

ENVIRONMENTAL  
AWARENESS:  
**Wildlife**

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Written by  
Otis F. Curtis, 4-H Agent, The University of Connecticut



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# Introduction

This project describes some basic principles of wildlife and some things you can do to study it.

What is wildlife? Most people think only of furred and feathered creatures when "wildlife" is mentioned. But in fact all creatures not tamed or domesticated are wildlife. This includes reptiles, amphibians, crustaceans, insects, spiders, and fish, as well as birds and mammals. The same ecological principles apply to all, so in learning about one animal we may come to understand many.

For many years man's interest in wildlife was limited to those animals he killed for food or clothing, to protect himself, or for recreation. We now recognize that all wild creatures have value.

Wildlife can be found everywhere; you do not need a forest or a marsh. "Waste" areas are often very rich in wildlife. The best place to begin the study of wildlife is any place convenient enough for you to go there often. When you have developed your skills and understanding in places near your home, you will be able to make the most of a field trip to woods or marsh.

If the activities in this project do not describe exactly the kinds of wildlife you would like to study, you can adapt the procedures to suit your needs. Also, most of the references mentioned in the project contain a wealth of detailed information or additional activities.



Left, chipmunks become accustomed to humans and can be studied at close range. Middle, the frog can be found nearly everywhere, study species convenient to you. Right, nesting studies must be done carefully to avoid driving the birds away.

## ENVIRONMENTAL AWARENESS:

# Wildlife

## Basic Principles for Understanding Wildlife

All wildlife species must have certain basic things, and they must have them all year around. They need food to eat, water to drink, and cover or shelter to protect them from weather and from enemies. They also need a certain amount of living space.

This living space, which you may think of as “elbow room” or “personal space” is an area in

Wildlife habitat is an area that provides the food, water, shelter and living space necessary to sustain a population of any wildlife species.



which an animal will tolerate few if any animals of its own kind.

This area may be a few square feet for a field mouse, or a few thousand acres for a bear. Requirements for each species will be different, but whatever the requirements are for a certain species, **all four** must be met in an area or the species will not exist in that area.

To use a simple example: even if there were more than enough water, living space, and shelter you wouldn't expect to find deer living in an area that had no food. Many wildlife species have special ways of meeting their four basic needs. For example, in order to avoid a winter scarcity of food,



some animals hibernate, others migrate to where there is enough food, and others store food. Some are independent of ponds and streams because they get enough water from dew or from their food.

## HABITAT

Habitat is any area which fills the four basic needs of any particular species. Some habitats are obvious — a stream is fish habitat, and a hayfield is woodchuck habitat. But habitat requirements can be very specific — for example “fish habitat” can be further divided into “bass habitat” and “trout habitat”. **Habitat is the most important influence on wildlife.**

When you become more familiar with wildlife and wildlife habitat, you will be able to locate a likely place to look for squirrels, for example, just by looking at the habitat. And if someone asks you, “Why aren’t there any pheasants around here?” you will probably first think of **habitat**, and try to determine what there is about the area that makes it not suitable pheasant habitat.

Sometimes certain conditions of temperature, salinity (saltiness), humidity, intensity of light, and other factors are important to a particular species, and must be present in addition to the four basic needs in order to make an area suitable habitat for that species.

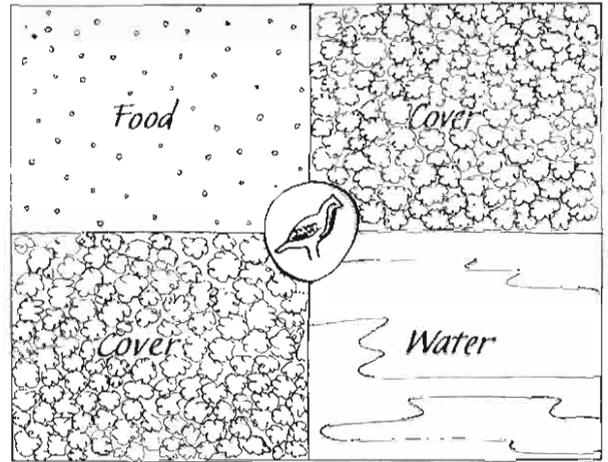
## INTERSPERSION

To intersperse is to mix, so that like things are not all in the same place. Food, water and shelter should be interspersed so that an animal can get all the things it needs without traveling too far.

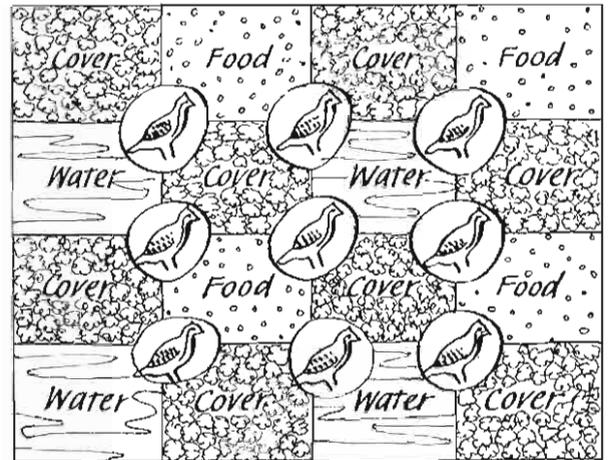
You may someday hear the term “edge effect”. Where any type of vegetation type meets another — for example the border between a woods and a field or the border between a marsh and a meadow — is an edge. Edges support more wildlife than pure woodland or pure meadow or pure marsh. This is the edge effect: an increase in wildlife populations near an edge. Water must be available, but not necessarily at the edge.

At any given time, habitat in an area has a fixed limit for the kind and number of animals that may live in it. This number of animals that can be supported by the habitat is called “carrying capacity”. In the same way, a farm pasture has a carrying capacity because it is limited in the number of cattle it can supply with food. By improving habitat or pasture, the number of animals it will support can be increased.

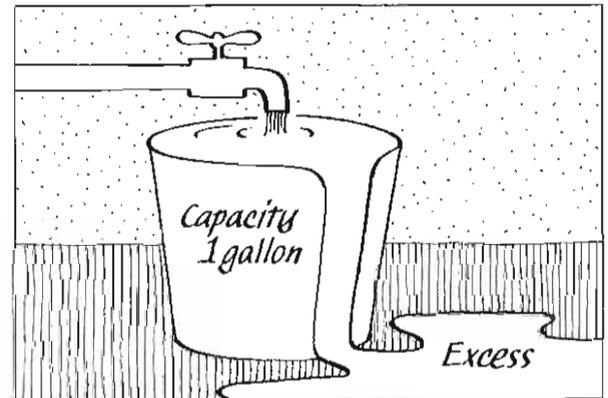
The carrying capacity of the habitat is usually lowest during the late winter. Natural changes in



*Poor interspersed — not much wildlife*



*Good interspersed — Some acreage as before but food, water, and shelter meet in nine places, not just one. Therefore nine times as many places for wildlife to live.*





An edge between the field and forest.  
Edges support high populations of wildlife species.

vegetation, such as trees taking over what was an open field, is an example of changing habitat. Natural changes affect carrying capacity the same as do changes made by man. If the population is greater than the carrying capacity, the excess animals will die or leave.

## NICHE

Each species fills a slightly different place in nature, or "niche" (rhymes with "ditch"). Even though a chipmunk and a cottontail rabbit live on the same plot of ground, they don't eat the same foods, and therefore occupy different niches. Any difference in food, nesting behavior, etc. means the niche is different. Niches of two species may be similar, but are hardly ever the same.

## TERRITORY

Many animals "own" a territory at certain times. This is an area, usually right around the home or nest, which the animal will defend against members of its own species and, occasionally, other species. Many birds share the tree in which they nest with birds of other species, but chase off any of their own kind. If a male pheasant defends a territory of three acres and you have a six acre field, you will

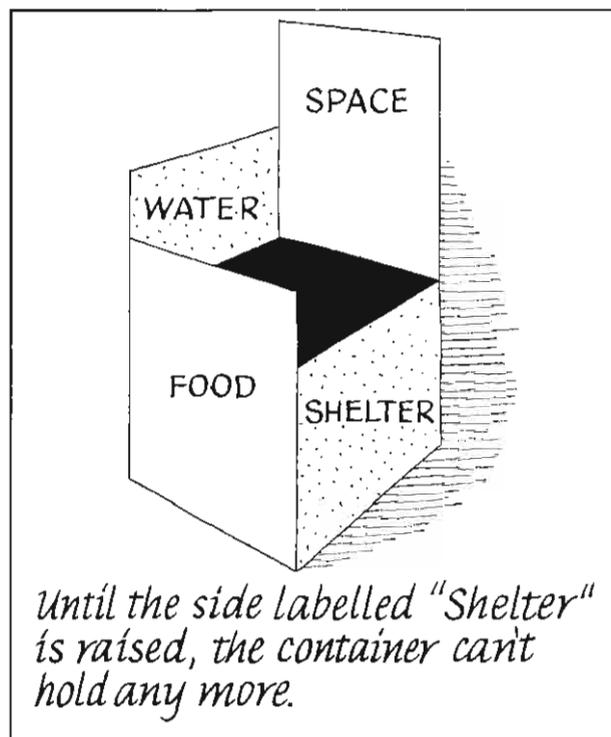
have only two male pheasants no matter how much food, water, and shelter are available. In this case, living space is the limiting factor.

## LIMITING FACTOR

The need — food, water, shelter or living space — that is in shortest supply and therefore prevents the wildlife population from getting larger is the **limiting factor**. In our example of deer, food was the limiting factor on the deer population. If a large farm has grain crops (food), ponds (water) plenty of space, but no hedgerows or other "waste" areas, what is the limiting factor on the pheasant population? Shelter, (cover) of course, since there are few hiding places. In this case the population will be kept on a low level because few young will hatch (few places to nest) and there will be increased mortality (death) from predators and bad weather.

Limiting factors are very important to wildlife management. If you want to increase the pheasant population, you have to know what is holding the population down. If it is lack of shelter, providing more food won't help.

Sometimes the population is below carrying capacity because of reasons that are difficult to discover: disease, parasites, excessive rainfall, etc.



## POPULATION DYNAMICS

Dynamics is the study of forces and influences which cause change. Animal populations are always under pressure to change. The balance or imbalance of various forces determines whether the population will increase, decrease, or remain the same size. As a student of wildlife you should think in terms of populations.

Sometimes you will become concerned with individual members of a population — for example, when you try to save a bird with a broken wing. But the key to understanding wildlife is to understand the population — all of the animals as a group — and recognize that the individual is but one of the population.

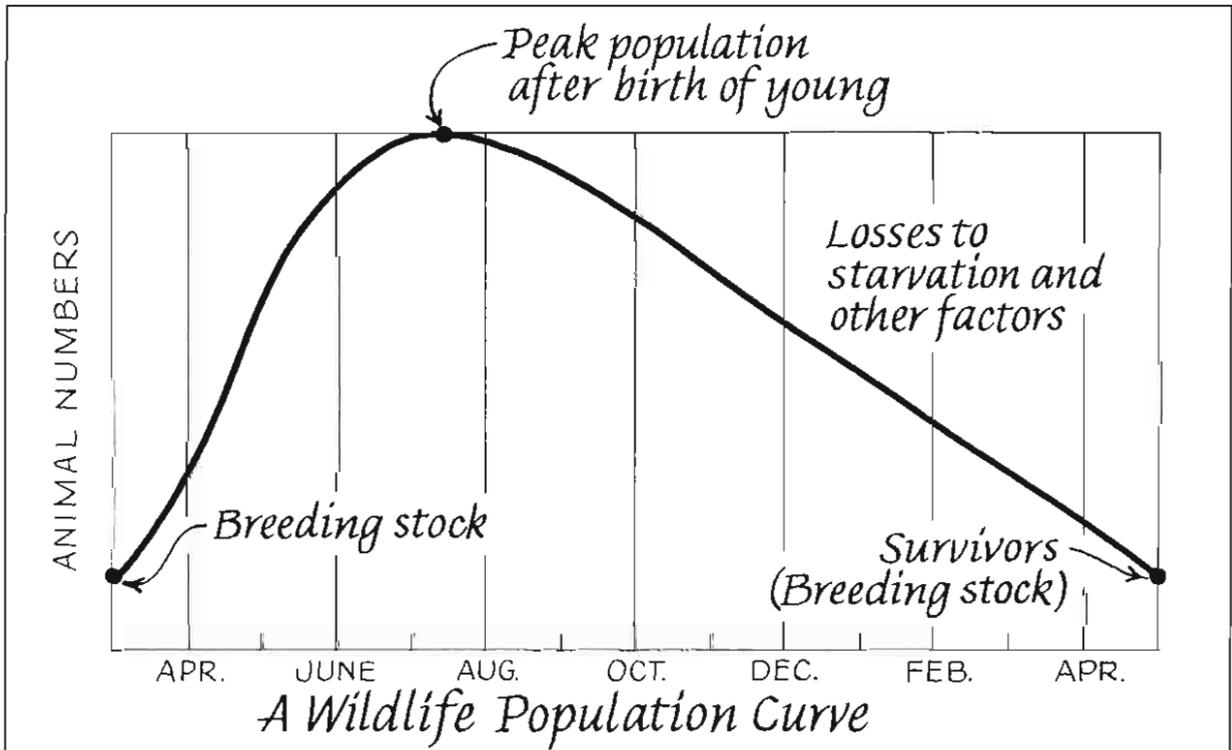
For example, a wildlife population goes through an annual cycle. A bird like the bob white quail enters the breeding season (spring) at the low point of the annual cycle. With sixteen chicks raised by each pair of adults the population soon is raised to nine times what it was before breeding season. (Before hatching, population is two. After hatching, population is  $2 + 16 = 18$ ). Obviously, the habitat could not long stand a nine-fold increase in population every year: the carrying capacity would be exceeded. So what happens? Between one breeding

season and the next, most of the members of the population die, so when breeding time arrives the following spring, the population is the same size again.

This population curve describes a stable population: there is no net increase or decrease in size from one year to the next. But if more birds remain to enter a breeding season than entered the preceding breeding season, the population increases. If the opposite happens, it decreases.

What happens between breeding seasons to cause animals to die? Natural things. Some die of disease or injury. Predators kill some for food. (Predators go through the same cycle as other animals). Winter storms may cause death from exposure, particularly if shelter is a limiting factor. If food is in short supply, the weaker animals starve.

The "survival strategy" is different for many species: instead of producing many young and losing many to mortality (death) some species produce fewer and lose fewer. Most predators and larger animals are in this category. Still others produce more and lose more: a single pair of mice may produce several hundred young a year, but if the population is to remain stable, all but two of the total must die.



