

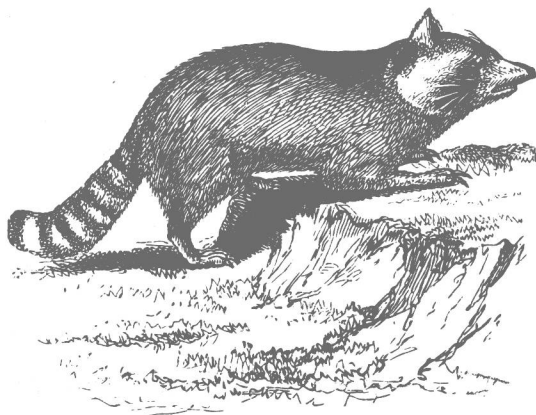


LOOKING at the  
HIGHER FORMS of LIFE

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# LOOKING at the HIGHER FORMS of LIFE



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# Chapter **1**\_\_\_\_\_

## **LOOKING AHEAD—**

Listed below are some of the topics or problems discussed in this chapter. You may use these as guidelines or things to look for in your study of the following pages.

1. Soil forms a thin layer on most parts of the earth's surface.
2. Soil comes from the weathering of rocks. It may be a residual or a transported soil.
3. Soil usually consists of two zones—a dark top layer rich in humus, called the topsoil, and a lighter-colored, lower layer, called the subsoil. The subsoil rests on bedrock.
4. Many factors influence the nature of soil. These include the kind of rock from which the soil was derived, the kinds of plants and animals living in the soil, the climate of the area, and the location of the soil—in the valley or on the hillside.
5. Soil formation is a very slow process. It is important to save soil. Soil conservation includes the protection of fields and forests against fire, and overgrazing of the pastures by animals; it includes crop rotation, contour farming on rolling or hilly land, strip cropping on cultivated slopes, terracing of steep-sloped hillsides, planting crop cover to reduce erosion, and irrigating deserts and other dry areas.

# **SOIL AND LIFE**

## WHAT SOIL IS

The thin layer of loose material that covers the rocks at the surface of the earth is called the **rock mantle**. The part of the rock mantle in which plants will grow is called **soil**.

Soil is made up mostly of broken and decomposed rocks. Soil is usually a mixture of sand, silt, clay, and humus. Sand, silt, and clay are

derived from rocks. **Humus** is made up of decaying remains of plants and animals. It gives soil a dark color. Humus makes the soil porous so that it can absorb air and water. It also contains a rich supply of chemicals that plants need for growth.

Rich soil is easy to cultivate and yields a good harvest.

*Western Growers Association*





*American Airlines*

A view of the rocks that make up the Grand Canyon. Wind, water, and air are slowly crumbling and decomposing the rocks in the canyon. The mud, silt, and sand are carried down stream by the river water. What happens to this sediment?

Soil contains many kinds of living things. Some of these are tiny and can be seen only with a microscope. A handful of soil, for example, may contain millions of tiny forms of life called **bacteria**. Besides bacteria, many kinds of worms and burrowing animals may live in the soil.

## HOW SOIL IS MADE

Soil is formed by the weathering of rocks at the surface of the earth. Weathering is the process by which rocks crumble and decompose. Wind, water, and air are some of the agents that bring about this weathering.

Some of the ancient rocks of the earth are shown here in the inner gorge of the Grand Canyon.

*United States Geological Survey*





*Geological Survey of Canada, C. F. Gleeson*

This valley near Dawson City in the Yukon Territory of Canada shows trees growing in the dark-colored topsoil. Rocks are exposed in the cliff below the topsoil.

Water, in particular, is an important factor in the formation of soil. Rain water falling on the rocks or soil is capable of dissolving various soluble minerals. These are leached, or taken, out of the rock or soil and carried away in solution by the water.

Over a long period of time, rocks are broken into bits and pieces. Eventually the fragments become smaller and smaller. They are mix-

ed with humus and finally become soil.

