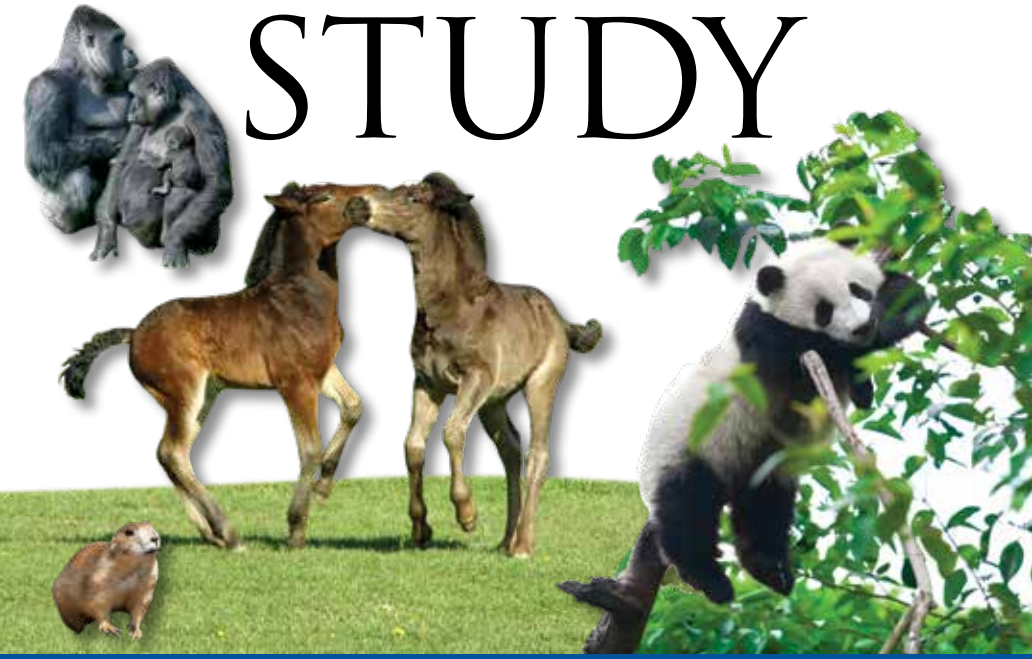
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Scouting America

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MAMMAL STUDY



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Impala

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American bison



Humpback whale

What Is a Mammal?

When you hear the word "animal," chances are that you think of a dog, a cat, a bear, or a squirrel. And you're right, of course.

Sometimes, though, the word "animal" is used in its scientific meaning. To a scientist, the word covers a much broader field. It includes insects, birds, fish, amphibians, reptiles, shellfish, worms, and many other living things. In fact, it includes everything that can move on its own power and a few creatures that can't. The sponge, for example, spends its whole adult life attached to the bottom of the ocean, but it is an animal.

Anybody can see that although fish, frogs, snakes, birds, and mammals all have backbones, they are pretty distant cousins. They do not look much alike, they do not act alike, but many of them share the same habitat.

We call a sponge an animal because, unlike plants, it does not manufacture its own food. Plants make food from water and carbon dioxide. Animals cannot do this.

But when we get down to the simplest living organisms, even scientists can't always agree on whether they are plants or animals. We can say that:

- Most animals move on their own; plants cannot.
- All green plants make their food; animals cannot.
- Most plants have cellulose cell walls; animals do not.



Cottontail rabbit

All vertebrates have some kind of backbone; invertebrates do not. Vertebrates like the shark and ray have a cartilaginous backbone with a central rod called the notochord. In the higher vertebrates, the backbone is made up of segmented bones called vertebrae. These vertebrates include fishes, amphibians, reptiles, birds, and mammals.



A shark's backbone is made up of cartilage; sharks are vertebrate animals that lack true bones found in other fish, amphibians, reptiles, birds, and mammals.

So how does a scientist decide what a mammal is? The first question a scientist asks is: Does the animal nurse its young? If it does, it is a mammal. No other animal can produce milk for its young.

Another question is: Does it have hair? If it does, it is a mammal. Some insects have growths that look like hair, but only mammals have true hair. Some mammals have very little. Rhinoceroses, hippopotamuses, elephants, and whales are in this category. But if it does have real hair, it has to be a mammal.



Cheetahs

Another important difference between mammals and other animals is the brain. If you could give an IQ test to every species of animal, all mammals would score in the high range and all other animals would score low (with the exception of birds). There would be big variations among the mammals, of course. Humans would be at the head of the class, while the platypus and opossum would be far, far in the rear. Their brain development has made mammals the dominant kind of animal in the world. They are not the most numerous; in fact, mammals make up less than one-half of 1 percent of all species of animals.

Mammals have certain bodily structures that other animals do not have. They have fewer bones in the skull than other vertebrates. They are the only vertebrates with a single bone (dentary) on each side of the lower jaw. The dentary bones are the only ones in which the teeth of the mammal are anchored. In addition, mammals are the only vertebrates with three bones or ossicles that transmit sound waves from the ear drum to the inner ear sensory cells. Their teeth are different (heterodont) and usually rather specialized. They have a diaphragm that separates the chest from the abdomen. And nearly all mammals have seven vertebrae in the neck.

A mammal may weigh as little as $^{1}/_{12}$ ounce, as do some shrews, or as much as 150 tons, like the blue whale. It may spring, waddle, swim, or even fly. But if it has milk for its young, has hair of some kind—even quills like the porcupine—has a more complex brain, and has warm blood, then it is a mammal.

Mammals are warm-blooded. This is important because it means that mammals have a stable blood temperature even when it is cold or hot outside, so they can adapt to all kinds of climate. Birds are warm-blooded, too, but reptiles, amphibians, and fish are not.

Ancestral Protozoa—The Animal Kingdom "Tree of Life"


Mammals


Birds


Reptiles


Fishes


Amphibians

Vertebrates


Lower chordates

Chordata


Insects


Arachnids


Echinodermata

Arthropoda


Myriapods


Cephalopods


Crustaceans

Invertebrates


Bivalves

Mollusca

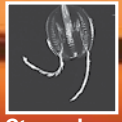

Annelida


Gastropods

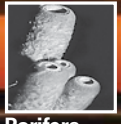

Nemathelminths

Invertebrates


Platyhelminths


Ctenophora


Coelenterata


Porifera


Protozoa



African elephant with young

Classifying Mammals

A million or more different kinds of animals are now alive. The scientist needs to have an orderly way to identify animals by name. The system of classification was developed to separate animals by their differences and groups them according to the ways they are alike.

Scientists have grouped mammals into three categories:





Marsupials, like the kangaroo *(right)* and the opossum, give birth to young that are only partially developed. Young in many species typically are protected by a pouch (marsupium), while others cling to the mother's fur. When the young are born, they find their way to the mother's nipples, which may be protected by a marsupium. The young stay there for several weeks or months, nourished by their mother's milk.

Monotremes are mammals that lay eggs. Five species exist—the duck-billed platypus *(right)* and four types of echidnas—and they all can be found only in Australia and New Guinea. These mammals share some reptilian characteristics but are not closely related to reptiles.

Placentals are mammals that bear live young. The word "placental" comes from a similar word, "placenta," which is the organ that grows inside the mother to nourish the young as it develops before birth. Examples include almost any mammal you can think of, including rabbits *(left),* lemurs, bats, aardvarks, horses, whales, pigs, and humans. Marsupials also possess a placenta, but their placentas are relatively primitive, and the young are born only partially developed. Full-term development occurs outside the uterus.



Six steps are used in this classification, with each step narrowing down the range of differences and increasing the similarities between animals. (There may be some substeps, too, but we won't go into them.) The final two steps—the genus and the species—give the animal its scientific name.

The six steps are:

Phylum (plural, phyla)

This very broad, basic division comprises animals with one or more characteristics in common. Although all zoologists use the same system of classifying animals, they do not always agree on how the classification should be done. And so the animal kingdom may be divided into 20 or more phyla: Many of the phyla are made up of very small, simple organisms that we do not usually think of as animals at all, such as microscopic animals, insects, and worms. All animals with backbones belong to the phylum Chordata.

Class

Each phylum is divided into classes. Chordata, for example, includes Classes Pisces (fish), Amphibia (amphibians), Reptilia (reptiles), Aves (birds), and Mammalia (mammals). Mammals are in a separate class because they are the only animals that produce milk for their young and have true hair.

Order

Next, each class is divided into orders. In Class Mammalia, 30 orders are commonly recognized. Of these, the following are native to the United States:

They are the Orders Eulipotyphla, Chiroptera, Cingulata (formerly Edentata), Lagomorpha, Rodentia, Cetacea, Carnivora, Sirenia, Perissodactyla, and Artiodactyla.

Each order has distinguishing characteristics. Rodentia, for example, is made up entirely of gnawing mammals, and Perissodactyla of mammals with either one or three toes on each hoof. The Order Primates includes you. It also includes apes, monkeys, marmosets, and several other small mammals, none of them native to the United States.



The monkey is a member of the Order Primates.

Family

Each order is next divided into families made up of mammals with even greater similarities. For example, the Order Carnivora, which is made up of flesh-eaters, includes both dogs and cats. Obviously cats and dogs are different in many ways. So the cats are placed in the Family Felidae, while the dogs are in Family Canidae.

The number of families in each order varies. The largest order, Rodentia, has 35 families. The aardvark, a strange-looking African ant-eater, is the only species in the only family of Order Tubulidentata.

Genus (plural, genera)

Now that we have separated the cats from the dogs, we are getting near the end of our classification. Members of the same genus are very similar to each other. Within our Family Canidae, for example, we find the wolves, foxes, coyotes, and dogs. But there are plenty of differences among them, too, so they are separated into genera. The coyote and the wolf are fairly close cousins, so they are included in the Genus *Canis* within the Family Canidae.



