Objective:

1) To learn the basics of ecology.

2) To identify in the field examples of the basic ecological principles and environmental concepts covered in this lesson plan.

Materials:

1) Comfortable hiking clothes.

Procedures:

The purpose of this hike is to introduce to the campers the basic ecological principles and environmental concepts important to an understanding of the cause-and-effect relationships in the environment. Some of these principles and concepts are described in the following pages. The underlined words are key vocabulary that the campers should learn in this lesson.

The staff leading the hike need to decide on the area near camp that is best suited for this hike before the campers arrive. The area should have many examples of the various principles and concepts that can be pointed out to the campers. For example, a grass field being taken over by shrubs and small trees from a nearby forest is a good sampling of succession. The field or forest may also be used
for explaining food chains.

As the campers may already know some of these ecological principles, they should be encouraged to participate in discussing these various principles and concepts. Challenge the campers to find their own examples of what has been learned or to bring up concepts that have been missed.

Ecological Principles and Environmental Concepts

**Biomass**

*Biomass* is the total weight or mass of all living matter in a particular habitat or area. Energy and resources are converted through *food chains* to biomass.

**Biotic Community**

A community is an interdependent group of plants and animals living in a particular habitat or restricted area. The individuals within a community rely solely upon each other for survival. The major activity of all the individuals within a community is the securing of food for sustaining life.

**Carrying Capacity**

The maximum population that a given ecosystem can support indefinitely is that ecosystem's *carrying capacity*. Any environment has a limited amount of resources (including energy) and can, therefore, support a limited amount of life. The carrying capacity determines how many
organisms can be maintained and in what condition. As a population of individuals increases in numbers, it also increases in density. More individuals in an area mean more demands on the available resources. When the resources are serving as many individuals as possible, and those individuals are living in optimum conditions, the environment has reached its carrying capacity.\textsuperscript{11}

**Competition**

Competition occurs among all living organisms for space, food, water, and other necessary life supplies. On our earth we have a limited supply of these necessities. Therefore, as a population of individuals increases, competition becomes greater.

The distinction of competition within a species or among species is present in a community. Competition between plant species for energy is called **interspecific competition**. Competition within a species for energy is termed **intraspecific competition**.\textsuperscript{12}

**Ecological Succession**

Ecological succession can be defined as the sequence of living communities which tend to succeed and replace one another in a given area over a period of time. Succession starts with a **pioneer community** which is able to colonize and inhabit any bare surface. The end product in succession is known as a **climax community**. This is a relatively stable
community. It is able to maintain itself over long periods of time and to regenerate and replace itself without further change.

Pioneer Community $\rightarrow$ Intermediate Communities $\rightarrow$ Climax Communities

Succession takes place on land and in water. The successional stages may take hundreds of years to go from pioneer vegetation through the intermediate stages to the climax vegetation. Along with the replacement and change in types of plants go replacement and change in the animals dependent upon such types of plants.\textsuperscript{13}

There are two types of ecological succession. These are primary succession and secondary succession. Primary succession begins on an area, such as bare rock, lava, or sand, that has not been previously occupied by a community of organisms. Secondary succession begins on an area, such as abandoned farmland, a new pond, or land disrupted by fire, that had previously been occupied by a community of organisms.\textsuperscript{14}

Ecology

Ecology is the study of the interrelationship and interdependence of all living things and how all living things effect each other. Four concepts are very important in the study of ecology:

1. **Diversity** - There is a wide variety of natural
things that make up our environment. Each segment of nature is unique and not subject to exact duplication.

2. **Interrelationships** - In nature, there is a state of equilibrium. Nothing can be changed without affecting other parts of nature.

3. **Adaptation** - All living things have to adjust to changing natural environments. Plants and animals have adapted to changes of temperature, water, food, pestilence, etc., throughout the several billion years of the earth's existence.

4. **Succession** - (see Ecological Succession) This is the natural change that takes place by the gradual replacement of one community by another.

**Ecosystem**

An ecosystem is any area where living organisms and nonliving matter work together trading life substances over and over again. The exchange of these materials never ends and is necessary for life to go on.

One element of an ecosystem contains non-living matter (water, air, minerals, and chemicals). These are necessary for an ecosystem. They help living organisms grow and they replace natural waste.

The second part is made up of producers. These are green plants, organisms that can make their own food by photosynthesis.

The third part is made up of consumers. These are animals that eat green plants, but also serve as food to other consumers. There are herbivores which only eat green plants, and carnivores which eat the herbivores and may also eat green plants.
The fourth part is made up of decomposers. These are organisms, bacteria, mushrooms, or other fungi, which break down the tissues and excretions of other organisms to simple substances that will return to the ecosystem to be used again. 16

Food Chains

A food chain is a sequence of organisms, including producers, herbivores, and carnivores, through which energy and materials move within an ecosystem. One of the most basic relationship within the biotic community is the food chain. Each individual within a chain relies upon another individual for its necessary food. Every link in the chain becomes important for the survival of the entire community.