Soil that forms by the weathering of rocks on which it rests is called residual, or undisturbed soil. In many cases, however, the soil may have been carried from the place where it was formed to a new location. The rock particles are carried by wind, water, or glaciers to a different place. This kind of soil is called transported soil.

Soil does not usually form in the parts of the world that are permanently covered by snow and ice. On the other hand, a warm and wet climate often produces a good, or fertile, soil. *Coast and Geodetic Survey*



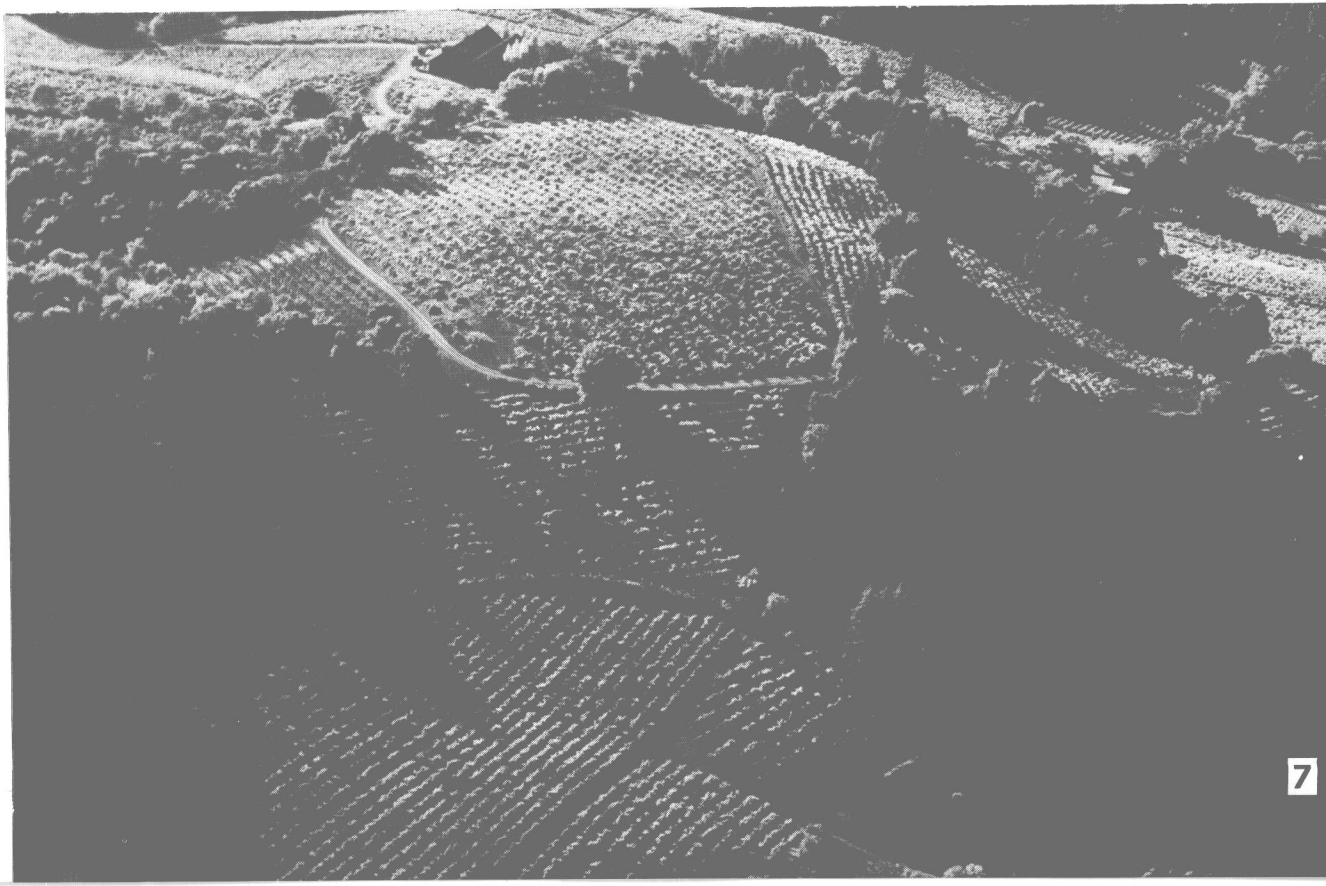
Most soil, regardless of how it was formed, consists of two zones or layers. The top layer is usually rich in humus and dark in color. It is called **topsoil**. Below is a lighter-colored zone made up of fine fragments of rocks, but with very little humus. This is the **subsoil**. The subsoil rests on **bedrock**, or solid

rock. Usually the total thickness of soil varies between several inches and a few feet.

