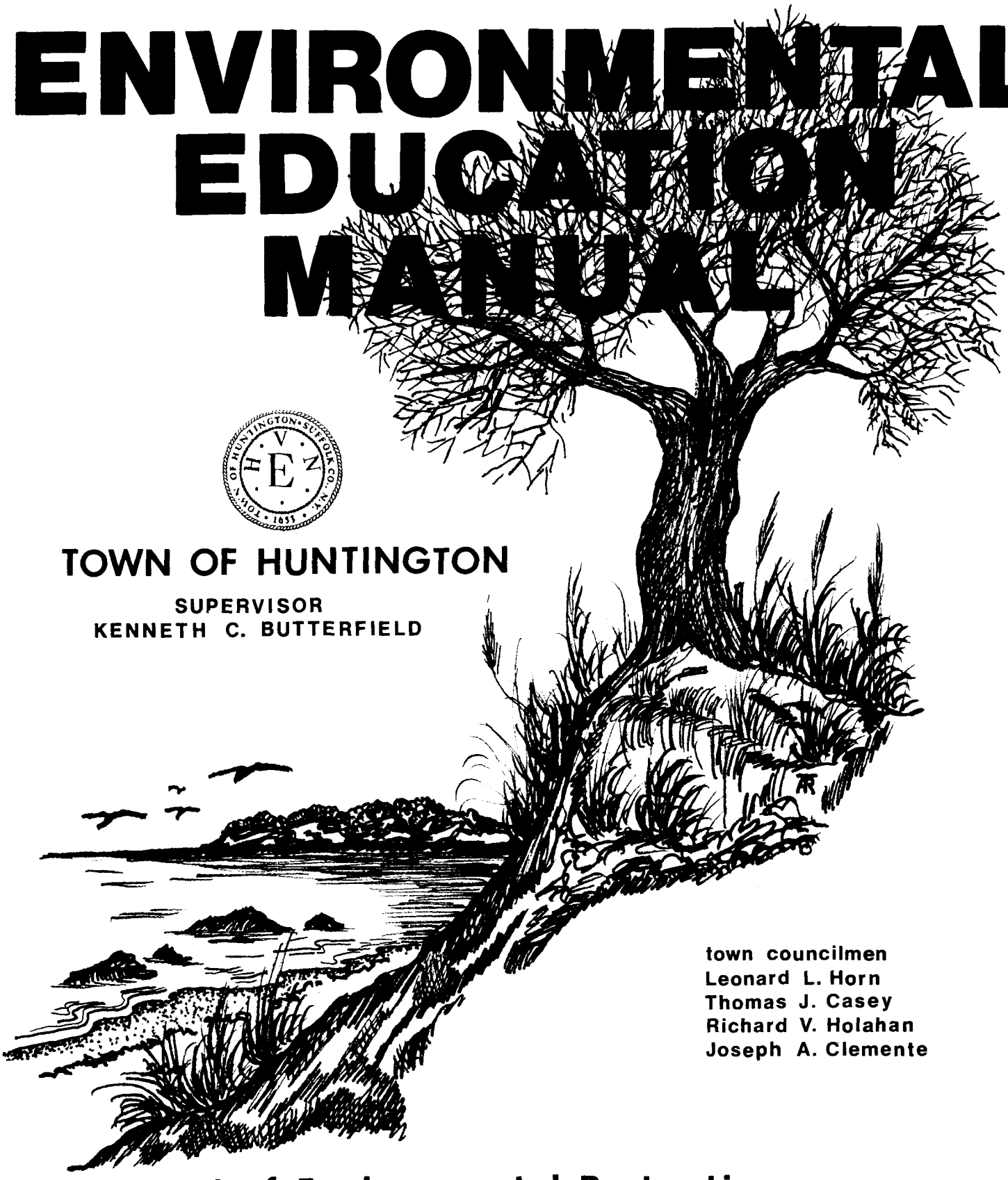
ENVIRONMENTAL EDUCATION MANUAL



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ENVIRONMENTAL EDUCATION MANUAL

revised edition

PREPARED BY

The Department of Environmental Protection

Town of Huntington, New York

1977

This manual is a compilation of instructors' notes and lecture materials prepared for the Environmental Education Program of the Department of Environmental Protection, Town of Huntington, New York

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This Environmental Educational Manual was developed as a group effort by the Department of Environmental Protection of the Town of Huntington.

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PREFACE

Responding to the needs of our local school districts, Huntington's Department of Environmental Protection conceived and developed an Environmental Education Program that is designed to provide educators in our public schools with a broad background in fundamental environmental science. Emphasizing local ecology, the program will make them aware of the environmental issues that face their community today and acquaint them with the resources available within the Township of Huntington that can be used as outdoor learning laboratories for their classes.

A major goal of this project is, of course, to enable our school districts to provide a higher level of environmental education for our students so that as adults, they will understand the impact that their decisions will have on our natural resources.

Long Island, taken as a whole, is the environment in which we live. It is, however, composed of a number of different, smaller environments which include freshwater ponds, the salt water of Long Island Sound, hills and flatlands, dense forests, agricultural land and marshlands. Each has evolved in its own manner and is composed of its own ecosystems or relationships between living organisms and the non-living environment. Many are fragile microcosms of life in which the balance of nature is tenuously maintained.

The lecture series will discuss many of these diverse environments and ecosystems, explaining how those of us who live in Huntington are affected by and affect them.

The fertility of the soil, the availability of fresh water, the quality and quantity of shellfish and finfish, the quality of air and the beauty of our forests and meadows, are our partners in life and will be discussed.

One of the more important messages that this educational program will emphasize is the uniqueness of much of the environment and many of the ecosystems of Long Island. Scientists have come to recognize that our geology, physiography, climate and hydrology are different than the surrounding areas of upstate New York, Connecticut and New Jersey, and, therefore, require more effort to understand and greater care to manage than previously anticipated.

Members of our community are just beginning to realize the magnitude of environmental issues. Sewer projects, solid waste disposal methods and alternative energy sources are large capital projects requiring intelligent, environmentally sound decisions. It is only through a complete understanding on the part of our teachers and their students of the environmental issues that face all of us, that these decisions will be made, not only today, but in the future. Decisions which will allow us to develop in harmony with, rather than in opposition to, the environment that sustains us all.

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LIST OF FIGURES

LECTURE #1

BASIC PRINCIPLES OF ECOLOGY

Our environment is everything that surrounds us

1. living
2. non-living

It influences our lives - something changed in our environment often causes a change in our life. Categories of environment:

1. man made
2. that which was here before man

Those things here before man are our natural resources:

air

fresh water

salt water

animals

trees

plants

and the earth itself with its minerals, topsoil and topography

Our natural resources are responsible for:

1. the quality of our lives
2. life itself

- Life is a constant exchange between living things and the environment that surrounds them.

- Living things take from their environment natural resources:
  - air
  - water
  - food

- They add to the environment waste products in the form of:
  - gases
  - liquids
  - solids

- Waste products of one living thing may be useful to another
  1. plants give off oxygen
  2. bacteria waste enhances soil

- Life is dependent upon:
  1. a relationship between living things and their non-living environment
  2. harmony within that relationship

- Ecology is the study of this relationship
  1. the interaction of living things with one another and their environment,
  2. the balance of nature

- There are many types of environments

    1. a city
    2. an open field
    3. a forest
    4. a pond
    5. a large harbor

  Each environment

    1. affects the living things within it
    2. has its own types of plants and animals
    3. has its own inter-relationships necessary for life within itself.

- Two basic parts of ecology common to all environments are:

    1. the community
    2. the ecosystem

- A community: Plants and animals that live together in any one environment and provide food for each other.

  An Ecosystem: The relationship between living and non-living things that sustains life.

- Superficially, ecosystems are different because each environment contains different types of plants, animals and relationships that have been built up between them.

- All ecosystems are, however, made up of four basic parts which allows a comparison to be made between them. These common units of all ecosystems are:

    1. Non-living materials including water, air and chemicals such as nitrogen and phosphorus, which are part of the ecosystem and found in the surrounding environment.
    2. Producers - living green plants which convert sunlight into energy rich foods that are used by most members of the community.
    3. Primary and secondary consumers
        A. Primary consumers are those that eat the food manufactured by the producers.
        B. Secondary consumers are animals that survive by eating the primary consumers.
    4. Decomposers - Bacteria and fungi that decompose or break down the complex chemicals of dead animals and plants, or their waste products, into simple substances so that they can be taken back into the ecosystem and used again by the community members.

- Ecosystems are cycles of nature that

    1. assure a healthy environment for the living and growing organisms within a community
    2. maintain the balance of nature
    3. assure harmony among living things.

- Ecosystems can be upset by:

    1. severe changes in physical factors such as temperature,
    2. the removal of an essential member of the ecosystem,
    3. the introduction into the system of a foreign material.

- Pollution - an excess of a material added into an environment that will upset the balance of its ecosystems.

- To pollute is to add some substance, harmful to living things into a normal, healthy environment. It can be a chemical, dust, gas or even a loud noise. It might even be a material normally found there but whose concentrations have now increased to the point where it is harmful.

- In studying environment and ecology with young people, it is beneficial to have them establish one or more of the actual ecosystems that exist within the environments that surround their homes or schools. A walk into a forest should include the identification of all the parts of at least one ecosystem found there. In this way they will more readily understand the interactions within nature and more readily understand the interactions between nature and man.

LECTURE #2

THE GEOLOGY OF LONG ISLAND

Long Island's landscape today is a complex mixture of hills valleys, beaches and streams, which all derive their origin from events taking place during different geologic eras.

These major periods of geological history and the activities that are known to have taken place during these periods of time are indicated in Figure 2-1.

The major geologic strata (Figure 2-1) that have formed and that are responsible for Long Island as we currently know it are:

1. Bedrock, located between 400 to 1000 feet below sea level, formed in Precambrian times more than 400 million years ago and composed of crystalline metamorphic and igneous rock.

-The bedrock under Long Island developed at an angle following a southeast trending slope.

2. Wedges of sands, clays and gravels ranging in thickness from 200 - 1200 feet, that rest on the bedrock and were formed during the Cretaceous Period.

-These sediments were formed from eroding applachian

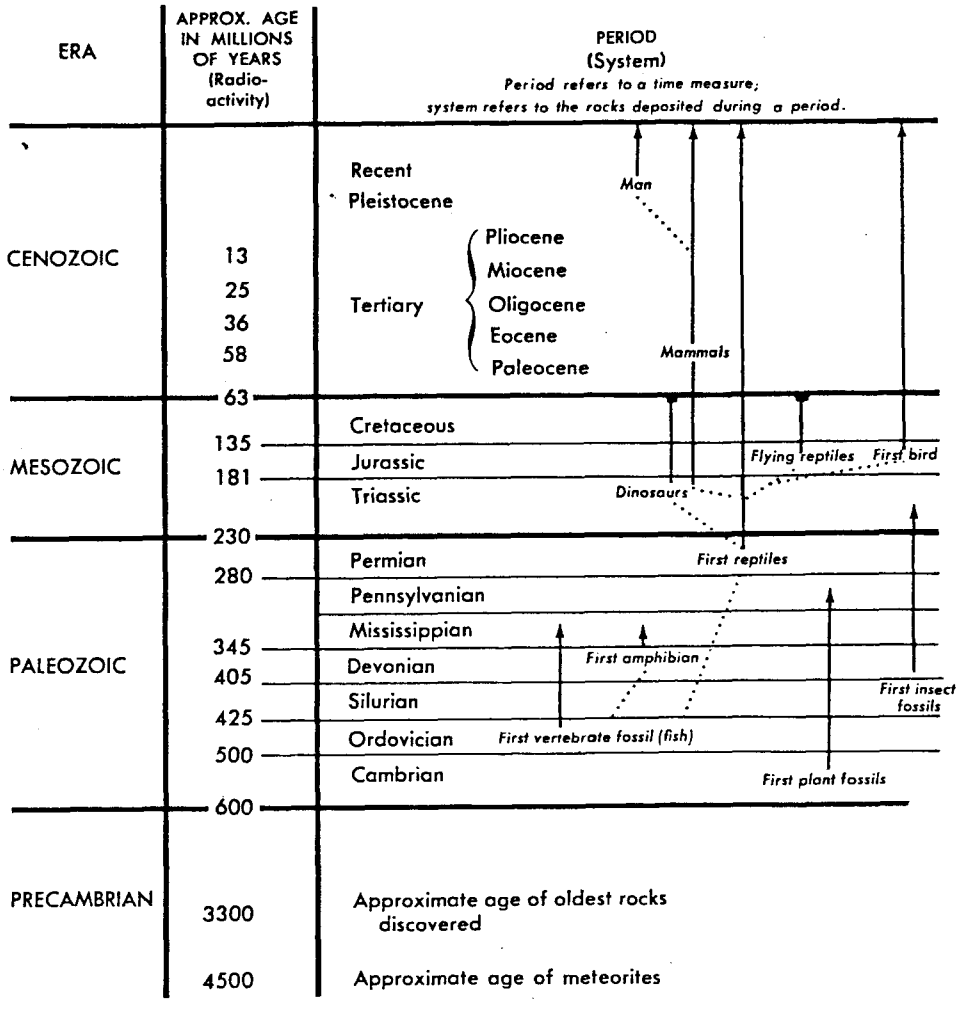

ERA
APPROX. AGE IN MILLIONS OF YEARS (Radio-activity)
PERIOD (System)
Period refers to a time measure; system refers to the rocks deposited during a period.
CENOZOIC
MESOZOIC
PALEOZOIC
PRECAMBRIAN
13
25
36
58
63
135
181
230
280
345
405
425
500
600
3300
4500
Recent
Pleistocene
Tertiary
Pliocene
Miocene
Oligocene
Eocene
Paleocene
Cretaceous
Jurassic
Triassic
Permian
Pennsylvanian
Mississippian
Devonian
Silurian
Ordovician
Cambrian
Approximate age of oldest rocks discovered
Approximate age of meteorites
Man
Mammals
Flying reptiles
First bird
Dinosaurs
First reptiles
First amphibian
First insect fossils
First vertebrate fossil (fish)
First plant fossils

Figure 2-1

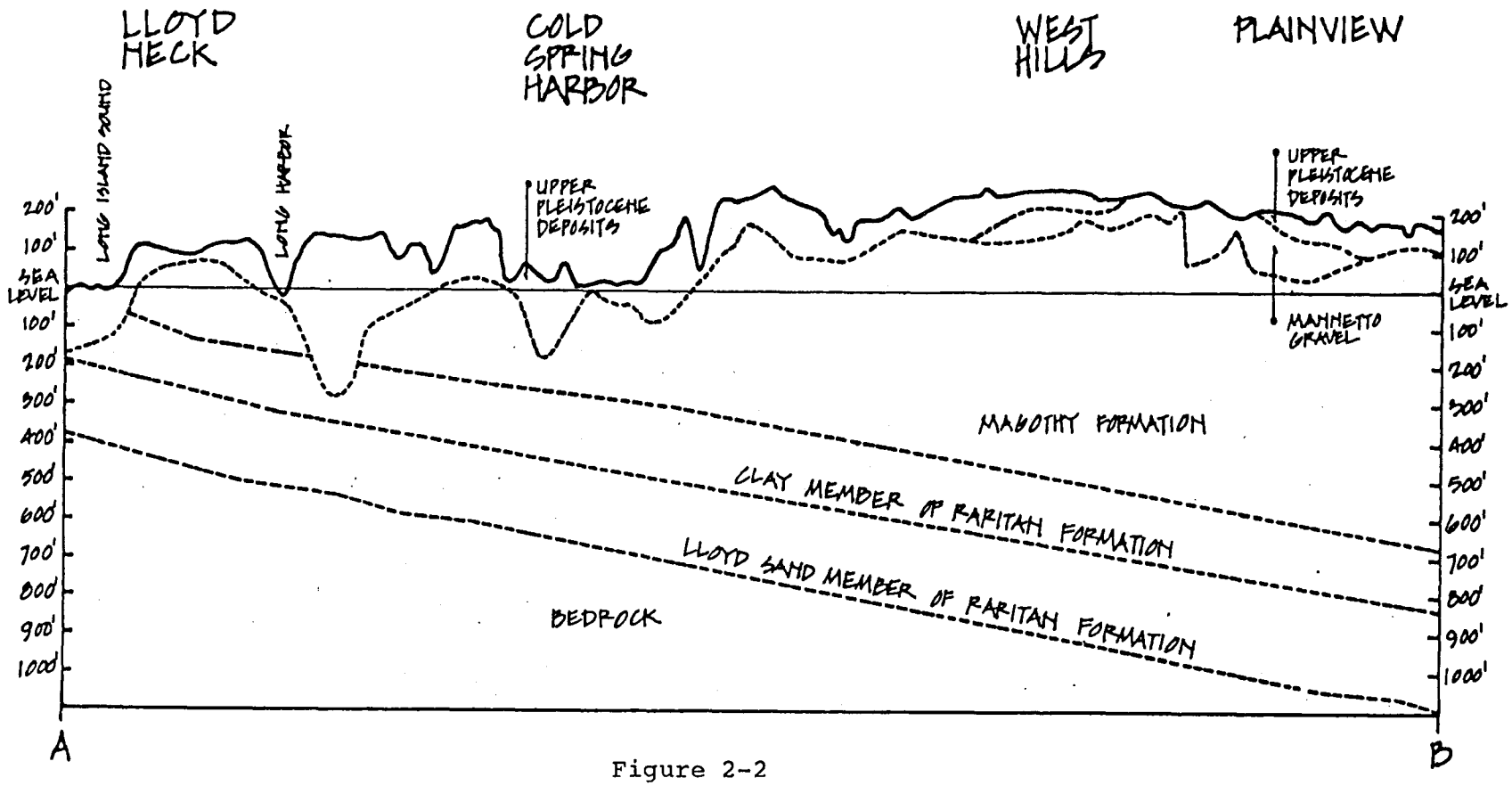


Figure 2-2

GEOLOGIC SECTION FROM LLOYD NECK TO PLAINVIEW, HUNTINGTON, NY

SOURCE; USGS WSP 1669-D

highlands on the mainland and carried to the low-lying coastal areas by rivers and streams.

-Cretaceous sediments are divided into three formations, the lowest or oldest is the Lloyd, the middle strata, the Raritan clay and the upper or most recent, the Magothy.

-All are predominantly unconsolidated gravel and sand, highly permeable and excellent for storing water.

-Because they do store water here on Long Island, they are referred to as aquifers.

3. An uppermost strata of clay, silt, sand and gravel, between 10 - 500 feet thick, that rests on the Magothy and was formed during the Pleistocene or age of glaciers.

-The Pleistocene was the most recent of the geological events to effect Long Island and had the greatest effect on its current shape, topography and land features.

-During the Pleistocene, which started approximately 300-400 thousand years ago, from two to five glaciers moved across Long Island.

-Each deposited sands and gravels that it pushed in front of it or left behind as it melted.

-The last of the massive continental glaciers that moved into this region occurred approximately 100,000 years ago, during what is known as the Wisconsin age of the Pleistocene period. It did the most to shape the surface of Long Island as we currently know it.

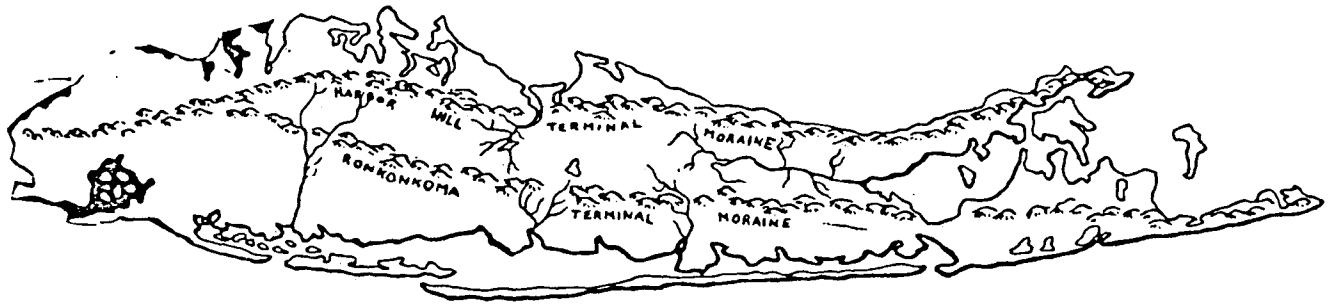
-This last large glacier moved across Long Island twice, stopping the first time almost midway down the center of the island and then retreating northward. When it moved south again, it stopped just landward of what is our current north shore.

-At the stationary melting fronts of each of these glacial advances, large accumulations of rock debris were deposited forming two prominent ridges (Figure 2-3) called terminal moraines. along the length of the middle of Long Island and the north shore.

-These hills, the Ronkonkoma and Harbor Hill terminal moraines are Long Island's most prominent land feature.

-When the glaciers melted, the melt water from the harbor hill position cut channels through the Ronkonkoma moraine forming natural valleys. Route 110 sits on one such valley through the Ronkonkoma moraine.

-The melt carried with it ground up soils, rocks and sands, moved southward and created the outwash plains to the south



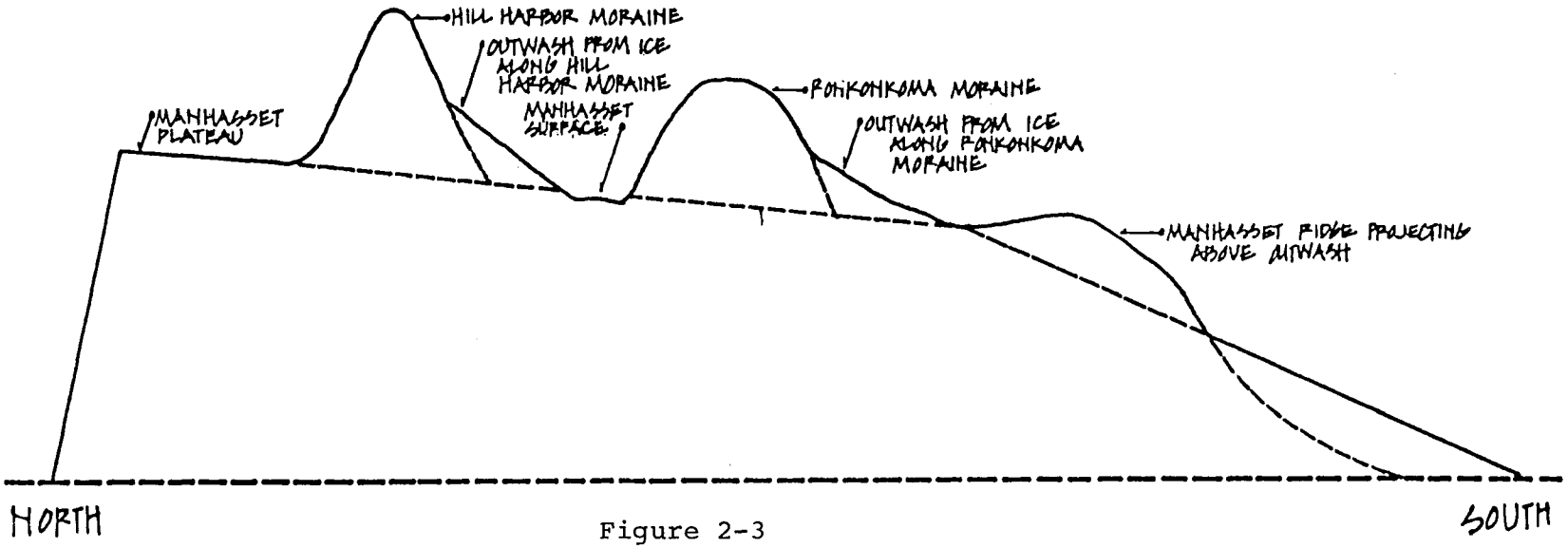


Figure 2-3

NORTH-SOUTH PROFILE OF LONG ISLAND

SOURCE; USGS PROFESSIONAL PAPER 82

of the Ronkonkoma range. This eventually led to the fine sand beaches of the south shore of Long Island.

