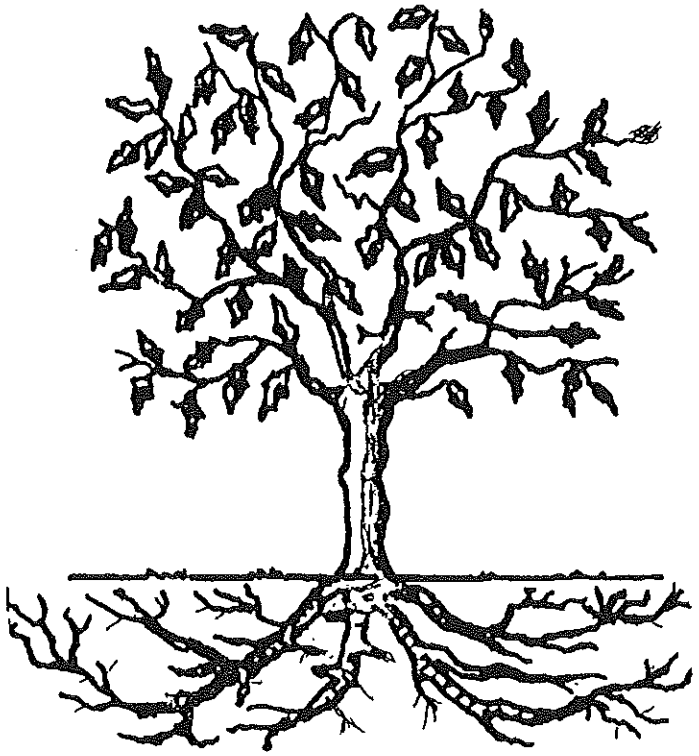
PLANT-SOIL RELATIONSHIPS



A CURRICULUM GUIDE

INTERMEDIATE LEVEL

LESSON PLAN & STUDENT WORKSHEET

NEW JERSEY FOREST SERVICE

FOREST RESOURCE EDUCATION CENTER
370 East Veterans Highway, Jackson, NJ 08527
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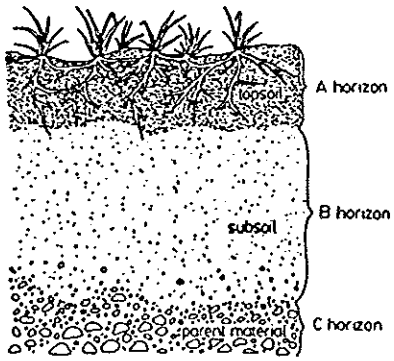
FOREST RESOURCE EDUCATION CENTER
370 E. VETERANS HIGHWAY, JACKSON, NJ 08527

PLANT-SOIL RELATIONSHIPS

INTRODUCTION



Soils of the Pine Barrens are characteristically porous and highly acidic. In most of the 13 major soil types found in the region, rain water percolates very rapidly into the vast aquifers which contain an estimated 17 trillion gallons of fresh water. The early settlers called the area Pine Barrens because traditional agricultural crops would not grow in the sandy acid soil. Eventually, they came to realize that the profitable harvest would be from the vast forests of Pitch Pine, White Cedar, and Red, Black and White Oak. Frequent fires have shaped the composition of the forests, continually killing back the oaks and cedars but allowing the Pitch Pine to dominate. The thick bark and resprouting ability of Pitch Pine following fires have made them the dominant species in many portions of the Pinelands. Fires also reduce the organic duff on the forest floor, thus depleting soil fertility.

OBJECTIVES

1. Students will be able to recognize at least four selected soil types that are found in the Pine Barrens.
2. Students will be able to conduct field investigations at a study plot collecting and evaluating a soil sample.
3. Students will be able create and describe the components of a soil profile
4. Students will be able to describe the soil making process of weathering.
5. Students will be able to describe the methods in which pioneer plants begin the process of biological succession.

6. Students will be able to describe how soil-plant relationships determine wildlife habitat.
7. Students will be able to describe why soil conditions should be considered in determining the best uses for a site.
8. Students will be able to describe at least three negative human impacts on soil, and propose remedies and solutions to soil degradation problems.

PRE-TRIP ACTIVITIES

The teacher may introduce the topic of **Plant-Soil Relationships** by illustrating the concept of **Biotic Pyramid** in demonstrating basic ecological principals. Next, the class may practice with the **Key to Soil** using samples gathered from the vicinity of the school site.
Also, prior to the field activities, the students should become familiar with the **Soil Terms** and **Soil Types** included on the following pages. A preview of field trip activities, dividing students into small groups and reviewing the responsibilities of individual group members will make the field trip more productive.

FIELD INVESTIGATIONS

Students will visit several locations at the **Forest Resource Education Center**. There are 8 different **Soil Types** that can be investigated nearby. At the selected site, students will refer to the **Soil Type** description and evaluate the soil conditions, using the **Field Investigations Data Sheet** provided. Each group will collect a soil sample, using the **Key to Soil** to determine the soil type and using the **Soils Color Chart** to determine the standard soil color. Students will record a site description, list dominant vegetative species , and dig, measure and lay out a **Soil Profile.**

POST-TRIP ACTIVITIES

Students may employ the skills and experiences gained from the Field Investigations to evaluate one or more Soil Types on or in the vicinity of their school site as to soil properties, profile, suitability and limitations for such uses as lawns, playgrounds parking lots, tree and shrub plantings, etc.