Generally, food chains follow this pattern:

Green plants → Herbivores → Carnivores → Larger Carni­vores → Top Carnivore (has no larger predators)

These relationships within a community are often illustrated as a biotic pyramid.

\[
\begin{align*}
C_1 & \quad \text{Primary consumers} \quad = \text{herbivores} \\
C_2 & \quad \text{Secondary consumers} \quad = \text{carnivores} \\
C_3 & \quad \text{Tertiary consumers} = \text{top carnivores} \\
P_1 & \quad \text{Producers} \quad = \text{green plants}
\end{align*}
\]
The number of individuals within a community is determined by the amount of energy available in green plants and by the efficiency of individuals within the community in converting this to a form useful for maintenance, growth, and reproduction. In the biotic pyramid, the greatest numbers of organisms, the greatest mass, and the greatest amount of food energy are to be found in the lowest layers of organisms, the green plants. As we move up each step in the pyramid, energy is lost to the carrying out of necessary life processes.

Food chains are emphasized as a means of beginning to understand the more complex interrelationships within the ecosystem. 17

**Food Web**

A food web is a series of complex, interlocking food chains. 18

**Limiting Factors**

A limiting factor is any component of the environment that limits the reproduction of a population or the growth of an individual. The presence and success of an organism or a group of organisms depend upon a complex of conditions. Any condition which approaches or exceeds the limits of tolerance is said to be a limiting factor.

Limiting factors are divided into two categories: physical and biological. Physical factors which might limit
population growth would include factors of climate and weather, the lack or the overabundance of water and minerals, the suitability of terrain, and many other factors. Biological factors include competition, predation, parasitism, disease, and other interactions within or between species that are limiting to growth or increases in numbers.19

Evaluation:

The two hour ecology hike is of value to the campers because it provides the opportunity to be introduced to the basic ecological principles and environmental concepts in the field rather than in the classroom. The campers are able to look upon and examine examples of these principles and concepts while they are being explained by the hike leader. The hike leader must continually ask questions to keep the campers interested and thinking during the hike. For example, while the leader is explaining the meaning of an ecosystem, he/she is pointing out an example of an ecosystem: a forest. Examples of questions to ask are as follows:

1. Name other ecosystems. Examples: a pond, a meadow.
2. List the non-living and living aspects of the forest.
3. How are they all interrelated?
4. How is each necessary to sustain the existence of the others?20

This hike is meant to be a new and fun experience of learning about the environment. This introduction to ecology should help the campers better understand and appreciate
their work projects and their environmental awareness experiences during the four weeks at camp.

Follow Up:

These ecological principles and environmental concepts are basic to understanding the environment. Therefore, the camper should become familiar with their meanings. This can be done by explaining their importance with each new work project and environmental awareness project. And at the end of camp, the campers themselves will have an opportunity to evaluate how well they understand these ecological principles and environmental concepts as they are represented in questions on the Environmental Awareness Appraisal post-test.
THIRD DAY; TUESDAY

Tuesday evening the two groups from Monday evening switch activities. Group one takes the Ecology hike and group two works on Orienteering skills.

FOURTH DAY; WEDNESDAY

Wednesday evening can be spent in organized recreation. There should be several activities going on at the same time. Good activities are swimming, volleyball, softball, and basketball, although the recreational activities will depend on the camp's facilities. The activities should be organized and supervised by staff.

Everyone should be encouraged to attend the recreational activities. It is a good time for the campers to relax and have fun with their fellow campers.

FIFTH DAY; THURSDAY

The two hour environmental awareness time during the evening should be blocked off for the campers' individual environmental awareness projects. It is important that the campers do spend this time working on their projects. They will usually have only one day a week to work on them.

The campers' living leaders should be on hand to help the campers if they should need it. Those campers with projects that need special supervision should have their living leaders near at all times.

Again, it must be stressed that the campers are to
use the full two hours working on their projects.

SIXTH DAY; FRIDAY

All during camp it is important for the Environmental Awareness Coordinator and the Environmental Awareness Leaders to be getting feedback from the campers on the program. One way of receiving this feedback is to give the campers a weekly environmental awareness evaluation form to fill out. The author suggests giving the campers this evaluation form during their lunch break every Friday. It will only take five minutes or less to fill out. The crew leaders can then collect the forms and turn them in to the Environmental Awareness Coordinator.

Friday evening can be spent in recreation and leisure activities.