# Project Activities

There are a great many activities for you in a wildlife project. You can improve habitat, observe wildlife, make maps, take photographs, preserve animal sign, do research on a specific animal, conduct a community campaign to benefit wildlife, teach people about wildlife, or many other things. Only a few of these things are described in this project booklet. Read through the activities described in the following pages and choose the ones you like. If you need other activities, use your imagination to adapt these activities to meet your needs.

## RECORD-KEEPING

Regardless of what activities you choose, you should keep a record of everything you do. **Don't** wait until you're finished with an activity before you sit down to write about it! A good field ecologist (a wildlife student like yourself is a field ecologist) always records observations as they are made. Best for this purpose is a pocket-sized, bound notebook; and a pen with waterproof ink, carried with you and **used** every time you go to the field or work on your project indoors. A loose-leaf notebook written in pencil will be satisfactory, but you will be tempted to make changes in what you've written. **Never** change field notes; if you change your mind, make an additional entry but leave the original.

This project has no forms or blanks to be filled in as you proceed. At some time in the future you will probably want to write a report on your project, either for a school science project, for a 4-H award trip, or for some other purpose. If you don't have good records you'll wish you did, so start your records when you start your project. Your records needn't be complicated; think of them as a scientific diary. Make them clear, concise, and to the point, and they will be useful to you later.

## OBSERVING WILDLIFE

Observing wildlife is more than just looking at animals: observing means perceiving, noticing, or watching. You are observing wildlife when you use your ears or nose to determine something about an

animal and, strictly speaking, you are observing wildlife when you perceive by interpreting animal sign.

Practice and experience will make you more skillful at observation, just as practice and experience make you better at basketball or playing the piano. This section of the Wildlife Project contains suggestions that will make your wildlife observation easier and more successful.

Keep the following points in mind when observing wildlife:

Use your knowledge of wildlife to assist you. If you're trying to observe a particular species, learn all you can about it before you go afield, then concentrate on the most likely places. If you're out to observe wildlife in general, remember that during the reduced light of dawn and dusk more species are active than during midday. Also, remember that increased animal populations occur around edges where food, water, and shelter are nearby.

Be safe. Tell someone where you will be and when you plan to return. If in an unfamiliar area carry a U.S.G.S. map and a compass and learn to use them both. During hunting season wear a bright orange jacket and hat.

Be inconspicuous — wear dull-colored clothing (except in hunting season). Don't make more noise or movement than necessary.

Be patient. Look carefully for animal sign as well as for animals.

Be comfortable. Apply and carry insect repellent. Proper clothing is important. If you plan to be sitting still in cool or cold weather, wear extra warm clothing. Durable shoes or boots and denim or similar clothing can ward off the effects of rocky terrain and thick underbrush. Use adequate rain-gear — being soaked is no fun.

Keep checking wind direction. Animals downwind are more likely to detect you; they will do their best to remain unseen.

Remember that nearly everything out doors is a home for something. If you lift a rock to look for a salamander, replace it exactly as it was. Never disrupt or destroy anything needlessly.

Use binoculars if possible. With them you won't need to get as close and risk scaring the animal away.

Don't overlook the small things — chewed branches or fresh droppings may be clues that animals are nearby.

You will be able to see better if the light is at your back, not in your face.

There are three basic techniques for observing wildlife: walking, stalking, and waiting.

**WALKING.** This technique is a good one to begin with if you are not familiar with the area. You are less likely to see wildlife than you would be waiting or stalking, but if you are alert for animal sign and record your observations in your field notes and on a map, you may identify good places for stalking or waiting on your next trip.

**STALKING.** It is difficult to sneak up on wild animals since their lives depend on their ability to avoid detection by predators. It can be done, however.

Stalk upwind (a precaution not necessary for birds, most of whom have a very limited sense of smell). Avoid unnecessary movement of your body or of the vegetation as you pass through it.

Anticipate the route the animal may take. Using terrain and vegetation as concealment, move to a place where you can wait for the animal to pass by. This is especially easy if an animal is following a stream.

Animals are less likely to catch sight of movement directly toward or away from them than they are side-to-side movement. Be silent. Step on rocks, logs, and bare earth instead of dry leaves. As you take a step, land on your toes first, then your heel. If close to an animal and no bare spots are available, carefully remove leaves and other noisemakers from each spot you wish to place your foot.

Inconspicuous clothing is particularly important. Use the principle of "disruptive coloration," which will make you less conspicuous by breaking up the outline of your body.

Take advantage of bad weather. The sounds of wind and rain will conceal any noise you make and it will be easier to stalk wildlife. If you dress appropriately you will be comfortable (except possibly in the bitterest weather) and still be able to observe.

A rubber foul weather suit — jacket, coveralls, and hat — can be worn over clothing appropriate to

the temperature and will make you an all-weather person. Such a suit is well worth the cost if you spend much time outdoors.

**WAITING.** This technique will allow you the most detailed observation of wildlife. Some people, however, are too impatient to give it a fair test. Comfort is especially important since swatting insects, standing up to shift position, stretching, or moving to get warm will prevent wildlife from appearing. If you sit still for a long time you may be surprised how quickly wildlife will appear.

No extra equipment is really necessary, but since it is to your advantage to become "part of the scenery," extra preparation may be worthwhile. Dark, inconspicuous clothing is especially important. If your skin is light, you may want to use charcoal to darken your face and hands. Take a letter to write or a book to read, but be careful not to make quick movements when you turn pages. Take a lawn chair or stool and cushion if you can still be concealed when so seated. Try to locate yourself downwind from where you expect the wildlife will be. If you can look down upon the animals, you will be able to see better, and you will be less likely to be seen. Sitting on a branch (bring a cushion) or constructing a simple platform in a tree will sometimes keep you from being seen by animals walking right under you.

A blind can be constructed if you locate a particularly promising spot for observation. A simple blind may be just some branches propped up to keep you from being seen. Semi-permanent blinds are appropriate if you want to return to the same place frequently — for example a beaver marsh, a den tree of a raccoon family, or a nest on which you are keeping records. A large dark-colored tarp or a dark canvas tent with holes cut in strategic places will allow you to move around, eat meals, and continue observation without disturbing the wildlife. Once the animals become accustomed to the blind's presence, you will be able to observe very easily. Do not place such a blind too close to the animals, as it may cause them to go elsewhere. If possible, locate the blind where you can approach and enter through bushes or other concealment without being seen or heard by the wildlife.

Take along field guides or other materials so you can read about what you are observing.

# Habitat Improvement

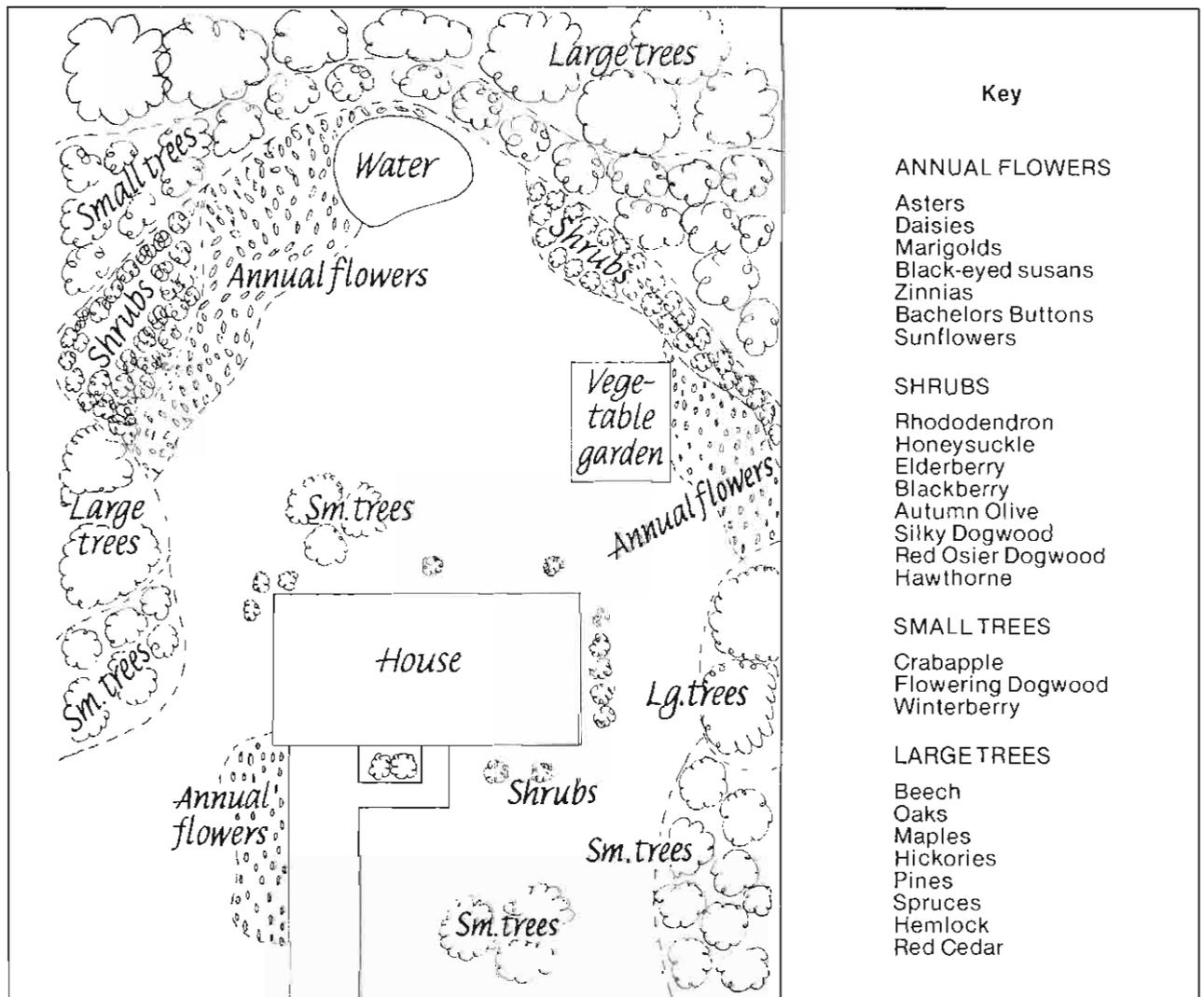
Habitat improvement can be anything from building birdhouses for a yard or park to planting shrubs and building ponds on a farm or other large area. Remember limiting factors. Try to provide what is in short supply in the area you are improving. Make a plan or map of your habitat improvement activities.

## PLANTING

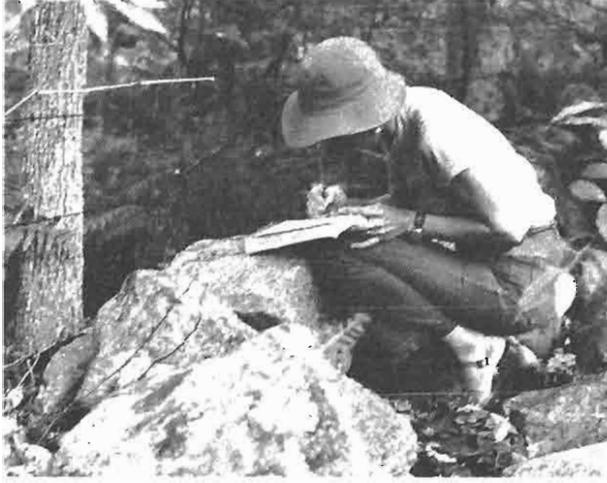
Planting of trees, shrubs, and herbaceous (non woody) plants is one of the best ways to improve wildlife habitat because plants, carefully selected with wildlife in mind, provide food, shelter, and

resting places year after year with no further assistance from you. To find out what species will grow in the climate of your region, contact the Soil Conservation Service office in your area.

**HOUSE LOT PLANTING.** Owners of suburban house lots frequently can devote a back corner to wildlife plantings with spectacular results. Some (but unfortunately not many) people plan the landscaping of their entire lot with both wildlife and appearance in mind. The illustration shows one example of the many types of trees, shrubs, and annuals that may be used. Incidentally, lawn grass alone is useful to almost no wildlife species.



For more details go to your library and read in the April-May 1973 issue of National Wildlife Magazine, "Invite Wildlife to Your Backyard." A reprint is available for a small charge from National Wildlife Federation, 1412 Sixteenth Street, N.W., Washington, D.C. 20036.



Careful recording of your observations is an important part of your wildlife project.

**SMALL AREA PLANTING.** On most farms there are corners, gullies, and other odd, small areas which are not used in normal farm operations. These are excellent locations for small patches of food (see Food Plot Planting, below) and cover plantings. Shrubs and trees are used in such areas to provide winter food and protection.

Such plantings are best if bordered by a hedge of shrubs and contain a small grove of conifer trees, either pine, spruce, or both. The combination of food and shelter will attract many wildlife species.

**FOOD PLOT PLANTING.** In areas where cover is abundant, food plot planting can provide a valuable source of grain and green vegetation. Food plots should always be planted near permanent cover as they usually provide little protection of their own during winter. Small plots provide enough food for most wildlife species. Many types of wildlife use them at various times of the year.

Seed can be purchased at a farm supply store or ordered at a garden store. Usually you will have to prepare the soil. If you have machinery available, discing or roto-tilling is recommended. If you have no machines to use, turn with a spade and rake the soil to give the grain a head start on the weeds.

Corn should be planted one inch deep, 10 inches apart, in rows 30 inches apart. If you plant in "hills", plant 3 or 4 seeds in hills spaced 36" apart. The other grains can be broadcast by hand and raked into the soil. Use the following quantities for food plots remembering that if your food plot is less than one acre in size, reduce the amount of seed accordingly:

Corn — 7 lbs. per acre

Buckwheat — 50 lbs. per acre

Oats, wheat, and rye — 2 bushels per acre

Millet — 20 lbs. per acre

Sorghum — 6 lbs. per acre

If farm machines are available, regular planting machinery should be used.

**FENCE ROW PLANTING.** Scattered area of good wildlife food can be useless if there are no travel lanes or corridors, which wildlife use to get across wide open areas. These travel lanes can be natural hedge rows which modern farming has nearly eliminated through farm clean-up practices and maximum land use.

By planting hedge rows of wildlife shrubs, you help wildlife move under protective cover, and provide food at the same time.

By establishing hedge rows, the amount of available habitat is multiplied many times because of the edge effect.

This same principle of wildlife corridors also applies in suburbs and cities. Whenever possible, natural areas, parks, and other "green spaces" should be connected to one another to allow animals to travel under cover. Neighbors can even cooperate with one another to coordinate the landscaping of their lots, so that their shrubs and other plantings are connected to one another and serve as a corridor.

