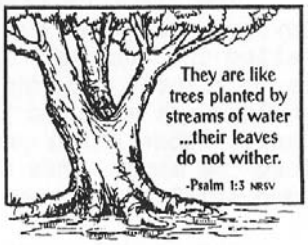
CHAPTER 1 -
AWARENESS OF THE ENVIRONMENT

How many are your works, O Lord! In wisdom you have made them all. The earth is full of your creaturs. Psalm 104:24

Wandering in the wilderness for forty years, the children of Israel grew close to nature. They knew the songs of the birds and the cries of animals. They slept beneath the stars and watched the seasons come and go. They saw the glories of God's great creation and cried out with the Psalmists "Come let us bow down and worship. Let us kneel before the LORD our maker for He is our God and we are the people of His pasture." Behold your God as you study his creation.



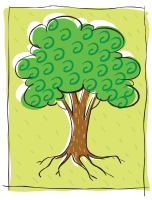
PLANTS

In the beginning God created the heavens and the earth. . . then God said, "*Let the land produce vegetation, seed bearing plants and trees on the land that bear fruit with seeds in it according to their various kinds.*

TREES

Trees are woody plants with a single erect stem, growing to a height of ten feet or more. They are distinguished from shrubs, which are also woody plants, since shrubs are usually smaller than trees and tend to have stems growing in a clump.

The United States has over 800 species of native and naturalized trees growing wild over 600 million acres of forest. This produces about ten billion dollars worth of forest products yearly. Of these 800 plus species, over 650 are the broad-leafed trees such as oaks, maples, cherry, ash and birch. Conifers, such as pine, hemlock, spruce, fir and cedar account for over 100 kinds and there are over 15 kinds of palm trees in the warmer regions.



Trees are very complex living things. They are composed of leaves, flowers, fruits, seeds, bark, buds, roots and wood. All of these parts may vary in some degree between two different trees, so you can see how broad the study of trees can be.

Leaves, using the energy of sunlight, make food for the tree from water and carbon dioxide. All trees produce a flower of some kind. It may not always be recognizable, but it is there.

The stem, or trunk, of the tree develops or grows due to a layer of cells called the cambium. This layer of cells is constantly growing and dividing. Those cells that grow and push outward form the bark. Those that grow and push inward form the wood. This constant

formation of wood enables the tree to grow larger.

The wood is made up of cellulose and lignin. New wood cells produced in the springtime are often longer and thinner than those that form later, and so each season is often marked by an annual ring. This fact is helpful in determining the age of a tree.

The fruits of trees bear the seeds by which the tree reproduces. These seeds may be spread by many means. Some seeds have "wings" which the wind carries or blows to other areas.

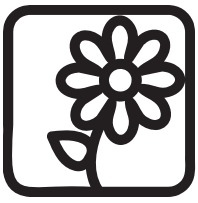
The roots of the tree anchor it to the ground. They absorb water and minerals from the soil. Some trees have a long slender taproot that grows deep. Others have a spreading system of roots. The spread of a tree's root system is at least equal to the spread of its crown or branch growth.

Trees are an important natural resource. They provide us with wood and wood products, turpentine and resins. They also hold soil, preventing floods, and provide home and shelter for many kinds of wildlife. We should use great care and wisdom when dealing with such a valuable product.

The everyday study of trees must begin with identification. This is not as difficult as may be thought. A systematic description of this process of identification follows and will enable you to identify trees correctly on your next outing or field trip.

Trees are classed into two broad groups: the conifers or cone bearing trees which hold their leaves all year and bear their seeds in cones, and the deciduous trees which lose their leaves in the fall and do not bear their seeds in cones. It is usually quite simple to decide to which group a particular tree belongs. When this has been done, you are ready to pin down the actual identity of the tree. There are many tree identification books available from your Library. Using them you will be able to identify most trees.

WILDFLOWERS



When you travel along roads and highways to fields and woods, you will see flowers that differ from those which you may have growing in your yard at home. Those that you have growing in your yard are usually grown from seeds or bulbs and roots purchased from a store. These varieties have been selected because they have appeal to the general public and are sought for planting in yards. They all have their beginnings in some wild flower. The flowers, which you see growing along roadways, fencerows and streams as you wander in the field, are termed wildflowers. It is the purpose of this section to describe some and give information on their identification.