Environmental Awareness Evaluation Form

1. E.A. Activities for this week were:
   A. Fantastic
   B. So So
   C. Put me to sleep

2. Time devoted to E.A. this week:
   A. Just right
   B. E.A., What's that?
   C. Too much

3. My crew leader's attitude toward E.A.:
   A. Enthusiastic
   B. Neutral
   C. Didn't care
4. My E.A. leader's attitude toward E.A.:
   A. Enthusiastic
   B. Neutral
   C. Didn't care

5. E.A. materials this week were:
   A. Understandable
   B. An insult to my intelligence
   C. Too difficult to understand

6. The E.A. Coordinator's time spent with us:
   A. He/she should be here more
   B. Adequate to cover the information
   C. Wish he/she would leave us alone

7. The E.A. Coordinator's attitude was:
   A. Enthusiastic
   B. Neutral
   C. Didn't care

8. Opportunity for discussion was:
   A. Adequate
   B. Not enough
   C. Too much

9. My questions were:
   A. Answered satisfactorily
   B. Answered in too much detail
   C. Not answered

10. The overall E.A. program in camp is:
    A. I didn't know we had one
    B. About right
    C. Fanatical

11. What suggestions would you make to improve the E.A. program for next week?
SEVENTH DAY; SATURDAY

Every Saturday morning should be spent in investigating different components of the environment. The investigations are an introduction into the following week's environmental theme. The first Saturday morning should be spent investigating the soil. The soil investigation is described in lesson plan number seven.

The investigation should be presented with the campers' fullest involvement in the activity in mind. The following guidelines may help the leader in conducting the environmental investigations.22

1. Minimize as fully as possible the amount of lecturing, showing, or telling.

2. Go over the objectives of the investigation, briefly, with the campers so they will know what to expect.

3. Do a preview of the investigation in the place where it is to be conducted.

4. Plan and pace the session so that each task can be done thoroughly and well.

5. Discuss possible hazards and sanitary provisions with the campers before leaving for the study area.

6. Make sure that there is enough equipment and that it is in working order.

7. Use the lesson plans as a guide, particularly for the questioning and discussion periods, but don't hesitate to revise as necessary once the plan has become familiar.

8. Start the summarization of the investigation at least a half hour before the time period ends.

9. Use the summarizations as evaluation tools. The discussion that concludes each session will reveal what concepts and understandings have been acquired by the campers and what additional information they
may need.

10. Do a self-evaluation of the session so that improvements can be made for later sessions.

Saturday afternoon should be reserved for a field trip to a nearby state park. One of the objectives of the field trip is to orient the campers to environmental careers. Thus, it is important to have the Park Ranger, Naturalist, and/or other park employees talk with the campers. It is a good idea to talk with these people before visiting the park to set up a session with them and the campers. Encourage the campers to ask questions about the job opportunities and qualifications in a state park, seasonal and permanent. Questions about management problems and practices should also be welcomed.

It is also a good idea for the campers to visit the park's nature center. A hike with the naturalist should be taken, if possible. The campers then have an opportunity to review the ecological principles and environmental concepts they learned earlier in the week, and to gain new and interesting information from the naturalist.

Another objective of the field trip is to familiarize the campers to the state parks system and thus, to create in them an appreciation for those areas specially set aside for public use. It is important for the campers to know, to appreciate, and to preserve and wisely manage their state's natural environment and heritage.
LESSON PLAN # 7
SOIL INVESTIGATION

Objectives:
1) To describe three ways in which living organisms in the top part of the soil affect the soil.
2) To construct a micromonolith of a soil profile.
3) To determine and record texture, structure, pH, temperature, and color of each soil layer.

Materials:
1) Four stakes per five YCCers.
2) String for each group of five YCCers.
3) Hand lenses.
4) One soil pH kit per five YCCers.
5) One soil thermometer per five YCCers.
6) One sewing tape per five YCCers.
7) Three jelly cups and lids per YCCer.
8) One micromonolith card per YCCer.

Procedures:

This soil investigation is divided into two parts, each part being approximately one hour in length, with one-half hour for discussion after each part.

The campers should be broken into small groups of five if there is enough equipment available. The smaller the group, the more the campers are able to participate.
Each camper should be given a "Soil Fact Sheet," found at the end of the lesson plan, before the investigation begins. The soil micromonolith card can be given to them before the start of part two.

Begin the investigation by reviewing quickly what will take place in the allotted time. The objectives of the investigation should also be presented to the YCCers.

PART ONE: SOIL INVESTIGATION*

Instructions:

As members of the first expeditionary force into this strange world, you will be asked to thoroughly infiltrate one area. The plan of action is given below. But first, a few words of caution: no one has ever entered this area before. From all outward appearances there do not seem to be any dangers. But it appears to be a very delicate form of life--past experiences in other areas has shown that the inhabitants of these worlds do not like to be disturbed and are easily destroyed. It is therefore necessary to proceed with extreme caution to avoid calling their attention to the invasion.

If an alarm is set off and general panic insues, your task force will be unable to gather the information vital to our mission. Proceed carefully, taking mental

* Adapted from pp. 23 of the YCC Resource Guide: Preliminary Manuscript, U.S. Youth Conservation Corps.
pictures often, and remembering that it is up to you to understand the everyday activities of the inhabitants of this microworld.