MATERIALS

Thermometers	Rulers
Soil pH Test Kits	Field Guides
Data Sheets	Clipboards
Auger	Pencils

EVALUATION

In terms of objectives as stated. By implementing Post-Trip Activities, the instructor will be able to evaluate the students' knowledge and understanding of Plant-Soil Relationships.

GENERALIZATIONS

1. Soil makes up the thin layer of the earth that supports plant life.
2. Soil conditions are an important determining factor in the natural vegetation growing in a given area.
3. Weathering and the growth of pioneer plants occur during soil formation.
4. Soil and plant relationships help to shape wildlife habitat, abundance and diversity.

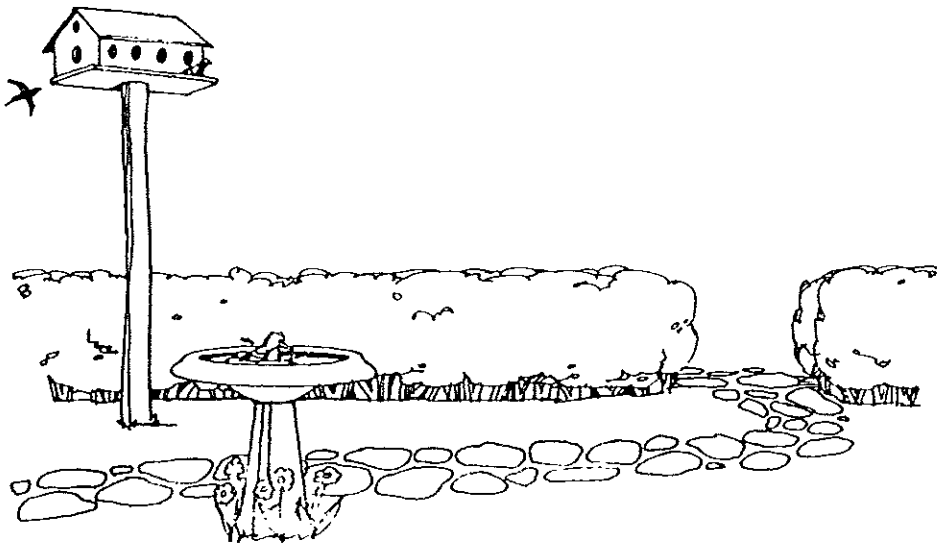
FOREST RESOURCE EDUCATION CENTER

PLANT-SOIL RELATIONSHIPS

NEW JERSEY CORE CURRICULUM CONTENT STANDARDS

Science Standards

5.1.4 Describe components of a system and how they influence one another.
5.2.6 Identify problems that can be solved by conducting experiments.
5.2.7 Collect and organize data to support the results of an experiment.
5.2.9 Communicate experimental findings using words, charts, graphs, pictures and diagrams.
5.2.11 Assess the risks and benefits associated with alternative actions.
5.6.11 Explain how organisms are affected by different components of an ecosystem and the flow of energy through it.
5.10.8 Describe and explain the causes of the natural processes and events that shaped the earth's surface and interior.
5.12.5 Compare and contrast practices that affect the use and management of natural resources.



Bringing the Soil Survey into Your Classroom

Soil Surveys can provide the link between a classroom of students and their environment.

We use it, we abuse it, we take it for granted. Yet our world could not exist without it.

It is our SOIL.

The soil survey is the most intensive resource inventory of land *ever* made in the United States. The soil survey is an extremely useful tool for both students and adults to examine the intricate relationships between humans and the world around them.

The usefulness of soil survey maps becomes evident as you explore different land uses and their effects on the quality of life and the environment. A soil map displays the types of soils found in any location of interest. You can use these maps and text to determine which land uses are best suited to each soil landscape.

Soil surveys help in planning the layout and maintenance of parks, campsites, ski areas, and golf courses. Your county's survey can help you decide where to buy property or where to build your house.

In Social Studies:

- Have your students find their town and school on a soils map. Identify the soil type on which the school is built.
- Have them find out as much as they can about this soil. What are its best uses? What would be a poor use of this soil?
- What are the past uses of the schoolground -- was it formerly farmland, pasture or woodland?
- Have any artifacts been found in this area? Locate a nearby historic site on the soils map.
- Could soil type have influenced the uses of this site?

In Geography:

- Study map symbols and man-made features. How did the features get there?
- Have your students find their town and school on the soils map. From the school, trace the travel route to their homes.
- What is the main soil in the neighborhood? Is it a good soil for homes?
- Is there a part of the town that floods from time to time? What is the soil type in this area? If the soil survey had been available, could the flooding problem have been avoided? How?
- Locate a nearby farm on the soils map. Does it have good soils for growing crops?

Things to think about when using a soil survey:

- What makes one soil different from another?
- Why are farms and houses on certain soils but not on others? Why are cities where they are?
- What soils would be best for building new schools, houses, and shopping malls? What soils should be saved for farmland?
- Which soils can support endangered species? Why?
- What is a wetland soil? What makes it wet?
- What landscapes do the soil maps represent? How do soils relate to the ecosystems on each type of landscape?
- How have land use patterns developed historically in relation to soil types? Where is future development likely to occur?

For more information about teaching soils, and for activities to share with your students, the publication "Teaching Soil and Water Conservation" is available free of charge from your local Soil and Water Conservation District Office. Also, "Conserving Soil" is available from the National Association of Conservation Districts (NACD) by calling 1-800-825-5547.