-Glacial erratics or large boulders are found on Long Island as part of morainal deposits. These boulders were broken from rock formations in New England, carried here by the glacier and then dropped.

-Kettle lakes are another product of glacial ice. Large chunks of the glaciers broke off and sunk into the soft sand of the period. When they melted in warmer weather, small lakes and ponds called kettle lakes were created.

Lake Ronkonkoma is an example of a kettle lake.

Post Glacial Activity

-During the glacial period sea level was 350 feet below its present point.

-As the glaciers melted the seas increased in height and flooded over the north and south shores of the island to form a ragged appearing, deeply embayed coast.

-The most notable topographical changes on Long Island since the glaciers, have occurred at this coastline.

-Waves, wind and currents have eroded and reshaped the soft glacial sediments to form numerous sandy shoreline features such as the barrier beaches.

-On the less sheltered eastern portion of Long Island, wind, waves and currents have smoothed out the rough coastal features, producing a nearly straight shoreline.

-In the western half of Long Island, nature has not yet smoothed out the irregular character of the jagged coastline features.

-Long Island is classified as being in the geologic division of the United States known as the North Atlantic Coastal Plain. (Figure 2-4) Along with Cape Cod and a few other land masses on the Atlantic Coast, it is unique in that the majority of its underlying strata are composed of unconsolidated sands and gravels.

-Most other regions, including the rest of New York State, consists predominantly of Bedrock.

-It is the unconsolidated nature of Long Island's sub-strata which has enabled it to develop unique environments that require special considerations and management techniques.

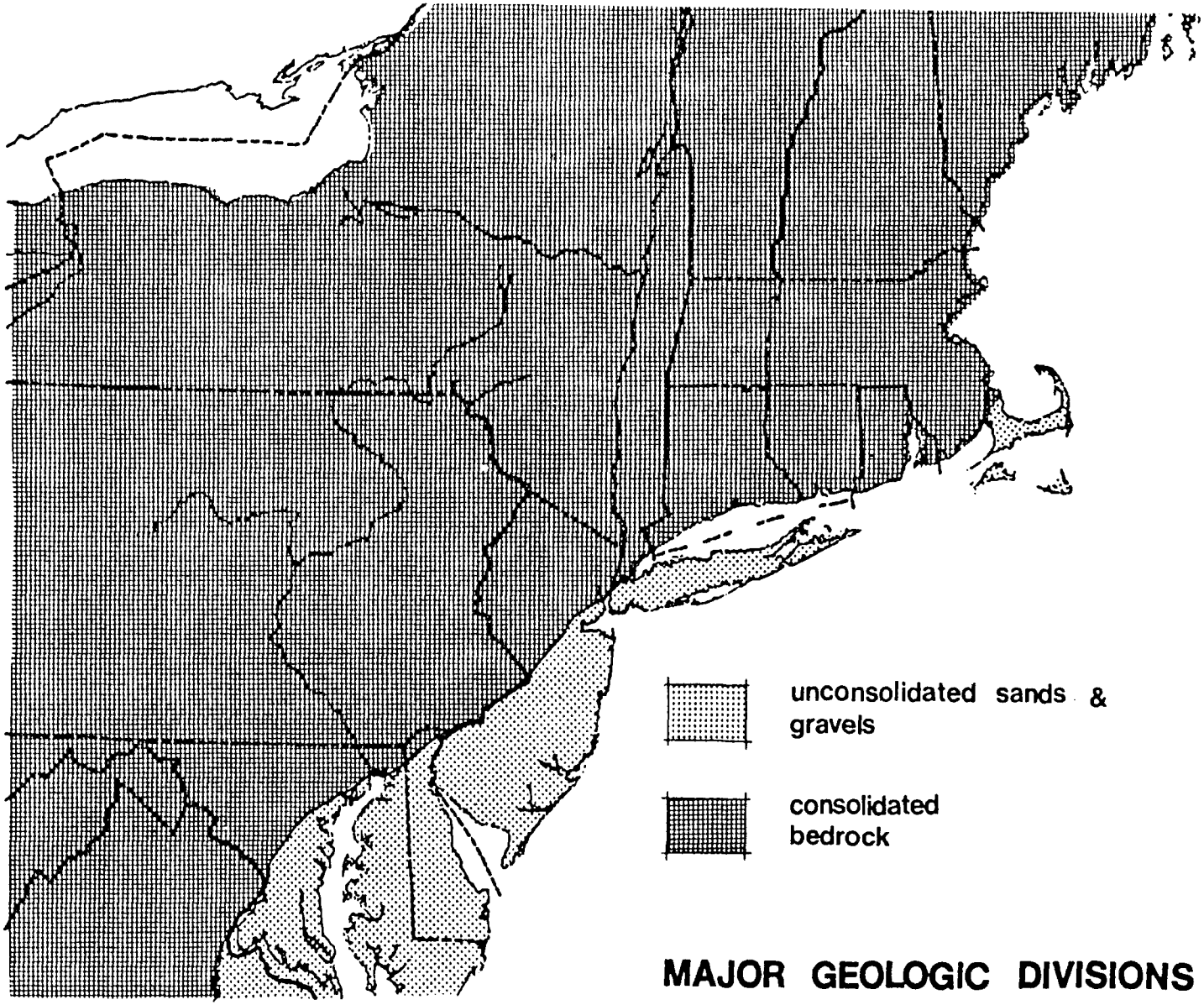


Figure 2-4

MAJOR GEOLOGIC DIVISIONS OF THE NORTH ATLANTIC STATES

SOURCE; U.S.G.S. GEOLOGIC MAP OF THE UNITED STATES, 1932

LECTURE #3

THE LAND

SOILS

I. Introduction

A. Importance of soil

1. basis of all life

2. determine location of various human activities

3. determine types of vegetation that grow

B. Lecture should aid in explaining soils to students

II. Soil Components - what combination of elements make up the soil

A. Weathered Rock Fragments - pieces of rock that have broken away from larger forms

1. chemical weathering - breakdown caused by chemical interaction between water and rock components

2. physical weathering - sloughing off (exfoliation) and fragmenting of larger rocks by freeze/thaw cycle and grinding/tree roots

B. Minerals - particles found within parent material

1. broken down by chemical reaction

C. Water : Air

1. percentage in soil is determined by the porosity of the soil

2. the larger the weathered rock fragments or grain, the more air

3. the smaller the grain, the more water held in the soil

Soils (continued)

D. Organic debris in the soil

1. built up by decaying material - "growth" part of the soil

2. upper layer of the soil

III. Origins of soil in Huntington

A. Basic soil mantle is the remnant of the last ice age

1. this material has been broken down over centuries, by chemical and physical weathering.

2. moved by wind and erosion to present locations over centuries

3. both climate and vegetation have a uniform character in Huntington

a. this means that any differences in soil are due to the original parent material and topography

1) glaciers brought parent material from long distances and varied locations

2) some soils tend to concentrate in lowlands, slopes or hilltops

IV. Soil Horizons or Strata - system of dividing the soil based on grain size, minerals, contour and organic content

A. "A" Horizon - upper level of soil

1. that part of the soil that concerns humans

a. necessary for plant life

b. contains almost all organic matter and organisms found in soils

Soils (continued)

c. highest concentration of minerals utilized by plants

B. "B" Horizon - middle layer of soil

1. contains the organic matter and chemicals leached from the "A" Horizon

2. difference in texture from "A"

3. lighter in color

C. "C" Horizon - bottom of soil profile

1. contains practically no organic matter

2. contains larger fragments of the parent material

V. Soil Classification

A. Samples taken from each acre of land and analyzed

1. grain size (principle soil determinant) or texture of soil ranges from clay (smallest) to silt and sand (largest)

a. experiment for students, using a sieve

2. other determinants

a. slope

b. porosity

c. location

3. loam contains a fraction of all three

B. Huntington's Soil - general characteristics

1. range from silt loam to sand

2. clay dominated soils are rarely found in Huntington

Soils (continued)

C. Huntington's Soils - specific characteristics

1. Haven and Riverhead soils are characterized by the following factors:

   a. deep, well drained

   b. level to gently sloping

   c. medium to coarse texture

   d. found on outwash plains

   e. formed in silty deposits overlying thick layers of coarse sands and gravels

2. Carver Plymouth soils

   a. deep, excessively drained

   b. coarse texture

   c. found on moraines

   d. little or no silt

   e. found on slopes - silt has been eroded out

3. Montauk soils

   a. deep, moderately well drained

   b. medium textured to coarse

   c. located on moraines

   d. largely silt loam

   e. fragipan development may restrict water movement

Soils (continued)

4. general location of various soil types
    a. soil location is complicated by relocation of various soils due to erosion and redeposition
    b. silt loams on plateaus
    c. loam and sandy soils on the edge of slopes
    d. sandy soils are invariably found on steep slopes
    e. loam and silt loam eroded from hillsides is deposited in the valleys

VI. Soil Erosion

A. Definition
    1. process of detachment of soil particles
    2. on-going process natural to all land forms
        a. lost soil is replaced by decaying material - natural balance
    3. attainment of base level - sea level

B. Types of erosion
    1. water erosion in process
        a. sheet erosion
            1) rain falls faster than it can be absorbed by the ground
        b. rill erosion
            1) suspended particles are fed into crop rows
            2) least noticeable process of erosion in

Soils (continued)

Huntington, but most important in terms of total soil loss and sediment contribution

c. gully erosion

1) concentration of water from sheet and rill erosion into larger water courses

2) due to high permeability of Huntington soils, rill and gully erosion are only prevalent on fields stripped of vegetative cover

2. wind erosion (Aeolian)

a. occurs on dry soils

b. removes tinest particles, leaving coarser, poorer soil

3. mass wasting

a. slumping

b. spontaneous action

c. observed where clay sublayer acts as a lubricant

d. found along bluffs by shoreline and in old and new strip mine sites

4. coastal erosion

a. movement of material along coast

1) erosion and accretion

a) responsible for development of cliffs

b) loss of bluffs

Soils (continued)

VII. Soil types and plant associations

A. There is not a precise correlation between specific soil groups and plant association, but a relationship does exist

1. only general categories are found

2. "A" Horizon is the determining factor in a soil/plant association

a. morainic soil deposits

1) canopy - oaks, maples, cherry

2) understory - huckleberry, dogwoods, mt. laurel

b. outwash plains (sandy soils)

1) development of pine barrens

2) sparser growth - due to higher porosity and leaching out of minerals and organic matter

c. when groundwater occurs near the surface

1) the decay or organic matter is retarded

2) this matter accumulates resulting in peat bogs

3) red maples and blueberry, red cedar and greenbriar are found

3. difficult to determine precisely which soil will support which plants

a. beyond the detail needed here

Soils (continued)

VIII. Conclusion

A. Importance of soil as a determinant in location of human activities

B. Existing relationship between plants and soils

LECTURE #4

VEGETATION

I. Introduction - vegetation is a major feature in the landscape

A. Something we are always aware of

B. Important to understand where they grow and why they grow in certain locations

II. Needs and uses of vegetation

A. Retention of soil on the land

1. slows erosion by a breaking rainfall impact and holding the soil in place (roots)

B. Purification of the air

1. exchange of gases

2. effect on climate

a. retention of moisture

b. change of wind patterns

c. absorption of solar energy

C. Aesthetic Appeal

1. softening of landscape

2. signal of seasonal changes

III. Definitions

A. Plant Succession

1. Process by which an area develops from Pioneer Growth to Climax Forest

a. tolerant plants take hold

1) grasses

2) low shrubs

b. weed trees develop in protected ground (tolerant trees)

1) black cherry

2) sumac

a) plants able to withstand wind and sun exposure

b) able to grow in thin soils - aid in building up soils

c. weed trees provide shade for seedling growth of less tolerant trees

d. soil sufficiently developed to allow growth of climax forest

1) eventually climax trees shade out weed trees of intermediate stage

2) enrich soils with leaves and debris of climax plants.

IV. Examples of vegetative types in Huntington

A. Pioneer Association (Figure 4-1)

1. first vegetation to become established following natural or human disruption

a. tolerant - plant able to withstand harsh climate and poor soils

1) beard grass and goldenrod found in fields around Huntington

2) first woody vegetation found to grow in Huntington area

a) red cedar (Juniperus virginiana)

b) myrtle (Myrica carolinensis)

c) black cherry (Prunus serotina)

(1) predominant weed tree

(2) quick-growing

(3) quick germination

d) sumac

3) plants developing on poor soils

a) green briar (Smilax)

b) poison ivy (Toxicodendron radicans)

c) honeysuckle (Lonicera sp.)

B. Intermediate Forest

1. plant growth following pioneer

2. characterized by a great variety of plants

3. first large trees

4. heavy undergrowth

a. much light still getting to "forest" floor

C. Climax Forest Plant Association (Figure 4-2)

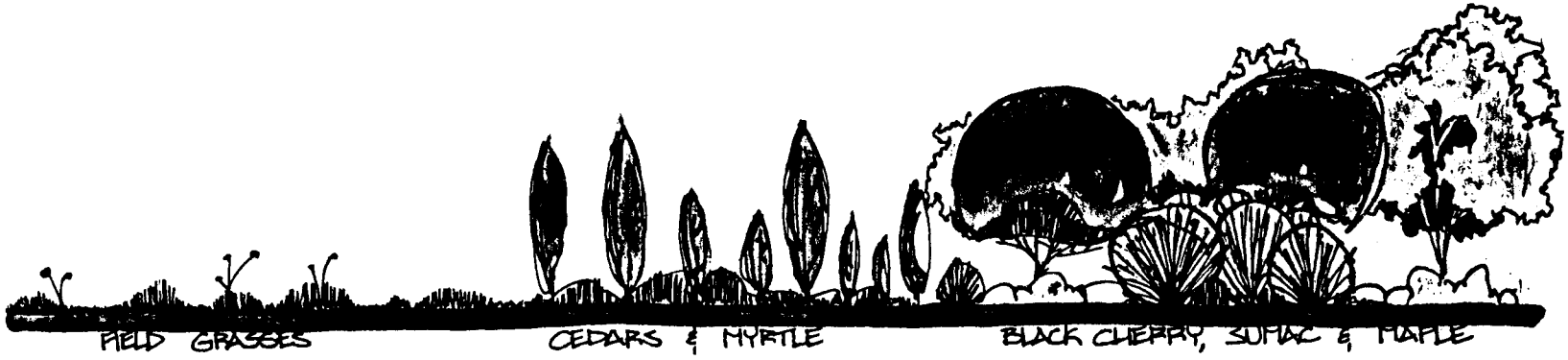
1. relatively permanent plant community

2. same vegetative types continue until next environmental disruption

3. upland deciduous forest found in Huntington

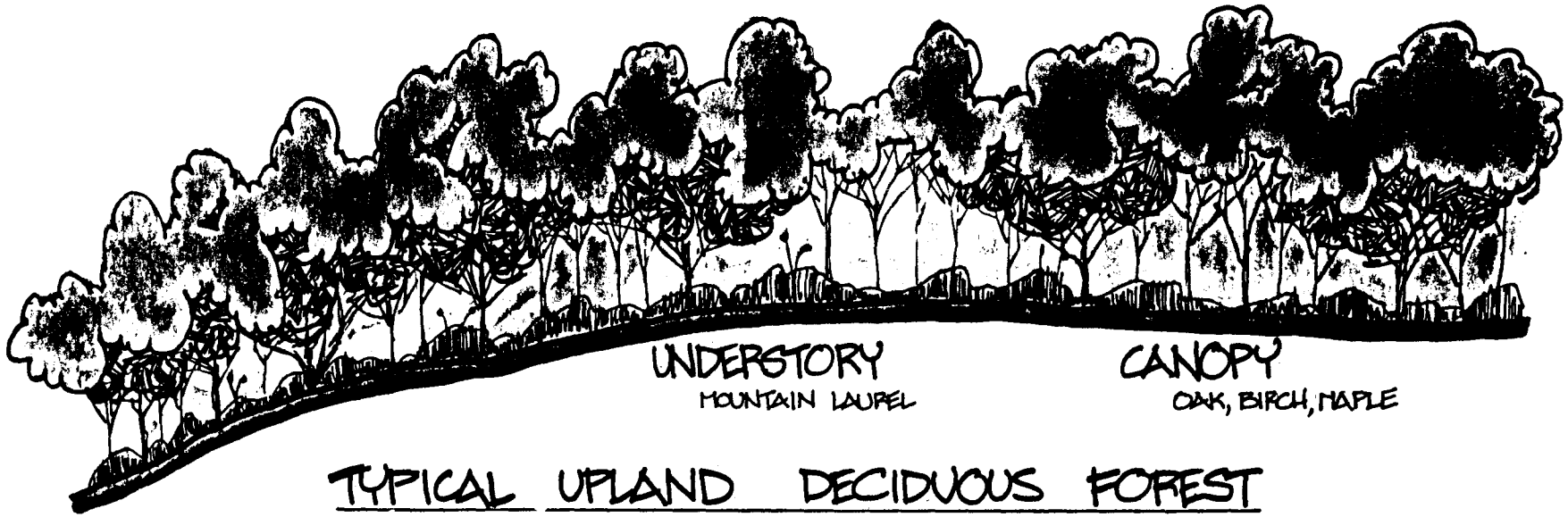
a. part of the East Coast/Appalachian upland forest

b. modified to local conditions



DEVELOPMENT OF PIONEER ASSOCIATION

Figure 4-1



TYPICAL UPLAND DECIDUOUS FOREST

Figure 4-2

c. canopy

1) black oak (Quercus velutina)

a) formally white oak and chestnut

2) yellow birch (Betula lutea)

3) tulip tree (Liriodendron tulipifera)

4) butternut hickory (Juglans cinerea)

5) red maple (Acer rubrum)

6) white ash (Fraxinum Americana)

d. understory

1) Mountain Laurel (Vaccium corymbosum)

4. Pine Barren Association (Figure 4-3)

a. climax forest type found in well-drained, sandy soils

1) canopy

a) pitch pines (Pinus Rigida)

b) black oak (Quercus velutina)

c) type determined by extent of control of fires

(1) frequent fires favor growth of pines - seed germination

2) understory

a) high and lowbush blueberry (Vacciuum augustifolia and corymbosum)

3) considered by some experts to be a long term, intermediate forest, eventually developing into an upland deciduous climax forest

D. Beach Vegetation (Figure 4-4)

1. major determinants

a. intensity of sunlight

b. variations in temperature

c. winds

2. chances of survival increase as protection increases in a location

3. beach vegetation characterized by hardy, low plants

a. beach plum (Prunus maritimia)

b. wild rose (Rosa rugosa)

c. bayberry (Myrica pennsylvanica)

d. ammophila

4. plants act to trap sand and build beach

V. Conclusion

A. Things to do in the field

1. estimate stage of vegetation type

a. pioneer, intermediate or climax

2. guess at history of area by examining plant association

a. logged over

b. farm field at one time

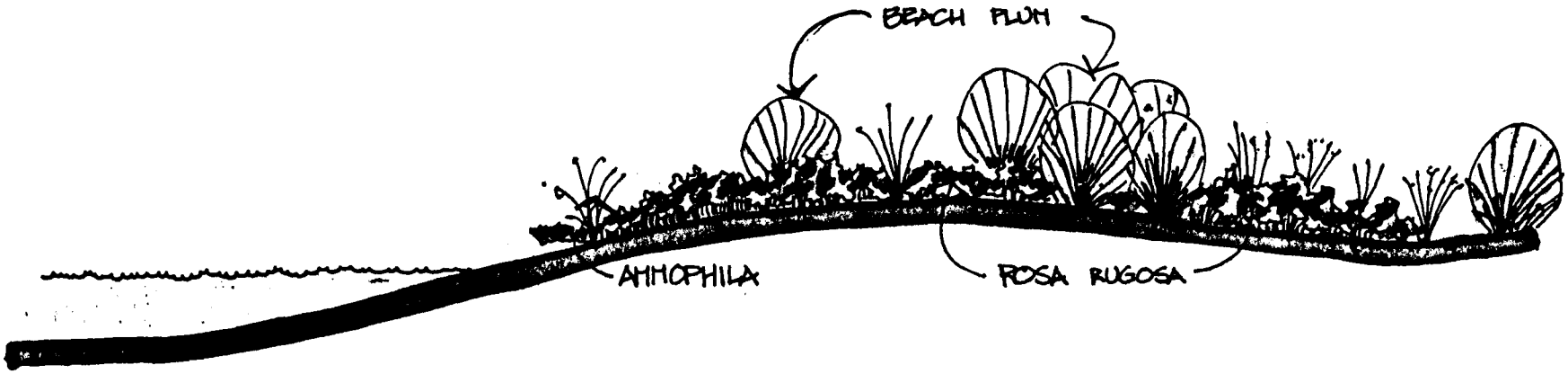
c. burned over

d. selective cutting in the past

e. natural disturbance

PINE BARRENS

Figure 4-3



TYPICAL BEACH VEGETATION ASSOCIATION

Figure 4-4

B. Discussion has only covered some major plant associations

1. salt water marshland plant association

2. freshwater pond plant association

LECTURE # 5

FRESHWATER ENVIRONMENT

I. Hydrology

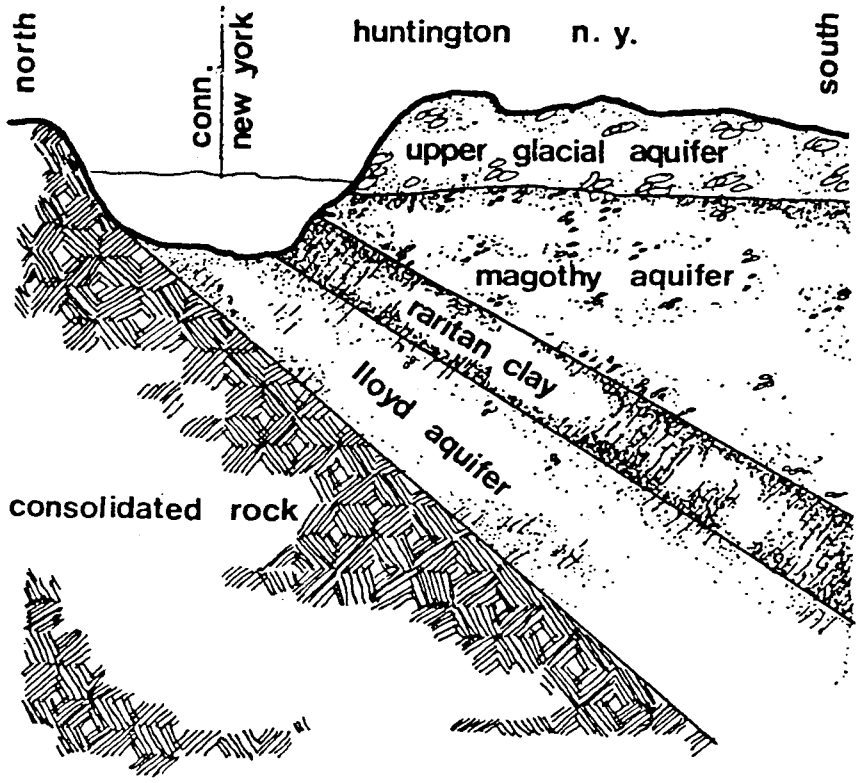
A. Glacial Deposition - formation of aquifers

1. Due to the structure and permeability of the glacial deposits, three aquifers (water-retaining geologic formations) were created. (Figure 5-1)

a. Upper Glacial Aquifer - the top layer and first to be penetrated by wells and cesspools.

b. Magothy Aquifer - the middle layer where a tremendous amount of water is retained; increasingly being relied upon for water supply.

c. Lloyd Aquifer - the bottom layer which does not transmit water as well as the other two.