Plan of Action:

1. Plant four stakes about one and one-half feet apart, forming a square.

2. String cord around stakes, making a quadrate.

3. Make no sounds; you have captured the territory.

4. Observe the surface of life; use hand lens.

5. Ask yourself:

   What kinds of plants are in the community?
   What is on the surface other than living plants?
   What animals did you find? (insects, spiders...)
   Feel textures; observe color.

6. Using a spoon or stick, carefully scrape the top inch of soil to one side. Repeat to uncover the second and third layers. Compare litter, duff, and humus.

7. Remember to tour each others' territories.

8. Place all matter back to its original state.

Questions and Discussion:

1. What did you find?

2. When would you expect to find more organisms? different organisms?

3. How do the organisms you found benefit the soil?

4. What are some reasons for odors in the soil?
Questions and Discussion:

1. Move the group to the soil profile or soil pit.
2. What can we see as we look at this cross section of soil?
3. What are some things that would be important to find out about it? (accept all comments)

The observable characteristics of color, texture, structure, temperature, and the acidity or alkalinity (pH) of a soil are indications of some soil conditions important in land use planning.

The campers are going to collect and record some of this information. For the next few minutes, they will stay together as a group to develop skills in collecting soil data. After that, they will be working on their own.

Note to Instructor:

Quickly (10 minutes) go over the following items about soil and the techniques for collecting the data with the campers. This instructional session is extremely important. The campers will use the skills they develop in this session when they collect data for the micromonolith.

Soil Components:

1. Soil layers (Horizons)

Mark where the soil changes color and general appearance. Many soils have three major layers or horizons; i.e., top soil, subsoil, and parent material. Because soil formation has many variables, you may find more or less. Measure and record the depth of each major layer.
2. Color

Describe and record the color of each major layer. Have participants pick their own description of color.

3. Texture (How the soil feels)

Determine and record the texture of each major layer. Texture is determined by feel. Push and rub moistened sample between thumb and forefinger. Spit on sample to moisten.

If it feels gritty ............... sandy loam
If it feels smooth and slick, not very sticky ............... silty loam
If it feels smooth, plastic, very sticky ............... clay loam

Have samples of sandy loam, silty loam, clay loam in cans. Have campers practice with these samples to find out what the textures feel like before determining textures of the soil profile under study.

4. Structure (How the soil is put together)

Determine the structure of each major layer. Carefully break apart a shovelful of soil from each layer and match its characteristics with one of the structure words on the micromonolith lab sheet.

5. Temperature

Determine and record the temperature of each layer. Plant's growth depends upon soil temperatures during the growing season. Find out the growing season before the lesson.

6. pH (acidity or alkalinity)

Determine and record the pH of each major layer. Plants need many soil nutrients to grow well. The degree of pH also affects how plants grow.

Note to Instructor:

Demonstrate how to use the pH kit in front of the whole group. Use some foreign material like cigar ashes as a demonstration. Mention not to compact the sample in the
porcelain dish. Use just enough pH reagent to saturate the soil sample. Then match the color at the edge of the soil sample in porcelain dish with the pH color chart.

Constructing a Soil Micromonolith:

Using the skills you have just developed, and the available equipment, construct a soil micromonolith of this soil profile. Record your observations on the soil micromonolith lab sheet. You may want to make a micromonolith using the cards and jelly cups; if so, ask your instructor.

Air Temperature three feet above soil surface __________
Air Temperature just above soil surface __________

Sketch your soil profile, label the layers or horizons and record the data.

DATA

Contents of material above soil:

______________________________
______________________________
______________________________

Depth ____" to ____"

A-Horizon (Topsoil) Color:____

Depth: ____" to ____"

Texture: Sandy loam __, Silty loam __, Clay loam __.

Structure: Columns __, Blocky __, Granules __, Platey __.

pH: ____ Temp: ____°F

Plant roots visible: _______
Record below, the same information as above for the rest of the layers or horizons.

Describe type of rock in the bedrock (if present) ______

_____________________

_____________________

_____________________

Evaluation:

The soil investigation is a good introduction to any work project relating to the soil. The soil investigation can also be used to introduce land use planning.

Follow Up:

The following week's environmental awareness time will be spent learning more about soil. There will be a lesson plan on analyzing the campers soil data from Saturday's investigation to follow up on this lesson.
SOIL FACT SHEET

Soil - the weathered upper layer of the earth’s crust mixed with living organisms and decomposed material. Soils are composed of: 1) air, 2) water, 3) minerals, and 4) organic matter.

Litter - identifiable dead things on the surface.

Duff - partially decomposed organic matter; compacted.

Humus - almost completely decomposed non-identifiable organic matter.

Horizons - soil layers.

pH - acidity or alkalinity. An indicator of how well certain plants can grow in the soil. The degree of acidity or alkalinity in the soil governs how active (chemically) different parts of it are. Plants can only get essential nutrients at certain pH’s. pH 6.5 is best for most plants. However, coniferous trees like acidic soil.