The leopard is a member of the Family Felidae.

Species

Lastly, the sixth classification further divides animals into species. Here is where an animal gets its full scientific name, which includes its genus and species. Thus the coyote becomes *Canis latrans* and the timber wolf becomes *Canis lupus.*

There often is a seventh step in classification when there are two or more members of the same species that may vary slightly in appearance or geographic distribution. They are given a third title, the subspecies. But members of a subspecies can interbreed with those of the species, so they actually are considered to be the same. You know that all kinds of dogs—from terriers to Dalmatians—can interbreed. Therefore, they are all of the same species, even though they might not look alike.

It's Not Just a Dog

Kingdom: Animal

Phylum: Chordata

Class: Mammalia

Order: Carnivora

Family: Canidae

Genus: *Canis*

Species: *lupus*

Subspecies: *lupus familiaris*



Classifying Mammals You See

While it may sound confusing, the classification procedure will become more easy with practice. When you begin studying mammals, you will need a field guide to help you with the Latin names for genera and species.

Suppose you see a squirrel in the park and decide to classify it. You can quickly take the first two steps because you already know that it is a mammal. Therefore, it must be in the Phylum Chordata and the Class Mammalia. If you could examine its teeth (but do not try to do that), you would find that as a rodent it has only two incisors (gnawing teeth) above and two below.

Most rodents have four toes on each front foot and five toes on each hind foot. If the squirrel has these, it is a member of the Order Rodentia. Consulting your field guide will lead you to discover that it belongs to the Family Sciuridae, which includes squirrels as well as woodchucks, chipmunks, and prairie dogs.

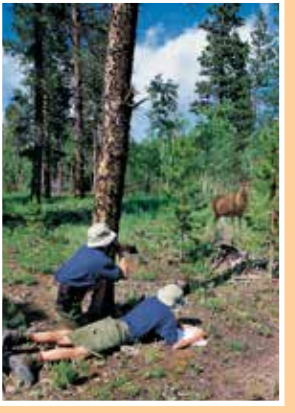


Rock squirrel

As the squirrel scampers up a tree, you note that it is a pretty good size and that its color is mixed gray and a yellowish brown. The tail is big and bushy and tipped with white. Its underbelly is whitish.

If you live east of the Mississippi River, you can be pretty sure that what you see is an Eastern gray squirrel. Its scientific name is *Sciurus carolinensis.* If you live in the West and see a squirrel that is a little grayer, it is a Western gray squirrel *(Sciurus griseus)*. Note that while the genus *(Sciurus)* is the same for both, the species is not.

Take your field guide into a large park or woods and try your skill. Observe any mammals you see as closely as possible. Find out, if you can, what it eats. Estimate its size. Note its color. Remember what its body looked like, particularly the head. Does it stay on the ground? Does it burrow? The answers to these questions will help you classify the animal exactly. Of course, you will need a guide to the scientific names, but with it you should have no trouble classifying the common mammals in your area.





Polar bear

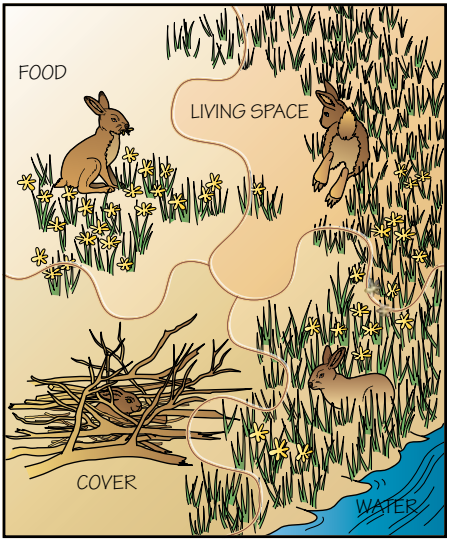
Where Mammals Live

If you want to spot a black bear, you would not go looking for it in the desert. And if you hope to see tree squirrels, you would not begin your search on the treeless Great Plains. You know that you have to go where these animals live.

Every animal needs a food supply, shelter, water, and living space. It makes its home where these needs are met. Such an area is called the habitat. A beaver, for example, needs a watercourse in order to carry out its life functions. It needs a supply of deciduous trees, preferably aspens, cottonwoods, or willows, that can be used for food. And so if you want to look for beaver, you must look along streams bordered with hardwood trees. You will not find a beaver very far from water.

On the other hand, the kangaroo rat, which lives in deserts in the West, may never come within miles of a watercourse. And it may never drink water. It gets its water supply directly from the food it eats.

The digestion of food results in the production of what is known as metabolic water. All animals produce metabolic water from the protein, fats, and sugars they digest. The kangaroo rat has biological adaptations that allow for smaller losses of body water in its urine, feces, and exhaled air. Thus the digestion of food results in a net gain of water that reduces or removes the need to drink. But like any other animal, it needs shelter, and the kangaroo rat finds it by burrowing underground.



Animal needs for life



Red fox



Wolf

Mammals can be found in every natural habitat—grasslands, forests, woodland border areas, sea coasts, swamps and marshes, rivers and lakes, oceans, mountains, and deserts. Even where humans have changed the face of nature, mammals are likely to thrive—in city parks, streets, backyards, cemeteries, even barren playgrounds.

But in nature, mammals will be found in one or more of the conventional habitats. Many, like the red fox, can adapt themselves to several habitats where their needs can be met. You may find this fox in a brushy area near a marsh, in woodlands, on mountains, or even in your backyard if you live in a suburb. A meat-eating animal (of the Order Carnivora, remember?) may travel over several habitats in search of dinner.

The following pages describe the major habitats of mammals in the United States and the mammals you are most likely to see in each.

Fields and Prairies

With everything from lush green mountain valleys to hot, barren deserts, fields and prairies can be home to many mammals. The number of trees dotting fields and prairies is small in comparison to woodland areas, so the mammals who live in these areas will not be dependent on the shelter or bounty that a tree can provide. Field and prairie mammals may live underground, and sometimes their water supply is scarce. Some of the resident mammals, like the elk and deer, feed mainly on grasses and other plants, and some predatory mammals, like wolves, may feed off of other animals.



Elk



White-tailed deer



Vole

Eastern Woodlands

This geographic term is commonly used to describe the eastern half of the United States. Just as its name implies, the area typically is greatly populated with trees, wildflowers, and shrubs that can be used resourcefully by the mammals that live there. The four seasons in this climate are moderate, so the animals need not be extremely adaptive. Some of the mammals you will find in this region include black bears and bobcats.



Cottontail rabbit



Weasel



Bobcat



Black bear



Raccoon



Mink



Woodchuck



Skunk

Streams, Lakes, and Marshes

Wetlands provide prime real estate for mammals like moose and beavers, who get their food supply from the products of the nutrient-rich waters. The mammals here can be dependent on other forms of life that thrive in wet areas, like the bat, which feeds off the many mosquitoes, flies, and beetles that make their homes near water.

Manatees live in estuaries, rivers, and shallow waters off many coasts. In the United States they mainly are found off the coast of Florida. Manatees are not related to sea lions or dolphins but are more closely related to elephants. These curious and friendly creatures can weigh well over a ton, and can grow from 8 to 15 feet long. Manatees continuously grow molars, which is good because the sand on the plants they eat tends to wear down their teeth.

Manatees have been hunted extensively and are now mainly in danger from water pollution, boat propellers, and loss of habitat.





Porcupine



Squirrel

Western Pine Forest

The mammals that inhabit the pine forest regions of the western United States are much the same as those of the eastern woodlands. The forest areas receive adequate rainfall to provide all animals with needed nourishment, and the vegetation tends to be lush and green.

Sighting Mammals

No doubt you have seen wild mammals in nature, even if you live in the heart of a large city. Squirrels abound in most parks, and you may also see cottontail rabbits and perhaps field or other mice in the park.

But you know that mammals do not rush out to greet you in the wild. Most of them are very shy. And a large percentage of mammals are nocturnal—that is, they stay in their dens or burrows during the day and venture out for food at night.

For these reasons, spotting mammals is not easy. The biggest population of wildlife is likely to be found in what ecologists call an "edge" habitat, that is, on the border between a field and a wooded area or the border between woods and swamp.



Tips for Spotting Mammals

Here are some of the ways you can increase your chances of seeing mammals in their natural habitat.

Naturally, the less noise you make the more likely you are to spot animals.

Blend Into the Landscape. Find a comfortable spot to sit or lie prone. Stay absolutely still and be patient. Some mammals will lose their fear of you after a time and venture out of hiding. If you want to make your presence even less obvious, build a blind one day and go into it a day or two later when the animals have gotten used to it. Take binoculars if you have them.

Go Out at Night. With your parent or guardian or another Scout, visit a natural habitat at night. Take a flashlight. Shine the light at intervals on the trail ahead, into treetops, and into dense brush. Skunks, foxes, deer, flying squirrels, raccoons, and opossums may be looking at you.

Take to the Water. Look along a stream bank or lakeshore for tracks in the mud and sand. That night, go out in a boat with a flashlight and row to a point offshore from where you saw the tracks. Sit quietly, and at the slightest sound, aim your light toward it. Or anchor near a beaver dam or muskrat house and shine your light whenever you hear a sound.

Stake Out a Burrow. If you spot a hole in the ground while on a hike, poke some pencil-sized sticks lightly into the ground around it. If the hole is a mammal's burrow, you will find the sticks knocked down when you come back to look at it later. So sit down in a comfortable spot nearby and wait. If you are patient, you may be rewarded by a look at a woodchuck, badger, ground squirrel, pocket gopher, or chipmunk.