### HOW SOILS DIFFER

There are many kinds of soil. The type of soil depends partly upon the kind of minerals in the rocks

Grapevines are shown growing in the fertile soil of Napa Valley in California.



from which it was formed. Climate plays a large part in changing and forming materials in the soil. For example, good soils do not form in the cold polar regions. Rocks covered by snow and ice remain unchanged for a long time. A warm

and wet climate, on the other hand, often produces fertile, or good, soil.

Where soil is located on the land surface can also influence the nature of the soil. It has been found that soil on the top of a hill differs from the soil forming on the slope. This

Fertile soil is often found on the floor of the valley. Artichokes are shown growing in the Salinas Valley of California.

*Greater Watsonville Chamber of Commerce*





*United States Forest Service Photo*

in turn, differs from the soil on the level ground in the valley. Yet all these soils may form from the same rocks and with the same climate. Moreover, in the bottoms of valleys, topsoil is often rich and deep because it has been washed down into the valley from surrounding slopes.

The kind of soil depends in part upon the kinds of plants and ani-

mals living in the soil. One type of soil will form in an orchard of fruit trees, another kind in fields covered with grapevines, and still another kind in a forest.

mals living in the soil. One type of soil will form in an orchard of fruit trees, another kind in fields covered with grapevines, and still another kind in a forest.

Red fir growing in a forest

*United States Forest Service Photo*



Harvest workers are picking the grapes in a vineyard.



The wise use of land is important in order to conserve our soil.

Soil formation is a slow and complex process. Often thousands of years are needed to make a thin layer of soil. It is important to save the soil we have.

## THE LOSS OF SOIL

The quality of soil is affected in many other ways. For example, if the same crop is planted in the same soil year after year, the soil will lose each year a little of the kinds of minerals or chemicals that particular crop needs. After several years, the crops will grow smaller in quantity and poorer in quality. The soil can no longer supply the plant's need for particular minerals or chemicals. On the other hand, if