**STREAM BANK PLANTING.** A stream in a pasture soon becomes a mudhole if cows or other animals are allowed to walk in or out of it. Shrubs planted along the banks keep soil from washing and discourage animals from walking in and along the stream. They should be allowed access to water only where soil conditions will keep erosion to a minimum.

For further information on stream improvement practices to increase fish (another form of wildlife) populations, contact the Soil Conservation Service office in your area.

## WHERE TO GET SHRUBS AND TREES

You can purchase plants from garden stores or nurseries, but there are less expensive sources. Shrubs and trees for wildlife are available at a very low cost from many state conservation departments. Normally they must be ordered several months in advance and picked up in spring for planting. For information on this program contact the Soil Conservation Service Office or conservation department office in your area.

You can propagate your own shrubs by layering, grafting, or making cuttings from existing shrubs. Some shrubs can be raised from seed. Your Cooperative Extension Service office should be able to provide information on this subject.

Shrubs can be transplanted. Be sure you don't destroy the habitat in one area to improve another. Dig shrubs only from an area of plentiful shrubbery where natural reproduction is occurring.

**PLANTING TECHNIQUES.** There is more to transplanting than digging them up in one place and putting them in a hole somewhere else. Following are general guidelines. For further information ask at your area Cooperative Extension Service office.

1. Transplant only small trees and shrubs. bigger transplants suffer from root injury and even if they survive may take a long time to recover.
2. Transplant in spring before the buds start to grow. If you must transplant in fall, wait until leaves have fallen, and protect transplanted shrubs from winter winds. Evergreens can be transplanted earlier in fall and later in spring than deciduous shrubs (shrubs that lose their leaves in winter).
3. Always keep the roots moist.
4. Evergreen plants require a ball of earth around the roots when you move them. Deciduous plants can be transplanted without a root ball ("bare root"), but if possible you should let some soil cling to roots.

The following recommendations apply to planting shrubs and trees only a few inches tall, which is what you will have if you grow your own from seed or from cuttings, or if you order from your state conservation department. Planting large shrubs takes time and is more difficult but results are seen sooner. You may wish to intersperse a few

larger shrubs with your planting of seedling shrubs.

For small transplants it is especially important to remove sod, grass, and weeds within a foot of where you will put each plant. This allows the new shrub to get a head start without being crowded.

Plant the shrubs very soon after receiving them or if you grew your own, very soon after digging them. If you are unable to do this, find a shady place to "heel them in". This is done by digging a trench deep enough to cover the roots of the plants and temporarily planting the whole bunch together to ensure that the roots will not dry out. Planting can then be done as time becomes available. When planting, use the following steps:

1. Space shrubs two feet apart, trees and autumn olive, six feet.
2. Strike blade of mattock or grub hoe full depth into the ground.
3. Open slit or hole.
4. Place plant with roots spread into hole and tamp firmly with heel.

If a mattock or grub hoe is not available, use a shovel or spade. It is important that the roots be covered before they dry out and also that earth be packed firmly around them. Carrying the seedlings from hole to hole in a pail of water will keep the roots from drying out.

Apply fertilizer in a ring around each shrub or tree. Do not over-fertilize, and be sure that you do not fertilize the weeds surrounding the plant. If possible, water each transplant soon after planting.

## IMPROVEMENT OF EXISTING HABITAT

Often there is a great deal that can be done with the vegetation already existing on the land.

In nature, vegetation goes through a process called succession. For example, a bare field soon grows up with grass and weeds. This is followed in a few years by shrubs, then a few (perhaps many) years later by trees, and then perhaps many decades later by a different kind of tree. By controlling this process of succession you can benefit wildlife. This is because one stage of succession may be better for wildlife than the stage that follows it.

**SLASH CUTTING.** Deer normally are browsers: they eat twigs and buds from shrubs and trees. In the winter this is nearly 100% of their diet.

Thus deer need an early successional stage,

because if succession proceeds too far all the trees will be too tall for the deer to reach the branches, and the trees shade out the shrubs. You can improve the existing habitat for deer by cutting a section of woods to create a clearing. The sprouts from the stumps and the shrubs (which now get enough sunlight) provide deer food. This is a good activity for late winter when the deer may be starving, since the twigs of the cut trees are easily reached.

Rabbits eat the same food as deer in winter, so slash cutting will provide food for rabbits as well as deer. The fallen trees provide shelter for deer, rabbits, and many other animals.

**HEDGEROW IMPROVEMENT.** Most other wildlife species also favor brushy growth. For them hedgerows can often be improved by removing larger trees which tend to shade out brushy vegetation.

Before you decide to cut down a large, old tree be sure to consider its present value to wildlife (nuts for food, hollow branches for shelter, etc.) and its value as a beautiful part of the landscape in the area. Whenever trees are cut, always pile the branches as described below in "Brushpiles and Rock Dens."

Some trees such as sumac provide wildlife food only in early stages. In such cases it is good management to cut the mature trees and allow the young trees to grow. On the other hand, fruit trees such as apple should be encouraged to grow so that they will produce more and better fruit. Cut surrounding vegetation and remove sucker shoots that

use up plant energy without producing fruit. Whenever cutting is done, the brush should be used to create more brush piles.

**WEEDS.** Most people don't see the value of weedy areas. Weeds are excellent natural food supplies for birds and small animals. Many times all you need to do to improve habitat is to resist the urge to pull up or cut down weeds. The number following the name of the weed in this list is the number of bird or mammal species known to use it for food.

Jewelweed	7	Dock	35
Pokeweed	28	Pigweed	55
Ragweed	71	Poison Ivy	61
Crabgrass	22		

These are conservative figures for just a few of the hundreds of common weeds.

To improve the appearance of an area you have selected for growing weeds, plant a border of zinnias, marigolds, or other ornamental plants. Many garden flowers are useful as wildlife food if allowed to go to seed.

### **BRUSH PILES AND ROCK DENS**

Shelter from weather and predators is vital for wildlife. Brush piles can be made to last longer and be more useful to wildlife if a stump or large rock in the center creates a space underneath the brush. Pile on larger branches first, crisscross fashion, to prevent settling and allow more space within the

A small hole can be a large benefit to hole-nesting birds, squirrels, and other wildlife.



This woodchuck den has an obvious "front door" and a well-concealed "back door" some distance away.



pile. Small branches should be laid on last.

“Living brush piles” can be created by cutting unwanted trees or large bushes halfway through, then pulling them down in a crisscross fashion. If a strip of bark remains on at least one side of each tree, it will continue to live, and grow into a tangle, providing much shelter.

Rock dens are simply rock piles carefully constructed to provide shelter. Use larger rocks to shape tunnels and interior chambers, then pile smaller rocks and sod or brush over the top. Keep in mind the principle of interspersions; these dens will be most useful if they are near food and water.

## WATER HOLES AND PONDS

Most animals need water at least once a day. If they must travel very far, the population will remain small — in this case water is the limiting factor.

You can get advice on building ponds from the Soil Conservation Service office in your county. Usually some expense is involved, but you may be able to build a small water hole for very little if you have a low, soggy area on your property.

Larger ponds provide swimming, fishing, and boating as well as nesting sites for wildlife, so the investment may be worthwhile.

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# Building Houses, Feeders, and Baths

You can improve wildlife habitat by building nesting or den sites, watering places, and feeding places. In addition to helping animals and birds, you may cause them to come near enough to watch from your window.

The instructions on the following pages will give you some ideas. Other plans and descriptions can be found in books and publications available from the Cooperative Extension Service, The Audubon Society, your library, and other organizations.

Most popular are bird houses, feeders, or baths. The principles of bird house construction can be applied to den sites for squirrels, raccoons, or other hole-inhabiting animals. And, when you build a bird feeder or bird bath you will probably be feeding and watering other animals as well as birds.

## HOUSES

Don't forget that when you build a bird house you are providing a nesting site only for birds that nest in holes. Most birds need shrubs, trees, or fields to nest; good wildlife habitat has places for many kinds of animals.

A well-built house for birds should be durable, rainproof, cool, and readily accessible for cleaning. Wood is the best building material. Sawmill waste (rough slabs with bark on) is cheap and satisfactory for most purposes.

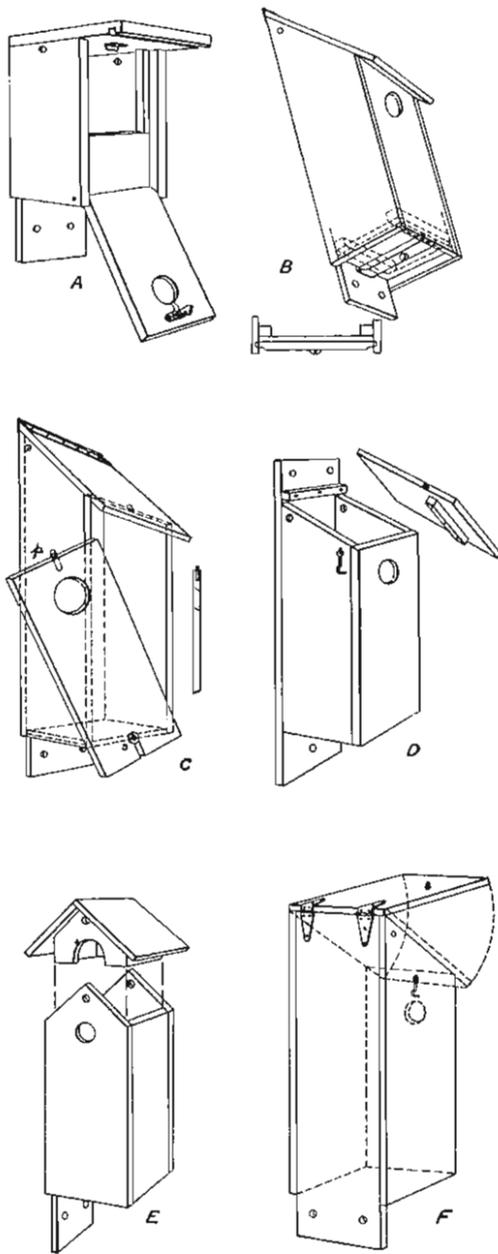
Bird houses will last much longer if they are painted. Dark green, brown, gray, or other dull colors are best. Do not paint the inside, and avoid painting the inside of the entrance hole. Roofs should have enough slant to make water run off quickly.

Since entrance holes for bird houses are usually made near the top, the inside of the house should be roughened, grooved, or cleated to assist the young in climbing to the opening. A perch at the en-

Small clumps of shrubs can produce a substantial increase in wildlife populations.



—Accessible nest boxes: **A**, Hinged front held up by a catch; **B**, removable bottom, released by the slight turn of a cleat; **C**, swinging front, held in place by the pin *p* and by tightening the screw *s*; **D**, and **E**, removable tops; **F**, hinged top.



trance helps enemies and is not needed by the occupants.

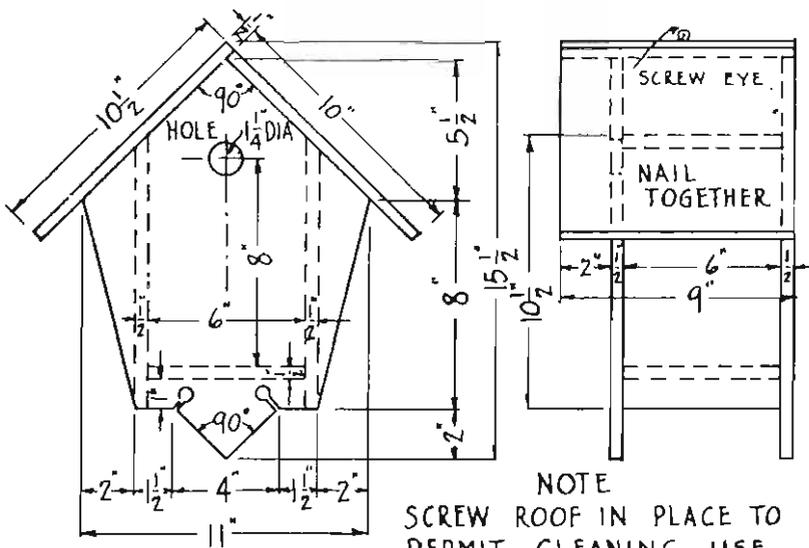
Wood is a fairly good heat insulator, and a single opening permits very little ventilation, so drill one or two small holes through the walls near the top of the box to give limited circulation of air without producing drafts.

All bird houses should be readily accessible and built to be easily opened, inspected, and cleaned. Get rid of all intruders. These include mud daubers, paper wasps, bees, and other insects; sometimes even mice and flying squirrels.

It is advisable to clean nest boxes immediately after broods have left even if the parent birds show signs of using the house for another family. Old eggs and dead nestlings can be discarded and parasites reduced. The material removed should be wrapped in a paper and burned or buried. (Birds will rid themselves of many parasites if you provide water and dust or sand baths. These are nature's means of keeping down body parasites.) On the whole, clean nest boxes have a better chance of being occupied and the birds have a much better chance for survival.