Make a Tracking Pit. A tracking pit is a baited area designed to attract animals to food so that you can get their tracks. If you sit quietly some distance from a tracking pit at night and shine a flashlight occasionally at the pit, you may spot mammals enjoying the free lunch.

Leave No Trace reminds us to respect wildlife when observing animals in their native habitat. Always observe from a distance and be respectful of mating, nesting, and birthing seasons.

Reading Mammal Signs

Regardless of whether you have good luck at spotting mammals, you should learn to recognize the signs, or evidence, of mammals. The most common signs are tracks, but you can also find droppings and signs of feeding, scratchings, gnawings, rubbings, and game trails. You can also find animal homes—nests, burrows, and dens.

When you learn how to look for them, you should have no trouble in turning up mammal signs on any hike.

Tracks



Animal tracks are quite easy to find in any habitat where there is some soft material, such as snow, mud, soft earth, or dust. As a rule, the best places to look are stream banks, puddles, and lakeshores.

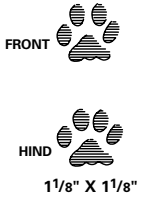
Many times you will find a track that does not look like anything in your field guide because it is not all there. Perhaps the ground is irregular, and so claws or other features do not appear in the track. The same animal's track may look different in the snow and in dust. The "perfect track" may not appear very often. In addition, you must remember that not every track you see was made by a mammal. Reptiles, birds, and amphibians make tracks, too.

Marmots are hefty members of the squirrel family—they can weigh as much as 16 pounds. Marmots feed on vegetation all summer to prepare for their hibernation. In winter, the marmot climbs down into the burrow it has dug with its powerful claws, and closes up the entrance, packing it tightly with soil and plants. When hibernating, marmots reduce their heart rate, body temperature, and use of oxygen, and they live off their body fat. Most marmots hibernate for about seven months, but in Alaska they are known to stay underground for as long as nine months.

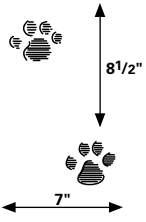
During the summer, some marmots choose a more open space to live, such as between rocks at the bottom of a mountain slope.

Marmot burrows can be hundreds of feet long, and have openings for escaping and scouting. Snakes, raccoons, foxes, and other animals use abandoned marmot burrows as their new homes.

Generally, the front foot and the hind foot of the same mammal make different tracks. The size, shape, and number of toes are likely to be different. Like anything else, skill in reading tracks comes only with practice.



HOUSE CAT



LYNX



COUGAR



OTTER



DOG



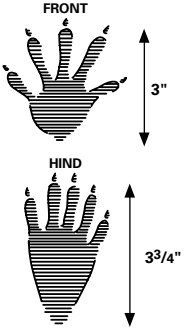
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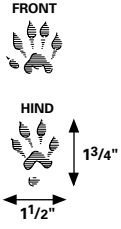
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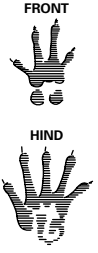
WOLF



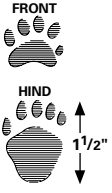
RACCOON



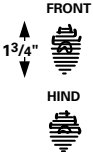
MINK



SQUIRREL



SKUNK



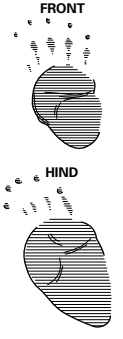
WEASEL



CHIPMUNK



RABBIT



PORCUPINE

As an aid in learning how to read tracks, you may want to preserve a few that you find in the wild. This can be done by plaster casting.

To make a plaster cast of a track you find on the trail, you will need a cardboard strip and some plaster of paris. Notch the edges of the cardboard and bend it to form a collar. Place the collar around the track you want to preserve. Mix the plaster of paris, pour it into the collar, and wait for it to harden. In warm weather, the cast will harden in about 20 minutes. When it is completely dry, remove the cast and brush off the dirt. On the back of the cast, write the date and location. When you have identified the animal that made the track, write its name as well.



Casting a mold is a way to bring home a souvenir of a track you found.

When you have learned to identify common mammal tracks, you can "read" interesting animal stories. You may see where a raccoon lunched on mussels and left the shells along the lakeshore.

As soon as you can identify a few tracks, try a little detective work. With practice, you will be able to learn a number of things about the animal just from its tracks. For example, how far apart are the tracks? The answer tells you two things—the size of the mammal and whether it was walking, running, or something in between. The depth of the track and whether it is deeper in front than in back helps to tell whether it was traveling slowly or swiftly.

Droppings

Animal droppings may also be found. It usually takes a little practice to identify droppings for sure, unless tracks at the site can be definitely identified. Often droppings can tell a story just as well as tracks—for instance, if you find mouse hairs in the "scat" of a fox. You will find drawings of the droppings of mammals in *A Field Guide to Animal Tracks.*

Feeding Signs

Sometimes the signs of feeding will tell you what mammals are in the area. They take many forms. Gnawed bark of a tree, nipped twigs and small branches, shells of acorns or other nuts, bits of fur or feathers, skeletons or carcasses, closely clipped grass, holes in the ground—all these may be signs of feeding.

Signs that plant-eating animals like deer and rabbits are around usually are easy to find. Rabbits will browse on low-growing shrubs, nipping off the ends of new shoots. They also will eat the bark on young saplings. Deer, too, browse on the tender buds and twigs of trees and shrubs. In harsh winters the snow level will cause their browse line to be higher as they reach for food.



Gnawing work of a beaver

Muskrats eat the tender parts of some water plants, discarding the tougher parts, which float to the surface of a lake or pond.

Porcupines like tree bark, and often you may see the top of a pine stripped of bark all the way around. Sometimes a hole in the ground will tell you that a skunk or fox found a mouse nest and dug it out for supper.

Dens, Nests, and Burrows

Mammals have a wide variety of homes—or no home at all. Many of the hoofed animals, such as the deer, have no permanent shelter. The white-tailed deer, for example, wanders around its home range of about one to two square miles.

But most mammals do have some kind of a home—in the earth, in a shallow nest on the surface, in a cave, in a rock crevice, or in a hollow tree.

Some mammal homes are easy to spot and identify. You can't miss a beaver lodge or a muskrat house because of their distinctive construction.

Burrows are harder to identify because many mammals are burrowers. Generally the size, location, and shape will give you a clue. Woodchuck burrows are often found in open fields and, if you look carefully, you will find two holes, one with a mound of dirt nearby and the other without a mound.



Prairie dogs

Beavers cut down entire trees near their water dens, then cut them into shorter lengths and store the branches on the stream bottom. During the winter their food supply must be close at hand.

A red fox burrow resembles a woodchuck's but the tunnel is bigger and the location is less likely to be near buildings or roads used by people. But if it is in an appealing place, a fox may take over and enlarge a woodchuck's burrow. Skunks or rabbits may also live in abandoned woodchuck burrows.

Bears use caves, hollow logs, undercut banks, and uprooted trees for their dens. In the high-mountain country of the western United States, cougars use caves or rock crevices for shelter. Many bats are most at home in caves.

Prairie dog burrows look like miniature volcano craters. The mound around the entrance is used as a lookout post and also keeps surface water from running down the hole. Coyotes, ground squirrels, chipmunks, some mice, gophers, and moles also make their homes underground.

Another mammal that gives clear evidence of its presence is the woodrat. This tiny rodent is the king of thieves among mammals, and its big nest of leaves, twigs, and debris may look like a junkyard. The woodrat brings home everything it finds and is especially fond of bright things like mirrors and bits of metal.



Woodrat

Game Trails

Game trails are like wildlife highways. Animals may share a single pathway through the woods, across a meadow, or up a hillside, and use that trail for many years. Look for evidence of animal tracks, droppings, and hair on any well-used pathway through the brush. Find a secluded spot a little bit off the trail to observe the mammals that pass through. Be careful not to get too close to the trail so as not to spook the animals that use it.

Other Signs

Evidence of mammals also may be found in signs of rubbings, gnawing, and scratching. Buck deer, for example, rub the "velvet" from their newly grown antlers in the spring by scraping the antlers against a sapling. Look for scarred or smoothed bark on young trees.

Bears will tear off the outer bark of evergreen trees to eat the inner bark, and you may find the vertical rips made by a bear's teeth. You also may find their claw marks and hairs on trees they have climbed.

In the Western states, high in the mountains, you might come upon a small haystack near a fallen tree or a rock. It is the winter food supply of the pika, which looks like a small guinea pig but belongs in the same order as rabbits and hares. The haystack is made up of various plants that the animal gathers in mountain meadows.

Many other animals leave distinctive signs of their presence. One we have not mentioned so far is the most distinctive of all. Here is a hint—it is an odor. Give up? The skunk, of course.

Studying Habitats

Requirement 3 has three options. Requirements 3(a) and 3(b) are quite similar, the major difference being that for 3(a) you must study two habitats. For 3(b) the 25-acre area may cover only one habitat or several. (The third option, 3(c), is on the life history of a mammal.)

If you choose to do 3(a) or 3(b), your choice may be decided by the kinds of natural habitats you can go to easily. In the city, for example, there might be a large park nearby that, if it has no stream or pond, might have only one animal habitat. That would be a good site for requirement 3(b), but not for 3(a).

On the other hand, the two or more habitats needed to complete requirement 3(a) may cover small areas. A short stretch of country roadside might be one habitat and an acre or two of marsh might be another.

It makes sense that the larger the area of habitat you cover, the more mammals you are likely to see. However, that is not necessarily true. The number of various mammals that an area of land or water will support with food, water, shelter, and living space is called the carrying capacity. It is like a water bucket. You can fill it only to its capacity; after that limit is reached, the bucket overflows. So does the land.