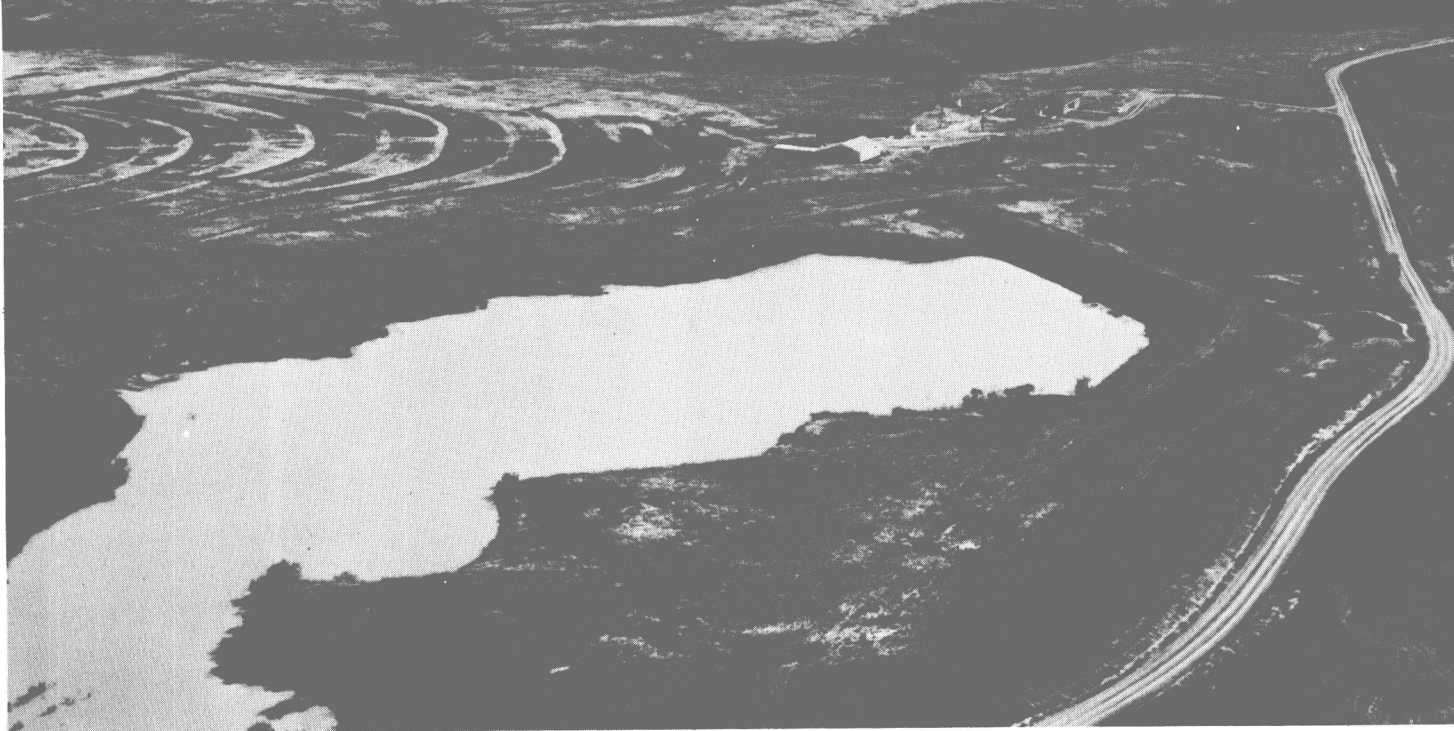
*Canadian National Film Board*

crops are rotated, or changed each year, and soil is enriched artificially, or fertilized, with chemicals and other helpful materials, rich crops can be raised for many, many years.

Erosion of soil can be greatly reduced by properly cultivating and planting the land.

*Canadian Government Travel Bureau*





*United States Department of Agriculture*

Large amounts of soil are lost each year by floods. Floods can be controlled by building dams, spillways, and other structures that retard floodwater.

## OTHER LOSSES OF SOIL

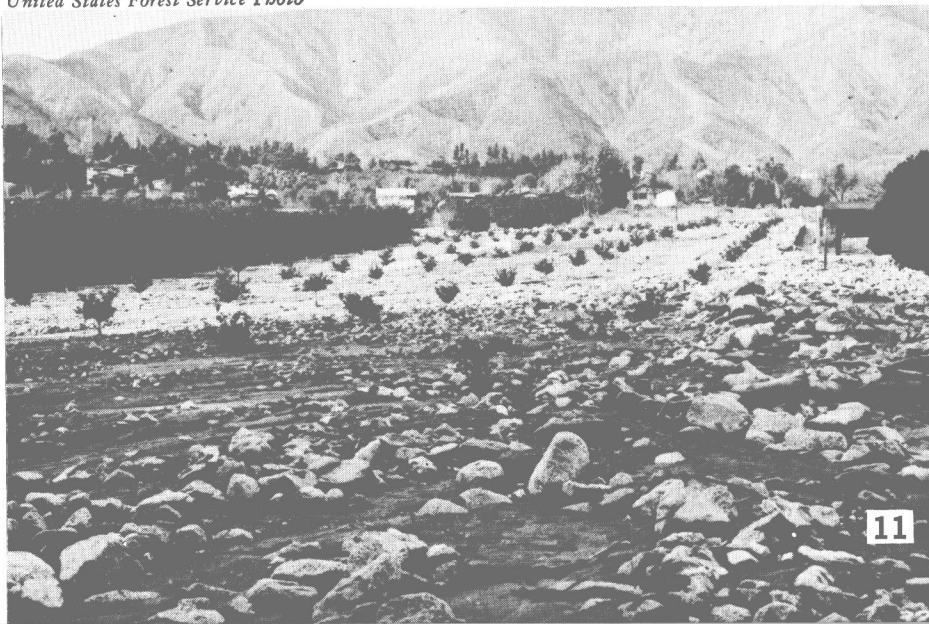
Another way to lose good soil is through erosion by wind and water. If soil is left without plant covering, wind can pick up the soil and blow it away. Much good topsoil is lost in this way.