First, let's look at how a typical flower is constructed. There are four main parts of every flower: the petal, the sepal, the

pistil and the stamen. (See Figure 1-1) Each has a purposeful part of the flower. The petals of

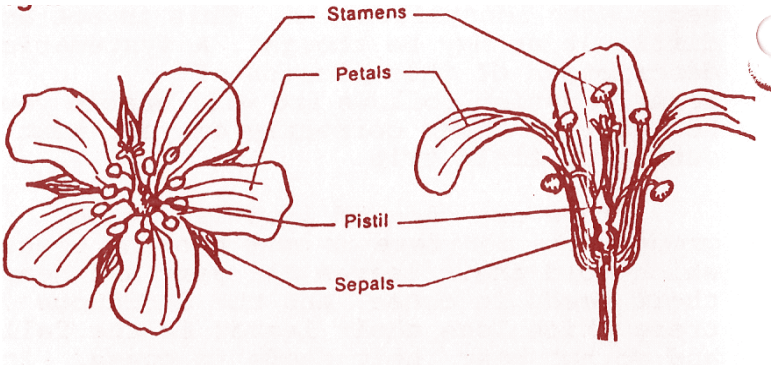


Figure 1-1

the flower are the showy part, that which we admire for color or form.

The sepals are the rings of smaller, generally green, bracts below the petals. These often are colored also, and have different forms from one kind of flower to another.

The pistils and the stamens are the essential parts of every flower for they are the means for the reproduction of that plant. The stamens produce the pollen that fertilizes the pistil and enables the ovules in the pistil to develop into seeds. This transfer of pollen grains may take place due to the wind or may be accomplished when insects crawl around in the flower in search of nectar. Pollen grains, clinging to the hairs on the legs of the insect, are carried from the stamens to the pistil. The flowers of any plant have only one goal: producing seeds for the propagation of that plant.

The word "flower" is generally used to describe a flowering plant, although it is actually the name of only one part of the plant. Many flowering plants are very useful to us, providing materials for food, clothing and shelter. Plants that we do not like and which do not provide useful materials are usually termed "weeds". It is a characteristic of weeds that they are active, hardy flowering plants that thrive in poor soil and under adverse conditions.

Flowers are in bloom every month of the year in some parts of the country. Only a few are found during the winter, the natural resting time for nature. Late in the spring, there is a general rush of blooming when many flowers push forth. This rush slacks off in the early summer and is followed by another surge of blooms in the early fall.

Most identification systems for flowers are based on color. Guidebooks are divided into sections of flowers, which are white or whitish, yellow and orange, pink or red, blue or violet and green or brown. Obtain a good guide to flowers and study it. Learn the system of identification, which it proposes. Then take to the field for hours of enjoyment of color and form.

ANIMALS

And God said, "*Let the water teem with living creatures and let birds fly above the earth, across the expanse of the sky.*" So God created the great creatures of the sea and every living and moving thing with which the water teems according to their kinds and every winged bird according to its kind.

FISH

It has been estimated that there are about 30,000 species of fish in the world today. About 4,000 are found in North America. Many fish live only in fresh water, many in saltwater. Some divide their lives between the two. Some species live only in cold water while others are

found only in warm water. Some are found the world around and others are limited to a single body of water.

Basically a fish has a backbone, is cold-blooded, lives in water and breathes by means of gills. All fish swim, some also crawl along the bottom by means of specialized fins. Some burrow in the mud, others glide through the air, creep from pond to pond and, in the case of some eels, migrate through wet grass.

Fish do not see very well. This is due to their eye structure and the fact that as they swim deeper, the available light grows dimmer. Fish can hear and are sensitive to vibrations, currents and changes in temperature and pressure. They have a well-developed sense of balance and of taste. Fish are usually of stream-lined shape and are very efficient in the water.

