111
Watershed	115
Nearest Town	121
Vegetation	127
Woody Plants	129
Herbaceous Plants	138
Mammals	143
Birds	147
Reptiles and Amphibians	151
Van Deusen	157
Soils	165
Wetlands	171
Wetland Wildlife Rating	173

	Page
Classification and Evaluation of Freshwater Wetlands as Wildlife Habitat in the Glaciated Northeast	177
Category Code Sheet	201
Definitions	205
Personnel	211
References	213

LIST OF FIGURES

Figure		Page
1	Location of Sections	7
2	A-1 Elk Neck: Bayside Forest	8
3	A-2 Elk Neck: Upland Wetland	10
4	B-1 Northern Shore: Bayside Bluff	12
5	B-2 Northern Shore: Upland Deciduous Forest	14
6	B-3 Northern Shore: River Cross Section	16
7	B-4 Northern Shore: Upland Swamp	18
8	C-1 Middle Shore: Tidal Marsh	20
9	C-2 Middle Shore: Lowland Swamp	22
10	C-3 Middle Shore: Upland Forest	24
11	C-4 Middle Shore: River Cross Section	26
12	C-5 Middle Shore: Mill Pond and Fresh Water Marsh	28
13	D-1 Southern Shore: Upland Swamp	30
14	D-2 Southern Shore: River Cross Section	32
15	D-3 Southern Shore: Maritime "Forest"	34



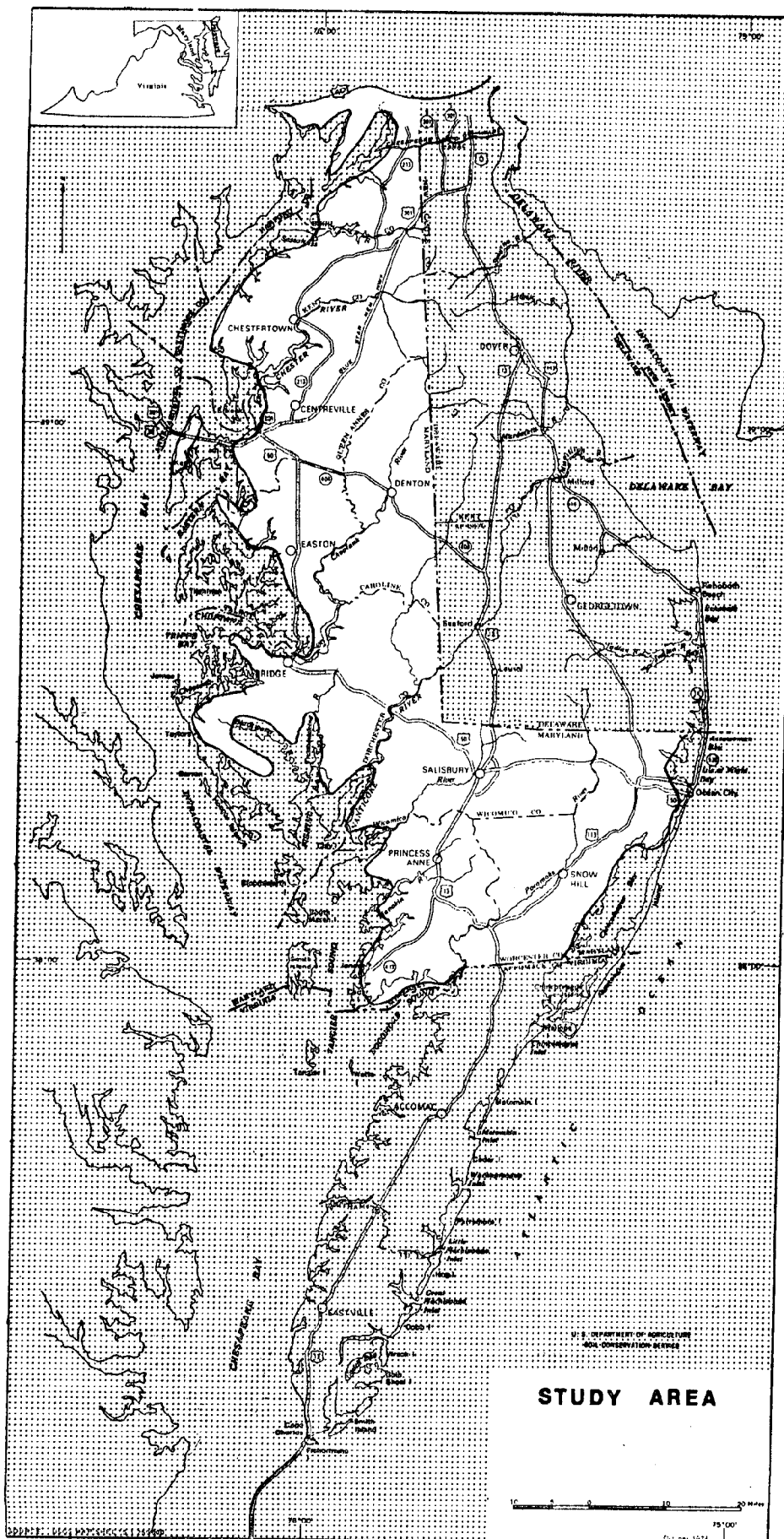
INTRODUCTION

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

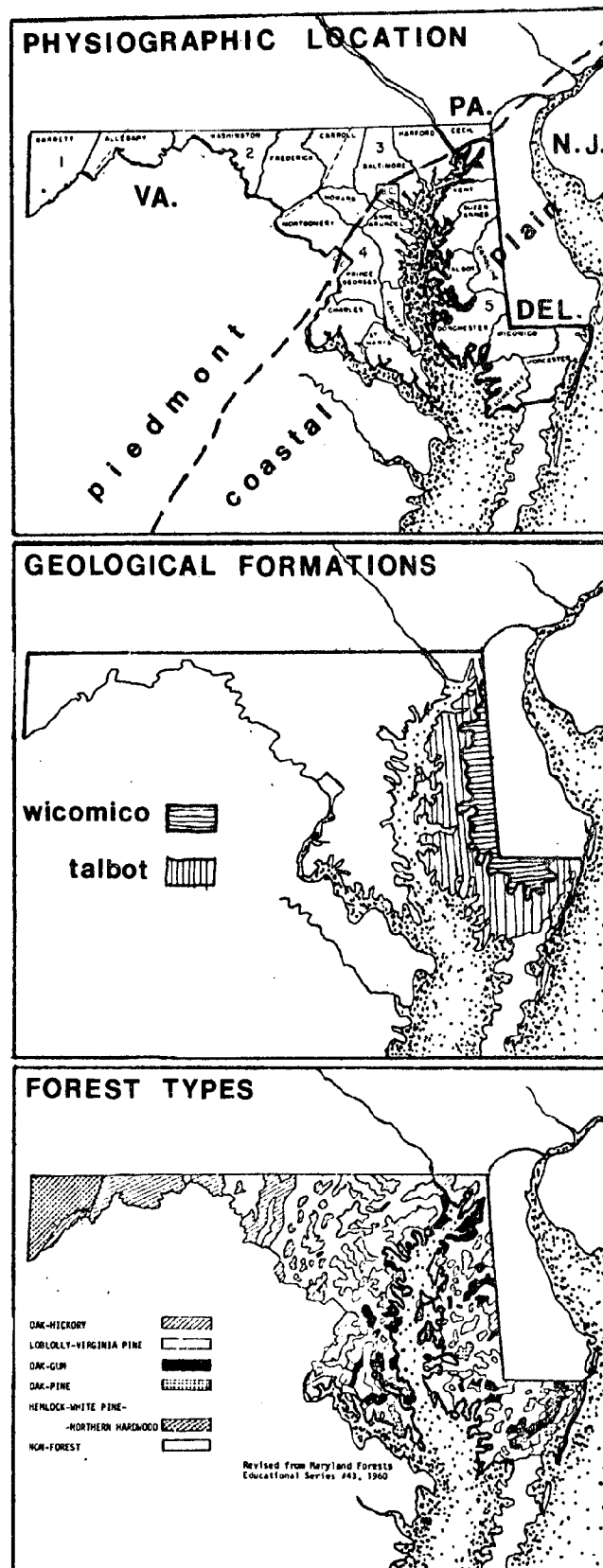
The study area is confined to up-land natural areas and non-tidal fresh-water wetlands on Maryland's Eastern Shore. The Eastern Shore is considered to be that part of Maryland which is on the Delmarva Peninsula south of U.S. Highway 40.

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).

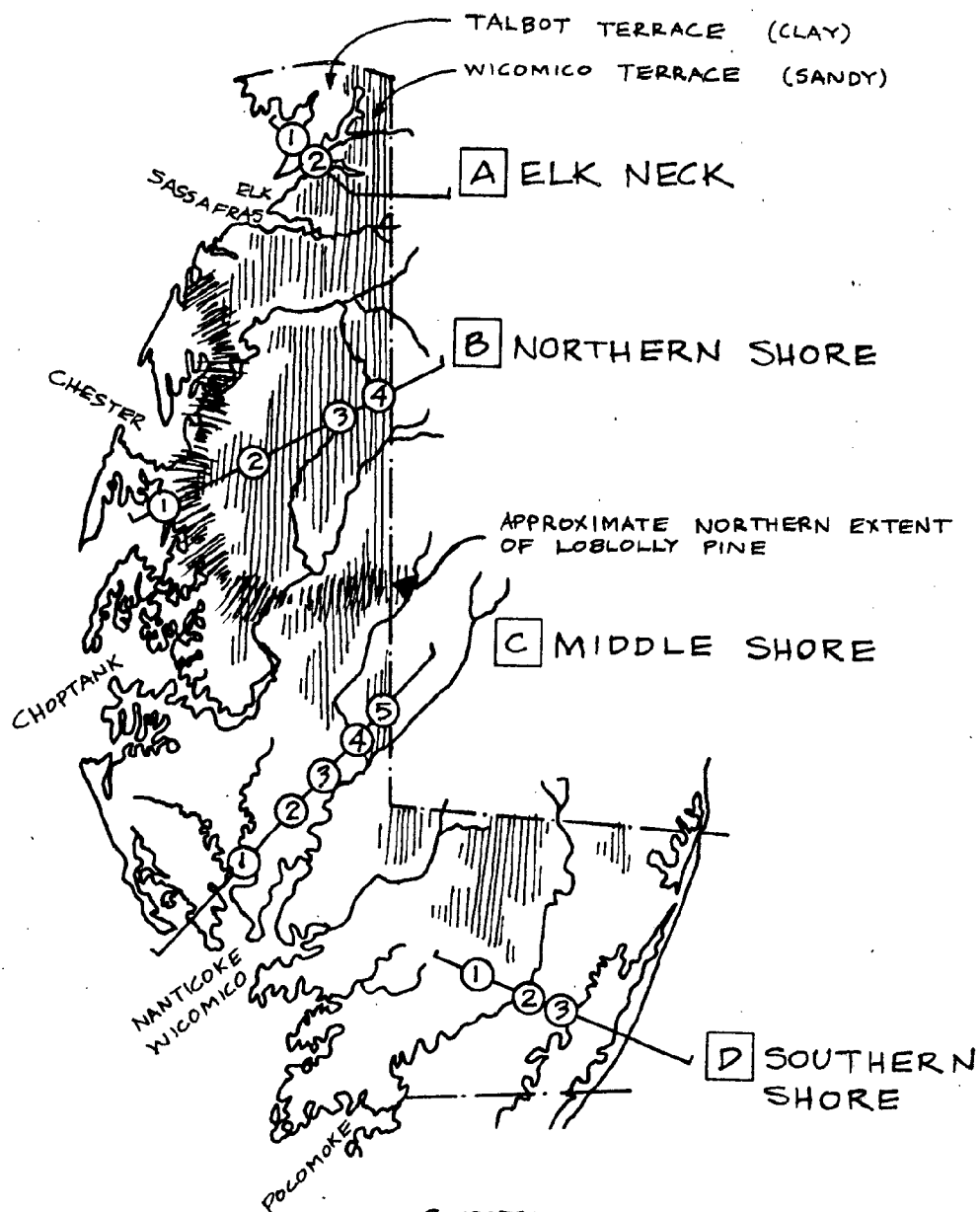
Within sections animals are distinguished in characteristic patterns. Some species are found throughout, while others are limited to specific habitats.

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 1

LOCATION OF SECTIONS



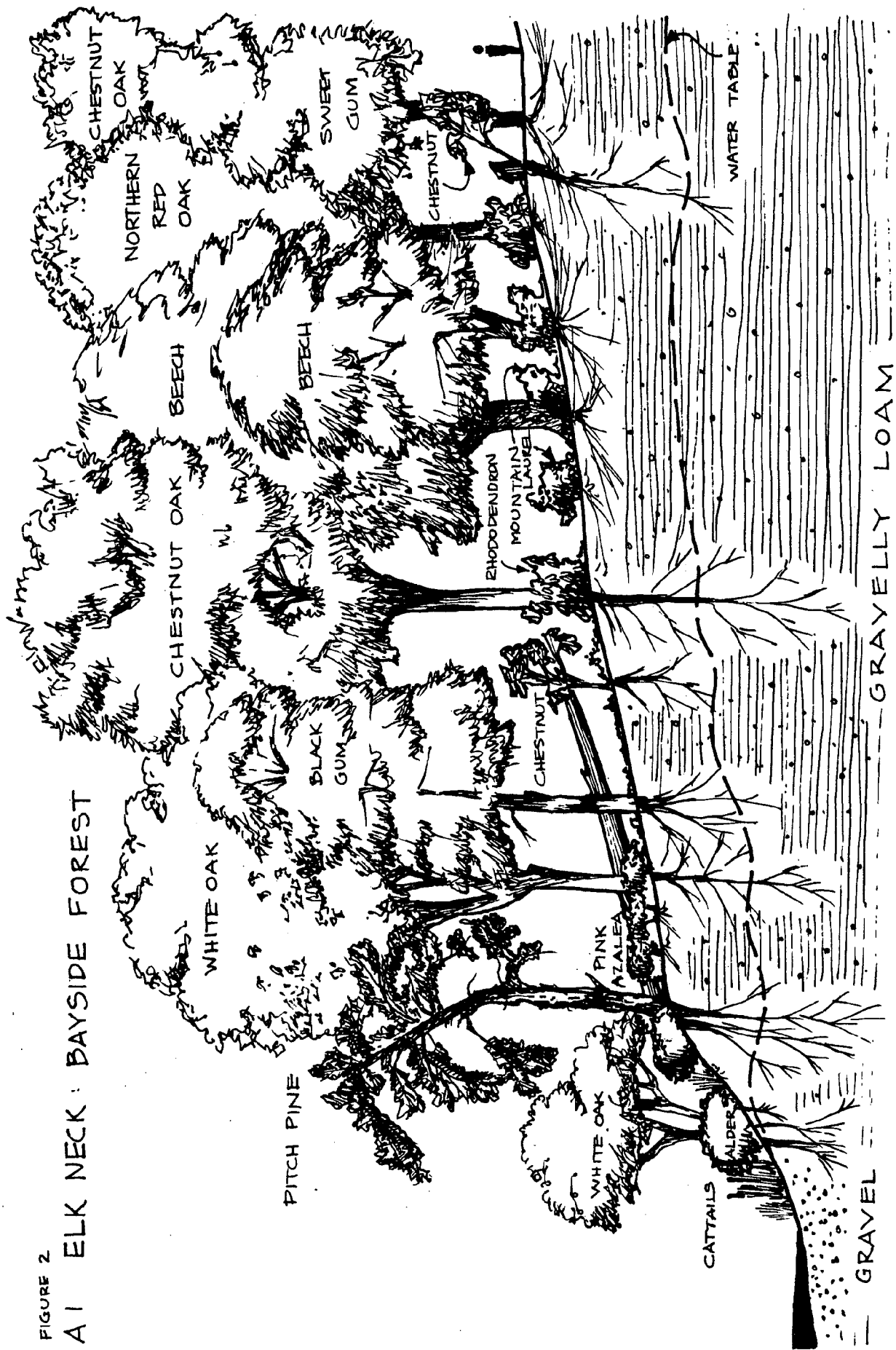
SOURCES:

SHREVE, 1910, p. 103

FIELD STAFF OBSERVATION, 1975

FIGURE 2

A1 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

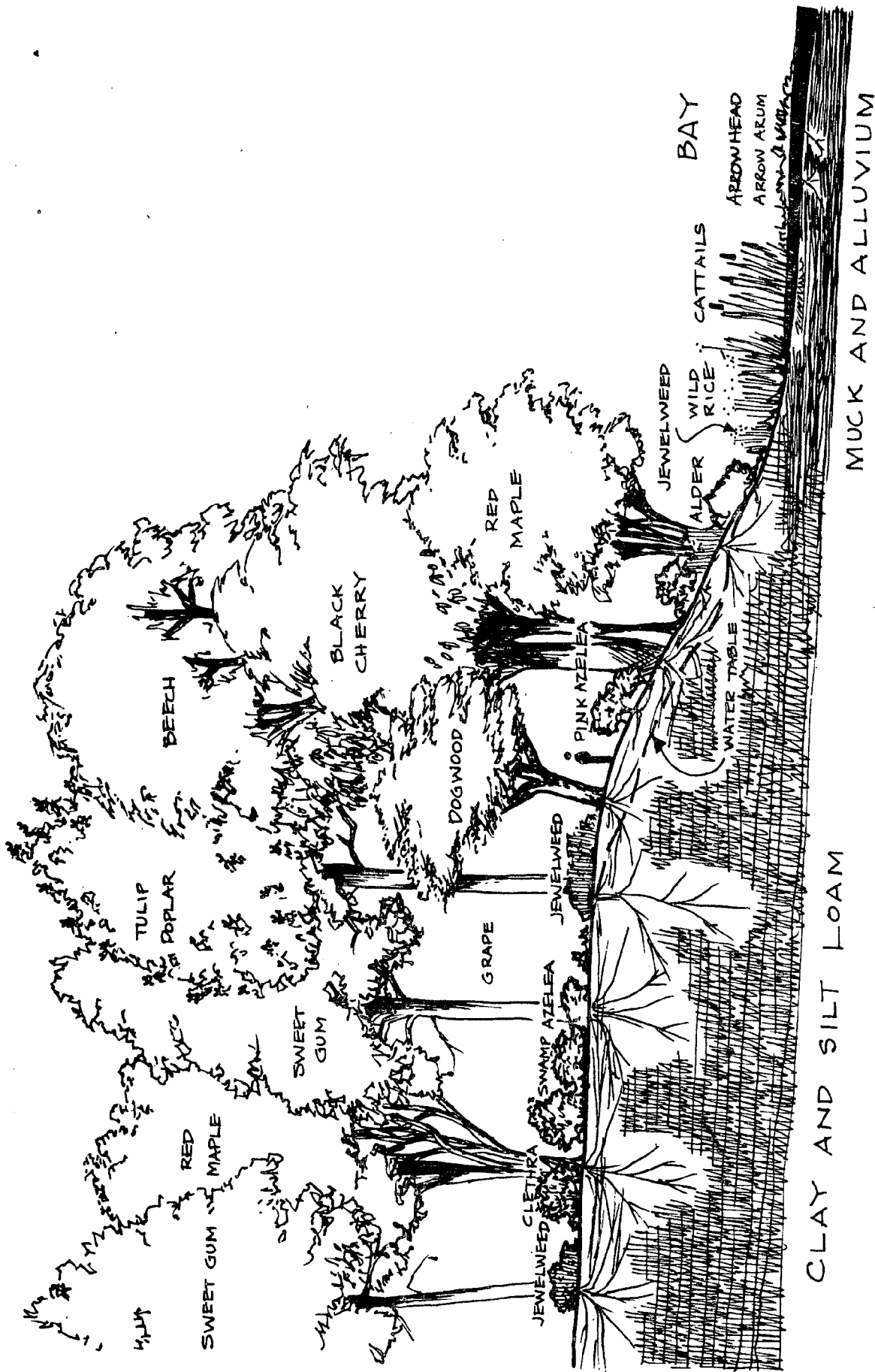
and rhododendron are well established. Beech, tulip poplar, and several of the upland oaks are the canopy dominants. Along the Bay, cattails, rushes and small red maples and white oaks create a dense edge. Much of the Neck is protected by the State. The remainder is gradually being developed with cottages.