In Science:

- Have your students research how soil is formed. What is the geologic connection to soil type and properties.
- Did the ancient glaciers affect the soils in your area? How?
- Study the relationships between soil, climate and native plants.
- Determine the PH (acidity/alkalinity) of a soil.
- What role does wetland soil play in the ecosystem?
- Build an accurate 3-dimensional model using the soil survey. Use paper mache to make the mountains and the valleys. Paint the lakes and rivers blue.

In Environmental Studies:

- Discuss which is the best use of a level, well-drained soil - homes or farms? What is the best use of hilly land.
- Find a piece of land on the soil map that would be ideal for a pond. How about a new park or wildlife refuge? How about a new road or building?
- If your students could rebuild their town, how would they change it based on the information in the soil survey?
- What soils are subject to erosion? What types of soils carry pollutants quicker and easier than other types?

SOIL TERMS

1.AERATION- the circulation of air within the soil. Plants require oxygen within the root zone.

2.COMPACTION- occurs when air and water cannot travel freely through the soil. Compacted soil can be aerated by spading, forking, rototilling or discing the soil to allow air and water circulation. Compaction may occur naturally in some soils or may occur by heavy construction equipment or frequent vehicular or pedestrian traffic.

3.EROSION- the transportation of soil due to water and wind action. Erosion can be prevented by the use of cover crops, contour planting, terracing, wind breaks and other soil stabilization methods.

4.FROST HEAVING- the lifting action exerted by the soil during successive freezing and thawing during the winter. Sandy soils exhibit light to moderate heaving, while heavier clay soils can literally lift roots out of the ground and crack pavement and foundations.

5.PERCOLATION-is the downward movement of water through soil.

6.PERMEABILITY- is the amount of downward movement of the soil when it is saturated. Soil structure, porosity, texture and compaction influence permeability. Permeability is an important consideration in the planning and design of site drainage and septic systems for new construction.

7.PIONEER PLANTS- the combination of weathering and accumulating organic material allow for the establishment of pioneer plants such as lichens and mosses that can colonize infertile rocky soil. Chemicals produced by lichens help to further break down rock surfaces. Mosses help trap drifting

soil particles. Eventually, as plant materials decay, the soil is gradually enriched with these nutrients, and further water holding capacity is possible. Over a long period of time the soil fertility will allow for "higher" plants to become rooted. Plant roots emit carbon dioxide that forms carbonic acid when dissolved in soil water, accelerating the weathering process. In time the soil may be fertile enough for pioneer shrubs and tree seedlings to sprout in full sunlight, which in turn provide enough shade for forest species to sprout. This evolutionary process from pioneer species to mature forest is known as **Plant Succession.**

8. RUNOFF- water that does not percolate or seep into the ground before entering stream channels.

9.SHRINK-SWELL POTENTIAL- depends mainly on the amount and type of clay in the soil. The shrinking and swelling of some soils can cause damage to building foundations and roadways.

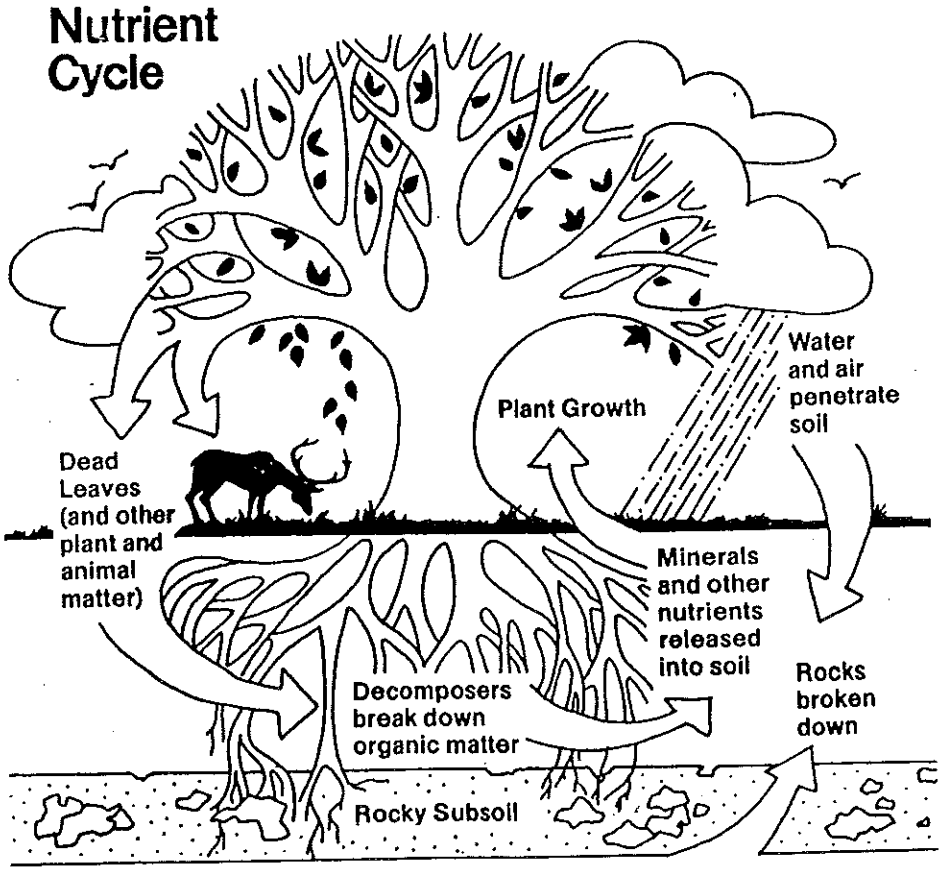
10. SOIL PROFILE- weathering gradually breaks down the **Bedrock** into smaller rock particles. A **Soil Profile** is a cross-section of soil layers or horizons of soil. The substratum layer of stones and rocks is called **Parent Material** (C-Horizon), as soil is ultimately produced by the eventual breakdown of these particles. The next zone is referred to as **Subsoil** (B-Horizon), and may contain high concentrations of clay or other fine particle materials. The surface layer (A-Horizon) is known as **Topsoil**, and contains plant and animal organisms, and is the most productive soil horizon. Above the topsoil is the **Duff** (O-Horizon), consisting of leaf litter and decomposing organic material that add nutrients to the soil. Frequent fires such as those experienced in the Pine Barrens reduce soil fertility by burning off the duff layer.