Aquifers of Huntington

Figure 5-1

(from Penn Study)

B. The upper limit of the Upper Glacial Aquifer forms our water table.

1. layer used for principle water source
2. water forms the shape of a dome, thickest section at Dix Hills, approximately 70 feet above mean sea level; slopes down to ten feet above mean sea level near coastal areas.
3. There is a constant movement of water from high water table relief to lower areas which is naturally replenished by rainfall (approximately 48" annually).

C. Magothy and Lloyd Aquifers

1. where water table exceeds 60 feet above mean sea level, the pressure forces the underlying water down into deeper aquifers.

II. Water Cycle - A closed system

A. Water is constantly recycled throughout the earth and appears in a variety of forms during the course of its travels. When precipitation falls on the land, some evaporates again into the atmosphere within a short period of time. Of the water that does not immediately evaporate, some is absorbed by plants or is consumed by animals, some runs off the surface of the land into ponds and lakes and soon percolates through the soil to the water table.

The constant evaporation from water surfaces, as well as transpiration from the bodies of plants and animals, returns the water to the atmosphere. Where, upon contact with cooler air, forms clouds and eventually falls to earth as precipitation.

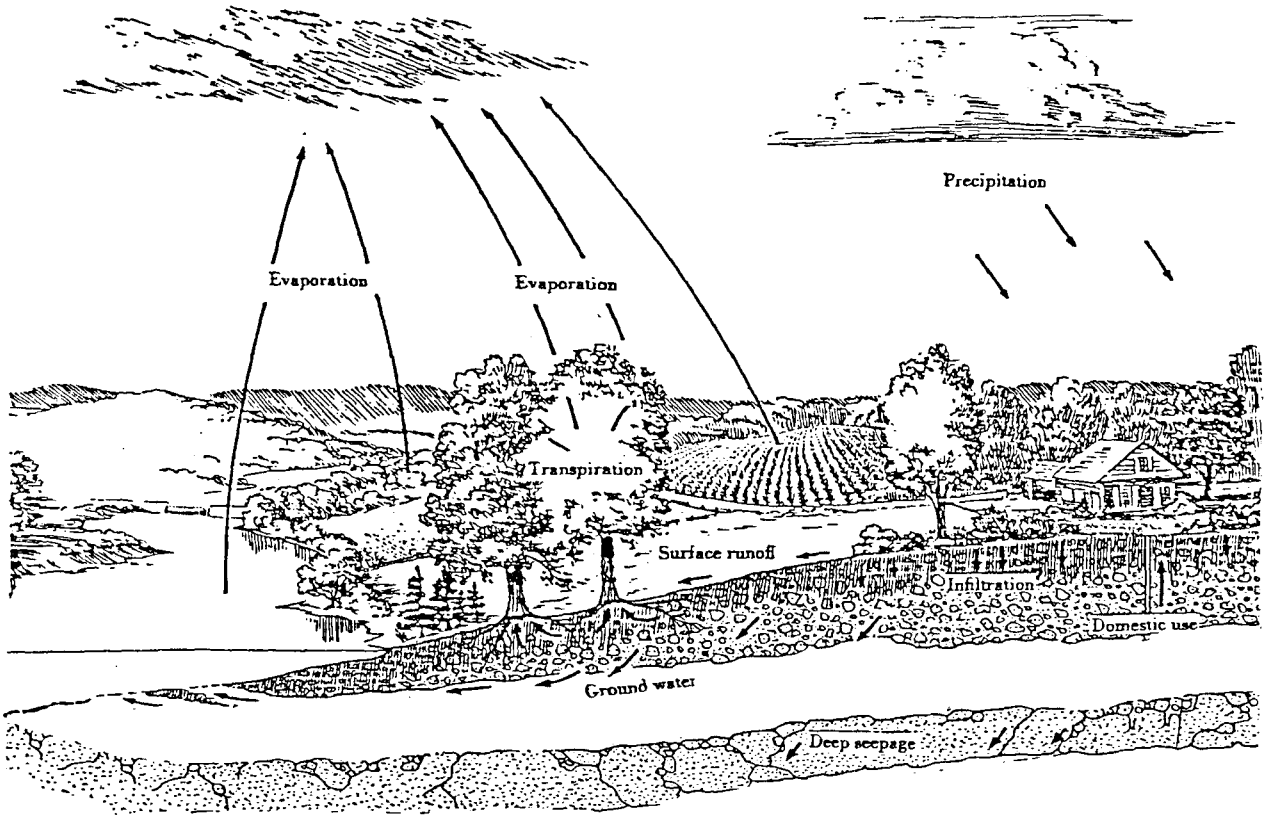


Figure 5-2 HYDROLOGY CYCLE (from Smith 1966)

B. Definitions

1. Water cycle - constant interchange of water between air, land and sea and between the living organisms and their environment. (Figure 5-2)
2. Evapotranspiration - the combined water loss of the actual evaporation of water from land surfaces and vegetation.

III. Freshwater Resources

A. Long Island Freshwater Formations

1. A water table pond forms where surface topography is close to or cuts into water table (i.e. Twin Pond)

2. A kettle hole pond or lake results from glacial activity and is a basin or depression created by the melting of a large detached block of ice left behind by a retreating glacier. (i.e. Lake Ronkonkoma)

3. Clay lens pond - an area where a layer of impermeable clay had been deposited through glacial activities and forms a water retaining area. (i.e. Deforest Pond)

4. Man-made ponds - a layer of impermeable material (bentonite, vinyl, etc.) that holds water. (i.e. Heckscher Pond)

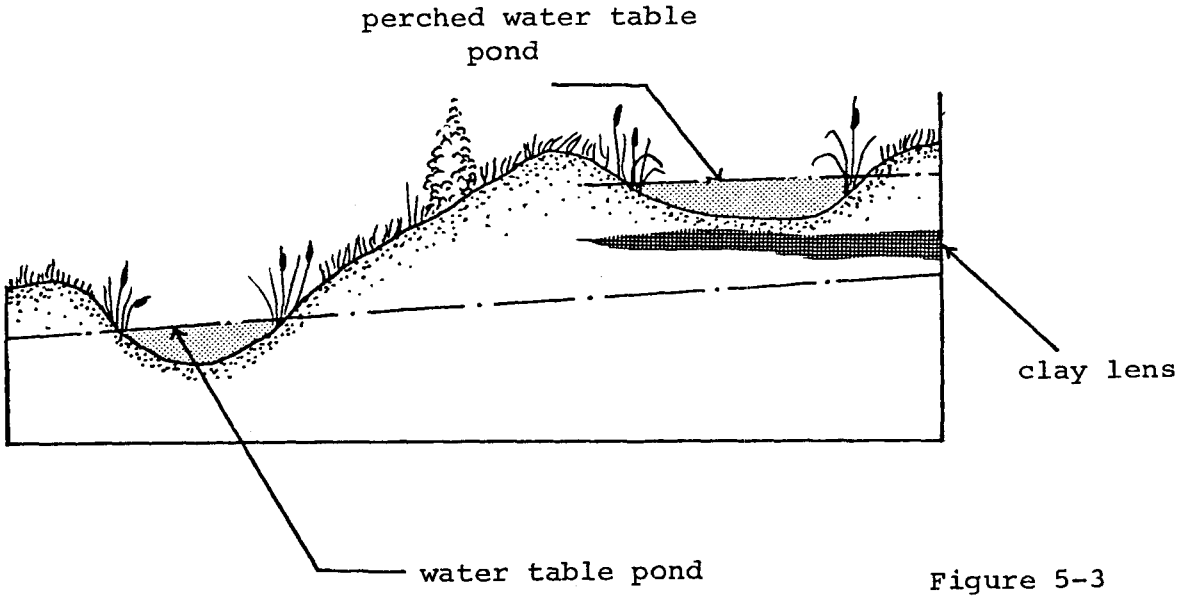


Figure 5-3

Typical Pond Formations found on Long Island

B. The differences between a pond and a lake

1. Pond - shallow, rather small body of standing water with a relatively uniform temperature.
2. Lake - large, body of water, deep enough to support definite temperature gradients.

C. A typical pond has a variety of vegetation and animal life associated with it depending on the depth and nutrient resources available.

1. Resource inventory
    a. Basic components
        1) soils
        2) vegetation
        3) wildlife
    b. determine what is there, types of soils, kinds of animals etc. and their quality, disturbed vegetation, eroded soils, etc.
    c. describe the areas adjacent to your site because they may effect its future.
2. Plants
    a. Algae - the dominant plant in terms of numbers primarily found within the top two feet or to the depth that sunlight penetrates. Except in exceptionally clear water, sunlight doesn't usually penetrate more than three feet.

b. Floating plants may be found at any depth

1) free-floating - duck weed, wolfia, water hyacinths

2) bottom-rooted - water lilies, American lotus

c. Submergent plants are normally found in water less than three feet deep.

1) examples include sago, milfoil and sagittaria

d. Emergent plants are usually found in water less than 1½ feet deep

1) examples include Potamogeton, smartweed, sedges, cattail, phragmites and arrowhead

3. Animals - depending on the amount of food available, there can be a large variety of animals to be observed.

a. Zooplankton

b. Insects - dragonflies, water bugs, water striders, whirligig beetles

c. Amphibians - frogs, spring peepers, bull frogs

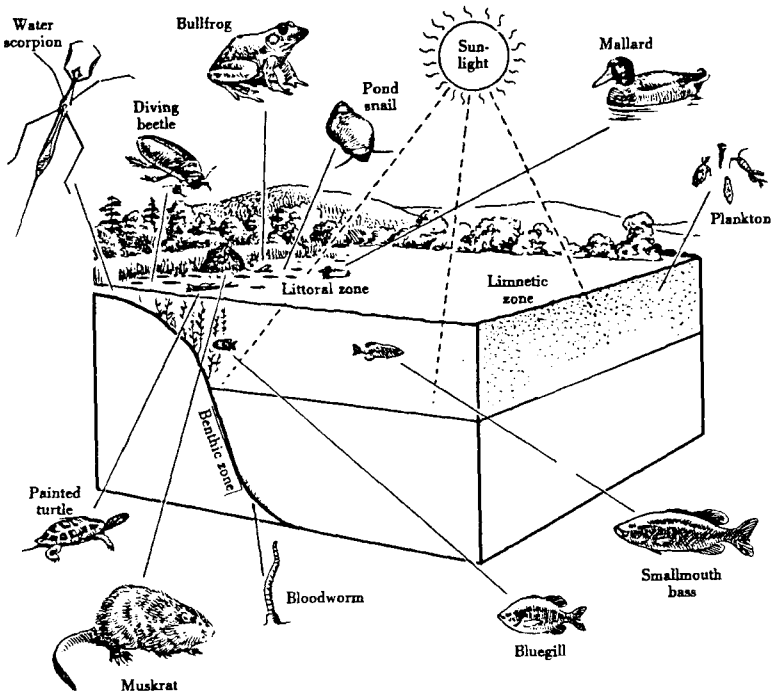
d. Reptiles - turtles, water snakes

e. Fish - bluegills, trout, killies, carp

f. Associated rodents and mammals - raccoon, rabbits, muskrats, squirrels, possum.

4. Wetlands form on adjacent land that is either covered with water or waterlogged during some periods of the year.

a. typical plants are sedges and cattails.



A TYPICAL POND ECOSYSTEM (From Smith, 1966) Figure 5-4

IV. Food Chain (food web - Figure 5-5)

A. All of the plants and animals of the pond environment interact and form a food chain or web.

1. Plants - primary producers
2. Herbivores - primary consumers
3. Carnivores - secondary consumers
4. Omivores - combined carnivore and herbivore
5. Scavengers and decomposers

V. Productivity and succession

A. Productivity refers to the amount and rate of nutrients that are recycled and the organic material that is produced relative to the size of the pond.

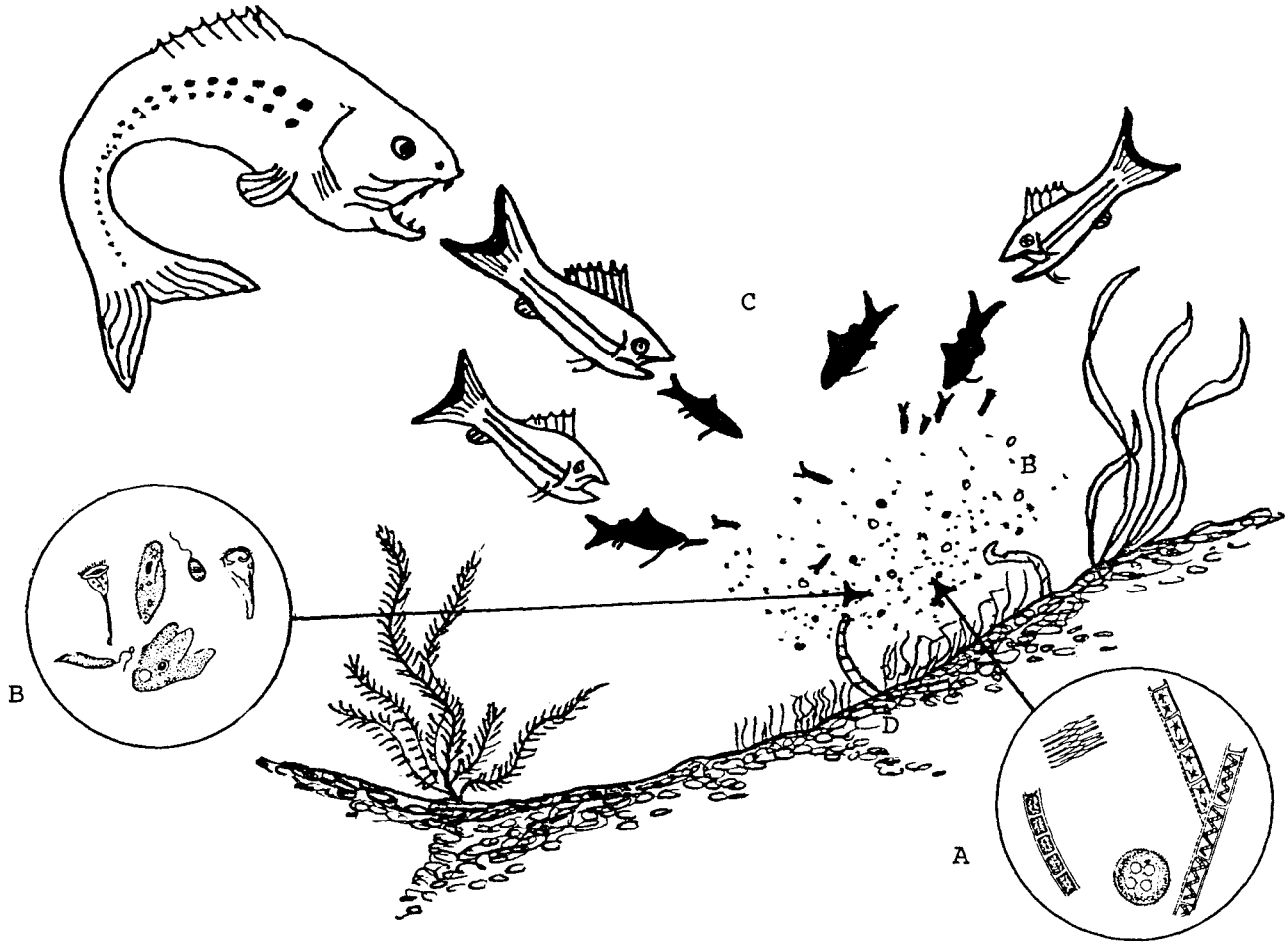


Figure 5-5

FOOD CHAIN

A Primary producers
phytoplankton
diatums
aquatic plants

B Primary consumers
zooplankton
mosquito larvae
freshwater mussel
fish fry
waterfowl

C Secondary consumers
juvenile and adult fish
insect nymphs
water bug
frogs
waterfowl

D Scavengers
blood worms
sow bug
tadpoles
turtles

1. Oligotrophic - low productivity, newly formed pond with low minimal resources available
2. Mesotrophic - high productivity, able to support large varieties or organisms
3. Eutrophic - able to support limited amount of organisms due to overabundance of certain nutrients

B. Succession of freshwater area

1. A pond is a temporary habitat. As the gradual accumulation of sediment and decaying organic materials slowly fills in the pond, vegetation advances forward to the center. This continual "filling in" process shrinks the perimeter of the pond, making it shallower. Once the opposite shores meet, the area fills to form a meadow which then succeeds through the various first stages.

VI. Importance of our freshwater resources.

A. They are an integral part of a healthy ecological balance on Long Island

B. They support both migratory and year-round wildlife

C. They act as a recharge basin replenishing our groundwater resources.

D. They provide recreation and relaxation to all that visit them.

E. They serve as an important educational resource.

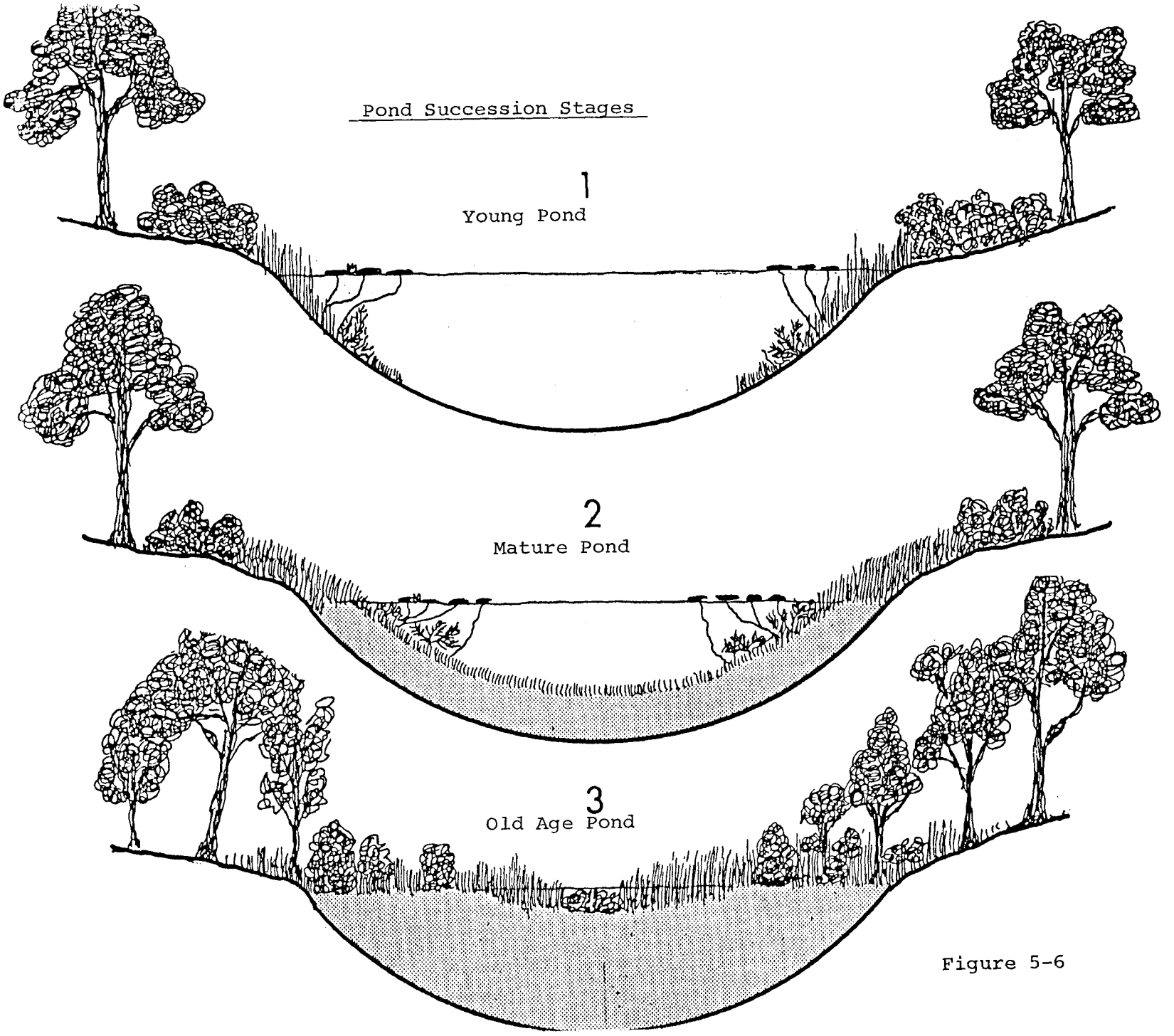

Pond Succession Stages
1
Young Pond
2
Mature Pond
3
Old Age Pond

Figure 5-6

LECTURE # 6

MARINE ENVIRONMENT LECTURE OUTLINE

I. INTRODUCTION

The Long Island marine environment is decidedly different from the open ocean that usually comes to mind when we refer to "marine environment." Five factors distinquish the Long Island Waters from that of the open ocean.

A. The average depth of the coastal ocean, the area lying over the continental shelf, is 70 meters and the average depth immediately around Long Island is considerably less while typical depths of the open ocean range from 4000 to 6000 meters.

B. Tides are an influence along coasts.

C. Coastal waters have contact with the land and have a fresh water input.

D. Winds have a more pronounced effect on the coastal ocean. They build dunes and generate waves and currents.

E. There is less water to be moved, heated, cooled, diluted and evaporated in the coastal waters so that the processes that occur there are on a compressed time scale.