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



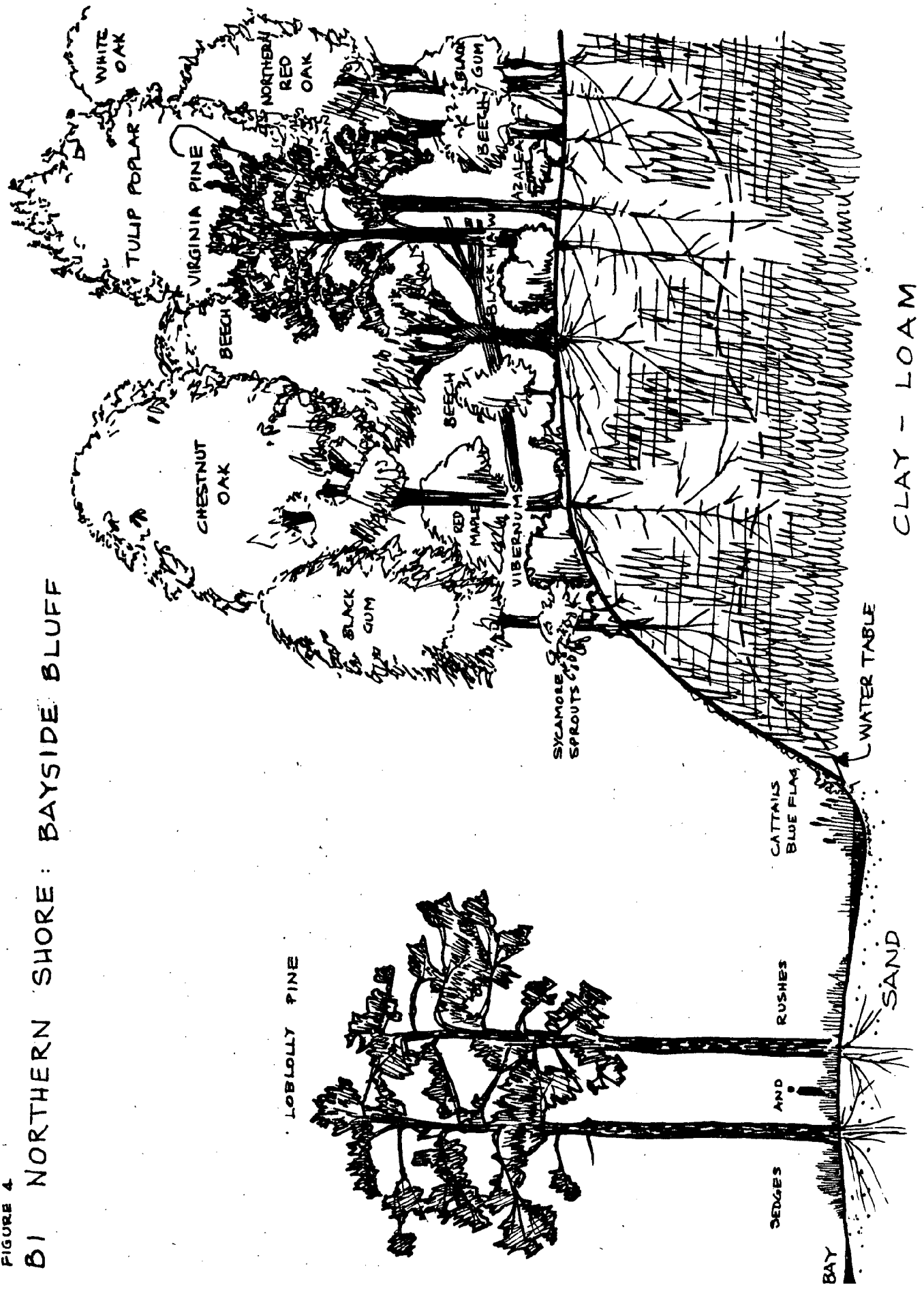
A-2 ELK NECK: UPLAND AND LOWLAND WETLANDS

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 habitats made by adjacent wetlands and upland woodlands. Muskrat, fox, frogs and many birds are found.

FIGURE 4

B1 NORTHERN SHORE: BAYSIDE BLUFF



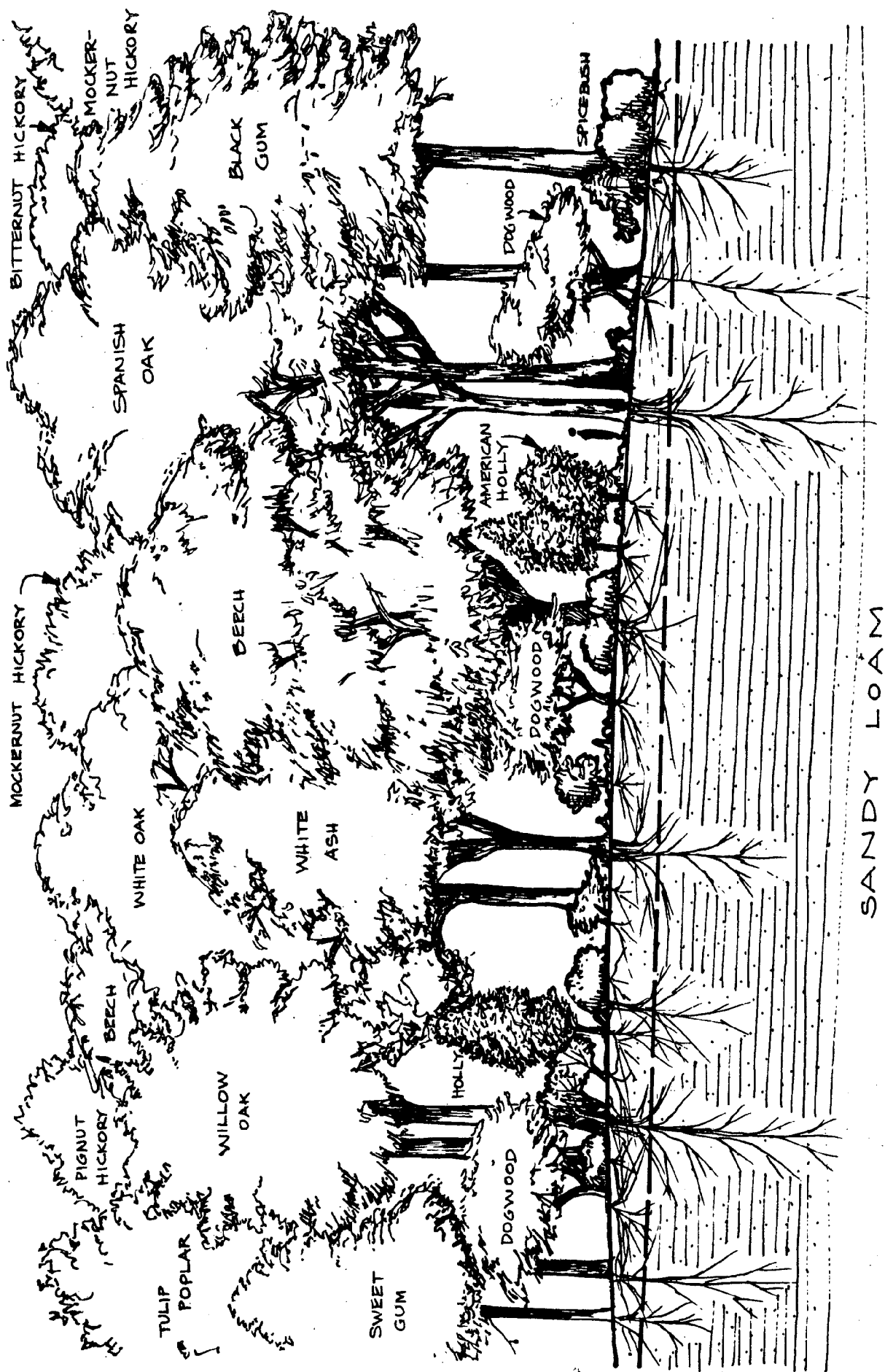
B-1 NORTHERN SHORE: BAYSIDE BLUFF

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.

B2 NORTHERN SHORE: UPLAND DECIDUOUS FOREST



SANDY LOAM

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
Pileated woodpeckers	Carolina chickadee
Red-headed woodpecker	Carolina wren
Hairy woodpecker	Wood thrush
Downy woodpecker	Yellow-throated vireo
Eastern wood pewee	Red-eyed vireo
	Black and white warbler

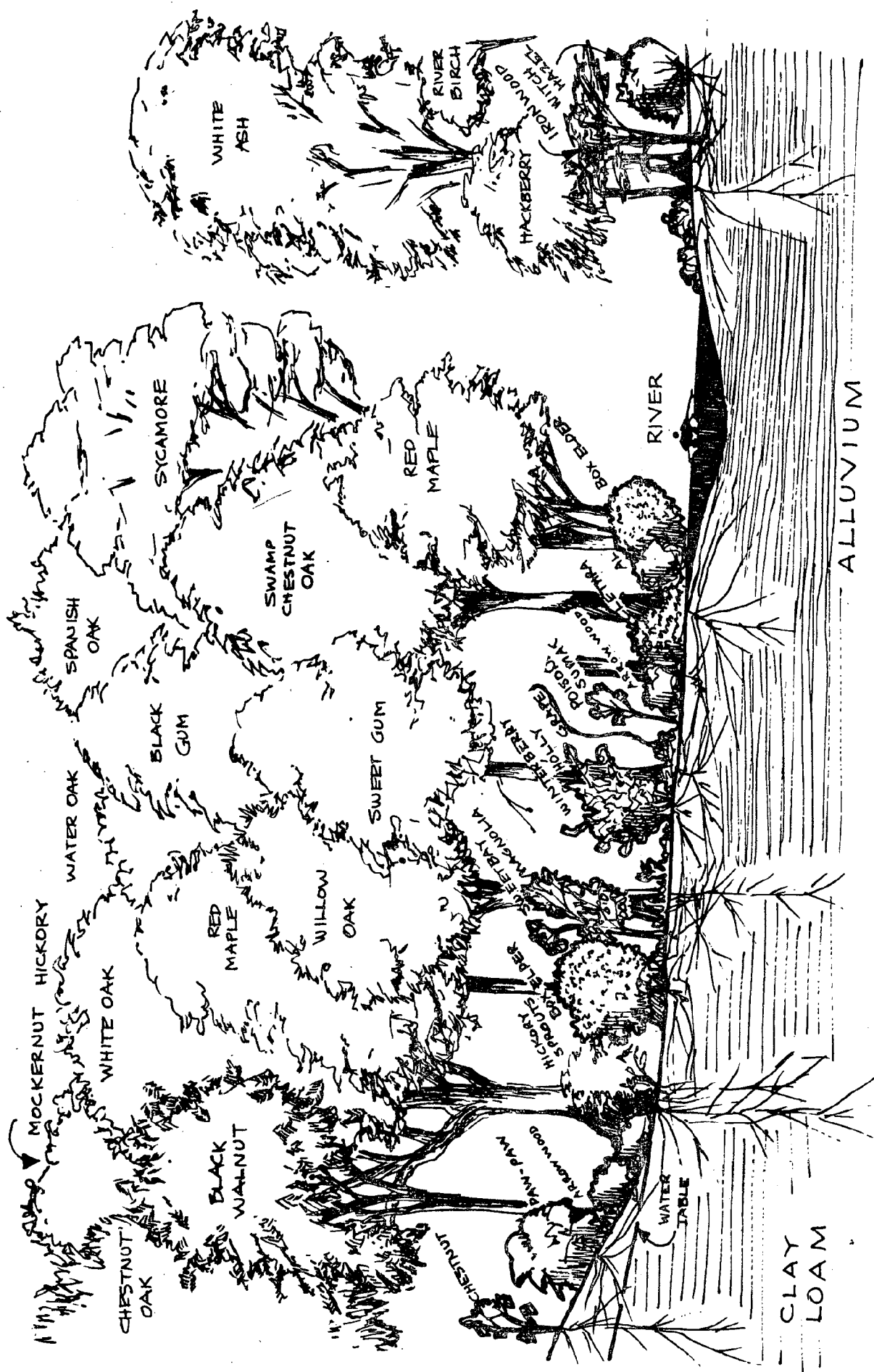
Among the avian hunters are:

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

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:

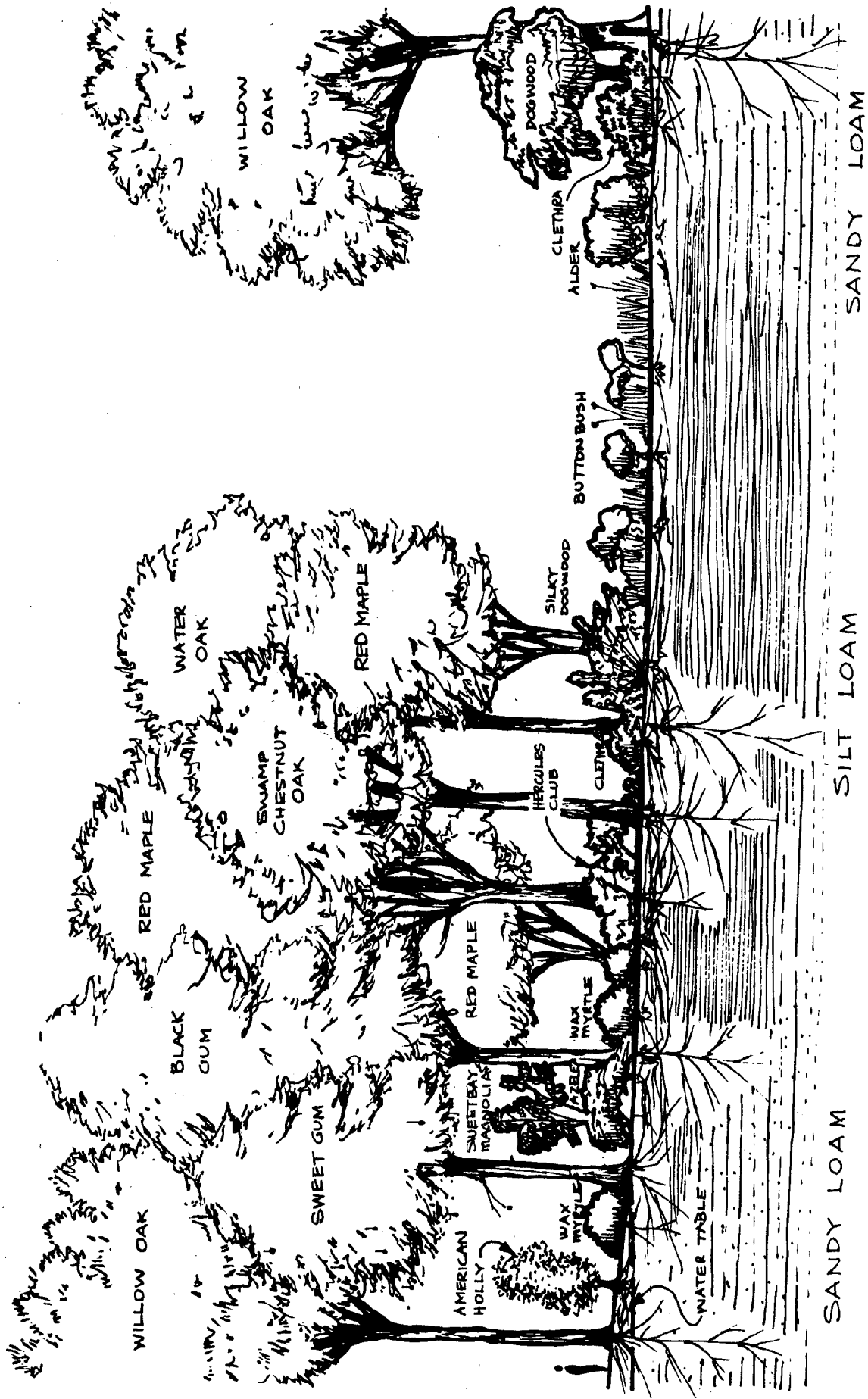
Bobwhite quail	Warblers
Woodcock	Wood duck
Red-headed woodpecker	Red-shouldered hawk
Cardinal	Barred owl

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.

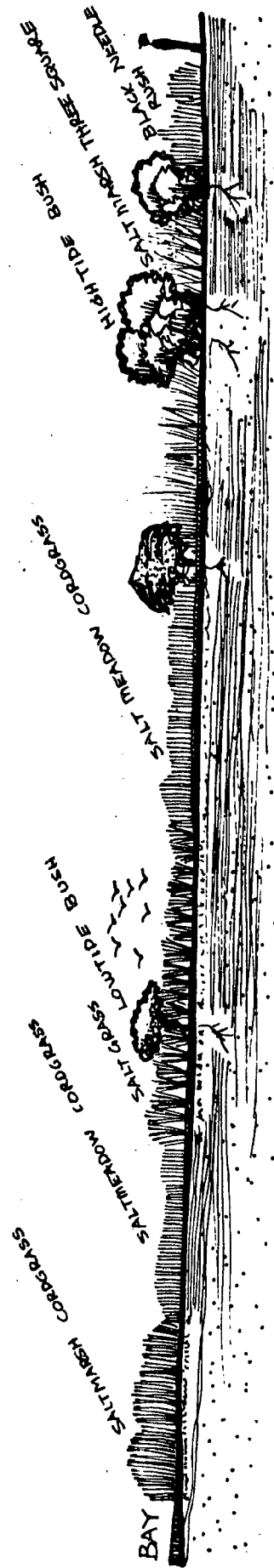
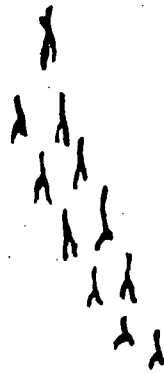
In some places, rising water levels have apparently drowned trees, allowing a shrub

swamp to develop. Typical species are: button-bush, 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 boundaries.

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:

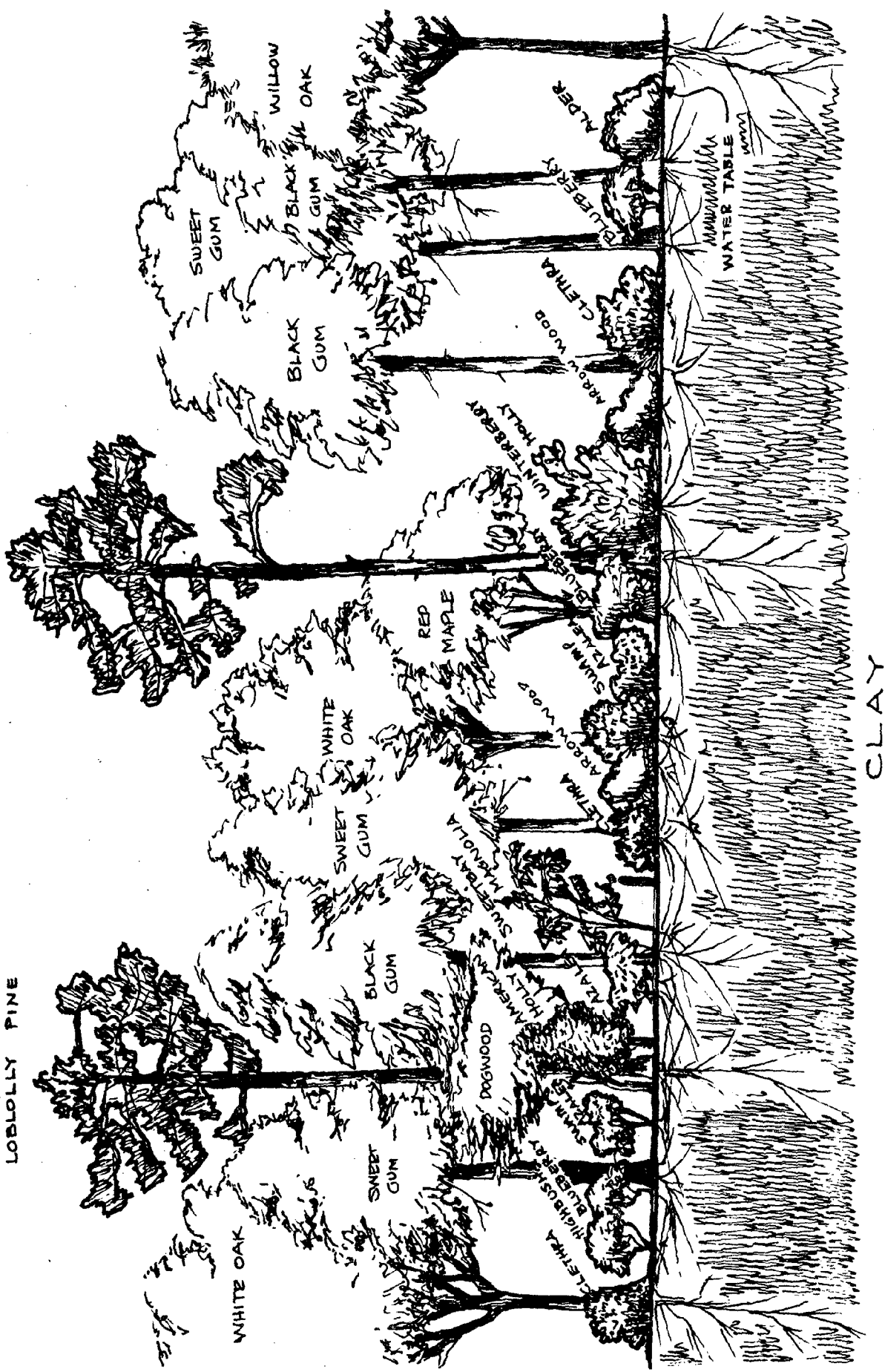
River otter	Muskrat
Mink	Nutria

FIGURE 9

C2 MIDDLE SHORE : LOWLAND SWAMP

LOBLOLLY PINE

LOBLOLLY PINE



C-2 MIDDLE SHORE: LOWLAND SWAMP

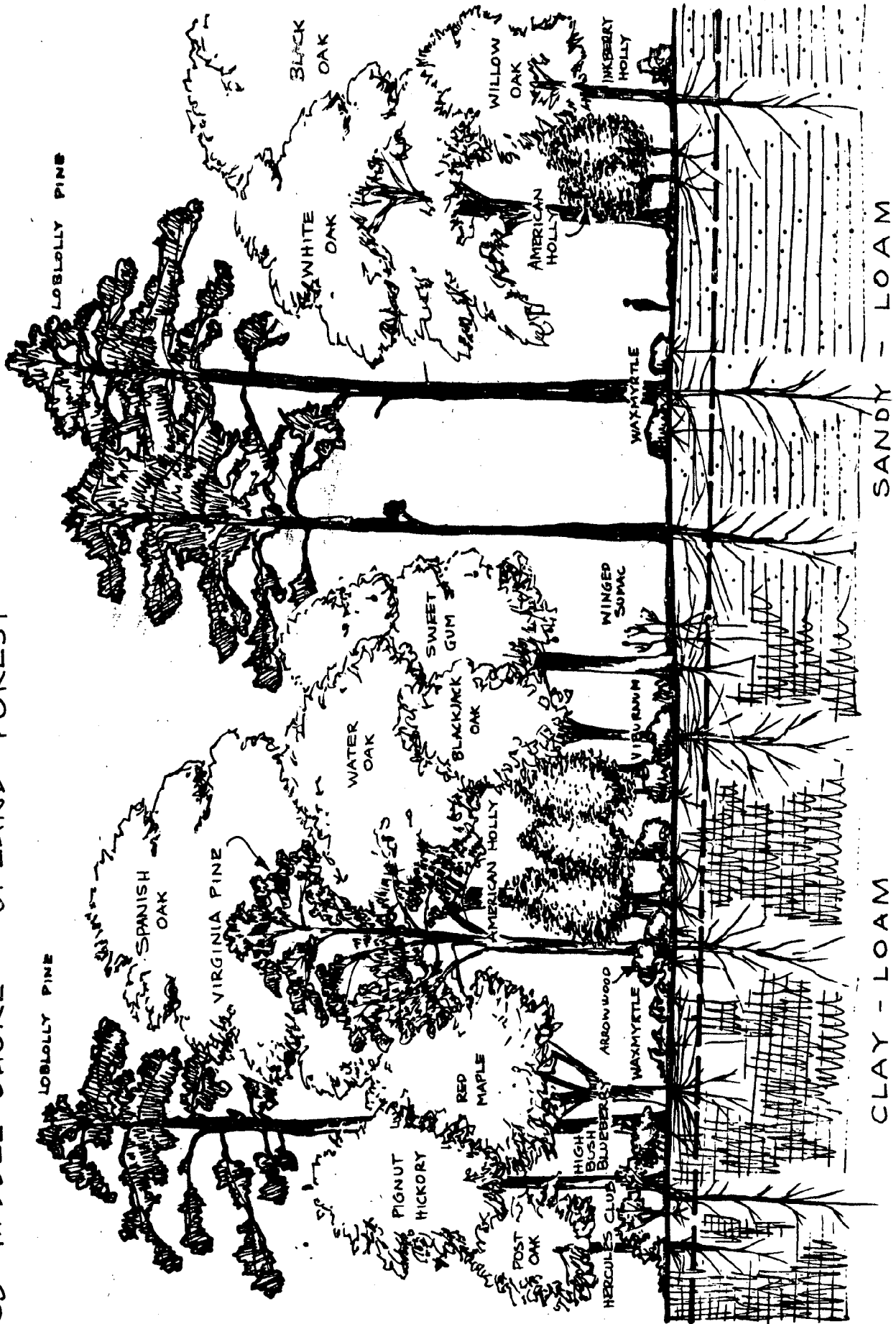
Low-lying freshwater areas, generally underlain by impervious clays, form the headwaters of a series of streams draining into the tidal marshes of Dorchester County. Trees do not grow tall in the standing water. Soil conditions are anaerobic and acid, retarding nutrient availability. White and willow 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, viburnums, 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 predominantly 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