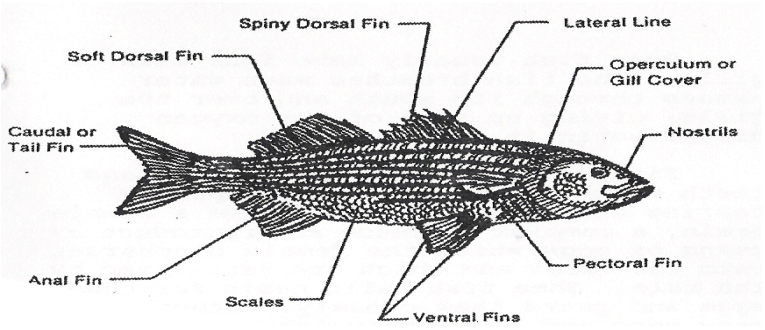
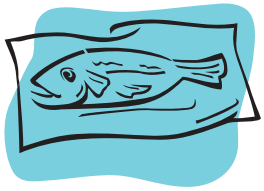


Figure 1-2

Parts of fish have precise names and, as in the case of birds, identification is greatly aided if we know these parts by their individual or proper names. Fish have two sets of paired fins, the pectoral and the ventral. In addition, they have three unpaired fins, the dorsal or back, and caudal or tail, and the anal. These fins differ in size and shape from fish to fish. The gills are covered by a gill cover called, the operculum. Fish have nostrils; two openings on each side, and ears for which there are no external openings. (See Figure 1-2)



While a number of fish do not have scales, the majority does. The number of rows of scales is constant for a species of fish and the scales are useful in identification. Fins may help in identification also, the rays or spines being of different number in different fishes.

Bony fish usually have four sets of gills. The fish breathes when water passes through its mouth and over the gills, giving up some of the oxygen dissolved in it.

Fish usually have large mouths and teeth, which are suited for grasping, tearing and grinding. Fish have a simple brain, a complex skeleton and reproduce by means of eggs, which the female discharges into the water that are fertilized by the male. Some fish build nests for these eggs and guard them closely. Others lay many eggs and completely ignore them.

BIRDS

There are in the world today about 8,600 different species of birds. Some 1,500 species grouped into about 75 families live in North America.

A bird is an animal with feathers. Body feathers provide insulation for the body of the bird. Wing and tail feathers aid in flight. Form and structure of feathers vary with different birds, but

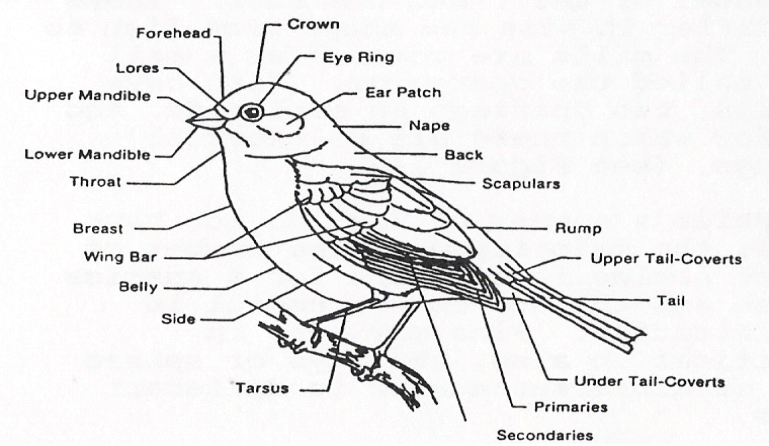
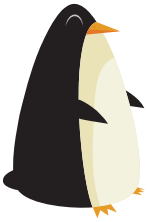


Figure 1-3

basically they are similar. Each feather has rows of branched barbs that hook together. On long flight feathers, the barbs mesh tightly to form a firm structure. Contour feathers and an undercoat of finer down cover the bird's body. (See Figure 1-3)



Most, but not all, birds fly. Those, which do, have light but strong hollow bones and the wings, are designed to propel them through the air. Some have air sacs in their bodies that add lightness. Those birds that do not fly, such as the ostrich and the penguin, use their wings for balance or to propel themselves through the water.