Very acid (organic) Neutral Very alkaline (Ca,Mg,P,K)
1 7 14

Soil Development - the way in which the soil is continually being influenced by the world around it. Major influencing factors: 1) parent material, 2) climate, 3) topography, 4) the biota, 5) time.

Lichen - a fungus and an alga living together for mutual benefit (symbiosis). The alga manufactures
carbohydrates and the fungus supplies the alga with water and minerals.

Young Soils - those next to a river or stream, with slight horizon development. The soil particles are not getting a chance to settle.

Structure - the way the soil particles stick together.
  i.e. sand = no structure.

Texture - the way the soil feels. If it feels gritty... the texture is sandy. If it feels smooth and slick, not very sticky...the texture is silty. If it feels smooth, plastic, very sticky...the texture is clayey.

Micromonolith - a small cross section of a soil profile. Can be made by sketching the layers of the profile or by putting samples of each layer in a small jar.
Environmental Awareness Hours: 12

Day 1

Morning:
1. Worship Services

Afternoon:
1. Recreation and leisure

Evening:
1. Special film

Day 2

Evening, two hours:
1. Group # 1 - Analyzing Soil Data
2. Group # 2 - Making trail snacks

Day 3

Evening, two hours:
1. Group # 2 - Analyzing Soil Data
2. Group # 1 - Making trail snacks

Day 4

Lunch Break, 15 minutes:
1. Lifestyle Analysis Exercise
Evening:
1. Recreation
2. Crafts

Day 5

Evening, two hours:
1. Individual Environmental Awareness Project

Day 6

Lunch Break, five minutes:
1. Environmental Awareness Evaluation

Evening:
1. Special campfire

Day 7

Morning, two hours:
1. Water Investigation

Afternoon, four hours:
1. Field trip - Fish and Wildlife Area, or Wildlife Refuge

Evening:
1. Square dance

FIRST DAY; SUNDAY

The second Sunday of camp may be considered a day off for the YCCers. This day should be loosely structured. Church services should be made available to those who wish to participate in them. The afternoon may be spent in
recreation and leisure activities. Afternoon field trips led by group living aids to nearby sites, such as a forest preserve or cave, may also be undertaken. For the camper's evening activity, a feature film made for their age group may be shown.

SECOND DAY; MONDAY

Monday evening is again spent on two hours of environmental education time. The campers should be divided into two groups, not necessarily the same two groups that were formed on that first Monday. Group one will be analyzing their soil data from Saturday's soil investigation, and group two will be making trail snacks in preparation for the canoe trip during the third week. The group analyzing soil data should be divided into groups of five campers per activity leader. Group two may be divided into groups of eight or nine campers per activity leader.
LESSON PLAN # 8

ANALYZING SOIL DATA

Objectives:

1) Demonstrate the ability to determine the best uses of the land in the area sampled, using the data from the soil micromonolith and the land capability charts.

2) Describe three things that man does to determine the proper management of the soil resource.

Materials:

1) Soil data and soil micromonolith card from Saturday's soil investigation.

2) Pencils.

3) 100" stick per five YCCers.

4) Level or jar of colored water per five YCCers.

Procedures:

This lesson plan on analyzing soil data continues the YCCers' education on soil as a resource. Lesson plan #7 provided the campers the opportunity to develop some skills of collecting data about the soil environment. The campers will further their education by interpreting their data and then applying that data to making some decisions about the best uses of the land that was sampled.

There are several charts that will be needed to analyze the soil data. Each group of campers should have a
copy of these charts. The charts are presented on the fol-
lowing pages along with the procedures of the lesson.

Begin by reviewing quickly what will take place in
the two hours. The objectives should also be presented to
the YCCers.

Each group of YCCers should use the soil data they
collected and the following charts to answer the following
questions:

The potential of the soil for water storage and plant
growth is: excellent ___ good ___ poor ____.

Why? ________________________________

EFFECT OF SOIL DEPTH ON PLANT GROWTH AND WATER STORAGE

Deep soil (over 42"")
Moderate deep soil (20" - 42"")
Shallow soil (20" & under)

Excellent water storage
and plant growth
Good water storage and
plant growth
Poor water storage and
plant growth

Chart I will give the relationship of color to
soil conditions.