II. ESTUARIES

Estuaries are areas where fresh and salt water mix. They are formed in the narrow boundary zone of the sea and the land, and their form and extent is constantly altered by erosion and the deposition of sediment. Small changes in sea level have drastic effects.

A. Origin of Estuaries:

The estuaries as we know them today on Long Island and throughout the world are the result of sea level rising following the melting of the last glaciers (Figure 6-1).

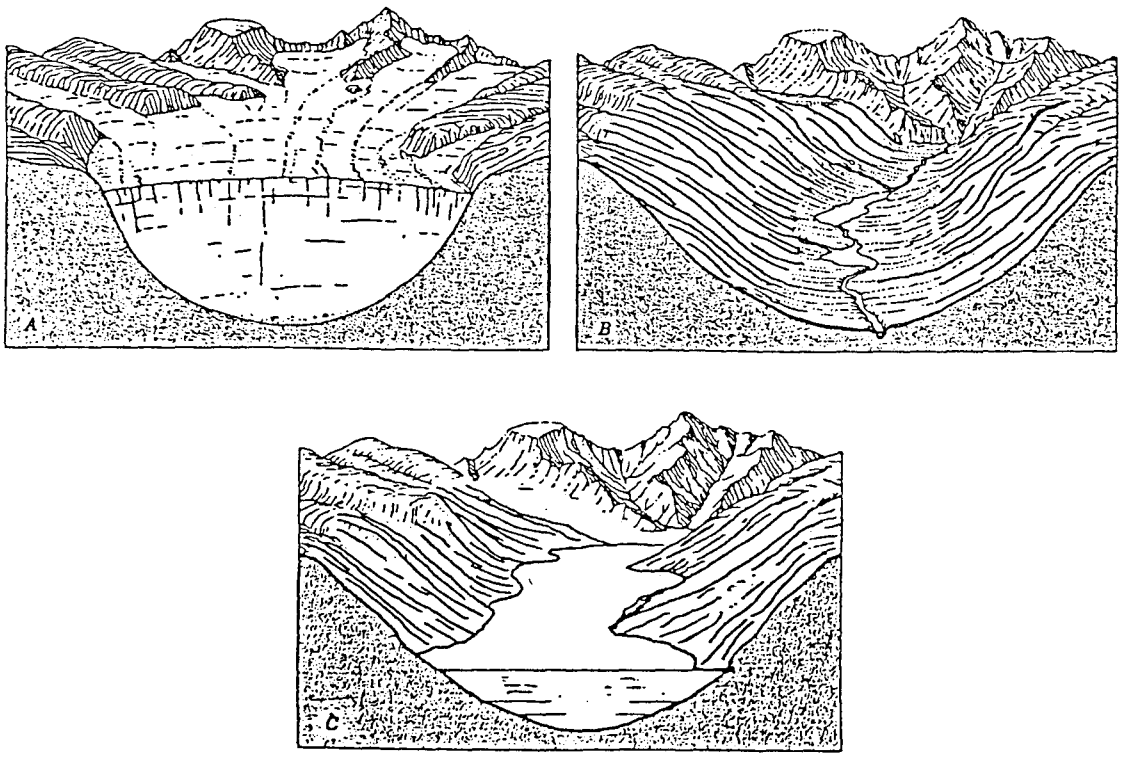


Figure 6-1

Development of estuary in glaciated coast (A) during maximum glaciations (B) as glacier melts, the excavated valley floor may be occupied by streams and lakes; (C) as sea level rises, as a result of melting ice sheets, the ocean water fills the valley and forms an estuary.

B. Types of Estuaries:

1. Although there is really no one adequate classification of individual estuarine types, scientists recognize four major categories:

   a. drowned river valleys

   b. fjords

   c. lagoons

   d. tectonic

2. Long Island is unusual in having two distinct forms:

   a. north shore: drowned river valleys

   b. south shore: lagoons

C. Estuarine circulation

1. caused by interaction of tides, and river flow.

2. two basic types of estuarine circulation:

   a. stratified estuary - large freshwater input and minimal tidal force (Figure 6-2)

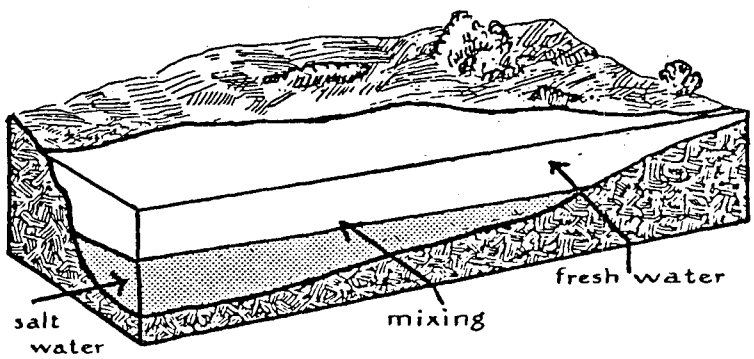


Figure 6-2

Schematic representation of a stratified estuary showing fresh and saltwater flow. (D. W. Pritchard 1955)

b. mixed estuary - low river flow and large tidal flow (Figure 6-3)

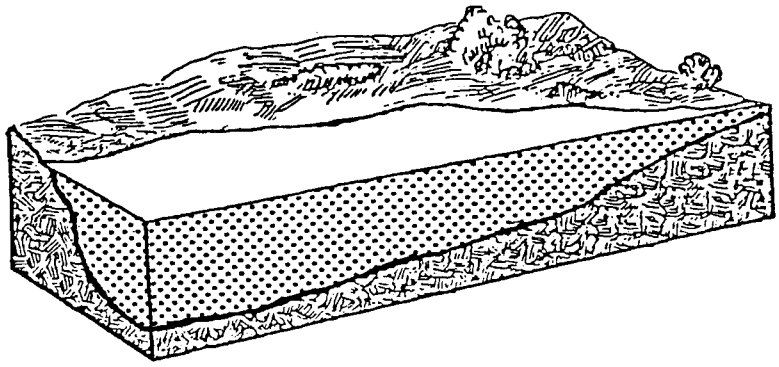


Figure 6-3

Schematic of mixed estuary showing lack of distinct freshwater flow. (D. W. Pritchard 1955)

3. The Long Island situation

a. north shore, Huntington, - mixed estuaries, unusual in that freshwater flow is from runoff and groundwater rather than rivers, large tidal flow - 7 to 8 foot tidal regimes

b. south shore - moderately stratified - numerous small rivers and streams, 2 foot tidal regimes

D. Exceptional value of estuaries is due to a combination of physical factors:

1. Confinement - provide shelter from wave action, allows plants to root, clams to set, retains suspended life and nutrients, restricts predators.
2. Depth - allows light to penetrate, fosters growth of marsh plants and tidal flat biota, deters deep water predators.
3. Salinity - stratified flow beneficial to many organisms, deters oceanic predators.
4. Circulation - system of transport for suspended life, nutrients, enhances flushing of contaminants.
5. Tide - transports nutrients and suspended life, dilutes, flushes wastes, regulates feeding, breeding and other functions.
6. Nutrient storage - trapping mechanisms, such as sediments and marsh grasses, store nutrients within estuary.

E. The estuary is a stressed environment -

1. because of mix of salt and freshwater, the temperature and salinity may vary greatly throughout an estuary;
2. few marine species can tolerate severe changes in temperature and salinity, and therefore
3. few species can live in estuaries; the <u>species diversity is low</u>, but

4. those that can live there have few competitors and thrive

F. The values of estuaries to man

1. provide breeding habitat for finfish and shellfish
2. provide feeding grounds and cover for many marine species
3. support finfish and shellfish fisheries
4. transportation routes
5. waste disposal
6. recreational boating
7. aesthetically pleasing

III. Tides

A. Tides are created by the gravitational pull of the sun and the moon and the rotation of the earth.

B. Tides are easily observed and unlike other oceanographic operations, can be measured quite simply.

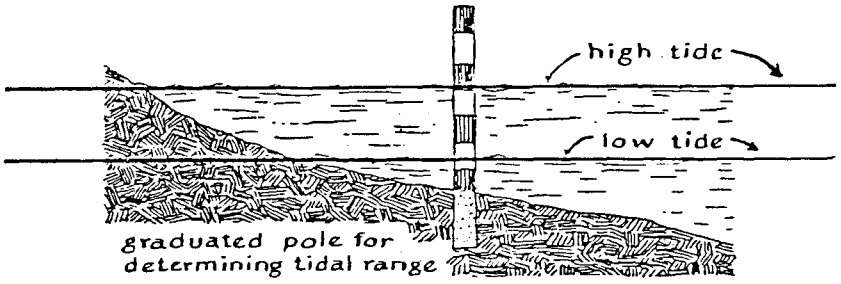


Figure 6-4

Simple Measuring Device for Determining Tidal Range (Gross, 1972)

C. Three types of tides

1. daily tides - one high tide and one low tide each day.
2. semi-daily - two high tides and two low tides each day.
3. mixed tides - two unequal high tides and two unequal low tides each day.
4. Long Island is unusual in that:
   a. On Long Island we have semi-daily tides but most of the North American Continent has mixed or daily tides.
   b. The tidal regime or the distance the tide rises and falls varies greatly around Long Island. In Huntington the tide rises and falls almost eight feet. As you go towards New York City or towards Orient Point, the tidal regime decreases to 3 feet or less. The tide throughout Great South Bay is approximately two feet.

D. Tides influence estuarine ciculation (Section II-A) but they also play a role in determining the types of marine animal and plant life that may exist in an area. Generally the greater the tidal regime, the greater the currents and more stress on the system.

IV. Beaches

A. Profile of a typical beach (Figure 6-5)

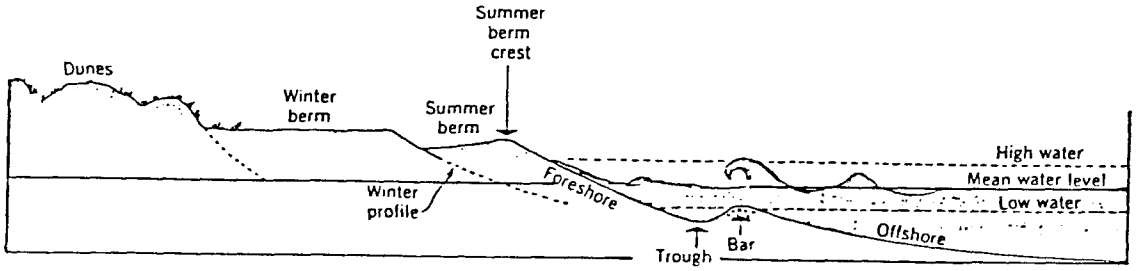


Figure 6-5

Beach Profile

B. Source of beach sands

1. immediate source is almost entirely from the adjacent sea bottom
2. most of this originally came from
   a. runoff
   b. cliff erosion
   c. wind blown sand from dunes may be locally important, such as on Fire Island

C. Beach cycles - beaches are constantly changing

1. beaches generally build up during periods of low wave energy and decrease during periods of high wave energy.
2. short beach cycles
   a. unseasonal storms
   b. tidal cycles

3. Seasonal beach cycles

   a. beaches are cut back and may disappear during the stormy winter season

   b. beaches are built up during the calmer summer months

D. Littoral drift - currents and turbulance generated by waves stir up sediment and carry it parallel to the coast.

1. two forms of littoral drift:

   a. longshore drift is offshore and created by the winds

   b. beach drift is on the beach itself and is caused by wave movements. (Figure 6-6) This can be observed and monitored on our Huntington beaches

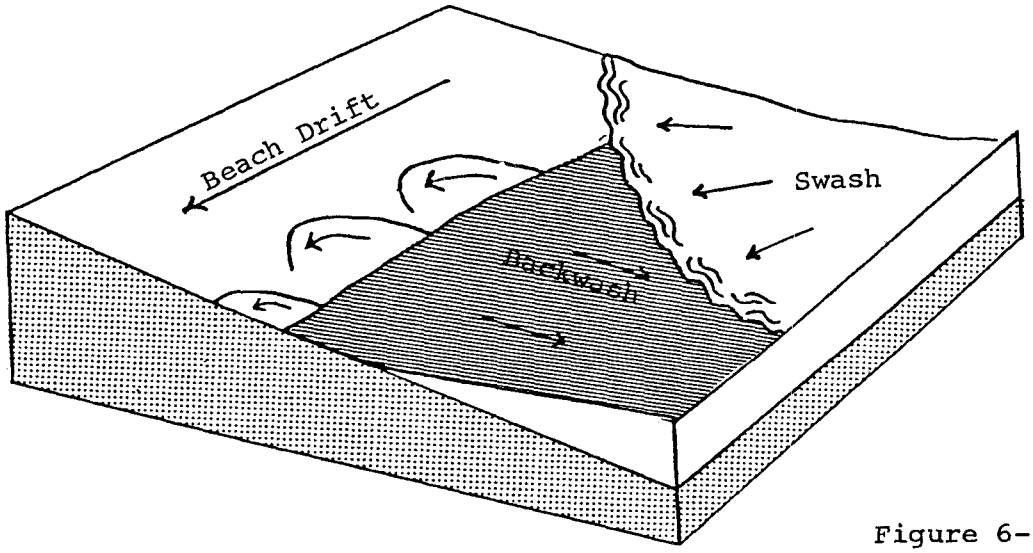


Figure 6-6

Beach Drift

Waves obliquely approaching a beach move diagonally up the beach face, (swash) and then the water moves directly down the beach (backwash). Sand moves along the beach in a series of arched points (beach drift).

V. Waves

A. Significance of waves

1. Waves are of great importance to maritime engineers and coastal scientists. They must be considered when building anything from a bulkhead or seawall to a port or depot for ocean liners and tankers.

2. Waves help determine what our area's beaches will be like.

3. Waves help determine the types of animals and plants that can live on a beach.

B. Typical wave

1. Waves are generally described by several common measurements.

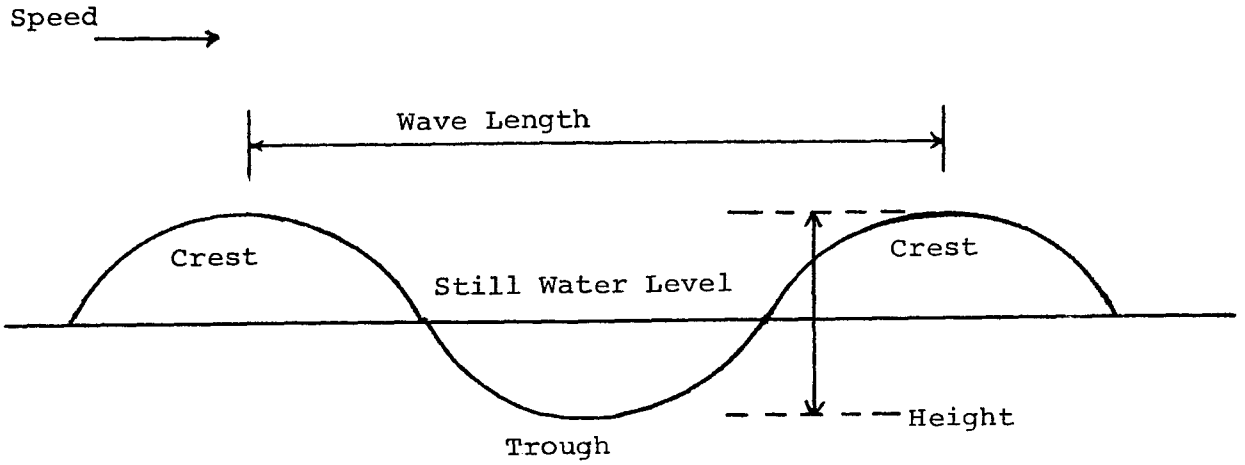


Figure 6-7

An Ideal Wave

C. Waves are generated by:

1. Wind - by far, the majority are created by winds.
2. Volcanic activity
3. Earthquakes
4. Glaciers
5. Waves created by volcanic activity, earthquakes and glaciers are termed Tsunami. They are not detectable at sea but are very destructive near land.

D. The size of a wave is determined by:

1. the speed of the wind;
2. the distance the wind travels or fetch:
3. the length of time the wind blows.

E. Waves break when they are near shore. There are four distinct types.

1. Spilling waves - the most common, the water is turbulant and bubbles spill down the front of the wave. The resulting beach is flat.
   a. This type of wave permits growth of saltwater wetlands.
2. Plunging waves - crest curls over large air pocket. The resulting beach slope is moderately steep.
3. Collapsing waves - breaking occurs over lower half of wave with almost no air pocket. The resulting beach has a steep slope..

4. surging waves - waves slide up and down beach with little or no bubbles. The resulting beach slope is very steep.

VI. Estuarine Sediments

A. Deposition of sediment is a characteristic of almost all estuaries and contributes to the very low visibility of the water.

B. Source of sediment

1. The bulk of the sediment in an estuary is derived from the watersheds
2. Some of it comes in from the adjacent sea floor
3. A small amount comes from the loosening of the bottom muds by crawling animals and the decomposition of organic matter

C. The deposition of sediments is controlled by:

1. the speed of the current
2. the particle size of the sediment

D. Most estuarine organisms spend their time burrowing in bottom deposits and estuarine muds are an extremely productive component of our coastal waters.

E. The type of sediment present in an area determined the type of animals and plants that may be present.

1. shellfish and most burrowing worms are found in the softer, less consolidated sediments. Firmer and rockier sediments have a greater abundance of attached algae.

F. The rate of sedimentation also influences the plants and animals that may be present.

1. when sedimentation significantly increases due to excessive erosion from surrounding hills, the plants and animals may be smothered and will not be able to recolonize the area until the erosion is stopped

VII. Vegetation

A. There are two main groups of plants in our estuaries

1. Marine Plants

a. Algae - photoplankton and seaweeds

b. Vascular plants - eelgrass

2. Maritime plants - influenced by being near salt water but never permanently covered by it.

a. Saltwater wetlands

B. Algae

1. phytoplankton are present in our estuaries and serve as a source of food for innumerable marine species including shellfish.

a. There are many forms of algae but of interest to us are their numbers. They increase in summer when the temperature is warm and the sunlight is strong and may discolor the water during blooms - periods of extreme growth.

2. Vascular plants

a. The vascular plant most familiar to Long Island is eelgrass which grows primarily in Great South Bay. It is partly responsible for the extremely productive shellfish grounds by slowing the water and allowing microscopic organisms to settle out as food for shellfish.

C. Saltwater wetlands

1. A large part of our estuaries value is due to the associated wetlands. Among the natural functions of these areas that are important to man are:

   a. Hydraulic - the wetlands serve as a natural buffer from waves, tides and boat wakes due to the resiliency of the grasses.

   b. Sedimentation function - the wetlands filter both upland runoff and tidal flows and act as a sediment trap.

   c. Pollution moderating influence - the wetlands trap and use excess nutrients that pass through the marshes both from stormwater runoff and from daily tidal action.

   d. Fish and wildlife habitat - the wetlands act as breeding grounds, nesting areas, feeding grounds, shelter and nursery grounds for many forms of marine life.

   e. Basic food production - perhaps the single most essential value of our saltwater wetlands is the primary nutrient production through the breakdown of materials and plant growth.

2. Salt marshes are beds of inter-tidal, rooted material which are alternately inundated by the rise and fall of the tide. There are two zones.
   a. regularly flooded marsh, which runs between mean low water and mean high water;
   b. the irregularly flooded marsh, which extends from mean high water up to storm high tide line.
3. The regularly flooded marsh includes such plants as cordgrass, saltwort and numerous species of algae such as sea lettuce.
4. The irregularly flooded marsh includes such plants as salt hay and Phragmites.
5. The salt marsh is a tide stressed environment. There are rapid diurnal or daily changes in salinity, temperature and drainage that exert a strong control over the kinds of plants and animals that are present.

VIII. Productivity and Food Chain

A. Productivity is the amount of organic material produced in a given period of time. It is usually measured for a column of water, 1 square meter in surface area.
   1. Production by green plants occurs only to the depth to which light penetrates which is called the photic zone. In estuaries light may penetrate to the bottom thus making the entire area productive.

2. Several factors effect productivity:

   a. Depth of the photic zone

   b. concentrations of limiting nutrients

   c. temperature

   d. rate of grazing of herbivores

3. The coastal ocean is 5 - 10 times as productive as the open ocean because:

   a. mixing of water by currents etc.,may extend to the bottom, releasing nutrients in benthic deposits.

   b. coastal and tidal currents continually mix water, preventing loss of nutrients due to stratification.

   c. photic zone may extend to the bottom.

   d. availability of nutrients from stormwater runoff.

B. As in the freshwater environment, the plants and animals of the marine environment comprise a food chain from bacteria that breakdown dead material to the noble sea and shore birds (Figure 6-8).