Most birds have four toes, three forward and one behind. Some birds, such as the woodpecker, have two toes forward and two behind. In many of the perching birds the toes lock automatically around a perch when the bird lowers its body, so that the bird can sleep without falling off. The bird's toes have been created for climbing, scratching, grasping and tearing and swimming. Long toes distribute the weight of birds that walk on mud and sand. Extra feathers protect the feet of ptarmigans and Arctic owls. The long legs of wading birds, the webbed feet of swimmers and other differences show specialized uses of various kinds. (See Figure 1-4)

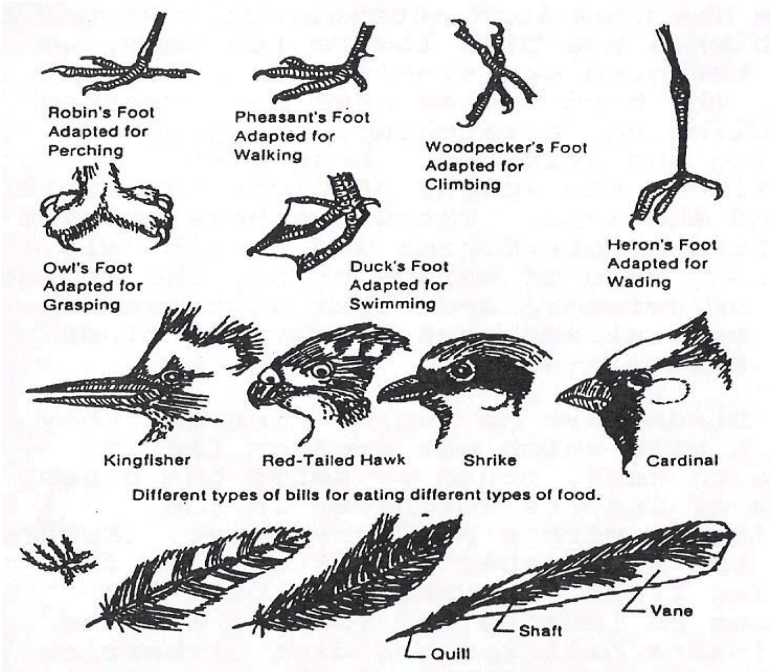


Figure 1-4

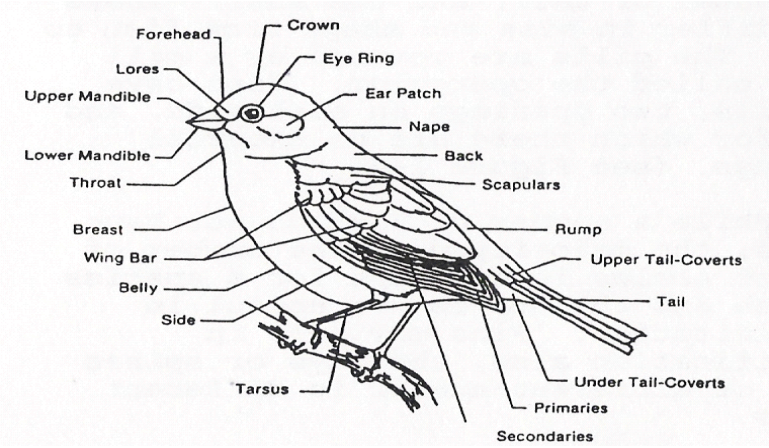
Birds have no teeth. Instead they have a bill which was created for the birds to tear, crush or seize the flesh, seeds or insects whichever is the particular bird's preferred diet. Notice that the kingfisher's bill is made for tearing flesh, the shrike's bill for feeding on insects and rodents and the cardinal's bill for its diet of berries and seeds. (See Figure 1-4)

Birds are warm-blooded and very active creatures. There body temperature varies between 101 and 112 degrees and their activity requires much food daily. Many birds eat their weight in food each day and some are known to eat up to 3,000 small insects a day!

Birds are found almost everywhere where food is available to them. Each species has a habitat preference, some tolerating wide variations in habitat and others being unable to tolerate even small changes.

All birds are hatched from eggs laid by the female in a nest or sometimes on the bare ground. Either the female or the male or both incubate eggs alternately. This incubation takes from 11 to 63 days. Some birds, such as ducks, are able to run almost as soon as they are hatched, although most species must be fed in the nest for several days or weeks before they are fledged.

Males of almost all species are more brightly colored than the female, but in many species, the females are of a larger size than the male.