What can be said about the following, based on the color of
the top soil, or A horizon? ________________________________

Amount of organic material ________________________________

Erosion factor ________________________________

Fertility ________________________________

What can be said about the drainage in the B horizon, based
on color? ________________________________
### CHART I

**RELATIONSHIP OF COLOR TO SOIL CONDITIONS**

<table>
<thead>
<tr>
<th>Top Soil Condition</th>
<th>Dark (dark grey, brown to black)</th>
<th>Moderately Dark (dark brown to yellow-brown)</th>
<th>Light (pale brown to yellow)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of organic material</td>
<td>Excellent</td>
<td>Good</td>
<td>Low</td>
</tr>
<tr>
<td>Erosion Factor</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Aeration</td>
<td>Excellent</td>
<td>Good</td>
<td>Low</td>
</tr>
<tr>
<td>Available nitrogen</td>
<td>Excellent</td>
<td>Good</td>
<td>Low</td>
</tr>
<tr>
<td>Fertility</td>
<td>Excellent</td>
<td>Good</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Subsurface Soil Color (B Horizon) Condition**

- **Dull Grey (if in low rainfall soils)**: Water-logged soils, poor aeration
- **Yellow, red-brown, black (if in forest soils)**: Well drained soils
- **Mottled grey (if in humid soils)**: Somewhat poorly to poorly drained soils

### CHART II

**EFFECTS OF TEXTURE ON SOIL CONDITIONS**

<table>
<thead>
<tr>
<th>Type</th>
<th>Water holding capacity</th>
<th>Looseness of soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandy loam</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>Silty loam</td>
<td>Good to excellent</td>
<td>Good</td>
</tr>
<tr>
<td>Clay loam</td>
<td>High (plants can't use it in clay)</td>
<td>Poor</td>
</tr>
</tbody>
</table>

Using the structures that were recorded, and the chart, "Effects of Structure," what can be said about the drainage properties of the soil for:

- **Topsoil (A)**
- **Subsoil (B)**
CHART III
EFFECTS OF STRUCTURE ON SOIL CONDITIONS

<table>
<thead>
<tr>
<th>Type</th>
<th>Penetration of water</th>
<th>Drainage</th>
<th>Aeration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columns</td>
<td>Good</td>
<td>Good Vertical</td>
<td>Good</td>
</tr>
<tr>
<td>Blocky</td>
<td>Good</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Granular</td>
<td>Good</td>
<td>Best</td>
<td>Best</td>
</tr>
<tr>
<td>Platey (low rainfall soils)</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>(like stack of plates)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CHART IV
pH RANGE OF PLANTS

<table>
<thead>
<tr>
<th>pH 1 to 4.5</th>
<th>6.5 to 7</th>
<th>8.5 to 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1 to 4.5 is too acid for most plants)</td>
<td>(Most plants do best here)</td>
<td>(8.5 to 14 is too alkaline for most plants)</td>
</tr>
</tbody>
</table>

Example of Plants in pH Range:

pH 4.0 - 5.0: rhododendrons, camellias, azaleas, blueberries, fern, spruce.
pH 5.0 - 6.0: pines, firs, holly, daphne, spruce, oaks, birch, willow, rhododendron.
pH 6.0 - 7.0: maple, mountain ash, pansy, asters, peaches, carrots, lettuce, pines, firs.
pH 7.0 - 8.0: beech, mock orange, asparagus, sagebrush.

Using the pH ranges that were recorded and the table above, complete the following chart:
**CHART V**

<table>
<thead>
<tr>
<th>Some plants that could grow here based on the pH and chart</th>
<th>Some plants actually observed growing here</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Did your inferences about the soil pH-plant relationships check out? Yes ____ No ____ Explain: ________________________

**CHART VI**

**SOIL TEMPERATURE**

<table>
<thead>
<tr>
<th>Soil temperature</th>
<th>Conditions during growing season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 40°F</td>
<td>No growth, soil bacteria and fungi not very active</td>
</tr>
<tr>
<td>40°F to 65°F</td>
<td>Some growth</td>
</tr>
<tr>
<td>65°F to 70°F</td>
<td>Fastest growth</td>
</tr>
<tr>
<td>70°F to 85°F</td>
<td>Some growth</td>
</tr>
<tr>
<td>Above 85°F</td>
<td>No growth</td>
</tr>
</tbody>
</table>

The growing season for the area is ______________________

What does the soil temperature chart tell you? ____________
Note to Instructor:

Explain to the campers that all the information needed, except the slope of the land, to discuss some land uses of the study area has been obtained. Demonstrate how to measure the slope; then have the campers work in groups of five to measure other slopes in the study area.

Determining the slope of the land:

1. Select a place that represents the average slope of the land being studied or take several measurements and average them.

2. Place one end of a 100” stick on the slope that is to be measured. Hold outright to be about level.

3. Place a level or jar with some liquid in it on the outright stick. Raise or lower the stick until level.

4. Measure the number of inches the free end of the stick is off the ground.

5. The number of inches is the slope of the land in percent.

The following is a chart for soils in one kind of land, climate, and plants. Other areas may require a different set of criteria.
# CHART VII