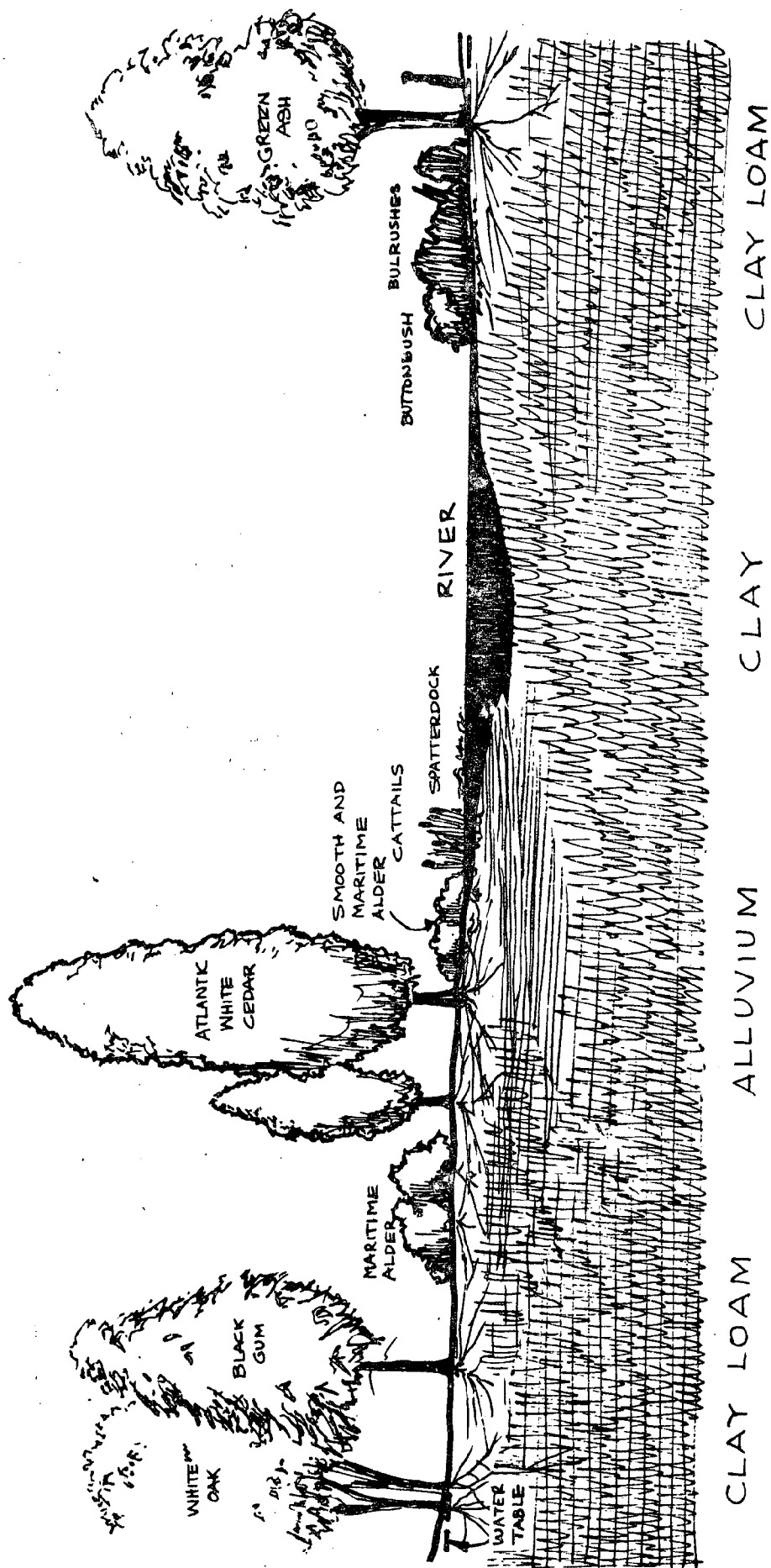
Birds include some ubiquitous species and some specially adapted to the pine woodlands:

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.

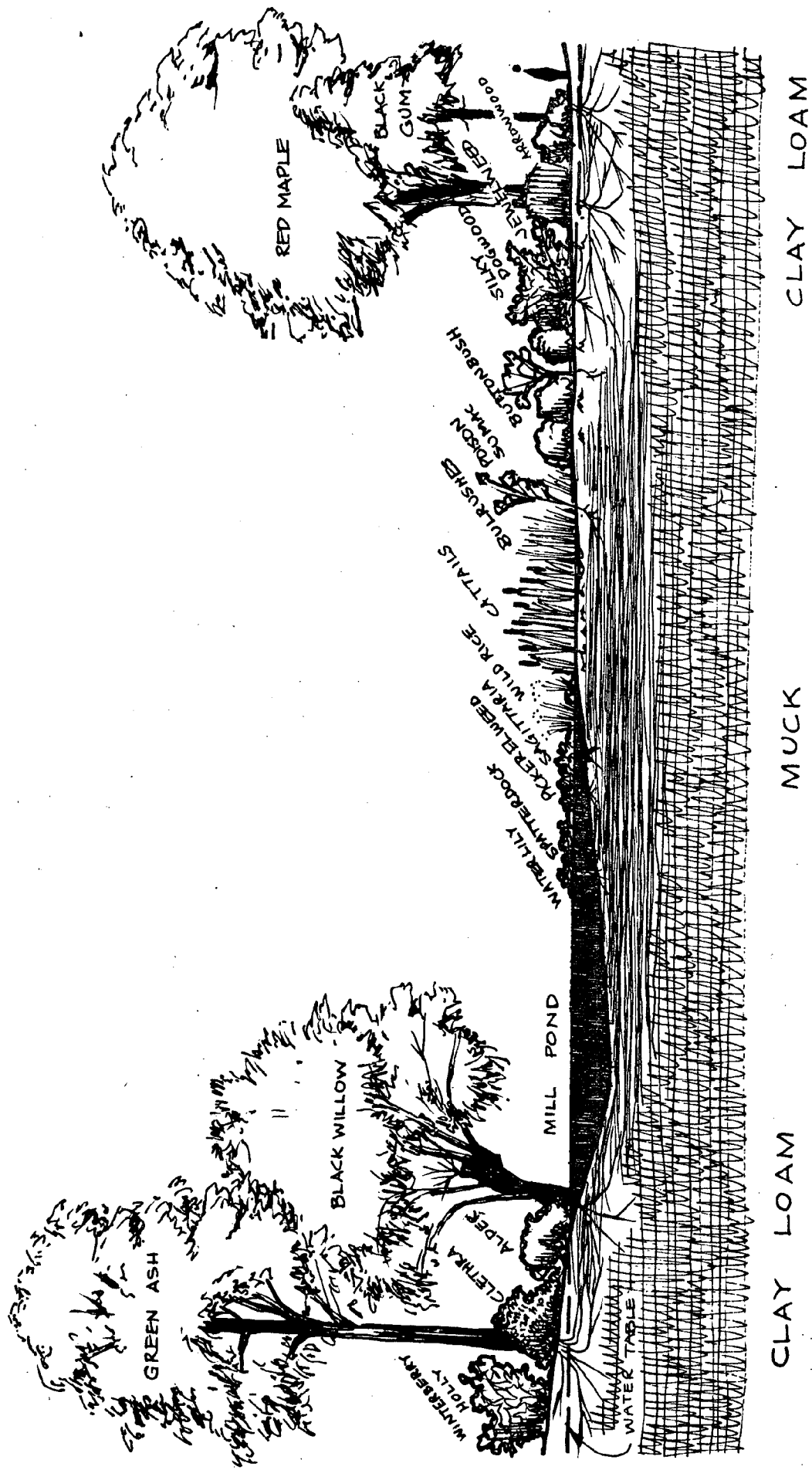
Some of these areas are favored hunting spots, others are inaccessible because of entangling vegetation. Few have been drained or cleared, although marketable timber has been removed.

Amphibians and terrestrial 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.

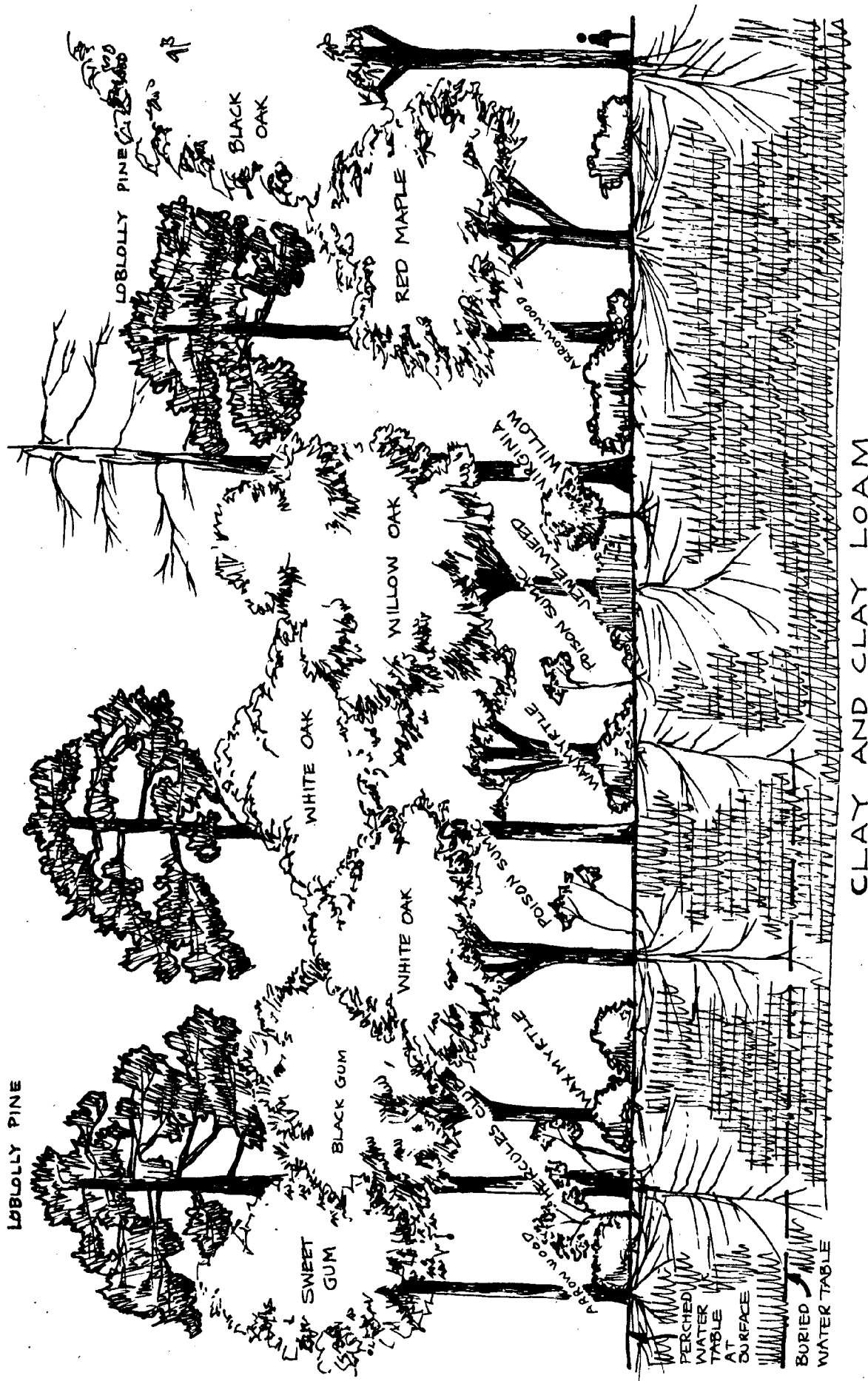
The ponds are generally ringed by a band of riparian trees such as red maple, white ash, green ash, black willow, blackgum and sweetgum. Shrubs such as winterberry holly, clethra, Virginia willow, alder, poison sumac and buttonbush grow to the water. Sedges, blue flag, Carolina rose, and various ferns 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



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.

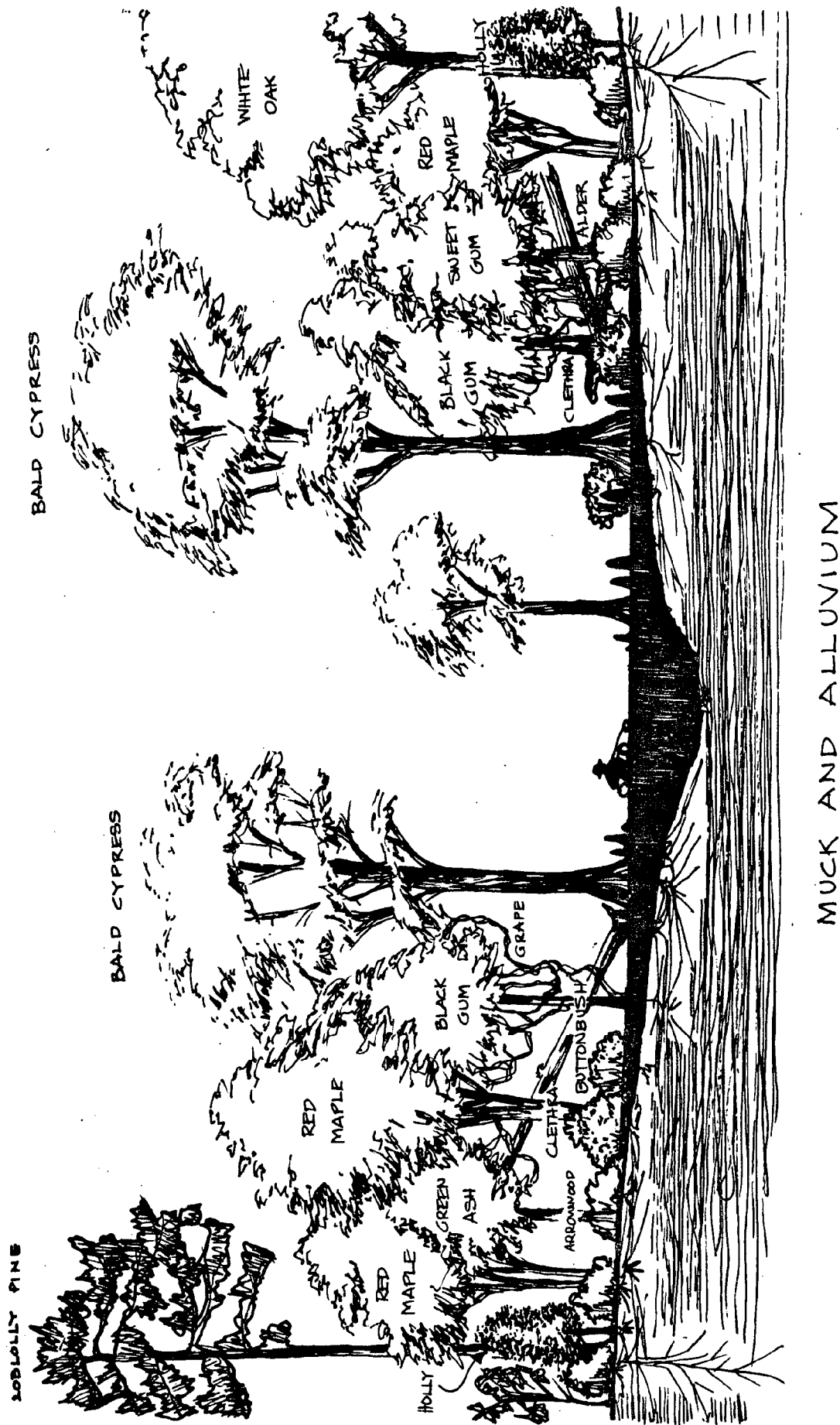
The ground surface is saturated all or most of the year. The canopy is between 50 and 70 feet high; the shrub layer is thick. Loblolly pines are ubiquitous being tolerant of the poorly drained conditions (Fowells, 1965). There are pure pine stands where the shrub layer is sparse. Red maple,

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



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 occurring 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).

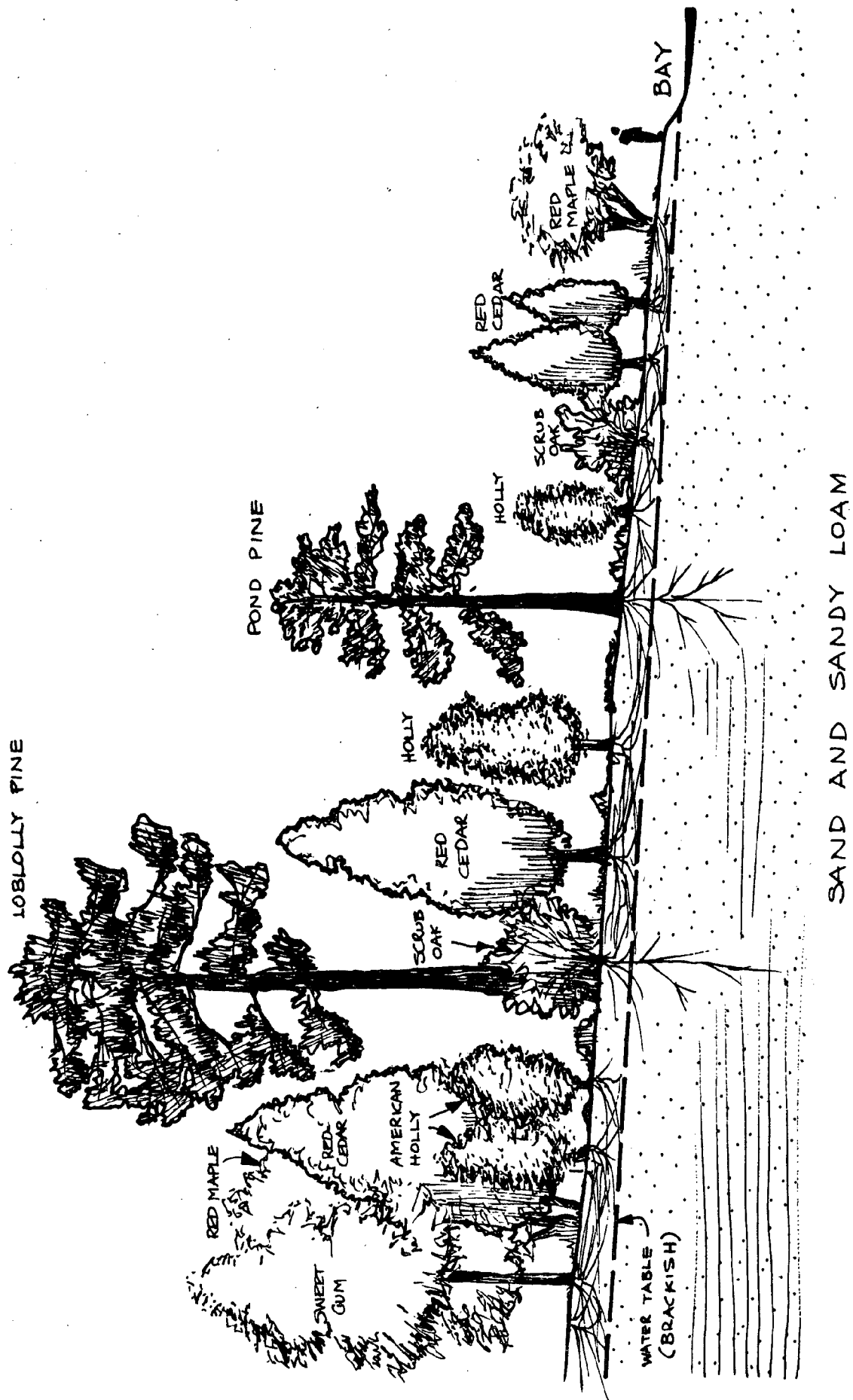
Along much of its length, the river has no well defined bank. Trees and shrubs occur in open water. Shrubs and vines are abundant, making overland access almost impossible. Inaccessibility has preserved much of the area.