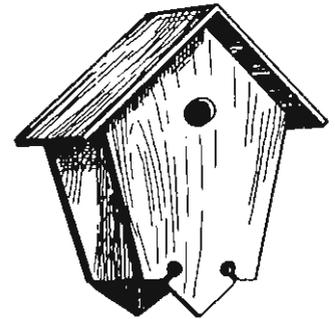
### Nest Specifications

Species	Floor of Cavity Inches	Depth of Cavity Inches	Entr. above Floor Inches	Diam. of Entr. Inches	Height above Ground Feet
Bluebird	5x5	8	6	1½	5—10
Robin	6x8	8			6—15
Chickadee	4x4	8—10	8—8	1-1/8	6—15
Titmouse	4x4	8—10	6—8	1¼	6—15
Nuthatch	4x4	8—10	6—8	1¼	12—20
House wren	4x4	6—8	1—6	1—1¼	6—10
Carolina wren	4x4	6—8	1—6	1½	6—10
Tree swallow	5x5	6	1—5	1½	10—15
Barn swallow	6x6	6			8—12
Purple martin	6x6	6	1	2½	15—20
Phoebe	6x6	6			8—12
Great crested flycatcher	6x6	8—10	6—8	2	8—20
Flicker	7x7	16—18	14—16	2½	6—20
Red-headed woodpecker	6x6	12—15	9—12	2	12—20
Downy woodpecker	4x4	9—12	6—8	1¼	6—20
Hairy woodpecker	6x6	12—15	9—12	1½	12—20
Screech owl	8x8	12—15	9—12	3	10—30
Saw-whet owl	8x6	10—12	8—10	2½	12—20
Barn owl	10x18	15—18	4	6	12—18
Sparrow hawk	8x8	12—15	9—12	3	10—30
Wood duck	10x18	12—24	12—16	4	10—20

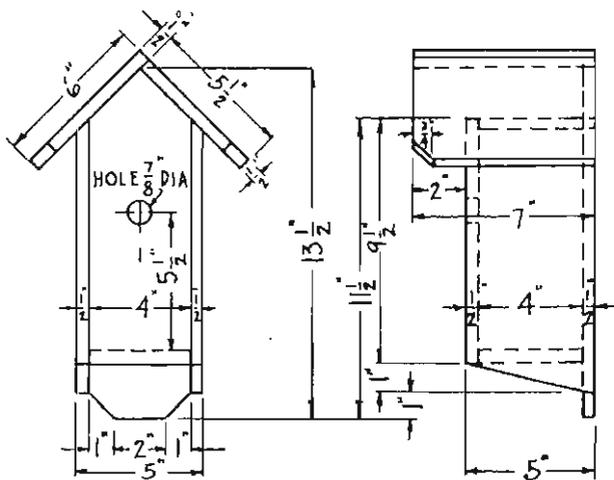


FRONT VIEW

SIDE VIEW



FOR BLUE BIRD



FRONT VIEW

SIDE VIEW



WREN HOUSE



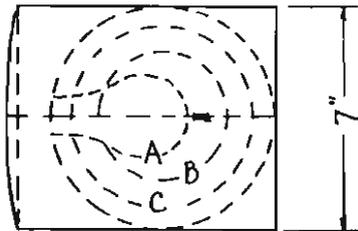


MAKE IN TWO HALVES GOUGE OUT INSIDE THEN HOLD TOGETHER WITH TWO WIRES

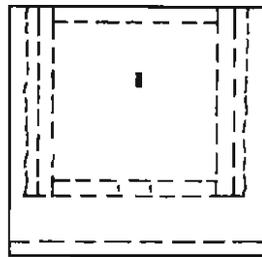
FOR SWALLOW OR BLUE BIRD



FOR TREE SWALLOW OR BLUE BIRD

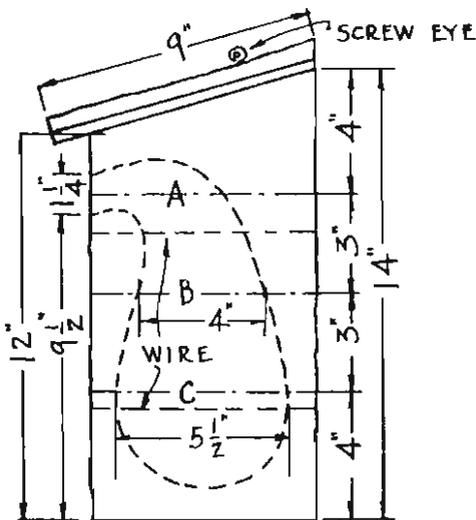


TOP VIEW

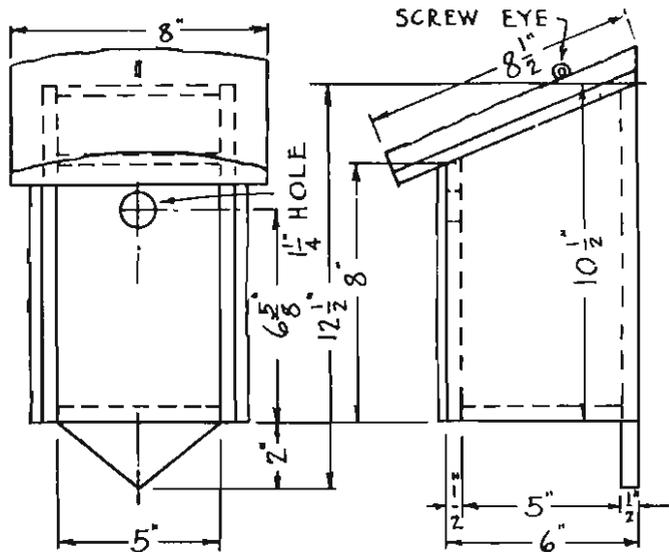


TOP VIEW

SCREW TOP IN PLACE TO ALLOW FOR CLEANING



SIDE VIEW



FRONT VIEW

SIDE VIEW

## BIRD FEEDERS

Some bird feeders are merely board platforms where foods are placed and others are fancy, deluxe models. Some type between these extremes is probably best. In any case there are certain rules which should be followed with any feeding station.

1. For best results it should be set up in the fall before cold weather sets in. Feeding stations are most effective and most used in winter months.
2. Once established, you should keep food available at all times and never let the food supply run out until spring. Birds will depend on it after they have been using it for only a short time.
3. Any platform type feeder where you are offering seeds and grains should be roofed and protected from rain and snow so that the food will stay dry and not spoil.
4. A feeding station should be made cat-proof if it is on a post, pole, or tree.
5. The station should be fairly close to the house, so you can enjoy watching the birds and also keep a check on the food supply.
6. It will be more effective if it is located near some kind of escape cover such as bushes or shrubs.

These same bushes and shrubs, however, will allow cats to hide near the feeder and easily kill many birds that come to the ground. To avoid this, place a wire screen fence around the base of any nearby shrub that could provide concealment for a cat.

There are a great many foods which birds will eat from your feeding station. A wide variety of foods will get you a greater variety of birds. Mixtures of cracked corn, millet, wheat, and sunflower seeds are always acceptable. Add to this some meats of walnuts or hickory nuts, peanuts or peanut butter, some raisins or cut up apples. Left over corn-bread is an excellent and attractive food for most wintering birds. Avoid feeding anything spoiled. If food becomes moldy or rotten, take it out of the feeder.

In the same feeder or a nearby, separate feeder, offer sand or other gritty materials to the birds. Birds have no teeth and use sand in their

stomachs to grind food. Many birds killed by cars in winter were forced to go to the roads for sand.

Placing food under or near a platform feeder will attract some species of birds which will not use the elevated feeding station. Doves appreciate an offering of this type and will be joined at times by birds which normally don't feed on the ground.

Probably the easiest established and certainly one of the most effective bird feeding stations is a suet feeder. Beef suet (similar to but not the same as fat) can be attached to the trunk or low limb of a tree and will provide much needed energy-producing food during the cold of winter. It is attractive to woodpeckers, titmice, nuthatches, and many other birds. A large chunk of suet wrapped in one inch-mesh wire and firmly attached to a tree trunk makes a good bird feeder. The wire mesh will deter cats and raccoons — animals which will completely destroy a less sturdy suet feeder.

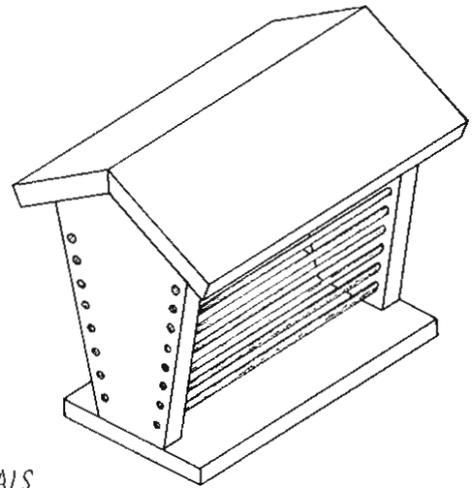
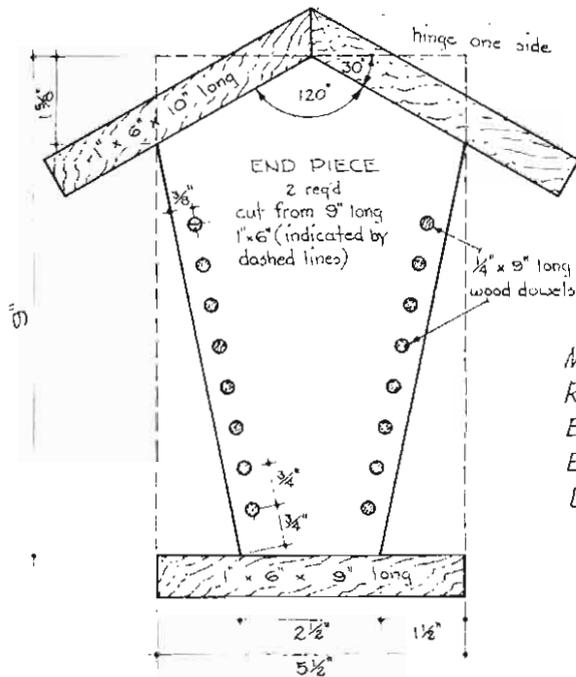
If left up during the summer, you may be treated to the sight of a brood of young birds brought there by their parents. In summer, however, suet may smell bad and you may have to move the feeder away from the house.

Hummingbirds drink nectar and eat small insects they find in flowers. They migrate south in winter, but a special feeder set up in the spring may attract them through the entire summer.

Hummingbird feeders and food tablets may be purchased at many garden supply or other stores. Homemade feeders and food mixtures work just as well. To make a food mixture, dissolve one tablespoon of sugar or honey in two tablespoons of water. **Never** make it too strong, as this may kill the birds. If you mix a larger batch in the 1:2 ratio and store it for later use, be sure to keep it in the refrigerator.

An easy feeder to make is simply a small pill bottle or vial fastened at an angle to a small pole or hung from a bush 2-5 feet from the ground. Red is attractive to hummingbirds, so cut a red "flower" from such material as an old plastic detergent bottle and place it around the opening of the vial. Fill the vial with the solution, and change it periodically to keep it from spoiling. Whether you use a commercial feeder or a homemade feeder you may need to place a ring of petroleum jelly around the pole to keep the ants away. Frequent cleaning may be necessary for any hummingbird feeder, especially in hot weather.

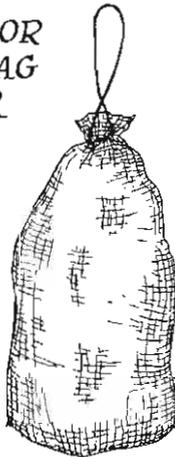
The plans on the following pages will give you further ideas on building feeders.



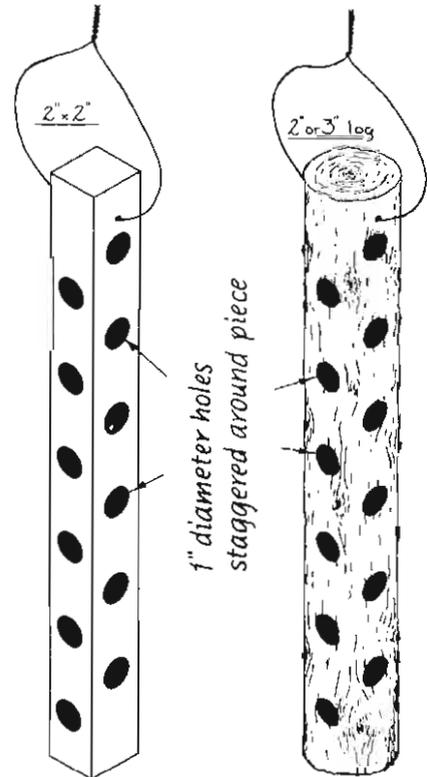
**MATERIALS**

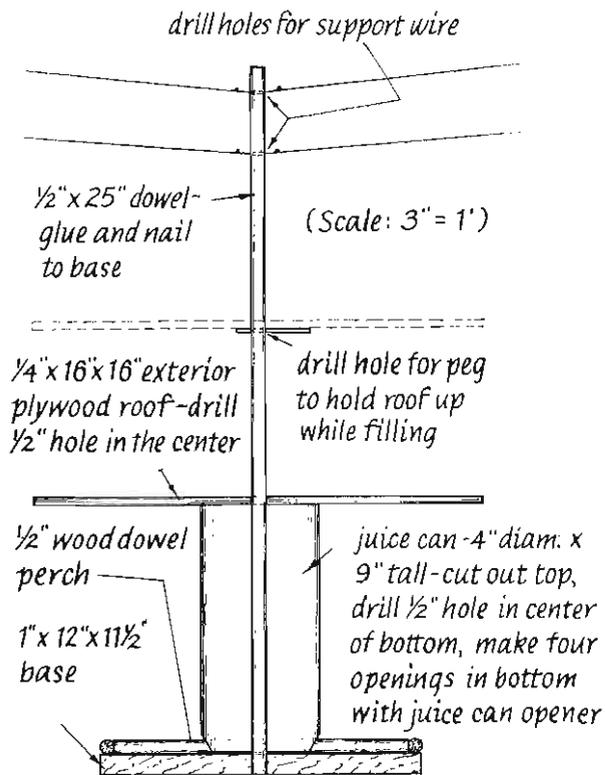
- Roof 2- 1" x 6" x 10"
- End 2- 1" x 6" x 9" } from 4' long 1 x 6
- Base 1- 1" x 6" x 9"
- Dowel 16 - 1/4" x 9" — from 4 dowels, ea. 36"

**ORANGE OR  
ONION BAG  
FEEDER**



**FEEDER FOR  
MIXED FEED  
OR SUET**

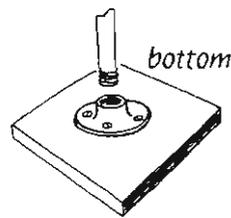




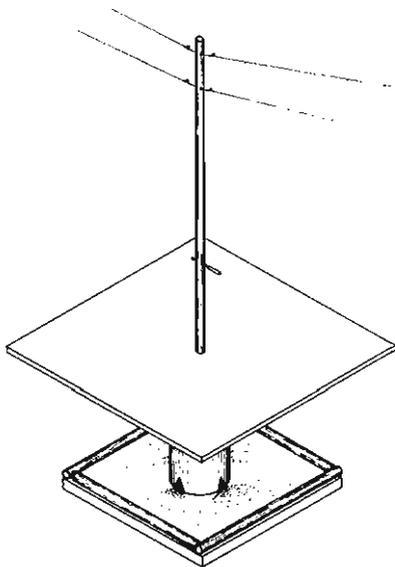
JUICE CAN FEEDER

dowels, half-rounds, or quarter-rounds for edges

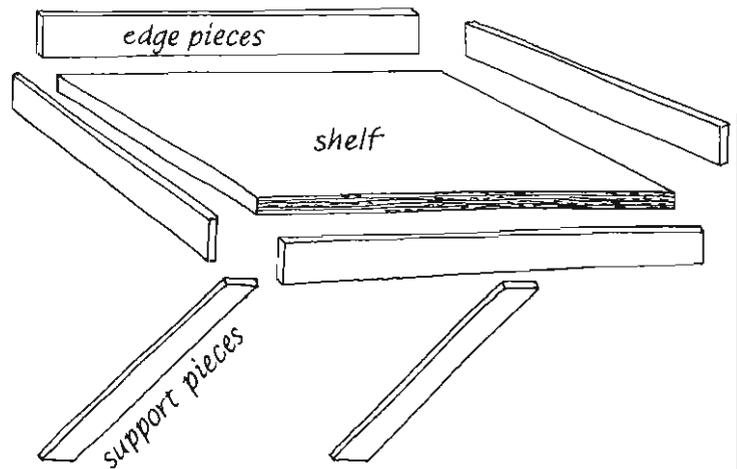
Support from ground with metal pipe and floor flange (from plumbing or hardware store)