Sometimes flood waters tumble down hillsides, carrying with them

stones and gravel, sand, and mud. When a field is flooded, these materials may be deposited on top of good soil, making it useless for planting. Swift currents in streams can pick up topsoil, carry it along for a while, and then drop it at the bottom of a river or a lake, or carry it out to sea.

*United States Forest Service Photo*

A once fertile land which produced fine crops. The orchard was partly damaged by a forest fire and further devastated by heavy floods. When a plant cover is destroyed, floodwaters do greater damage, washing away topsoil.





Silt deposits on the left bank of Don Pedro Reservoir, Stanislaus, California

*United States Forest Service Photo*

The silt that is dropped to the bottom of a lake behind a dam takes up space. Because of silting, the lake will hold less and less water. Thus, not only is good soil lost, but also much needed water storage space is lost. Huge sums of money may have to be spent to remove the sediment or—since this is very costly—build a new dam.

In many areas where dams are built for water storage or flood control, large desilting plants are constructed to prevent silting. Silting up of dams is a common problem in California where irrigation is widely practiced.

Gully erosion on the edge of a forest. The steeper the land surface, the less the plant cover, the faster is the erosion.

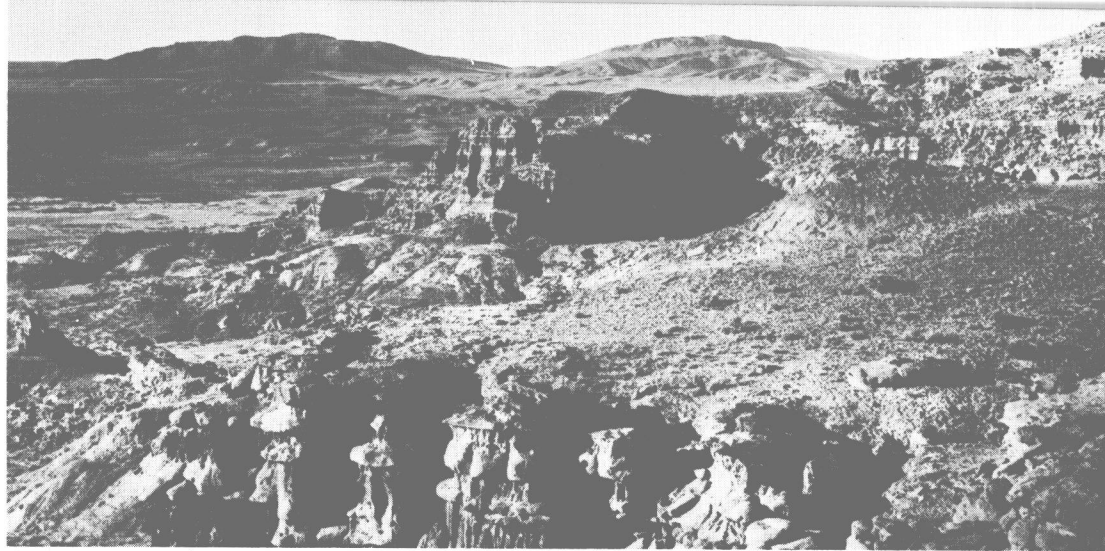
*United States Forest Service Photo*



*United States Forest Service Photo*



These gullies were caused by heavy logging and lack of drainage.



*American Museum of Natural History*

Weathering is responsible for the unusual shapes of these rocks in Wind River, Wyoming.