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.

*JOHNSTOWN-SHIPPEN CREEK WOODS

150793300021305

LOCATION SITE TYPE, BIOLOGICAL UNIT
NEAREST TOWN, COUNTY, ELECTION DISTRICT
AREA, ELEVATION, WATERSHED
TOTAL STREAM MILE
LOWER SLOPE
KENT
3000 FEET
FOREST
NUMBER
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

LOBLOLLY PINE AND OAKS CHARACTERIZE THESE FORESTS ON THE CHESTER RIVER. IT IS ONE OF THE LARGEST FORESTS IN THE VICINITY, AND HAS OVER A MILE OF SHORELINE IN 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 IN THE FOREST FLOOR. IN THE OTHER SUBSECTION MAKING UP 79% OF THE AREA, BARKS, 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.

DEGREE OF IMPROVEMENT
VISUAL EXPERIENCE
DIVERSITY
ACCESS TO AREA
NATURAL INTEGRITY
CONTIGUOUS LAND USE
AQUATIC BUFFER ZONE
SECURITY
CURRENT USE
OWNERSHIP
ZONING
INVENTORY DATE

INFREQUENT
MEDIUM
MEDIUM
EASY
NATURALLY TRANSITORY
N-AGRICULTURE
S-WATER BODY
E-WATER BODY
N-AGRICULTURE
N-ADEQUATE
S-NOT APPLICABLE
E-NOT APPLICABLE
W-ADEQUATE
AREA SAFE FOR FIVE YEARS
SEVERAL HOMES
PRIVATE INDIVIDUAL
(MORE THAN ONE OWNER)
RURAL
06/19/75

BIBLIOGRAPHY
MARYLAND DEPT. STATE PLANNING 1975 (UNPUBLISHED) INVENTORY OF MARYLAND CRITICAL AREAS.
PEOPLE CONTACTED
MR. AND MRS. JAMES G. HAUPY, R.D. 3, CHESTERTOWN, MD. 21620.
GEORGE F. JOHNSON, R.D. 3, CHESTERTOWN, MD. 21620.

JOHNSONTOWN-SHIPPEE CREEK WOODS

15079333021305

01

02

SUBSECTION SAMPLED & SIMILAR SS

AREA OF SUBSECTION

059 ACRES

219 ACRES

SOIL TYPE & NATURAL SOILS GROUP

SAA BI

ENA F3

RUNOFF POTENTIAL

SLIGHT 181

HIGH 1081

DEPTH TO WATER TABLE

2-4 FT

1 FT

WELL DRAINED SOILS

YES

NO

SLOPE AND SOIL ERODIBILITY

15% - MEDIUM (228)

15% - HIGH (1437)

EASE OF PASSAGE

EASY

MODERATE

DISTANCE TO WATER BODY

0-10 FEET

0-10 FEET

TYPE OF WATER BODY

POND

POND

WATER BODY SIZE AND DEPTH

50 ACRES

50 ACRES

WATER BODY MATERIAL

SAND

SAND

BEACH LENGTH AND WIDTH

SAND

SAND

BEACH TYPE

SAND

SAND

PERCENT OF STREAM SHADED

SAND

SAND

DISTURBANCE PRIMARY & SECONDARY

SAND

SAND

VEGETATION TYPE

SAND

SAND

TOTAL AVERAGE COVER BY LAYER

SAND

SAND

SELECT CUTTING WINDTHROW

SAND

SAND

SELECT CUTTING WINDTHROW

SAND

SAND

VEGETATION TYPE

SAND

SAND

TOTAL AVERAGE COVER BY LAYER

SAND

SAND

KEY TO VEGETATION

SAND

SAND

L-1 LAYER

SAND

SAND

C-CANOPY

SAND

SAND

D-JUNDER

SAND

SAND

S-SHRUB

SAND

SAND

COV-AVERAGE PERCENT COVER

SAND

SAND

IMPORTANCE

SAND

SAND

R-RARE OR UNIQUE

SAND

SAND

C-CHAMPION TREE CANDIDATE

SAND

SAND

E-ENDANGERED

SAND

SAND

DBH-DIAMETER AT BREAST HEIGHT

SAND

SAND

S-SOURCE

SAND

SAND

D-DB SEVERED

SAND

SAND

R-REPORTED

SAND

SAND

D-DEN, NEST, SPOOR R-RARE

SAND

SAND

RES-RESIDENCE

SAND

SAND

R-REBBERING

SAND

SAND

H-MIGRATORY

SAND

SAND

H-WINTER CONCENTRATION

SAND

SAND

YR-YEAR AROUND RESIDENT

SAND

SAND

UN-UNKNOWN

SAND

SAND

X- ANY *X* DENOTES INPUT ERROR

SAND

SAND

*GEOLOGY

SAND

SAND

*MINIMUM DIMENSION 400-600 FT

SAND

SAND

*VEGETATION TYPES

SAND

SAND

*PERCENT 5-10 AC OPENINGS 3-58 *

SAND

SAND

*VISUAL EXPERIENCE SCORE 13 *

SAND

SAND

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:

<u>SIZE</u>	Size of area Minimum dimension (feet)
<u>WATER</u>	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
<u>VEGETATION</u>	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
<u>WILDLIFE</u>	Species (from citations) Species sighted Seasonal concentration of wildlife Wetland class Interspersion of vegetation Cover type Dens, nests, spoors Residency Frequency
<u>SOILS</u>	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 reconnaissance 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

UPLAND NATURAL AREAS DATA FORM

JRGR Crew

1 Area Number

21 # Area Name

56 Date

58 Date

64 Size of Area (acres)

68 Access to Area

69 Nearest Town

71 Elevation

75 Minimum Dimension

76 Zoning

77 Current Use

79 Ownership

CARD # 2

3 North Contiguous Landuse

5 South

7 East

9 West

11 North Coastal Buffer Zone

12 South

13 East

14 West

15 Geology

18 % of 5-10 Acre Openings

19 Occurrence

20 Diversity

21 Natural Integrity

Col. No. CARD#2

22 **2** Security1. 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. Unknown23 **02** # Of Vegetation Types25 **13** Visual Experience Score27 **02** Visual Experience Term29 **4008** Primary Category33 **3091** Secondary Category37 **6001** Tertiary Category41 **LARGE PINE-OAK FOREST ALONG THE CHE**76 **STER** One Line Description (continue one line description onto Card#3 when necessary)

CARD#3

3 **RIVER**

38

61 **05** Location

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

63 **04** Site-Type

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

65 **09** Ecological Unit

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

CARD#4

1 **2154** 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 citations as shown in the enclosed sample and give it a number as follows:

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

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.

1

CARD		coun.		elect.	coun.		field
				dist.	site		site
7	/	1	5	07	9	33	00

CARD

3

33

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

CARD

3

33

G	E	O	R	G	E		F	.		J	O	H	N	S	O	N	,		R	.	D	.		3	,		C	H	E
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	<u>little/none</u>	audible	loud
Nature of offsite noise	<u>infrequent</u>	intermittent	constant

Visual

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

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

13 Experience Total Score (enter in boxes)

Experience Term (enter in box)

	Score	
1.	6-9	low
<u>2.</u>	10-14	medium
3.	15-18	high

TEXT (p.1)

CARD

LOBLOLLY PINE AND OAKS CHARACTERIZE THESE FORESTS ON THE

CARD

CHESTER RIVER. IT IS ONE OF THE 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 TRIBUTARIES, SHIRPEN CREEK. THIS

CARD

FOREST DEMONSTRATES FOREST SUCCESSION--IN ONE SUBSECTION

CARD

COVERING 21% OF THE SITE, A DENSE UNDERSTORY OF SWEETGUMS IS

CARD

COMING UP UNDER A CANOPY OF LOBLOLLY PINES. SEEDLINGS OF OAK

CARD

AND OTHER TOLERANT HARDWOODS ARE 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)

CARD

P	I	N	E	S		A	S		T	H	E		D	O	M	I	N	A	N	T		C	A	N	O	P	Y		T	
R	E	E	S	.		W	I	L	D	L	I	F	E		I	S		A	B	U	N	D	A	N	T	.				

E	S	P	E	C	I	A	L	L	Y		D	E	E	R		A	N	D		U	P	L	A	N	D		G	A	M
E	.		N	O		O	S	P	R	E	Y		N	E	S	T	S		W	E	R	E							

S	I	G	H	T	E	D		I	N		T	H	I	S		S	I	T	E	,		B	U	T		T	H	O	S
E		N	E	S	T	I	N	G		A	L	O	N	G		T	H	E		C	H	E	S	T	E	R			

R	I	V	E	R		F	R	E	Q	U	E	N	T		T	H	E		A	R	E	A	.		B	A	L	D	
E	A	G	L	E	S		N	O		L	O	N	G	E	R		N	E	S	T		I	N		T	H	E		

S	I	T	E	,		B	U	T		O	C	C	A	S	I	O	N	A	L	L	Y		V	I	S	I	T	.
S	E	V	E	R	A	L		H	O	M	E	S		H	A	V	E		B	E	E	N		B	U	I	L	T

W	I	T	H	I	N		T	H	E		S	I	T	E		A	N	D		O	W	N	E	R	S		I	N	T	
E	N	D		T	O		P	R	E	S	E	R	V	E		T	H	E		N	A	T	U	R	A	L				

[illegible][illegible][illegible][illegible]

Col. No. CARD#5

1 **3** **0** **1** Subsection Sampled
 5 **0** **5** **9** 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 5. B+ Slight
 2. D High 6. B Slight
 3. C+ Moderate 7. A Low
 4. C Moderate

26 **6** High Water Table(depth)
 1. Less than 1 ft. 5. 4-5 ft. 9. Greater than 8 ft.
 2. 1-2 ft. 6. 5-6 ft.
 3. 2-3 ft. 7. 6-7 ft.
 4. 3-4 ft. 8. 7-8 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 3. .24 Low 5. .32 Medium 7. .43 High
 2. .20 Low 4. .28 Medium 6. .37 Medium 8. .49 High
 30 **1** Water Body Distance 1. 0-10 feet 3. 50-100 feet 5. 200-300 feet 7. Greater than 500 feet
 2. 10-50 feet 4. 100-200 feet 6. 300-500 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

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.

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.

33 **6** Water Body Size 1. Less than 1 acre 3. 5-10 acres 5. 20-30 acres
 2. 1-5 acres 4. 10-20 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 **1** Beach Length 1. Less than 500 feet 3. 1000-1500 feet
 2. 500-1000 feet 4. Greater than 1500 feet
 37 **1** Beach Width 1. Less than 1 foot 3. 10-20 feet
 2. 1-10 feet 4. Greater than 20 feet

38 **1** 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

0	8	1

 % 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

0	8	1

 Wetland Wildlife Rank

43

0	8	1

 Vegetation Type

46

1	7
2	0

 Primary Disturbance

48

1	7
2	0

 Secondary Disturbance

- | | |
|--|---|
| 1. Channelization (Channelizat) | 16. Air Pollution (Air Pollutn) |
| 2. Dredging | 17. Selective Cutting (Selct Cutng) |
| 3. Sewer Outlet | 18. Clear Cutting (Clear Cutng) |
| 4. Culverts | 19. Fire |
| 5. Bulkheading | 20. Windthrow |
| 6. Dikes | 21. Disease |
| 7. Dams | 22. Litter Accumulation, leaf (Leaf Litter) |
| 8. Change in Watertable (Chng watrtbl) | 23. Dumping |
| 9. Logs and Debris (Log + Debris) | 24. Littering, paper (Paper Litter) |
| 10. Beaver Dams | 25. Vandalism |
| 11. Algal Blooms | 26. Trampling |
| 12. Fecal Odor | 27. Motor Vehicles (Motr Vehicl) |
| 13. Siltation | 28. Postagricultural (Post Ag) |
| 14. Erosion | 29. Other |
| 15. Noise | 30. 1172 |

50

3

 Ease of Passage

- | | |
|---------------------|--|
| 1. <u>Difficult</u> | - Thick understory or wet mucky soil |
| 2. <u>Moderate</u> | - Interspersed understory or wet soils |
| 3. <u>Easy</u> | - Open understory, dry soils |

- | |
|--------------|
| 31. Flooding |
| 32. Grazing |

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 Nest-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.	coun.	field	sub
site	dist.	site	site	sec
5	1	5	0	7
9	3	3	0	0
1	0	0	1	

Species	LAYER	IMPORT	Avg cov	DBH	SPECIES NAME	REPROD	1	2	3	4	5
						cov	DBH	cov	DBH	cov	DBH
14	0	4	4	5	1	6	4				
22	0	3	1	3	1	0	3				
30	0	5	4	8	1	0	3				
38	0	3	4	6	2	5					
46	0	1	8	7	2	1					
54	0	0	3	3	2	0					
62	0	3	4	6	3	3					
70	0	5	7	1	3	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	X-yes	1=1-4"
2. understory 4. herb	1-10	O-no	2=4-6"
Importance	2-20		3=6-9"
1. unique or rare	3-30		4=9-12"
2. champion tree(>2ft.)	4-40		5=12-18"
3. endangered	9-90		6=18-24"
			7=24-30"
			8=30-36"
			9= > 36"

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 5. B+ Slight 2. D High 6. B Slight 3. C+ Moderate 7. A Low 4. C Moderate																																																																
26	1			High Water Table(depth)	1. Less than 1 ft. 5. 4-5 ft. 9. Greater than 8 ft. 2. 1-2 ft. 6. 5-6 ft. 3. 2-3 ft. 7. 6-7 ft. 4. 3-4 ft. 8. 7-8 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 3. .24 Low 5. .32 Medium 7. .43 High 2. .20 Low 4. .28 Medium 6. .37 Medium 8. .49 High																																																																
30	1			Water Body Distance	1. 0-10 feet 3. 50-100 feet 5. 200-300 feet 7. Greater than 500 feet 2. 10-50 feet 4. 100-200 feet 6. 300-500 feet 8. Contained within some subsection																																																																
31	1	1		Water Body Type	<table border="0"> <tr> <td>01</td> <td>Dace Trickle Stream</td> <td>17</td> <td>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.</td> </tr> <tr> <td>02</td> <td>Trout Feeder</td> <td></td> <td></td> </tr> <tr> <td>03</td> <td>Trout Stream</td> <td>18</td> <td>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.</td> </tr> <tr> <td>04</td> <td>Sucker Stream</td> <td>19</td> <td>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.</td> </tr> <tr> <td>05</td> <td>Bass Feeder</td> <td>20</td> <td>Tidal Wetlands - marshes and swamps which are influenced by the tide.</td> </tr> <tr> <td>06</td> <td>Bass Stream</td> <td></td> <td></td> </tr> <tr> <td>07</td> <td>Pickering Stream</td> <td></td> <td></td> </tr> <tr> <td>08</td> <td>Bullhead Stream</td> <td></td> <td></td> </tr> <tr> <td>09</td> <td>Catfish Stream</td> <td></td> <td></td> </tr> <tr> <td>10</td> <td>Carp Stream</td> <td></td> <td></td> </tr> <tr> <td>11</td> <td>Tidal Stream</td> <td></td> <td></td> </tr> <tr> <td>12</td> <td>Ocean - Atlantic Ocean</td> <td></td> <td></td> </tr> <tr> <td>13</td> <td>Bay - Bays indicated on County Topographic Maps.</td> <td></td> <td></td> </tr> <tr> <td>14</td> <td>Pond - small enclosed body of freshwater, often artificially formed.</td> <td></td> <td></td> </tr> <tr> <td>15</td> <td>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.</td> <td></td> <td></td> </tr> <tr> <td>16</td> <td>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.</td> <td></td> <td></td> </tr> </table>	01	Dace Trickle Stream	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.	02	Trout Feeder			03	Trout Stream	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.	04	Sucker Stream	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.	05	Bass Feeder	20	Tidal Wetlands - marshes and swamps which are influenced by the tide.	06	Bass Stream			07	Pickering 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.		
01	Dace Trickle Stream	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.																																																																		
02	Trout Feeder																																																																				
03	Trout Stream	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.																																																																		
04	Sucker Stream	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.																																																																		
05	Bass Feeder	20	Tidal Wetlands - marshes and swamps which are influenced by the tide.																																																																		
06	Bass Stream																																																																				
07	Pickering 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.																																																																				
33	6			Water Body Size	1. Less than 1 acre 3. 5-10 acres 5. 20-30 acres 2. 1-5 acres 4. 10-20 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. <u>Peat</u> - fibrous organic material with recognizable plant parts. 2. <u>Muck</u> - black ooze composed of silt and decomposed organic matter. 3. <u>Silt</u> - fine sediment with little organic material. 4. <u>Sand</u> - granular sediment. 5. <u>Gravel</u> - granular sediment with particles larger than 2mm (approximately 1/8 in.). 6. <u>Cobble</u> - round or sub-round, water-worn rock 2 1/2-10 inches in diameter. 7. <u>Rock</u> - solid aggregate of minerals larger than a cobble.																																																																
36				Beach Length	1. Less than 500 feet 3. 1000-1500 feet 2. 500-1000 feet 4. Greater than 1500 feet																																																																
37				Beach Width	1. Less than 1 foot 3. 10-20 feet 2. 1-10 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% 2 - 20-30% 4 - 40-50% 6 - 60-70% 8 - 80-90%
40

--	--	--

 Wetland Wildlife Rank 1 - 10-20% 3 - 30-40% 5 - 50-60% 7 - 70-80% 9 - 90-100%
43

0	8	2
---	---	---

 Vegetation Type

46

1	7
---	---

 Primary Disturbance
48

2	7
---	---

 Secondary Disturbance

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

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#(5)

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 Nest-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.	coun.	field	sub
		dist.	site	site	sec
1	5	1	5	0	7
			9	3	3
				0	0
				0	0
				2	

	Species				LAYER	IMPORT	Avg cov	DBH	SPECIES NAME				REPROD	1	2	3	4	5
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	0-45	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

CARD 1

NATURAL AREA NUMBER

COUNTY		ELECTION DISTRICT		SOURCE		COUNTY SITE NUMBER		FIELD SITE NUMBER		WATERSHED NUMBERING SYSTEM										WATERSHED
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
						9														

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

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.

County Site Number

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

Field Site Number

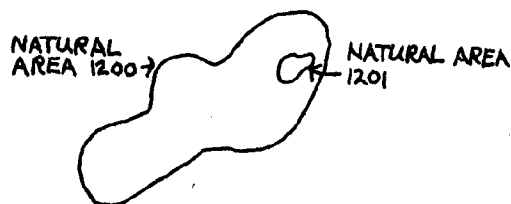
Natural Areas are given a 4-digit number. The first two digits refer to the County site number. The second 2-digits refer to the Field Site number or other natural areas contained in a larger natural area. Thus number 1200 refers to a larger natural area while number 1201 refers to a smaller natural 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.

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

[illegible]

Leave a space between words

DATE

Indicate the month, day and year.

	<u>Month</u>		<u>Month</u>
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

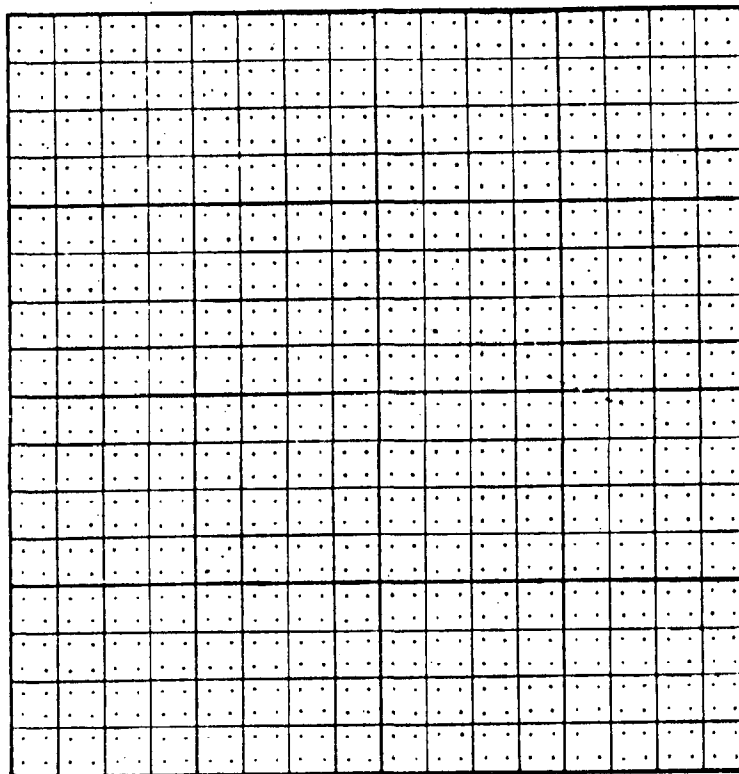
Count the number of acres of each natural area

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.

COPYRIGHT, 1942, by Milton M. Bryan

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

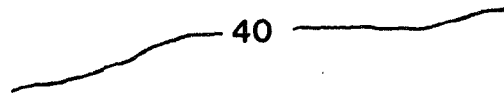
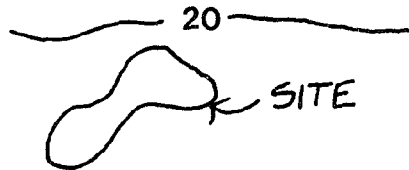
ELEVATION

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
--	--	---	---

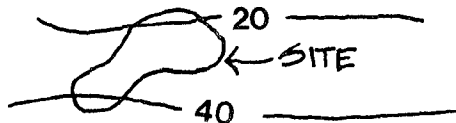


Where more than one contour interval exists

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 | 5. 600-800 feet |
| 2. Less than 200 feet | 6. 800-1000 feet |
| 3. 200-400 feet | 7. 1000-1200 feet |
| 4. 400-600 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 | 09. Swimming |
| 02. Vehicular Traffic
(i.e., motor bikes) | 10. Fishing |
| 03. Trails | 11. Boating |
| 04. Hunting | 12. Pasture |
| 05. Wildlife Management | 13. Agriculture |
| 06. Timber Management | 14. Woodlots |
| 07. Single Home | 15. Dumping |
| 08. Several Homes | 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.