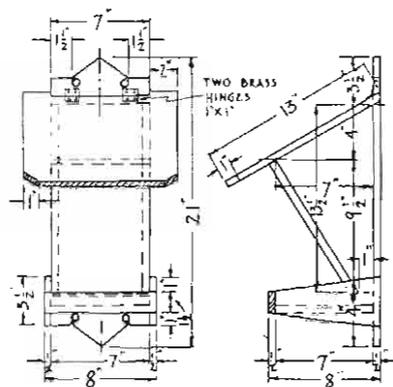
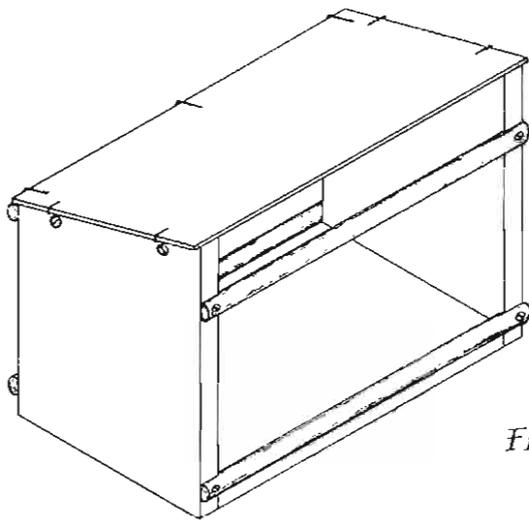


OPEN FEEDER

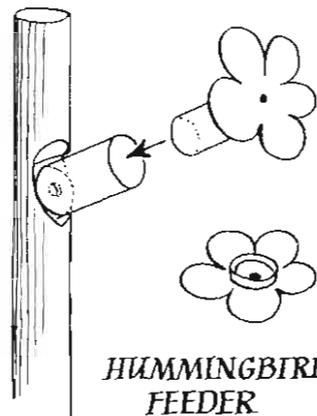
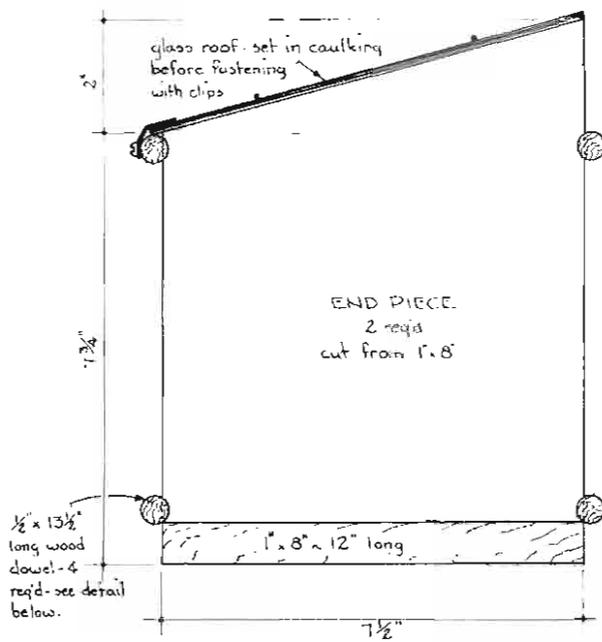


SHELF FEEDER

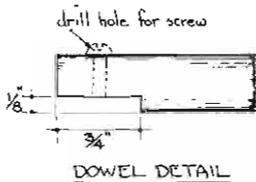




### FEEDING BOXES



### HUMMINGBIRD FEEDER



Plastic pill bottle with bright plastic "flower" cemented to cap - 1/8" hole in flower and cap allows access to sweet liquid - the bottle fits into larger pill bottle screwed to stake at an upward angle.

## SHEET METAL PREDATOR GUARDS

Birdhouses or bird feeding stations attached to poles should be placed where squirrels, cats, or other unwelcome guests cannot leap from overhanging or nearby roofs or branches.

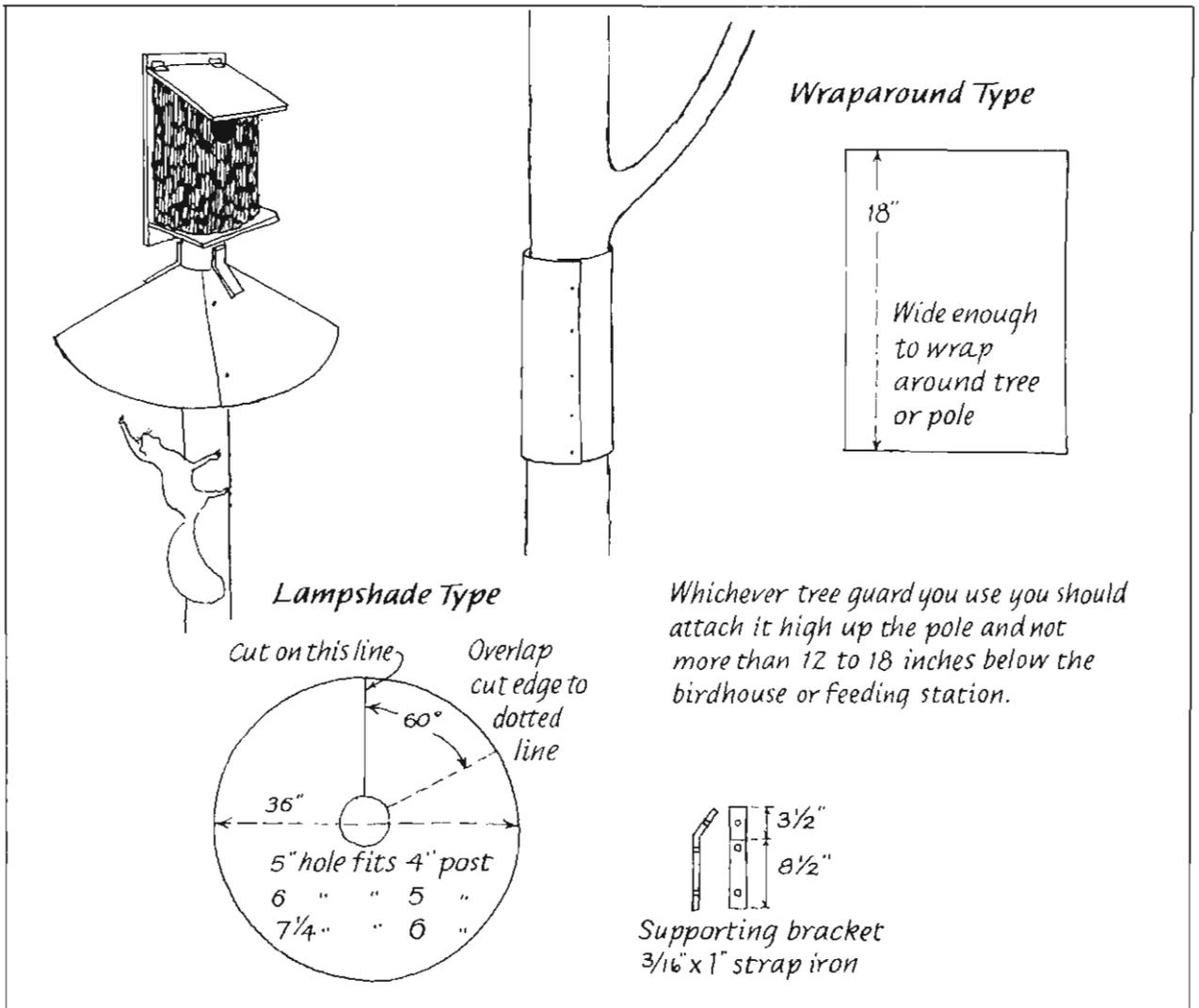
Also, guards should be placed on the pole beneath the feeder or house to prevent climbing from the ground.

You can make two kinds of guards. One type is a piece of tin wrapped around the pole and nailed to it. Animals will not be able to get a grip on the tin and cannot climb the pole. The other kind is a flaring piece of metal that looks like a lampshade and is a barrier the predator cannot pass.

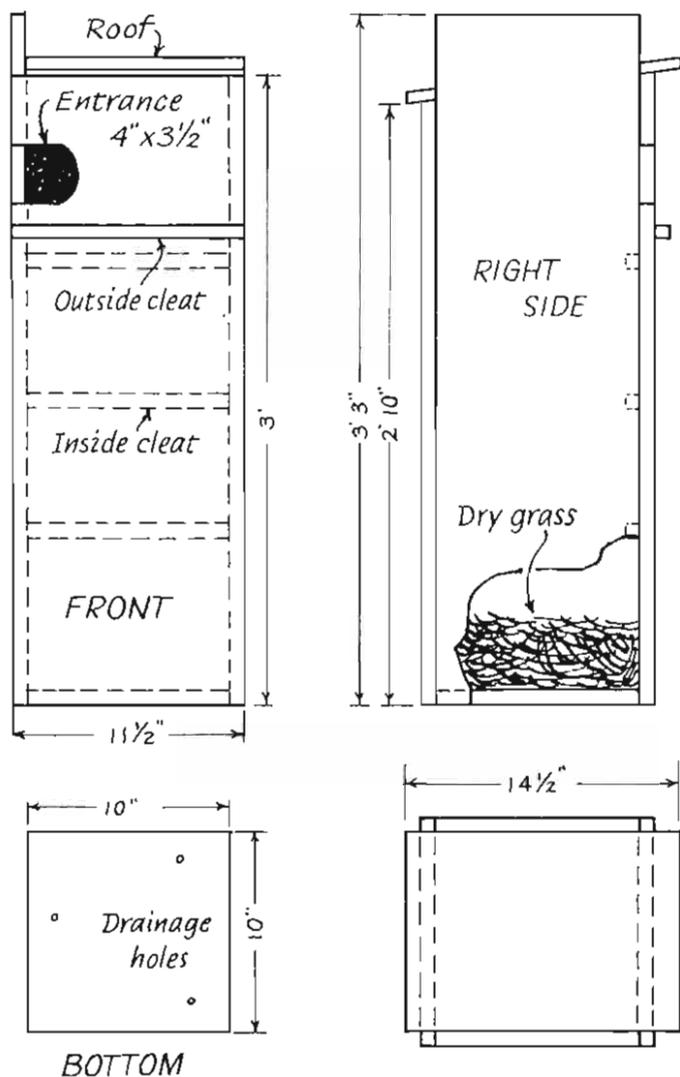
A bird bath is used for both bathing and drink-

ing, and is an interesting and entertaining addition to bird study in the summer. Birds will also come to a bird bath in winter if you use an electric heat tape to keep it from freezing.

A bird bath should be fairly large, shallow and easy to clean. It may be a store-bought bath mounted on a pillar, or half of an old truck tire placed on the ground. Be sure there is open space around the bath so that birds are safe from cats while they are bathing or drinking. A garbage can lid may be set on three or four posts of equal height, or a large upended drain tile. A flat rock in the lid will give it stability as well as provide a choice of water depth while bathing. In any case never allow the bird bath to dry out. Similar structures containing sand and dust may become very popular with birds.



# Squirrel, Raccoon, and Goose Nests



## Squirrel Nest Box

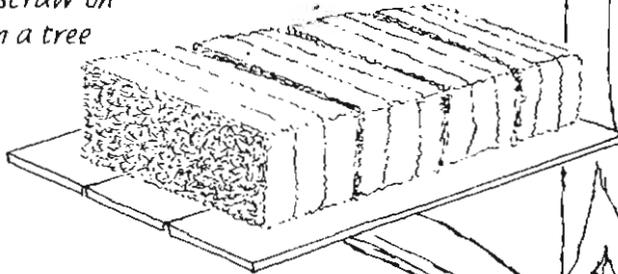
1. Left side ends at roof level, right side does not.
2. Add cleats for climbing inside and outside.
3. Make roof easily removable for cleaning.
4. Do not paint
5. Add dry grass for nesting material.
6. Place box 15' or higher on side of tree trunk.
7. Use  $\frac{3}{4}$ " plywood or 1" boards

**Raccoon Nest Box** — Like squirrel nest box except:

1. Make entrance hole 6" x 8".....
2. Put an additional cleat on the outside, halfway between top cleat and bottom of box.....
3. Place on side of tree trunk with bottom of box resting on a large branch.

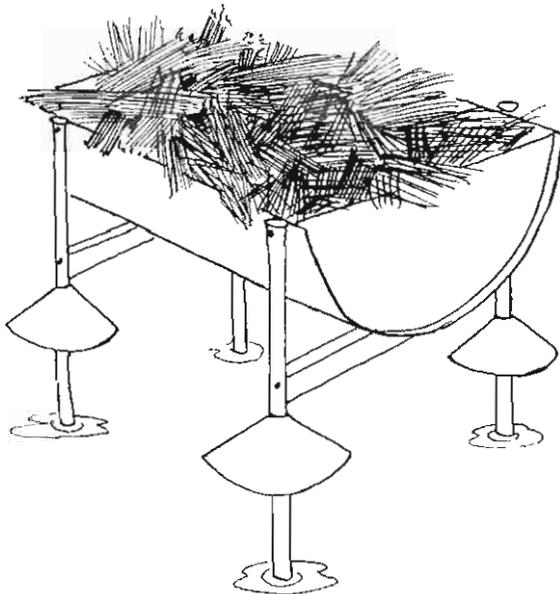
### *Hay Nest*

*Place 4 bales of hay or straw on a platform on posts or in a tree*



### *Barrel Nest*

*A 50-gallon half barrel mounted on posts makes a good nest. Drill several drainage holes in bottom.*



*Construct several nests for geese and locate within 100 yards of water, or on posts in shallow water. Establish the nests no later than March 1. Several kinds of nests may be used to determine the most acceptable type.*

*Nests should be located a few feet above the ground, or if on the ground on an elevated site. Do not place nests closer than 100 yards apart.*

# Preserving Animal Sign

Animal sign is any evidence that an animal was present. A feather, a footprint, a chewed branch or nut, and scat (dropping, feces, or dung) are all animal sign. Since most wild animals are shy and nocturnal, wildlifers usually depend on sign to learn about the wildlife in an area. Carefully study all animal sign that you find. Preserving sign for later study and exhibition is a rewarding activity.