11. SOIL REACTION- is expressed as the degree of alkalinity or acidity in the soil as a range in **pH** value. A **pH** of 4.0 is

strongly acid, a **pH** of 7.0 is neutral and a **pH** of 9.0 is strongly alkaline. Individual plant species have different tolerances for **pH** (see chart).

12. TEXTURE- is the relative proportions of sand, silt and clay particles in soil. The basic textural classes in order of increasing proportion of fine particles are: sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silt clay loam, sandy clay, silty clay and clay.

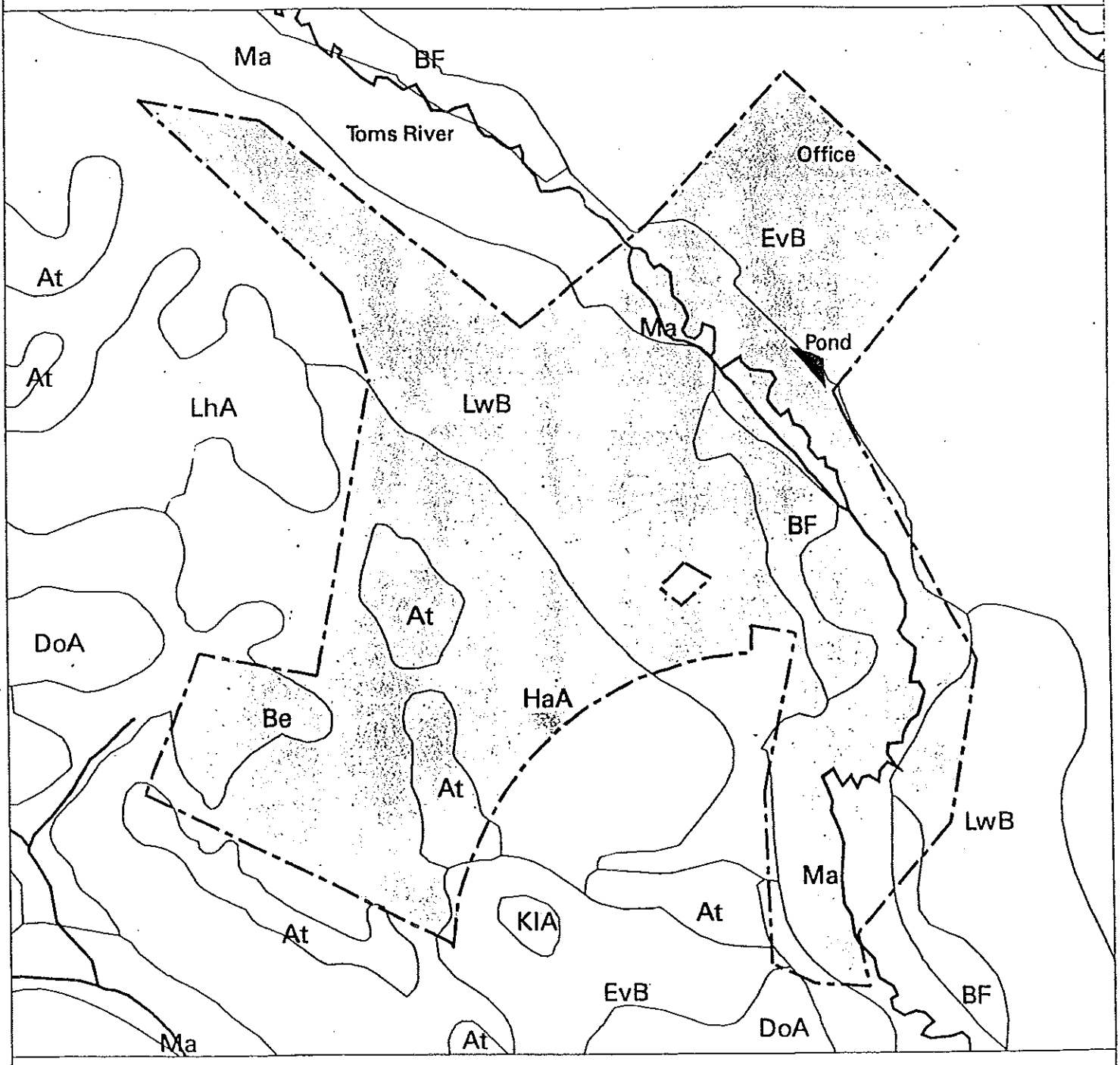
13. WATER CAPACITY- is rated on the basis of soil characteristics that influence the ability of soil to retain water and make it available to plants.



N.J. Forest Service

Forest Resource Education Center

Jackson, New Jersey



SOILS

At - Atsion Sand
Be - Berryland Sand
BF - Berryland Sand, Frequently Flooded
DoA- Downer Loamy Sand, 0-5% slope
EvB- Evesboro Sand, 0-5% slope
HaA- Hammonton Loamy Sand, 0-5% slope
KlA- Klej
LwB- Lakewood Sand, 0-5% slope
Ma - Manahawkin Muck

DIVISION OF PARKS AND FORESTRY N. J.