*Canadian Government Travel Bureau*

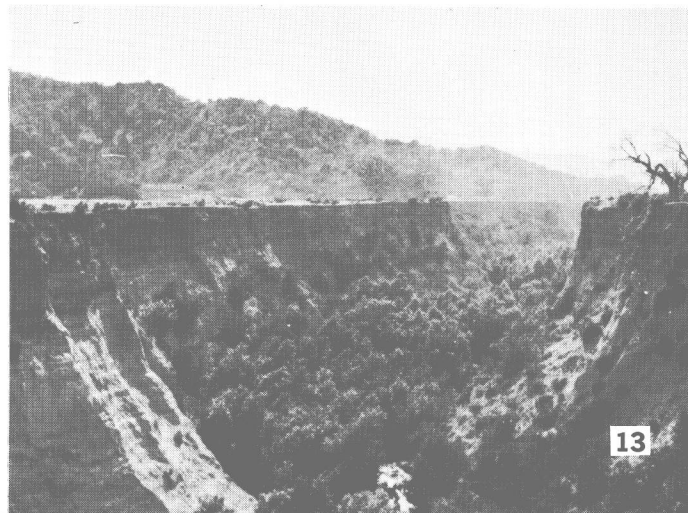
The rock debris at the base of the mountain is the product of weathering.

In dry regions, the topsoil is often removed by wind. During the early part of this century, great areas of grassland in the southwestern part became converted into a "dust bowl."

*United States Forest Service Photo*

This huge gully was cut into farmland that had been overgrazed by animals. Overgrazing means that the land has so many grazing animals that the grass and other plants are eaten down to their roots. The plants may die or grow poorly.

*United States Forest Service Photo*



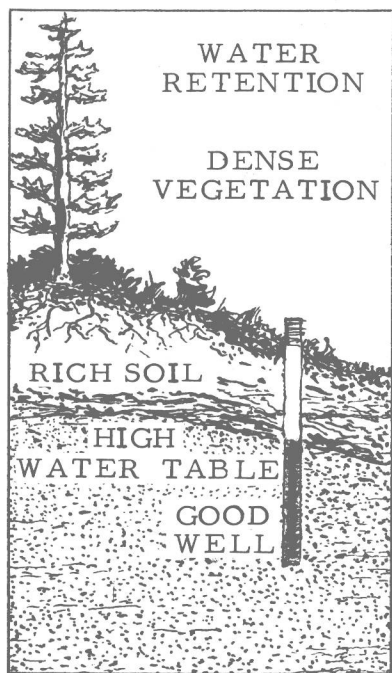
## HOW SOIL, WATER, AND PLANTS ARE INTERRELATED

Loss of soil leads to the loss of plants. Loss of plants means the loss of watersheds. Loss of watersheds means loss of water and wildlife.

Any area that has a natural plant cover of trees and shrubs serves as a watershed. The soil in such areas is usually soft, rich humus that will absorb much rain water. The plant cover prevents the rain from hitting the soil with full force. The rainwater drips off leaves and branches to the soil, where it is absorbed and stored in underground reservoirs that feed into rivers or streams. Thus, instead of

running rapidly down a hillside, water is stored for future use. The streams running down mountainsides are prevented from flooding. These streams are able to draw from the underground reservoirs long into spring and summer. Some of them may have water all year round.

The plants in a watershed not only help prevent floods and save soil; they also feed the wildlife in the area and enrich soil. Dead leaves and branches that fall onto the ground decompose and become part of the soil. The roots of plants break up small rock particles and sometimes even large rocks, which will eventually become part of the soil. The plants, of course, get food ma-