Sketching is an invaluable skill in recording animal sign. Develop your ability to its maximum.

Most animal scat is dry and does not have an offensive smell. From scat you can identify the animal and what that animal had been eating. Dried scat can be collected and preserved by painting with varnish. As with any collection, photograph, or sample you take in the field, be sure to enter in your notes all details concerning the find. Location, tracks, habitat, and any other evidence may contribute to your conclusion at a later time.

Tracks are usually the most obvious animal sign. They can be found in mud, sand, snow, or dust. Tracks can tell fascinating stories of “what happened here.” Wildlife biologists can tell a good deal about a wildlife population by interpreting tracks.

Freshly fallen snow provides an easy opportunity for tracking. Tracks in snow usually do not last long, however, and are difficult to preserve except by photography.

The best tracks for study and preservation are made in soft mud or moist fine sand. Stream banks

Plaster casts of tracks make an interesting collection.



are a good place to search, since wildlife is usually attracted to streams.

Making plaster casts is the best way to preserve tracks. A collection of casts with field notes and species information can be an excellent exhibit or display.

To make plaster casts you should have all your materials together **before** you begin. Remember that plaster of Paris hardens very quickly. Follow the instructions exactly, until you have enough experience to get the “feel” of what you are doing. Practice on some unimportant tracks (your own perhaps) before you go afield for wildlife tracks.

## Materials:

1. Plaster of Paris — at least one pound for a track made by a dog sized animal. (Be sure you use Plaster of Paris, which hardens in 10-30 minutes. Patching plaster may take hours to harden.)
2. Cup or small can for measuring.
3. Mixing pan or can — a quart coffee can works fine.
4. Water.
5. Strips of cardboard or stiff plastic, 2” wide, about 12-24” long.
6. Paper clips.
7. Small brush, such as an old tooth brush.

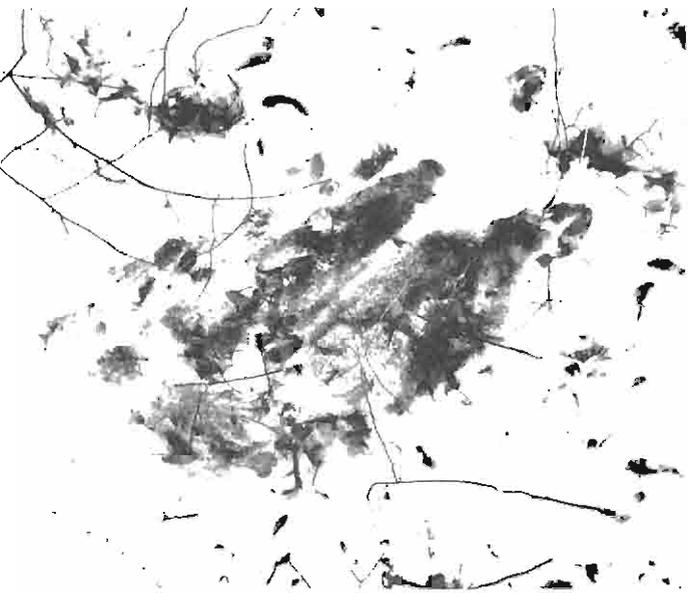
## To Make a Cast:

With a strip of cardboard make a circular wall around the prints. Press it into the soil, mud, or snow and clip ends together to make a form to hold the plaster.

Make a **thin** batter by adding 1 ½ parts plaster of Paris to 1 part water. Work quickly, because plaster sets quickly. When making a cast of a track in snow remember snow will melt (plaster of Paris hardens by a chemical reaction that gives off heat) unless you cool the mixture as you’re making it by mixing in some snow; or dust plaster of Paris into the print to form a base. Pour the mixed plaster carefully over the print.

After the plaster has hardened (10-30 minutes—it depends on your mixture), lift the cast and carefully remove the cardboard. Clean gently with a brush. You now have a **negative cast**.

For a **positive cast**, smear the negative cast with petroleum jelly and make a cast of your first cast.



When deer bed down in snow they leave a distinctive mark. Photographs are the best means to record impressions in the snow.

When hard, take off the cardboard and separate the negative and positive casts with care. The positive cast is a duplicate of the original track.

#### Other tips:

After you gain experience, you will no longer need to measure. You can tell by the look and feel when the mixture is right — about the same as melted ice cream.

Materials other than plaster can be used to advantage. Paraffin as a negative for example, is easily removed from a plaster positive (by melting).

You may not need the cardboard strips if you can improvise earth dams for the plaster.

Carry materials in a knapsack with you in the field just as a photographer would carry a camera....just in case.

Make a "track pit," which is simply an area prepared especially for getting tracks. In a promising location (across a known wildlife trail, near a den, etc.) find a spot with fine sandy soil or other soil with suitable texture for good tracks. Dig it up — clean off all leaves, rocks, and other debris. Moisten if necessary and smooth with a board or broom. Make plaster impressions as soon as possible after tracks are made, since tracks may lose their sharpness when they dry. Some species can be attracted to a track pit with peanuts, apples, or other bait.

# Photography

Photographs are an excellent way to record information and to tell others about your activities. Pictures add a great deal of interest to exhibits and talks you give about your project.

You don't have to take pictures of the animals themselves. Take photographs of habitats, dens, signs, or plantings. If you want to photograph animals, a greater investment of time, effort, and money will probably be necessary to get good pictures. It may be a worthwhile investment, however, because you can't help but learn a great deal about animals as you photograph them.

This section will give you ideas about how to use photos in your wildlife project regardless of the type and cost of camera and equipment. No effort is made in this project to introduce you to the subject of photography. To expand your knowledge of photography read the books at the library, bookstore, camera store, and in the 4-H Photography project. For further information and skills you should get help from someone whose hobby is photography, or take a course at a camera shop, community center, or community college.

## GENERAL SUGGESTIONS

In addition to basic techniques, there are a few things you should keep in mind when you take photographs for your wildlife project.

Get as close as you can to the subject without getting it out of focus.\* This is especially true of small items such as tracks, nutshells, and so forth. This will make the subject — the purpose of taking the picture — as large as possible in your picture.

Don't try to get too much in one picture. It's better to take two good pictures than one poor picture.

Take notes as you take pictures. They make a good permanent record of your activities as well as a means of improving your photography.

- #1 9:00 a.m. (date) nutshells on rock near bird feeder
- #2 9:30 a.m. (date) bluebird house showing nearness to open field
- #3 10:00 a.m. (date) raccoon footprints near stream

Before you take a picture, think carefully exactly what you are trying to show. Write this in your notes. Then be sure your picture will show what you want. Take more than one picture to be certain.

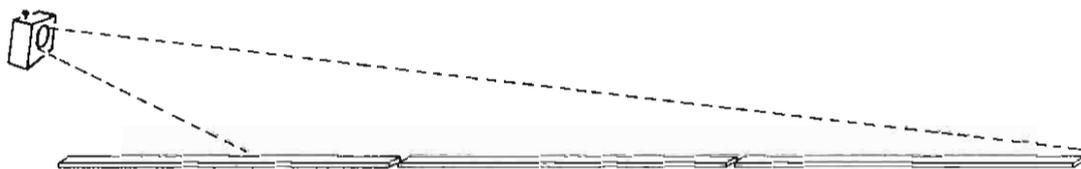
You may not be able to show all you want to unless you have a closeup lens. If you're not ready for that investment, use written notes and sketches to record details too small to show in your pictures.

Side lighting is usually better than front lighting for small objects because details show better when shadows show on one side or the other.

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\*If you have a simple camera and want to find how close the subject can be without being out of focus, do the following test: Lay 3 yardsticks end-to-end on the ground. Take a picture of them with the camera a few inches above the end of the end of the yardsticks.

When you get the picture back, the inch markings nearest the camera will be out of focus, but those further away will be in focus. The nearest one in focus tells you your closest focal point. If you repeat the test under different light conditions, you will know your closest focal point for each light condition.



## PHOTOGRAPHS OF ANIMALS

If you have ever tried to photograph wild animals, you already know that it is not easy. You will need a good deal of patience regardless of the technique you use.

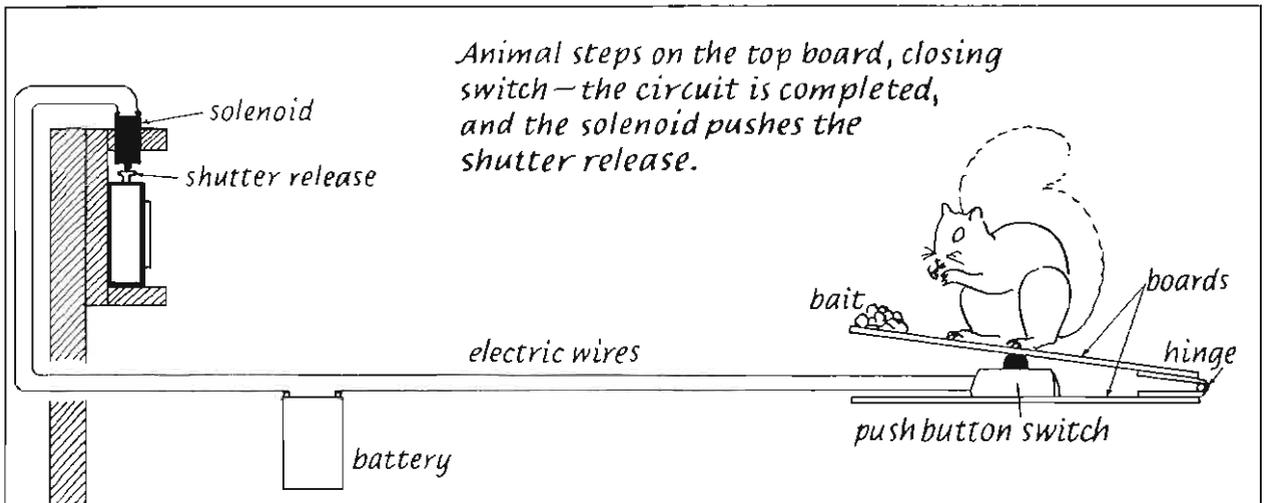
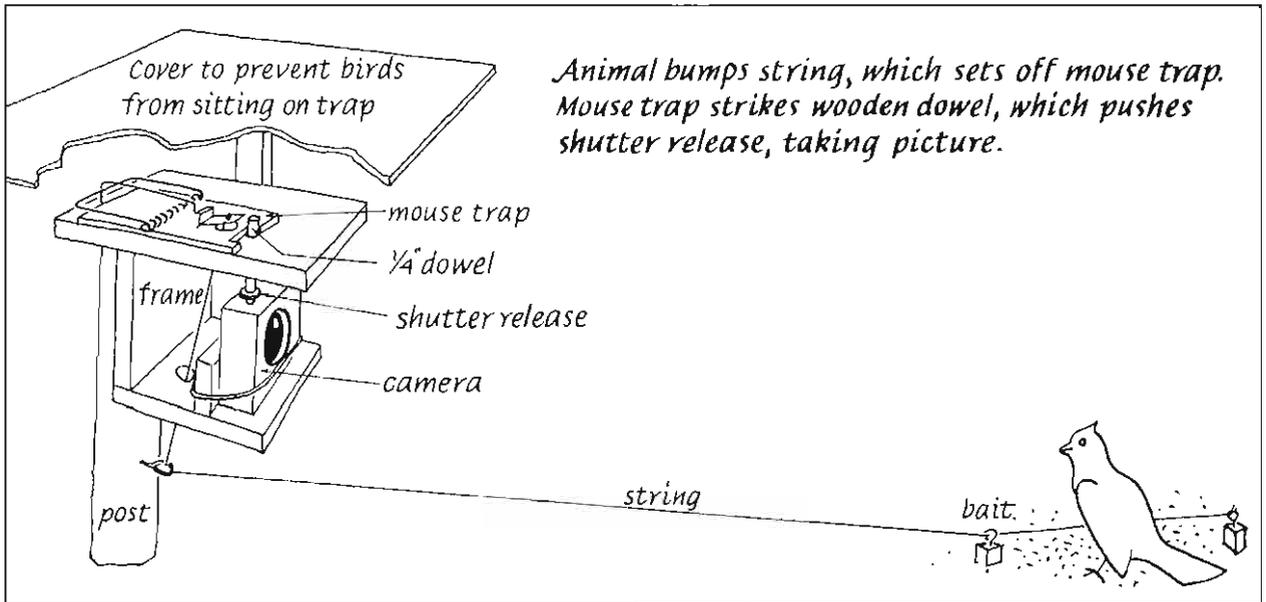
Some animals, such as reptiles and amphibians, can be captured, photographed in a natural setting, then released. For others, such as some birds and small mammals, you can use food to coax them in close to you. For other animals and other techniques, you will need varying amounts of patience and equipment combined with stalking and "engineering" skills.

Blinds, described in the section on observing

wildlife, are very useful. A good place for a blind is near a bird feeder.

If you have a tripod (or can devise some means of holding your camera still) and a way of releasing the shutter by remote control, you can put your camera where you expect the animal to be. Watch from a place of concealment some distance away and, when the animal is in the right place, take the picture. You may be able to devise a way to have an animal take its own picture.

For some cameras you can purchase remote control devices. Or you can use the diagrams shown here for ideas on how to make one for your camera and equipment. A flash will be useful since many animals are active at night.



# Mapping

Maps are used by wildlife biologists to record data as well as to tell others about the wildlife in an area. Maps are used in many different situations by people in many different jobs, because maps are an excellent means of putting a great deal of information on a single sheet of paper.

A well-made map is easy to understand. It is better to make two easy-to-read maps of the same area (for example, one vegetation map and one soils map) than to make one cluttered map. A good approach is to first make several copies of a base map, which includes only major landmarks and boundaries. Each time you map something new (for example vegetation, animal territories, or a daily wildlife observation) use a new base map. Other uses for your base map are described later in this section.

Before you begin your own mapping, study the sample base map and sample vegetation map, and learn some of the standard mapping symbols.

To make a map of your own study area you will need good quality paper that will withstand much erasing, a medium-soft (no. 2) pencil, a ruler, and a clip board or other hard drawing surface. A compass and measuring tape of steel or non-stretching plastic or cloth will enable you to make your map much more accurate. The best compass for this purpose is one with a protractor built into a transparent base plate. Compass and tape are not absolutely essential. Without a compass, you can estimate direction fairly accurately.