NJ Forest Service, GIS

GEOGRAPHIC INFORMATION N NJDEP SYSTEM

Scale: 1"=1000'

SOME TYPICAL PINELANDS SOILS

At ATSION SAND pH: 3.6-5.5

Atsion soils are sandy, acidic and poorly drained. Found in depressions and broad flat lands, Atsion Sands support natural vegetation consisting of Pitch Pine, Red Maple, Sour Gum, Swamp White Oak, Sweet Gum and Willow Oak with a dense tall understory of Highbush Blueberry, Inkberry, Sheep Laurel, Sweet Pepperbush and Greenbriar. The high fire frequency, infertility and a seasonable high water table of less than 1 foot make land where this soil is found to have severe limitations for housing, roadways or active recreation facilities. Two areas of Atsion Sand can be found in the southwestern portion of the Forest Resource Education Center.

A- Horizon: 0-5"- black sand (10YR 2/1)
5-18"-light gray sand (10YR 7/1)

B- Horizon: 18-24"- dark reddish brown loamy sand(5YR 3/2)

C- Horizon: 24-60"- light gray sand (10YR 6/1)

BF BERRYLAND SAND, Frequently Flooded pH: 3.6-5.0

Berryland soils are sandy and very poorly drained, and are found in wet bottomlands and along stream corridors. Tree species encountered are Atlantic White Cedar, Pitch Pine, Sour Gum, Red Maple, Sweet Gum, American Holly and Swamp Magnolia. The shrub zone is a dense understory of Sweet Pepperbush, Highbush Blueberry, Winterberry Holly, Inkberry, and Leatherleaf. The nearly saturated soils with a high water table of about 6" have been utilized with modifications for blueberry fields and cranberry bogs. These soils are unsuitable for picnic areas, trails or any type of development or roadways. The floodplain and associated hardwood swamp along Toms River at the Forest Resource Education Center are classified as Berryland Sand, frequently flooded.

A- Horizon: 0-11"-black sand (10YR 2/1
11-15"-gray sand (10YR 5/1)

B- Horizon: 15-24"-very dark brown loamy sand (10YR 2/2)
24-35"-light brownish gray sand (10YR 6/2)

C- Horizon: 35-60"-light gray sand (10YR 7/

DoA DOWNER LOAMY SAND (0-5% slope) pH3.6-5.0

The deep, well drained Downer soils are coarse, loamy and acidic. Natural canopy vegetation includes White Oak, Black Oak, Chestnut Oak, Pitch Pine, Shortleaf Pine and Virginia Pine. Understory species are Lowbush Blueberry, Mountain Laurel, Black Huckleberry and Bracken Fern. Downer soils when exposed and impacted become very dusty. Droughty and with limited fertility for natural herbaceous growth, these soils are unsuitable for productive crop cultivation and upland wildlife plantings. The water table is usually greater than 6 feet, with moderate permeability. Downer soils are located in the vicinity of the southwest corner of the Forest Resource Education property.

A-Horizon: 0-2" grayish brown loamy sand (10YR 5/2)
2-16" brown loamy sand (10YR 5/3)
B-Horizon: 16-24" yellowish brown sandy loam (10YR 5/6)
24-31" yellowish brown light sandy loam (10YR 5/6)
C-Horizon: brownish yellow sand (10YR 6/6)

EvB EVESBORO SAND (0-5% slopes) pH 3.6-5.0

Deep, excessively drained sands make up Evesboro soils, found on top of watershed divides and nearby side slopes. Tree species encountered are Chestnut Oak, Post Oak, Blackjack Oak, White Oak, Pitch Pine and Sassafras, with a fairly open understory of Lowbush Blueberry and Bracken Fern. Evesboro Sands have a low suitability for seed crops and grain, and generally provide poor wildlife habitat due to lack of cover and diversity. Exposed soil is too sandy, dusty and droughty for most recreational uses, but its rapid permeability and a water table of greater than 6 feet allow for adequate utilization for dwelling foundations, basements and roadways.

A-Horizon: 0-1" grayish brown sand (10YR 5/2)
1-9" brown sand (10YR 5/3)
B-Horizon: 9-33" yellowish brown sand (10YR 5/6)
C-Horizon: 33-60" yellow sand (10YR 7/6)

HaA HAMMONTON LOAMY SAND (0-5% slopes) pH 3.6-5.0

Hammonton soils are deep, moderately drained acid sands found in shallow depressions, on low sub-watershed divides and adjacent side slopes. Canopy species include White Oak, Southern Red Oak, Black Oak, American Holly and Pitch Pine. Typical shrub zone may consist of Lowbush Blueberry, Greenbriar, Mountain Laurel and Inkberry. Seed crops, grain, grasses and wild herbaceous plants will grow in Hammonton Loamy Sand. Runoff is slow and permeability is moderate in Hammonton soils. This soil supports habitat for woodland and openland wildlife species. Recreation uses are more suitable than building site development due to moderate wetness and frost action potential. A large area in the southwestern portion of the Forest Resource Education Center is Hammonton Loamy Sand.