CARD 2

CONTIGUOUS LAND USE

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

- | | |
|-------------------------|------------------------|
| 01. Natural Area | 09. Road |
| 02. Wetland | 10. Highway |
| 03. Water Body | 11. Railroad |
| 04. Park | 12. Residential |
| 05. Old Field | 13. Commercial |
| 06. Managed Forest | 14. Industrial |
| 07. Agriculture | 15. Recreational |
| 08. Wildlife Management | 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 | 08. Piney Formation |
| 02. Lowland Deposits | 09. Nanjemoy Formation |
| 03. Upland Deposits | 10. Aquia Formation |
| 04. Yorktown Formation | 11. Brightseat Formation |
| 05. St. Mary's Formation | 12. Monmouth Formation |
| 06. Choptank Formation | 13. Magothy Formation |
| 07. Calvert 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 wildlife 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 ofrare, 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 contiguous 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 | <u>Pond</u> - small enclosed body of freshwater often artificially formed. |
| 02 | <u>River</u> - a flowing body of water designated as a river on the County Topographic Maps and <u>interior to the first bridge</u> . |
| 03 | <u>Tidal Stream</u> - a stream whose water level fluctuates due to tidal influence. |
| 04 | <u>Non-Tidal Stream</u> - a stream which is above tidal influence. |
| 05 | <u>Marsh</u> - the soil is usually covered with water during the growing season. Vegetation includes grasses and forbs such as bulrush, cattails, arrowheads and smartweeds. |
| 06 | <u>Bog</u> - waterlogged soils supported by a spongy covering of mosses. Typical vegetation includes heath shrubs, moss and sedges. |
| 07 | <u>Wooded Swamp</u> - 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 | <u>Shrub Swamp</u> - 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 | <u>Forest</u> - 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 | <u>Early Forest</u> - 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 | <u>Thicket</u> - upland site which is not less than 40 acres and contains shrubs, and herbaceous plants with occasional tree seedlings or saplings. |
| 12 | <u>Old Field</u> - 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:

	<u>County</u>
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.

NAME		DATE		Maryland Upland Natural Areas Study	
------	--	------	--	-------------------------------------	--

IDENTIFICATION		PUBLICATION DATE		FORTRAN STATEMENT		LIMIT		EXERCISES	
LINE	NUMBER	1	2	3	4	5	6	7	8
1	729	729	729	729	729	729	729	729	729
2	729	729	729	729	729	729	729	729	729
3	729	729	729	729	729	729	729	729	729
4	729	729	729	729	729	729	729	729	729
5	729	729	729	729	729	729	729	729	729
6	729	729	729	729	729	729	729	729	729
7	729	729	729	729	729	729	729	729	729
8	729	729	729	729	729	729	729	729	729
9	729	729	729	729	729	729	729	729	729
10	729	729	729	729	729	729	729	729	729
11	729	729	729	729	729	729	729	729	729
12	729	729	729	729	729	729	729	729	729
13	729	729	729	729	729	729	729	729	729
14	729	729	729	729	729	729	729	729	729
15	729	729	729	729	729	729	729	729	729
16	729	729	729	729	729	729	729	729	729
17	729	729	729	729	729	729	729	729	729
18	729	729	729	729	729	729	729	729	729
19	729	729	729	729	729	729	729	729	729
20	729	729	729	729	729	729	729	729	729
21	729	729	729	729	729	729	729	729	729
22	729	729	729	729	729	729	729	729	729
23	729	729	729	729	729	729	729	729	729
24	729	729	729	729	729	729	729	729	729
25	729	729	729	729	729	729	729	729	729
26	729	729	729	729	729	729	729	729	729
27	729	729	729	729	729	729	729	729	729
28	729	729	729	729	729	729	729	729	729
29	729	729	729	729	729	729	729	729	729
30	729	729	729	729	729	729	729	729	729
31	729	729	729	729	729	729	729	729	729
32	729	729	729	729	729	729	729	729	729
33	729	729	729	729	729	729	729	729	729
34	729	729	729	729	729	729	729	729	729
35	729	729	729	729	729	729	729	729	729
36	729	729	729	729	729	729	729	729	729
37	729	729	729	729	729	729	729	729	729
38	729	729	729	729	729	729	729	729	729
39	729	729	729	729	729	729	729	729	729
40	729	729	729	729	729	729	729	729	729
41	729	729	729	729	729	729	729	729	729
42	729	729	729	729	729	729	729	729	729
43	729	729	729	729	729	729	729	729	729
44	729	729	729	729	729	729	729	729	729
45	729	729	729	729	729	729	729	729	729
46	729	729	729	729	729	729	729	729	729
47	729	729	729	729	729	729	729	729	729
48	729	729	729	729	729	729	729	729	729
49	729	729	729	729	729	729	729	729	729
50	729	729	729	729	729	729	729	729	729
51	729	729	729	729	729	729	729	729	729
52	729	729	729	729	729	729	729	729	729
53	729	729	729	729	729	729	729	729	729
54	729	729	729	729	729	729	729	729	729
55	729	729	729	729	729	729	729	729	729
56	729	729	729	729	729	729	729	729	729
57	729	729	729	729	729	729	729	729	729
58	729	729	729	729	729	729	729	729	729
59	729	729	729	729	729	729	729	729	729
60	729	729	729	729	729	729	729	729	729
61	729	729	729	729	729	729	729	729	729
62	729	729	729	729	729	729	729	729	729
63	729	729	729	729	729	729	729	729	729
64	729	729	729	729	729	729	729	729	729
65	729	729	729	729	729	729	729	729	729
66	729	729	729	729	729	729	729	729	729
67	729	729	729	729	729	729	729	729	729
68	729	729	729	729	729	729	729	729	729
69	729	729	729	729	729	729	729	729	729
70	729	729	729	729	729	729	729	729	729
71	729	729	729	729	729	729	729	729	729
72	729	729	729	729	729	729	729	729	729
73	729	729	729	729	729	729	729	729	729
74	729	729	729	729	729	729	729	729	729
75	729	729	729	729	729	729	729	729	729
76	729	729	729	729	729	729	729	729	729
77	729	729	729	729	729	729	729	729	729
78	729	729	729	729	729	729	729	729	729
79	729	729	729	729	729	729	729	729	729
80	729	729	729	729	729	729	729	729	729
81	729	729	729	729	729	729	729	729	729
82	729	729	729	729	729	729	729	729	729
83	729	729	729	729	729	729	729	729	729
84	729	729	729	729	729	729	729	729	729
85	729	729	729	729	729	729	729	729	729
86	729	729	729	729	729	729	729	729	729
87	729	729	729	729	729	729	729	729	729
88	729	729	729	729	729	729	729	729	729
89	729	729	729	729	729	729	729	729	729
90	729	729	729	729	729	729	729	729	729
91	729	729	729	729	729	729	729	729	729
92	729	729	729	729	729	729	729	729	729
93	729	729	729	729	729	729	729	729	729
94	729	729	729	729	729	729	729	729	729
95	729	729	729	729	729	729	729	729	729
96	729	729	729	729	729	729	729	729	729
97	729	729	729	729	729	729	729	729	729
98	729	729	729	729	729	729	729	729	729
99	729	729	729	729	729	729	729	729	729
100	729	729	729	729	729	729	729	729	729

**Number of forms per card may vary slightly

11 CARD 5

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

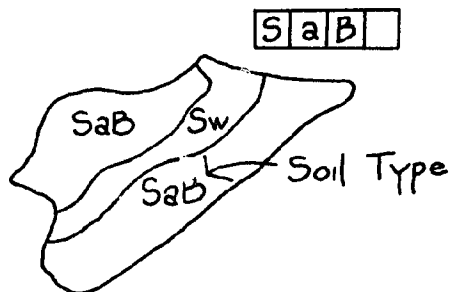
Keep all numbers to the right when less than three digits.

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 | <u>Dace Trickle Stream</u> |
| 02 | <u>Trout Feeder</u> |
| 03 | <u>Trout Stream</u> |
| 04 | <u>Sucker Stream</u> |
| 05 | <u>Bass Feeder</u> |
| 06 | <u>Bass Stream</u> |
| 07 | <u>Pickereel Stream</u> |
| 08 | <u>Bullhead Stream</u> |
| 09 | <u>Catfish Stream</u> |
| 10 | <u>Carp Stream</u> |
| 11 | <u>Tidal Stream</u> |
| 12 | <u>Ocean</u> - Atlantic Ocean. |
| 13 | <u>Bay</u> - Bays indicated on County Topographic Maps. |
| 14 | <u>Pond</u> - small enclosed body of freshwater, often artificially formed. |
| 15 | <u>Bog</u> - 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 | <u>Shallow Freshwater Marsh</u> - 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 | <u>Deep Freshwater Marsh</u> - 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 | <u>Shrub Swamp</u> - 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 | <u>Wooded Swamp</u> - 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 | <u>Tidal Wetlands</u> - 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. Fetid Odor
13. Siltation
14. Erosion
15. Noise
16. Air Pollution (Air Pollutn)
17. Selective Cutting (Sclct 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 of 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.

<u>SOURCE</u>	<u>FREQUENCY</u>	<u>RESIDENCY</u>
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.

NAME



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.

1

CARD		coun.		elect. dist.	coun. site		field site	
7	/				9			

CARD

3
33

[illegible]

CARD.

3
33

[illegible]

CARD

3
33

[illegible]**CARD**

3
33

[illegible]

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.

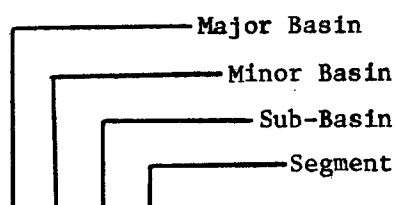
TEXT(p.1)

CARD		elect.		coun.		field	
coun.		dist.		site		site	
8				9			

[illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible]

WATERSHED

WATERSHED DESIGNATIONS



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 Chincoteague 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 Nanticoke
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.

Worcester 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

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 *Amelanchier 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 (Trumpet creeper).
- 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 bignonioides*. 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 wintergreen).
- 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 dogwood).
- 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*. Scotch Broom.
- 224 *Decadon verticillatus*. Swamp loosestrife.
- 225 *Diervilla Lonicera*. Bush Honeysuckle (Bsh Honeysuckle).
- 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 arborescens*. Wild hydrangea.
- 291 *Hypericum* spp. St. John's-wort.
- 292 *Hypericum densiflorum*. 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 buxifolium*. Sand myrtle
- 325 *Koeleria paniculata*. Goldenrain-Tree (Goldenrn-Tree).
- 328 *Larix laricina*. American larch.
- 331 *Laurothoe 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 *Menispermum 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 *Philadelphus 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 *Phoradendron 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 bicolor*. 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 Rhododendron 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 rotunfolia*. 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 Oxycoccus*. Small cranberry (Sml cranberry).
- 666 *Vaccinium stamineum*. Deerberry.
- 667 *Vaccinium vacillans*. Low blueberry.
- 670 *Viburnum* spp. Viburnum.
- 671 *Viburnum acerifolium*. Maple-leaved 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 sinensis*. 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 *Anthoxanthum* 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 wintgrn).
- 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 *Cypripedium* 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 *Equisetum arvense*. 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 *Gyrostachys* spp. Ladies Tresses.
- 852 *Habenaria* spp. Orchis.
- 855 *Heimerocallis 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 (Bottle-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 (Frغت 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 (Interrupt 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 *Pteridium aquilinum*. Bracken Fern.
- 1020 *Ruppia maritima*. Tassel Pondweed (Tassel 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 Nettle).
- 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 *Thalypaterus palustris*. Marsh fern.
- 1071 *Tracaulon* spp. Tear-Thumb.
- 1201 Unknown fern.
- 1202 Unknown grass.
- 1203 Unknown sedge.
- 1204 Unknown herb.

MAMMALS

MAMMALS

Mammal identification numbers are always preceded 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 hudsonius. 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



REPTILES AND AMPHIBIANS

Herptofauna identification numbers are always
preceded 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 *Plethodon 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

Reptiles and Amphibians - cont.

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 Copper-head).

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

VAN DUSEN INDEX

MARYLAND STREAM CLASSIFICATION

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

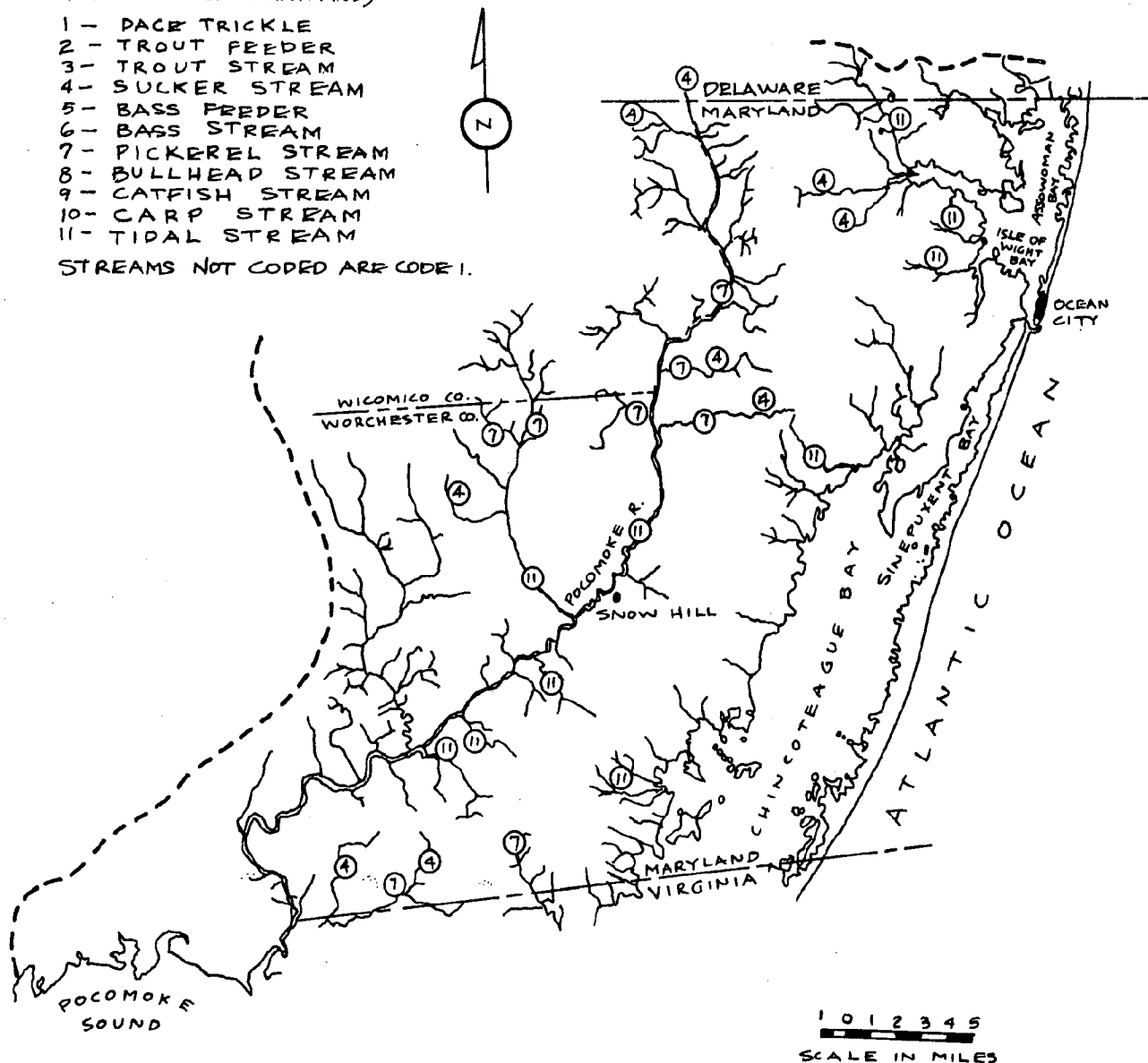
Code No.	Stream Class	Width	Depth	Temp.	Water Quality	Bottom	Flow	Volume	Characteristic Forms	Shade and Cover	Misc. Characters
1	DACE TRICKLE	0 to 3'	Very Shallow	Cool	Usually clear water except in spring	Boulders Gravel Sand	Little	Little	Blacknose Dace	Usually has some forest cover but may have none	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	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 & Crayfish	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	BULLHEAD 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 pan-fishes	Medium shade and cover	Frequent deep pools
10	CARP STREAM	70' and over	Medium to Mod.	Warm	Muddy some-times 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

ATLANTIC OCEAN DRAINAGE AND POCOMOKE RIVER WATERSHED

STREAM CLASSIFICATION (STANDARD FOR MARYLAND)

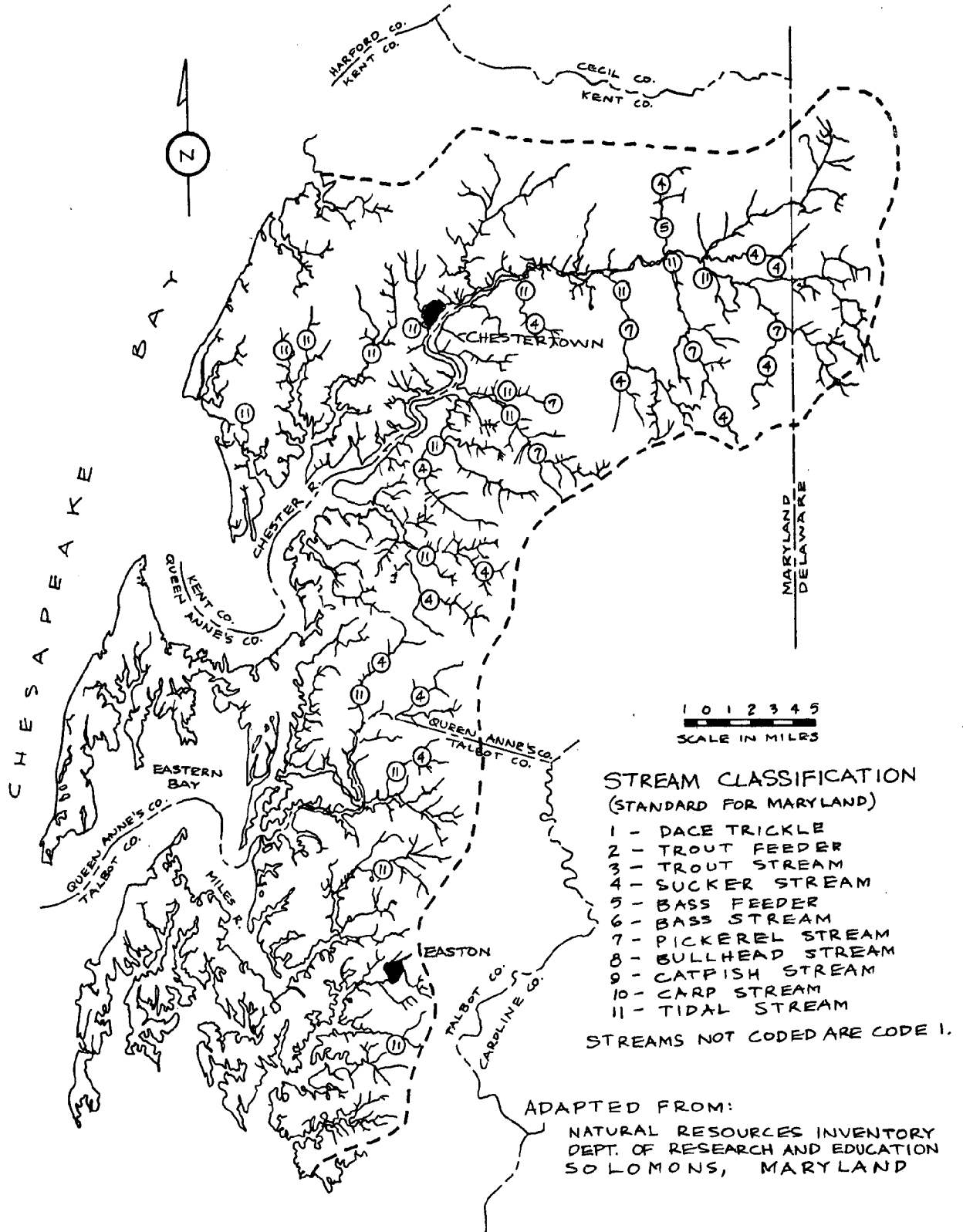
- 1 - DACE TRICKLE
- 2 - TROUT FEEDER
- 3 - TROUT STREAM
- 4 - SULKER STREAM
- 5 - BASS FEEDER
- 6 - BASS STREAM
- 7 - PICKEREL STREAM
- 8 - BULLHEAD STREAM
- 9 - CATFISH STREAM
- 10 - CARP STREAM
- 11 - TIDAL STREAM

STREAMS NOT CODED ARE CODE 1.