However, for approximations of distance without measuring, you should learn "pacing." Determine the average length of your step, then count steps, and multiply. For example, if your step is 2½ feet, and you walked 200 steps, you have walked 500 feet. Be sure to take into account anything that affects the length of your step: going downhill your steps will be longer, in a difficult terrain they will be shorter, etc.

Visit the area you are to map, and make your base map as accurate as you can. Think of it as what you would see if you were looking down from an airplane. Include on your base map all features that will help you mark locations of the areas you are studying.

Contour lines should be used if relief (difference in elevation) is important in the area you are mapping. If you do make a contour map, it

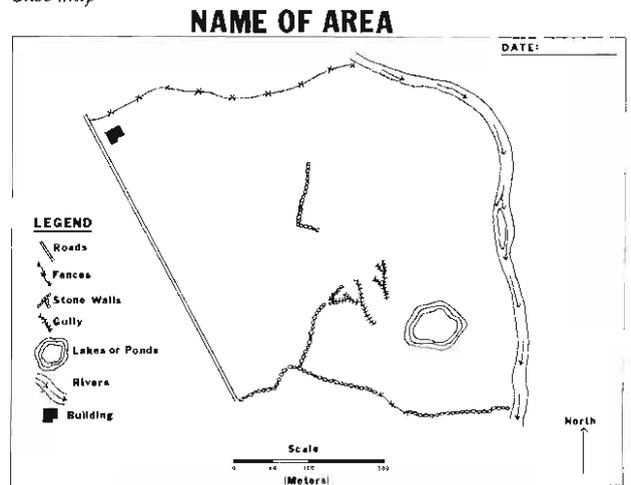
would be best to put only contour lines on one copy of your base map. If you try to put contour lines and other information on the same map, it will become crowded and confusing.

Contour lines show difference in elevation. Where contour lines are close together on a map they show that the land is steep, and where they are far apart the land is flatter. To avoid crowded notations you need label only every fifth contour. Usually, elevations are indicated in feet above sea level. To get an idea of how many feet (or meters) above sea level your area is, check contour maps available from the U.S. Geological Survey. These maps, at a scale of 1:24,000 (one inch on the map is 2,000 feet [24,000 inches] on the ground), provide a good introduction to mapping.

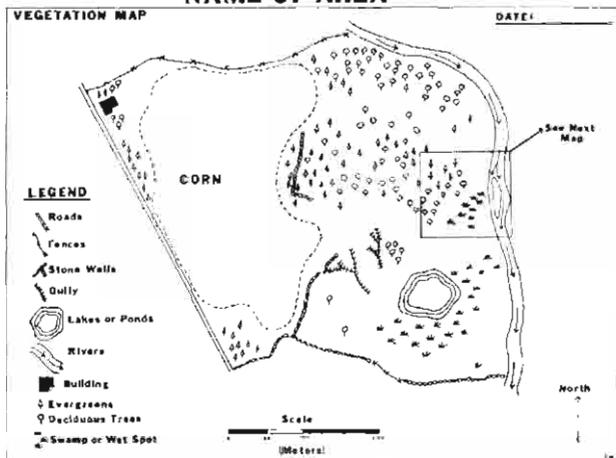
Many local stationery and bookstores sell these maps. If you cannot locate maps locally, send a post card to Map Information Office, United States Geological Survey, General Services Building, Eighteenth and F Streets, NW, Washington, D.C. 20405, and request a free Topographic Map Index Circular for your state. Use this index to decide which maps you need, then follow the instructions for ordering given in the index circular. You may also ask for a free booklet, "Topographic Maps," which explains maps and mapping.

Once you have made a base map of your area you can use it many ways. You can use a different base map each day to record field observations and

Base map

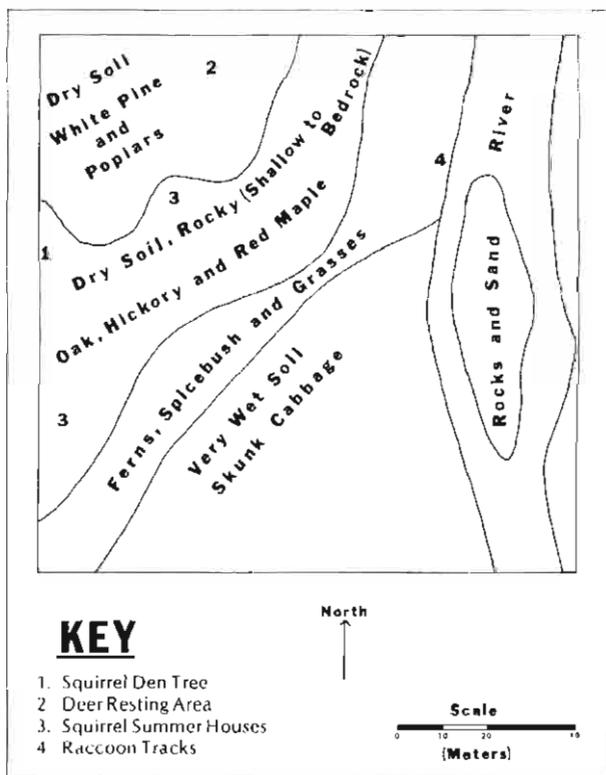


## NAME OF AREA



### Large scale map

## NAME OF AREA



the route you walked. The map can be keyed to your field notebook.

You can map different aspects of your study area, such as depth of snow, amount of rainfall, wind speed, temperature variation, plant species distribution, soil types, habitat types, home ranges of various animals, nests, and so on. Many investigations will require that you look in science books, 4-H projects or other sources to learn how to set up your own measuring devices.

As part of this wildlife project you should look at each aspect of the area as a part of wildlife's environment. You should try to understand how each may have an effect on wildlife, and perhaps determine how wildlife distribution is affected by what you have discovered.

Large scale maps (i.e. 1:100) show more detail than small scale maps, and can be very useful. For example, the sample vegetation map shows a small area of woods and marsh.

A wildlifer like yourself sees much more, however, and can indicate additional information about the same area on a map of larger scale. For example, see the sample large scale map of the same area of woods and marsh. Using such a map will allow you to display much more detailed information about specific habitat resources and needs.

Wildlife and other observations can be recorded on large-scale maps very accurately, giving specific locations of nests, and animals of small home range such as shrews.

The uses of maps are limitless. They will help you learn about wildlife and help you tell others about your activities. Maps are a very useful part of an exhibit, or demonstration, or talk on your wildlife project.

# Census Methods

Knowing **how many** animals are in an area is sometimes very important. For example, after you have worked on habitat improvement in an area, wouldn't you like to know whether the wildlife population has increased? Measuring the effect of human activities such as using pesticides, draining marshes, or building rock dens and brush piles can only be determined by knowing how large the population is **before** and **after** the activity. Wildlife managers use wildlife census methods to help them decide what management techniques are necessary.

Knowledge of population size can help measure the effect of other events as well, such as invasion of a species that competes for nesting space, or disease, or a very wet summer that floods the nests of ground-nesting birds.

Many times the exact number of animals is not really important — what is important is whether the population has increased or decreased. Then it doesn't matter whether you account for every single animal. What is really important is that you use exactly the same techniques each time you make your census. Then you can say with some certainty that your results indicate an increase or decrease in population, even though the numbers may not be precise.

There are many different census methods. Some methods may be used on almost any species, while others can be used only for a few species.

**SPECIES LIST.** This is simply a list of the different kinds of animals, or their sign, which you see. It is a good beginning from which to plan your other census activities, but the only way it can be used to indicate population change is if a species appears or disappears.

**SPECIES — NUMBERS LIST.** This list of species also includes the number of times each species is observed. The species-numbers list is more valuable because it contains more information than the species list, but the information is not certain. "Was this scat made by the same raccoon whose tracks I found near the stream?" or "Is that the same chickadee that scolded me five minutes ago?" are difficult questions to answer. Many of the other methods of wildlife census are simply different ways of answering questions like these.

**SAMPLING.** A sample is a portion of the total which is carefully selected to be representative of the total.

If you want to measure the woodchuck population in an area, you don't have to count every woodchuck. This is particularly true if you simply want to find out if the population has increased or decreased.

You can count woodchuck burrows and use these as an index of population without calculating exactly how many actual animals there are. You may need to use tracks to be sure that woodchucks are living in each den, however. If you want to calculate exactly how many animals there are, you must have some knowledge of woodchucks. They live alone in burrows, except for females, who in spring and summer average four young per litter. If you assume the population is half males and half females, half the burrows will contain one woodchuck and half will contain five. Thus the burrows will average three woodchucks.

Let's say you're studying wildlife on a farm that has several hayfields, and the total acreage of hayfields is 100 acres.

If you want to estimate how many woodchucks are in the 100 acres, you don't need to count burrows in every field. You can take a sample instead. Choose a field that is a good representative of the rest of the fields — let's say you choose a field pretty much like the rest that has ten acres. Count the burrows — let's say you find three. The ten acres with the three burrows is your sample. If you repeat the counting next year and the population in that field has increased, you can be reasonably certain that the population in the entire 100 acres has increased also.

Most census methods involve sampling in one way or another, and for all methods careful attention should be paid to getting a good sample. For example, let's say that last year you kept a species list of birds in a certain area. Then as you make this year's species list, you take a trail through the marsh which you didn't take last year. If in the marsh you see a new species for your list, you can't say that the species is a new arrival since last year, since your sampling method is different.

You can get an even better estimate of a population if your sample is a known fraction of the

total population. In the case of the woodchucks, you sampled a ten-acre field and found three burrows. Since the total hayfield acreage is 10 times as large as your sample, the total woodchuck population will be 10 times as large as your sample. You can set up an equation to solve mathematics problems like this:

$$\frac{10 \text{ acres}}{100 \text{ acres}} = \frac{3 \text{ burrows}}{X \text{ burrows}}$$

Cross multiply

$$10 X = 3 \times 100$$

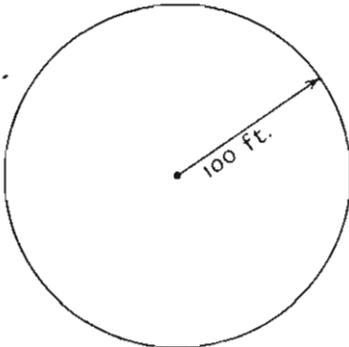
$$X = 30$$

A good check of your work is to take another sample in another field, and see if your results are the same, or reasonably close.

Similarly, you can estimate the squirrel population in a woods using a sample. Sit in one place for thirty minutes (the best time is sunrise) and count the squirrels you see. At the end of thirty minutes, estimate the average distance you can see through the woods. (It might be best to look from the place you have been sitting and select a point in the woods that is at your limit of observation [as far away as you could see a squirrel] then **measure** the distance to it). This distance is the radius of a circle, and you have been sampling the area within that circle.

For an example, let's say that you sat in a 40 acre woods for 30 minutes and observed 3 squirrels. You measure the distance to your limit of observa-

tion and it is 100 feet. Thus you have sampled a circle 100 ft. in radius.



Area of a circle is Pi times the radius squared.

$$A = \text{Pi } R^2$$

$$\text{Pi} = 3.14$$

$$R = 100$$

$$A = 3.14 \times 100^2 = 3.14 \times 10000$$

$$= 31400 \text{ sq. ft.}$$

One acre equals 43560 square feet,  
so you observed

$$\frac{31400}{43560} \text{ or about } 0.72 \text{ of an acre.}$$

Using mathematics again, you can find out how many squirrels there are in the entire 40 acre woods.

$$\frac{3 \text{ squirrels}}{0.72 \text{ acre}} = \frac{X \text{ squirrels}}{40 \text{ acres}}$$

Cross multiply

$$0.72 X = 3 \times 40$$

$$X = \frac{3 \times 40}{0.72}$$

$$X = \text{approximately } 167 \text{ squirrels}$$

Wildlife biologists usually speak of population "per acre". In this case,  $167 \div 40 = 4.2$  squirrels per acre.

Note that you can get this "squirrel per acre" figure without knowing the total acreage of the woods.

$$\frac{3 \text{ squirrels}}{0.72 \text{ acre}} = \frac{X \text{ squirrels}}{1 \text{ acre}}$$

$$X = 3 \div 0.72 = 4.2 \text{ squirrels per acre}$$

When possible, you should repeat your census from different observation points, then average your

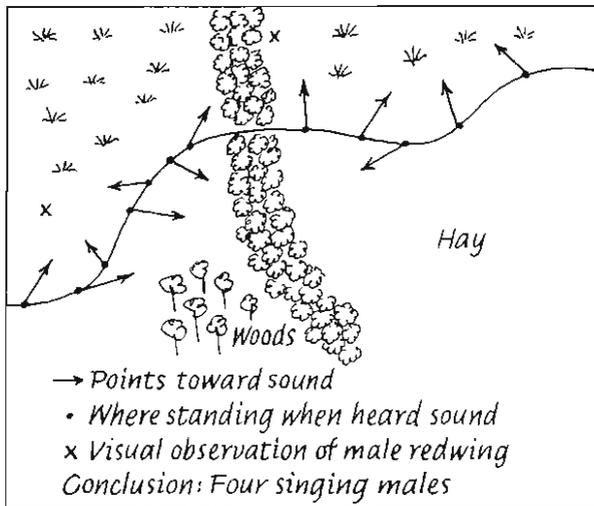


results. The more times you repeat, the larger your sample becomes, and the more accurate your results will be.

Most wildlife censuses use sampling instead of counting the entire population. Be sure to allow for anything that might make your sample different from the rest of the area.

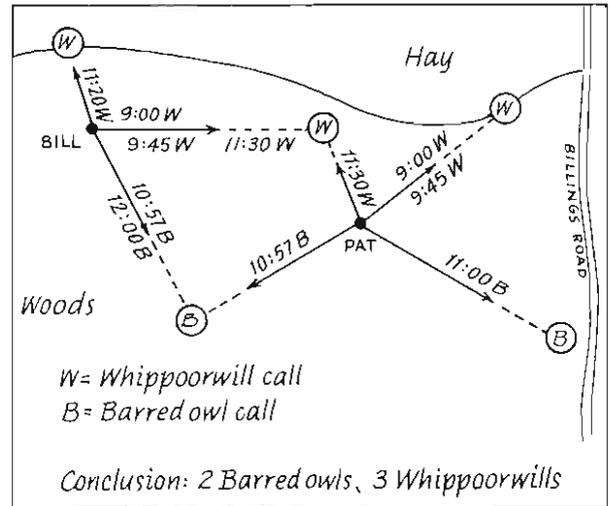
### MAP CENSUS

A base map can be used for many different kinds of census. One example is a "singing males" census. Male birds of many species announce their territory by singing — each species has a distinctive song. Let's use the redwing blackbird for an example. As you walk a route you will hear males singing their "kon-ka-ree" song. Each time you hear one sing, draw on your map an arrow pointing from where you're standing toward the source of the sound. Place an X if you actually see the bird.