Biologists have found that releasing cottontails in a habitat is not likely to raise the rabbit population for long. The reason is that it is very likely that nature has already given that particular habitat all the rabbits that can possibly find food and shelter there. And so, when well-meaning persons put in more rabbits, the rabbits become an "overflow." The land simply will not support them. The result is that the excess rabbits must either leave or die. This often happens when the seasons change. For example, the population of a woodland area will fluctuate as summer changes to winter, when the food supply is much less available.

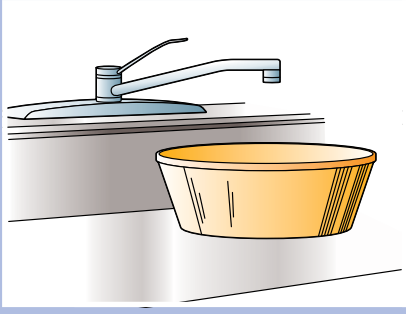
When studying habitats, always be mindful of Scouting America's Outdoor Code:

As an American, I will do my best to—
- **Be clean in my outdoor manners.**
- **Be careful with fire.**
- **Be considerate in the outdoors**
- **Be conservation-minded.**

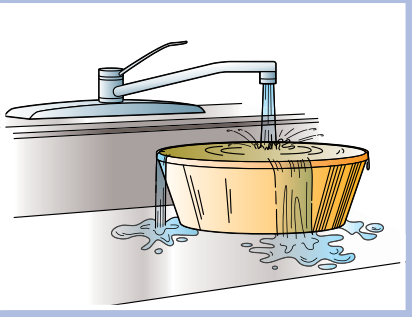


Snowshoe hare

Overflow



This is called carrying capacity.



A 2-gallon container holds only 2 gallons.



Likewise, a given area of land supports only the number of animals whose needs for food, water, cover, and living space are supplied.



Thus, surplus fish and wildlife from breeding populations or stocking disperse and settle new areas that have not reached the carrying capacity, or die from various causes if new open dispersal areas are not available.



Study Skins

Study skins are the natural skins of mammals or birds that are preserved for scientific study. The purpose is to show the animal in a compact, easily stored form. Study skins are used by scientists and researchers in museums.

Mounted specimens are similarly preserved, but they are shown as closely as possible to the way they appeared in nature. A wall-mounted deer's head and base-mounted bird are examples of mounted specimens. They are essentially trophies and are not made for their scientific value other than in museum habitat cases.

Getting Your Specimens

Before you start to prepare your study skin, make sure you have rubber gloves and a mask that covers your nose and mouth, such as a painter's mask. The gloves will help prevent contamination of your skin from organisms carried on the skin and in the blood of the mammal. The mask is worn to help you avoid breathing any disease particles that might be on the animal's fur or in its dander. Keep the gloves and mask on for as long as you are handling the animal and until the work area is properly cleaned.

The work area should be well-ventilated and large enough that you are not cramped. Prepare the area by covering a table with a large plastic trash bag, then a thick piece of cardboard, then a thick layer of newspaper. When you are finished working, place all of the newspaper and cardboard into the plastic bag for disposal and thoroughly clean the tabletop and floor around your work area with a strong household cleaner.

If you plan to purchase a live mouse, discuss with your counselor a proper and safe way to humanely euthanize the mouse.

However, do not trap and use deer mice or white-footed mice to prepare for the study skin. Avoid contact with these rodents and their urine and droppings. They may carry hantavirus, which could develop into Hantavirus Pulmonary Syndrome, which can be transferred to humans and could result in a fatal lung disease.

As requirement 4(a) suggests, your best bet would be to trap a mouse using a mousetrap. Their small size makes them easy to prepare for study skins, and most are not protected by law. Once you have caught your mouse, remove the dead mouse (while wearing rubber gloves and a face mask) from the trap and begin your preparation.

If for some reason mice cannot be obtained, check with a local conservation office. A representative there may be able to furnish a specimen that you can use. Remember that laws govern the trapping and killing of certain mammals. If you are in doubt about what mammals may be taken, ask the conservation officer.

Skinning Your Specimen

To create a study skin, first weigh the specimen using a household scale. Using the metric system, record the four standard measurements with a ruler: total length (from tip of nose to tip of tail, not including the fur), tail length from the base of tail to the tip (not including fur), hind foot length, and ear length from base of ear to tip of ear.

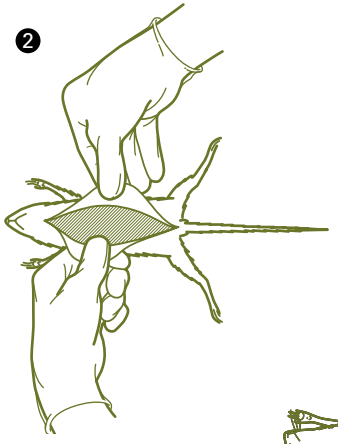
Now you are ready to skin the animal:

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Step 1—Place the animal on its back. Using a sharp knife, make a cut from the base of the neck to the vent at the animal's rear. Cut just deep enough to sever the skin.

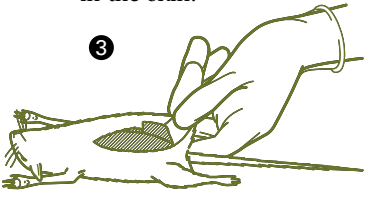
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Step 2—Using the thumbs and forefingers, pull the skin away from the body all around to the back. Loosen the skin as much as you can around the thighs.

Step 3—To free the skin around the rear legs, bend the animal's knee sharply upward. You should then be able to slip the skin over the knee joint and work it free of the rest of the leg. Cut the leg off at the "ankle" and leave the foot in the skin.

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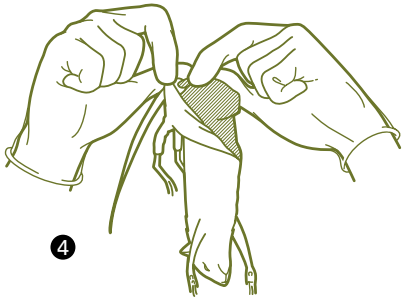


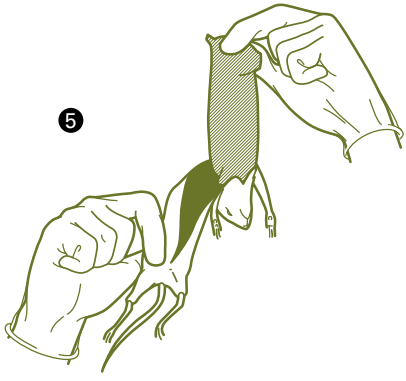
Step 4—Using your fingers, strip the skin off the tail.

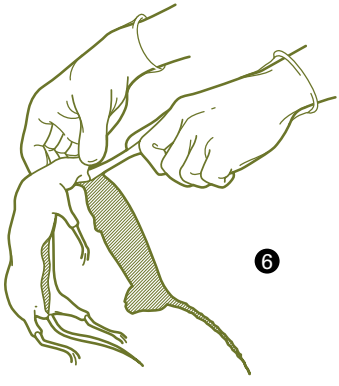
Step 5—Carefully strip the skin downward, as if pulling off a glove, until it is stopped by the animal's front legs. Free the front legs by bending them as you did the back legs. Cut the leg off at the "wrist" and leave the paw in the skin.

Step 6—Again using your fingers, begin peeling the skin over the skull. Use your knife carefully around the ear opening, cutting as close to the skull as you can to free the skin. Continue using your knife carefully in the area of the eyes, removing the eyeballs but not the eyelids. Take care around the nose to cut close to the bone. Cut the lips at the gum line.

Step 7—Dispose of the carcass except the skull. Sever that and keep it. It will be part of the study skin specimen.







Preserving the Skin

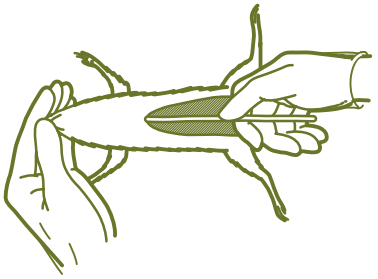
To keep the skin from deteriorating and being damaged by insects, it must be thoroughly cleaned and a preservative applied. Proceed as follows:

Step 1—Using a scraper or knife, carefully clean all bits of flesh, fat, and cartilage sticking to the inside of the skin. Take particular care not to cut through thin skin on ears, nose, and lips.

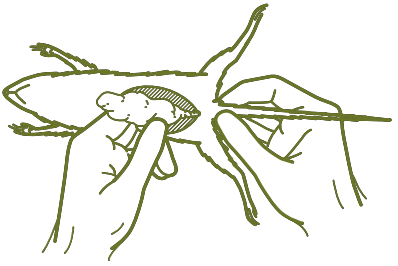
Step 2—If the fur side of the skin is dirty, wash it with a weak solution of ammonia in cold water.

Step 3—Use borax, a white, crystalline salt that you can get at a supermarket, as a preservative. Rub the borax thoroughly into the inner side of the skin. Cover all parts.