Equipment needed for spotting and identifying birds is a good guidebook and a pair of binoculars. Go into the field with someone who already knows birds. Listen to recordings of bird voices and visit local museums to study the birds common to your locality. The more you learn about birds, the easier it is to spot and identify a particular bird on your field trips and other outings.

It is a great help in identifying birds if you know what the different parts of a bird are called. The figure above shows a typical bird form with the various parts labeled. When you spot a certain bird perhaps you will note that it has a bright red ear patch. Later, when you look through your guidebook, this will be of great value in identification. It is best to have a small notebook in which you can make notes during your trips. Do not try to depend on your memory; you will see too much and are likely to forget.

The best time to look for birds is in the early morning. Birds sing and start actively feeding as soon as dawn lightens the eastern sky. During the heat of the day most birds become inactive and silent, but many start singing and feeding again toward evening. The best time of the year to see birds is during the spring and fall migrations.

Birds can be attracted in the summertime with houses and birdbaths. They need cover for protection against wind, cold and their enemies. You can provide natural cover in the way of shrubs and trees or you can supply birdhouses. Each birdhouse must be built for a specific kind

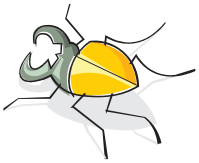
of bird. You will not attract wrens to a bluebird house. Get proper plans and construct houses with proper materials. Birds need water for drinking and bathing just as much as they need food. They like moving, shallow water. An old bucket with a drop hole hung over an old baking pan will do very satisfactorily.

You can attract and study birds in the wintertime with bird feeders and shelters. Birds are able to care for themselves and get food during the winter unless there is severe weather. If their food supply is cut off, they will need help. Find out the best way to build feeding stations and place them near shrubbery to provide cover. Fill your feeders with seeds, suet or peanut butter. Birds appreciate and require more than dried breadcrumbs.

God said, "*Let the land produce living creatures according to their kinds; livestock, creatures that move along the ground and wild animals, each according to its kind*."

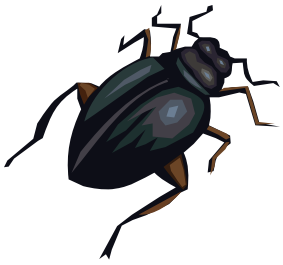
INSECTS

The insect group is the largest group of animals in the world. There are more species of insects than there are species of plants, mammals and birds. Over 600,000 species of insects have been identified and it has been estimated that this great quantity represents only about ten percent of the insects yet to be discovered.



Insects are found almost everywhere. You would be amazed at the large number of different kinds of insects, which you can find in your own backyard. You could spend several years studying just the insects in this small single area.

Insects have what is known as an exoskeleton. This means that the insect's skeleton is on the "outside." On the inside of this skeleton are attached the muscles that control the movements of the insect. Compare this construction with that of the vertebrates. The skeleton of man is an endoskeleton or "inside" skeleton. In the insect, the skeleton or body is jointed. This fact, together with the fact that an insect has six legs, serves to identify an animal as an insect. An insect in adult form always has six legs and a jointed body.



The six legs of insects are arranged as three pairs. If you will observe a slow moving insect of sufficient size to clearly see its legs moving when it walks, you will see that the insect actually walks on three legs at any one time, the front and rear legs on one side and the middle leg on the opposite side. Thus, the insect is always firmly planted on a tripod support and always in balance.

The jointed body of an insect is composed of three sections: the head, the thorax or mid-section and the abdomen. The thorax has three segments, each with a pair of jointed legs. Also common to most insects are two pairs of wings attached to the thorax, two sets of jaws, two kinds of eyes and one pair of antennae. There are variations of these factors however.

Adult female insects lay eggs. From these eggs one of three types of insect creatures are

hatched, a miniature adult, an immature nymph, or a larva. Some insects hatch into the miniature adult type. Here the small insect looks like a small version of the adult. It gradually grows and develops into the adult form. Another type of insect hatches into an immature nymph, which develops in various stages and forms into the adult. Here, wings may not be evident until possibly, the fourth nymph stage and beyond. This type of development is known as incomplete metamorphosis. The last type of insect develops through what is known as complete metamorphosis. Here the egg hatches into a larva or worm-like stage. This larva eats and grows and then spins or forms a cocoon or shell around itself, entering what is called the pupa stage. During this stage inside the cocoon or shell, the insect develops further toward its adult form. It later hatches from the cocoon or shell as a fully formed adult.