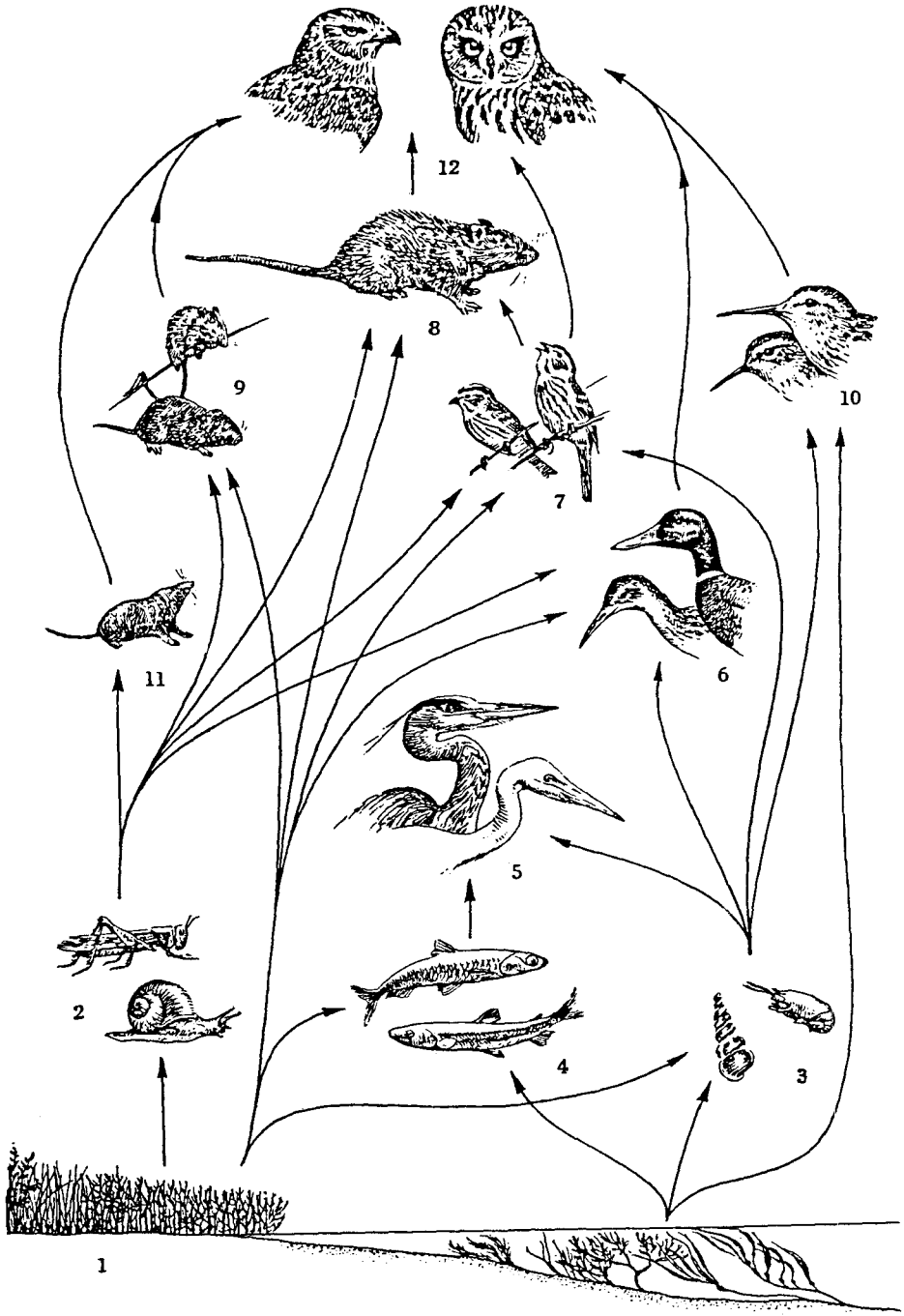


Figure 6-8. *A midwinter food web in a Salicornia salt marsh (San Francisco Bay area). Producer organisms (1), terrestrial and salt marsh plants, are consumed by herbaceous terrestrial invertebrates, represented by the grasshopper and snail (2). The marine plants are consumed by herbivorous marine and intertidal invertebrates (3). Fish, represented by smelt and anchovy (4), feed on vegetative matter from both ecosystems. The fish in turn are eaten by first-level carnivores, represented by the great blue heron and common egret (5). Continuing through the web, we have the following omnivores: clapper rail and mallard duck (6); savanna and song sparrows (7); Norway rat (8); California vole and salt-marsh harvest mouse (9); the least and western sandpipers (10). The vagrant shrew (11) is a first-level carnivore, while the top carnivores (second level) are the marsh hawk and short-eared owl (12).* (Food web adapted from Johnston, 1956.)

LECTURE #7

THE AIR ENVIRONMENT

I. AIR, CLIMATE AND POLLUTION

HISTORICAL NOTE

Air has never been pure. Long before man invented the internal combustion engine, volcanos and forest fires blackened the skies and decaying vegetation produced methane. However, nature had time to self-cleans the atmosphere eons before man appeared.

In ancient times, population levels were generally low and any pollutants were diluted by the vastness of atmospheric space.

With the development of large cities, air was endangered by man's activities. As early as 1300, a royal proclamation halted the burning of coal because of escaping noxious fumes in London. Later it was discovered that these fumes were caused by coal's sulphur content and a process known as coking supressed most of this problem.

More recent significant problems were: the industrialized areas of Meuse River Valley, Belgium and Donora, Pennsylvania; the smog of Los Angeles and England; and the mid 60's episode with pollutant-filled inversions in New York City and Tokyo.

ATMOSPHERE

Air - is a mixture of:

78%. - Nitrogen

21% - Oxygen

1% - Carbon Dioxide, Argon and other inert gases, varying amounts of water vapor

THE TROPOSPHERE

The air we breath is limited. It is the innermost 12-mile layer of atmosphere called the Tropósphere that is crucial to life on earth.

THE MIXING DEPTH

A still thinner area than the Trophosphere. The mixing depth exists just above the earth's surface where contaminants are blended and diluted by air.

TEMPERATURE INVERSION

A layer of warm surface air becomes trapped under a layer of colder air and creates a smothering "lid" on the air, pollution and area below.

Factors for an inversion condition:

- Climate (High pressure, no wind and low mixing depth)
- Topography
- Type of Area (Heavily industrialized or urbanized)

II. TYPES SOURCES AND EFFECTS OF POLLUTANTS (Figure 7-1)

PARTICULATES

Solid or liquid matter, including dust, smoke fumes, fly ash.

SOURCES:

Industrial processes, incinerators and fossil fuel burning plants, especially those that burn coal; also automobile exhaust.

HEALTH EFFECTS:

Disruption of the lung's normal cleansing mechanism. Additionally the particles can contain or carry materials that exhibit direct toxic effects on a biological system.

OTHER EFFECTS:

Scattering and absorption of sunlight which results in haze, reduces visibility and reduces solar energy reaching earth; particles soil materials, are corrosive.

NITROGEN DIOXIDE (NO_2)

A reddish-orange-brown gas with a characteristic pungent odor.

SOURCES:

Emitted in approximately equal quantities from motor vehicles and from fossil fuel burning operations, most notably power plants.

HEALTH EFFECTS:

Increased respiratory infections in children (particularly bronchitis); eye, nose and throat irritation when combined with sunlight and hydrocarbons to form photochemical smog, inhibition of cilla action and damage to lung tissue.

OTHER EFFECTS:

Corrosion of metal surfaces, deterioration of rubber, fabrics and dyes, serious injury to vegetation.

PHOTOCHEMICAL OXIDANTS

Extremely reactive oxidizing agents formed primarily by reaction between oxides of nitrogen and hydrocarbons in sunlight (smog) includes ozone.

SOURCES:

Secondary reaction products originating largely from fossil fuel combustion byproducts.

HEALTH EFFECTS:

Irritates eyes, lungs, nose and throat, causes difficult breathing.

OTHER EFFECTS:

Toxic to plants.

SULFUR DIOXIDE (SO_2)

A heavy, pungent, colorless gas.

SOURCES:

Installations burning a fossil fuel. Electric power plants, home heating.

HEALTH EFFECTS:

Impairment of breathing and irritation of eyes, throat and lungs. Fortunately, breathing effects appear to be reversible when the insult is removed.

OTHER EFFECTS:

Yellows leaves of plants, corrosion and deterioration of iron, steel, copper, nickel and aluminum.

CARBON MONOXIDE (CO)

A colorless, odorless gas.

SOURCES:

Internal combustion engines (95 percent from automobile exhaust); CO is a normal byproduct of incomplete fossil fuel combustion.

HEALTH EFFECTS:

Hemoglobin - the oxygen-transporting substance in the blood - combines 200 times more readily with carbon monoxide than with oxygen. This results in reduced circulating oxygen with subsequent oxygen deprivation to vital tissues of the body. The two tissues most sensitive to this, the heart and the brain, are most seriously affected.

Due to hemoglobin's affinity for carbon monoxide, even low levels cause dizziness, headache, fatigue and slower reactions; dangerous to sufferers of heart disease, anemia and circulatory ailments. At 1000 parts per million exposure, death results by paralyzed normal brain function.

HYDROCARBONS (HC)

Chemicals from combustion of organic compounds and other evaporated chemicals.

SOURCES:

Internal combustion engines, industrial processes.

HYDROCARBONS (CONTINUED)

HEALTH EFFECTS:

No direct health effect alone, only when combined with nitrogen dioxide to form photochemical smog.

OTHER EFFECTS:

Certain specific hydrocarbons can produce cancer in animals and cause plant damage as a component of photochemical oxidants.

FLORIDES (F)

A gas, never found in its pure state in nature.

SOURCES:

Either gaseous or solid emmissions of such industrial processes as the manufacture of fertilizer and aluminum, iron ore smelting and ceramics.

HEALTH EFFECTS:

At low levels good for bones and teeth of both animals and man.

OTHER EFFECTS:

Can damage vegetation. Some plants (alfalfa) can concentrate and accumulate these florides and then livestock eating the plants as forage can become ill.

SMOG

A product of the photochemical process.

The smogmaker

HEALTH EFFECTS:

Eye irritation, breathing difficulties.

SMOG (CONTINUED)

OTHER EFFECTS:

Vegetation damage, deterioration of materials and decreased visibility.

RADIATION

Radioactivity is harmful to man because the rays can ionize (charge) the air through which they pass and any substance exposed to them; and they can penetrate the human body and continue ionizing atoms within it, thus damaging critical molecules of human cells.

SOURCES:

Most radiation comes from natural sources - in our foods, in rocks, in the air and in the water. (An annual average dose per person of 130 millirems.) Other radiation is man-made, X-ray equipment (annual average of about 100 millirems) from fallout (annual average of 5 millirems per person thus far). In industry, the maximum permissible dose of direct, whole-body radiation of persons from all radioactive materials, airborne or non-airborne, is 5,000 millrems per year.

EFFECTS:

Little is known about the effects of the small doses of radiation. Large acute exposures will produce nausea, radiation burns, change in blood and disorders of the central nervous system which can result in death. Long term effects may cause cataracts or a variety of cancers.

The sources of air pollution

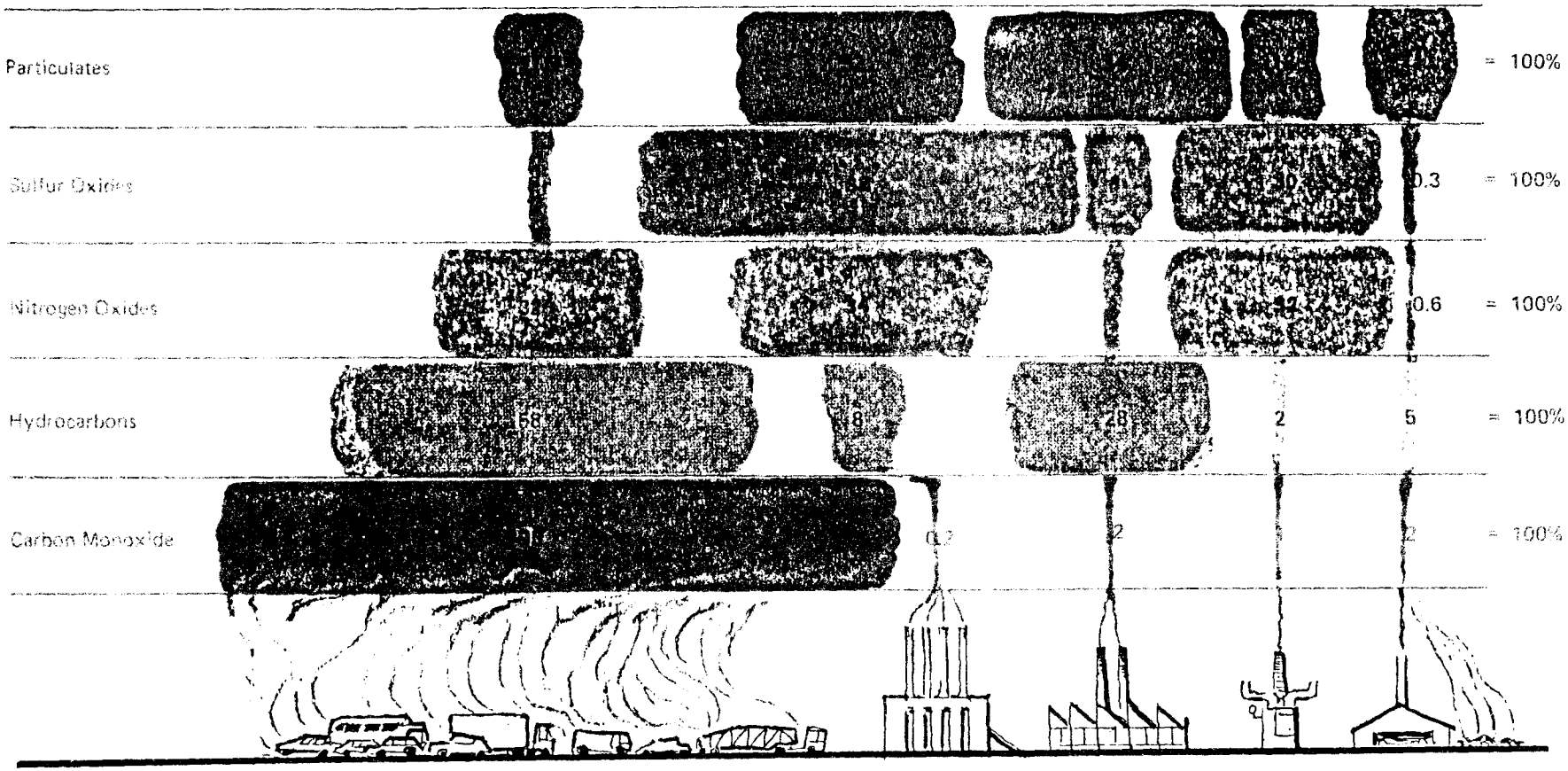


Figure 7-1

NOTE: (not represented in the above chart) - Major cost damage (about $16 billion a year) Sulfur Dioxide is the cause of the most damage to health and also residential property, materials and vegetation. The next pollutant that has the highest damage function is particulates.

Source: NYS Dept. of Environmental Conservation - Division of Educational Services

Art: Ed Kenney

III. AIR POLLUTION CONTROL

STRATEGIES

The concept of Air Quality Management.

TYPES OF AIR POLLUTION CONTROL

- Control at the source (change material and process to have low air pollution potential)
- Add-on Devices and material collected
  - Settling Chamber, large particulates
  - Electrostatic PPT, small particulates
  - Cyclone, medium particulates
  - Adsorption Devices, gases and odors
  - Scrubbers, gases and small particulates
  - Incineration, gases and odors

MEASUREMENTS

Air contaminants are measured either in terms of volume or weight for a given quantity of air. The volume measurement is usually in terms of parts of contaminants for one million parts of air (ppm). The weight measurement is defined either in terms of micrograms (ug) or milligrams (mg) for cubic meter of air. (See "Summary of Ambient Air Standards" Figure 7-2)

SUMMARY OF AMBIENT AIR STANDARDS - FEDERAL AND STATE

Contaminant	Interval*	Federal Std (Primary)		New York State Standards			Federal Std (Secondary)	
		PPM	$\mu g/m^3$ (25°C)	PPM	$\mu g/m^3$ (25°C)	Level(s)**	PPM	$\mu g/m^3$ (25°C)
SULFUR DIOXIDE	(Annual) Arithmetic Mean	0.03	80	0.03	80	All		
	24-Hr Conc	0.14	365	0.14 †	365	All		
	3-Hr Conc						0.50	1300
	1-Hr Conc			0.50 ‡	1300	All		
PARTICULATE (Suspended)	(Annual) Geometric Mean		75		75 ♦	IV		
					65	III		60
					55	II		
					45	I		
	24-Hr Conc		260		250	All		150
CARBON MONOXIDE	8-Hr Conc	9	10 mg/m^3	9	10 mg/m^3	All	9	10 mg/m^3
	1-Hr Conc	35	40 mg/m^3	35	40 mg/m^3	All	35	40 mg/m^3
PHOTOCHEMICAL OXIDANTS	1-Hr Conc	0.08	160	0.08	160	All	0.08	160
HYDROCARBONS (Non-Methane)	3-Hr Conc (6-9 a.m.)	0.24	160	0.24	160	All	0.24	160
NITROGEN DIOXIDE	(Annual) Arithmetic Mean	0.05	100	0.05	100	All	0.05	100
FLUORIDES	(6 months)							
a) Total Fluorides as F (Dry Weight Basis)	Growing Season			40		All		
	Any 60-Days			60		All		
	Any 30-Days			80		All		
b) Gaseous Fluorides as F (Volume Basis) parts per billion	12-Hr Conc			4.5 ppb	3.7	All		
	24-Hr Conc			3.5 ppb	2.85	All		
	1-Wk Conc			2.0 ppb	1.65	All		
	1-Mo Conc			1.0 ppb	0.8	All		
BERYLLIUM	1-Mo Conc				0.01	All		
HYDROGEN SULFIDE	1-Hr Conc			0.01	14	All		
SETTLEABLE PARTICULATES (Dust Fall-State Standards Only)	(Annual) Geometric Mean				.60 mg/cm^2/mo ♦	IV		
					.40 mg/cm^2/mo	III		
					.30 mg/cm^2/mo	II		
					.30 mg/cm^2/mo	I		

*Except for Annual Values, the Federal Standards are values not to be exceeded *more than once a year* while N. Y. S. Values are maximum values, unless otherwise noted.

**The state is divided by air quality priorities into four levels: from Level I, denoting the areas of least pollution to Level IV being generally urban areas of heavy pollution.

†Also 99% of 24-hr. values shall not exceed 0.10 ppm (260 $\mu g/m^3$) on an annual basis.

‡Also 99% of 1-hr. values shall not exceed 0.25 ppm (650 $\mu g/m^3$) on an annual basis.

♦Also 84% of 24-hr. values shall not exceed (in $\mu g/m^3$): 110 (Level IV); 100 (III); 85 (II); 70 (I) on an annual basis.

♦Also 84% of monthly values shall not exceed (in mg/cm^2): 0.09 (Level IV); 0.60 (III); 0.45 (II); 0.45 (I) on an annual basis.

Figure 7-2

State of N.Y., D.E.C.

LECTURE #8

MAN'S IMPACT

I. Land and Land Planning

Introduction

A. Review of natural conditions, resources and processes completed

1. interrelationship exists among all elements - they effect each other

2. man has, at times, imbalanced the systems

a. result is loss of vegetation

b. erosion

Destruction of the land

A. Erosion within the Town of Huntington

1. sensitivity of morainal topography to exposure to weather

B. Loss of vegetation within the Town of Huntington

Causes of Destruction of Land

A. Housing

1. removal of vegetative cover

2. failure to stabilize slopes

B. Roads and Transportation corridors

1. failure to stabilize slopes

2. channeling of runoff, producing gullying

C. Farms

1. sheet runoff

D. Sand Mining

1. exposed slopes

Land Planning

A. Man's attempt to order development for present and future well-being

B. Tools of land planning

1. zoning

a. past criteria

1) socio/economic

a) tax base

b) existing development

c) human convenience

b. possible future criteria

1) consideration of resources and processes

a) soil types

b) vegetative associations

c) topography

d) hydrologic cycle

c. examples of projects that have considered natural resources as a criteria for development

II. Sewage

Sewage is waste material in water from our homes, factories and restaurants.

- It is waste flushed down a toilet, sink, drain or pipe.

- It can be oil, grease, chemicals, soap, paint or acid.

- Whatever it is and wherever it comes from, sewage is the major cause of water pollution in the United States.

- Until just a few years ago, the majority of the sewage produced in this country was allowed to flow directly into oceans, rivers, streams and lakes.

- Often into the same water people later used for drinking.

- Sewage emptied into surface water breeds disease, kills fish and other animals, causes the growth of excessive algae, uses up oxygen in the water and makes it unsafe for drinking. In addition, water that looks dirty and has waste material floating in it is not as desirable for boating, swimming and fishing.

- In some parts of the country, and this includes Long Island, sewage is poured directly into large holes in the ground that have been lined with concrete cesspools or septic tanks.

- On Long Island, this large amount of sewage, entering the ground through cesspools, has caused yet another pollution problem. Degradation of our underground freshwater drinking supplies.

- Nitrates from human waste have moved downward through the soil and are beginning to show up in the aquifers.

- Water, drawn from wells in many parts of Long Island, contain harmful concentrations of nitrates.

- <u>What are the solutions</u>

- Studies show that if a family of four is surrounded by approximately one acre of land, clear rainwater will dilute their waste so that when it gets to the groundwater below it will be harmless.

- If more than one family lives on an acre, evidence shows that rainwater over that area is not enough to dilute their sewage if it is placed in the ground.

- This will eventually lead to underground freshwater contamination.

- If this is the case, sewering and sewage treatment must be considered.

- Sewering is the construction of pipes which remove sewage from homes and factories and direct it towards a sewage treatment plant.

- Here the waste material can be treated, the harmful chemicals removed and the water safely put back either into surface waters or the ground.

- In sewage plants, incoming material is treated with oxygen, chlorine and other chemicals and the solids are removed.

- Water leaving the plants is relatively pure and can even be made drinkable.

- Sewage treatment is expensive and costs increase dramatically with the amount of treatment undertaken.

- The best way to control water pollution is to treat sewage before it get into surface waters or the ground.

- Pollution control after the fact is much too difficult and expensive.

- Laws have been passed that make it illegal to put untreated sewage into surface water.

- It is also illegal to put it into the ground if it contains harmful chemicals from industrial waste.

- Because of this, waste water from many industrial plants is treated at the plant for removal of harmful chemicals.

- For many years water was used once and thrown away.

- Today, water is and should be recycled.

III. Solid Wastes

What is it?

30% - paper

20% - yard waste

20% - food waste

30% - glass, metals and other

Volume of Solid Waste

The average per person daily waste collection is 5.3 lbs. or 1.1 tons per year.

Increasing quantities of solid waste are due to: high-consumption economy; acceptance and usage of packaged goods and planned obsolence of such things as automobiles.

Methods of Disposal

Past Methods

- Open dump, open dump burning

Present Methods

- Sanitary landfill and incineration

Future Methods

- Energy resource recovery with retrieval of metals, recycling and source reduction (bottle bill)

Up to 75% of solid waste management costs are attributed to collection of wastes and their transportation to processing plant or disposal site. Due to this fact, source reduction is an attractive alternative.

Huntington presently operates its three incinerators six days a week, 24 hours a day. The residue from incineration, along with the major amount of material that goes directly to the landfill, will fill our landfill sites within three years. The Multi-Town Regional Resource Recovery and Solid Waste Management Program may be Huntington's only feasible solution to an immediate problem.

IV. Toxicology

The important thing to remember when discussing the toxicity of chemicals or foreign materials, whether in our air, water or food, is that there is no such thing as a 100% safe chemical. There is also no such thing as a 100% harmful chemical. Toxicity depends upon the concentration or amount of foreign material or toxic substances present.

The most harmful of materials in sufficiently small amounts will produce no untoward effects.

The safest of chemicals in high enough amounts will produce undesired effects in a living system.

- Toxicology is the study of the harmful or unwanted actions of chemicals on living tissue. It is the unwanted or unexpected effect that appears when a living system is subjected to an externally administered foreign material or surplus of a chemical that is natural to the system.

- The question "is that material safe or harmful?" is no longer used by scientists.

- All chemicals have degrees of harmfulness and safety depending upon their concentrations.

- There is no strict line of demarcation on one side of which you can place the safe and on the other side of which you can place the toxic chemicals.

- Biological variation is the reason why there is no clear-cut safe or poisonous material.

- No matter how homogeneous a test group, the drug you are testing or the chemical you are exposing the group to will produce a variety of effects.

- The range will be from no effect at all to the maximum that was expected with some even having a completely unexpected reaction.

- A textbook response will not be seen in all of the subjects.

- The only guarantee you have, following the exposure of a group to a harmful chemical, is that you will get a variation of effect and a distribution of response.

- This distribution can be plotted and is known as the normal Gaussian distribution pattern, the familiar bell shaped curve seen below.