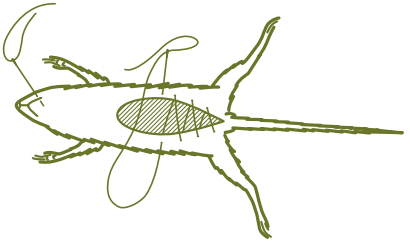
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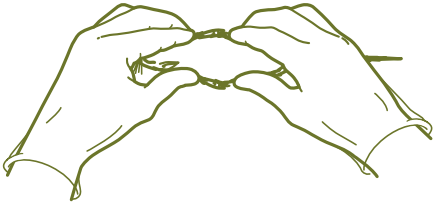
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Stuffing the Skin

For stuffing a small animal, a single wire running from head to tail is enough for support. The body and head are then packed loosely with cotton and the incision sewed up. Proceed as follows:

Step 1—Cut a piece of wire about 2 inches longer than the animal's length from nose to the tip of the tail. Bend the head end into a tight loop; insert the wire into the skin, taking care not to push it through the skin of the tail. You might also want to put wire into the legs of the animal, so they will stay stiff when it dries. The wire in each of the legs should be long enough to extend into the cavity but not so long that the wire in the front legs' crosses with the wire in the back legs.

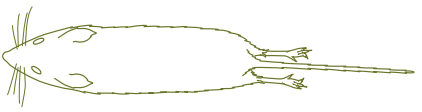
Step 2—Loosely pack soft cotton batting into the legs and then fill the head and body cavities.

Step 3—Use a needle and thread to stitch up the incision. Close the skin's mouth and put a couple of stitches in it to keep it closed.

Step 4—Use your fingers to shape the body as naturally as you can. The animals should be shown in a straight, belly-down position. The legs should be extended to front and back.

Step 5—Pin the skin to a board until it is completely dry.

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Preparing the Skull

A study skin should always have the animal's skull with it. It is a good idea to attach the skull so that there is no doubt it belongs with the specimen. Prepare it as follows:

Step 1—The skull must be thoroughly cleaned of all head tissue, including the skin, eyeballs, and tongue. Remove the brain tissue by inserting a stick and slushing out the contents from the skull. This will be easier if you put the skull in boiling water for a few minutes and then scrape it.

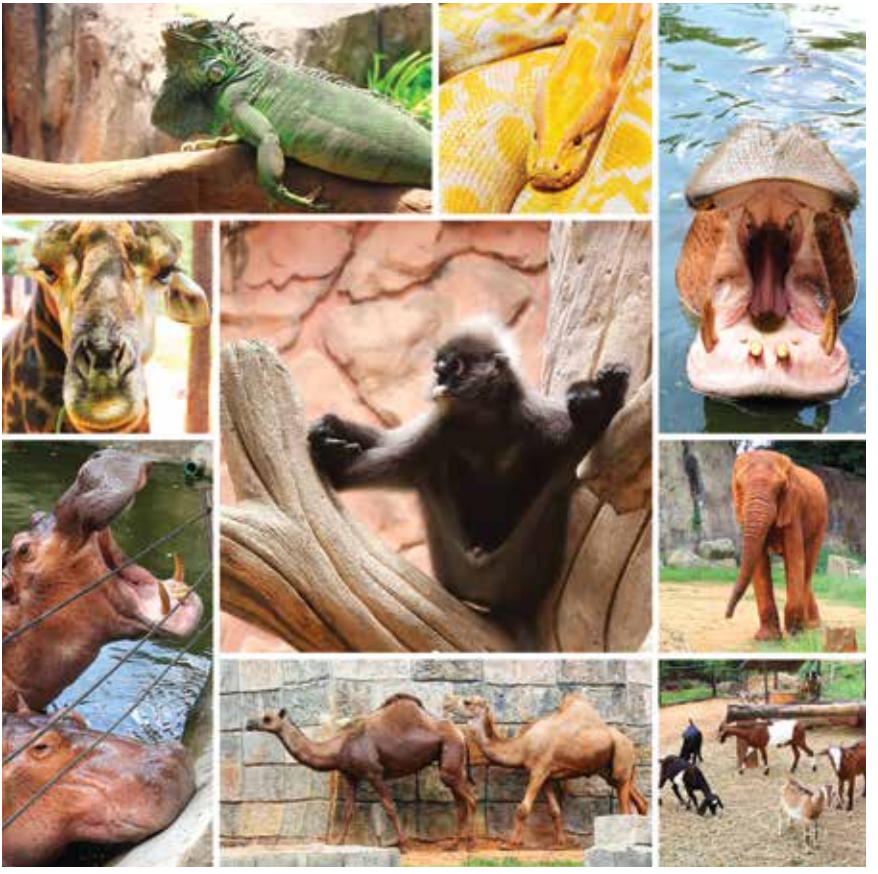
Step 2—When the skull is completely clean, boil it again with a little laundry detergent, then soak a short while in diluted hydrogen peroxide.

Identifying Your Specimen

To have scientific value, every study skin must be tagged and labeled. Identify the species and give its sex, the date you caught it, its length, its weight if you know it, where you caught it, and your name. Tie the tag with this information to a rear foot.



While most museums and laboratories use dermestid beetle larvae to clean bird carcasses and small skulls, a more practical method for Scouts is by boiling.



Your local zoo will provide plenty of opportunities to photograph a wide variety of mammals in a short period of time. A zoo makes a good alternative if you don't live near an area where mammals can easily and safely be observed in the wild.

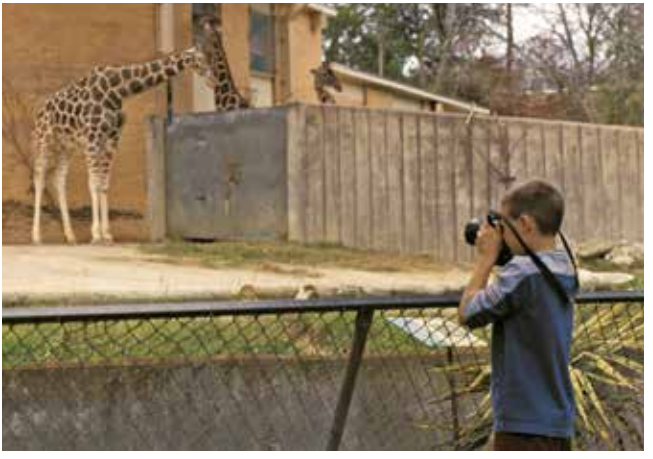
Photographing Mammals

If you are a photography fan, you will have a lot of fun with this requirement. But if you have never done any camera work or only the simplest kind, it may be a challenge.

Wild animals will rarely come up and pose for a family portrait, and very few will hold still for "just one more." But you do not need a lot of expensive equipment to take good pictures of wild mammals.

You should, however, have a good basic camera—not necessarily a fancy, expensive one, but one with a telephoto lens or portrait attachment, synchronized flash, and a shutter speed of at least 1/100th of a second. Without them you will not be able to get clear, sharp wildlife pictures—unless you have patience and good luck!

Few wild animals will permit you to get close enough to take the kind of snapshots that you get of your family.



Many of today's larger zoos have exhibits based on the natural habitats of animals. This makes it easier to observe animals in a setting similar to what would be found in nature.

Principles of Leave No Trace

The principles of Leave No Trace that are used in trekking and camping also apply when observing wildlife in their habitats. Pay attention to the environment as you observe, study, and photograph mammals for the merit badge requirements.



PLAN AHEAD AND PREPARE

Proper trip planning and preparation helps hikers and campers accomplish trip goals safely and enjoyably while minimizing damage to natural and cultural resources. Be sure to check the weather report, know the terrain you are planning to hike, and allow enough time to reach your destination and return.



TRAVEL AND CAMP ON DURABLE SURFACES

Damage to land occurs when visitors trample vegetation or communities of organisms beyond recovery. The resulting barren areas develop into undesirable trails, campsites, and soil erosion. Minimize damage to wildlife's habitat by using existing trails and selecting designated or existing campsites.



DISPOSE OF WASTE PROPERLY (PACK IT IN, PACK IT OUT)

This simple yet effective saying motivates backcountry visitors to take their trash home with them. It makes sense to carry out of the backcountry the extra materials taken there by your group or others. Accept the challenge of packing out all trash, leftover food, and litter.



LEAVE WHAT YOU FIND

Allow others a sense of discovery, and preserve the past. Leave rocks, plants, animals, archaeological artifacts, and other objects as you find them. Examine but do not touch cultural or historical structures and artifacts.



MINIMIZE CAMPFIRE IMPACTS

Some people would not think of camping without a campfire. Yet the naturalness of many areas has been degraded by overuse of fires and increasing demand for firewood.



RESPECT WILDLIFE

While observing wildlife, this is perhaps the most important Leave No Trace principle. Quick movements and loud noises are stressful to animals. Considerate campers and hikers practice these safety methods:

- Observe wildlife from afar to avoid disturbing them.
- Give animals a wide berth, especially during breeding, nesting, and birthing seasons.
- Store food securely and keep garbage and food scraps away from animals so they will not acquire bad habits. Never feed wildlife. Help keep wildlife wild.

You are too close if an animal alters its normal activities.



BE CONSIDERATE OF OTHERS

Thoughtful campers respect other visitors and protect the quality of their experience by traveling in small groups, keeping the noise down, and respecting the privacy of others.

©Leave No Trace: LNT.org

Methods of Photographing Wild Mammals

Wildlife photographers use three methods—stalking, concealment in a blind, and "trapping," a method in which the animal takes its own picture.

Safety

Nearly all animals will avoid people if they can. Mammals, however, can be dangerous, especially if a person gets between an adult and its young. Always be careful when observing wild animals. Never go out alone if there is the possibility of encountering bears or mountain lions.



Be patient! Hunting with a camera is a real sport, but it is not a sport for the person who does not have the patience for stalking and waiting.

If you plan to use flash, you had better set up the reflectors a day or two ahead of time to let the animals get accustomed to them and lose their fear of these shiny objects.