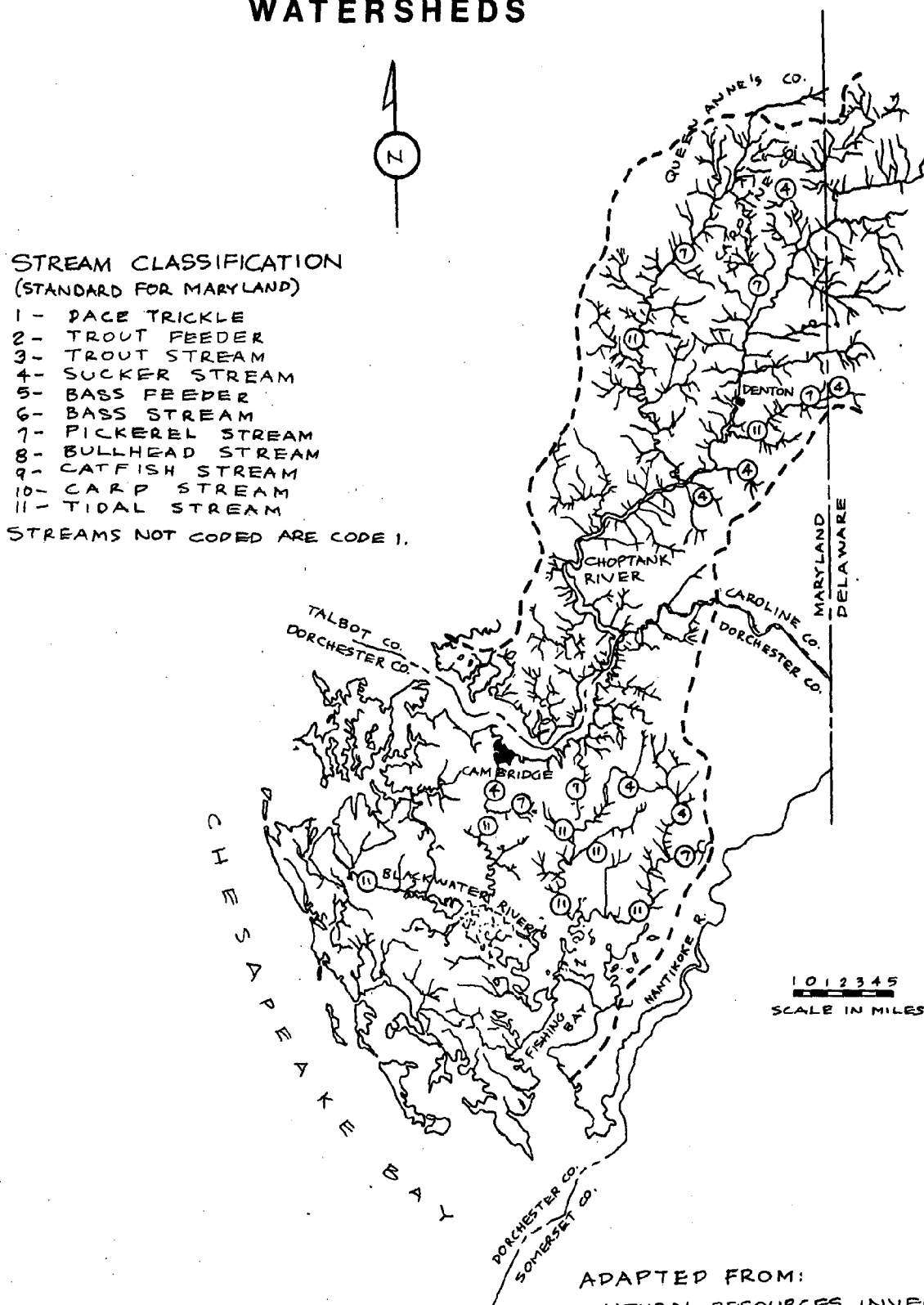


ADAPTED FROM:
NATURAL RESOURCES INVENTORY
DEPARTMENT OF RESEARCH AND EDUCATION
SOLOMONS, MARYLAND

EASTERN BAY AREA AND CHESTER RIVER WATERSHED



CHOPTANK AND BLACKWATER RIVERS WATERSHEDS



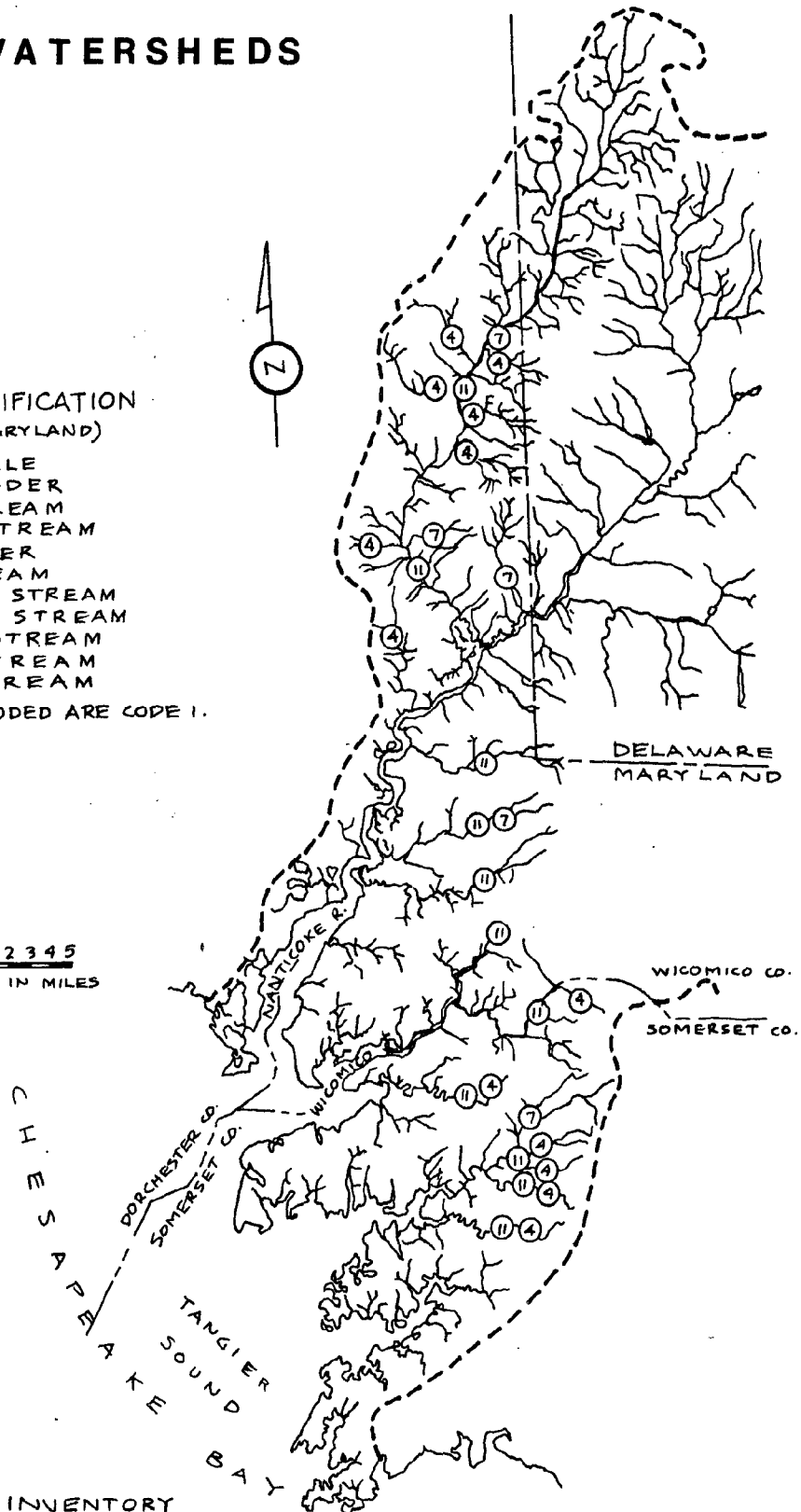
NANTICOKE AND WICOMICO RIVERS WATERSHEDS

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

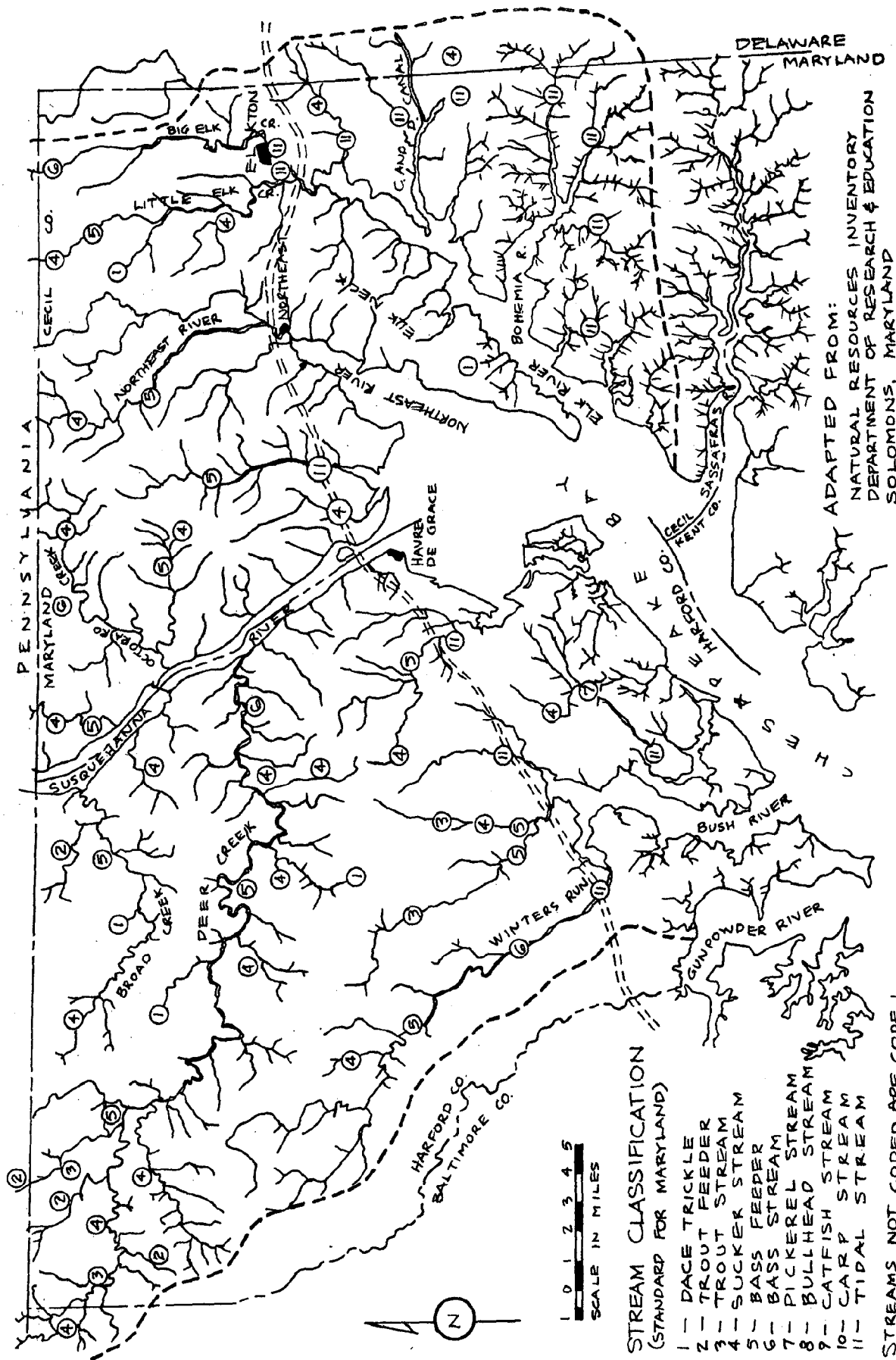
STREAMS NOT CODED ARE CODE 1.

1 0 1 2 3 4 5
SCALE IN MILES



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

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			--	B _p
Buttertown	C ⁺	1-2		.43	B ₂
Chillum	C ⁺	5	*	.32	B ₂
Christiana	B	5	.*	.37	B ₃
Clay pits	D			--	B _p
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

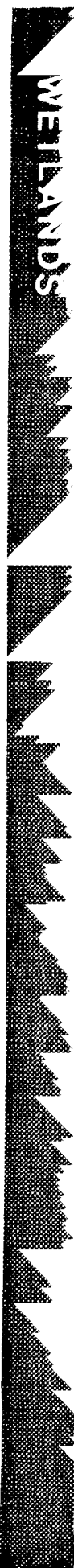
Soil Series	Runoff Potential Rating	Depth to Seasonal High Water Table	Well Drained Soils	Erodibility Coefficient	Natural Soil Group
Elkton	D+	0-1		.43	F ₃
Evesboro	B+	10	*	.17	A ₁
Fallsington	D+	0-1		.28	F ₁
Fort Mott	B+	5	*	.20	A ₁
Galestown	B+	5	*	.17	A ₁
Gravel pits	D			--	B _p
Johnston	D	0		.43	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			

<u>Size</u>	<u>Rank</u>
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

	<u>Cover Types</u>	<u>Site Types</u>	<u>Rank</u>
14. Upland-isolated	24	17,18,19	3.0
15. Upland-lakeside	23		2.5
16. Bottomland-isolated	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. Cover occupies less than 5 percent of wetland area.

Wetland Wildlife Categories - cont.

Surrounding Habitat Types

	<u>Habitats</u>	<u>Rank</u>
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

	<u>Rank</u>
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

	<u>Rank</u>
37	3.0
38	2.0
39	1.0

WETLAND WILDLIFE RATING

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

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 interspersions of cover and water; and vegetative interspersions. 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).

¹This 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.

²Reference: 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

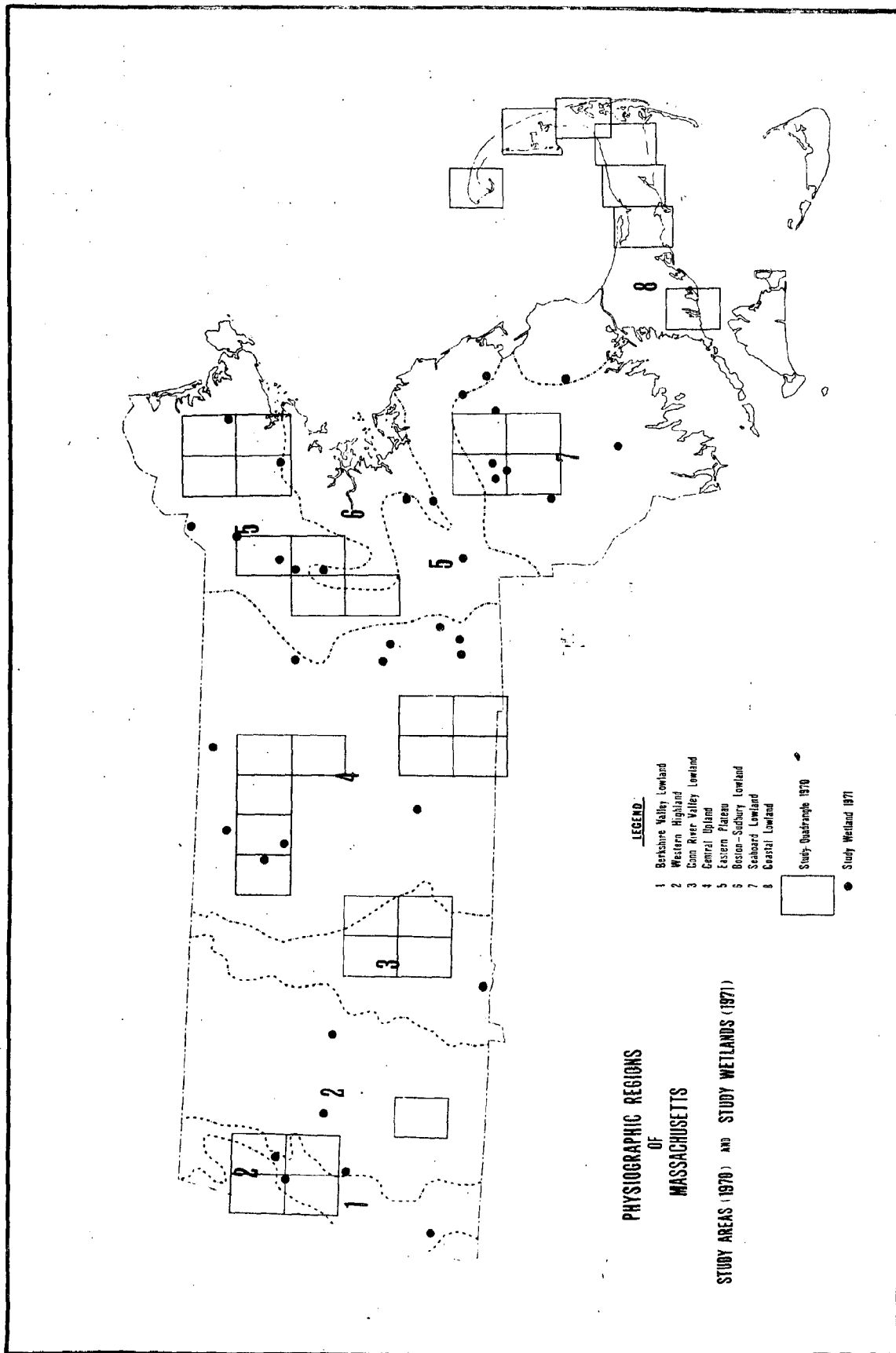


Figure 1. Physiographic regions of Massachusetts, study areas for wetland reconnaissance (1970) and high value study wetlands (1971).

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*).

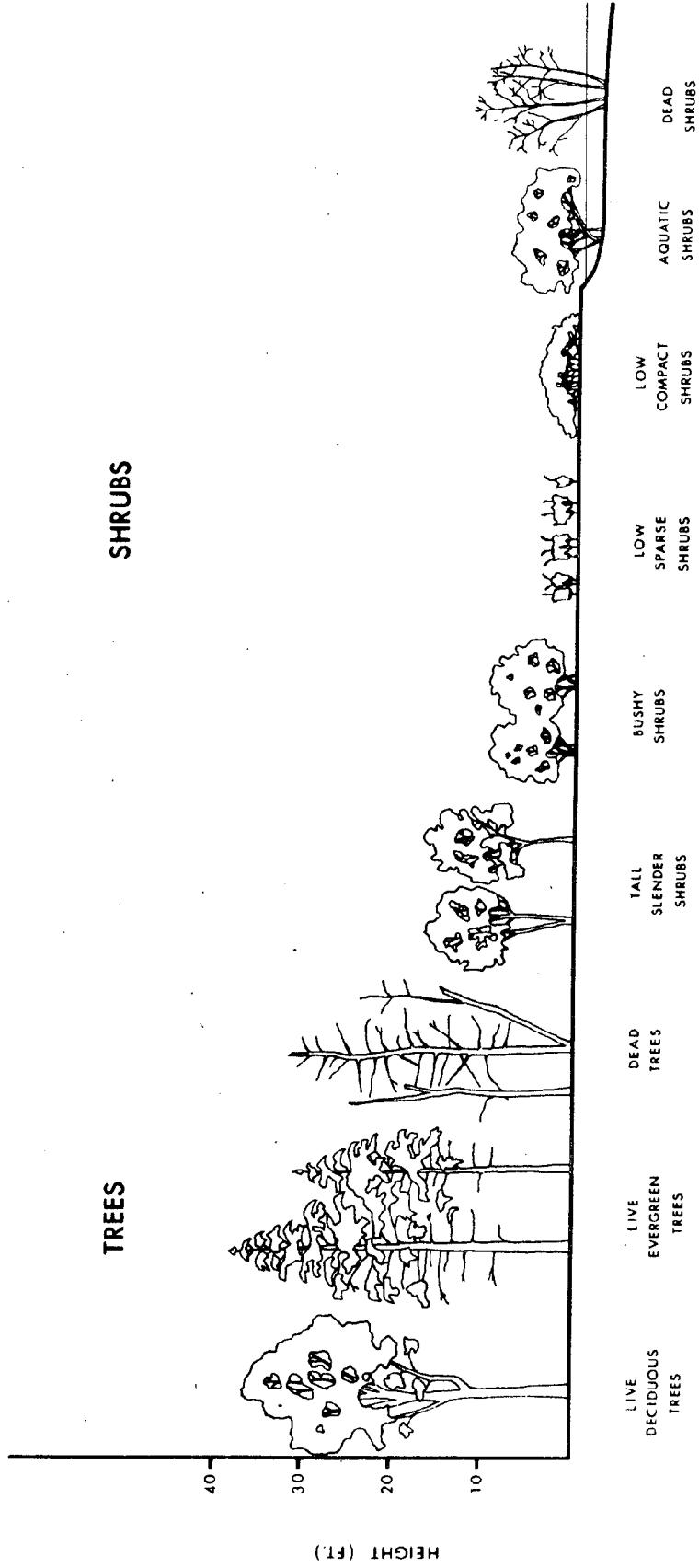


Figure 2. Sub-forms of wetland trees and shrubs.