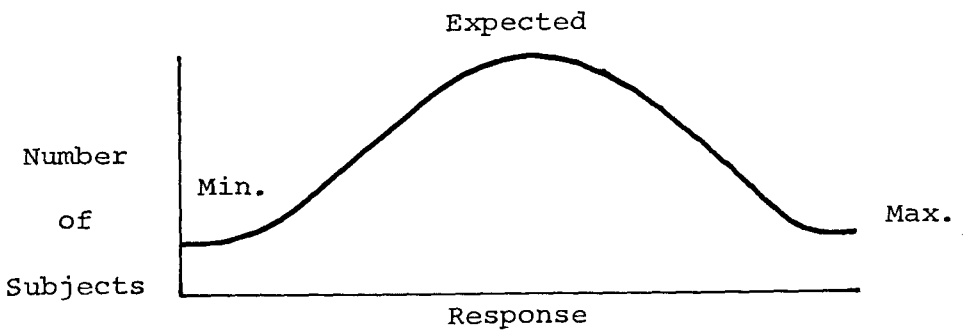


Figure 8-1

Factors that account for biological variation include: differences in metabolism, age, sex, nutrition, pathology and genetics.

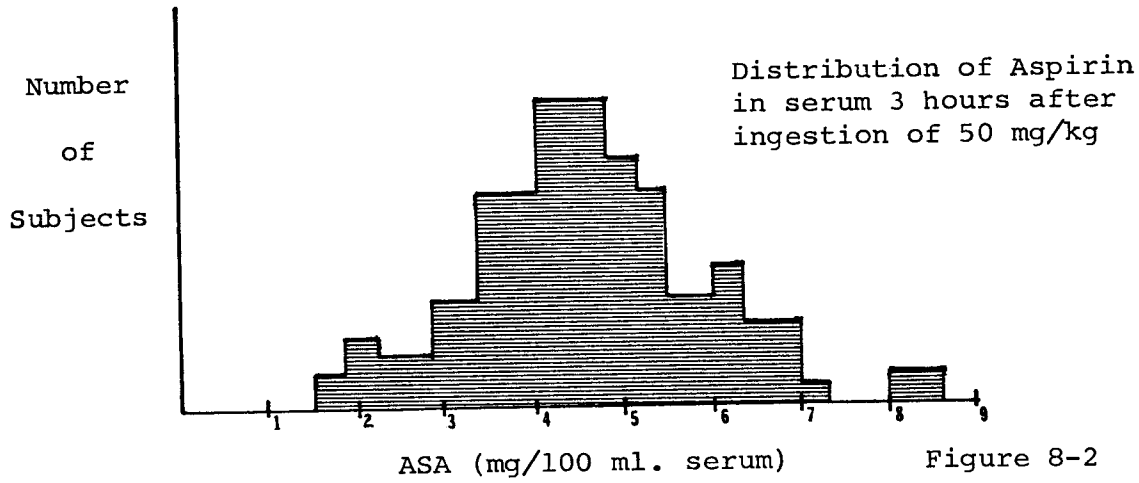


Figure 8-2

- Aren't testing procedures supposed to tell us what to expect from pollutants in our environment?

- Top scientists have been asked these questions and the following is a summary of their statements:

"Scientists who perform experiments on laboratory animals routinely ponder whether the results from experimental studies can be extended to man and if so, with how much certainty. This scientific question has special relevance to the toxicologist as well as to the government official who must set safety standards for the ever-increasing number of chemicals in our environment, while relying for the most part on data gathered from animal experiments."

"Uncertainties related to animal testing are recognized not by scientists, but also by Food and Drug Administration officials who make administrative decisions about the safety of a wide variety of chemicals. The food additive section of the Code of Federal Regulations states 'to provide assurance that any substance is absolutely safe for human or animal consumption is impossible. This is particularly true for substances intended for human consumption which have been tested in animals."

- It would be simple if we could declare something safe or unsafe and not have to worry about our decision.

- Because of biological variation and the increased sensitivity of our young and elderly, this cannot be done.

- We must, therefore, watch all chemicals and be concerned about their concentrations in our surrounding environment.

- Unnecessary ones should be eliminated.

- Necessary ones carefully tested and monitored.

V. Energy

Why is energy a topic that is discussed when talk turns to the environment?

1. Our major sources of energy are natural resources which cannot be replaced. We are, therefore, using up a part of the environment that surrounds us.

2. As we obtain these sources of energy it often means destroying the environments in which they are found.

3. As these natural resources are used to produce power, they release waste products into the environment that are harmful to living things.

Today, coal, oil and gas are our main sources of power and energy.

- Each is a non-renewable natural resource.

- Each has associated with its production and transportation serious adverse environmental impact.

- Coal and oil, when burned to produce power, release large amounts of harmful contaminants into our environment.

- On Long Island, oil is the prime material used for energy. Electricity, homes and automobiles run on it or its by-products.

- As the amounts of oil used increase, so do the contaminants released from it.

- There are ways, however, to reduce the adverse side effects associated with the use of these natural resources.

- Safe chemicals can be added to the burning process to get rid of harmful polluting gases.

- Filters placed on chimneys, where coal and oil are burned, will trap harmful pollutants.

- Waste products from their incinerations can be treated and moved into safe areas so they cannot get into surrounding land or water.

- Conservation, however, is probably the soundest solution to many of the problems we have.

- As less energy is used there will be less damage to our environment.

- Safer and cleaner sources of energy can also be used. The sun, wind and tides are already being studied and in many areas used.

- Nuclear energy must also be considered but it has the problem of safety.

Field Trips

Two days of field trips are scheduled for the class including visits to environmentally-oriented facilities throughout the Town of Huntington (landfill site, sewage treatment plant and an incinerator) and selected natural areas. They will include demonstrations of field methods in geology and aquatic and marine biology.

This section of the manual contains an outline for studying a freshwater ecosystem as well as a specific geology field trip to Target Rock.

Field Study of a Pond Ecosystem

I. Introduction

A. A pond is a relatively closed system where the resident animals and plants are confined to a specific area and therefore are easy to study.

B. In order to understand all of the interactions of a freshwater ecosystem, a pond must be studied for at least a complete year and one day each season, it should be sampled during the early morning, midafternoon and evening.

II. Selection of a Pond

A. Try to select a pond for which some background information is available.

B. Obtain a topography map from the United States Geological Survey (USGS) and, if available, an aerial photograph. From these maps, make your own field maps that show slopes, various topographical features and other pertinent details.

C. Determine the extent of the pond's watershed.

III. Field trip to the Pond

A. Become familiar with the area with the help of your maps, observing and adding other significant information you may see.

B. Check for inlets and outlets as well as natural drainage and eroding banks surrounding the pond. Make note of the proximity of homes, lawns, man-made drainage sites and other forms of development.

IV. Soil Composition

A. Determine the soil composition of the area surrounding the pond. With the aid of the Soil Conservation Services' Suffolk County Soil Survey, you will be able to classify the soils as clays, sand, silt or organically rich humus. From information already ascertained, determine the main water source and the type of pond (perched or regular water table, vernal, dammed stream or man-made).

V. Surrounding vegetation provide a clue to the pond's stage of succession.

A. Identify the main plants and shrubs; try to determine if the water level has been altered; identify major aquatic plants, determine if they are emerging into pond surface area.

B. Look for dead and dying trees and new growth thus indicating a change in vegetatior. is occurring and a new successional stage may be imminent.

VI. Depth Contour Maps

A. It is important to learn the depth of a pond because this will determine the extent of plant growth and the types of fish and wildlife that can live there.

B. A contour map of the bottom will also be of help in selecting sampling site.

VII. Selection of Study Sites

A. Using information that you have collected you can select a number of sites in and around the pond that together

will give you an accurate picture of the changes and interaction occurring throughout the year.

B. Select and designate various study sites that have different characteristics which can be compared, i.e. shallow or deep sections of water, areas that are in constant sun or constant shade or at the inlet or outlet.

VIII. Sampling a Pond

A. Although it is important to sample through each season of the year, the frequency of the sampling can be divided by your particular time and schedule constraints... the more frequently you sample, the more accurately you can assess the pond's ecosystem. Common sampling schedules are one week, two weeks and monthly intervals.

B. Biota Samples

1. Sample plants, animals, plankton and algae at each site, making sure to record the conditions and depth at which each was found. Don't forget bottom sediment samples for this is where much of the pond's life is found. Samples should be taken in the spring, summer, fall and winter (if possible), thereby observing the developmental stages of a population.

C. Chemical Analysis

1. Depending on the availability of equipment, perform a series of tests at each site throughout the year,

particularly spring, summer and early fall.

2. Physical and chemical tests to be included are color, turbidity, total suspended solids, temperature, pH, dissolved oxygen, free carbon dioxide, nitrates and alkalinity.

3. At sampling sites when the water depth exceeds three feet, a sample of water should be taken near the bottom and tested. If the depth is great enough, samples can be taken at three foot intervals until you reach the bottom.

IX. Methods for testing

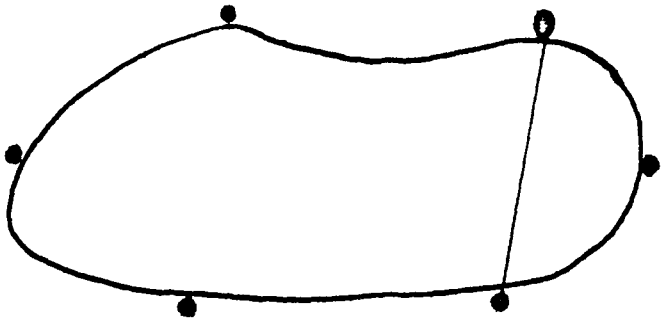
A. Physical

1. Depth Contour Map - there is an organized method of taking depth readings ("soundings") in order to determine the bottom profile of your pond.

a. On your map, plot points along the perimeter of your pond at intervals so that lines drawn between the points on opposite sides of the shore will give best coverage of the pond's surface area.

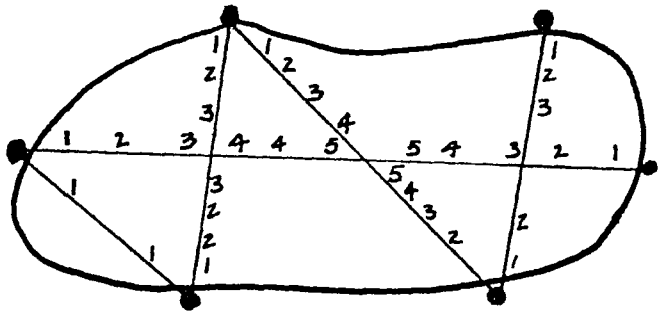
b. As per your map design, stake out the pond and stretch a rope, which has been marked in equal intervals, between the first two points. These are the "sounding runs" and your guideline for taking your soundings (Figure A).

Figure A



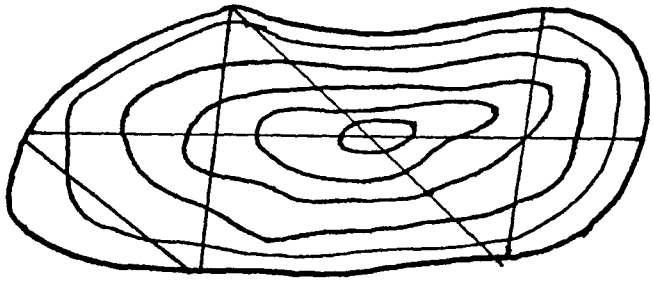
c. As the boat travels along the sounding run, stop at each interval, take a depth reading and record it on the map. Stretch the rope between the next two points and continue until all runs are completed (Figure B).

Figure B



d. To complete your map, join the equal depth readings (Figure C).

Figure C



B. Chemical

1. The chemical analysis of the water will aid in understanding the pond's ecosystem.

   a. When obtaining the water sample, always record the time, temperature of the air and water, and weather conditions (clear or cloudy sky, any unusual conditions that occurred within the last few days).

   b. Follow the directions for your water testing analysis kit to acquire the necessary chemical data.

      Note: Since dissolved oxygen excapes very rapidly from your sample, the test should be done immediately.

C. Biological

1. Small animal life

   a. Seining, dip nets, water skimmers and plankton nets can be used to collect free swimming organisms as well as those which are along the surface.

   b. Dip nets, water skimmers and hand rakes can be used around the vegetation. Carefully inspect leaf surfaces and stems for attached organisms.

   c. The organisms collected should be placed in white enamel pans or collecting jars for observation and study.

2. Large animal life

   a. In order to sample a population of large animal life such as fish, frogs and turtles, patience and a large net are necessary.

   b. Activities of muskrats, raccoons, waterfowl and other animals may also be observed. Although capturing these animals is not recommended.

Geology Field Trip

I. Introduction

A. Target Rock offers the best example of glacial deposits here in Huntington. The field trip will include a walk to the bluffs that face Huntington Bay to view the glacial stratigraphy and beach geomorphology. The on-going coastal processes and the origins of the glacial material that makes up the bluffs will be discussed. Also field tests on boulders eroded from the cliffs will be demonstrated as well as the differences in the composition and grain size of the glacial material as opposed to the beach sediments.

II. Field Excursions (Target Rock Refuge)

A. Bluffs along Huntington Bay (glacial stratigraphy)

1. Stop 1 - 100m northwest of stairway

a. the cliff section here reveals a sequence of outwash, tilly outwash and loess

(1) Outwash - basal unit consisting of stratified sands and gravels about five meters thick

(2) Till - compact brain layer with abundant larger rocks and clay - undifferenciated one inch thick contacts may be difficult to see

(3) Second unit of outwash - thickens to two meters

(4) Loess - wind blown silt and clays deposited as a capping upon the glacial deposits as the glacier receded.

2. Stop 2 - actively slumped section in the high point of the bluffs

   a. the cliffs section here reveals a series of hard grained sediments above the till

   b. the base outwash unit referred to as A16 is below the beach level and undesirable

   c. The outwash unit above the till has been replaced by the fine grained sediments. The lower part of these sediments are clays, silts and fine sand, which grades into fine and medium sized sands. This deposit represents a lake that formed between the ice front and the uplands to the south. One can look across the bay to Eaton's Neck and see a well defined horizontal band. These are also lake sediments though possibly not from the same lake. The fact that lakes developed here is taken as evidence that the ice sheet stopped here during the recession which allowed enough time for the development of lakes from the ice meltwater.

3. Some of the effects of the ice standstill at the "Necks"

   a. cutting of a east/west channel which is now Lloyd Harbor

   b. ice tongues expanded into and excavated U-shaped valley where the bays are today

   c. lakes formed depositing fine grained silts and clays

B. Beach geology

1. boulders eroded from cliffs are deposited at base of slope.

   a. storms, waves, winds and rains do the eroding while the littoral current carried the sand and leaves the boulders behind.

   b. the beach and cliffs are eroded back. When the British first started using Target Rock for cannon practice, it was at the base of the bluffs.

   c. the boulders are used by geologists who trace the boulders' origins back to New England and by this method can tell which direction the glaciers came from.

2. Coastal Currents

   a. Tidal currents formed East Beach to the south

   b. Formation of East Beach cuts off northward arm of Lloyd Harbor and formed the present day brackish pond.

3. Beach forms

   a. Back Beach

   b. Fore Beach

   c. Intertidal zone

   d. Tarket Rock rock type

III. Demonstrations

A. Comparisons of grain size and composition between beach sand and glacial till

1. Hand and magnifying glass analysis

a. grain size

b. sorting

c. amounts of clays, silts and sand particles in each

d. minerology

2. Permeability

a. using the clear plastic tubes, half fill one with beach sand and half fill the other with glacial till

b. record the amount of time it takes for one pint of water to pass through each tube

c. this indicates the amount of pore space, percentage of clay particles and sorting of each sample

3. Mineral and Rock Identification

a. Characteristics of minerals useful in identification

(1) relative hardness

(2) luster

(3) streak

(4) cleavage and fracture

(5) specific gravity (density)

(6) color

b. characteristics of rocks useful in identification

(1) important concept - rocks are composed of one or more minerals

(2) color, hardness, grain size, density, types of individual minerals present and any odd occurrances are aspects of rocks useful in identification

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Note - "R" preceding page number (i.e. R-1) denotes information is found in the Resource Inventory Manual.

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Huntington Outdoors
Nature Study Areas

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LIST OF FIGURES (Continued)

INTRODUCTION

We in the Town of Huntington, are fortunate in having within the town, examples of natural features characteristic of those seen throughout Long Island. Our beaches, marshes, forests and plant and animal communities make it unnecessary to travel great distances to observe and study nature. Their diversity and accessibility offer excellent opportunities for outdoor environmental education.

The following section of this manual contains an introduction to our town's natural resources and a compilation of selected sites throughout Huntington which will be valuable to you for use as outdoor learning laboratories where these resources can be studied.

Although only a brief environmental inventory of each area has been provided, these sites lend themselves to a more complete environmental analysis which can be easily accomplished as class projects. In addition, many of these sites offer the opportunity for our young people to study the interactions within nature and between themselves and nature.

The Department of Environmental Protection will be pleased to supply additional information on any of these sites to prepare you for a field trip into the area, upon request.

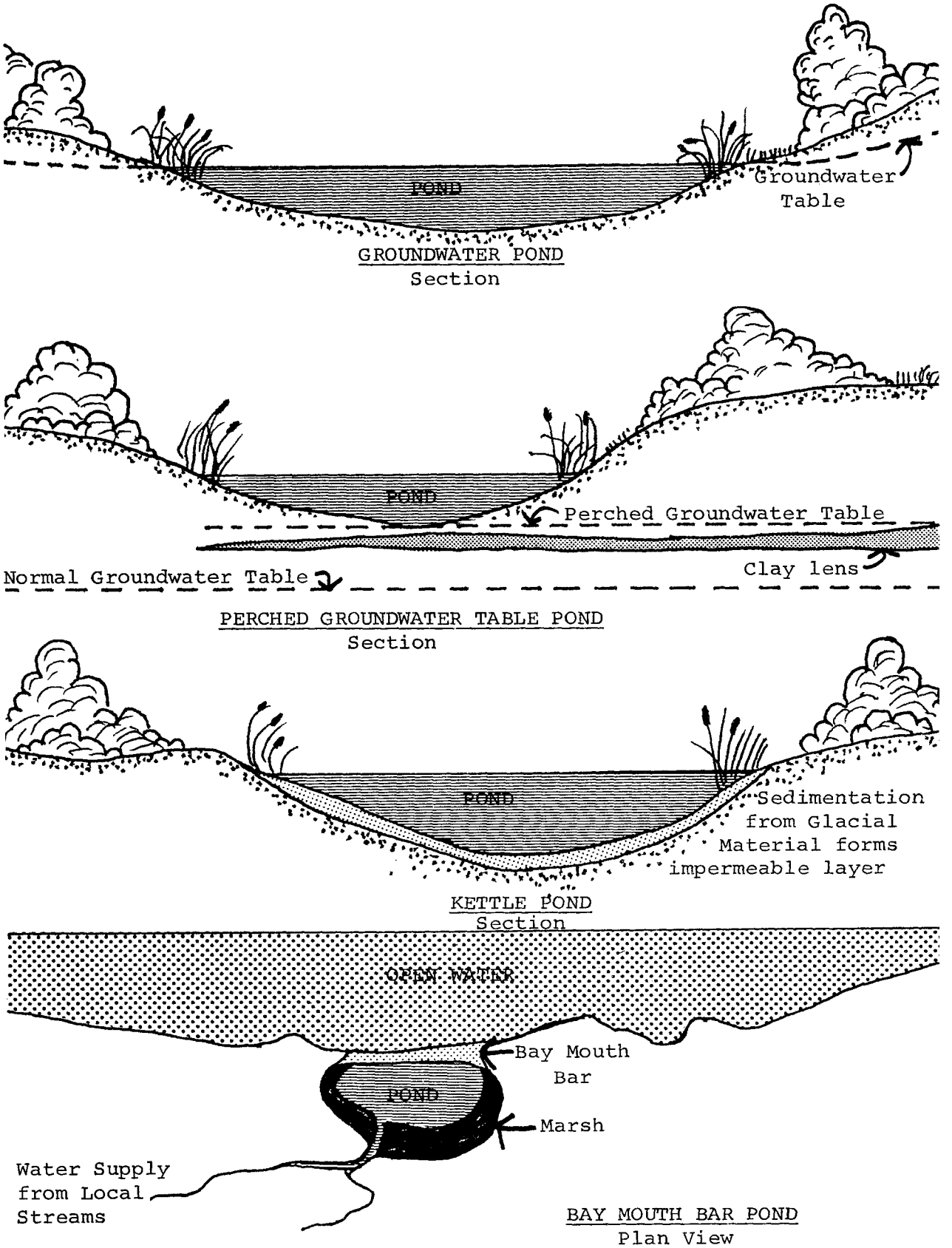
GEOLOGY

Huntington's subsurface structure is composed of three distinct formations, each representing a stage in the natural history of this area. The lowest unit is bedrock, lying 400 to 1000 feet below sea level, dating back approximately 600 million years. Overlying the bedrock are deposits of sand and clay, 135-60 million years old, ranging in thickness from 200 to 1200 feet. The upper layer consists of unsorted sand and gravel laid down during the ice ages, approximately 25,000 years ago.

HYDROLOGY

Due to the unconsolidated nature of the geologic structure overlying bedrock on Long Island and its highly porous character, precipitation, when hitting the ground, moves downward through the soil and becomes trapped in the sands below. This trapped water is called an aquifer and supplies Long Island with its fresh drinking water.