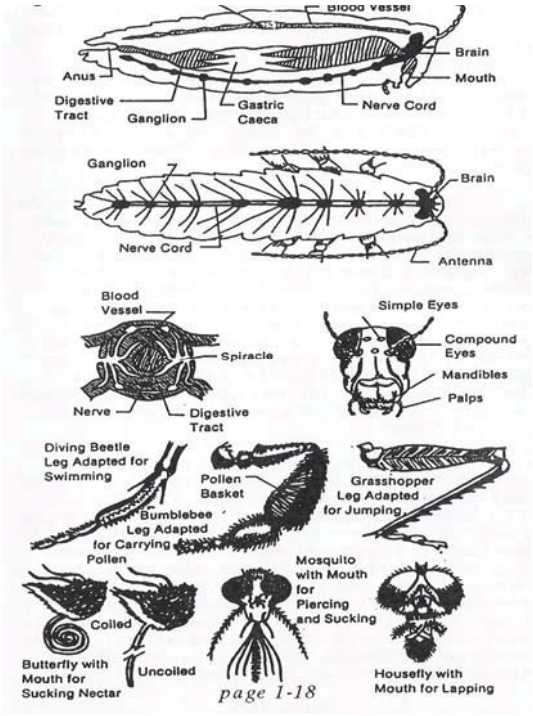


Figure 1-5

An insect sees by means of two kinds of eyes, compound and simple. The compound eyes are the larger, bulging eyes, which are so evident on most insects. They are called compound eyes because they are made up of many lenses. Each lens contributes to the image that an insect sees. Because the compound eyes bulge outward, insects with the largest eyes are capable of seeing up, down, forward and rearward as well as to either side. The simple eyes of insects are located between the compound eyes on the head. These simple eyes detect changes in light intensity rather than actually seeing. Both types of eyes are illustrated for the grasshopper in Figure 1-5. Even with large compound eyes and additional simple eyes, insects probably do not see objects in sharp detail or perfect focus. Their eyes are of fixed-focus design and cannot focus from a distant object to a near one as our eyes can. Having no eyelids, insects cannot squint their eyes in a bright light and always sleep with their eyes open.

Insects eat anything from wood to blood. Termites eat wood. Mosquitoes live on the blood of animals and humans. Many insects thrive on vegetation, other insects, dead animals or microscopic organisms in ponds and streams. Those insects that have jaws or mandibles use them in a different manner. Insect jaws work sideways rather than up and down like other animals. The mouthparts of insects are created for the type of food that that insect eats. In figure 1-5 we see the tube-like mouth of the butterfly or moth which is used for sucking nectar from deep within a flower, the piercing mouth parts of the mosquito which is used to pierce the skin and suck blood and the mouth parts of the housefly which

are made for lapping at liquid and solid food particles. Paper Wasps have large strong jaws that they use for biting off bits of wood and chewing them into a pulp, which is then used in making a nest.

An insect does not possess lungs. It breathes by means of openings in the sides of its body. Air enters these openings and oxygen is carried directly to the bloodstream of the insect through a system of branching tubes.

Running the length of the insect's body is a nerve cord that is attached to the brain. At various points along this nerve cord are nerve centers or ganglion to which are attached nerves leading to the surfaces of the insect's body. Hairs or spines at the surface transmit "feeling" through the nerves to the ganglion and along the nerve cord to the brain. Antennae and eyes also connect to the brain to provide senses from these parts. Both a side view and a top view of a typical nerve system are shown in Figure 1-5.

The antennae of many insects provide the insect with both hearing and smelling. The antennae of different insects vary greatly in size and shape. The antennae of insects have pits or holes in them that serve to collect the odors and provide the insect with the smell of an object. Antennae are also sensitive to vibrations and many insects are able to find or identify prey, food or mates by means of this built-in radar. Other insects have actual ear openings somewhere in the body with which they hear sounds around them.

In the air, insects are able to attain high speeds, reach great altitudes and travel long distances. They do not fly like the birds, by flapping or rowing their wings, but move their wings in a series of figure-eight motions. Insects can outmaneuver birds and can stop in mid-air, fly straight up, drop to the ground, and even fly backward. To do these things, insects possess great muscle structures that control the wings. These muscles represent as much as 50% of the insect's weight in one instance.