A similar technique, called triangulation, can be used by partners at night to census owls, whippoorwills or other birds difficult to see because of darkness. Partners sit at stations several hundred feet apart and record the direction and exact time (watches must be synchronized) of each call heard. After the census, carefully copy all information onto a single map.

Where the arrows intersect is the approximate location of the bird at the time of the call. You may have to do this for several nights to determine whether you are hearing several birds or a single

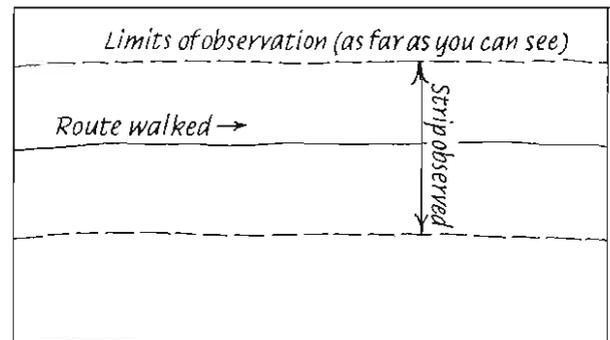


bird moving around. Using this technique, you can estimate populations as well as locate the place where you heard something happen — an owl capturing a grouse, for example.

On a map census always record direction of movement if you observe an animal moving. This will help you determine whether a later observation is the same or a different animal.

### STRIP CENSUS

When you walk through a woods or other habitat you can see a certain distance in either direction. The area you can see is rectangle called a "strip". Counting what you see is a strip census.



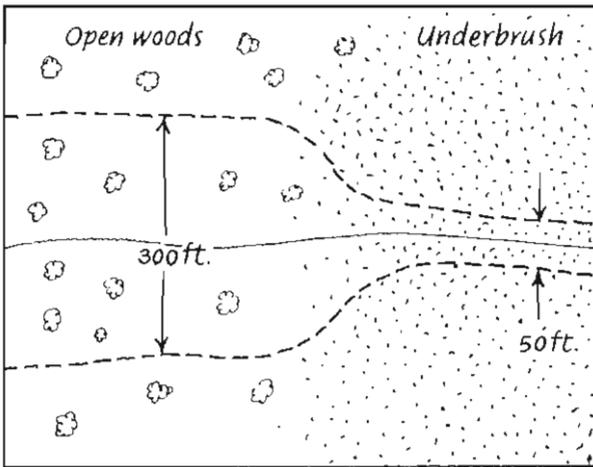
It is important to estimate how far you can see to the side as you proceed, and record this information on your map.

The area of a rectangle equals its width times its length. Thus the area of your strip equals the

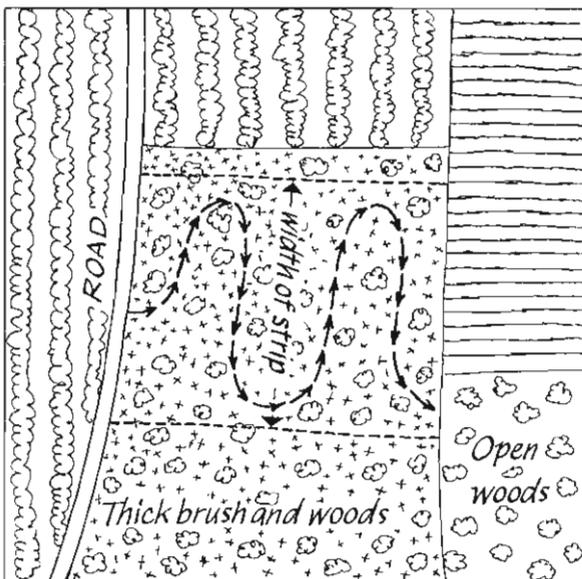
distance you walked times the total width. (Total width equals distance you can see to the left plus the distance you can see to the right).

Thus when you have completed walking a "strip" and have recorded distance walked, width of strip, and number of animals observed, you can calculate the number of animals per acre. Multiply this by the number of acres in the parcel, and you have an estimate of the total population of the parcel. You can census more than one species at the same time using this method.

In underbrush the strip is narrower than in open woods.

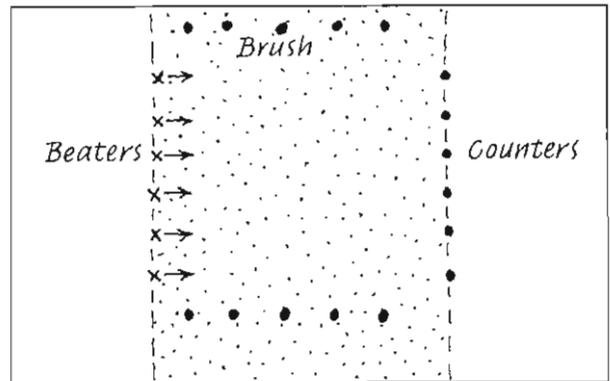


Sometimes, particularly in dense undergrowth, you must zig-zag in order to have a wide enough strip.



## DRIVE CENSUS

For some kinds of habitat, observation is very difficult unless the wildlife is driven in to the open. Several people are necessary for a drive. The "beaters", or people to drive the wildlife, line up abreast close enough together to prevent wildlife from escaping unseen.



Counters line up at the opposite end and at the sides of the drive. The beaters then walk toward the counters, making noise to drive the wildlife ahead of them. Counters census all wildlife that goes past them, and beaters count all that go back past them.

Care must be taken that two people don't count the same animal. In open areas such as pastures or hayfields, beaters can drag ropes between them to flush out many rabbits, pheasants, or similar animals that would otherwise remain silent and unseen. A **well trained** dog can be very helpful, but a poorly trained dog will be a nuisance at best.

## SPECIAL CENSUS TECHNIQUES

Many census techniques have been devised for particular species. For example, counting deer droppings can provide a good estimate of deer population. For training in these techniques contact an official of the state conservation department or read about them in books from a library.

## MARKED ANIMALS

Professional wildlife managers and others who are licensed by proper officials sometimes use techniques which involve live trapping, marking, and release of animals. Do not attempt to trap birds or

animals unless you have been trained and licensed by proper state and federal officials.

You can, however, practice the technique on insects, for example, the grasshopper population in a field.

First, use a net to capture as many grasshoppers as you can in a few minutes. Mark each one with a small dot from a felt marking pen or fingernail polish, then release it. Keep careful count of how many you have marked and released — let's say you have captured, marked, and released 50. After a few hours, go back to the field and capture another sample of grasshoppers. Let's say you cap-

ture 100 grasshoppers: of these, let's say five are marked and 95 are unmarked. Now you can use mathematics to estimate the total population.

$$\frac{5 \text{ marked}}{100 \text{ sampled}} = \frac{50 \text{ marked}}{X \text{ total population}}$$

$$5X = 50 \times 100$$

$$X = 1000 \text{ total population}$$

This method is most accurate for a population that is isolated (so that marked animals will not leave before your second count) and well-mixed (so the marked animals are dispersed throughout the total population).

## Additional Activities

The activities suggested here are just a few of the things you can do to gain more knowledge about wildlife and increase your abilities. Use your imagination to think of others. More detailed explanations of some of these and other activities can be found in other books and pamphlets.

Raise wildlife shrubs from seed or cuttings, write a habitat improvement leaflet, and give a leaflet and a bundle of shrubs to people in your area who will agree to plant them. Plant them yourself at your school or other town property.

Observe and record daily migration of pigeons or gulls from roost to feeding areas.

Investigate, write a report, and report to your group about careers in wildlife.

Write a report or give a talk on the subject of hunting. Discuss the conflict and issues between those who oppose hunting and those who favor it. Do a similar report on the subject of trapping.

Choose one essay from Leopold's *Sand County Almanac*. For example, "January Thaw". Write a similar essay about your own experiences and try to describe your feelings.

Put different kinds of feed in similar feeders, and determine food preferences of different bird species. Compare your findings to their natural diet. Do this for ants, chipmunks, raccoons, caterpillars, or other wild creatures.

Interview a Conservation Officer in your area. Write an article for your school newspaper or another publication on "A Day in the Life of a Conservation Officer".

Learn to identify the sounds of various animals. (Records are available to help you with this). Use a tape recorder to record sounds you hear.

Give a talk to your group or a community organization on state wildlife management programs in your area. Include the theories behind the various activities.

Using books from a college library or bookstore, study the adaptations of a certain species for survival. Explain how each adaptation helps the animal fit its niche.

Choose a spot such as a pond, or a lone tree in a field, and observe and record its use by animals. Construct a food web based on your observation.

Write a short story about an animal. Avoid the temptation to give the animal human emotions. Research carefully to be sure your account of the animal's behavior is accurate.

Learn to identify ten birds. Then repeat for mammals, fish, reptiles, insects, etc. Don't learn just from books. Observe in the field, noting habitat, flight or running pattern, and other distinguishing characteristics.

Collect, identify and press (preserve) plants

from a certain habitat. Mount and display with information on each plant's use to wildlife.

Write a letter to the editor of your local newspaper. Point out a wildlife situation that needs attention, or express your opinion on a controversy concerning wildlife the newspaper is covering.

Census the entire animal and/or plant population of a few square feet of vacant lot, roadside, or other area. Note which species are native and which were introduced from other parts of the world.

Make an anthology of wildlife poems by various authors. Write wildlife poetry of your own.

Observe (you will need binoculars) parent birds carrying food to young in a nest. Record number of trips per hour and kinds of food. Estimate total amount of various types of food the nestlings eat each day.

Identify a controversy involving wildlife in your area. Summarize the points of view of all sides of the issue.

Choose any species of wildlife in your area. Write a report, give a talk to your group, or prepare an exhibit on the species.

Rewrite the zoning laws of your town or city as if you were a beaver. Do the same thing for a hawk.

Observe a marsh, pond, meadow or other gathering place for wildlife from two hours before sunrise until two hours after sunrise. Record what you observe. Write a story or poem about your experience.

Make a scrapbook of newspaper and other articles concerning wildlife.

Prepare an exhibit on some aspect of your project for a fair, your school class, or a store window.

Make a balanced aquarium. Read about food webs in a pond, then collect plants and prey and predator species of animals. Set up the aquarium **carefully** following instructions you have found in a book on the subject. Try to strike a balance of prey and predator species.

Make a wildlife resource map of your school property, a park, a neighbor's property, or a similar place.

Watch television programs concerning wildlife. Make a list of concepts mentioned or implied.

Learn to prepare "study skins" of animals found dead along the roads. Check with your conservation officer, since you should know the laws concerning this.

In cooperation with your librarian, make a list of books in your library on the subject of wildlife. Include novels and poetry as well as biographies

and other non-fiction. Using these books as well as other items, make a bulletin board or display to put up in your library during National Wildlife Week.

Observe a bird building a nest. Determine average distance traveled per trip. Calculate total distance traveled to build nest.

Write a report on a rare or endangered species.

Lead a field trip for a group of young children. Help them learn some basic facts and concepts about wildlife. Cause them to be interested in and care about wildlife.

Write a "Wildlifer's Diary" patterned after the January to December section of Leopold's *Sand County Almanac*.

Visit a state or federal wildlife management area or refuge. Interview officials and observe management practices. Write a report on the activities being conducted.

Raise earthworms. Write a report on their importance to all plants and animals.

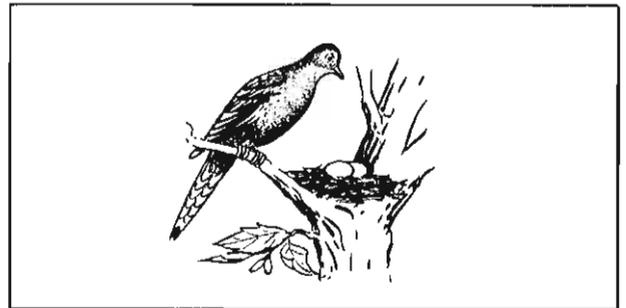
Subscribe to a state or national magazine that deals with wildlife or read one regularly at your library.

"Adopt" a species of wildlife that occurs in your area. Observe it daily, or whenever possible, for a month or a year. Record your observations. Learn all you can about it from books, recordings, learned people, etc. as well as from your observations.

Locate a nest being built by a bird. Observe it closely during the nesting season and keep detailed records of activity. Include number of trips per hour when building, behavior when other birds, cats, etc. are nearby, number of eggs and when laid, hatching date, etc. Compare your observations to information published on that species in books.

Make crossword puzzles using wildlife terms. Make several using different themes, such as endangered species, food plants, predators, introduced species, etc.

Sketch, paint or draw an animal. Study the work of other wildlife artists.



## SUGGESTED READING

The books listed here will further improve your understanding of wildlife. Most are appropriate for readers twelve and older. School libraries and many public libraries have, or can get, numerous books about wildlife written at an elementary school reading level. Check with your librarian to use this excellent means of motivating and educating young people.

**Field Book of Nature Activities and Hobbies** — W. Hillcourt, G. P. Putnam's Sons, New York, N.Y.

**Complete Guide to American Wildlife** — H. Collins, Harper and Row, New York, N.Y.

**Our Wildlife Legacy** — D. Allen, Funk and Wagnalls Co., New York, N.Y.

**A Sand County Almanac** — A. Leopold, Ballentine Books, New York, N.Y.

**Field Book of Natural History** — E. Palmer and H. Fowler, McGraw - Hill, New York, N.Y.

**Golden Nature Guides** — Several subjects and authors, Golden Press, New York, N.Y.

**Peterson Field Guide Series** — Several subjects and authors, Houghton Mifflin, Boston, Ma.

**Birds of North America** — C. Robbins, B. Bruun, H. Zim & A. Singer, Golden Press, New York, N.Y.

**Wildlife Biology** — R. Dasmann, John Wiley and Sons, New York, N.Y.

**Practical Wildlife Management** — G. Burger, Winchester Press, New York, N.Y.

**Game Management** — A. Leopold, Charles Scribner's Sons, New York, N.Y.

**American Wildlife and Plants** — A. Martin, H. Zim and A. Nelson, McGraw - Hill, New York, N.Y.

**Wildlife Habitat Improvement** — J. Shomon, B. Ashbaugh & C. Tolman, National Audubon Society, New York, N.Y.

**The Web of Life** — J. Storer, Signet Books, New York, N.Y.

**Wildlife Management Techniques** — R. Giles (ed), The Wildlife Society, Washington, D.C.

**Ornithology in Laboratory and Field** — O. Pettingill, Burgess, Minneapolis, Minn.