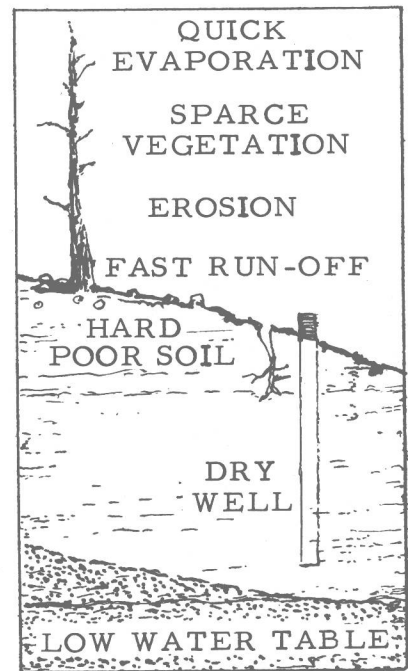
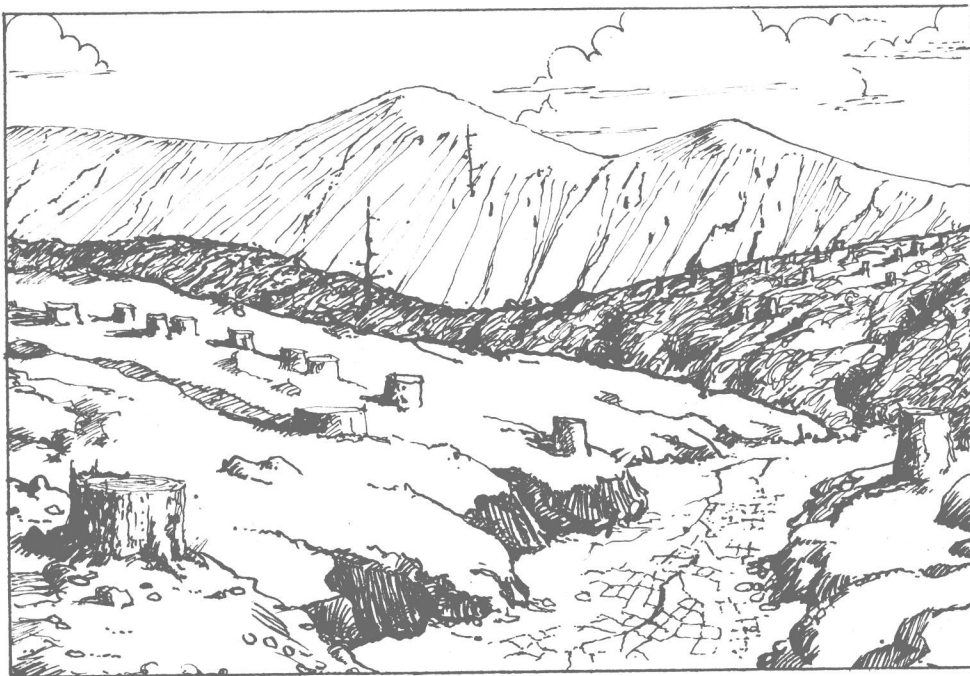
terials and water from the soil. These the plant uses and converts, with the help of air and sun, into food it can use. This process of conversion is called **photosynthesis**, which is explained later in this section.

Animals living in the area get their food from the plants, either directly by eating plants, or indirectly by eating animals that do eat plants. Animals, in turn, help plants by scattering seeds from which new plants will grow. When an animal dies, it will decompose and add organic materials to the soil. Thus in a never-breaking chain, soil, water, plants, and animals serve one another.



*United States Department of Agriculture*

Root system of blackjack oak tree





*United States Department of Agriculture*

## HOW TO SAVE SOIL

In order to prevent soil from being used up, washed away, or lost in other ways, many precautions must be taken. A plant cover is the best protection against wind erosion and rapid runoff of water. Roots of plants help to keep soil in place. They also keep the soil loose, which enables rain water to be absorbed and prevents rapid runoff.

*United States Department of Agriculture*



The fence divides two pastures. The one to the right has been properly cared for. The one to the left has been overgrazed and improperly used.

A good farmer will know what it takes to prevent loss of topsoil. He will usually not cultivate a hillside, but rather will use it as grazing land. When he does cultivate a hillside, he will plow furrows so that they run horizontally rather than vertically. Each horizontal furrow

Contour farming is a good conservation practice for the wise use of sloping farmland.