Insects that do not possess wings capable of flight generally move about by walking or hopping. The legs of insects are sometimes specially created for certain uses. Figure 1-5 shows the legs of the diving beetle, bumblebee and grasshopper.

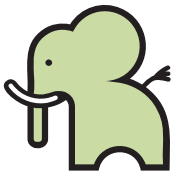
MAMMALS

Mammals are the dominant form of animal life today. They are called "Mammals" because of the female's mammary glands, which provide milk for her young. This one characteristic sets the mammals apart from other warm-blooded, back-boned animals. Mammals are hairy, have varied teeth for cutting, tearing and grinding, a unique skull, a more complex brain than other animals, and their young are born alive.

According to recent estimates, there are approximately 3,500 known species of living mammals. There are about 650 species in North America, 350 north of Mexico. Some are very rare; others are so common that scores may be found in the area of one acre.

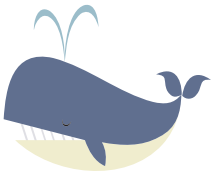
Seeing mammals is not as easy as seeing birds or flowers. Mammals in a natural manner keep out of sight for protection. Some have concealing color or patterns. Some burrow beneath the surface of the ground and are rarely seen. Others are nocturnal, venturing forth only at night.

Mammals are found on every continent. They are found in the mountains, deserts, arctic snows, marshes, meadows, forests, farms, and cities and in the depths of the ocean. Some have been created for very specific environments.



Mammals range greatly in size from the extremely large to the tiny. The blue Whale which is a mammal may weigh more than 3,000 pounds and the Pigmy Shrew way weigh only 1/14 ounce or less than a dime. Blue whales may reach a length of more than a hundred feet and the Pigmy Shrew rarely exceeds 3 inches.

Mammals are warm-blooded. This characteristic, which birds also possess, enables the mammal to invade all types of environments - air, land and sea -from the equator to the poles.

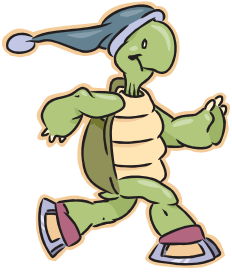


An outer covering of hair is the peculiar property of mammals. A few, like the whale, are practically hairless. The presence of hair and mammary glands are two of the important characteristics of mammals.

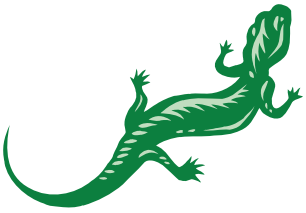
There are many different characteristics of mammals. One characteristic of mammals is that the young are cared for inside the mother prior to birth. The feet of mammals vary with hoofs or padded toes for running; claws for digging, grasping and climbing and webs for swimming. Teeth range from the tusks of the peccary to the gnawing molars and incisors of rodents. Some mammals hibernate. Mammals are capable of flight, gliding, and running, jumping, crawling, swimming, burrowing and diving.

Man has domesticated many mammals for his use. These include cows, horses, sheep, pigs, cats and dogs. Many animals, such as the cow, have been improved through selective breeding and differ a great deal from their ancestors.

REPTILES AND AMPHIBIANS



The study of reptiles and amphibians must begin by defining and learning the difference between these two types of animals. Reptiles usually have four legs (except for snakes and a few lizards); each foot with three to five clawed toes; skin usually with horny scales, sometimes-bony plates. Most lay eggs with hard or leathery skin. Reptiles include turtles, lizards, snakes, alligators and crocodiles. Amphibians have four legs, a smooth or warty skin, usually moist. They have no visible scales. Their toes are never clawed. The eggs are usually laid in jelly-like masses in water. Amphibians include frogs, toads and salamanders.