A-Horizon: 0-10" dark, grayish brown sandy loam (10YR 4/2)
B-Horizon: 10-28" yellowish brown sandy loam (10YR 5/6)
28-35" yellowish brown loamy sand (10YR 5/6); light brown-gray mottles (10YR 6/2)
C-Horizon: 35-48" yellow sand (10YR 6/8);light gray mottles (10YR 7/2)
48-60" light gray sand (10YR 7/2); brownish yellow mottles (10YR 6/8)

KlA KLEJ

Soils of the Klej seriers are deep, poorly to well drained, acidic and sandy. Klej soils are found in depressions and on low flat divides. Natural vegetation consists of Black Oak, Pin Oak, Scarlet Oak, White Oak, Southern Red Oak, Sour Gum, Pitch Pine, American Holly and Virginia Pine. Understory species are Lowbush Blueberry, Sheep Laurel, Inkberry and Black Huckleberry. Extreme acidity and a seasonal high water table of 1.5- 2 feet make for fair habitat for openland and woodland wildlife. The sandy, wet soil and frost action potential limit use for recreation, roadways and building site development. A small pocket of Klej soil is located adjacent to the south of the Forest Resource Education Center property.

A-Horizon: 0-2" very dark, grayish brown loamy sand (10YR 3/2)
2-5" brownish gray loamy sand (10YR 5/2)
B-Horizon: 5-30" brownish yellow loamy sand (10YR 6/6)
30-38" yellow loamy sand (10YR 7/6);medium distinct light gray mottles (10YR 7/2)
C-Horizon: 38-60" light gray sand (10YR 7/2); yellowish Brown mottles (10YR 5/6)

LwB LAKEWOOD SAND (0-5% slopes) pH 3.6-4.5

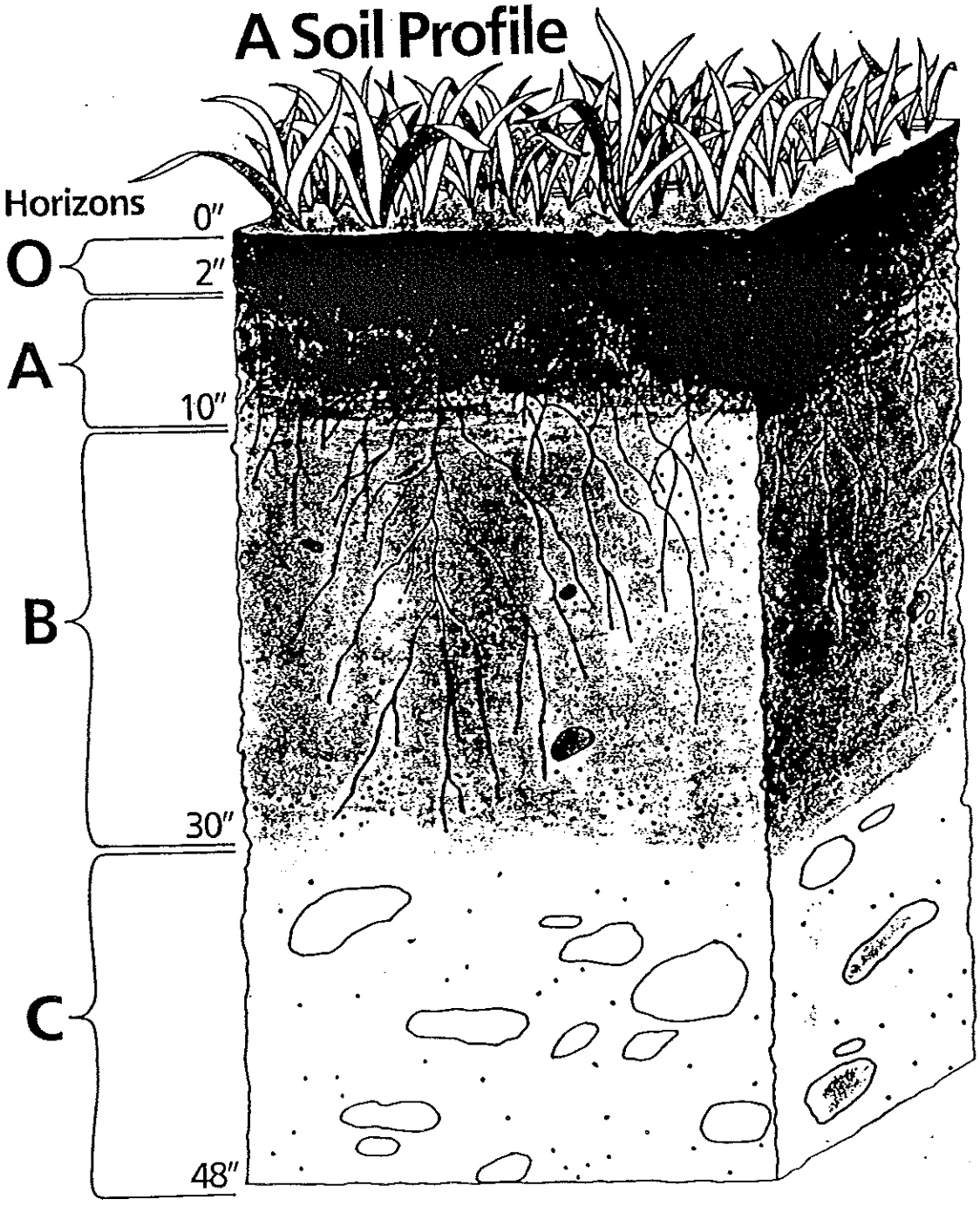
Lakewood soils are deep, excessively drained, acidic sands located along watershed divides and nearby side slopes. Tree species encountered are Pitch Pine, Blackjack Oak, Post Oak, Chestnut Oak, White Oak, Sassafras and Black Oak. The understory is chiefly Lowbush Blueberry and Scrub Oak. The water table is usually in excess of 6 feet. Wildlife habitat is generally poor. Suitability for recreational facilities is limited due to loose sands found in bare soil areas, although Lakewood Sand has some potential for building sites and roadway development due to the excellent drainage.