Stalking

As a Scout you have learned something about stalking. If you are skillful at it, this method will sometimes get you close enough to large mammals like deer and elk to take their picture. If you have a telephoto lens, you should be able to get a satisfactory shot at 100 to 150 feet.

Here are some stalking tips:

- Have all adjustments made on your camera—the light reading, exposure time, and the distance you hope to be from the animal when you shoot.
- Many mammals have rather poor vision but keen hearing and sense of smell. Each time it looks up, "freeze"—and stay frozen until it looks away. Avoid all sudden movements and unnecessary sounds.
- Shoot when you have reached the distance you have previously calculated as the right one. Another five steps, and you may be watching the south end of a northbound animal.

Concealment

Anything that you can use to conceal yourself can be used as a blind. A tent, a hollow tree, or a cave may serve well. All you need is something that will keep you from being seen and leave a hole for you to look out and for your camera lens.

The site for a blind might be a regular mammal feeding station or water hole. Set up your blind downwind from the spot where you expect the animals to come. If possible, place

it where the sun will be behind your camera. Camouflage the blind with branches, grasses, and reeds to make it look as much a part of the landscape as possible.

Place your camera on a tripod, ready for action, and then relax. Make as little noise as possible. Be patient. You may have to wait in your blind for hours or even days before you get the picture you want.

Trapping

In this method the animal trips the camera's shutter and takes its own picture. You do not even have to be around. It has advantages, but it has disadvantages, too. For one thing, you can only take one picture a day (or night). For another, you may not get a pose you like.

To make your "trap," you need a sturdy tripod, a 4-inch strap hinge, rubber bands, a 12- to 18-inch cable release to fit your camera, and tenpenny finishing nails cut to 1 inch long and filed round on both ends.

You will need to fasten the hinge to the tripod with rubber bands so that it opens and closes easily. Place the cable release through a screw hole in the hinge so that the closing hinge will press the release and operate the shutter. Then loop three or four strong rubber bands around the hinge to hold it closed.

Open the hinge and hold it open with the 1-inch nail. When you pull the string or wire, the nail comes out of the hinge. The hinge closes and presses the cable release, which trips the shutter.



Setting up your "trap" close to home will give you easy access to reset it as needed.

The next step is to make the mousetrap trigger that will pull the string to take the picture.

To set up your camera, drive a stake into the ground under the tripod and fasten the trap to it so that the snapper snaps downward when the trigger is released. Set the trap and run a piece of string or fine wire from the snapper to the nail in the hinge, pulling it as tight as possible. When the snapper snaps, it pulls out the nail. The hinge closes and presses the cable release, which trips the shutter and takes the picture.

Suppose we want a woodchuck coming out of a hole. We'll drive a small stake into the ground on one side of the hole and tie a piece of thread to it. We'll drive a stake into the ground on the other side and screw in it a small screw eye about 2 inches above the ground. We'll run the thread from stake No. 1 through the eye in stake No. 2 and tie it to the trigger on the mousetrap. When the woodchuck comes out to eat, he hits the strings above to his burrow and takes his own picture.

Try your backyard. Any mammal that will come to a feeder can be photographed.

To make the feeder, drill a 1/4-inch hole in a board tray or a half log, top to bottom. Drive a stake beside the tray or log.

Set the tripod and camera with the mousetrap fastened to the stake underneath. Set the trap and fasten the string to the snapper and to the nail in the hinge. Tie a piece of thread to your bait. Set the bait on the feeder over the hole. Run the thread through the hole and tie it to the trigger on the trap. Now, when a mouse or other small mammal picks up the bait, it triggers its own picture.



Another method that you can use to photo-trap a mammal in the field is to use a trail camera. The camera operates using a built-in sensor that detects heat and movement. When the camera senses activity, it automatically "wakes up" and records a digital image of whatever is standing in front of the lens to a flash memory card. The cards are inexpensive to buy and can be used over and over again. The images can then be downloaded to your home computer for viewing.

There are many game camera manufacturers today that offer user-friendly cameras of varying quality and price ranges, from as low as $60. A game camera will be the most successful at capturing images of wildlife when placed at an appropriate location. This could be a feeding station, fence, or creek crossing, along a beaten trail, or adjacent to an active scrape or rub.



Moose



Making a Tracking Pit

A tracking pit is a small area of ground prepared so that animal tracks will show up well. It is baited to attract animals to it. Ernest Thompson Seton, one of the founders of the Boy Scouts of America (now Scouting America), may have invented the tracking pit; regardless, he described it more than 60 years ago.

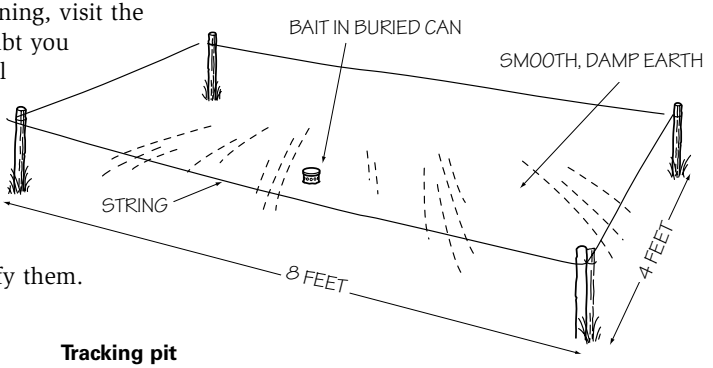
Making a tracking pit is an especially good project for Scout camp because you can set up your tracking pit some evening near your campsite. Then, without bothering anybody in camp or having them bother you, you can get up early in the morning and check your tracking pit. It is a good idea to put the pit in an out-of-the-way place even though you are checking it early.

To make a pit, loosen the soil in a 4-by-8-foot area of bare ground. Make it soft enough so that you sink in an inch or two when you walk on it.

For the bait container, use a coffee can. Punch a few holes about an inch from the top. Put scraps of meat or fish inside and put the plastic lid on. Now bury the can in the center of the tracking pit to about 2 inches from its top. Then rake the tracking pit smooth, so that the animal that visits it will leave tracks.

In the morning, visit the pit, and no doubt you will find several animal tracks, including probably some left by birds. Use a field guide to tracks to identify them.

Oftentimes at Scout camp, there will be special hikes organized early in the morning, and, unless you put your pit in an out-of-the-way place, it may be inadvertently trampled. So look carefully before selecting your site. Find barren ground for your tracking pit—don't clear the area.



Tracking pit



Herbivore (cottontail rabbit)

Carnivore (badger)

Omnivore (bear)

Insectivore (shrew)

The Food Chains of Mammals

When they are talking about mammals' eating habits, scientists divide the mammals into four major groups:

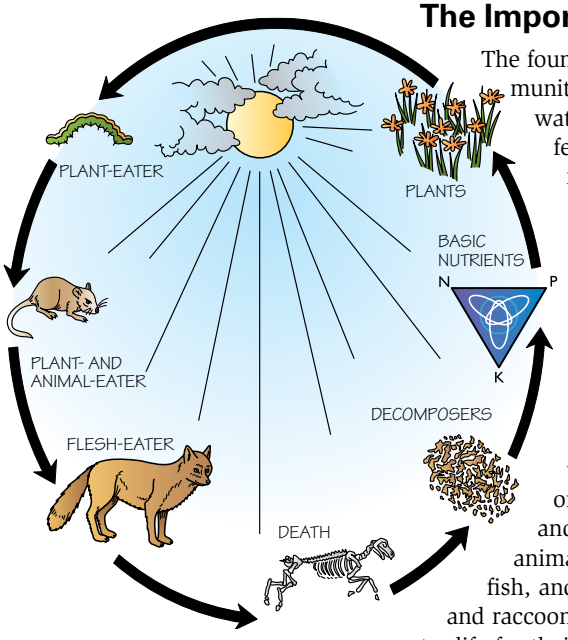
- **Herbivorous mammals** eat only plants. Examples: white-tailed deer, cottontail rabbit, porcupine.
- **Carnivorous mammals** feed mainly on other animals, including insects. Examples: weasel, wolf, badger.
- **Omnivorous mammals** eat both plants and animals. Examples: raccoon, skunk, bear.
- **Insectivorous mammals** feed on insects. Examples: the majority of North American shrews and bats.

All mammals depend on plants for life. The way the largest mammal is linked to the soil through other small animals is called a food chain. The chain starts in the soil. There plants begin to sprout, drawing on the energy of the sun to combine carbon dioxide, water, and minerals from the soil to make their own food. And the plants become food for many kinds of animals, from the tiniest insect to the large deer.

Among the plants growing here is succulent clover, a favorite of some insects and mammals. The clover blossoms are visited by a butterfly, and as it lands it suddenly is seized by a shrew, the smallest mammal in America and one of the hungriest. The shrew makes short work of the butterfly and goes on the prowl again for something to satisfy its huge appetite. But the shrew is careless, and suddenly it is pounced upon by a weasel, which quickly kills the tiny predator.

This is an example of a food chain: from soil to plant to insect to small mammal to larger mammal and back to soil with the death of the weasel, whose remains decay and nutrients return to the soil to be utilized by plants.

The Importance of the Soil



Terrestrial food chain

The foundation of any animal community (either on land or in the water) is the soil. If the soil is fertile, it will produce a flourishing plant growth. This will support a vigorous and abundant population of animals.

The water that flows from the soil also will carry dissolved minerals (natural fertilizer) that will permit a healthy growth of plants in the water. This will be the basis of the aquatic food chain and of populations of such animals as crustaceans, insects, fish, and of mammals such as otters and raccoons, which depend in part on water life for their food.