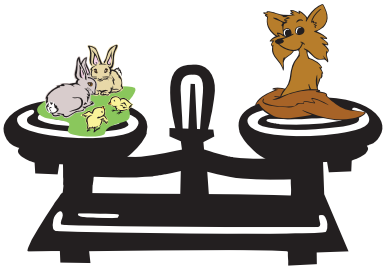


Snakes are our best-known reptiles. There are some 250 species and subspecies in the United States. Of these, 36 produce poison harmful to man, although poisonous snakes are common in only few places and their bite rarely brings death to a healthy person. All snakes except Blind Snakes have large scales across the belly. Snakes have no limbs, no ear openings and no movable eyelids. They do, however, have separately movable lower jaws, enabling them to swallow prey larger than their normal mouth size. Snakes have small, hooked teeth and the fangs of poisonous species are grooved or hollow.

The tongue of a snake serves as a simple feeler and "smeller." This tongue brings odorous particles into the mouth and into contact with smell-sensitive organs there, supplementing the sensations the snake receives through its nostrils. Snakes hear by picking up vibrations from the ground through the entire body. Snakes have fairly good eyesight; some are able to see very well at night.

Snakes feed on insects, worms, frogs, mice, rats and rabbits. They are considered beneficial in that they help control the rodent population, but are also considered harmful in that they destroy frogs and toads. Of course the poisonous snakes are considered harmful for obvious reasons.

BALANCE OF NATURE



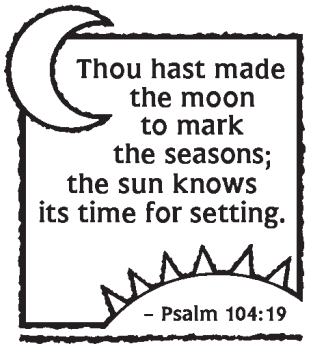
Wildlife is very closely interrelated, and all species have some role in keeping the plan of nature operating properly. You have probably heard of the "balance of nature." This term applies to the idea that all forms of life have a purpose in nature and that all creatures contribute to the plan, keeping it in balance. In a cycle of life in nature, for instance, let's consider the oak tree. An oak tree produces acorns, which serve as food for the squirrel, which is in turn caught and eaten by the fox. The fox, in turn, is caught and eaten by a bobcat which later dies of a natural disease. The earth, producing nutrients for the soil, which in turn provide food for an oak tree, gradually absorbs the bobcat's body and the cycle begins again. This is a simplified example, but it illustrates the interdependence of nature in general. In addition to the above, also consider that the acorns serve to propagate the oak tree, that fleas live on the body of the squirrel, that the fox helps to keep the local rabbit population in check, and that the bobcat distributes plant seeds by means of burrs which stick to its coat of fur and fall to the ground perhaps a great distance from where they were picked up. These seeds produce plants that serve as food for other local animals and birds. The procession is endless.

Wild animals are a natural resource. If we are to leave these and other natural resources in good condition for future generations, we must care for them and not waste them.

Observing and getting to know about animals means more than just seeing and identifying them. To really study them you must observe all facets of their life, their environment and their development. You must watch how they live, how they feed and what they eat, how they protect themselves, where they live and how they raise and train their young. Doing all this requires much patience. You must go where the animals are at the time they are there. This means that you may have to get up very early or stay up very late to observe a certain animal in

its natural surroundings. There may be some animals that you will never see in your lifetime in their natural habitat.

Then God said, "*Let us make man in our image, in our likeness and let them rule over the fish of the sea and the birds of the air; over the livestock, over all the earth and over all the creatures that move along the ground*." ... Then God said, "*I give you every seed-bearing plant on the face of the whole earth and every tree that has fruit with seed in it. They will be yours for food and to all the beasts of the earth and all the birds of the air and all the creatures that move on the ground; every thing that has breath of life in it, I give every green plant for food*." And it was so. God saw all that he had made and it was very good and there was evening and there was morning the sixth day.



UNIT 1
GOD'S WONDERFUL CREATION
OBJECTIVES

CHAPTER 1—AWARENESS OF ENVIRONMENT

Recruit

1. Identify 5 of each of the following found in your area. State the characteristics of each and their possible uses:
   A. Trees
   B. Birds
   C. Mammals

Camper

1. Identify 5 of each of the following found in your area. State the characteristics of each and their possible uses:
   A. Fish
   B. Amphibians
   C. Reptiles

Frontiersman

1. Identify 5 of each of the following found in your area. State the characteristics of each and their possible uses:
   A. Wildflowers
   B. Insects