A-Horizon: 0-1" black sand (10YR 2/1)
1-10" light brownish gray sand (10YR 6/2)
B-Horizon: 10-14" yellowish brown sand (10YR 5/4)
14-36" yellowish brown sand (10YR 5/6)
C-Horizon: 36-60" brownish yellow sand (10YR 6/6)

Ma MANAHAWKIN MUCK

As the name implies these saturated acid soils, located in stream valleys and wide depressions are very poorly drained, containing organic, acidic materials derived from woody plants. Tree species found in these swampy soils are Atlantic White Cedar, Red Maple, Sour Gum, Swamp Magnolia, Pitch Pine and Sweet Gum. The dense understory consists of Sweet Pepperbush, Highbush Blueberry, Inkberry, Winterberry Holly and Greenbriar. The watertable may be found at or near the surface, unless the soil is inundated. Many wildlife species utilize White Cedar swamps. Where hardwoods dominate, the wildlife potential may drastically diminish due to the lack of browse and cover. Manahawkin Muck soils will not support

any type of human development, except for limited potential for cranberry production; however, protection from flooding, sanding and ditching of cranberry bogs is necessary.
A-Horizon: 0-39" black muck with organic fibers (5YR 2/1)
B-Horizon: 39-46" gray sand (10YR 5/1)
C-Horizon: 46-60" gray gravelly sand (10YR 6/1)



SOIL COLORS

For each soil listed below, use crayons to color in the squares using the proper colors. Press firmly when coloring, unless the color is indicated as "light". Color in MOTTLES by swirling the crayons to make it look like "marble cake"

ATSION SAND

A-Horizon	black sand (10YR 2/1)	black & sepia (light)
	light gray sand (10YR 7/1)	timberwolf & tumbleweed
B-Horizon	dark reddish brown loamy sand (5YR 3/2)	brown, sepia & black (light)
C-Horizon	light gray sand (10YR 6/1)	gray & tumbleweed

BERRYLAND SAND (Frequently Flooded)

A-Horizon	black sand (10YR 2/1)	black & sepia (light)
	gray sand (10YR 5/1)	sepia & black & white (light)
B-Horizon	very dark brown loamy sand (10YR 2/2)	black & sepia (light)
	light brownish gray sand (10YR 6/2)	tumbleweed & gray (light)
	light gray sand (10YR 7/2)	tumbleweed

DOWNER LOAMY SAND

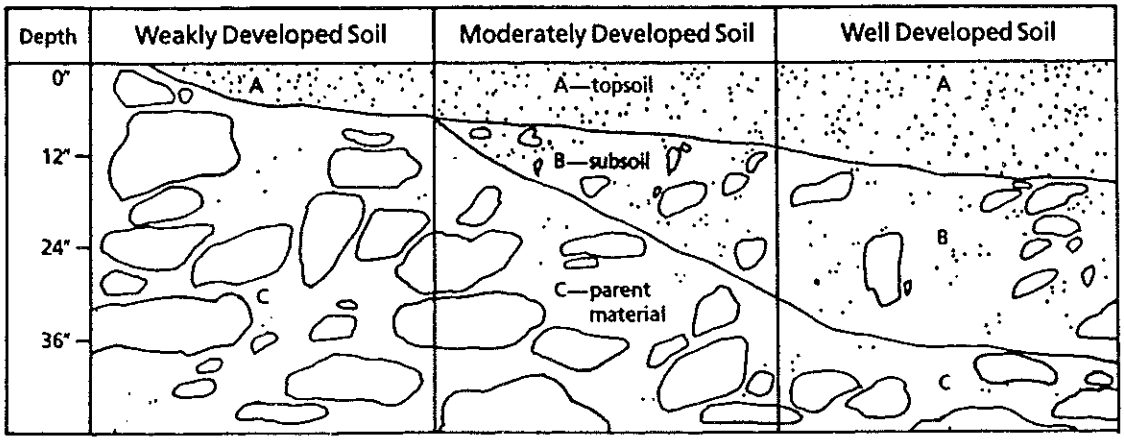
A-Horizon	grayish brown loamy sand (10YR 5/2)	tumbleweed & black (light)
	brown loamy sand (10YR 5/3)	brown & sepia
B-Horizon	yellowish brown sandy loam (10YR 5/6)	brown & tan

THE KEY TO SOIL

- Use this dichotomous key to determine the soil type of your sample.

1. IS THE SOIL GRITTY(CONTAINING TINY ROUGH GRANULES)?
   If yes — go to # 2
   If no — go to #3
2. WILL THE SOIL STAY TOGETHER IF PRESSED INTO A FIRM BALL?
   If yes — this soil is SANDY LOAM
   If no — this soil is SAND
3. IS THE SOIL STICKY AND ROUGH?
   If yes — go to #4
   If no — go to #5
4. IS THE SOIL HARD TO SQUEEZE?
   If yes — this soil is CLAY
   If no — this soil is CLAY LOAM
5. IS THE SOIL SMOOTH(SOFT AND SILKY)?
   If yes — this soil is LOAM
   If no — this soil is silty loam
6. IS THE SOIL WET AND MUCKY(FULL OF HIGHLY DECOMPOSED MATERIAL)?
   If yes — this soil is MUCK
   If no — you're out of luck!