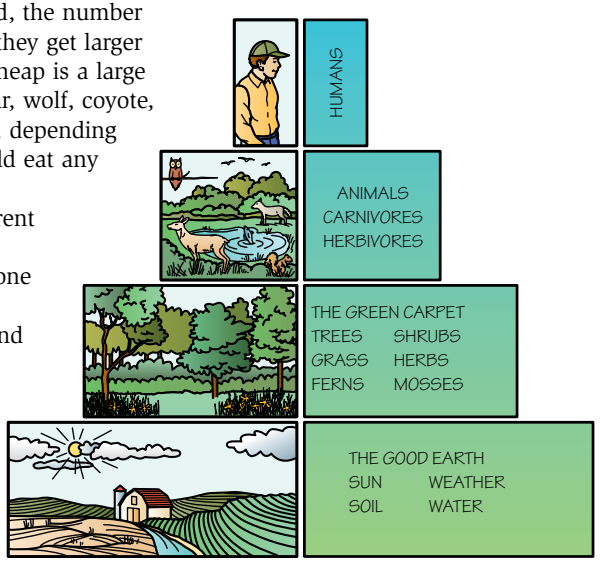
This very close connection between the soil, the plants, and all animal life is part of the web of nature. Each strand of the web depends on the other strands. The soil nurtures the plants. As they die and decay, the plants enrich the soil. The animals must have the plants to live. And when the animals die, their bodies decompose and help to make the soil more fertile.

The Pyramid of Numbers

Sometimes biologists picture this life community supported by the land as a "pyramid of numbers." The smallest animals are at the bottom. There are lots of them, and they live, for the most part, directly on vegetation. In the next level of this pyramid are animals larger in size and fewer in number. Some of them will feed on lesser creatures in the step below, and some will live on plants.

As we go up the pyramid, the number of animals gets smaller, and they get larger in size. On top of the whole heap is a large flesh-eater, such as the cougar, wolf, coyote, bobcat, eagle, or horned owl, depending on the area. This animal could eat any of those below it.

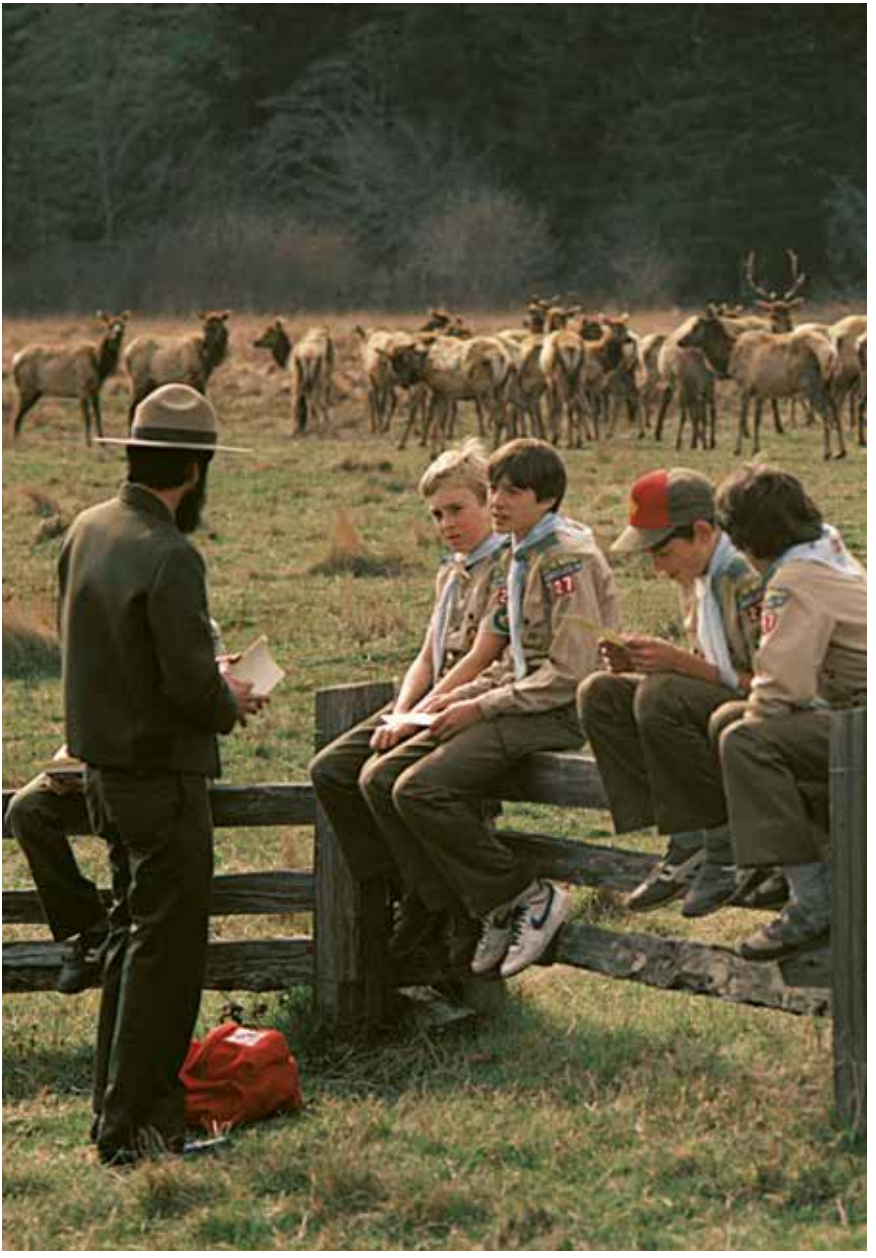
The populations of different animals along the food chain will change with time. Now one animal will be plentiful, then another. They will increase and decline, like the teetering of a pair of scales. Usually, however, the vegetable-eaters will not get so abundant that they destroy the plants they live on. When they get too numerous, their enemies have good hunting; they catch the prey that is common and easily found.



The pyramid of life

On the other hand, meat-eaters do not increase to a point where they wipe out the creatures that support them. When animals like foxes, raccoons, coyotes, and wolves get too plentiful, there is likely to be disease or other factors that kill a lot of them off. Animals are always most healthy and produce more young after they have been thinned out. That is why hunting is frequently beneficial to a population.

Almost anywhere you happen to study the relationships of wild animals, you will find that they form a well-organized community. It will to some extent show the structure of this pyramid of numbers. There will be many small plant-eating animals and fewer of the larger predatory kinds that live on them.



Reporting on Mammals

If you live in or near a city that has a natural history museum, you will not want to miss a chance to visit it, even if you do not do this optional requirement. Not only will the exhibits of mounted mammals and study skins be very interesting to you, but you will have a chance to see how they are prepared.

Older methods of preserving mammals include taxidermy, which involves mounting the skin over a built-up model of the animal, wax impregnation of the animal's body, and study skins, which were covered in requirement 4(a).

What You Will See in a Museum

Make arrangements beforehand by phoning. Your counselor may be able to help you arrange an appointment. Tell the museum authorities that you are a Scout working on the Mammal Study merit badge and that you would like to observe how specimens are prepared.

Several fascinating methods are used to prepare specimens. For example, beetle larvae are sometimes used to clean off bits of flesh from animal skeletons.

Many museums now freeze-dry whole animals to preserve them for display. The animal is first put into a natural pose and then frozen into that position by pouring liquid nitrogen over the joints. The liquid nitrogen freezes the joints almost instantaneously. The entire specimen is then placed in a freezer. When it has frozen solid, it is put in a vacuum chamber where it is slowly dried out. This process gives the museum a specimen that resembles the live animal as closely as possible. It is so natural that fleas on the mammal are preserved with it, just as they were in life.

Cataloging Specimens

Not all the mammal specimens a museum has are on display all the time. Many are filed away in drawers, cabinets, or other containers. Because it would be very easy for a museum to lose track of all its specimens, a record of each one is kept in a central file.

A catalog gives the number assigned to each specimen. It includes information about its species, sex, size, where and when it was found, and the type of preparation (mounted, study skin, skull only, etc.).

Purposes of a Museum

What good is a big collection of all these study skins, mounted specimens, and bones? Well, if you learn anything at all on your visit to a museum, it will have served its main purpose—education. And that would be reason enough to have natural history museums.

But such museums serve another purpose—to help scientists in their work. Museums give scientists the chance to examine and study thousands of mammal specimens—many times the number they could find and catch by themselves. If a zoologist had to trap every single mammal he or she wanted to study, it would be difficult to study very many during his or her lifetime.

A Mammal's Life History

Requirements 4(c) and 3(c) call for you to give a life history of a mammal; the difference between the two requirements is that one deals with a game animal—that is, one for which there are hunting or trapping regulations. You can find out which are game mammals in your state by checking with a conservation officer or a sporting goods store.

For example, suppose you decide to find out the life story of a mouse. No matter where you live, you could do it because one or more of the species is in every part of America—including our cities.



American bison

You may have a little difficulty actually seeing mice that come out at night (nocturnal) and stay in their nests during the day. But if you go into fields during the day and search around grass runways,

you may stumble on a young family of meadow voles, which are active during the day (diurnal). In the city, in cleaning up around garbage cans, you may find nests of house mice. In an abandoned bird's nest or hollow logs, you may find the white-footed or deer mouse.

You can get information about a particular mammal from personal observation and from talking with your science teacher, a conservation officer, or anyone who knows wildlife. You also can refer to books, such as those listed in the resources section in this pamphlet.

The requirements ask that you write a "life history," but it need not be in story form. Your counselor will be more impressed if you gather accurate data. Written questions and answers will impress your counselor more than a real story that is weak on facts.

Notice that requirement 4(c) says "a native game mammal that lives in your area." Not all game mammals now living in your area are necessarily native. They may have been imported from some other area.