The springs, ponds and lakes found throughout Long Island are the result of either fresh water trapped at the surface by impermeable clay layers, or surface depressions that dip down into the water bearing aquifer. (Fig. 1)



WATER FORMATIONS

Figure 1

VEGETATION

A General Description

Following the close of the final ice age, the botanical history of the present plant associations in the Town of Huntington began. (A plant association refers to any group of plants that normally grow together under similar soil and climatic conditions.) Due to the climate existing at that time, only those plants able to adapt to the cold conditions survived. As the glaciers retreated and the climate progressively warmed, a greater variety of plants flourished, resulting in the plant associations that can be observed today in the Town. (Fig. 2)

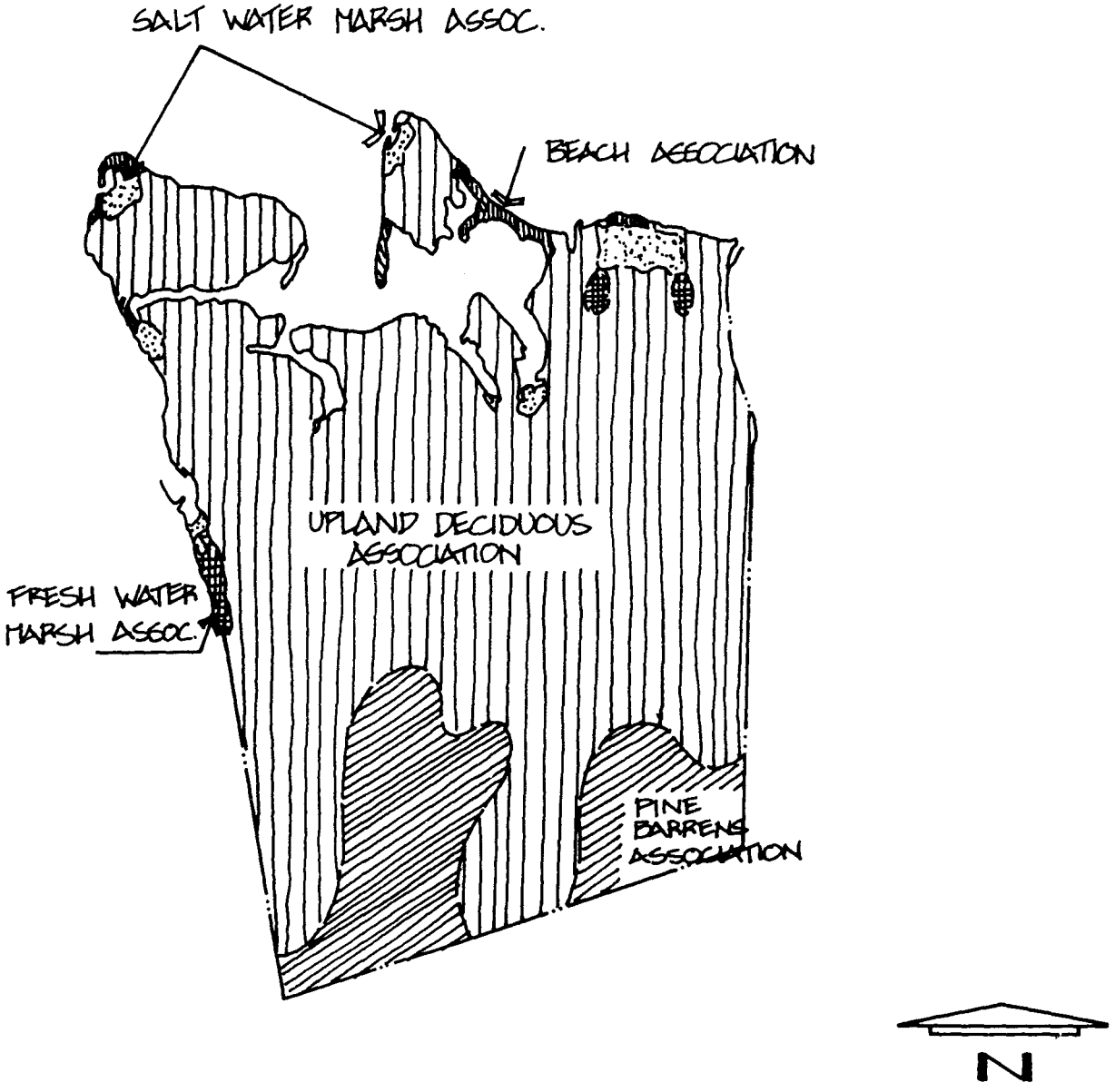
Plant Associations

Pioneer

This term refers to those areas that have been disturbed by natural occurrences or human activities and are in the process of revegetation. (Fig. 3) Among the first plants to take hold in these disturbed locations are Beardgrass and Goldenrod.

These may be followed by Red Cedar and Myrtle which tend to retard growth of the less tolerant grasses. The regenerative process, commonly called succession, continues with the growth of Black Cherry, Sumac and Silver Maple, while at the same time the soils become enriched by the decay of dead plant material. On poorer soils Green Briar, Poison Ivy and Honeysuckle may be found.

This Pioneer Association can be seen in town where a farm has not been worked in several years.



PLANT ASSOCIATIONS

FIG. 2

Pine Barrens

Consisting primarily of pines and oaks with an understory of low and highbush blueberry, pine barrens (Fig.4) are a unique plant association located in well-drained, sandy soil conditions. The name "barren" is derived from the limited variety of vegetation that normally grows in these areas.

Fires are a natural occurrence in this association and are an important factor in the germination phase of pine seeds. In areas where natural fires have been controlled, oak becomes the dominant species in this plant association.

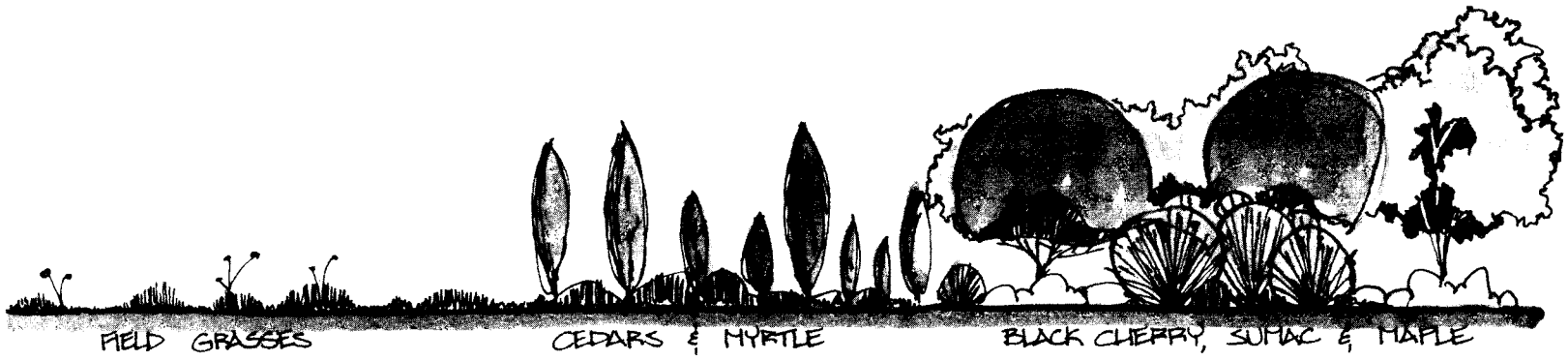
Pine Barrens can be observed at Otsego Park.

Upland Deciduous

Among the various plant communities found throughout the Town, the Upland Deciduous Association (Fig. 5) is the prevailing type. Black oaks predominate in the dry, sunny areas. Birches and Mountain Laurel are found in the cool areas and Tulip Tree, Butternut Hickory, Red Maple and White Ash dominate in the moist locations.

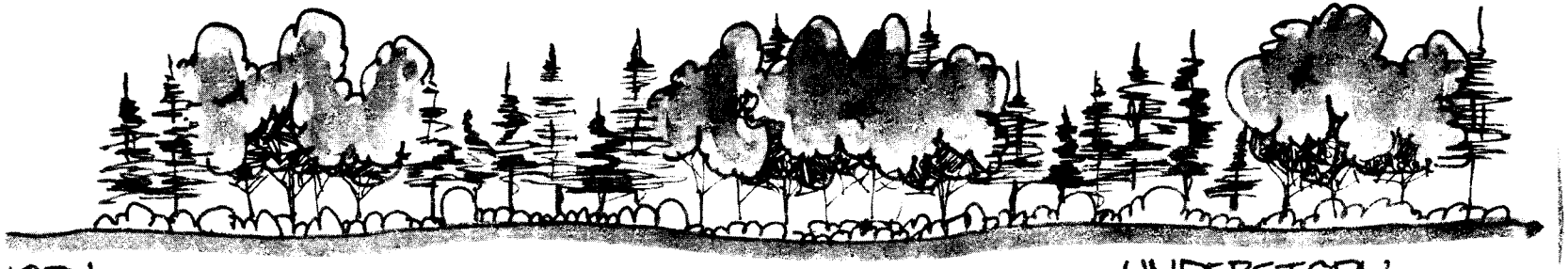
Upland deciduous forests can be observed at the following locations:

Target Rock Natural Wildlife Preserve (#2)
Eaton's Neck (#3)
Nature Conservancy (#4)
Organic Garden (#7)
Manor Plains (#11)
West Hills Park (#12)
Heckscher Park (#14)
Arboretum (#15)
Caumsett (#16)
Vanderbilt (#17)
DeForest (#18)



DEVELOPMENT OF PIONEER ASSOCIATION

FIG. 3



PINE BARRENS

FIG. 4

Freshwater Ponds and Marshes

This association is typically found along the edges of freshwater ponds and streams and include Sedges, Cattails and Rushes. Birches, Red Maples and Willows are often found along the borders of ponds. (Fig.6)

Freshwater ponds and marshes can be observed at the following locations:

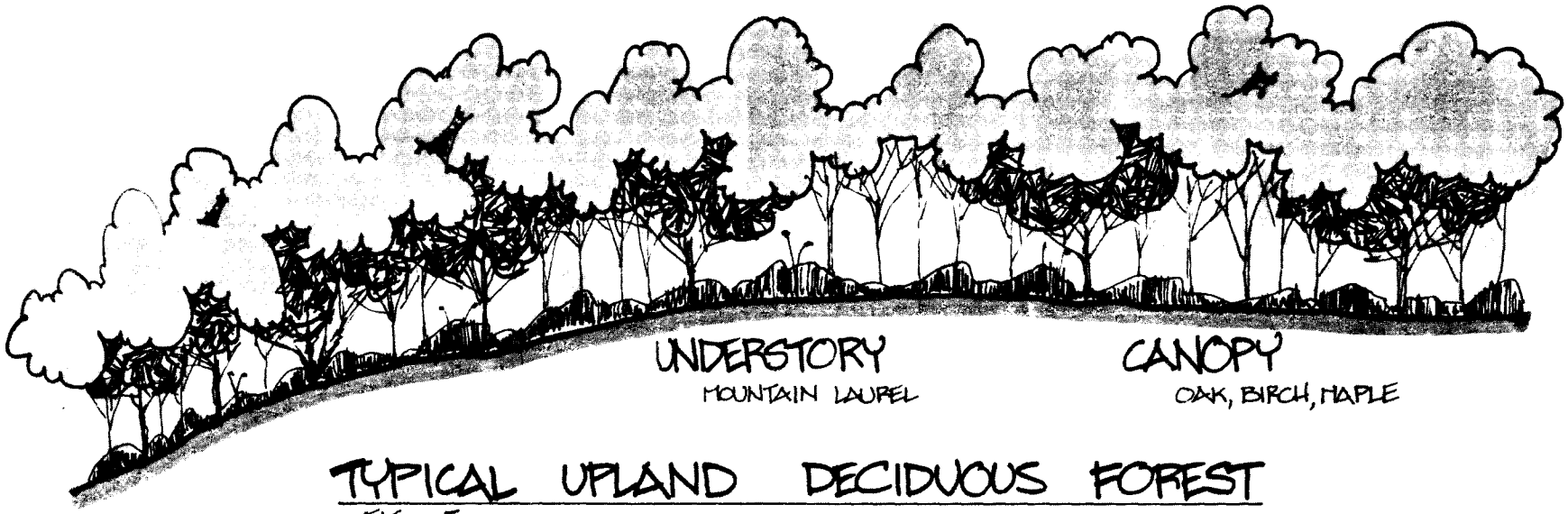
Crab Meadow (#1)
Target Rock National Wildlife Preserve (#2)
Nature Conservancy (#4)
Organic Garden (#7)
Manor Hills (#11)
West Hills Park (#12)
Heckscher Park (#14)
Arboretum (#15)
Caumsett (#16)

Saltwater Wetlands and Estuaries

This association is found along the harbors and bays of Long Island. The plants located here are unusual in that they are able to survive being covered by the tides twice a day. Typical plants that grow in saltwater wetlands and estuaries include Saltwort, Cordgrass and Salt Hay. (Fig.7)

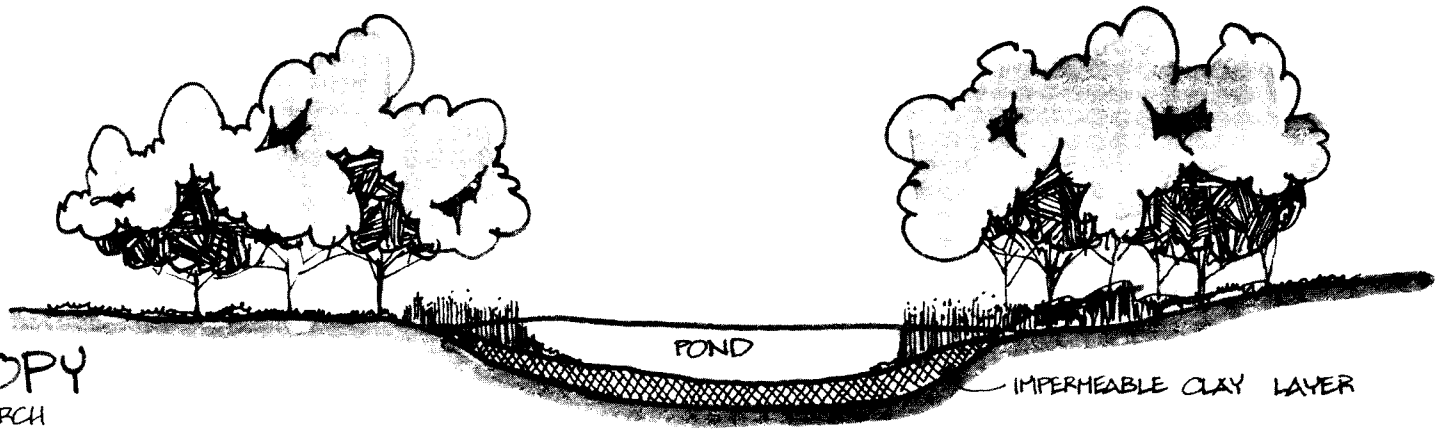
Saltwater wetlands and estuaries can be observed at the following locations:

Crab Meadow (#1)
Target Rock National Wildlife Preserve (#2)
Eaton's Neck (#3)
Nature Conservancy (#4)
Sand City (#5)
West Neck Beach (#6)
Makamah (#8)
Centerport Beach (#10)
Caumsett (#16)



TYPICAL UPLAND DECIDUOUS FOREST

FIG. 5



CANOPY
OAK, BIRCH

POND EDGE
CATTAILS
SEDGE

TYPICAL FRESH WATER POND

FIG. 6

Beach Vegetation

This association, consisting primarily of Beach Plum, Beach Grass. Wild Rose and Bayberry, is found on Long Island's sandy beaches. (Fig.8) All these plants are capable of surviving this harsh environment of poor soil conditions, excessive sunlight and salt spray. Many of these plants perform the important function of holding the sand in place, thereby preventing erosion.

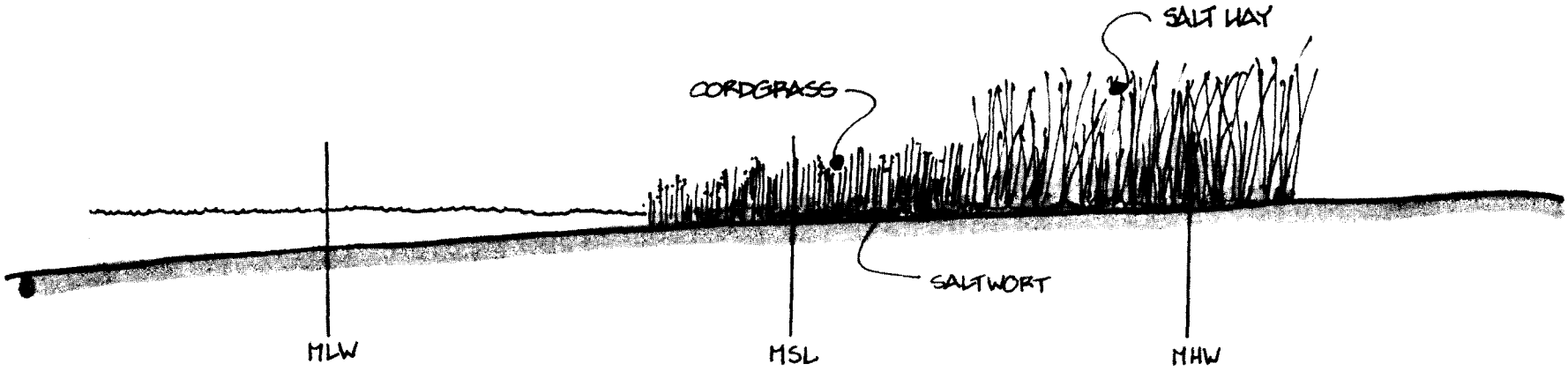
Beach vegetation associations can be observed at the following locations:

Crab Meadow (#1)
Target Rock National Wildlife Preserve(#2)
Eaton's Neck (#3)
Nature Conservancy (#4)
Sand City (#5)
West Neck Beach (#6)
Makamah (#8)
Centerport Beach (#10)
Manor Plains (#16)

WILDLIFE

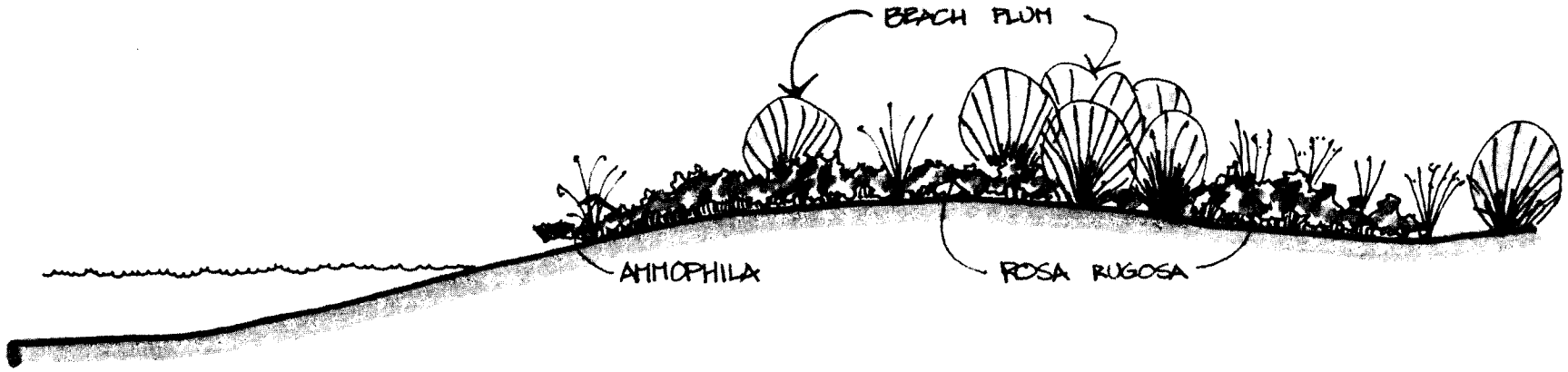
Animals found in the Town are typical of those species normally inhabiting a northern deciduous forest. Mammals range from small to medium in size, the largest being the White Tail Deer. Other mammals found within the Town include Oppossum, Woodchucks, Flying Squirrel and Skunks.

A wide variety of amphibians, reptiles and birds can also be observed.



TYPICAL SALT WATER WETLAND

FIG. 7



TYPICAL BEACH VEGETATION ASSOCIATION

FIG. 8

CLIMATE

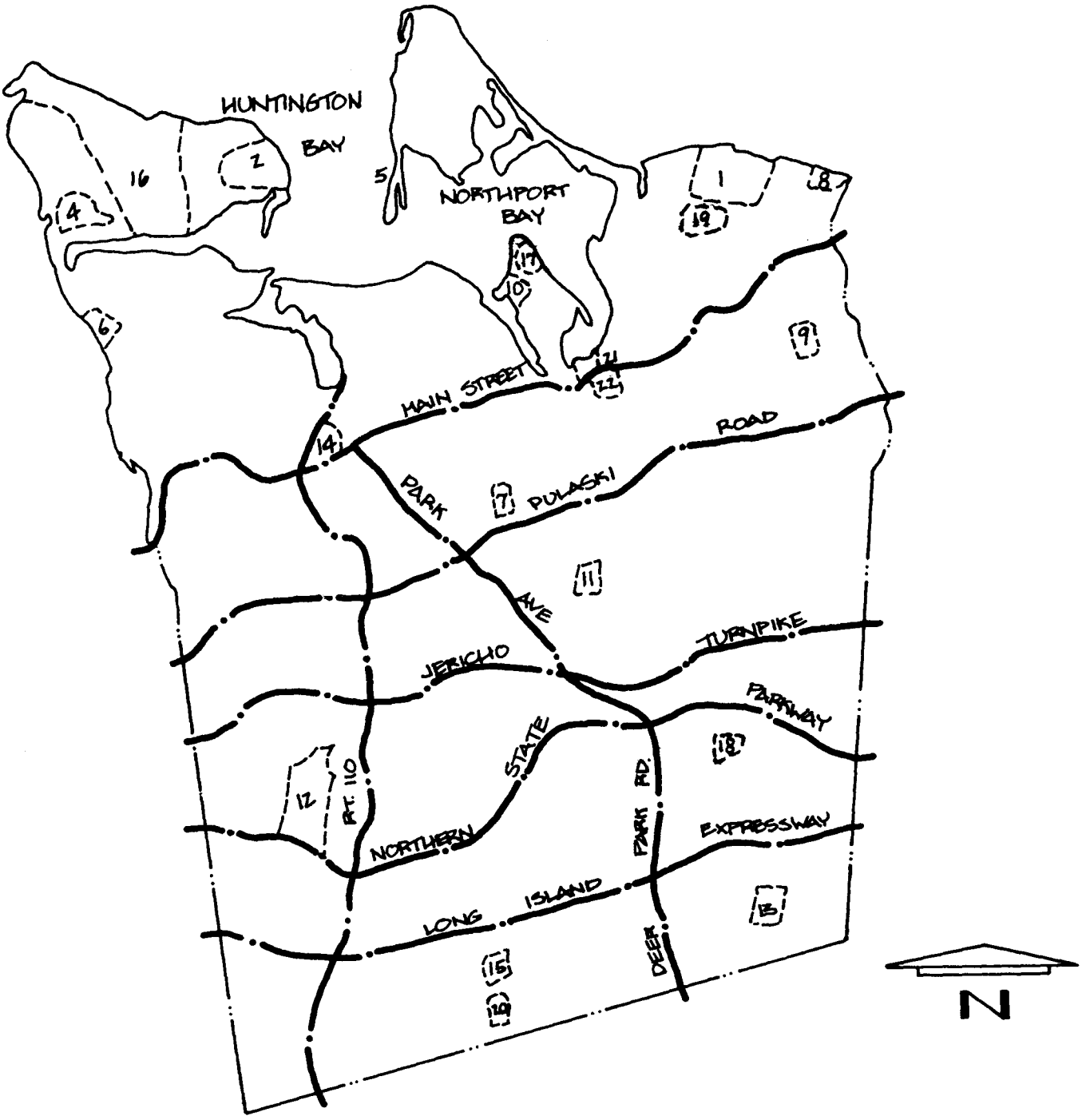
Located between 40° and 41° north latitude, the Town of Huntington lies in a temperate zone. Because of its proximity to the Atlantic Ocean as well as Long Island Sound,Huntington's temperatures are consistently a few degrees higher than the New York State average. The median yearly temperature for the area is 53.7°F, with mean monthly temperatures ranging from a low of 23.1°F in February to a high of 84.3°F in July.