## LAND USE CHART

<table>
<thead>
<tr>
<th>Agriculture Uses</th>
<th>Slope</th>
<th>Erosion hazard</th>
<th>Soil depth</th>
<th>Drainage</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm crops - cultivation good soil practices</td>
<td>0-3</td>
<td>None</td>
<td>Deep</td>
<td>Well</td>
<td>Loam or silty loam</td>
</tr>
<tr>
<td>Farm crops - few to several special cultivation practices</td>
<td>3-20</td>
<td>Slight</td>
<td>Moderate</td>
<td>Somewhat</td>
<td>Sandy loam or silty clay</td>
</tr>
<tr>
<td>Occasional cultivation many special practices</td>
<td>20-30</td>
<td>Severe</td>
<td>Shallow</td>
<td>Poor</td>
<td>Sand or Clay</td>
</tr>
<tr>
<td>Pasture-Woodland cultivation, no machinery can be used</td>
<td>0-2</td>
<td>None to slight</td>
<td>Deep</td>
<td>Well to Poor</td>
<td>Stoney</td>
</tr>
<tr>
<td>Pasture, timber growing, woodland, wildlife, no cultivation machinery</td>
<td>30-90</td>
<td>Very severe</td>
<td>Deep to shallow</td>
<td>Well to poor</td>
<td>Sandy, silty claying or claying</td>
</tr>
<tr>
<td>Wildlife, recreation</td>
<td>all</td>
<td>None to extreme</td>
<td>Deep to shallow</td>
<td>Excessive to poor</td>
<td>Rocky, Rockland, river wash, sand dunes</td>
</tr>
</tbody>
</table>
The most limiting soil factor will determine the best agricultural use of the land.

Man's varied uses of land has demanded criteria to determine proper management practices for living on the land. Examples in addition to agricultural uses include: prescriptions for aesthetic management, soil site indexes for growing timber, criteria for greenbelts, etc. The following chart enumerates land uses.

**CHART VIII**

**OCCUPANCY LAND USES BY MAN**

<table>
<thead>
<tr>
<th>Some Uses &amp; Factors</th>
<th>Slight Limitation</th>
<th>Moderate Limitation</th>
<th>Severe Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Roads and Streets</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slopes</td>
<td>0-12%</td>
<td>12-30%</td>
<td>Over 30%</td>
</tr>
<tr>
<td>Depth</td>
<td>Over 40&quot;</td>
<td>20-40&quot;</td>
<td>Less than 20&quot;</td>
</tr>
<tr>
<td>Watertable</td>
<td>Over 20&quot;</td>
<td>10-20&quot;</td>
<td>Less than 10&quot;</td>
</tr>
<tr>
<td><strong>Building Sites</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slopes</td>
<td>0-12%</td>
<td>12-20%</td>
<td>Over 30%</td>
</tr>
<tr>
<td>Depth</td>
<td>Over 40&quot;</td>
<td>20-40&quot;</td>
<td>Less than 20&quot;</td>
</tr>
<tr>
<td>Watertable</td>
<td>Over 30&quot;</td>
<td>20-30&quot;</td>
<td>Less than 20&quot;</td>
</tr>
<tr>
<td><strong>Septic Tank Filter</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fields</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope</td>
<td>0-7%</td>
<td>7-12%</td>
<td>Over 12%</td>
</tr>
<tr>
<td>Depth</td>
<td>Over 6'</td>
<td>4-6'</td>
<td>Less than 4'</td>
</tr>
<tr>
<td>Watertable depth</td>
<td>Over 4'</td>
<td>2-4'</td>
<td>Less than 2'</td>
</tr>
<tr>
<td>below trench</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Picnic and Camp Areas</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope</td>
<td>0-7%</td>
<td>7-15%</td>
<td>Over 15%</td>
</tr>
<tr>
<td>Stones</td>
<td>0-20%</td>
<td>20-50%</td>
<td>Over 50%</td>
</tr>
<tr>
<td>Watertable during season of use</td>
<td>Over 30&quot;</td>
<td>20-30&quot;</td>
<td>Less than 20'</td>
</tr>
</tbody>
</table>
Questions and discussion:

Using the data from the preceding pages and the Land Use Chart, answer the following questions.

According to the agriculture and occupancy land use charts, this land could be used for:

Agriculture use:
(list & explain why)

Occupancy: (yes or no and with what limitations)
Roads and streets:
Building sites:
Septic tank filter fields:
Picnic and camp areas:

I feel the best uses of this land would be: (justify your answer)

Discussion:

1. How have you classified this land?

2. Based on your observations and the data you collected, do you feel this land is being properly used?

3. In your estimation, have man's activities affected the classification of this land?

4. Could man improve the capability of this area? How?

5. How could man reduce the capability of this area?

Summary questions:

1. What are some factors that contribute to soil formation?

2. What evidences of geological changes have you noticed in this area?
3. What other factors might affect uses of the land? (climate, growing season, needs of community, economic, past history of uses, etc.)

4. What did we find out about the environment in the study today?

5. How are soil characteristics important in environmental management?

6. How can we summarize our discussions and investigations?

7. What processes and methods were used in our investigation today?

Evaluation:

During the session's evaluation period, the objectives should always be reviewed to see if they have been achieved. When the campers are finished with analyzing their soil data, they should be able to demonstrate the ability to determine the best uses of the land in the study area, and to describe three things that man does to determine the proper management of the soil resource. As a result of this session, they should also be able to describe how they feel about man's effect on this soil environment, and to describe how they feel about man's effect on the soil environment where they live.