- NOTE: Loam is a mixture of sand, clay, silt and organic matter.



FIELD INVESTIGATIONS: Collecting a Sample

NAME(S):

_____

DATE:__/__/____ TEMPERATURE: AIR_____,
WATER_____
USING THE CORE SAMPLER OR A TROWEL, DIG
DOWN 6"
AND DETERMINE THE **SOIL TYPE**, USING THE **KEY TO SOIL. SOIL TYPE**
IS_____
SOIL
SERIES:_____
TREE
SPECIES:_____

_____
___
SHRUB SPECIES:

_____

_____
___
EVIDENCE OF HUMAN DISTURBANCE:

_____

_____
___

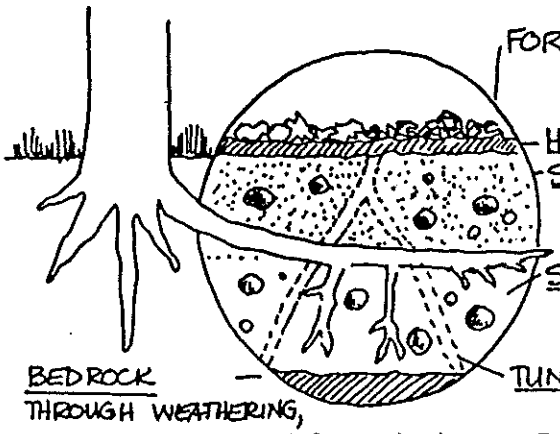
SOIL PROFILE

	A-Horizon	B-Horizon	C-Horizon
Depth			
Texture			
Color			
Moisture			
Soil Reaction (pH)			
Hue-Value-Chroma			

GIVE 3 FACTS ABOUT THIS SOIL
SERIES_____

YOUR RECOMMENDATIONS FOR SITE USE (Give reasons for your answers)

SOIL IS FAR MORE THAN DIRT



FOREST LITTER - LEAVES, TWIGS AND OTHER NATURAL DEBRIS KEEPS SOIL MOIST AND PROTECTS FROM EROSION

HUMUS - THE LAYER WHERE DECOMPOSITION OCCURS

SURFACE SOIL - HIGH IN NUTRIENTS FROM DECAYING FOREST LITER. HOME OF EARTH WORMS, SOURCE OF MUCH OF A TREE'S FOOD, OBTAINED BY SHALLOW ROOTS.

SUBSOIL - SOIL PARTICLES FROM PARENT MATERIAL (WHERE SOIL ORIGINATED). ROOTS HERE ANCHOR THE TREE AND ABSORB WATER.

TUNNELS - INSECTS, DECAYING ROOTS AND BURROWING ANIMALS CREATE TUNNELS THAT HELP LET AIR AND WATER PENETRATE

BEDROCK — THROUGH WEATHERING, CONTRIBUTES TO NEW SOIL. THIS IS THE PARENT MATERIAL OF ALL SOIL. THROUGH TIME, IT MAY ACCUMULATE IN PLACE, OR WASH OR BLOW AWAY TO BE DEPOSITED ELSEWHERE.

KLEJ

A-Horizon	very dark grayish brown loamy sand (10YR 3/2)	black & sepia
	brownish gray loamy sand (10YR 5/2)	tumbleweed & black
B-Horizon	brownish yellow loamy sand (10YR 6/6)	tan
	yellow loamy sand (10YR 7/6)	yellow, tan & orange
	medium distinct light gray mottles (10YR 7/2)	tumbleweed
C-Horizon	light gray sand (10YR 7/2)	tumbleweed
	yellowish brown mottles (10YR 5/6)	brown & tan

LAKEWOOD SAND

A-Horizon	black sand (10YR 2/1)	black & sepia (light)
	light brownish gray sand (10YR 6/2)	tumbleweed & gray (light)
B-Horizon	yellowish brown sand (10YR 5/4)	sepia
	yellowish brown sand (10YR 5/6)	tan & brown
C- Horizon	brownish yellow sand (10YR 6/6)	tan

MANAHAWKIN MUCK

A-Horizon	black muck with organic fibers (5YR 2/1)	black
B-Horizon	gray sand (10YR 5/1)	sepia, black & white
C-Horizon	gray gravelly Sand (10YR 6/1)	gray & tumbleweed

	yellowish brown light sandy loam (10YR 5/6)	brown (light) & tan
C-Horizon	brownish yellow sand (10YR 6/6)	tan
	EVESBORO SAND	
A-Horizon	grayish brown sand (10YR 5/2)	tumbleweed & black (light)
	brown sand (10YR 5/3)	brown & sepia
B-Horizon	yellowish brown sand (10YR 5/6)	brown & tan
C-Horizon	yellow sand (10YR 7/6)	yellow & tan & orange
	HAMMONTON LOAMY SAND	
A-Horizon	dark, grayish brown sandy loam (10YR 4/2)	brown & black (light) & timberwolf
B-Horizon	yellowish brown sandy loam (10YR 5/6)	brown & tan
	yellowish brown loamy sand (10YR5/6)	brown & tan
	light brown gray mottles(10YR 6/2)	gray (light) & tumbleweed
C-Horizon	yellow sand (10YR 6/8)	yellow, orange & burnt sienna
	light gray mottles (10YR 7/2)	tumbleweed
	light gray sand (10YR 7/2)	tumbleweed
	brownish yellow mottles (10 YR 6/8)	burnt sienna, orange & yellow