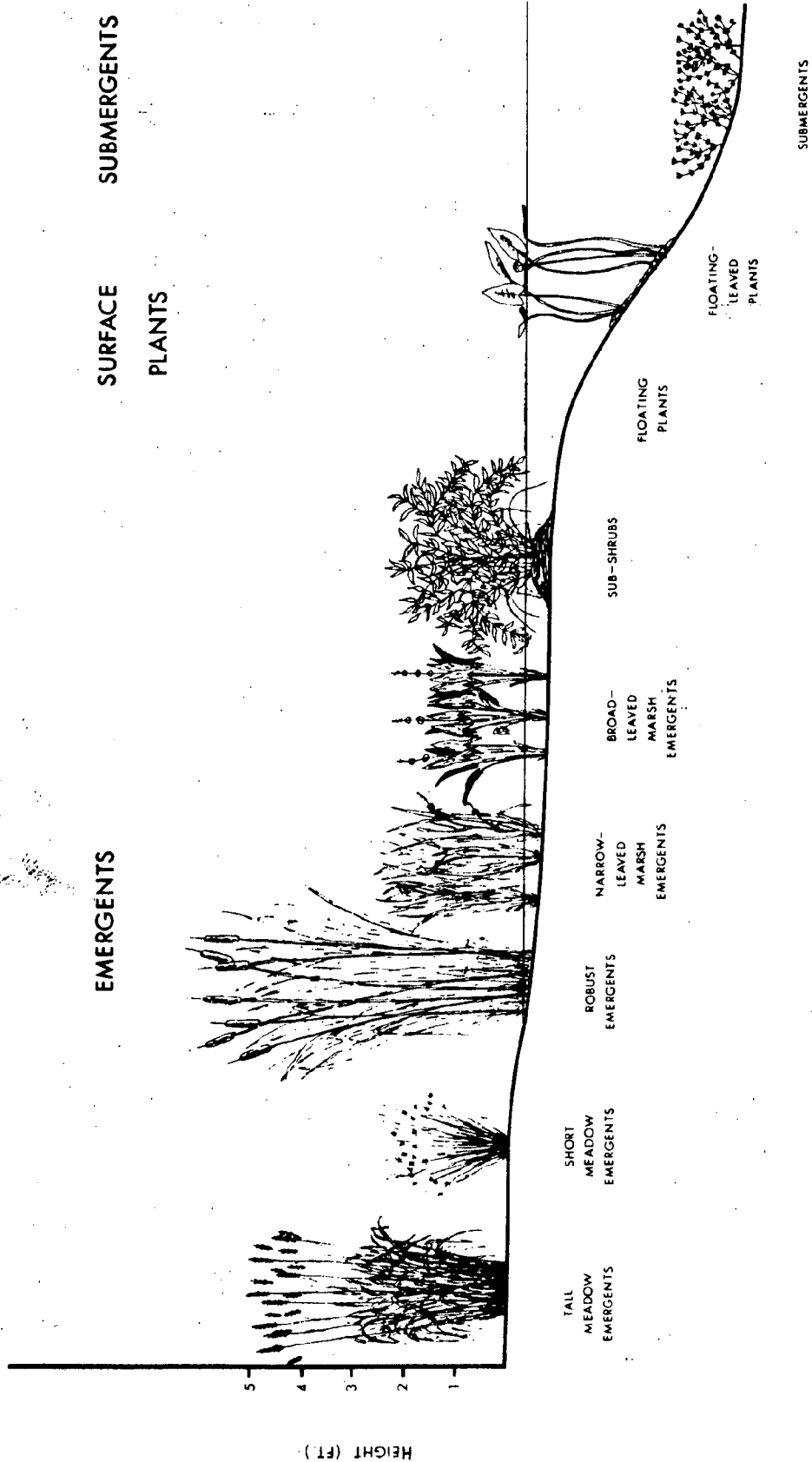


Figure 3. Sub-forms of wetland emergents, surface plants and submergents.

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 or 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 interspersions 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 interspersions 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.



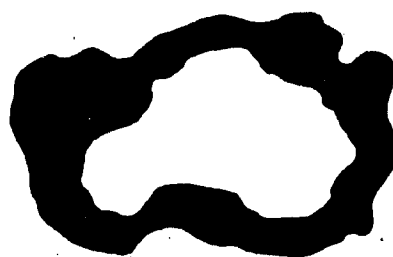
COVER TYPE 1



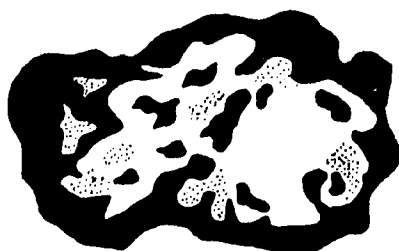
COVER TYPE 2



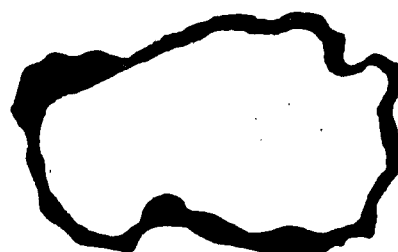
COVER TYPE 3



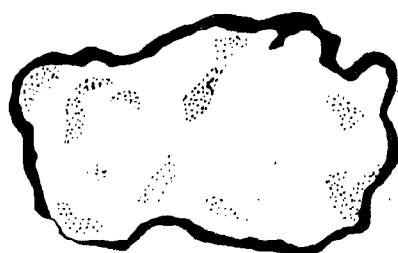
COVER TYPE 4



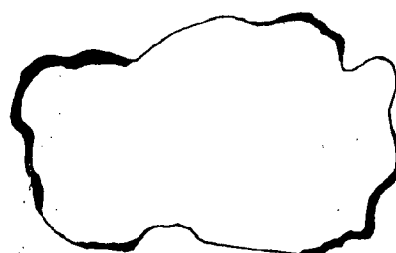
COVER TYPE 5



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.

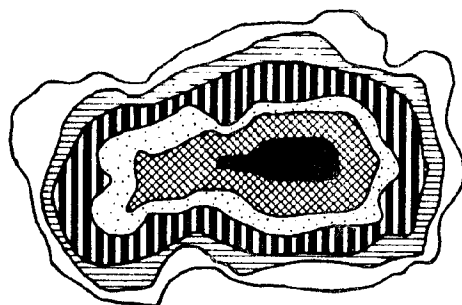
Surrounding habitat types. The nature of the surrounding habitat is a key feature determining a wetland's wildlife value. Waterfowl and most other wetland wildlife depend upon suitable surroundings for food and nest sites. The surrounding habitat types also determine what upland species are likely to 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

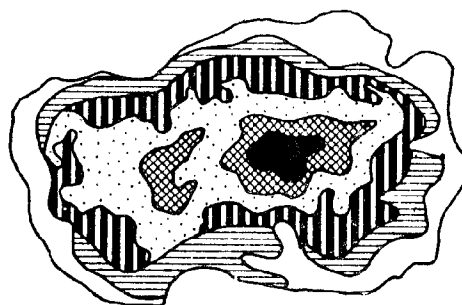
Additional descriptive components. The components described so far represent the most important ecological features determining a wetland's wildlife value. Two other components, wetland juxtaposition and water chemistry, are useful in wetland evaluation (see next section) but are not employed in classification.

Criteria for Wetland Evaluation

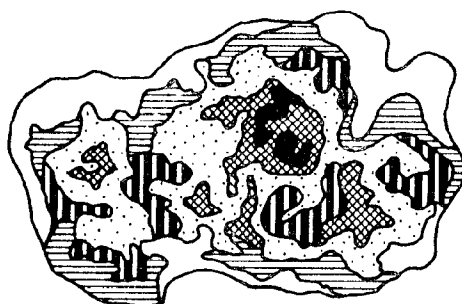
Once a wetland has been classified, evaluation is straightforward. Table 1 contains ten criteria and a relatively simple rating system. Each criterion has specifications describing three or more possible categories into which a given wetland might be placed. Specifications have been assigned ranks, ranging 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)
<u>Criteria</u>	<u>Specifications</u>				
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 bottomland - lakeside		upland - isolated

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

Table 1. (Continued)

Rank	(3.0)	(2.5)	(2.0)	(1.5)	(1.0)
<u>Criteria</u>	<u>Specifications</u>				
Wetland Juxtaposition (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 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 con- stitute more than 90% of surrounding habitat: 1. forestland 2. agricultural or open land 3. salt marsh	1 or more of fol- lowing constitute 50-90% of surrounding habitat: 1. forestland 2. agricultural or open land 3. salt marsh (or) 1 of preceding con- stitutes more than 90% of surrounding habitat.	1 or more of following con- stitute 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)
<u>Criteria</u>	<u>Specifications</u>				
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, especially 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 interspersions 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.

Literature Cited

- Beaumont, A. B. 1956. The soils of Massachusetts. Univ. Massachusetts Ext. Serv. Spec. Circ. No. 64. Amherst, Mass. 32 pp.
- Brooks, J. L. and E. S. Deevey, Jr. 1963. New England. Pp. 117-162. In Frey, D. G. (Ed.), Limnology in North America. Univ. Wisconsin Press, Madison, Wis. 734 pp.
- Fernald, M. L. 1950. Gray's manual of botany. 8th ed. American Book Co., N.Y. 1632 pp.
- Golet, F. C. 1972. Classification and evaluation of freshwater wetlands as wildlife habitat in the glaciated Northeast. Ph.D. Thesis. Univ. Massachusetts, Amherst, Mass. xv+ 179 pp.
- _____ and J. S. Larson. 1974. Classification of freshwater wetlands in the glaciated Northeast. U. S. Fish and Wildl. Serv. Resource Pub. No. 116. Washington, D.C. 56 pp.
- Jahn, L. R. and R. A. Hunt. 1964. Duck and coot ecology and management in Wisconsin. Wis. Conserv. Dept. Bull. No. 33. Madison, Wis. 212 pp.
- Juday, C. 1942. The summer standing crop of plants and animals in four Wisconsin lakes. Trans. Wis. Acad. Sci., Arts and Letters 34:103-135.
- Larson, J. S. 1971. Progress toward a decision-making model for public management of freshwater wetlands. Trans. N. Am. Wildl. and Nat. Resources Conf. 36:376-382.
- MacConnell, W. P. and L. E. Garvin. 1956. Cover mapping a state from aerial photographs. Photogrammetric Engineering 22(4):702-707.

- MacConnell, W. P. and H. R. Pywell. 1969. Use of aerial photographs to evaluate the recreational resources of the Connecticut River in Connecticut. Univ. Massachusetts Agr. Exp. Sta. Bull. No. 574. Amherst, Mass. 73 pp.
- Martin, A. C., N. Hotchkiss, F. M. Uhler and W. S. Bourn. 1953. Classification of wetlands of the United States. U. S. Fish and Wildl. Serv. Spec. Sci. Rept. No. 20. Washington, D. C. 14 pp.
- McGilvrey, F. B. (Ed.) 1968. A guide to wood duck production habitat requirements. U. S. Fish and Wildl. Serv. Resource Pub. No. 60. Washington, D.C. 32 pp.
- Mendall, H. L. 1958. The ring-necked duck in the Northeast. Univ. Maine Bull. 60(16). 320 pp.
- Moizuk, G. A. and R. B. Livingston. 1966. Ecology of red maple in a Massachusetts upland bog. Ecol. 47(6):942-950.
- Motts, W. S. and M. Sainès. 1969. The occurrence and characteristics of ground-water contamination in Massachusetts. Univ. Massachusetts Water Resources Research Center Pub. No. 7. Amherst, Mass. 70 pp.
- Moyle, J. B. 1945. Some chemical factors influencing the distribution of aquatic plants in Minnesota. Am. Midland Naturalist 34(2):402-420.
- _____. 1946. Some indices of lake productivity. Trans. Am. Fisheries Soc. 76:322-334.
- Office of River Basin Studies. 1954. Wetlands inventory of Massachusetts. U.S. Fish and Wildl. Serv., Boston, Mass. 14 pp.+ appendices.
- Shaw, S. P. and G. C. Fredine. 1956. Wetlands of the United States. U. S. Fish and Wildl. Serv. Circ. No. 39. Washington, D.C. 67 pp.
- Stewart, R. E. and H. A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. U. S. Fish and Wildl. Serv. Resources Pub. No. 92. Washington, D. C. 57 pp.
- Weller, M. W. 1964. Ecology. In Delacour, J. (Ed.), The waterfowl of the World. Country Life, Ltd., London. Vol. 4. 364 pp.
- _____. and C. S. Spatcher. 1965. Role of habitat in the distribution and abundance of marsh birds. Iowa Agr. and Home Econ. Exp. Sta. Spec. Rept. No. 43. Iowa State Univ. of Sci. and Tech., Ames, Iowa. 31 pp.
- Williams, C. S. and W. H. Marshall. 1938. Evaluation of nesting cover for waterfowl on Bear River Refuge. Trans. N. Am. Wildl. Conf. 3:640-646.

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 (terrestrial 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 di-
versity 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 susceptibility, 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 Marker Tim O'Meara George Robbins Eric See Arthur Tai

REFERENCES

BIBLIOGRAPHY

MARYLAND AND CHESAPEAKE BAY REGIONAL STUDIES

- Besley, F. W., 1916. The Forests of Maryland. Maryland State Board of Forestry, Baltimore, 152 pp. (With county maps).
- Brodie, J.E. and Nolley, J., 1974. Maryland's Primary Wood Industry. Department of Natural Resources, Annapolis: Md., 59 pp.
- Cleaves, E., 1968. Geological Map of Maryland, Maryland Geological Survey.
- Cohen, S.M. and McErlean, A.J., 1972. A Cross-Reference Index to Current (1971-1972) Biological and Biology-Related Research on Chesapeake Bay, Washington, D.C.: Smithsonian Institution, College Park: University of Maryland, Gloucester Point: Virginia Institute of Marine Science, 60 pp. plus 161 pp. Addendum.
Inventory of Research Preliminary to Corps. of Engineers Study.
- Ferguson, R.H., 1967. The Timber Resources of Maryland, U.S.D.A. Resource Bulletin NE-7, Upper Darby: NE Forest Experimental Station, 93 pp.
- Footner, Hulbert, 1944. Rivers of the Eastern Shore, 375 pp.
- Lippson, A.J., 1973. The Chesapeake Bay in Maryland-An Atlas of Natural Resources, Baltimore, Johns Hopkins Press, 56 pp. (Maps).
Excellent Description of Species Dynamics in Bay.
- Maryland Department Forests and Parks, 1966. Maryland State Parks: A Master Plan for Outdoor Recreation, 1967-1976, 27 pp.
- Maryland Department Forests and Parks, 1971. Maryland State Parks-Action Program for Development.
Detailed Development Phasing of Individual Parks.
- Maryland Department of Natural Resources, 1970. A Guide to Maryland's Public Hunting Areas, 49 pp.
- Maryland Department of State Planning, 1970. Maryland Outdoor Recreation and Open Space Concept Plan.
- Maryland Department of State Planning, 1970. Scenic Rivers in Maryland, 40 pp. (With Maps).
Surveys 7 Rivers (Including Pocomoke) and outlines State Plans for Preservation and Development.
- Maryland Department of State Planning, 1973. Natural Soil Groups of Maryland, Pub. 199, 153 pp. and Tables.
- Maryland Department of State Planning, 1974. State and Federal Land Inventory, 68 pp. (With Maps).
- Maryland Department of State Planning, et. al., 1965. Classification and Inventory of Wildlife Habitats in Maryland, Baltimore, 74 pp.

- Maryland Department of State Planning, Maryland Geological Survey, U.S. Geological Survey, 1969. Groundwater Aquifers and Mineral Commodities of Maryland.
- Maryland Geological Survey, 1902. Cecil County, 32 pp. (With Maps).
Explores Geology, Soil, and Forest Resources.
- Maryland Geological Survey, 1926. Kent County, 184 pp. (With Maps).
Explores Geology, Forest, and Soil Resources.
- Maryland Geological Survey, 1926. Queen Anne's County, 174 pp. (With Maps).
Explores Geology, Soil, and Forest Resources.
- Maryland Geological Survey, 1926. Talbot County, 174 pp. (With Maps).
Explores Geology, Soil, and Forest Resources.
- Maryland Geological Survey General Report, 1906. Vol. 6.
Includes Descriptions of Physical Features, Geology, Soils, and History of each County.
- Maryland Geological Survey General Report, 1918. Vol. 10.
Includes Geographical Descriptions, Excursions, Natural Resources, and Water Bearing Formations by County.
- Murray, G.E., 1961. Geology of the Atlantic and Gulf Coastal Province of North America, NYC: Harper Bros., 692 pp.
- Natural History Society of Maryland, 1973. Endangered Amphibians and Reptiles of Maryland: A Special Report, Bulletin of the Maryland Herpetological Society, 9(3):42-93.
- Penfound, W.T., 1952. Southern Swamps and Marshes in Botanical Review. 18(G):413-446.
- Raymond, Parish, Pine, and Plavnick, 1973. The State of Maryland Historical Atlas, Annapolis: Maryland Department Economic and Community Development, Maryland Department of State Planning.
Good Geo-Referenced Overview of Historical Development from Indian Times. Illustrates Isolation of Eastern Shore.
- Shreve, Forrest, 1910. The Plant Life of Maryland, Maryland Weather Service Special Pub. 3:533 pp.
Excellent Analysis of Vegetation Areas as Related to Soil Geology, etc. (Good Introduction to Area).
- Soil Conservation Service, 1936. Soil Survey of Kent County, Maryland, Washington, D.C.: U.S.D.A. (Out of Print).
- Soil Conservation Service, 1957. Soil Survey of Dorchester County, Maryland, Washington, D.C.: U.S.D.A. (Maps Only).
- Soil Conservation Service, 1964. Soil Survey of Caroline County, Maryland, Washington, D.C.: U.S.D.A.
- Soil Conservation Service, 1966A. Soil Survey of Queen Anne's County, Maryland, Washington, D.C.: U.S.D.A.

- Soil Conservation Service, 1966B. Soil Survey of Somerset County, Maryland, Washington, D.C.: U.S.D.A.
- Soil Conservation Service, 1970A. Soil Survey of Talbot County, Maryland, Washington, D.C.: U.S.D.A.
- Soil Conservation Service, 1970B. Soil Survey of Wicomico County, Maryland, Washington, D.C.: U.S.D.A.
- Soil Conservation Service, 1973A. Soil Survey of Cecil County, Maryland, Washington, D.C.: U.S.D.A.
- Soil Conservation Service, 1973B. Soil Survey of Worcester County, Maryland, Washington, D.C.: U.S.D.A.
- Soil Conservation Service, 1975A. Delmarva River Basins Study -- Plan of Work (U.S.D.A. et. al.,) (A 3 State Cooperative Watershed Study, Primarily Agricultural).
- Soil Conservation Service, 1975B. Erodibility Factors (K) and Textures of the A, B, and C Horizons of Maryland Soils and Land Types, in Maryland Technical Guide, Appendix A-3, College Park: SCS (U.S.D.A.) 17 pp.
- Stewart, R.E., 1962. Waterfowl Populations in the Upper Chesapeake Region, Special Scientific Report-Wildlife No. 65, Washington, D.C.: Bur. Sport Fisheries and Wildlife (U.S. Department of Interior) 208 pp. (With Maps).
- Tatnall, R.R., 1946. Flora of Delaware and the Eastern Shore Wilmington: Society of Natural History of Delaware 313 pp. (With Maps).
Annotated Taxonomic Listing.
- Tinker, D.W. and Boynton, W., 1970. Assateague Ecological Studies Final Report, University of Maryland, Natural Resources Institute Contribution No. 446.
- Virginia Institute of Marine Science, 1974. Coastal Wetlands of Virginia: Interim Report 3, 52 pp.
- Vokes, H.E., 1957. (Revised 1968 by J. Edwards). Geography and Geology of Maryland, Maryland Geological Survey, Bulletin 19.
Companion to Cleaves, Geological Map of Maryland.
- Wallace, McHarg, Roberts, and Todd, 1972. Maryland Chesapeake Bay Study, 403 pp. (Describes Natural and Social Parameters Affecting Bay Planning).

EASTERN SHORE DISTRIBUTIONAL STUDIES

- Brown, R.G. and Brown, M.L., 1972. Woody Plants of Maryland, Port City Press, Baltimore, 347 pp.
Complete Taxonomic Reference for Trees, Shrubs and Vines.

Brush, Grace, 1975. (Unpublished). Forest Ecology of the Piedmont Region. Maryland, 50 pp. (With Distribution Maps).
Outlines Dr. Brush's Sampling Techniques.

Conant, Roger, 1945. An Annotated Check List of the Amphibians and Reptiles of the Delmarva Peninsula, Wilmington: The Society of Natural History of Delaware, 9 pp.

McCauley, Robert H., 1941. A Distributional Study of the Reptiles of Maryland and the District of Columbia PhD. Thesis: Cornell University, 75 pp.

Natural History Society of Maryland, 1969. The Amphibians and Reptiles of Maryland and The District of Columbia, in Bulletin of the Maryland Herpetological Society, 5(4), pp. 99-153. (Mainly Distributional Maps).

Paradiso, J.L., 1969. Mammals of Maryland, North America Fauna, No. 66, Washington D.C.: Bur. Sport Fisheries and Wildlife (U.S. Department of Interior) 194 pp. (Complete Listing with Distributions).

Robbins, Chandler, 1975. (Unpublished). Maps of Bird Species Ranges in Maryland, 167 pp.

Taylor, G. and Flyger V., 1973. Distribution of the Delmarva Fox Squirrel (*Sciurus Niger Cinereus*) in Maryland, in Chesapeake Science 15(1):59-60.

EASTERN SHORE NATURAL AREA INVENTORIES

Brush, Grace, 1975. Personal Communication - Vegetational Study Sites on The Eastern Shore.

Maryland Department of Natural Resources, 1973. Chesapeake Bay: Inventory of Potential Shoreline Access, Recreation and Open Space Areas: Part 2 The Eastern Shore (Unpublished).

Maryland Department of Natural Resources, 1973. Potential Wildlands in Maryland. (Inventory Keyed to Maps).

Maryland Department of State Planning, 1968. Catalog of Natural Areas in Maryland, State Planning, Publication, 148, Baltimore, 108 pp.
Early State Listing of Natural Area Sites.

Maryland Department of State Planning, 1975. (Unpublished) Inventory of Maryland Critical Areas.

Maryland Department of State Planning, Maryland Geological Survey,
U.S. Geological Survey, 1969. Catalog of Natural Areas in Maryland.

Metzgar, R.G., 1973. Wetlands in Maryland. Departments of State Planning, Natural Resources, and Comm. and Econ. Dev., Annapolis.
Discusses Ecological, Economic and Legal Aspects of Wetland Development or Preservation.

Smithsonian Institution on Center for Natural Areas, 1974A. Natural Areas
of the Chesapeake Bay Region: Ecological Priorities.
Site Inventory Plus Discussion of Ecological Parameters.