Yearly average long-term precipitation is approximately 44 inches. Again, the Town's proximity to large water bodies accounts for so little sub-freezing precipitation.

Prevailing winds during the summer are south and southwest, with winds coming from the northwest the remainder of the year.

SITE DESCRIPTIONS

The following sites in the Town of Huntington exhibit many of the vegetative, geologic and wildlife characteristics discussed in the preceding sections. These descriptions will enable visitors to plan trips to the sites to observe specific environmental features. (Fig. 9 & 10)



SITE LOCATIONS

FIG. 9

LOCATIONS	VEGETATION					GEOLOGY				
	PIONEER	UPLAND DEC.	FRESH WATER	SALT WATER	BEACH	BLUFFS	SPITS	MORAINES	OUTWASH PLS.	KETTLE POND
1 CRAB MEADOW				●	●					
2 TARGET ROCK		●		●		●	●			
3 EATON'S NECK	●	●	●			●				
4 NATURE CONS.										
5 SAND CITY				●	●		●			
6 W. NECK BEACH					●	●				
7 ORGANIC GARDEN			●						●	●
8 NAKAMAH	●				●	●				
9 MEADOWLARK PARK	●	●						●		
10 CENTERPORT BCH.				●	●	●	●			
11 MANOR PLAINS	●		●						●	
12 WEST HILLS		●						●	●	
13 OTSEGO									●	
14 HECKSCHER PARK			●					●		
15 ARBORETUM PARK			●							●
16 CAUMSETT ST. PK.	●	●	●	●	●	●	●			
17 VANDERBILT										
18 DE FOREST		●	●					●		●
19 CRANBERRY BOG		●	●					●		
20 BUTTERFLY PARK		●	●					●		
21 NORTHPORT HBR.	●			●	●					
22 TWIN PONDS		●	●							

SITE CHARACTERISTICS

FIG. 10

(1) CRAB MEADOW

Location - Northport, at end of Waterside Avenue

Size - 425 acre site including a beach and salt marsh

Ownership - Town of Huntington and Suffolk County
For information phone HA-1-1000

Use - Beach activity, picnic tables and barbeques are available.

A great variety of marine habitats are available for study from rocky shoreline to sandy beach. The adjacent salt marsh is the largest in Huntington and is an excellent area for ecological studies.

Wildlife - Many types of waterfowl and other wildlife, including raccoon and muskrat, can be observed. There is also a large population of marine animals along the shoreline and throughout the wetlands such as fiddler crabs, mussels, clams, barnacles and horseshoe crabs.

Vegetation - Vegetation associated with the salt marsh includes, cord grass, salt hay, spike grass and saltwort. Beach pea, marsh elder and black grass grows in the zone between the beach and marsh.

Geology - Crab Meadow, with a hilly northern edge bordered by the Town golf course, is part of the lower Manhasset plateau. Recent marine deposits from the beaches and erosional outwash from the plateau produced the marsh in this area. Soils consist of sands close to the shore with silty loams inland.

(2) TARGET ROCK NATIONAL WILDLIFE REFUGE

Location - Lloyd Neck

Size - 80 acres

Ownership - United States Fish and Wildlife Service
Phone 271-2409

Use - The refuge is open from 9 A.M. to 5 P.M. daily for the purpose of hiking, photography and nature study. Pets must remain in the designated parking area. Due to its small size and undeveloped state, visits are by appointment only.

Wildlife - The refuge has a variety of bird and mammal life. Of special interest is the concentration of warblers during their May migration. Resident species of mammals include cottontail rabbits, raccoons and gray squirrels. Bobwhite quail, ring-necked pheasants and mourning doves also reside on the refuge. Occasionally, mallards, black ducks and Canada geese are seen on the brackish pond near the beach. Silently approach the pond or the beach and you may observe a variety of shore and wading birds throughout the seasons. The Long Island area provides a habitat for large concentrations of wintering waterfowl and rafts of ducks are often seen from the shore of Huntington Bay.

Vegetation - Rhododendron and azalea gardens make a spring visit an exceptional treat. Hiking trails provide access to most of the refuge. A small tidal marsh cordgrass exists along East Beach.

Geology - Located in the Harbor Hill moraine, the soils of the refuge are primarily Riverhead and Haven graded loams of less than 5% slope. Steep bluffs are found along the bay shore. There is a 14' rock found at the base of the bluffs, claimed to be used for gunnery practice by the British.

(3) EATON'S NECK LIGHTHOUSE

Location - Lighthouse Road, Eaton's Neck, New York

Size - Approximately 10 acres - 73 foot high lighthouse

Ownership - Federal United States Coast Guard
For information phone 261-6918

Use - Tours are conducted by appointment only. This historical site still functions as a lighthouse and U.S. Coast Guard station where one can see weather instruments in use.

Wildlife - The area is surrounded by a large estate with much open space, allowing for a large variety of wildlife with most typical Long Island species being represented.

Vegetation - Along the eastern shore of the embayment is a saltwater marsh. Surrounding the lighthouse is a hardwood forest with oak, red maple, tulip, poplar and mountain laurel as dominant species.

Geology - This site is a good example of the large bluffs that face Long Island Sound along the north shore of Huntington. The bluffs consist of layered strata of undifferentiated glacial till, outwash, and loess which were deposited by the Wisconsin glacier. Areas of sands deposited by tidal currents can be observed along the beach.

(4) NATURE CONSERVANCY

Location - Upland Farm, Lawrence Hill Road
Cold Spring Harbor

Size - 54 acres

Ownership - For information write P.O. Box 72, Cold Spring Harbor, N.Y. 11724 - Phone (516) 367-3225

Use - Upland Farms is the central office of the Nature Conservancy. This national organization owns and maintains various locations throughout Long Island for environmental study. These locations include waterfowl sanctuaries and upland forests as well as meadows in different stages of succession.

Wildlife - Most of the Nature Conservancy's property is undeveloped and undisturbed; therefore, the wildlife found at a specific location is dependent on the natural environment of the particular area.

Vegetation - The areas contain various vegetative associations depending on their location within the Town of Huntington.

Geology - Typical Long Island formations, with soils similar to other north shore areas, are found at individual sites.

(5) HOBART BEACH AND SAND CITY SPIT

Location - End of Eaton's Neck Road, Eaton's Neck

Size - Approximately 40 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Beach Activities and Nature Study. Access is limited during June and July when the spit supports one of the largest Least Tern colonies on the East Coast.

Wildlife - Shore birds, including gulls and terns can be observed at Sand City. Marine organisms native to Long Island waters can also be found.

Vegetation - Though vegetation is quite sparse along the middle of the beach, west of the parking lot one can see many examples of various beach vegetation. In the southern section, beach grass has been planted to stabilize the wind blown sands and establish a dune community.

Geology - Sand City is a sand spit delineating the western border of Northport Bay. This spit was formed by the steady erosion of the north shore bluffs by wave action and deposition of this eroded material by the long shore current. Sand mining operations have removed much of the southern half of the spit. When standing in the parking lot, one gets a large panoramic view of Northport Bay and Huntington Bay including the entrances of Northport, Centerport, Huntington and Lloyd Harbors. Sand City protects the inner bays and harbors from the impact of large, storm-generated waves.

(6) WEST NECK BEACH

Location - 25A to West Neck Road

Size - 27 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Beach activities and nature study

Wildlife - Marine fauna includes barnacles, sand worms, periwinkles, clams, mussels and small fish such as killies and spearing.

Typical shore species and migratory waterfowl are seen in the area including ducks, terns, gulls, and occasionally egret and heron.

Vegetation - Marine plant life such as Codium, Fucus, Ulva and blue-green algae are found here.

There is a transition in vegetation from a saltwater wetland through typical shoreline and beach vegetation to a northern hardwood forest.

Geology - The beach is comprised of sands, gravels, cobbles and boulders eroded from the bluffs behind the beach. Tidal currents and storm waves move the sand along the coast, leaving the heavier boulders behind. The beach faces out into Cold Spring Harbor which is a drowned river valley from an earlier period of geologic history in Huntington.

Other - In the nearby pond, fish, including bluegills, perch and bass can be found. Amphibians and reptiles are abundant. One can see muskrats and raccoons here as well.

The largest black oak in the United States, with a circumference of 19' 7", is on West Neck Road, approximately two miles north of the beach.

(7) ORGANIC GARDEN

Location - Greenlawn, junction of Greenlawn and Dunlop Roads

Size - 15 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Organic gardening

Vegetation - In this open farmland area, one can find many agricultural crops such as kale, swiss chard, lettuce, beets, corn and eggplant being grown organically. In addition, there is a large compost pile which is part of the Town's leaf recycling program. No chemical fertilizers or pesticides are used but instead, leaf compost and manure enrich the soil and natural methods, such as organic vegetable spray, provide insect control.

Wildlife - A number of birds are attracted to the open fields and to the vernal ponds in the area. The location also offers an opportunity to view abundant insect life.

Geology - Located in the Harbor Hill Moraine, the soils are rich Montauk and Haven loams.

Other - Printed material on organic gardening principles is available upon request.

(8) MAKAMAH BEACH

Location - North end of Makamah Road along Long Island Sound

Size - Approximately 15 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Fishing and Nature Study

Wildlife - Numerous sea birds use the mussel and clam beds as feeding grounds during low tides. The surrounding area is still rural and one may see small rodents and reptiles as well as larger mammals, including foxes and raccoons.

Vegetation - The plant associations which can be viewed include a limited beach association and an upland forest. Forest succession can be observed by viewing the pioneer species, beach communities and upland forests.

Geology - The area exhibits a variety of geologic phenomena, including eroding bluffs. At the eastern edge of the property a high degree of earth slumping has occurred due to thick clays overlain by unconsolidated glacial soils. During rainy periods, the upper soils become saturated and slide over the wet clays causing extensive erosion. The Town of Huntington has stabilized part of the bluff with a stone wall and natural plantings. The soils are of the Carver and Plymouth sands variety.

(9) MEADOWLARK PARK

Location - Off Middleville Road near Veterans Hospital

Size - 60 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Though presently undeveloped, future plans for the site call for recreational facilities and a passive nature study and hiking area.

Wildlife - The park is heavily wooded and protected from urban growth. Species that are typically found here are not encountered in high density, developed areas. They include rabbits, squirrels, raccoons, chipmunks, field mice, shrews, moles, reptiles, snakes and turtles. In addition, a wide variety of bird life is present.

Vegetation - This area is an excellent example of a northern hardwood forest with stands of white pine, locust, dogwood, red maple and poplar. It is a good example of old field vegetation and natural forest succession.

Geology - Meadowlark Park is located in the Harbor Hill moraine, a remnant of the last glacial age. The soils are primarily Riverhead and Haven loams.

(10) CENTERPORT BEACH

Location - end of Little Neck Road, west on the Centerport Peninsula.

Size - Approximately 14 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Recreational swimming, boating and nature area.

Wildlife - Since this area includes a tidal wetland, many species of birds and sea creatures use it for their feeding and breeding activities. Species of birds that may be found here include herons, gulls, ducks, geese and terns. Many small crustaceans at low tide scavenge among the marsh grasses and fish use the area for spawning.

Vegetation - Numerous species native to coastal areas are found at Centerport Beach. Plants that can be observed include cordgrass, salt hay and marsh grass. In the back beach zone are rose, beach plum, goldenrod and other wild species. Beyond the parking lot is the beginning of a northern hardwood forest.

Geology - Inland, large cliffs show subsoil content and the effects of erosion. The constant shifting of beach sands can be observed along the shore.

(11) MANOR PLAINS

Location - 0.5 miles south of Little Plains Road on Manor Road

Size - 15 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Nature study area for school children

Wildlife - The park's vegetation attracts small mammals such as rabbits, field mice, squirrels and chipmunks. A pond has been constructed on the site, providing a habitat for reptiles and amphibians and a stopover spot for migrating birds. There is much bird life around the fringe areas of the field due to the abundant plant life. Meadowlarks and Bobwhites are common and an occasional Grasshopper Sparrow may be seen.

Vegetation - Old field vegetation is dominant in this park. Included are bayberries, cedars, wild grasses, goldenrod, wild rose, young birches, maples and firs. This vegetation offers good cover for field animals and provides food for wildlife. The pond contains typical aquatic plant life of Long Island, including wild rice, rushes, reeds and water lilies.

Geology - The park is located in a glacial outwash plain, a south sloping area composed of sand and gravel washed down from the northern Harbor Hill Moraine as the last glacier melted. To the east and south can be seen sharply rising hills vegetated by large oaks. These hills are a northern lobe of the Ronkonkoma Moraine, with lichen and moss covering the Riverhead and Haven soils.

(12) WEST HILLS PARK
(including former Camp Kaufman)

Location - Reservoir Road, West Hills

Size - 435 acres

Ownership - Suffolk County
For information phone 421-4655

Use - Camping, nature study and horseback riding

Wildlife - A number of upland species of mammals and birds are found here, including raccoons, chipmunks, woodchucks, squirrels, rabbits, pheasants and warblers. There is a small pond and associated freshwater wetland which supports various wildlife including amphibians and the red backed salamander.

Vegetation - A typical upland deciduous forest, comprised of oaks, poplars, maples, mountain laurel and birch is dominant.

Geology - Jayne's Hill, located on the site, is the highest point on Long Island at 400 feet.
West Hills Park is situated in the geologic areas known as the Ronkonkoma moraine and the Manneto Plateau, both glacial till deposits which form the hills of Long Island. The soil associations in the area are generally of the Riverhead, Carver, Haven and Montauk soils.

(13) OTSEGO PARK

Location - Carl Straight Path and Weymouth Avenue in Southeast Huntington

Size - 44 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Recreational fields

Wildlife - A number of species of birds and mammals, including rabbits, squirrels, chickadees and warblers, are found here. Box turtles also inhabit the area.

Vegetation - Pine barren vegetation is found at Otsego with the dominant species including scrub pines, white oaks and an understory of highbush blueberry.

Geology - Located in the morainal outwash plain, Otsego is a relatively flat area comprised of Riverhead and Haven soils.

(14) HECKSCHER PARK

Location - East of Huntington's main business district, off Route 25A and Prime Avenue

Size - 18.5 acres including a 4.5 acre man-made pond

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Play fields, sitting areas and walkways near many historically significant sites, including the Village Green which dates back to 1653

Wildlife - Domestic ducks, local bird species and grey squirrels predominate but are complemented by spring and fall migratory waterfowl such as mallards, swans, and Canada geese. Eels and carp can be seen in the pond.

Vegetation - The vegetation is largely disturbed but remnants of the former oak/chestnut forest are present. Examples of many native and ornamental tree species can be observed.

Geology - Heckscher Park is a till plateau north of the Harbor Hill moraine, comprised of Riverhead and Haven soils that have been regraded from their natural contours.

Other - In addition to normal recreation facilities, the park includes an art museum and a bandshell.

(15) ARBORETUM PARK

Location - North side of Wilmington Drive, 0.5 miles west of the Bagatelle-Wilmington Intersection

Size - 9 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Outdoor recreation and nature study

Wildlife - The wildlife consists primarily of birds, including Thrushes, Blackbirds and Sparrows. Several varieties of amphibians may be seen in the pond.

Vegetation - A small pond located in the park supports a variety of aquatic vegetation which can be observed in the spring and summer months.

Geology - Located within theRonkonkoma Moraine, the soil is Montauk loam.

(16) CAUMSETT STATE PARK

Location - Lloyd Neck, Huntington

Size - 1,476 acres including a 12 acre pond

Ownership - New York State
For information phone 669-1000

Use - Use of the site is by appointment only. The pond is currently being utilized by the New York State Conservation Department as a "source pond" for fish used to stock public fishing areas. It is the only source of smallmouth bass for stocking on Long Island.

Wildlife - Wintering waterfowl, including large flocks of geese can be observed. Animal species include various reptiles and amphibians as well as raccoons, muskrats and minks. Fish life includes largemouth and smallmouth bass, yellow perch, longeared sunfish and Eastern barred killifish.

Vegetation - The highlands are a typical northern hardwood forest comprised of red maples, tulip-poplars, chestnut oaks and black oaks. There are several open fields with typical old field vegetation. A saltwater wetland is located along the shoreline and further inland is a brackish wetland.

Geology - Lloyd Neck is within the lower Manhasset Plateau and became an island after the last glacial period. Subsequent shoreline accretion has joined it to the mainland. The existing Riverhead and Haven graded soils are deep and well drained.

(17) VANDERBILT MUSEUM

Location - Little Neck Road, Centerport

Size - 43 acres

Ownership - Suffolk County
For information phone 261-5656

Use - Museum and Planetarium

Wildlife - Small, upland deciduous forest mammals

Vegetation - Ornamental gardens

Geology - The Vanderbilt Estate is situated on a terminal moraine that forms the north shore of Long Island. This geologic structure is a remnant of the last ice age, and the soils are predominantly Carver and Plymouth sands.

Other - On exhibit in the museum are 17,000 specimens of marine and terrestrial wildlife from around the world. Also included are models of ocean-going vessels and one of the best equipped planetariums in the United States. Star shows are scheduled daily.

(18) DE FOREST PARK

Location - South of Northern State Parkway at the intersection of Buttonwood Drive and DeForest Road

Size - 11.2 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Nature study area

Wildlife - Wildlife in this area has been disturbed by development of a residential community near the park. The more common woodland species can be found here including squirrels, thrushes and ruffed grouse. The pond supports a variety of amphibians, fish and insects.

Vegetation - De Forest Park is a densely wooded area with typical hardwood species including locusts, oaks and walnuts. In the western half of the park one can observe a climax forest state being invaded by vines and field species. Around the pond are wild herbaceous plants that grow well in moist soils.

Geology - This park is located within the Ronkonkoma Moraine in the Dix Hills area. The soils of the park vary from well drained sandy soils in the west to poorly drained Haven loams near the pond and to the southwest.

(19) CRANBERRY BOG

Location - East of the intersection of Waterside Avenue and Seaside Road

Size - Approximately 20 acres

Ownership - Private

Use - The area has reverted back to its natural state and is presently undeveloped. It consists of a freshwater wetlands and pond system, surrounded by an upland forest. Streams travel through a developing old field succession area and eventually drain into the Crab Meadow saltmarsh complex.

Vegetation - The Cranberry bog provides a good demonstration of natural zonation in a small area, progressing from an upland forest to a freshwater system.

The forest species include wild cherry, dogwood, various oaks, beech, black birch and locust. There is also a well developed red maple forest in the more boggy areas.

The freshwater pond and wetlands, which are in various stages of succession, offer a variety of aquatic vegetation such as rushes, cattails, arrowheads and water lilies. Alanthus, blackberry and Phragmites are stabilizing the disturbed zone on either side of the LILCO right-of-way which cuts through the field.

Wildlife - This site is a suitable habitat for a variety of animals, both terrestrial and aquatic. Several small mammals such as muskrat, raccoon, rabbits and squirrels exist in the upland forest and along the edges of the wetlands. Frogs, turtles, snakes, salamanders and newts are among the amphibian and reptile populations of the area. Aquatic birds, including geese and duck, as well as numerous upland birds and marsh inhabitants have been sighted throughout the various zones.

Geology and Soils - The site is located in the lower Manhasset plateau and is part of the Crab Meadow watershed. Ground water is at or near the surface here, as evident by the mucky bog soils and freshwater ponds. The upland areas with well-drained soils, are on the sandy slopes.

(20) BUTTERFLY PARK

Location - South side of Farmington Lane in South Huntington

Size - 36 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Nature Study Area

Vegetation - The site is dominated by an upland deciduous forest consisting of red, black, chestnut and white oaks, dogwood, viburnums, high bush and low bush, blueberry, catbrier, sassafrass, mountain laurel and various ground covers and ferns. The forest in the western portion of the property as a more diverse understory than other parts because soils here are wetter. In the central portion is a large recharge basin which holds water year round and contains freshwater plants. The eastern portion has an older forest with a sparser understory.

Wildlife - The animal populations inhabiting this area are typical of a Long Island forest. They include squirrels, raccoon, opossum, rabbits, eastern chipmunk and woodland mice. Bird life is more active in the open central portion where ducks have been observed using the recharge basin for nesting. Swallows, cardinals, woodpeckers and other woodland birds use the open area and forest. Snakes and turtles have been rarely sighted.

Geology and Soils - The property is located on the Mid-Island Manhasset plateau, a remnant of past glacial activity. The area has been dissected by stream erosion which has caused its hilly topography. The soils in the eastern portion of the park are sandy and extremely well drained, while the western soils have more silt, hold water better and have a higher amount of organic matter. A small valley runs through the center and the soils there are extremely silty.

(21) NORTHPORT HARBOR NATURE AREA

Location - North side of 25A at the head of Northport Harbor

Size - 19.3 acres

Ownership - Town of Huntington

Use - Presently undeveloped, with the exception of the Greenlawn Water District pump house, this site was formerly used for disposal of dredge spoil from Northport Harbor.

Vegetation - The site contains both upland beach vegetation and a salt marsh association. Along the northern shoreline the salt marsh consists of cord grass, salt hay, and grasses associated with this type of environment. Although Phragmites is the most common plant found throughout the remainder of the site, other vegetation including seaside golden marsh elder, mullein, wild cherry and birch can also be observed.

Wildlife - Sea and shore birds are the predominant fauna of the area. Numerous insect types inhabit the sandy soil, with small rodents existing among the reeds, but the chances of observing these animals are limited.

Geology and Soils - Dredge spoil from work in Northport Harbor makes up the majority of surface deposits. The harbor has been filled in slightly covering the original marsh and bog soils. Well-drained sandy soils, with little organic matter, now exist on the site except for a strip adjacent to the harbor composed of mucky tidal soil.

(22) TWIN PONDS

Location - South side of 25A, west of Stony Hollow Road

Size - 7 acres

Ownership - Town of Huntington
For information phone HA-1-1000

Use - Nature Study Center

Vegetation - The site is dominated by a fresh water pond and a wide variety of aquatic vegetation. These species include arrowhead, two varieties of cattails, pondweed, duck weed, soft stem rushes, bullrush, three square rush, sedges, nettles, swamp milkweed, cardinal plant, jewel weed and various species of underwater plants. Surrounding the pond are numerous environments including mature red maple forest, old field vegetation, bog vegetation and wet low land forest which include Tulip trees, butternut, red maple and black walnut.

Wildlife - Because a large percentage of the property is covered by the pond, aquatic fauna dominates the wildlife. Duck, herons and other water birds are common along with amphibians and reptiles. There are different species of pond fish including bass, stream trout, sunfish, eels and carp.

Geology and Soils - The pond is located in the Northport Harbor watershed in an area where groundwater near the surface has produced a number of springs. The pond is fed by spring water from the south and drains through a stream into Northport Harbor. The soils are wet and high in organic matter. The soils along the eastern side of the pond are better drained and support upland species of vegetation.

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