Follow-Up:

If the campers would like to continue their study on the soil environment, the author suggests playing the land use simulation game - Centerplace City - from Teaching Materials for Environmental Education, U.S. Forest Service, or developing the camp's own simulation game using a local environmental land use problem.
LESSON PLAN # 9

MAKING TRAIL SNACKS

Objectives:

1) To learn how to dry food for high-energy trail snacks.

2) To learn how to pack food to save space and to reduce weight.

Materials:

1) Heavy-duty plastic bags (freezer bags).

2) Food ingredients (see trail snack recipes).

3) Oven.

Procedures:

The campers will be taking a two day canoe trip during the third week of camp. During this lesson the campers will prepare trail recipes for their lunches and snacks. They will also learn how to pack their snacks and main meal foods with the purpose to save space and reduce weight.

Divide the campers into groups of five. Because of such a large number of campers in the camp's kitchen, each group should be assigned a certain task. The trail snack recipes that are chosen depend on the campers' tastes and the camp's supply of ingredients. The trail recipes are found at the end of the lesson plan.

Sometime during the two hours, the campers should be
instructed as to how to pack the kitchen and food supplies for the canoe trip. A group from both Monday and Tuesday night sessions should be chosen to do the packing for the trip. The following paragraphs contain the instructions for packing light. This information is found on pages 54-59 in the book, *Wildlife Country How To Enjoy It*, compiled by The National Wildlife Federation.

The first job of a packer is to make several lists: menus, cooking equipment, foods on hand, foods to be bought, prices, weights, foods to be stored until the last minute. When the trip menu is complete, list the basic cooking equipment that will be needed for every meal. Then, starting with the breakfasts, list the amount of each food needed and the specific additional equipment required to prepare and serve it and each time it is needed. After listing all meals, total up all the food and equipment needed and make any changes that will simplify matters. It is best to keep the equipment at a minimum.

When it is time to pack the food, spread out all of the food that is to be taken along with the plastic bags and ties. To save space and reduce weight the boxes should be discarded and the food should be repackaged in heavy-duty plastic bags (designed for freezing foods). As each item is packed and labeled, check it off the list. This is also the time to combine items for ease of use in camp. For instance, it helps to empty a three-ounce box of powdered instant pudding mix into a quart bag with two-thirds cup of dried milk.
Then all that is needed is to add the water.

The next step is to pack all of the separate parts of each meal together in a larger plastic "meal bag." This makes it convenient to pull out of a pack on the trail. The large bags also make it easier to load and balance a pack or canoe.

Bathroom scales may be used for loading individual packs, for balancing saddle packs, or laying out a canoe load.

When the food has all been repackaged and labeled, spread out everything that is to be taken on the trip. The packing should be done in stages; the essentials such as tents and sleeping bags first. Then the pots, utensils, and meal bags. It is at this point that the personal items such as cameras and nature guides can be considered and added.

Evaluation:

This session on making trail snacks will be valuable to the campers in the future when they plan their own camping trips. They will be able to use the packing information and the recipes to make their trips easier and more enjoyable.

Follow-Up:

The campers will be using the information they gathered from this lesson plan for the two day canoe trip during the third week. When camp is over, it is hopeful that the campers will make special trips of their own, and thus, this information will be needed then.
RECIPES FOR TRAIL SNACKS

Basic Gorp

1 cup peanuts
1 cup raisins
1 cup M & M candies

Mix together equal amounts of peanuts, raisins, and M & M's. Package the mixture in individual plastic bags to be carried by each camper.

Note: You can substitute or add cashews, walnuts, sunflower seeds (shelled), chopped dates, chopped apricots, or shredded coconut to the basic gorp recipe.

Basic Fruit Leather

30-ounce can of applesauce

Coat an 11-inch by 16-inch cookie sheet with non-grease spray or stick. Spread applesauce evenly on the sheet so that it is no more than one-fourth inch thick. Dry the fruit puree in a slow oven (about 150 degrees F) with the door open a crack for six to eight hours. When dry, the leather will be translucent, pliable, and barely sticky. Peel the fruit leather from the pan, and roll and slice it into eight small, individual rolls. Each roll of this pure fruit candy is equivalent to one-half cup fruit.

Fresh Fruit Leather

6 pears, 6 peaches, or 18 apricots
3 tablespoons honey

Wash, core (or pit), peel, and slice the fruit. Puree the fruit adding honey to make the leather more pliable when dried. Then heat the puree just to boiling point in a saucepan before drying. Dry as usual.

Note: To give the leather extra body, add one-half cup applesauce to fresh berry purees. Lemon juice may be used to treat the fruit when first cut up, to prevent discoloration.