SITE OF SPECIES - RELATED RESEARCH ON EASTERN SHORE

- Beaven, G.F. and Oosting, 1939. Pocomoke Swamp: A Study of a Cypress Swamp on the Eastern Shore of Maryland, in Bulletin Torrey Botanical Club 66:364-389. (Excellent Vegetation Study Relating Cypress Area to Similar Ones Southward).
- Byron, G., 1968. Inside the Great Cypress Swamp of Sussex in Delaware Today, Part 1 in June-July 68, Part 2 in August-September.
- Carlson, C.W., 1968. Tilghman Island and Western Talbot County, Maryland, in Atlantic Naturalist 23(9):91-95.
- Conant, Roger, 1967. The Carpenter Frog in Maryland, In Bulletin, Maryland Herpetological Society, 3(2): pp. 41-42.
- Hansen, H.J., 1966. Pleistocene Stratigraphy of the Salisbury Area and its Relationship to the Lower Eastern Shore - A Subsurface Approach, Maryland Geological Survey Report of Investigations, No. 2.
- Joseph, S.R. and Bickley, W.E., 1969. Culiseta Melanura on the Eastern Shore of Maryland, College Park: Agricultural Experimental Station, Bulletin a-161, 69 pp.
- Little, E.L., Little S., and Doolittle, W.T., 1967. Natural Hybrids Among Pond, Loblolly and Pitch Pines, Upper Darby: Northeast Forest Exp. Station Research Paper NE-67, 22 pp.
- Little, S., 1959. Silvical Characteristics of Atlantic White Cedar, Upper Darby: Northeast Forest Exp. Station Paper, 118 pp.
- Little S. and Mohr, J.J., 1954. Reproducing Pine Stands of the Eastern Shore of Maryland, Upper Darby: U.S. Forest Service Northeast Exp. Station Paper NE-67, 11 pp.
- Little, S. and Mohr, J.J., 1963. Conditioning Loblolly Pine Stands in Eastern Maryland for Regeneration Upper Darby: Northeast Forest Exp. Station Research Paper NE-9, 21 pp.
- Little, S. and Mohr, J.J. and Spicer, L.L., 1958. Salt-Water Damage to Loblolly Pine Forests, In Journal of Forestry 56:1 pp. 27-28.
- Little S. and Somes, H.A., 1959. Viability of Loblolly Pine Seed Stored in the Forest Floor, In Journal of Forestry 57:11, pp. 848-849.
- Little S. and Somes, H.A., 1960. Sprouting of Loblolly Pine, In Journal of Forestry 58:3, pp. 195-197.
- Little S. and Somes, H.A., 1961. Prescribed Burning of the Pine Regions of Southern N.J. and Eastern Shore Maryland, Upper Darby: Northeast Forest Exp. Station Paper 151, 21 pp.

Maryland Geological Survey General Report, 1937. Vol. 13.
Includes Analysis of Upper Cretaceous Along C and D Canal.

Maryland Herpetological Society, 1963. The Spadefoot Toad in Maryland,
In Bulletin, Maryland Herpetological Society, 4(3):69-71.

Maryland Herpetological Society, 1966. New County Records from Maryland's
Eastern Shore, In Bulletin, Maryland Herpetological Society, 2(2):3-5.

Redmond, P.J.D., 1933. A Flora of Worcester County, Maryland, Washington
D.C.: Ph.D. Thesis, Catholic University, 104 pp.
Annotated Checklist - Not Complete.

Smith, Augustine, 1938. The Ecological Relations and Plant Successions in
Four Drained Mill Ponds of the Eastern Shore of Maryland, Washington,
D.C.: Ph.D. Thesis, Catholic University, W 1938, 40 pp.

Stine, C.J., 1967. Plants and Animals of a bit of Jungle on our Eastern
Shore, In Baltimore Sun, August 6, 1967.
Popular Description of Pocomoke Swamps.

Taylor, G. 1973. Present Status and Habitat Survey of the Delmarva Fox
Squirrel (*Sciurus Niger Cinereus*) with a Discussion of Reasons for
its Decline, College Park: Natural Resources Institute Publication
No. 555, 23 pp.

Wallace, McHarg, Roberts and Todd, 1974. Wye Island 3 Vols, Tech. Papers
for the Rouse Company, Columbia, Maryland.

PARAMETER RESEARCH

Allen, D.L., 1972. The Need for a North American Wildlife Policy, 37th
American Wildlife Conference pp. 46-53.

Antenucci, John, 1975. Maryland Department of State Planning, Baltimore,
Personal Communication,

Auberton, G.M. and Patrick J., 1972. Quality Water From Clear-Cut Forest
Land, In the Northern Logger and Timber Processor 20(8):14-15.

Avery, T.E., 1966. Foresters Guide to Aerial Photo Interpretation,
Washington, D.C.: U.S.D.A. Handbook 308, 40 pp.

Bay, R.R., 1967. Ground Water and Vegetation in Two Peat Bogs in Northern
Minnesota, In Ecology 48(2):308-310.

Bennett, L.J., 1938. The Blue-Winged Teal, It's Ecology and Management,
Ames: Collegiate Press, 144 pp.

Bent, A.C., 1926. Life Histories of North American Marsh Birds. Washington,
D.C.: Smithsonian Institution Bulletin, 135, 440 pp.

Betsen, Marius, and Joyce, 1968. Detection of Saturated Interflow in Soils
with Piezometers, In Soil Science Society of America.

- Betson, R.P., 1964. What is Watershed Runoff? In Journal of Geophysical Research 69(8):1541-1552.
- Bordmann, F.H., 1952. Factors Determining the Role of Loblolly Pine and Sweetgum in Early Oldfield Succession, Ph.D. Thesis: Duke University, 106 pp.
- Brandes, C.E., 1973. Methods of Synthesis for Ecological Planning, University of Pennsylvania, Masters Thesis, 97 pp.
- Braun, E. Lucy, 1972. Deciduous Forests of Eastern North American, NYC: Hafner, 596 pp.
- Brush, Grace, 1975. Department of Geography, Johns Hopkins University, Baltimore, Personal Communication.
- Buckman, H.O. and Brady, N.C., 1974 Ed. The Nature and Properties of Soils, NYC: The MacMillan Co. 653 pp.
- Bump, G. et. al., 1947. The Ruffed Grouse: Life History, Propagation, and Management, Buffalo: N.Y. State Conservation Department, 915 pp.
- Burt, W.H. and Grossenheider, R.P., 1964. A Field Guide to the Mammals, Boston: Houghton Mifflin Co. 284 pp.
- Burtis, James, 1975. Maryland Forest Service, Maryland Department of Natural Resources, Annapolis, Personal Communication.
- Caldwell, E.L., 1937. Pollution Flow from Pit Latrines When an Impervious Stratum Closely Underlies the Flow, In Infectious Disease 61:270-288.
- Caldwell, E.L., 1938. Studies of Subsoil Pollution in Relation to Possible Contamination of Ground Water from Human Excreta Deposited in Experimental Latrines, In Water Quality in a Stressed Environment. Wayne A. Pettyjohn, ed. 1972. Minneapolis: Burgess, pp. 207-208.
- Chiang, Sie-Ling, 1971. A Runoff Potential Rating Table for Soils, In Journal of Hydrology 13:54-62.
- Cody, M.L., 1974. Optimization in Ecology, In Science, 183:1156-1164.
- Conant, Roger, 1958. A Field Guide to Reptiles and Amphibians, Boston: Houghton Mifflin Co. 366 pp.
- Davis, S.N. and Dewiest, R.J.M., 1966. Hydrogeology, NYC: Wiley, 463 pp.
- Dunne, T., 1974. University of Washington, Department of Geological Sciences, Personal Communication.
- Dunne T. and Black, R.D., 1970A. An Experimental Investigation of Runoff Production in Permeable Soils, In Water Resources Research, 6(2):478-490.
- Emmett, W.W., 1970. The Hydraulics of Overland Flow on Hillslopes, Washington, D.C.: U.S. Geological Survey Prof. Paper 662-A.

- Environmental Protection Agency, 1973. Process and Procedures and Methods to Control Pollution Resulting From All Construction Activity, Washington, D.C.: EPA-430/9-73-007, 234 pp.
- Environmental Research Group, 1974. Maryland Executive Summary: Economic Survey of Wildlife Recreation, Atlanta: Georgia State University, 79 pp. (Plus Map).
- Erickson, Harold, 1975. Department of Biology, Towson College, Baltimore, Personal Communication.
- Federal Register, November 29, 1972. Coastal Zone Management Act of 1972.
- Foster, G.R. and Myer, L.D., 1972. Transport of Soil Particles by Shallow Flow, In Trans. ASAE, 15(1):99-102.
- Foster, G.R. and Wischmeier, W.H., 1973. Evaluating Irregular Slopes for Soil Loss Prediction, St. Joseph, Michigan: American Soc. Agricultural Engineers, Annual Meeting Paper No. 73-227.
- Fowells, H.A., 1965. Silvics of Forest Trees of the United States, Washington, D.C.: U.S.D.A. Agricultural Handbook, No. 271. 726 pp.
- Freeze, R.A., 1972B. Role of Subsurface Flow in Generating Surface Runoff, 2-Upstream Storage Areas, In Water Resources Research, 8(5):1272-1283.
- Frink, C.R., 1973. Testimony Presented at Department of Environmental Protection Hearings on Phosphates and Detergents, Hartford, Connecticut.
- Grubek, W.J. and Heald, W.R., 1974. Soluble Phosphate Output of An Agricultural Watershed in Pennsylvania, In Water Resource Research, 10(1): 113-118.
- Gleason, H., 1968. The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada, NYC:Hafner, 3 Volumes.
- Golet, F.C., 1973. Classification and Evaluation of Freshwater Wetlands As Wildlife Habitat in the Glaciated Northeast, Trans. Northeast Fish and Wildlife Conference 30:257-279.
Basis for Wildlife Measurement Used in This Study.
- Golet, F.C. and Larson, J.S., 1974. Classification of Freshwater Wetlands in the Glaciated Northeast, Washington, D.C.: U.S. Bureau of Sports, Fisheries, and Wildlife Resource Publication 116, 56 pp.
- Grice, D. and Rogers, J.P., 1965. The Wood Duck in Massachusetts, Boston: Massachusetts, Department of Fisheries and Game, Fed. Aid Project, W-19-R, 96 pp.
- Hack, J.R. and Goodlet, J.C., 1960. Geomorphology and Forest Ecology in a Mountain Region in the Central Appalachians, Washington, D.C.: U.S. Geological Survey Prof. Paper 347. 66 pp.
- Halla, Bud, 1975. Non-Game Program, Wildlife Administration, Maryland, Department of Natural Resources, Annapolis, Personal Communication.

- Hawkins, A.S. and Bellrose, F.C., 1940. Wood Duck Habitat Management In Illinois, In Transactions North American Wildlife Conference, 5:392-395.
- Hewlett, J.D., and Hibbert, A.R., 1967. Factors Affecting The Response of Small Watersheds to Precipitation in Humid Areas in (Sopper and Lull, Eds.) Forest Hydrology, pp. 275-290.
- Hewlett, J.D. and Nutter, W.L., 1970. The Varying Source Flow of Stream-flow From Upland Basins, In American Society of Civil Engineers, Procedures of the Symposium of Interdisciplinary Aspects of Watershed Management, Bozeman: Montana State University pp. 65-83.
- Hills, R.C., 1971. The Influence of Land Management and Soil Characteristics on Infiltration and the Occurrence of Overland Flow, In Journal of Hydrology, 13:163-181.
- Hochbaum, H.P., 1964. The Canvasback on a Prairie Marsh, Washington, D.C.: American Wildlife Institute, 201 pp.
- Horn, H.S., 1971. The Adaptive Geometry of Trees, Princeton: Princeton, University Press, 144 pp.
- Horton, R.E., 1933. The Role of Infiltration in the Hydrologic Cycle, In American Geographics Union Transactions, 14:446-460.
- Institute of Environmental Studies, University of Wisconsin, 1974. The Investigation of a Critical Resource Information Program for Wisconsin (CRIP) Phase 3 Report, Madison - IES Report 8, 426 pp.
- Institute of Environmental Studies, University of Wisconsin, 1975. Selected Conclusions Concerning Critical Area Data Needs, Critical Areas Workshop Working Paper 1.
- Jahn, L.R. and Hunt, R.A., 1964. Duck and Coot Ecology and Management In Wisconsin, Madison: Wisconsin Conservation Department Bulletin, No. 33, 212 pp.
- Jones and Stokes Associations, 1974. Development Guidelines For Areas of Statewide Critical Concern, Sacramento: California Office of Planning and Research, 228 pp.
- Kardos, L.R. and Sopper, W.E., 1972. Renovation of Municipal Wastewater Through Land Disposal by Spray Irrigation, In (Sopper and Kardos, Eds.) Recycling Treated Municipal Wastewater and Sludge Through Forest and Cropland, University Park: Pennsylvania State University, pp. 148-164.
- Klopfer, P.H., 1969. Habitats and Territories: A Study of the Use of Space of Animals, NYC: Basic Books, Inc. 117 pp.
- Kramer, H. William, 1975. Capital Programs, Maryland Department of Natural Resources, Annapolis, Personal Communication.
- Kuchler, A.A., 1973. Problems in Classifying and Mapping Vegetation for Ecological Regionalization, In Ecology, 54(3):512-523.

- Lee, C.H., 1942. Transpiration and Total Evaporation, In Mienzer O.E., (Ed.), Hydrology, NYC: Dover Publication Company.
- Leopold, Aldo, 1933. Game Management NYC: Scribners and Sons, 481 pp.
- Leopold, L.B., 1968. Hydrology for Urban Land Planning - A Guidebook on the Hydrologic Effects of Urban Land Use, Washington, D.C.: U.S. Geological Survey Circular 554, 18 pp.
- Leopold, L.B., 1969. Quantitative Comparison of Some Aesthetic Factors Among Rivers, Washington, D.C.: United States Geological Survey Circular 620.
- Linehon, Jones, and Langcore, 1967. Breeding Populations in Delawares Urban Woodlots, In Audubon Field Notes, 21(6):641-646.
- Loucks, O.L., 1970. Evolution of Diversity, Efficiency, and Community Stability, In National Zoologist, 10:17-25.
- Lyon, C.J. and Reiners, W.A., 1971. Natural Areas of New Hampshire Suitable for Ecological Research, Dartmouth College Department of Biological Sciences Publication 4, 75 pp.
- MacArthur, R.H., 1964. Environmental Factors Affecting Bird Species Diversity, In American Naturalist, 96:387-397.
- MacArthur, R.H. and MacArthur, J., 1961. On Bird Species Diversity, In Ecology, 42:594-598.
- MacArthur, R.H. and Wilson, E.O., 1967. The Theory of Island Biogeography, In Monograph of Population Biology 1, Princeton: Princeton University Press.
- Martin, Hotchkiss, Uhler, and Bourn, 1953. Classification of Wetlands of the United States, Washington, D.C.: U.S. Fish and Wildlife Service Special Scientific Report, No. 20, 14 pp.
- Maryland Department of Natural Resources, (MDNR) Capital Programs Administration, 1975. Five, Ten, and Twenty Year Plan.
- Maryland Department of Natural Resources, (MDNR) Wildlife Administration, 1975. Five, Ten, and Twenty Year Executive Planning Process.
- McGillvrey, F.B. (Ed.), 1968. A Guide to Wood Duck Production Habitat Requirements, Washington, D.C.: U.S. Fish and Wildlife Resource Publication, No. 60, 32 pp.
- Mendall, H.L., 1958. The Ring-Necked Duck in the Northeast, Augusta: University of Maine Bulletin, 60(16):1-317.
- Meyer, L.D. and Kramer, L.A., 1969. Relations Between Land-Slope Shape and Soil Erosion, In Agricultural Engineering, 50(9): 522-523, ASAE Paper No. 63-749.
- Muenschner, W.C., 1944. Aquatic Plants of the United States Ithaca; Cornell University Press, 374 pp.

- Nichols, Bruce, 1975. Soil Conservation Service, Salisbury, Maryland, Personal Communication.
- Niering, W.A. and Egler, F.E., 1966. The Natural Area of the Audubon Center of Greenwich, Hartford: Connecticut Geological and Natural History Survey 20 pp.
- Niering, W.A. and R.S. Warren, 1974. Tidal Wetlands of Connecticut - Vegetation and associated animal populations Vol 1. Department of Environmental Protection, State of Connecticut in Cooperation with the Bureau of Sports Fisheries and Wildlife, U.S. Department of the Interior.
- Orser, P.N. and Shure, D.L., 1972. Effects of Urbanization on the Salamander, *Desmognathus Fuscus*, *In Ecology*, 53(6):1148-1154.
- Peterson, R.T., 1947. A Field Guide to the Birds, Boston: Houghton Mifflin Company, 230 pp.
- Phillips, E.A., 1959. Methods of Vegetation Study, NYC: Holt, Rinehart and Winston, 107 pp.
- Ragan, R.M., 1968. An Experimental Investigation of Partial Area Contributions, *In Int. Assoc. Sci. Hydrol. Symp. Hydro. Publ.* 76:241-252.
- Reese, A.W., 1971. Manistee National Forest Classification Study.
- Reichle, D. (Ed.), 1970. Analysis of Temperate Forest Ecosystems, NYC: Springer-Verlag.
- Robinette, G.O., 1972. Plants, People, and Environmental Quality, Washington, D.C.: U.S. Forest Service.
- Romero, J.C., 1972. The Movement of Bacteria and Viruses Through Porous Media, Water Quality in a Stressed Environment, *In Petty John W.A., (Ed), Minneapolis: Burgess*, pp. 200-224.
- Ropp, Kenneth, 1975. Capital Programs, Maryland Department of Natural Resources, Annapolis, Personal Communication.
- Shaw, S.P. and Fredine, 1956. Wetlands of the United States, Washington, D.C.: U.S. Fish and Wildlife Service Circular 39, 67 pp.
- Siccama, Tom, 1973. Natural Areas of Rhode Island, 400 pp. 308 Inventoried Sites as Computer Print-out.
- Smithsonian Institution Center for Natural Areas, 1974A. Natural Areas of the Chesapeake Bay Region: Ecological Priorities.
- Smithsonian Institution Center for Natural Areas, 1974B. Planning Considerations for Statewide Inventories of Critical Environmental Areas: A Reference Guide (For U.S. Army Corps of Engineers), 274 pp.
- Society of American Foresters, 1975. Forest Cover Types of North America, 67 pp.
- Spencer, H. E., 1968. Man-Made Marshes for Maine Waterfowl, Augusta: Maine Department of Inland Fisheries and Game, Game Division Bulletin, No. 9, 79 pp.

- Stewart, R.E. and Kantrud, H.A., 1971. Classification of Natural Ponds and Lakes in the Glaciated Prairie Region, Washington, D.C.: U.S. Fish and Wildlife Service Resource Publication 92, 57 pp.
- Stiles and Crohurst, 1923. Movement of B.Coli in Ground Water With Resulting Pollution of Well, In Engineering Contracting, 60:100-102.
- Sullivan, A.L., 1973. Terrestrial Ecology and Impacts of Urbanization, In Wissahickon Watershed Study, Philadelphia: Regional Science Research Institute pp. 219-250.
- Tans, William, 1974. Priority Ranking of Biotic Natural Areas, The Michigan Botanist, Vol. 13.
- Ten Broeck, Craig, 1975. Environmental Review and Planning, Wildlife Administration, Maryland Department of Natural Resources, Annapolis, Personal Communication.
- Twining, C., 1975. Baltimore's Revolutionary Trees, In American Foresters, 81(5):13-15.
- Van Deusen, R.D., 1954. Maryland Freshwater Stream Classification by Watersheds, Chesapeake Biological Laboratory, Maryland Department of Research and Education, 30 pp.
- Vannote, Robin, 1975. Stroud Laboratory, Academy of Natural Sciences, Philadelphia, Personal Communication.
- Virginia Division of State Planning and Community Affairs, 1972. Critical Environmental Areas, Richmond.
- Weller, M.W., 1964. Ecology, pp. 80-107, In Delacour J. (Ed.) The Waterfowl of the World, London: Country Life Ltd., Vol. 4.
- Weller, M.W. and Spatcher, C.S., 1965. Role of Habitat in the Distribution and Abundance of Marsh Birds, Ames, Iowa: Iowa Agricultural and Home Economics Experiment Station Special Report 43, 31 pp.
- Weyman, D.R., 1970. Throughflow on Hillslopes and It's Relation to the Stream Hydrograph, In Bulletin of Intern. Assoc. of Scientific Hydrology, 15(2):25-33.
- Wherry, Edgar T., 1961. The Fern Guide, Garden City: Doubleday and Company, 318 pp.
- Whipkey, 1965. Subsurface Stormflow From Forested Slopes, In Bulletin of Intern. Assoc. of Scientific Hydrology, 10(2):74-85.
- Williams, C.S. and Marshall, W.H., 1938. Evaluation of Nesting Cover for Waterfowl on Bear River Refuge, In Transactions North American Wildlife Conference, 3:640-646.
- Wisconsin Scientific Areas, Madison: Department of Natural Resources.
- Wolman, G.M., 1964. Problems Posed by Sediment Derived From Construction Activities in Maryland, Annapolis: Report of the Maryland Water Pollution Control Commission, 125 pp.

Wright, W.R. and Foss, J.E., 1972. Contributions of Clay and Organic Matter to the Cation Exchange Capacity of Maryland Soils, In Soil Science of America prdgs, 36(1):115-118.

Young, R.A. and Mutchler, C.K., 1969. Soil Movement on Irregular Slopes, Water Resources Research, 5(5):1084-1089.

Young, R.A. and Wiersma, 1973. The role of Rainfall Impact in Soil Detachment and Transport, Water Resources Research 9(6):1629-1634.

Zube, E.H., 1973. Rating the everyday Rural Landscape of the Northeastern United States, Landscape Architecture 63(4):370-375.