Deer

Managing Mammals

All mammals need food, water, shelter, and living space. Without all four they cannot survive. And so, if you want to influence their numbers, you must adjust the environment to their needs.

We have seen that the number of mammals a given area of land or water will support is called its carrying capacity. To influence that number, we must improve the habitat in some way.

If, for example, you would like to see more cottontails around your home, you might plant shrubs for food, and you might build a brush pile for cover. On the other hand, if you live in a city and your building is overrun with mice and rats, you would want to eliminate them. The best way is to clean up trash piles and keep a tight lid on garbage cans. Here are a few possible projects.



Black-footed ferret

The bat is the only mammal that can truly fly—not just glide. Many species of bats use a technique called echolocation to find insects and to avoid bumping into things as they fly at night. The bat emits a high-pitched sound that bounces off objects and returns, allowing the bat to judge the distance of the object.

Bats roost in caves or cavelike habitats during the day, and emerge at dusk to hunt. Many bat species feed on insects. A single bat is capable of eating 500 mosquitoes a night! Some Central and South American species consume blood and are a pest mainly to birds and livestock. Some consume fruit, pollen, and nectar.

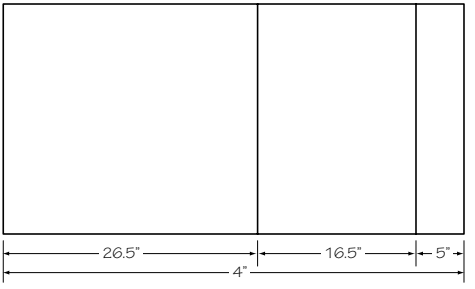
Healthy bats avoid humans, so never touch a bat. If it lets you approach, it could bite you and transmit rabies.

Bat House*

You will need the following materials:

- ☐ One 2-by-4-foot sheet of 1/2-inch outdoor grade plywood
- ☐ An 8-inch piece of 1-by-2-inch pine
- ☐ 20 to 30 1 1/4-inch coated deck or exterior-grade Phillips screws
- ☐ One pint of water-based black exterior stain
- ☐ One pint of water-based exterior primer
- ☐ One quart of flat, water-based exterior paint or stain
- ☐ One tube of paintable latex caulk
- ☐ A 1-by-3-by-28-inch board (optional, but recommended)
- ☐ Black asphalt shingles or galvanized metal (optional)
- ☐ 10 7/8-inch roofing nails (optional)

*Bat house plans reprinted with permission of Bat Conservation International Inc. For more information about bats and bat conservation, visit batcon.org.

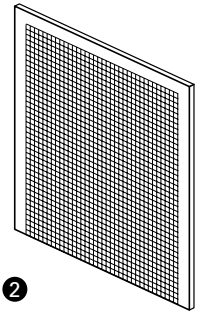


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To construct the bat house, follow these steps.

Step 1—Measure and cut the plywood sheet into three pieces, measuring 26 1/2 inches by 2 feet, 16 1/2 inches by 2 feet, and 5 inches by 2 feet.

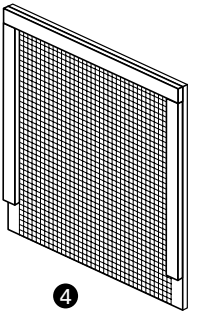
Step 2—Roughen one side of the largest piece by cutting horizontal grooves with a sharp object or a saw. Space the grooves 1/2 inch apart, cutting 1/32 inch to 1/16 inch deep.



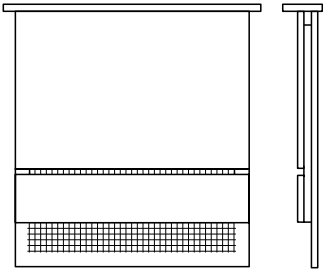
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Step 3—Apply two coats of black, water-based stain on one side of the grooved board and one side of the other two cut boards. **Note:** Do not use paint, because it will fill the grooves in the backboard, making it unusable.

Step 4—Measure and cut the pine strip into one 24-inch piece and two 20 1/4-inch pieces. Apply a strip of caulk to the pine pieces, then attach them to the backboard. Reinforce with the screws.



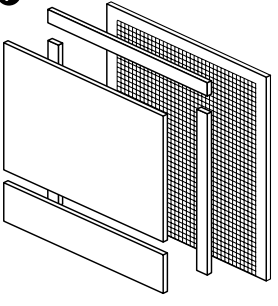
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Step 5—Apply caulk to the pine pieces again, then attach the front board. Reinforce the front of the house with screws.

Step 6—Caulk around all outside joints to further seal the roosting chamber.

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Step 7 (optional)—Attach the 1-by-3-by-28-inch board to the top of the house as a roof.

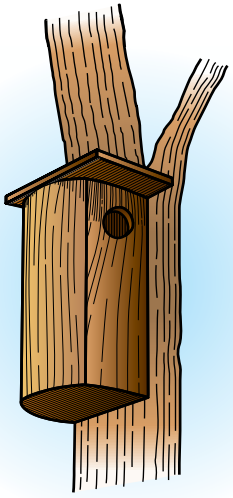
Step 8—Apply primer to the assembled bat house and follow with two coats of exterior paint or stain.

Step 9 (optional)—Use roofing nails to attach shingles or galvanized metal to the roof.

Finding a suitable place to mount a bat house will greatly increase the chances that a bat will choose to live there. Bat Conservation International offers several tips for choosing a good location.*

- Places that receive full, all-day sunlight are best.
- Bats are content in areas of diverse habitat and natural vegetation, within 1/4 mile of water.
- Bat houses should be mounted on poles or buildings, not trees or metal siding.
- The houses should be located at least 12 feet from the ground; 15 to 20 feet is better.
- Install a bat house at any time of the year.

**See batcon.org. Click on "Media & Info," and then "Information Flyers."*

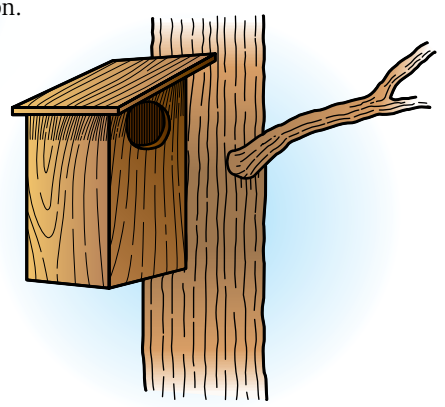


SQUIRREL NEST BOX

Squirrel and Raccoon Nest Box

The types of homes for different species are, of course, different. Raccoons need a fairly large cavity in a tree or hollow log, while squirrels require a smaller one in which to build their nests. Raccoon boxes should be placed in a wooded area not too far from water, while a squirrel box belongs in an oak or nut tree woodland.

Wooden nail kegs with a "roof" and an entrance hole would make a good mammal box. Be sure to place the hole on the side for easy entrance, and cut the entrance hole a little larger for bigger mammals like the raccoon.



RACCOON NEST BOX

Resources for Mammal Study

Scouting Literature

Pocket Guide to Mammals; Animal Science, Dog Care, Environmental Science, Fish and Wildlife Management, Nature, Pets, and *Veterinary Medicine* merit badge pamphlets

With your parent or guardian's permission, visit Scouting America's official retail site, **scoutshop.org**, for a complete list of merit badge pamphlets and other helpful Scouting materials and supplies.

Books

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Zim, Herbert Spencer, and Donald F. Hoffmeister. *Mammals: A Guide to Familiar American Species.* Golden Press, 1987.

Organizations and Websites

American Society of Mammalogists
P.O. Box 4973
Topeka, KS 66604
Telephone: 785-550-6904
mammalsociety.org

Association of Zoos and Aquariums
8403 Colesville Road, Suite 710
Silver Spring, MD 20910-3314
Telephone: 301-562-0777
aza.org

Bat Conservation International
500 North Capital of Texas Highway
Austin, TX 78746
Telephone: 512-327-9721
batcon.org

Leave No Trace
P.O. Box 997
Boulder, CO 80306
lnt.org

National Audubon Society
225 Varick St.
New York, NY 10014
Telephone: 844-428-3826
audubon.org

National Wildlife Federation
11100 Wildlife Center Drive
Reston, VA 20190
Telephone: 800-822-9919
nwf.org

Smithsonian National Zoo and Conservation Biology Institute
3001 Connecticut Ave., NW
Washington, DC 20008
Telephone: 202-633-2614
nationalzoo.si.edu/conservation

Acknowledgments

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Thanks to the Bat Conservation International, Austin, Texas, for allowing us to reprint with permission its plans for the bat house.

Scouting America is grateful to the men and women serving on the National Merit Badge Subcommittee for the improvements made in updating this pamphlet.

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U.S. Fish and Wildlife Service/Gary Kramer, courtesy—page 20 *(wolf)*

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Brian Payne—pages 5, 17 *(main photo in photo illustration)*, 27 *(casting series)*, 48, and 58 *(people)*

Randy Piland—pages 23 *(squirrel)* and 47

Steve Seeger—pages 9 and 13 *(rabbit)*

MERIT BADGE LIBRARY

Though intended as an aid to youth in Scouts BSA and qualified Venturers and Sea Scouts in meeting merit badge requirements, Scouting America's merit badge pamphlets are of general interest and are made available by many schools and public libraries.

Always check scouting.org for the latest merit badge requirements. If a Scout has already started working on a merit badge when new requirements for that merit badge are introduced, *they may continue to use the same pamphlet to earn the badge and fulfill the requirements therein.* In other words, the Scout need not start over again with the revised requirements.

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American Cultures
American Heritage
American Indian Culture
American Labor
Animal Science
Animation
Archaeology
Archery
Architecture
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Astronomy
Athletics
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